

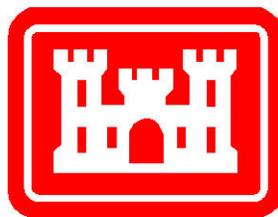
**FINAL
ENVIRONMENTAL ASSESSMENT**

**SOUTH WOLF CREEK
EXPANSION/UPGRADE PROJECT
LAWTON, OKLAHOMA**

PREPARED BY:



PREPARED FOR:



**US ARMY CORPS OF ENGINEERS
TULSA DISTRICT**

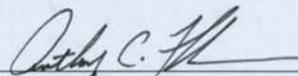
October 2007

FINDING OF NO SIGNIFICANT IMPACT

In accordance with the National Environmental Policy Act of 1969, including guidelines in 33 code of Federal Regulations Part 230, the City of Lawton has assessed the environmental impacts of the new parallel installation of approximately 33,296 LF of sanitary sewer trunk line. The project is identified in the Sewer System Evaluation Study (SSES) Report, Volume 1, prepared by Biggs and Mathews, Byrd Forbes, and CH2M Hill, as South Wolf Creek Trunk Expansion 1, South Wolf Creek Trunk Expansion 2, and South Wolf Creek Expansion 3. The project has been undertaken by the City of Lawton for compliance with State of Oklahoma, Department of Environmental Quality, Division of Water Quality Consent Order, Case No. 02-0397, issued January 17, 2004. The project is designed to remediate sanitary sewer overflows (SSOs) by increasing the carrying capacity of the existing collection system and/or replacing (or repairing) deteriorated sewer lines as outlined in the SSES Report mentioned above. The purpose of this project is to bring the City of Lawton into compliance with its NPDES permit pertaining to overflows of the sewer collection system. This assessment was prepared in accordance with U.S. Army Corps of Engineers regulations, Part 230, Policy and Procedures for implementing the National Environmental Policy Act. It has been determined from the enclosed Environmental Assessment that the project will have no significant adverse effects on the natural or human environment. Therefore an environmental impact statement will not be prepared.

14 OCT 07

Date



Anthony C. Funkhouser, P. E.

Colonel, U.S. Army

District Commander

Enclosure:
Environmental Assessment

ENVIRONMENTAL ASSESSMENT ORGANIZATION

This EA will facilitate the decision process regarding the proposed action and alternatives.

<i>SECTION 1</i>	<i>AUTHORITY, PURPOSE, AND SCOPE</i> of the proposed action summarizes the purpose of and need for the proposed action, provides relevant background information, and describes the scope of the EA.
<i>SECTION 2</i>	<i>ALTERNATIVES</i> examines alternatives for implementing the proposed action.
<i>SECTION 3</i>	<i>PROPOSED ACTION</i> describes the recommended action.
<i>SECTION 4</i>	<i>AFFECTED ENVIRONMENT</i> describes the existing environmental and socioeconomic setting.
<i>SECTION 5</i>	<i>ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION</i> identifies the potential environmental and socioeconomic effects of implementing the proposed action and alternatives.
<i>SECTION 6</i>	<i>RESTORATION PLAN</i> summarizes the restoration prescribed for the proposed alternative.
<i>SECTION 7</i>	<i>FEDERAL, STATE AND LOCAL AGENCY COORDINATION</i> provides a listing of individuals and agencies consulted during preparation of the EA.
<i>SECTION 8</i>	<i>REFERENCES</i> provides bibliographical information for cited sources.
<i>SECTION 9</i>	<i>APPLICABLE ENVIRONMENTAL LAWS AND REGULATIONS</i> provides a listing of environmental protection statutes and other environmental requirements.
<i>SECTION 10</i>	<i>LIST OF PREPARERS</i> identifies persons who prepared the document and their areas of expertise.
<i>APPENDICES</i>	<i>A</i> Coordination/Correspondence <i>B</i> Section 404 Permit <i>C</i> Cultural Resources Coordination <i>D</i> Sewer System Evaluation Study Final Report and Cost Analysis <i>E</i> Rangeland Productivity and Plant Composition <i>F</i> Public Comments <i>G</i> Newspaper Public Notice

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SECTION 1.0 AUTHORITY, PURPOSE AND SCOPE

This is an Environmental Infrastructure project federally authorized by Section 219 (f) (40) of the Water Resource Development Act of 1992 as amended by Section 502 of the Water Resources Development Act of 1999. The legislation authorized the United States Army Corps of Engineers to provide technical, planning, and construction assistance at a Federal expense not to exceed \$5,000,000 for a water-related infrastructure project. The project will be cost shared at the rate of 75% Federal and 25% non-Federal. Any project cost that exceeds the \$5,000,000 will be borne entirely by the sponsor. The sponsor may meet its 25% share by providing lands, easements, rights-of-way, disposal areas, and funding for construction.

The project described in this proposal provides for the new parallel installation of approximately 37,000 linear feet (LF) of existing sanitary sewer trunk line in the City of Lawton, Oklahoma (Figure 1.0, Figure 2.0). There are 26 projects identified in the Sewer System Evaluation Study (SSES) Report, Volume I (Appendix D). This environmental assessment addresses the projects identified in the SSES Report as South Wolf Creek Trunk Expansion 1, South Wolf Creek Trunk Expansion 2, and South Wolf Creek Expansion 3. The SSES Report was presented in April 1997 to the City of Lawton by Biggs and Mathews, Byrd Forbes and CH2M Hill, Inc. The City of Lawton is constructing the project to remediate sanitary sewer overflows (SSO's) under State of Oklahoma, Department of Environmental Quality, Division of Water Quality Consent Order, Case No. 02-0397, issued January 17, 2004. The project is designed to remediate sanitary sewer overflows (SSO's) by increasing the carrying capacity of the existing collection system as outlined in the SSES Report.

Total estimated cost for this project is \$6,800,000 to be funded from Sewer Rehab Phase I cost savings and a \$5,000,000 Federal Grant administered through the Corps of Engineers.

The purpose of this project is to bring the City of Lawton into compliance with its NPDES permit pertaining to overflows of the sewer collection system.

Several alternatives were considered by the City to alleviate the SSO's. The proposed project includes installing a new line parallel to the existing sewer trunk line.

The National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190) requires all Federal agencies to address the environmental impacts of any major Federal action on the natural and human environment. Guidance for complying with the NEPA is contained in Title 40 of the code of Federal Regulations (CFR), Parts 1500 through 1508, and Engineering Regulation (ER) 200-2-2, Procedures for Implementing NEPA. The primary intent of NEPA is to ensure that environmental information is made available to public officials and citizens regarding major actions taken by Federal agencies. This environmental assessment was developed to assure that construction of the proposed project complies with the intent of NEPA.

SECTION 2.0 ALTERNATIVES

Alternatives include a No Action Plan, which would retain existing conditions; and a proposed action plan, which would increase the sewer carrying capacity by the new parallel construction of additional sewer lines. The purpose of this project is to help bring the City of Lawton into compliance with the NPDES Permit pertaining to overflows of the sewer collection system. Under the existing conditions, it is not possible to meet the NPDES Permit conditions. A Cost Analysis (Appendix D) was used to determine the best method for preventing sanitary sewer system overflows as required by the EPA Administrative Order and the ODEQ Consent Order. The proposed action is a component of Option II which is designed to help reduce the inflow and infiltration by 25% and increase treatment capacity to 18 million gallons per day ADF.

2.1 No Action

The Council on Environmental Quality (CEQ) regulations implementing the provisions of the National Environmental Policy Act of 1969 (NEPA) requires Federal agencies to consider a "no action" alternative. These regulations define the "no action" alternative as the continuation of existing conditions and their effects on the environment, without implementation of, or in lieu of, a proposed action. This alternative represents the existing

condition and serves as the baseline against which to compare the effects of the other alternatives. The “no action” alternative would retain the existing conditions and would not result in any change in environmental conditions or fish and wildlife habitat.

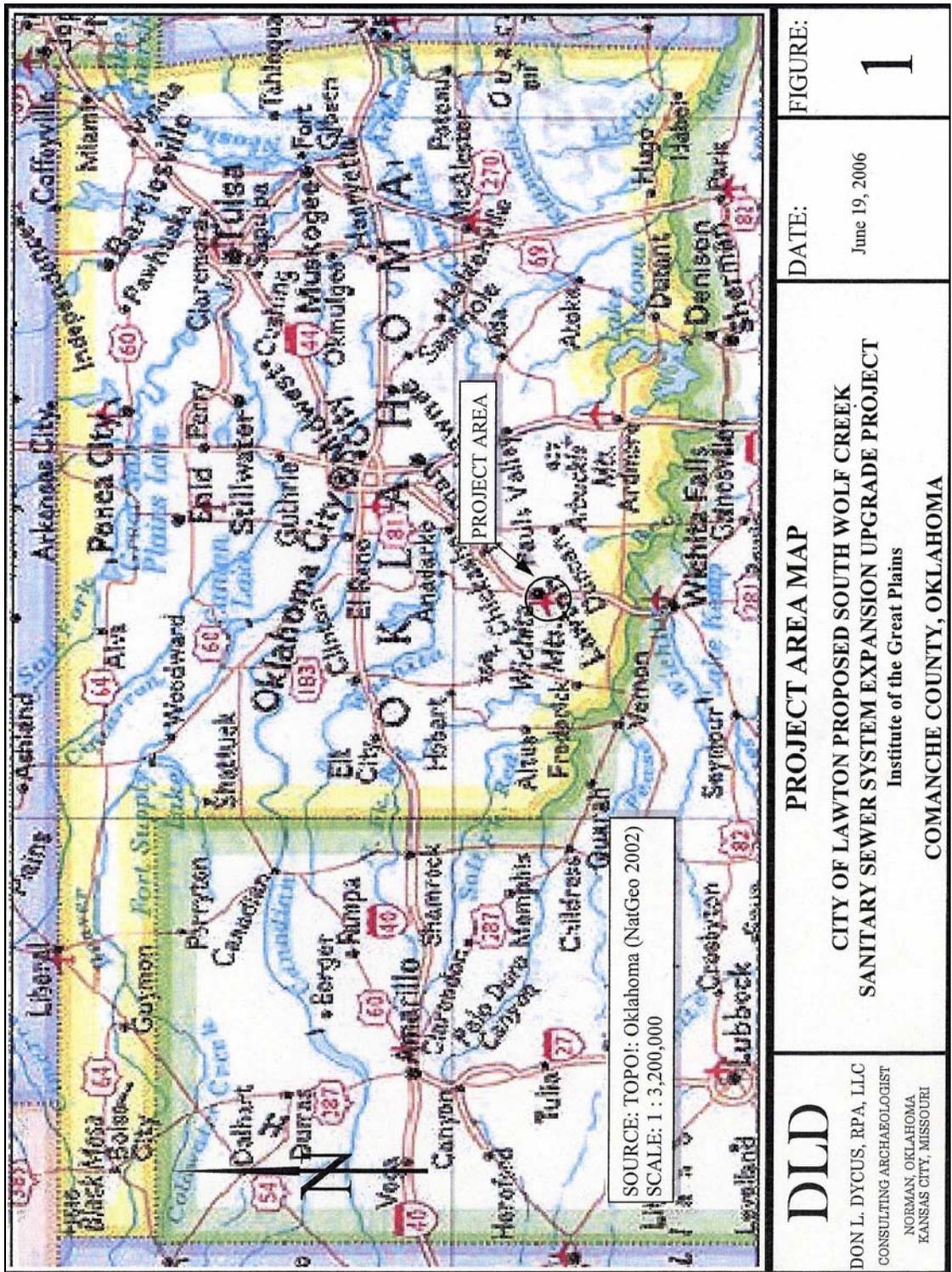


Figure 1.0. Project Area Map.

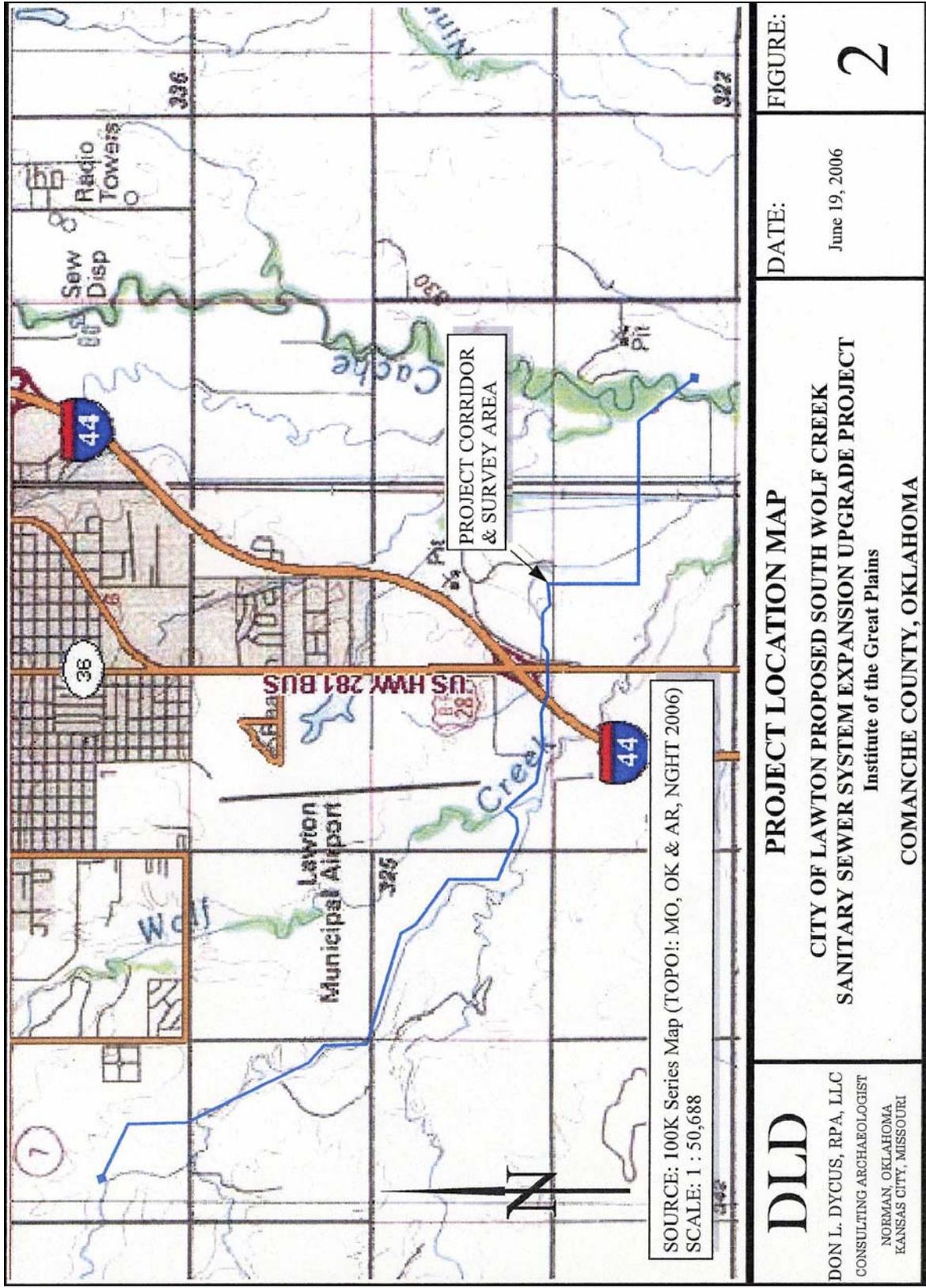


Figure 2.0. Project Location Map within the City of Lawton.



Photo 1.0. Aerial View of Project Site.

2.2 Action Alternatives

The project described in this proposal provides for the parallel installation of approximately 37,000 LF of new sewer line alongside the existing sanitary sewer trunk line as outlined in the Sewer System Evaluation Study (SSES) Report, Volume I, as presented in April 1997 to the City of Lawton by Biggs and Mathews, Byrd Forbes and CH2M Hill, Inc., as South Wolf Creek Trunk Expansion 1, South Wolf Creek Trunk Expansion 2, and South Wolf Creek Expansion 3 (See Appendix D).

This alternative was selected on the basis of cost analysis for preventing sanitary sewer system over flow. The proposed action is discussed in Section 3.0, Proposed Action; and referenced in Appendix D.

2.3 Cost Analysis (See Appendix D)

SECTION 3.0 PROPOSED ACTION

The proposed action is to complete three of the 26 projects listed in the SSES Report. They are identified as Project Number 17, South Wolf Creek Trunk Expansion 1; Project Number 18, South Wolf Creek Trunk Expansion 2; and Project Number 24, South Wolf Creek Expansion 3. South Wolf Creek Trunk Expansion 1 consists of construction of a new 42 inch line parallel to an existing 36 inch line between manhole numbers W085012M and C096014M (approximately 14,000LF). South Wolf Creek Trunk Expansion 2 consists of construction of a new 36 inch line parallel to an existing 30 inch line and a new 30 inch line parallel to an existing 27 inch line between manhole numbers W086009M and W085012M (approximately 10,000 LF). South Wolf Creek Expansion 3 consists of construction of a new 30 inch line parallel to an existing 27 inch line between manhole numbers W086012 and W086009M (approximately 13,000 LF). The total estimated cost for this project is about \$6,800,000. Funding will come from Sewer Rehab Phase I cost savings plus a \$5,000,000 Federal Grant administered through the U. S. Army Corps of Engineers.

SECTION 4.0 AFFECTED ENVIRONMENT

Comanche County has a temperate, continental climate of the dry, sub-humid type. The weather patterns that influence this area are sustained by the alternate movement of warm, moist air from the Gulf of Mexico and of either contrasting cooler, modified marine air from the West Coast or colder, dry air from around the Arctic Circle. Rapid changes are common and result in distinct fluctuations of temperature, humidity, cloudiness, wind, and precipitation.

Changes between seasons are usually gradual, and distinct seasonal characteristics vary in severity from year to year. Winters are mild; cold spells normally last only 2 to 5 days before the return of sunny skies and warm, southerly winds. Spring, the most variable season, normally has the heaviest rainfall and the greatest number of severe local storms and tornadoes. Summers are long and fairly warm. The discomfort caused by hot spells is often eased by southerly breezes and low humidity. Considerable precipitation occurs, generally as heavy local storms or as light ineffective showers toward the end of summer and rainfall increases early in fall. Fall is a season of pleasant, sunny days and cool nights.

Comanche County has an average annual temperature of 62.7° F. The average monthly temperature ranges from 40.7° in January to 83.7° in August. The average daily variation of 25.9° normally provides welcome relief during periods of extreme temperature. Freezing temperatures occur on an average of 74 days each year, between October and April, and on 5 of these days the highest temperature is below freezing. Minimum readings of 0° or below occur in about one year out of six.

The average annual precipitation ranges from about 27 inches along the western border of the county to 32.5 inches in the northeast corner. Records for the period 1931 to 1960 indicate a normal of 29.19 inches at the Wichita Mountains Wildlife Refuge and of 30.18 inches at Lawton. About 34 percent of the total precipitation falls in spring, 27 percent in summer, 24 percent in fall, and 15 percent in winter.

May, which is the wettest month, normally receives about 20 percent of the annual precipitation. January, the driest month, normally receives only 5 percent of the annual precipitation. The longest period during which no measurable precipitation was recorded at Lawton lasted from September 21, 1950 to January 1, 1951. Heavy 24-hour rains of at least 2 inches have occurred in all months, but 24-hour rains of 3 to 4 inches have occurred only in April, May and June and in September and October.

The average annual snowfall ranges from 5 inches in the southwestern part of the county to 7.5 inches in the north-central part. The snowfall season usually begins in November and continues through April. Heavy snow normally melts within 4 days.

The prevailing wind direction is northerly in January and February and southerly to southeasterly the rest of the year. The average wind speed is a little more than 12 miles per hour, but winds of 30 to 50 miles per hour are common. Gusts of up to 85 miles per hour occur occasionally in the vicinity of severe thunderstorms, which are most common from April through June. Tornadoes have struck in most parts of the county. During the past 89 years, a total of 26 damaging tornadoes have occurred; 14 of these have occurred in May. During the past 40 years, there have been 35 severe hailstorms, and more than half of these have occurred in May. Hailstones 3½ inches in diameter, some weighing 2 pounds, fell in the south-central part of the county in May, 1957.

The evaporation rate is high and is highest between May and October. The average annual lake evaporation is about 63.5 inches.

The dates of freezing temperatures are representative of the southeastern third of the county. At the higher elevations in the northeastern quarter, freezing temperatures occur 10 to 12 days later in spring and 5 to 9 days earlier in fall. The average freeze-free season is 216 days at Lawton and 200 days at the Wichita Mountains Wildlife Refuge.

4.1 Social and Economic Conditions

Lawton is the third largest city in Oklahoma. According to the Oklahoma Department of Commerce the population of Lawton in 2000 was 92,757. A projected 2030 population was prepared by the Lawton Chamber of Commerce (2030 Transportation Plan Update) based upon information released by the U. S. Army for Base Realignment and Closure (BRAC). The projected 2030 population for the City of Lawton is 121,700 and for Fort Sill is 15,700.

The low/moderate income areas are where at least 51% of families living in those areas are of low/moderate income level of \$11,800-\$31,450 annually. All areas where construction is proposed on this project are outside these low/moderate income areas. Thus it is concluded that none of the proposed project will disproportionately or unfairly impact any low income or minority communities within the area of construction.

4.2 Executive Order 12898

Executive Order 12898 requires each Federal agency to make environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.

Under NEPA, the identification of a disproportionately high and adverse human health or environmental effect on a low-income population, minority population, or Indian tribe does not preclude a proposed agency action from going forward, nor does it necessarily compel a conclusion that a proposed action is environmentally unsatisfactory. Rather, the identification of such an effect serves to heighten agency attention to alternatives (including alternative sites), mitigation strategies, monitoring needs, and preferences expressed by the affected community or population.

Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Bureau of the Census Reports in Income and Poverty. In identifying low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of

individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect.

Minorities are comprised of individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.

Minority populations are identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. In identifying minority communities, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a geographically dispersed/transient set of individuals (such as migrant workers or Native American), where either type of group experiences common conditions of environmental exposure or effect. The selection of the appropriate unit of geographic analysis may be a governing body's jurisdiction, a neighborhood, census tract, or other similar unit that is to be chosen so as to not artificially dilute or inflate the affected minority population. A minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds.

Disproportionately high and adverse human health effects: When determining whether human health effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable: (a) Whether the health effects, which may be measured in risks and rates, are significant or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death; and (b) Whether the risk or rate of hazard exposure by a minority population, low-income population, or Indian tribe to an environmental hazard is significant and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group; and (c) Whether health effects occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.

Disproportionately high and adverse environmental effects: When determining whether environmental effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable: (a) Whether there is or will be an impact on the natural or physical environment that significantly and adversely affects a minority population, low-income population, or Indian tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment; and (b) Whether environmental effects are significant and are or may be having an adverse impact on minority populations, low-income populations, or Indian tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group; and (c) Whether the environmental effects occur or would occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.

4.3 Executive Order 13045

On 21 April 1997, President Clinton issues Executive Order 13045 (EO 13045), Protection of Children from Environmental Health Risks and Safety Risks, which notes that children often suffer disproportionately from environmental health and safety risks, due in part to a child's size and maturing bodily systems. The executive order defines environmental health and safety risks as risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest (such as the air we breathe, the food we eat, the water we drink or use for recreation, the soil we live on, and the products we use or are exposed to). Executive Order 13045 requires Federal agencies, to the extent permitted by law and mission, to identify and assess environmental health and safety risks that may affect children disproportionately. The Order further requires Federal agencies to ensure that its policies, programs, activities, and standards address these disproportionate risks. Executive Order 13045 is addressed in this NEPA document to examine the effects this action will have on children.

4.4 Natural Resources

4.4.1 Terrestrial

The land use in the project area is predominantly cropland with some pasture and mixedgrass prairie (Photo 4.4.1). Mixedgrass prairie is considered a combination of shortgrass prairie and tallgrass prairie and contains more plant species than any other prairie type. Both short and tall grass plant species are here. Whereas grasses of a uniform height blanket tallgrass prairies, mixedgrass prairies are more open and feature grasses and plants of different heights. Little bluestem (*Schizachyrium scoparium*) is the dominant grass in mixedgrass prairie. Other species characteristic of tallgrass prairies include big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), buffalo pea (*Astragalus spp.*), purple prairie clover (*Dalea purpurea*), sunflowers (*Helianthus spp.*), goldenrod (*Solidago canadensis*), blazing star (*Liatris punctata*), prairie purple coneflower (*Echinacea angustifolia*), and aster (*Aster spp.*). Characteristic shortgrass prairie species include blue grama (*Bouteloua gracilis*), buffalograss (*Buchloe dactyloides*), red false mallow (*Sphaeralcea coccinea*), purple locoweed (*Oxytropis lambertii*), false indigo bush (*Amorpha fruticosa*), and prickly pear cactus (*Opuntia macrorhiza*). Trees include cottonwood (*Populus deltoides*), pecan (*Carya illinoensis*), sugarberry (*Celtis laevigata*), willow (*Salix nigra*), Chinaberry (*Sapindus drummondii*), and American elm (*Ulmus americana*).

4.4.2 Soils

Most of the soils of Comanche County are underlain by clastic sedimentary rocks. The more common of these are the sandstones and shales of the Permian system.

Meers quartzite, a metamorphic rock of the Precambrian system, is probably the oldest sedimentary rock in Oklahoma. It was derived from an ancient sedimentary rock that was engulfed in younger igneous rocks before the molten mass cooled and crystallized. Exposures have been reported in sec. 34, T. 4 N., R. 14 W.; in secs. 2 and 3, T. 3 N., R. 14 W.; and directly south of Meers.

Gabbro, anorthosite, granite, and rhyolite are all igneous rocks, late Precambrian in age. These are not the oldest igneous rocks in Oklahoma, but a study of radioactive minerals indicated that one sample was almost 600 million years old.

The Timbered Hills group and the lower part of the Arbuckle group are Cambrian in age. The oldest, the Reagan sandstone, rests on igneous rocks and contains weathered debris from them. Above the Reagan sandstone, from oldest to youngest, are the Honey Creek formation, which is largely sandstone and limestone; Fort Sill limestone; Royer dolomite; and Signal Mountain limestone.

The upper part of the Arbuckle group belongs to the Ordovician system. It is essentially limestone and contains, from oldest to youngest, the McKenzie Hill, Cool Creek, and Kindblade formations.

The Wichita formation, Hennessey shale, the El Reno group, the Marlow formation, Rush Springs sandstone, and the Cloud Chief formation are all Permian in age. The Wichita formation is the oldest of the Permian rocks in Comanche County. It is essentially shale but contains a considerable amount of sandstone and some conglomerate. The base bituminous gray sandstone is probably equivalent to the Garber sandstone north of the Arbuckle Mountains. The conglomerate, the Post Oak conglomerate member, is in the lower part of the Wichita formation. It rests on older sedimentary rocks and on igneous rocks near the Wichita Mountains and contains weathered debris from all of them. Near igneous exposures it contains igneous boulders and pebbles; near limestone exposures it contains limestone boulders and pebbles; in some areas it contains both types of debris. The debris is coarse near the mountains, becomes increasingly finer with distance, and finally grades into the shales and sandstones typical of the Wichita formation. Hennessey shale is mostly red shale but contains some reddish-brown to red sandstone. The El Reno group consists of Duncan sandstone in the lower part and the Chickasha.

The project appears to cross primarily Port clay loam (Pc) and Vernon soils on 5 to 12 percent slopes (VeD) with lesser areas of Broken alluvial land (Br), Lela clay (Lc), and Vernon soils on 3 to 5 percent slopes (VeC) being crossed. The Port clay loam and the Lela clay are listed as prime farmland.

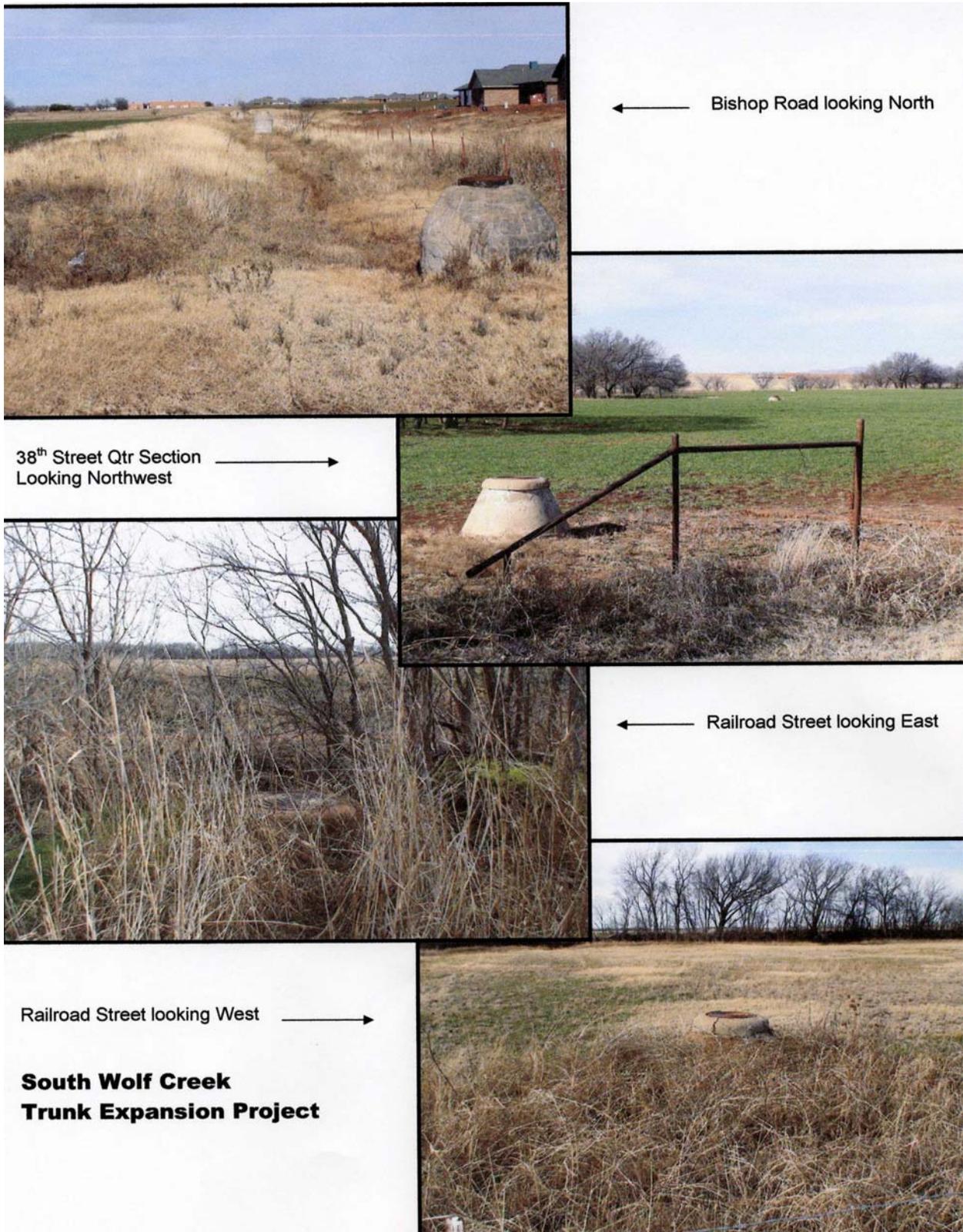


Photo 4.4.1. Land Use is Predominantly Cropland and Grassland.

4.4.3 Prime Farmland

Soil that is prime or unique farmland as defined in the Farmland Protection Policy Act is classified as prime farmland. According to the U.S. Department of Agriculture, it is soil that is best suited for producing food, feed, forage, fiber, and oilseed crops. Port clay loam is classified as prime farmland. The area classified as Port clay loam within the immediate project area is located at the southwest part of the project area.

4.4.4 Wild and Scenic Rivers

There are no streams within the project area that are classified as wild and scenic pursuant to the Federal Wild and Scenic Rivers Act, Public Law 90-542.

4.4.5 Aquatic and Wetlands

Several small areas along the project are classified as wetlands on National Wetlands Inventory maps published by the U. S. Fish and Wildlife Service. Essentially all are classified as palustrine unconsolidated bottom or unconsolidated shore, permanently flooded. They are mostly diked ponds with some being excavated. The alignment of the sewer line is such that it would avoid each of the listed wetlands. Topographic maps published by the U. S. Geological Survey (7.5 minute series) indicate that the proposed South Wolf Creek Interceptor crosses jurisdictional waters of the United States regulated by Section 404 of the Clean Water Act at ten (10) locations. The City of Lawton plans to cross these locations through directional boring. No dredged or fill material will be placed, permanently or temporarily, into any “waters of the United States,” including jurisdictional wetlands.

4.4.6 Fish and Wildlife

The diversity and abundance of fish and wildlife in the project area is limited by the proximity of the sewer line to an urban area and by the abundance of pasture and agricultural land. The sewer alignment would avoid aquatic habitat as described in Section 4.4.5. Various species of amphibians, reptiles, birds, and mammals would occur in the project area. Common amphibians in the area include Texas horned lizard (*Phrynosoma cornutum*), Texas toad (*Bufo speciosus*), and cricket frog (*Acris crepitans*). Reptiles found in the area include collared lizard (*Crotaphytus collaris*), blind snake (*Leptotyphlops dulcis*), lesser earless lizard (*Holbrookia maculata*), fence lizard (*Sceloporus undulatus*), eastern box turtle (*Terrapene carolina*), western ribbon snake (*Thamnophis proximus*), copperhead (*Agkistrodon contortrix*), and black rat snake (*Elaphe obsoleta*). Common birds in the area include American goldfinch, American robin, cattle egret, Cooper’s hawk, eastern meadowlark, house sparrow, Mississippi kite, mourning dove, northern mockingbird, northern cardinal, and red-winged blackbird. Mammals most likely to occur in the project area include species that are tolerant of urban activity. These include fox squirrel (*Sciurus niger*), eastern cottontail (*Sylvilagus floridanus*), Virginia opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), coyote (*Canus latrans*), and several species of rodents.

4.4.7 Executive Order 13112

On 3 February 1999, President Clinton issued Executive Order 13112 (EO 13112), Invasive Species, which notes that invasive species annually cause significant economic, ecological, and human health impacts in the United States. The executive order defines invasive species as an alien species whose introduction does or is likely to cause economic and environmental harm or harm to human health. Executive Order 13112 requires Federal agencies to not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States; and that all feasible and prudent measures to minimize risk or harm will be taken in conjunction with the actions. Executive Order 13112 is addressed in this NEPA document to incorporate measures that will prevent the inadvertent spread of exotic and invasive species. These preventative measures are described in Section 6.0, Restoration Plan.

4.5 Threatened and Endangered Species

The U. S. Fish and Wildlife Service indicates five species of birds are listed on the threatened or endangered species list that could potentially occur in Comanche County. These include the black-capped vireo,

interior least tern, whooping crane, bald eagle, and piping plover. Of these only the black-capped vireo potentially could occur in the project area. However, the project area does not contain suitable habitat for the black-capped vireo.

4.6 Cultural Resources

In accordance with Section 106 of the National Historic Preservation Act of 1966 (as amended), in May, 2005, consultation was initiated with the Oklahoma State Historic Preservation Office (SHPO) and the Oklahoma Archeological Survey (OAS). Additionally, appropriate Native American tribes were contacted to request information, including the Apache Tribe of Oklahoma; the Caddo Indian Tribe of Oklahoma; the Cheyenne-Arapaho Tribes of Oklahoma; the Chickasaw Nation, Oklahoma; the Choctaw Nation of Oklahoma; the Comanche Nation, Oklahoma; the Delaware Nation, Oklahoma the Fort Sill Apache Tribe of Oklahoma; the Kiowa Indian Tribe of Oklahoma; and the Wichita and Affiliated Tribes of Oklahoma (see correspondence in appendices).

An archaeological survey of the project area was completed in 2006 by Mr. Don Dycus for the Institute of the Great Plains in Lawton, Oklahoma (Appendix C). Two archaeological sites previously recorded, 34CM224 and 34CM227, are located near the project corridor, but no materials from either site were observed during the survey. Additional archaeological sites and standing structures were not observed and therefore none were recorded. Mr. Dycus recommended a “no historic properties affected” determination for the project. In subsequent letters from the SHPO and the OAS, these state agencies agreed with Mr. Dycus’ recommendation of “no historic properties affected” for the South Wolf Creek project. Section 106 coordination under the National Historic Preservation Act is therefore complete for this project.

4.7 Water Quality

The purpose of this project is to improve water quality. In September 1994 the City of Lawton, Oklahoma was placed under an EPA Administrative Order for non-compliance with their National Pollutant Discharge Elimination System (NPDES) permit relative to unauthorized overflows from the sewer collection system. In May 1995 the Oklahoma Department of Environmental Quality and the City executed a Consent Order Agreement to perform a Sanitary Sewer Evaluation Study to identify necessary collection system repairs and required expansion/improvements to reduce sewage overflows as a result of inflow, infiltration, and/or lack of capacity. This project is one of several designed to bring the City into compliance with its NPDES permit requirements.

4.8 Air Quality

Construction activity would have a minor temporary impact on air quality caused by heavy equipment operation and from fugitive dust (particulate) emissions in and around the project site. Contractors will comply with all appropriate Federal air quality regulations to limit the dispersal of particulate matter. A temporary increase in exhaust emissions would be expected during the project.

4.9 Hazardous, Toxic, and Radiological Waste

Potential for discovery of hazardous material during installation of the sewer trunk main was evaluated through examination of historic and current land use, review of environmental databases, and visual observations. Avoidance of HTRW during construction is desirable in order to minimize project delays, remediation costs, and environmental damage.

Lands in the project area are primarily composed of agricultural land. As such, these lands have not been subject to industrial development or other land use activities with associated potential for significant contamination. In addition, lands along the project corridor are also primarily agricultural and have a low potential for contaminant transport to the project. Accordingly, there is no reason to believe that environmental media in the project area have been significantly contaminated by past or current land practices or by releases from adjoining properties. No hazardous, toxic, or radiological waste has been observed and the potential for encountering these materials does not appear likely.

Finally, a site visit was conducted on April 3, 2006 that included a search for visual evidence of potential HTRW-related problems. This involved walking the project area as well as visual reconnaissance of surrounding areas. Areas of soil staining, evidence of unusual vegetative distress, drums of containerized waste, unusual topography (mounds or depressions), or other visual evidence of potential contamination were not noted at any location within the proposed project area.

SECTION 5.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

5.1 Social and Economic Impacts

5.1.1 Future Without-Project Conditions

Under the 'without-project' conditions, the City would continue to be in violation of its' NPDES permit requirements and the continued overflows of the sewer collection system would continue to have an adverse effect on the environment and the health of local populations. Under the existing conditions it is not possible to meet the NPDES permit conditions.

5.1.2 Future With-Project Conditions

Under 'with-project' conditions, the carrying capacity of the existing collection system would be increased and the sanitary sewer overflows during the wet weather conditions would be significantly reduced or eliminated. The reduced contamination of local streams from sewage overflows would improve public health and safety. The project is being constructed to reduce sewage overflows especially during high rainfall events so the City would be able to comply with EPA regulations and meet NPDES permit requirements.

5.2 Executive Order 12898

Increasing the carrying capacity of the collection system would have a positive economic and health effect on minorities and low-income populations.

5.3 Executive Order 13045

Increasing the carrying capacity of the collection system would have a positive effect on children's health and safety.

5.4 Natural Resources Impacts

5.4.1 Terrestrial

The proposed project would not result in the loss of any significant habitat or cause any long term adverse effects on natural environment.

5.4.2 Prime Farmland

There would be no impact on prime farmland (letter from NRCS, Appendix A).

5.4.3 Aquatic and Wetlands

By upgrading/replacing the sewer lines, there will be a positive impact on aquatic habitat and wetlands due to the improvement of water quality through the reduction of sewage contamination.

**Table 5.0
Impact Assessment Matrix**

Name of Parameter	Magnitude of Probable Impact						
	Increasing Beneficial Impact			No Appreciable Effect	Increasing Adverse Impact		
	Significant	Substantial	Minor		Minor	Substantial	Significant
A. Social Effects							
1. Noise Levels				X			
2. Aesthetic Values				X			
3. Recreational Opportunities				X			
4. Transportation				X			
5. Public Health and Safety		X					
6. Community Cohesion (Sense of Unity)			X				
7. Community Growth and Development			X				
8. Business and Home Relocations				X			
9. Existing/Potential Land Use				X			
10. Controversy				X			
B. Economic Effects							
1. Property Values			X				
2. Tax Revenues				X			
3. Public Facilities and Services				X			
4. Regional Growth			X				
5. Employment				X			
6. Business Activity				X			
7. Farmland/Food Supply				X			
8. Flooding Effect			X				
C. Natural Resource Effects							
1. Air Quality				X			
2. Terrestrial Habitat				X			
3. Public Facilities and Services			X				
4. Aquatic Habitat			X				
5. Habitat Diversity and Interspersion				X			
6. Biological Productivity			X				
7. Surface Water Quality		X					
8. Water Supply			X				
9. Groundwater				X			
10. Soils				X			
11. Threatened and Endangered Species				X			
D. Cultural Resources Effects							
1. Historic Architectural Values				X			
2. Pre-Historic & Historic Archeological Values				X			

5.4.4 Wildlife

Wildlife habitat is very limited along the construction route. Temporary disturbance would occur during construction of the sewer main but the disturbance would be minor and short term. There would be no long term negative affect on wildlife.

5.4.5 Wetlands and Water Quality Permits

Topographic maps published by the United States Geological Survey (7.5 minute series) indicate that the proposed South Wolf Creek Interceptor crosses jurisdictional waters of the United States at ten (10) locations. The City of Lawton plans to cross each of these locations through directional boring. No dredged or fill material will be placed, permanently or temporarily, into any "waters of the United States," including jurisdictional wetlands. Since the project does not involve the placement of dredge or fill material into regulated waters of the United States a Department of the Army permit pursuant to Section 404 of the Clean Water Act is not required (Appendix B).

5.5 Threatened and Endangered Species

There would be no impact on endangered species.

5.6 Cultural Resources

As outlined in Section 4.6 of this report, Section 106 coordination (National Historic Preservation Act of 1966, as amended) is complete. The proposed project will have no effect on historic properties.

5.7 Water Quality

By upgrading/replacing the sewer lines, there will be a substantial improvement in surface water quality.

5.8 Air Quality

Construction activity would have a minor temporary impact on air quality caused by heavy equipment operation and from fugitive dust (particulate) emissions in and around the project site. Contractors will comply with all appropriate Federal air quality regulations to limit the dispersal of particulate matter. A temporary increase in exhaust emissions would be expected during the project.

5.9 Hazardous, Toxic, and Radiological Waste

Based on the findings of the HTRW survey discussed in Section 4.8, the potential for discovery and significant problems related to HTRW during project construction or operation is believed to be low.

5.10 Noise

There would be an increase in noise from heavy equipment during the project, but this would be temporary and last only during the construction period.

5.11 Cumulative Impacts

No cumulative negative impacts are anticipated to occur as a result of the proposed project

SECTION 6.0 RESTORATION PLAN

The proposed project would be located in utility easements adjacent to existing outfall lines. Appropriate measures would be taken to control dust and noise during the construction phase. There would be no blasting or burning, or the use of herbicides or defoliants on this project. All soil and vegetation that must be disposed of will be disposed of only in approved areas outside the regulated floodplain.

During the construction process, adequate measures will be taken to minimize erosion and to protect area water courses from siltation and sedimentation. Vegetation removal will be kept at a minimum and complete restoration will occur upon completion of construction.

Following project completion all agricultural areas with compacted, disturbed, or exposed soil will be disked, fertilized, and returned to existing conditions (cropland or pasture). Areas outside croplands will be seeded with a native grass/forb mixture including side-oats grama, buffalograss, Tobosa, big bluestem, indiagrass and switchgrass. This is a mixture of grasses that are native to the area. Application rates for soil amendments (lime and fertilizer) will be determined by soil tests. Mulch will be applied as necessary, particularly on slopes and erodible soils (See Appendix E).

SECTION 7.0 FEDERAL, STATE, AND LOCAL AGENCY COORDINATION

The draft environmental assessment (EA) was coordinated with the following agencies having legislative and administrative responsibilities for environmental protection. A copy of the correspondence from those agencies that replied is in Appendix A. Each of these agencies is on the mailing list to review the draft EA during the public comment period.

Bureau of Indian Affairs
Federal Emergency Management Agency
Museum of Great Plains
Natural Resources Conservation Service
National Park Service
Oklahoma Department of Environmental Quality
Oklahoma Department of Tourism & Recreation
Oklahoma Historical Society
Oklahoma Water Resources Board
Southwestern Oklahoma Development Authority
Oklahoma Archeological Survey
U. S. Army Corps of Engineers
U. S. Fish and Wildlife Service

SECTION 8.0 REFERENCES

Biggs and Mathews, Byrd Forbes and CH2M Hill, Inc. *Sewer System Evaluation Study Report for Wastewater Collection System Improvements, Volume 1*. City of Lawton. April 1997.

Oklahoma Biological Survey. Website. www.biosurvey.ou.edu/

Oklahoma Climatological Survey. Website www.ocs.ou.edu/

Oklahoma Geological Survey. Website. www.ogs.ou.edu/

Soil Conservation Service. 1983. *Soil Survey of Comanche County, Oklahoma*. USDA, Stillwater, Oklahoma. p55-56.

Soil Conservation Service. 1983. *Soil Survey Legends for Prime Farmland Soils, Oklahoma*. USDA, Stillwater, Oklahoma. 185p.

U.S. Bureau of Census. 201. *2000 Census of Population and Housing, STF3*. www.census.gov/

U. S. Environmental Protection Agency. CERCLIS Database. Website www.epa.gov/superfund/sites/cursites

U. S. Environmental Protection Agency. Enforcement & Compliance History Online (ECHO).
Website. www.epa.gov/echo/

U. S. Environmental Protection Agency. Western Ecology Division, Corvallis, OR.
Ecoregions of Oklahoma. Website. www.epa.gov/wed/pages/ecoregions/ok_eco.htm

SECTION 9.0 APPLICABLE ENVIRONMENTAL LAWS AND REGULATION

Archeological and Historic Preservation Act, 1974, as amended, 16 U.S.C. 469, et seq
Clean Air act, as amended, 42 U.S.C. 7609, et seq
Clean Water Act, 1977, as amended (Federal Water Pollution Control Act, 33 U.S.C. 1251, et seq
Endangered Species act. 1973, as amended, 16 U.S.C. 1531, et seq
Environmental Justice (E.O. 12898)
Farmland Protection Policy Act, 7 U.S.C. 4201, et seq
Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1-12, et seq
Fish and Wildlife Coordination Act as amended, 16 U.S.C. 661, et seq.
Floodplain Management (E.O. 11988)
Invasive Species (E.O. 13112)
Land and Water Conservation Fund Act, 1965, as amended, 16 U.S.C. 4601, et seq
National Historic Preservation Act, 1966, as amended, 16 U.S.C. 4601, et seq
National Environmental Policy Act as amended, 42 U.S.C. 4321, et seq
Native American Graves Protection and Repatriation Act, 1990, 25 U.S.C. 3001-13, et seq
Protection of Children from Environmental Health Risks and Safety Risks (E.O. 13045)
Protection of Wetlands (E.O. 11990)
Rivers and Harbors Act, 33 U.S.C. 401, et seq
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq
Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, et seq
Water Resources Planning Act, 1965

Note: Full Compliance - Having met all requirements of the statutes, Executive Orders, or environmental requirements for the current state of planning.

SECTION 10.0 LIST OF PREPARERS

The following personnel contributed to the preparation of this document:

Willie R. Whisenhunt - Assistant Director of Sewer Rehab - City of Lawton, Oklahoma

Roger L. Bridges, P.E. - Civil Engineer - City of Lawton, Oklahoma

Pratap Ganti. P.E. – Civil Engineer – City of Lawton, Oklahoma

Kenneth L. Shingleton, Jr. – Archaeologist; 7 years U.S. Army Engineer District, St. Louis; 6 years U.S. Army Engineer District, Tulsa.

Jerry C. Sturdy – Biologist; 3 years U.S. Fish and Wildlife Service; 8 years U.S. Army Garrison, Fort Chaffee, Arkansas; 26 years U.S. Army Engineer Districts, Tulsa and Fort Worth.

APPENDIX A
COORDINATION/CORRESPONDENCE

**Mailing List for City of Lawton, Oklahoma
South Wolf Creek Expansion/Upgrade Project
Environmental Assessment**

U. S. Senator Jim Inhofe
1924 S. Utica, Suite 530
Tulsa, OK 74104-6511

U. S. Senator Tom Coburn
1800 South Baltimore, Suite 800
Tulsa, OK 74119

U. S. Representative Tom Cole
711 S. W. D Ave., Ste. 201
Lawton, OK 73501

Senator Don Barrington
4506 N. E. Highlander Circle
Lawton, OK 73105

Representative Don Armes
10506 Southwest Tinney Road
Faxon, OK 73540

Mr. Richard E. Greene
Federal Region IV Administrator
Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202

Mr. Steve Thompson
Executive Director
Oklahoma Department of Environmental Quality
P.O. Box 1677
Oklahoma City, OK 73101-1677

Dr. Robert L. Brooks
University of Oklahoma
Oklahoma Archeological Survey
111 E. Chesapeake
Norman, OK 73019-0575

Dr. Bob L. Blackburn
State Historic Preservation Officer
Oklahoma Historical Society
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Oklahoma City, OK 73105

Mr. Gary Gorshing
Executive Director
Southwestern Oklahoma Development Authority
P. O. Box 569
Burns Flat, OK 73624

Mr. Duane A. Smith, Executive Director
Oklahoma Water Resources Board
3800 N. Classen Blvd.
Oklahoma City, OK 73118

Mr. Ron L. Hilliard
State Conservationist
USDA NRCS
100 USDA, Suite 206
Stillwater, OK 74074-2655

Mr. Jerry Brabander, Field Supervisor
U.S. Fish & Wildlife Service
9014 E. 21st Street
Tulsa, OK 74129

Mr. Greg D. Duffy, Director
Oklahoma Dept. of Wildlife Conservation
P.O. Box 53465
Oklahoma City, OK 73105

Mr. Alonzo Chalepah, Chairperson
Apache Tribe of Oklahoma;
P.O. Box 1220
Anadarko, OK 73005

Mr. LaRu Parker, Chairperson
Caddo Indian Tribe of Oklahoma
P.O. Box 487
Binger, OK 73009

Mr. Darrell Flyingman, Chairperson
Cheyenne-Arapaho Tribes of Oklahoma
P.O. Box 38
Concho, OK 73022

Mr. Bill Anoatubby, Governor
Chickasaw Nation, Oklahoma
P.O. Box 1548
Ada, OK 74821

Mr. Gregory E. Pyle, Chief
Choctaw Nation of Oklahoma
P.O. Drawer 1210
16th & Locust Street
Durant, OK 74702

Mr. Wallace Coffey, Chairperson
Comanche Nation, Oklahoma
P.O. Box 908
Lawton, OK 73502

Mr. Kerry Holton, President
Delaware Nation, Oklahoma
P.O. Box 825
Anadarko, OK 73005

Mr. Jeff Houser, Chairperson
Fort Sill Apache Tribe of Oklahoma
Route 2, Box 121
Apache, OK 73006

Mr. Billy E. Horse, Chairman
Kiowa Indian Tribe of Oklahoma
P.O. Box 369
Carnegie, OK 73015

Mr. Gary McAdams, President
Wichita and Affiliated Tribes, Oklahoma
P.O. Box 729
Anadarko, OK 73005

Roxane Runkel
National Park Service
Intermountain Regional Office
Planning & Environmental Quality
12795 W. Alameda Parkway
Lakewood, CO 80228

Mr. Hardy Watkins, Executive Director
Oklahoma Department of Tourism and
Recreation
P. O. Box 52002
Oklahoma City, OK 73105

Mr. John Hernandez, Director
Museum of the Great Plains
P. O. Box 68
Lawton, OK 73501

U.S. Army Corps of Engineers
Tulsa District
Attn: CESWT-PE-E (Nolen)
1645 S. 101 East Ave.
Tulsa, OK 74128-4609

Mr. Donald Fairley
FEMA Regional Environmental Officer
FEMA Region VI
FRC 800 North Loop 288
Denton, TX 76209

Mr. Dan Deerinwater
Regional Director
Southern Plains Regional Office
Bureau of Indian Affairs
P. O. Box 368
Anadarko, OK 73005

Mr. Jerry Ihler
Director of Public Works
City of Lawton
2100 SW 6th Street
Lawton, OK 73501

Mr. David Snider, Director
Lawton Public Library
110 SW 4th Street
Lawton, OK 73501



City of Lawton

Sewer Construction Division

Mailing Address: 103 Southwest 4th Street
Lawton, Oklahoma 73501
Telephone: (580) 581-3405

Shipping Address: 2100 South 6th Street
Lawton, Oklahoma 73501
Fax: (580) 581-3407

May 10, 2005

Southwestern Oklahoma Development Authority
P.O. Box 569
Burns Flat, Oklahoma 73624

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

To Whom It May Concern:

The City of Lawton is in the preliminary design phase of the SOUTH WOLF CREEK EXPANSION/UPGRADE project, which will parallel or modify the existing sanitary sewer lines that were installed in the mid 1970s. This project is being funded by a federal grant and administered by the U.S. Army Corps of Engineers, who requires that the City of Lawton contact potentially interested agencies concerning this project.

The City of Lawton is in the process of complying with an Oklahoma Department of Environmental Quality (ODEQ) mandate to update its sewer system throughout the city. A Sewer System Evaluation Study was completed in 1997. This study identified numerous sewer lines throughout the city that must be either upgraded or replaced. This document will cover the SOUTH WOLF CREEK EXPANSION/UPGRADE project.

Exhibit "A" contains the planning area map that shows the location of the proposed project.

The City of Lawton has scheduled a public hearing to address any issues that the public may have. The public hearing had been scheduled for July 12, 2005 at 6:00 p.m. in the City Council Chambers, City Hall, 103 SW 4th Street, Lawton, Oklahoma.

We would like to know if your office has any information that would significantly affect our project.

If you have any questions concerning this matter, please contact Roger Bridges or Tony Burrow with the Sewer System Technical Division, City of Lawton at (580) 581-3324. Your timely response will be appreciated.

Sincerely,

A handwritten signature in cursive script that reads "Roger L. Bridges".

Roger L. Bridges, PE
SSTD Civil Engineer

Enclosure (1)



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~~May 10, 2005~~

Planning Branch

~~U.S. ARMY CORPS OF ENGINEERS~~

TULSA DISTRICT

ATTN:CESWT-PE-P

1645 S. 101 East Avenue

Tulsa, Oklahoma 74128-4609

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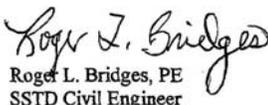
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May 10, 2005

State Conservationist
Natural Resources Conservation Service
Oklahoma State Office
100 USDA, Suite 206
Stillwater, Oklahoma 74074-2655

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May 10, 2005

U.S. Dept. of Interior
Fish & Wildlife Service
Ecological Services
222 South Houston, Suite A
Tulsa, Oklahoma 74127

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May 10, 2005

Federal Emergency Management Agency
Region IV, Mitigation Division
Federal Regional Center
800 North Loop 288
Denton, Texas 76209

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May 10, 2005

Oklahoma Department of Environmental Quality
Margaret M. Graham
Environmental Review Coordinator
P.O. Box 1677
Oklahoma City, Oklahoma 73101-1677

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Mailing Address: 103 Southwest 4th Street
Lawton, Oklahoma 73501
Telephone: (580) 581-3405

Shipping Address: 2100 South 6th Street
Lawton, Oklahoma 73501
Fax: (580) 581-3407

May 10, 2005

Association of South Central Oklahoma Governments
P.O. Box 1647
Duncan, Oklahoma 73534

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

To Whom It May Concern:

The City of Lawton is in the preliminary design phase of the SOUTH WOLF CREEK EXPANSION/UPGRADE project, which will parallel or modify the existing sanitary sewer lines that were installed in the mid 1970s. This project is being funded by a federal grant and administered by the U.S. Army Corps of Engineers, who requires that the City of Lawton contact potentially interested agencies concerning this project.

The City of Lawton is in the process of complying with an Oklahoma Department of Environmental Quality (ODEQ) mandate to update its sewer system throughout the city. A Sewer System Evaluation Study was completed in 1997. This study identified numerous sewer lines throughout the city that must be either upgraded or replaced. This document will cover the SOUTH WOLF CREEK EXPANSION/UPGRADE project.

Exhibit "A" contains the planning area map that shows the location of the proposed project.

The City of Lawton has scheduled a public hearing to address any issues that the public may have. The public hearing had been scheduled for July 12, 2005 at 6:00 p.m. in the City Council Chambers, City Hall, 103 SW 4th Street, Lawton, Oklahoma.

We would like to know if your office has any information that would significantly affect our project.

If you have any questions concerning this matter, please contact Roger Bridges or Tony Burrow with the Sewer System Technical Division, City of Lawton at (580) 581-3324. Your timely response will be appreciated.

Sincerely,

A handwritten signature in cursive script that reads "Roger L. Bridges".

Roger L. Bridges, PE
SSTD Civil Engineer

Enclosure (1)

mergeletters.doc

05/10/05



City of Lawton

Sewer Construction Division

Mailing Address: 103 Southwest 4th Street
Lawton, Oklahoma 73501
Telephone: (580) 581-3405

Shipping Address: 2100 South 6th Street
Lawton, Oklahoma 73501
Fax: (580) 581-3407

~~May 10, 2005~~

Planning Branch

~~U.S. ARMY CORPS OF ENGINEERS~~

TULSA DISTRICT

ATTN:CESWT-PE-P

1645 S. 101 East Avenue

Tulsa, Oklahoma 74128-4609

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

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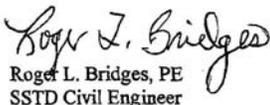
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Roger L. Bridges, PE
SSTD Civil Engineer

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City of Lawton

Sewer Construction Division

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Lawton, Oklahoma 73501
Telephone: (580) 581-3405

Shipping Address: 2100 South 6th Street
Lawton, Oklahoma 73501
Fax: (580) 581-3407

May 10, 2005

State Conservationist
Natural Resources Conservation Service
Oklahoma State Office
100 USDA, Suite 206
Stillwater, Oklahoma 74074-2655

**RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma**

To Whom It May Concern:

The City of Lawton is in the preliminary design phase of the SOUTH WOLF CREEK EXPANSION/UPGRADE project, which will parallel or modify the existing sanitary sewer lines that were installed in the mid 1970s. This project is being funded by a federal grant and administered by the U.S. Army Corps of Engineers, who requires that the City of Lawton contact potentially interested agencies concerning this project.

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Roger L. Bridges, PE
SSTD Civil Engineer

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City of Lawton

Sewer Construction Division

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Lawton, Oklahoma 73501
Telephone: (580) 581-3405

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Lawton, Oklahoma 73501
Fax: (580) 581-3407

May 10, 2005

Federal Emergency Management Agency
Region IV, Mitigation Division
Federal Regional Center
800 North Loop 288
Denton, Texas 76209

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

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Roger L. Bridges, PE
SSTD Civil Engineer

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City of Lawton

Sewer Construction Division

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Lawton, Oklahoma 73501
Telephone: (580) 581-3405

Shipping Address: 2100 South 6th Street
Lawton, Oklahoma 73501
Fax: (580) 581-3407

May 10, 2005

Water Management Division
Oklahoma Water Resources Board
3800 N. Classen Blvd.
Oklahoma City, Oklahoma 73118

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

To Whom It May Concern:

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Roger L. Bridges, PE
SSTD Civil Engineer

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05/10/05



City of Lawton

Sewer Construction Division

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Lawton, Oklahoma 73501
Telephone: (580) 581-3405

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Lawton, Oklahoma 73501
Fax: (580) 581-3407

May 10, 2005

Oklahoma Department of Tourism and Recreation
State Liaison Officer
Land and Water Conservation Division
P.O. Box 52002
Oklahoma City, Oklahoma 73105

**RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma**

To Whom It May Concern:

The City of Lawton is in the preliminary design phase of the SOUTH WOLF CREEK EXPANSION/UPGRADE project, which will parallel or modify the existing sanitary sewer lines that were installed in the mid 1970s. This project is being funded by a federal grant and administered by the U.S. Army Corps of Engineers, who requires that the City of Lawton contact potentially interested agencies concerning this project.

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Sincerely,

A handwritten signature in cursive script that reads "Roger L. Bridges".

Roger L. Bridges, PE
SSTD Civil Engineer

Enclosure (1)

mergeletters.doc

05/10/05



United States
Department of
Agriculture

Natural
Resources
Conservation
Service

Lawton Field Office
1606 NW Lawton
Lawton, Ok 73504
(580)353-1564

Roger L. Bridges, PE
City of Lawton
103 Southwest 4th St.
Lawton, OK 73501

July 10, 2005

Dear Sirs:

Our office has checked the proposed construction of the SOUTH WOLF CREEK EXPANSION/UPGRADE project. The soils associated are predominantly listed as a FtB, Foard and Tillman soils, 1-3% slopes, and are not listed as Prime Farmland and are NOT SUBJECT to the Prime Farmland Protection Policy Act.

The area is not listed as any potential wetlands. Our office does not make floodplain determinations. I would recommend, should you have flooding concerns, to contact the Comanche County Floodplain Board for further information.

Should you need further assistance, please feel free to contact me at 580-353-1564, ext. 3.

Sincerely,

J. Kirk Schreiner
District Conservationist

The Natural Resources Conservation Service works hand-in-hand with the American people to conserve natural resources on private lands.

AN EQUAL OPPORTUNITY EMPLOYER



DEPARTMENT OF ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

June 8, 2005

Planning, Environmental, and Regulatory Division
Planning Branch

Mr. Roger L. Bridges, P.E.
City of Lawton
103 Southwest 4th Street
Lawton, OK 73501

Dear Mr. Bridges:

This is in response to your May 10, 2005, letter requesting comments for the proposed South Wolf Creek expansion in Lawton, Oklahoma. The project consists of either replacing or repairing the existing trunk line and will follow the existing line.

The current flood plain maps for Lawton indicate the project will lie within the 100-year flood plain and/or flood way of Wolf Creek and its tributaries. The actual underground pipeline would have no adverse effect on the flood plains. However, if there are any other activities, such as temporary fill, this must be done in a manner that would not adversely effect flooding. All susceptible components must be protected from the 100-year flood plain. All of this project should be completed so that there is no significant increase in flood hazard and must comply with all local, State, and Federal flood plain ordinances.

If you have questions, please call me at 918-669-7197.

Sincerely,


Joseph R. Remondini, P.E., CFM
Project Manager
Flood Plain Management Services



City of Lawton

Sewer Construction Division

Mailing Address: 103 Southwest 4th Street
Lawton, Oklahoma 73501
Telephone: (580) 581-3405

Shipping Address: 2100 South 6th Street
Lawton, Oklahoma 73501
Fax: (580) 581-3407

May 10, 2005

Oklahoma Department of Tourism and Recreation
State Liaison Officer
Land and Water Conservation Division
P.O. Box 52002
Oklahoma City, Oklahoma 73105

**RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma**

To Whom It May Concern:

The City of Lawton is in the preliminary design phase of the SOUTH WOLF CREEK EXPANSION/UPGRADE project, which will parallel or modify the existing sanitary sewer lines that were installed in the mid 1970s. This project is being funded by a federal grant and administered by the U.S. Army Corps of Engineers, who requires that the City of Lawton contact potentially interested agencies concerning this project.

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If you have any questions concerning this matter, please contact Roger Bridges or Tony Burrow with the Sewer System Technical Division, City of Lawton at (580) 581-3324. Your timely response will be appreciated.

Sincerely,

Roger L. Bridges, PE
SSTD Civil Engineer

Enclosure (1)

This proposed project will have no adverse impact on any federally funded park or recreation area or state park.

Susan Selig
Director, Division of Planning & Development
Oklahoma Tourism & Recreation Department

mzgriemem.doc

05/10/05

TOTAL P.02



STEVEN A. THOMPSON
Executive Director

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

BRAD HENRY
Governor

November 28, 2005

Roger L. Bridges
Sewer Construction Division
City of Lawton
103 Southwest 4th Street
Lawton, OK 73501

Dear Mr. Bridges:

RE: City of Lawton - South Wolf Creek Expansion/Upgrade Project

We have completed a preliminary review of the above referenced project with regard to water quality, air quality, solid waste and hazardous waste. At this time, we have no objection regarding this project and only offer the following guidelines:

- a) The proposed project should not result in any adverse effects to the water quality or environment if the design and construction of the new improvements are in accordance with State design guidelines or standards.
- b) Prior to beginning any construction, a determination should be made as to whether an Oklahoma Pollutant Discharge Elimination System (OPDES) permit for the storm water runoff is required during the construction phase.
- c) During any construction, reasonable precautions should be taken to protect air quality by minimizing fugitive dust emissions.

If you have any questions or need clarification, please do not hesitate to contact me at 405/702-9122 or 1/800-869-1400.

Sincerely,

Margaret M. Graham
Environmental Review Coordinator
CUSTOMER ASSISTANCE PROGRAM

707 NORTH ROBINSON, P.O. BOX 1677, OKLAHOMA CITY, OKLAHOMA 73101-1677

printed on recycled paper with soy ink





City of Lawton

Sewer Construction Division

Mailing Address: 103 Southwest 4th Street
Lawton, Oklahoma 73501
Telephone: (580) 581-3405

Shipping Address: 2100 South 6th Street
Lawton, Oklahoma 73501
Fax: (580) 581-3407

October 21, 2005

National Park Services
Roxane Runkel
Intermountain Reg Office
Planning & Environmental Quality
12795 W Alameda Parkway
Lakewood, Colorado 80228

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

To Whom It May Concern:

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Exhibit "A" contains the planning area map that shows the location of the proposed project.

The City of Lawton had a public hearing on July 12, 2005 at 6:00 p.m. in the City Council Chambers, City Hall, 103 SW 4th Street, Lawton, Oklahoma.

We would like to know if your office has any information that would significantly affect our project.

If you have any questions concerning this matter, please contact Roger Bridges with the Sewer System Technical Division, City of Lawton at (580) 581-3324. Your timely response will be appreciated.

Sincerely,

Roger L. Bridges, PE
SSTD Civil Engineer

Enclosure (1)



The National Park Service reviewed this project, and determined that no parks will be affected; therefore, we have no comments.

Signed: Cheryl Eckhardt Date: 10/27/05



City of Lawton Sewer Construction Division

No Tails

E-mail: cityoflawton.ok.us
Telephone 580-581-3405
Fax 580-581-3407

Mailing Address: 103 Southwest 4th Street
Shipping Address: 2100 South 6th Street
Lawton, Oklahoma 73501

October 21, 2005

US Department of Interior
Fish and Wildlife Services
Ecological Services
222 South Houston, Suite A
Tulsa, Oklahoma 74127

Re: The South Wolf Creek Expansion/Upgrade Lawton, Oklahoma

To Whom It May Concern:

Attached are copies of our letter to you dated May 10, 2005 with maps showing the location of the proposed project, requesting a response from your office on any information that would significantly affect our project. Since we have not received any such response, ODEQ and OWRB have required us to request your comments again so that we can proceed with the environmental review necessary for this project.

Please send response at your earliest convenience to Roger Bridges at City of Lawton, Public Works, 103 SW 4th Street, Lawton, Oklahoma 73501.

Sincerely,
Roger L. Bridges
Roger L. Bridges, P.E.
SSTD Engineer

Enclosure

NO OBJECTION FINDING
The U.S. Fish and Wildlife Service does not object to implementation of the described action.
Date 9-19-06
Approved by *[Signature]*
U.S. FISH AND WILDLIFE SERVICE, TULSA, OK

PHONE MESSAGE		DATE 5-16-05	TIME 4:09	AM PM
FOR	Bubley			
M	of Rodney-Ascoy			
OF	Duncan			
PHONE ()				EXT.
<input type="checkbox"/> FAX	<input type="checkbox"/> MOBILE	<input type="checkbox"/> PAGER ()		
MESSAGE	Concerning Wolf Creek Upgrade.			
	Said take Ascoy off your list, they cant do anything.			
	SIGNED			SOT

- URGENT
- PHONED
- RETURNED YOUR CALL
- PLEASE CALL BACK
- WILL CALL AGAIN
- WAS IN
- WANTS TO SEE YOU



FEMA

*South Wolf Creek
Exp Upgrade*

FEDERAL EMERGENCY MANAGEMENT AGENCY
REGION VI
MITIGATION DIVISION

PUBLIC NOTICE REVIEW

We have no comments to offer We offer the following comments

WE WOULD REQUEST THAT THE LOCAL
FLOODPLAIN ADMINISTRATOR BE CONTACTED FOR
THE REVIEW AND POSSIBLE PERMIT REQUIREMENTS
FOR THIS PROJECT

*Busy
was plan
to plan
5/31/05*

*SENT TO
D.J. @ planning
5/26/05 busy*

REVIEWER

John Mc

DATE

5-19-05

APPENDIX B
SECTION 404 PERMIT



City of Lawton

Sewer Construction Division

E-mail: cityoflawton.ok.us
Telephone 580-581-3405
Fax 580-581-3407

Mailing Address: 103 Southwest 4th Street
Shipping Address: 2100 South 6th Street
Lawton, Oklahoma 73501

March 26, 2007

David A. Manning
Chief Regulatory Branch
Department of the Army
Corps of Engineers
1645 South 101st East Avenue
Tulsa, Oklahoma 74120-4609

RE: City of Lawton Environmental Assessment
South Wolf Creek Expansion/Upgrade Project

Dear Mr. Manning;

The City of Lawton received comments from the Corp of Engineers regarding the EA for the above project and is in the process of addressing them. However, the project has not commenced or been contracted. The Nationwide Permit (NWP) issued to the City of Lawton expired on March 19, 2007. Therefore, the City of Lawton requests the Corp of Engineers to issue a new 404 authorization for this project.

If you have any questions or need clarification, please do not hesitate to contact me at 580-581-3324.

Sincerely,

A handwritten signature in blue ink, appearing to read "Pratap Ganti", is written over a horizontal line.

Pratap Ganti, P.E.
Civil Engineer



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

June 2, 2005

Planning, Environmental, and Regulatory Division
Regulatory Branch

Mr. Roger L. Bridges, P.E.
City of Lawton
Sewer Construction Division
103 Southwest 4th Street
Lawton, OK 73501

Dear Mr. Bridges:

Please reference your letter of May 10, 2005, regarding the expansion of the South Wolf Creek sanitary sewer line. The proposed project is west and south of the Lawton Airport in Comanche County. We have reviewed the submitted data relative to Section 404 of the Clean Water Act.

Placement of dredged or fill material in the tributaries to Cache Creek associated with the proposed project falls within the scope of the enclosed Nationwide Permit (NWP) for Utility Line Activities, provided the conditions therein are met.

Please complete and return the enclosed "Permittee Construction Schedule" Form. Following completion of your activity, you must return the enclosed "Permittee Compliance Certification" Form. This is the certification referred to in General Condition 14 of the NWP.

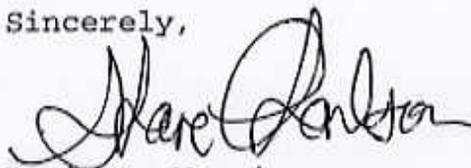
In reviewing this proposed activity, we have determined that the proposed action will have no known effect on Federally-listed endangered or threatened species or habitat critical for the survival of such species.

The issuance of NWP authorization for this project is based on an approved jurisdictional determination (JD). The affected streams are tributaries to Cache Creek which is a tributary to navigable waters. This approved JD is subject to an optional Administrative Appeal Process (AAP). Enclosed is a copy of the "Notification of Appeal Options and Process and Request for Appeal" form. You may appeal this determination in accordance with the instructions provided on the form. If you choose to file an appeal, no work may begin in waters of the United States or in a manner which could alter the hydrology of waters of the United States until the appeal process is concluded. Otherwise, no action is required on your part with regard to the appeal process. The NWP terms and conditions are not subject to appeal. However, if you do not agree to the terms and conditions of this NWP, you have the option to apply for an individual permit for your proposed activity.

This NWP is scheduled to expire on March 19, 2007. This verification is valid until that date. It is incumbent on you to remain informed of changes to the NWPs. The Corps will issue a public notice announcing the changes as they occur. Furthermore, if you commence, or are under contract to commence, the activity before the date the NWP is modified or revoked, you will have 12 months from the date of the modification or revocation to complete the activity under the present terms and conditions of this NWP.

Your permit has been assigned Identification Number 14607. Please reference this number during any future correspondence. If you have any questions regarding the AAP, or you cannot comply with the conditions listed in the enclosed permit, contact Mr. Shane Charlson at 918-669-7395.

Sincerely,



David A. Manning
Chief, Regulatory Branch

Enclosures



City of Lawton

Sewer Construction Division

Mailing Address: 103 Southwest 4th Street
Lawton, Oklahoma 73501
Telephone: (580) 581-3405

Shipping Address: 2100 South 6th Street
Lawton, Oklahoma 73501
Fax: (580) 581-3407

May 10, 2005

Regulatory Branch
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
ATTN:CESWT-PE-R
1645 S. 101 East Avenue
Tulsa, Oklahoma 74128-4609

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

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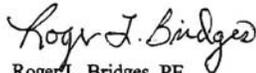
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Sincerely,


Roger L. Bridges, PE
SSTD Civil Engineer

Enclosure (1)

mergeletters.doc

05/10/05

APPENDIX C
CULTURAL RESOURCES COORDINATION



CHOCTAW NATION OF OKLAHOMA

Cultural Resources

P.O. Drawer 1210 • Durant, OK 74702-1210
1-580-924-8280 • 1-800-522-6170 • Fax: 580-920-3102

December 19, 2006

Roger L. Bridges, PE
City of Lawton
Sewer Construction Division
103 Southwest 4th Street
Lawton, Oklahoma 73501

Dear Roger L. Bridges, PE:

We have reviewed the following proposed project (s) as to its effect regarding religious and/or cultural significance to historic properties that may be affected by an undertaking of the projects area of potential effect.

Entity Requesting Service: City of Lawton, Sewer Construction Division

Project Description: The South Wolf Creek Expansion/Upgrade
Sanitary Sewer construction Project

County: Lawton, Comanche County, Oklahoma

Comments: After further review of the above mentioned project (s), it has come to our attention that the project is out of our area of interest. The Choctaw Nation of Oklahoma Tribal Historic Preservation Office defers opinion on the above historic components regarding their potential eligibility to the Caddo Nation of Oklahoma Tribal Historic Preservation Office.

Sincerely,

Terry D. Cole
Tribal Historic Preservation Officer
Choctaw Nation of Oklahoma

By: 
Caren A. Johnson
Administrative Assistant

CAJ: cp



Delaware Nation
NAGPRA/Cultural Preservation Office
P.O. Box 825, Anadarko, OK 73005
Phone: (405) 247-2448
Fax: (405) 247-9393

27 November 2006

Roger L. Bridges, PE
City Of Lawton
Sewer Construction Division
103 Southwest 4th Street
Lawton, Oklahoma 73501

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE, Sanitary Sewer Construction Project,
Lawton, Oklahoma

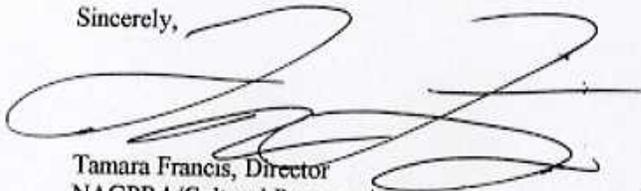
Thank you for contacting the Delaware Nation regarding the above referenced project. The Delaware Nation is committed to protecting archaeological sites that are important to tribal heritage, culture, and religion. Furthermore, the tribe is particularly concerned with archaeological sites that may contain human burial remains and associated funerary objects.

As described in your correspondence and, upon research of our database and files we find that the location of the project does not endanger known archaeological sites of interest to the Delaware Nation. Should this project inadvertently uncover an archaeological site we request that you immediately contact the appropriate state agencies, as well as the Delaware Nation. Also, we ask that you halt all construction and ground disturbing activities until the tribe and these state agencies are consulted.

Please also note that the Delaware Nation is the only Federally Recognized Delaware/Lenape entity in the United States. Consultation regarding inadvertent discoveries should be made only with the Delaware Nation designated NAGPRA/Cultural Preservation staff, located in Anadarko, OK.

We appreciate your cooperation in contacting the Delaware Nation. Should you have any questions, feel free to contact me at (405) 247-2448 or by email tfrancis@thedelawarenation-nsn.gov.

Sincerely,



Tamara Francis, Director
NAGPRA/Cultural Preservation



Oklahoma Historical Society

Founded May 27, 1893

State Historic Preservation Office

Oklahoma History Center • 2401 North Laird Ave. • Oklahoma City, OK 73105-7914
(405) 521-6249 • Fax (405) 522-0816 • www.okhistory.org/shpo/shpom.htm

November 16, 2006

Mr. Pratap Ganti
City of Lawton
103 Southwest 4th Street
Lawton, OK 73501

RE: File #0243-07; Lawton South Wolf Creek Sanitary Sewer Project

Dear Mr. Ganti:

We have received and reviewed the documentation concerning the referenced project in Comanche 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 historic properties affected by the referenced project.

Thank you for the opportunity to comment on this project. We look forward to working with you in the future.

If you have any questions, please contact Charles Wallis, RPA, Historical Archaeologist, at 405/521-6381.

Should further correspondence pertaining to this project be necessary, the above underlined file number must be referenced. Thank you.

Sincerely,

Melvena Heisch
Deputy State Historic
Preservation Officer

MH:kb



City of Lawton

Sewer Construction Division

Mailing Address: 103 Southwest 4th Street
Lawton, Oklahoma 73501
Telephone: (580) 581-3405

Shipping Address: 2100 South 6th Street
Lawton, Oklahoma 73501
Fax: (580) 581-3407

November 13, 2006

Mr. Gary McAdams, President
Wichita And Affiliated Tribes, Oklahoma
PO Box 729
Anadarko, OK 73005

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

To Whom It May Concern:

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Exhibit "A" contains the planning area map that shows the location of the proposed project.

The City of Lawton had a public hearing on July 12, 2005 at 6:00 p.m. in the City Council Chambers, City Hall, 103 SW 4th Street, Lawton, Oklahoma.

We would like to know if your office has any information that would significantly affect our project.

If you have any questions concerning this matter, please contact Roger Bridges with the Sewer System Technical Division, City of Lawton at (580) 581-3324. Your timely response will be appreciated.

Sincerely,

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Roger L. Bridges, PE
SSTD Civil Engineer

Enclosure (1)

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November 13, 2006

Mr. Alonzo Chalepah, Chairperson
Apache Tribe of Oklahoma
PO Box 1220
Anadarko, OK 73005

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

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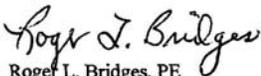
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November 13, 2006

Mr. LaRu Parker, Chairperson
Caddo Indian Tribe of Oklahoma
PO Box 487
Binger, OK 73009

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Sanitary Sewer Construction Project, Lawton, Oklahoma

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November 13, 2006

Mr. Darrell Flyingman, Chairperson
Cheyenne-Arapaho Tribes of Oklahoma
PO Box 38
Concho, OK 73022

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

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November 13, 2006

Mr. Bill Anoatubby, Governor
Chickasaw Nation, Oklahoma
PO Box 1548
Ada, OK 74821

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

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November 13, 2006

Mr. Gregory E. Pyle, Chief
Choctaw Nation of Oklahoma
PO Drawer 1210
16th & Locust Street
Durant, OK 74702

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

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November 13, 2006

Mr. Wallace Coffey, Chairperson
Comanche Nation, Oklahoma
PO Box 908
Lawton, OK 73502

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
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November 13, 2006

Mr. Edgar Francis, President
Delaware Nation, Oklahoma
PO Box 825
Anadarko, OK 73005

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Lawton, Oklahoma 73501
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November 13, 2006

Mr. Jeff Houser, Chairperson
Fort Sill Apache Tribe of Oklahoma
Rt 2 Box 121
Apache, OK 73006

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

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November 13, 2006

Mr. Clifford McKenzie, Chairperson
Kiowa Indian Tribe of Oklahoma
PO Box 369
Carnegie, OK 73015

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

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Mr. Bill Anoatubby, Governor
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Ada, OK 74821

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Comanche Nation, Oklahoma
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Lawton, OK 73502

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Delaware Nation, Oklahoma
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Anadarko, OK 73005

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Sanitary Sewer Construction Project, Lawton, Oklahoma

To Whom It May Concern:

The City of Lawton is in the preliminary design phase of the SOUTH WOLF CREEK EXPANSION/UPGRADE project, which will parallel or modify the existing sanitary sewer lines that were installed in the mid 1970s. This project is being funded by a federal grant and administered by the U.S. Army Corps of Engineers, who requires that the City of Lawton contact potentially interested agencies concerning this project.

The City of Lawton is in the process of complying with an Oklahoma Department of Environmental Quality (ODEQ) mandate to update it's sewer system throughout the city. A Sewer System Evaluation Study was completed in 1997. This study identified numerous sewer lines throughout the city that must be either upgraded or replaced. This document will cover the SOUTH WOLF CREEK EXPANSION/UPGRADE project.

Exhibit "A" contains the planning area map that shows the location of the proposed project.

The City of Lawton had a public hearing on July 12, 2005 at 6:00 p.m. in the City Council Chambers, City Hall, 103 SW 4th Street, Lawton, Oklahoma.

We would like to know if your office has any information that would significantly affect our project.

If you have any questions concerning this matter, please contact Roger Bridges with the Sewer System Technical Division, City of Lawton at (580) 581-3324. Your timely response will be appreciated.

Sincerely,

A handwritten signature in cursive script that reads "Roger L. Bridges".

Roger L. Bridges, PE
SSTD Civil Engineer

Enclosure (1)

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11/13/06



City of Lawton

Sewer Construction Division

Mailing Address: 103 Southwest 4th Street
Lawton, Oklahoma 73501
Telephone: (580) 581-3405

Shipping Address: 2100 South 6th Street
Lawton, Oklahoma 73501
Fax: (580) 581-3407

November 13, 2006

Mr. Jeff Houser, Chairperson
Fort Sill Apache Tribe of Oklahoma
Rt 2 Box 121
Apache, OK 73006

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

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Roger L. Bridges, PE
SSTD Civil Engineer

Enclosure (1)

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11/13/06



Oklahoma Archeological Survey

THE UNIVERSITY OF OKLAHOMA

July 12, 2006

Roger Bridges
City of Lawton
103 SW 4th Street
Lawton, Oklahoma 73501

RE: Proposed South Wolf Creek Sewer Line Expansion Upgrade. Legal Description: Sections 3, 10, 13, 14, and 24 T1N R12W; Sections 18-20 T1N R11W, Comanche County, Oklahoma.

Dear Mr. Bridges:

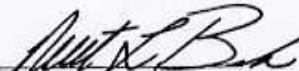
A cultural resources report of investigations has been received by this agency on the above referenced project. This agency confirms the recommendations contained in the report. The review was conducted in cooperation with the State Historic Preservation Office, Oklahoma Historical Society.

Please contact this office at (405) 325-7211 if buried archaeological materials such as chipped stone tools, pottery, bone, historic crockery, glass, metal items, or building materials are exposed during construction activities.

In addition to our comment on the cultural resource inventory conducted for this project, under 36CFR Part 800.3 you are reminded of your responsibility to consult with the appropriate Native American tribe/groups for any concerns they may have pertaining to this report.

Sincerely,

Staff Archeologist


Robert L. Brooks
State Archaeologist

:ls

cc: SHPO
Don Dycus
Comanche Tribe
Apache Tribe
Wichita & Affiliated Tribes

111 E. Chesapeake, Room 102, Norman, Oklahoma 73019-5111 PHONE: (405) 325-7211 FAX: (405) 325-7604
A UNIT OF ARTS AND SCIENCES SERVING THE PEOPLE OF OKLAHOMA



Oklahoma Historical Society

Founded May 27, 1893

State Historic Preservation Office • 2704 Villa Prom • Shepherd Mall • Oklahoma City, OK 73107-2441
Telephone 405/521-6249 • Fax 405/947-2918

June 6, 2005

Mr. Roger Bridges
City of Lawton
103 Southwest 4th Street
Lawton, OK 73501

RE: File #1369-05; Lawton South Wolf Creek Sanitary Sewer Project

Dear Mr. Bridges:

We have received and reviewed the documentation submitted on the referenced project in Comanche 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 archeological sites or other types of "historic properties," as defined in 36 CFR Part 800.16(1), 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 on-site investigation of all or part of the project impact area is necessary to determine the presence of archeological resources. In the event that such an investigation reveals the presence of prehistoric archeological 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, the above underlined file number must be referenced. If you have any questions, please contact Charles Wallis, RPA, Historical Archeologist, at 405/521-6381. Thank you.

Sincerely,

Melvena Heisch
Deputy State Historic
Preservation Officer

MH:sjo



Oklahoma Archeological Survey

THE UNIVERSITY OF OKLAHOMA

May 12, 2005

Roger Bridges
City of Lawton
103 Southwest 4th Street
Lawton, Oklahoma 73501

Re: City of Lawton proposed installation and modifications to sewer line; South Wolf Creek Expansion Upgrade. Legal Description: Part of Sections 3 10, 14, 13, 24, T1N R12W & part of Sections 18, 19, 20 T2N R11W, Comanche County, Oklahoma.

Dear Mr. Bridges:

The Community Assistance Program staff of the Oklahoma Archeological Survey has reviewed the above referenced project in order to identify areas that may potentially contain prehistoric or historic archeological materials (historic properties). The location of your project has been crosschecked with the state site files containing approximately 18,000 archeological sites, which are currently recorded for the state of Oklahoma. No sites are listed in your project area, but based on the topographic and hydrologic setting of your project, archeological materials are likely to be encountered. An archaeological field inspection is considered necessary prior to project construction in order to identify significant archeological resources that may exist in the project area. Please contact this office at (405) 325-7211 if you require additional information on this project.

This environmental review and evaluation is performed in order to locate, record, and preserve Oklahoma's prehistoric and historic cultural heritage in cooperation with the State Historic Preservation Office, Oklahoma Historical Society. In addition to our review comments, under 36CFR Part 800.3 you are reminded of your responsibility to consult with the appropriate Native American tribe/groups to identify any concerns they may have pertaining to this undertaking and potential impacts to properties of traditional and/or ceremonial value. Thank you for your cooperation.

Sincerely,


Elizabeth Teroba
Staff Archaeologist


Robert L. Brooks
State Archaeologist

ls
cc: SHPO

111 E. Chesapeake, Room 102, Norman, Oklahoma 73019-5111 PHONE: (405) 325-7211 FAX: (405) 325-7604
A UNIT OF ARTS AND SCIENCES SERVING THE PEOPLE OF OKLAHOMA



City of Lawton

Sewer Construction Division

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Lawton, Oklahoma 73501
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Lawton, Oklahoma 73501
Fax: (580) 581-3407

May 10, 2005

State Archeologist
The University of Oklahoma
Oklahoma Archeological Survey
111 Chesapeake
Norman, Oklahoma 73019

RE: The SOUTH WOLF CREEK EXPANSION/UPGRADE
Sanitary Sewer Construction Project, Lawton, Oklahoma

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Roger L. Bridges, PE
SSTD Civil Engineer

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05/10/05



City of Lawton

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Lawton, Oklahoma 73501
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Lawton, Oklahoma 73501
Fax: (580) 581-3407

May 10, 2005

Bureau of Indian Affairs (for projects in Western Oklahoma)
P.O. Box 368
Anadarko, Oklahoma 73005

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Sanitary Sewer Construction Project, Lawton, Oklahoma

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City of Lawton

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Lawton, Oklahoma 73501
Telephone: (580) 581-3405

Shipping Address: 2100 South 6th Street
Lawton, Oklahoma 73501
Fax: (580) 581-3407

May 10, 2005

Oklahoma Historical Society
State Historic Preservation Office
2704 Villa Prom, Shepherd Mall
Oklahoma City, Oklahoma 73107

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Sanitary Sewer Construction Project, Lawton, Oklahoma

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05/10/05

APPENDIX D
SEWER SYSTEM EVALUATION STUDY
FINAL REPORT AND COST ANALYSIS



City of Lawton

Sewer System Evaluation Study Report Volume I

for Wastewater Collection System Improvements

Biggs and Mathews
BYRD Forbes
CH2M HILL

April 1997

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APPENDIX "A"

- Figure 1 - Flow Monitoring and Rain Gauge Locations
- Figure 2 - System Dry Weather Capacity (Existing)
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APPENDIX "A" (con't.)

- Figure 4 - Historical 24-Hour Rainfall Events
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- APPENDIX "B"** Manhole Rehabilitation
- APPENDIX "C"** Mainline Rehabilitation
- APPENDIX "D"** Private Service Rehabilitation
- APPENDIX "E"** High Maintenance Line Segments

- VOLUME TWO** Flow Monitoring Data
- VOLUME THREE** Physical Inspection Data
- VOLUME FOUR** Smoke Testing Data
- VOLUME FIVE** T.V. Logs and Video Tapes

EXECUTIVE SUMMARY

1.0 Introduction

In September, 1994 the City of Lawton, Oklahoma was placed under an Environmental Protection Agency ("EPA") Administrative Order for non-compliance with their NPDES permit relative to unauthorized overflows from the sewer collection system.

Then in May, 1995 the Oklahoma Department of Environmental Quality ("ODEQ") and the City executed a Consent Order Agreement to perform a Sanitary Sewer Evaluation Study ("SSES").

In compliance with the Administrative Order and the Consent Order, an SSES was performed to identify necessary collection system repairs and required expansion/improvements to reduce sewage overflows as a result of inflow, infiltration, and/or lack of capacity.

The scope of work included in the study generally consisted of flow monitoring, physical inspection, smoke testing, internal T.V. inspection, system modeling, and rehabilitation/expansion recommendations with cost estimates.

2.0 Collection System Evaluation and Results

Thirty-seven (37) temporary flow meters were installed throughout the three major drainage basins to document wet and dry weather flows. From the flow metering data, it was determined that wet weather does impact the system. In the Cache Creek basin over 80% of the inflow occurs on less than 40% of the basin area. In the Squaw Creek basin, 80% of the inflow occurs on 70% of the basin area, and in the Wolf Creek basin, 80% of the inflow occurs on 60% of the basin area.

The collection system consists of approximately 6094 sewer manholes and 392 miles of sewer line ranging in size from 6" to 60" in diameter.

Smoke testing was performed on 1,614,000 linear feet of the system with defects observed in manholes, mainline segments, and private service lines. The various line segments were selected for smoke testing based on the results of the flow monitoring.

Subsequently, from the physical inspection and smoke testing, inspection of line segments by Closed Circuit Television (CCTV) was recommended for approximately 111,000 linear feet of sewer. Many of the concrete lines showed severe deterioration

ES-1

due to hydrogen sulfide corrosion and some of the lines had partially collapsed.

3.0 System Modeling and Hydraulic Analysis

A computer model was developed consisting of 1,476 line segments (manhole to manhole) of 10" and larger diameter pipe for a total of approximately 493,000 linear feet.

The model showed that during dry weather conditions, the existing system has adequate capacity to convey the wastewater to the treatment plant without overflows.

However, during the ODEQ approved design storm (2-Year/24-Hour Rain Event & 2020 Population Plan) the existing collection system cannot convey wastewater and wet weather inflow to the treatment plant without numerous widespread system overflows.

4.0 System Rehabilitation Recommendations

In an attempt to reduce wet weather inflow by 25% to 30%, and to enhance the long-term structural integrity of the existing system, an extensive rehabilitation and repair program is recommended to specifically address public collection system mainlines, collection system manholes, and private service lines.

Within the three major drainage basins, rehabilitation is recommended for 1625 manholes, 191,000 linear feet of mainline, and 2,109 private service lines.

In addition it is recommended that the City of Lawton establish and maintain an aggressive preventative sewer maintenance program so that every line in the system is cleaned/T.V. inspected on a 5 year cycle.

5.0 System Expansion Recommendations

Numerous expansion/upgrade projects are recommended to increase the system capacity in selected areas.

In order to convey the post-rehabilitation flows and to accommodate the increased flows based on the growth projected in the City's 2020 population plan, it will be necessary to install approximately 92,500 linear feet of new line ranging from 10" to 42" in diameter.

6.0 Final Report Closure

Based on the results of the study report, the following observation and conclusions

are offered:

- Dry weather capacity problems do exist; however, with the exception of periodic line stop-ups, dry weather flows are conveyed to the treatment plant without overflows.
- Wet weather inflow entering defective portions of the collection system does impact the system and causes sanitary sewer overflows.
- The City should initiate, as outlined in this study report, an aggressive and comprehensive rehabilitation/repair program in an attempt to reduce the wet weather inflow by 25% to 30%.
- Sanitary sewer overflows cannot be contained during the design storm by system rehabilitation/ repair work alone.
- The City should provide for selected area expansion/upgrade of lines, as outlined in this study report, to adequately convey the ODEQ approved Design Storm (2 Year/24-Hour & 2020 Plan).
- All recommended collection system rehabilitation/repair work should be completed throughout the system by December, 2014.
- Flow monitoring should be conducted periodically throughout the rehabilitation/repair program to assess and document the inflow reduction results.
- Along with the collection system rehabilitation/repair program, the recommended system expansion/upgrade lines should be constructed.
- All recommended collection system expansion/upgrade lines should be completed and in operation by December, 2018.
- The City should begin by May 1, 1997 their preventative sewer maintenance program so that the complete system is cleaned at least every 5 years.
- As funds become available the City should address the high maintenance line segments listed in Appendix "E". Consideration should be given to replacement of these lines.

7.0 Cost Estimates and Schedule

A comprehensive rehabilitation and expansion program is recommended for the City of Lawton.

The estimated costs for the proposed rehabilitation and expansion program is \$61,250,000, and is shown in table form on the following page.

The majority of rehabilitation work to repair the collection system defects for the reduction of wet weather inflow is scheduled for completion within the first 12-years, with the remaining inflow reduction work completed by the year 2014.

The expansion/upgrade projects will be done in conjunction with the rehabilitation program with all work being completed by the year 2018.

ES-3

SYSTEM REHABILITATION/EXPANSION COST SUMMARY

Item	Quantity	Estimated Cost
Manhole Rehabilitation	1,625 EA	\$ 698,000
Mainline Rehabilitation	191,000 LF	18,986,000
System Expansion/Upgrade	92,500 LF	20,700,000
Wet Weather Facility	15MG 1-EA	2,250,000
Sub-Total (Construction)		\$ 42,634,000
Engineering and Inspection	LS	4,466,000
Contingencies	LS	5,460,000
Sub-Total (Engineering and Contingencies)		\$ 9,926,000
City Maintenance Identified Rehabilitation	LS	7,500,000
Administration of Private Service Rehabilitation	LS	680,000
Flow Monitoring Assessment	LS	510,000
Estimated Grand Total		\$ 61,250,000

FINAL REPORT
SANITARY SEWER EVALUATION STUDY

1.0 Introduction

The City of Lawton, Oklahoma ("City") owns and operates a wastewater plant, which, treats an average dry weather flow of approximately 10,000,000 gallons per day ("GPD").

During storm events in which area rainfall amounts range from 2" to 3.7" in a 24-hour period (1 year to 2 year - 24-hour event), it is not uncommon for the treatment plant to receive an additional 28,000,000 gallons of extraneous water. With such wet weather flows, the collection system rapidly becomes overloaded and overflows occur in various portions of the system.

1.1 Administrative Order and Consent Order Compliance

In September, 1994 the City of Lawton was placed under an Environmental Protection Agency ("EPA") Administrative Order for non-compliance with their NPDES permit relative to unauthorized overflows from the sewer collection system.

Then in May, 1995 the Oklahoma Department of Environmental Quality ("ODEQ") and the City executed a consent order agreement to perform a Sanitary Sewer Evaluation Study ("SSES").

In an effort to comply with the EPA Administrative Order and the ODEQ Consent Order, the City contracted with CH2M-Hill to provide the necessary professional services for a system-wide SSES.

1.2 Purpose of Study

The purpose of the study was to comply with the EPA Administrative Order by identifying necessary collection system repairs and required system expansion/improvements to reduce sewage overflows as a result of inflow, infiltration, lack of capacity, or other design and/or construction related deficiencies.

In addition to providing for a full evaluation of the collection system, the comprehensive study was designed to develop a rehabilitation/capital

improvements program including a prioritized listing of recommended improvements and their associated costs.

1.3 Scope of Work

The scope of work for the study consisted of 10 major work tasks which were specifically designed to provide for a complete evaluation and analysis of the collection system.

Outlined below is a summary of the various tasks within the scope of work and as amended throughout the project.

Task No. 1 - Mobilization/Project Administration

- Conduct organizational meetings with City Staff and provide for an overall SSES project briefing.
- Establish filing systems for field data.
- Establish monthly project meetings to maintain schedule and budgets.
- Develop/implement a Quality Assurance/Quality Control Program.
- Schedule field personnel, mobilize project team, and set up local office.

Task No. 2 - System Mapping/Surveying

- Gather historical information for wastewater collection system.
- Develop a manhole and line segment numbering system for identification and inventory purposes.
- Provide collection system inventory of public sewers and manholes.
- Perform field survey of system manholes on lines 10-inches and larger with rim/cover elevations and coordinates.
- Create an "updated" sewer collection system map (scale: 1" = 200') in AutoCad format.
- Provide digital photography covering approximately 60 square miles of the City at a scale of 1" = 200'.
- All data and map files shall be compatible and set-up in a AutoCad release 12 or later version.

Task No. 3 - System-wide Flow Metering and Data Analysis

- Establish subbasin boundaries for metering.
- Determine and investigate flow meter sites.

- Clean flow metering sites for preparation of meter installation.
- Installation of thirty-seven (37) temporary flow meters to measure dry and wet weather flows.
- Provide for 6 rainfall gauges to record various storm intensities and durations.
- Provide for maintenance, operation, and data collection from all meters and rain gauges.
- Determine average flow under dry weather conditions for each site.
- Provide for analysis and tabulation of rainfall data and plots on flow hydrographs for each rainfall gauge and flow meter site.
- Determine peak inflow/infiltration rates under wet weather conditions at each flow monitor site.
- Determine relationship between peak inflow and rainfall intensity (Q vs. I) at each flow monitor site.
- Determine in-situ capacity of the existing pipeline segments for the portion of the system being metered.
- Identify peak rainfall induced inflow/infiltration from flow metering data.
- Compile and summarize all field data and evaluate and prioritize subbasins for smoke testing.
- Provide for meter removal.

Task No. 4 - Manhole and Line Segments Physical Inspection

- Provide above ground visual inspection at all manholes and along all line segments within the collection system.
- Document physical condition of the manhole exposed exterior, manhole lid, and other conditions along the line segments which could potentially indicate a system defect or inflow source.
- Provide rim to invert measurements on all manholes on lines 10 inches and larger.
- Record on computer forms all manhole and line data and incorporate into data base.

Task No. 5 - Collection System Smoke Testing

- Provide for "Notice To Residents" in smoke testing areas.
- Coordinate with City's fire and police departments relating to smoke test areas.
- Identify/Document exact locations of each system defect or source of infiltration/inflow, and include in the data base.
- Quantify each inflow source by considering the surrounding area

and the amount/density of the smoke encountered.

Task No. 6 - Internal Television Inspection

- Develop and Compile a television justification report based on the smoke testing, and dye flood tests.
- Prioritize line segments recommended for internal inspections.
- Clean utilizing a combination pressure/vacuum system in order to facilitate television inspection.
- Provide for internal inspection by television camera to determine structural conditions, method of rehabilitation, verify location of cross-connections or defects, and verify pipe joint conditions.
- Display information to be documented on videotape that indicates the line segment being televised, date televised, the line size, and distance from the entry manhole.
- Data to be recorded on a television log and all field notes, photographs, and videotapes provided on the selected line segments.

Task No. 7 - Analyze and Evaluate Collection System

- Input the existing flowline elevations, pipe sizes, line segment lengths, and top of manhole elevations (MSL) by conventional surveying methods for all interceptors/mains to be included in the model. (Lines 10 inches and larger)
- Investigate/collect the necessary information with regards to future development pending for calculation of estimated future sewage flows.
- Develop a computer model utilizing HydroWorks Software for analysis of the system.
- Provide for a maintenance inventory system, Maintenance Management System (MMS) by Applied Geographic Technologies.
- Define and construct the model from field survey data and existing system maps by imputing pipe diameter, pipe lengths, pipe invert elevations, top of manhole elevations, pipe roughness coefficients, and the 2-Year design storm event.
- Develop diurnal flow curves representing average daily flow from actual dry weather flow metering data for input into the computer model at meter locations in order to calibrate the system under normal flow conditions.
- Develop an infiltration/inflow hydrograph (based on "flow metering results") at each metering site for input into the model.
- By computer analysis, determine the theoretical hydraulic capacity of the existing system, and determine the hydraulic grade line for

- the system under normal conditions.
- Determine and analyze the effect of the design storm event imposed on the system.
- Provide system schematic and detailed cost estimates for recommended improvements.

Task No. 8 - Final Report and Recommendations

- Final comprehensive report will provide a summary of field activities and final results.
- A priority ranking of each system defect will be documented, with public and private sector defects identified separately.
- Recommendations for system rehabilitation/expansion to be provided along with budgetary cost estimates.
- Summary of the supporting data to be provided for recommended improvements.
- The hydraulic model, database, updated maps, videotapes, and field documentation and photographs to be presented in the final report.
- Provide six copies of an Executive Summary and Final SSES Report, along with three sets of supporting appendices.

Task No. 9 - SSES Deliverables

- Comprehensive flow metering results.
- Ranking for each defect by priority.
- Private and Public sector defect designation.
- Executive summary report.
- Final Report - Rehabilitation plan and cost estimates.
- Appendices - sketches, field logs, photographs, field database, photos.
- Assistance to City of EPA Quarterly Reports.
- Presentation of final report to City, State, and EPA.
- Updated collection system maps in ArcCad.
- MMS Software & Database.
- Calibrated Hydraulic Model & HydroWorks Software.
- Five flow meters, data logger, flow meter software, and accessories.
- Three rain gauges and rainfall software.
- Two smoke machines.
- Computer Hardware and Software.
- Training for Model, MMS, rain gauges, smoke machines, and flow meters.

Task No. 10 - Hardware/Software Support

- Identify computer hardware/software for City to Utilize Hydro Works, MMS, and other applications.
- Provide other digital photography. (1" = 200')
- Provide digitized map files to show structures as planimetric features.
- Provide digitized map files showing streets as planimetric features.
- Digitize lot/block boundaries.
- Provide contour elevations.

2.0 Collection System Evaluation and Results

A sanitary sewer condition assessment was conducted on the City of Lawton wastewater collection system to establish existing hydraulic flows at key locations and determine the condition of the sewer system serving the City. System defects were identified and documented to establish repair estimates. The assessment included temporary flow monitoring, manhole inspections, smoke testing, and internal closed circuit television inspection.

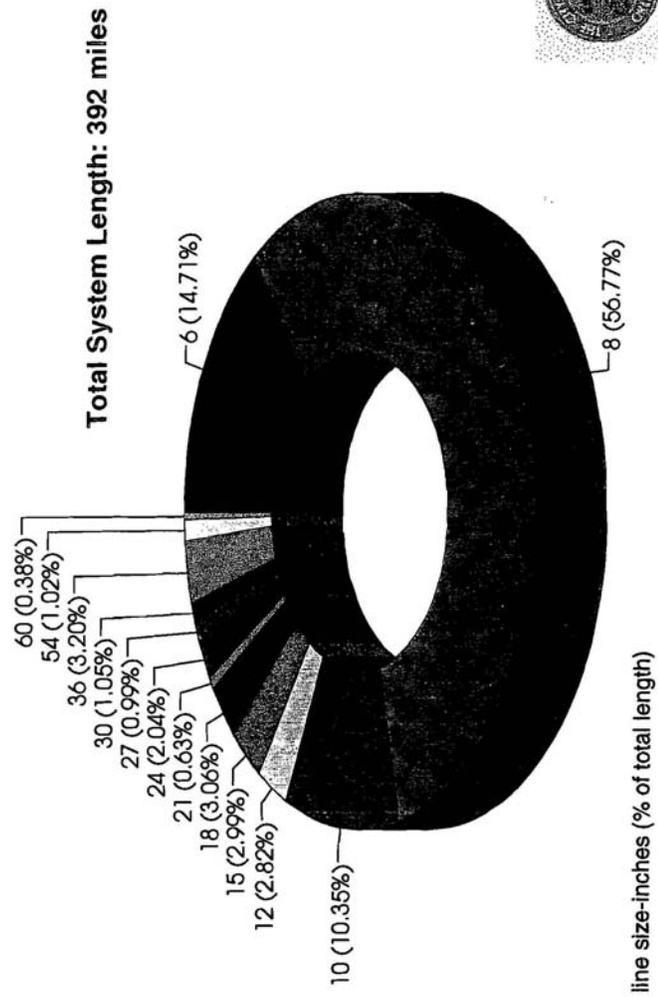
The Lawton wastewater collection system consist of approximately 392 miles of pipes (as of 9/1/96) ranging in sizes from 6 to 60 inches. Figure 2.1 presents a summary of the pipeline inventory by pipe size.

2.1 Flow Monitoring

There are various reasons to monitor wastewater flows. This project concentrated on establishing dry and wet weather hydraulic conditions in order to identify the magnitude of infiltration/inflow, establish pipeline capacity, and provide flow data for the hydraulic model calibration. Flow data presented in this report represents flows within the collection system in its present state. It should be emphasized, however, that collection systems are very dynamic in that new lines are constantly being added or repairs being made that may change the flow rates or characteristics recorded during this study. The emphasis on this project was in the area of pipeline capacity analysis with the specific purpose of producing a data set for use in hydraulic modeling of the collection system. The methodology and equipment used to implement wastewater monitoring may vary depending on the application. For this project, American Sigma area velocity meters were utilized to obtain representative flow data under the various hydraulic conditions anticipated.

Each meter was field calibrated prior to installation. Calibration is a simple procedure consisting of the verification of the depth and velocity measurements of the flow

Figure 2.1
Sewer System Inventory Summary



meter versus physical measurements. Installation consists of mounting the sensors on a steel mounting band that fits snugly in the pipeline. The data logger is then installed and secured in the manhole and the meter is activated at user defined sampling intervals.

Routine maintenance and service were undertaken during the flow monitoring period to confirm normal operation. The ability of the flow meter to record flow data is not affected by changing flow conditions such as surcharge or backwater conditions. However, physical obstructions such as debris and sediment do affect depth and velocity measurements adversely.

Originally, thirty-eight flow meters were installed which effectively segregated the system into thirty-eight sub-basins. However one meter (meter 301) had to be removed due to a continuous buildup of grease which rendered the meter inoperative.

Initial analysis of the flow data was performed by reading the raw data from the meter memory. This data was then uploaded to a personal computer for processing. A tabular and graphical presentation of the data was developed that provided specific information for the detailed evaluation.

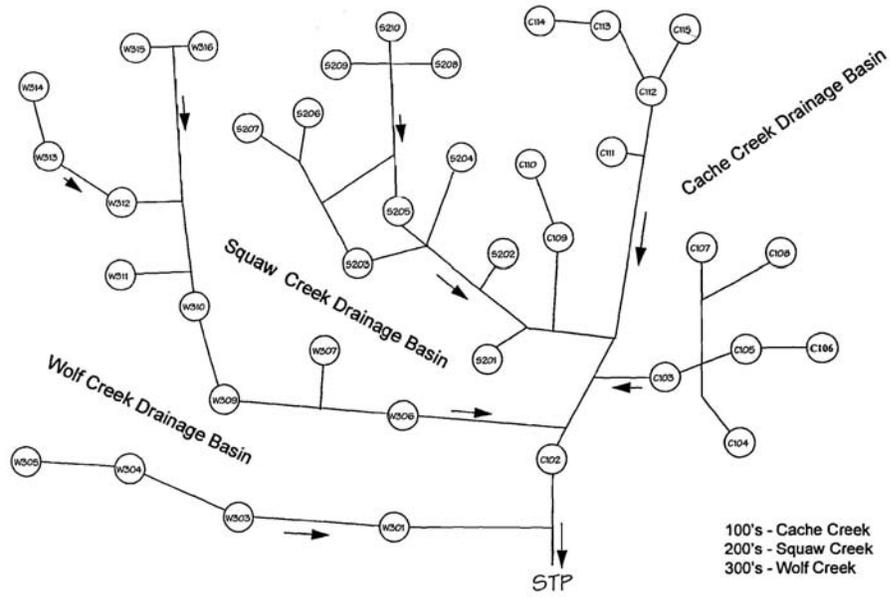
The data from thirty-seven flow meters was gathered for a period of approximately 45 days spanning May and June 1995. The metered sub-basins were then grouped into three larger drainage basins: Cache Creek, Squaw Creek, and Wolf Creek. A flow schematic of the collection system is presented in Figure 2.2 to indicate the flow pattern for the entire collection system and the boundary designations for the three major basins. The flow meter and also rain gauge locations are shown on a map presented in Figure-1 Appendix "A". The length of the monitoring period for each site varied from a minimum of 45 days to a maximum of about 60 days. Weekly site visits were conducted to retrieve the recorded raw data and to document field conditions.

2.2 Flow Data Analysis

Flow data was analyzed on a site by site basis for the entire monitoring period. Analysis of each site was performed by comparing the flow calculated by the continuity equation ($Q = VA$, where Q is flow, V is average velocity and A is the cross-sectional flow area) with flow calculated by the open channel Manning flow equation ($Q = 1.49/n R^{2/3} S^{1/2} A$, where n is Manning's coefficient, R is hydraulic radius, and S is slope).

For all sites the raw flow data was collected on 15 minute intervals. Hourly wastewater flow data and daily hydraulic summaries averaged from the 15 minute data for each of the thirty-seven monitoring sites are tabulated and presented in the flow monitoring data (Volume Two).

**Figure 2.2
Wastewater Flow Schematic Diagram**



Rain data from six rain gauges was also collected on 15 minute intervals during the monitoring period.

Table 2.1 presents a summary of the flow monitoring data. The data is grouped under its corresponding major drainage basin and the following provides a description of each flow monitoring parameter:

- In-situ Pipe Capacity in million gallons per day (mgd)**
This is the projected pipe full flow rate for the site under existing site conditions and a uniform flow condition. The values of existing capacity may be considerably lower or higher than design values based on pipe condition, root intrusion, silt deposition, encrustation, or pipe deterioration. The existing capacity was calculated based on flow depths and velocities recorded during the field investigation.

- Average Daily Flow (mgd) - Dry (Wet)**
This is the daily average flow at a specific site location. It is determined by averaging all 15 minute flow rates (calculated from the continuity and/or Manning's equation) of the dry or wet weather analysis period.
- Peak Flow Rate (mgd) - Dry**
This is the maximum flow rate which was observed during the dry weather analysis period.

- Minimum Flow Rate (mgd) - Dry**
This is the minimum flow rate which occurred during the dry weather analysis period.

- Peaking Ratio - Dry (Wet)**
This is the ratio of Peak Hourly Flow Rate to Daily Average Flow (also known as the peaking factor). It provides information on the variability of the wastewater flows. The closer this value is to 1.0 the less the flow fluctuates.

- Peak Percent Flow Capacity Used - Dry (Wet)**
This is the ratio of Peak Hourly Flow Rate to In-situ Pipe Capacity. It is useful in evaluating the percentage of existing pipe capacity used during peak flow conditions.

- Average Inflow Volume (mg)**
The wet weather inflow volume is calculated by taking the Average Daily Rainfall Dependent Infiltration/Inflow (RDII) minus the Average Daily Flow (Dry)

Table 2.1 - Wastewater Flow Data Summary

CACHE CREEK BASIN

DESCRIPTION/SITE	C102	C103	C104	C105	C106	C107	C108
In-situ Pipe Capacity (mgd)	46.401	24.884	3.586	1.541	1.814	0.603	0.796
Average Daily Flow - Dry (mgd)	8.628	1.096	0.178	0.564	0.379	0.127	0.036
Peak Flow Rate - Dry (mgd)	11.75	2.891	0.33	0.96	0.804	0.234	0.066
Minimum Flow Rate - Dry (mgd)	5.479	0.511	0.054	0.221	0.184	0.036	0.01
Peaking Ratio - Dry	1.36	2.64	1.85	1.74	2.12	1.84	1.83
Percent Capacity Used - Peak Dry	25.3	11.6	9.2	63.6	44.3	38.8	8.3
Average Daily Flow - Wet (mgd)	17.305	2.8	0.389	0.89	0.833	0.178	0.118
Average Inflow Volume (mg)	8.677	1.704	0.211	0.326	0.454	0.051	0.082
Average Discrete Inflow (mg)	1.293	1.034	0.211	0	0.454	0.051	0.082
Discrete Normalized Inflow (gal/ft/in)	8.07	14.27	2.84	0.00	3.75	0.90	2.82
Peak Flow Rate - Wet (mgd)	34.735	7.94	2.453	1.495	2.347	0.422	1.122
Peaking Ratio - Wet	4.03	7.24	13.78	2.65	6.19	3.32	31.17
Percent Capacity Used - Peak Wet	74.9	31.9	68.4	97.0	129.4	70.0	141.0
Peak Flow Depth - Dry (in)	18.275	6.924	3.836	7.996	7.35	3.773	2.98
Peak Flow Depth - Wet (in)	140.97	95.324	25.615	8.86	88.964	23.463	25.143
Pipe Diameter (in)	54	36	20.675	14.75	15	9.625	15.25
Peak Flow Depth/Diameter - Dry	0.34	0.19	0.19	0.54	0.49	0.39	0.20
Peak Flow Depth/Diameter - Wet	2.61	2.65	1.24	0.60	5.80	2.44	1.65
Pipe Footage (ft)	85850	40080	44380	48975	50100	35100	17350
Dry Weather Days	5/15-5/19	4/28-4/29	5/10-5/16	5/10-5/16	5/13-5/19	5/11-5/17	5/10-5/16
Wet Weather Days	5/6-5/7, 6/4	5/5-5/7, 6/4	5/5-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10	6/4, 6/10	5/5-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10

DESCRIPTION/SITE	C109	C110	C111	C112	C113	C114	C115
In-situ Pipe Capacity (mgd)	1.52	0.383	0.476	3.701	4.113	2.735	2.715
Average Daily Flow - Dry (mgd)	0.24	0.051	0.229	0.803	0.785	0.221	0.054
Peak Flow Rate - Dry (mgd)	0.422	0.116	0.381	1.729	1.583	0.55	0.29
Minimum Flow Rate - Dry (mgd)	0.062	0.012	0.08	0.308	0.195	0.02	0.021
Peaking Ratio - Dry	1.76	2.27	1.66	2.15	2.02	2.49	5.37
Percent Capacity Used - Peak Dry	27.8	30.3	80.0	46.7	38.5	20.1	10.7
Average Daily Flow - Wet (mgd)	0.338	0.147	0.416	1.592	0.832	0.27	0.09
Average Inflow Volume (mg)	0.098	0.096	0.187	0.789	0.047	0.049	0.036
Average Discrete Inflow (mg)	0.098	0.096	0.187	0.706	0	0.049	0.036
Discrete Normalized Inflow (gal/ft/in)	3.30	7.56	2.98	43.93	0.00	N/A	0.54
Peak Flow Rate - Wet (mgd)	4.275	1.046	1.325	4.625	1.443	2.563	0.974
Peaking Ratio - Wet	17.81	20.51	5.79	5.76	1.84	11.60	18.04
Percent Capacity Used - Peak Wet	281.3	273.1	278.4	125.0	35.1	93.7	35.9
Peak Flow Depth - Dry (in)	7.352	1.867	14.773	9.639	6.594	2.815	2.596
Peak Flow Depth - Wet (in)	32.882	13.415	21.55	51.236	4.773	10.092	5.907
Pipe Diameter (in)	23.875	7.625	14.5	26.5	14.625	9.87	11.75
Peak Flow Depth/Diameter - Dry	0.31	0.24	1.02	0.36	0.45	0.29	0.22
Peak Flow Depth/Diameter - Wet	1.38	1.76	1.49	1.93	0.33	1.02	0.50
Pipe Footage (ft)	19900	8950	44310	10700	52950	N/A	44575
Dry Weather Days	5/14-5/20	5/19-5/15	5/10-5/16	5/11-5/17	5/11-5/17	5/14-5/20	5/8-5/13
Wet Weather Days	5/5-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10

Table 2.1 - Wastewater Flow Data Summary (Cont'd.)

SQUAW CREEK BASIN

DESCRIPTION/SITE	S201	S202	S203/S205	S204	S206	S207	S208
In-situ Pipe Capacity (mgd)	1.578	2.802	7.351	2.676	3.56	0.577	0.69
Average Daily Flow - Dry (mgd)	0.274	0.623	2.07	0.724	0.529	0.177	0.308
Peak Flow Rate - Dry (mgd)	0.586	1.242	4.355	1.139	0.845	0.308	0.498
Minimum Flow Rate - Dry (mgd)	0.132	0.28	0.275	0.356	0.233	0.055	0.123
Peaking Ratio - Dry	2.14	1.99	2.10	1.57	1.60	1.74	1.62
Percent Capacity Used - Peak Dry	37.1	44.3	59.2	42.6	23.7	53.4	72.2
Average Daily Flow - Wet (mgd)	0.681	0.949	4.141	1.44	0.854	0.375	0.568
Average Inflow Volume (mg)	0.407	0.326	2.071	0.716	0.325	0.198	0.26
Average Discrete Inflow (mg)	0.407	0.326	1.002	0.716	0.325	0.198	0.26
Discrete Normalized Inflow (gal/ft/in)	4.21	3.65	4.08	5.07	8.47	3.67	2.75
Peak Flow Rate - Wet (mgd)	2.594	3.569	6.665	3.936	1.987	0.803	1.069
Peaking Ratio - Wet	9.47	5.73	3.22	5.44	3.76	4.54	3.47
Percent Capacity Used - Peak Wet	164.4	127.4	90.7	147.1	55.8	139.2	154.9
Peak Flow Depth - Dry (in)	5.909	9.29	N/A	8.077	6.698	4.524	8.978
Peak Flow Depth - Wet (in)	17.282	36.354	N/A	83.781	59.12	7.635	82.923
Pipe Diameter (in)	15.5	23.875	24/18.625	18.25	20.75	10.25	10.125
Peak Flow Depth/Diameter - Dry	0.38	0.39	N/A	0.44	0.32	0.44	0.89
Peak Flow Depth/Diameter - Wet	1.11	1.52	N/A	4.59	2.85	0.74	8.19
Pipe Footage (ft)	66588	62845	187589	99438	28080	39901	68418
Dry Weather Days	5/10-5/16	5/12-5/18	N/A	5/14-5/20	5/11-5/17	5/13-5/19	5/16-5/20
Wet Weather Days	5/5-5/7, 8/4, 8/10	5/5-5/7, 8/4, 8/10	10-Jun	5/5-5/7, 8/4, 8/10	5/5-5/7, 8/4, 8/10	5/5-5/7, 8/4, 8/10	5/5-5/7, 8/4, 8/10

DESCRIPTION/SITE	S209	S210
In-situ Pipe Capacity (mgd)	0.258	1.116
Average Daily Flow - Dry (mgd)	0.026	0.089
Peak Flow Rate - Dry (mgd)	0.05	0.187
Minimum Flow Rate - Dry (mgd)	0.013	0.033
Peaking Ratio - Dry	1.92	2.10
Percent Capacity Used - Peak Dry	19.4	16.8
Average Daily Flow - Wet (mgd)	0.156	0.245
Average Inflow Volume (mg)	0.13	0.156
Average Discrete Inflow (mg)	0.13	0.156
Discrete Normalized Inflow (gal/ft/in)	1.33	3.83
Peak Flow Rate - Wet (mgd)	0.576	1.245
Peaking Ratio - Wet	22.15	13.99
Percent Capacity Used - Peak Wet	223.3	111.6
Peak Flow Depth - Dry (in)	3.006	2.947
Peak Flow Depth - Wet (in)	69.024	64.984
Pipe Diameter (in)	10	10.75
Peak Flow Depth/Diameter - Dry	0.30	0.27
Peak Flow Depth/Diameter - Wet	6.90	6.05
Pipe Footage (ft)	72682	29730
Dry Weather Days	5/10-5/16	5/10-5/16
Wet Weather Days	5/5-5/7, 8/4, 8/10	5/5-5/7, 8/4, 8/10

Table 2.1 - Wastewater Flow Data Summary (Cont'd.)

WOLF CREEK BASIN

DESCRIPTION/SITE	W303	W304	W305	W306	W307	W309	W310
In-situ Pipe Capacity (mgd)	9.203	2.049	14.31	5.769	0.298	11.882	12.376
Average Daily Flow - Dry (mgd)	0.782	1.045	0.472	3.783	0.1	2.796	3.759
Peak Flow Rate - Dry (mgd)	1.198	1.745	1.373	5.456	0.156	4.749	5.704
Minimum Flow Rate - Dry (mgd)	0.509	0.725	0.155	2.172	0.057	0.775	1.538
Peaking Ratio - Dry	1.53	1.67	2.91	1.44	1.56	1.70	1.52
Percent Capacity Used - Peak Dry	13.0	85.2	9.6	94.6	52.3	40.0	46.1
Average Daily Flow - Wet (mgd)	1.129	1.283	0.655	4.869	0.157	5.361	6.167
Average Inflow Volume (mg)	0.347	0.238	0.183	1.086	0.057	2.565	2.408
Average Discrete Inflow (mg)	0.109	0.055	0.183	0	0.057	0.157	0.183
Discrete Normalized Inflow (gal/ft/in)	1.88	1.17	5.52	0.00	3.28	3.54	1.22
Peak Flow Rate - Wet (mgd)	3.379	3.2	2.743	7.853	0.728	9.668	10.466
Peaking Ratio - Wet	4.32	3.06	5.81	2.08	7.28	3.46	2.78
Percent Capacity Used - Peak Wet	36.7	156.2	19.2	136.1	244.3	81.4	84.6
Peak Flow Depth - Dry (in)	6.161	11.827	3.766	26.987	5.139	18.495	15.42
Peak Flow Depth - Wet (in)	11.148	16.302	5.305	56.807	24.702	47.306	88.921
Pipe Diameter (in)	26.75	18	18	36.625	10	38	31.875
Peak Flow Depth/Diameter - Dry	0.23	0.66	0.21	0.74	0.51	0.49	0.48
Peak Flow Depth/Diameter - Wet	0.42	0.91	0.29	1.55	2.47	1.24	2.79
Pipe Footage (ft)	41789	33895	23913	20512	13356	30568	108116
Dry Weather Days	5/5-5/11	5/8-5/11	5/8-5/11	5/14-5/20	5/12-5/18	5/10-5/18	5/14-5/20
Wet Weather Days	5/5-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10	10-Jun	5/5-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10

DESCRIPTION/SITE	W311	W312	W313	W314	W315	W316
In-situ Pipe Capacity (mgd)	1.186	5.903	0.993	1.5	5.059	0.725
Average Daily Flow - Dry (mgd)	0.139	0.751	1.038	0.516	0.747	0.518
Peak Flow Rate - Dry (mgd)	0.222	1.391	1.442	0.878	1.515	0.943
Minimum Flow Rate - Dry (mgd)	0.07	0.202	0.502	0.223	0.25	0.135
Peaking Ratio - Dry	1.60	1.85	1.39	1.70	2.03	1.82
Percent Capacity Used - Peak Dry	18.7	23.6	145.2	58.5	29.9	130.1
Average Daily Flow - Wet (mgd)	0.175	2.249	1.731	0.895	1.092	0.864
Average Inflow Volume (mg)	0.036	1.498	0.693	0.379	0.345	0.346
Average Discrete Inflow (mg)	0.036	0.805	0.314	0.379	0.345	0.346
Discrete Normalized Inflow (gal/ft/in)	0.99	5.10	2.30	5.20	3.00	2.23
Peak Flow Rate - Wet (mgd)	1.509	6.107	3.511	2.17	2.685	1.402
Peaking Ratio - Wet	10.86	8.13	3.38	4.21	3.59	2.71
Percent Capacity Used - Peak Wet	127.2	103.5	353.6	144.7	53.1	193.4
Peak Flow Depth - Dry (in)	2.584	8.829	15.779	8.29	6.979	12.614
Peak Flow Depth - Wet (in)	72.929	137.649	68.312	73.388	110.179	141.411
Pipe Diameter (in)	21	23.75	17.875	15.25	18	15
Peak Flow Depth/Diameter - Dry	0.12	0.37	0.88	0.54	0.39	0.84
Peak Flow Depth/Diameter - Wet	3.47	5.80	3.82	4.81	6.12	9.43
Pipe Footage (ft)	26333	113989	83275	52576	119242	98305
Dry Weather Days	5/17-5/19	5/10-5/16	6/13-6/15	5/11-5/17	5/10-5/16	5/12-5/18
Wet Weather Days	5/5-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10	5/6-5/7, 6/4, 6/10	5/5-5/7, 6/4, 6/10	5/5-5/7	5/6-5/7, 6/4, 6/10

Average Discrete Inflow (mg)

The discrete inflow for each sub-basin was determined by taking the Average Inflow Volume less all upstream sub-basin Average Inflow Volumes.

Discrete Normalized Inflow (gal/ft/in. rainfall)

To account for variations in the rainfall across the study area and compare the inflow contribution the average discrete inflow is divided by both the linear footage within the sub-basin and the rainfall that was recorded for the sub-basin. This value provides a technique for ranking the sub-basins based on the severity of inflow per linear foot of sewer.

Peak Flow Depth (inches) - Dry (Wet)

This is the average of all daily maximum 15 minute depth recordings which occur during the dry or wet weather analysis period.

Pipe Diameter (inches)

This is the measured internal diameter of the pipeline at the monitoring site.

Peak Flow Depth/Diameter (d/D) - Dry (Wet)

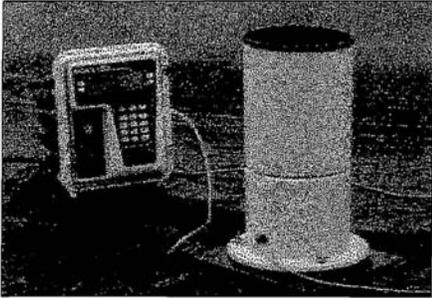
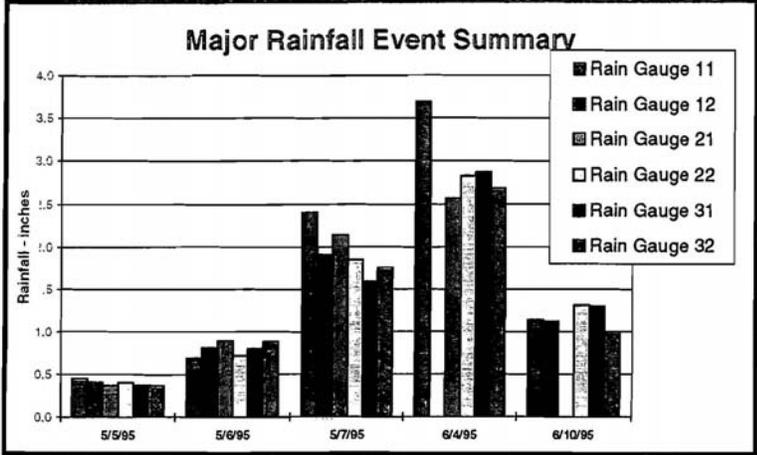
This is the ratio of Peak Hourly Flow Depth to Pipe Diameter. It is very useful in evaluating the pipe capacity being used during dry and wet weather. Values of d/D equal to or greater than 0.5 may indicate potential capacity problems.

Pipe Footage (feet)

Presented is the approximate linear footage within the sub-basin.

The wet weather storm days were taken generally from the three storm events that had the greatest impact on the collection system. The first of these occurred from May 5-7, 1995 and had an average total rainfall over the collection system of 3 inches. The second occurred on June 4, 1995 and had an average total rainfall over the collection system of 2.9 inches. The third storm event occurred on June 10, 1995 and had an average total rainfall over the collection system of 1.2 inches. Figure 2.3 presents a graphical summary of these major rainfall events. These overall rainfall averages were not used for individual sub-basin calculation purposes. Instead, the rainfall for each sub-basin was determined using the Thiessen polygon method to account for the spatial variation of the six rain gauges. As a result each sub-basin had different rainfall totals used in calculating the discrete normalized inflow depending on its position relative to the surrounding rain gauges.

Analysis and evaluation of all of the sub-basins determined that the system has a



Continuous Recording Raingauge

Figure 2.3 - Rainfall Data Summary

major response to wet weather events. As Figure 2.4 typifies, the response to a wet weather storm event is very dramatic and instantaneous. In this example the flow rate increases immediately to over five times normal and slowly returns to the normal pre-storm level. From the gathered data, it is apparent that most sites exceeded pipe capacity (based on depth of flow) during one of the three major storm events and many exceeded pipe flow capacity.

In the Cache Creek basin over 80% of the inflow occurs on less than 40% of the basin area (See Figure 2.5). This means that rehabilitation efforts can be concentrated on a relatively small portion of the basin and still achieve a large percentage reduction in inflow. In the Squaw Creek Basin (See Figure 2.6), inflow was found to be more uniformly distributed with approximately 80% of the inflow on 70% of the system footage. Finally, the Wolf Creek Basin (See Figure 2.7) inflow distribution was found to be 80% of the inflow on approximately 60% of the pipeline footage. Using the ratio of total inflow per inch of rain to total basin pipe footage as criteria, Cache Creek is seen to have the most severe inflow, Squaw Creek the second most severe, and Wolf Creek the least severe inflow problem. Hydrographs and detailed tabular flow data for each site are presented in the monitoring data (Volume Two).

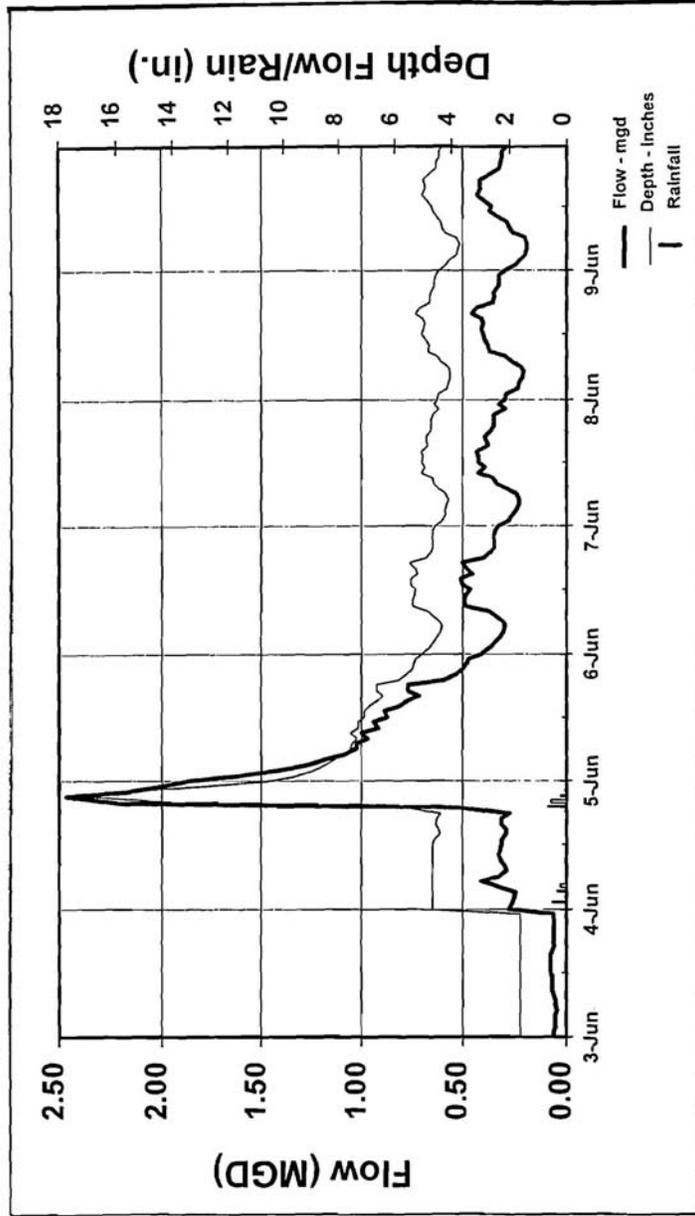
2.3 Physical Inspection

Data from the field investigations were recorded on standard forms for each of the phases of work and copies of all the database files are included in unattached field data volumes accompanying this report. The physical inspection data (Volume Three) was grouped into physical information, casting information, and interior information.

The manhole inspection field form provides for the collection of five types of data that includes: 1) general information such as the project number, crew leader identification, date of inspection, basin number, manhole number and whether or not the manhole was located and inspected; 2) physical information, such as surface conditions at manhole, manhole dimensions, length of pipe to next downstream manhole, materials of construction and a sketch illustrating the incoming and outgoing lines with proper orientation; 3) conditions of the manhole, such as defects in the various components of the manhole and evidence of infiltration/inflow and/or root intrusion; 4) environmental conditions, such as presence of gases, debris, etc.; and, 5) notes indicating unusual circumstances about a specific manhole. The pipe inspection form provides for recording the same types of information as a manhole inspection form except that it is specific to pipe conditions and defects.

A total of 6,094 manholes were inspected during this phase of the field investigation. Maps were update where necessary to visually represent the location of each manhole and connecting pipelines. Manholes were observed to vary greatly in construction and

**Figure 2.4
Typical Storm Event Response**



Study: Squaw Creek Basin

Daterange: 6/3/95-6/10/95

Site Name: S201

Site Address: Lee Blvd. at Drainage Ditch

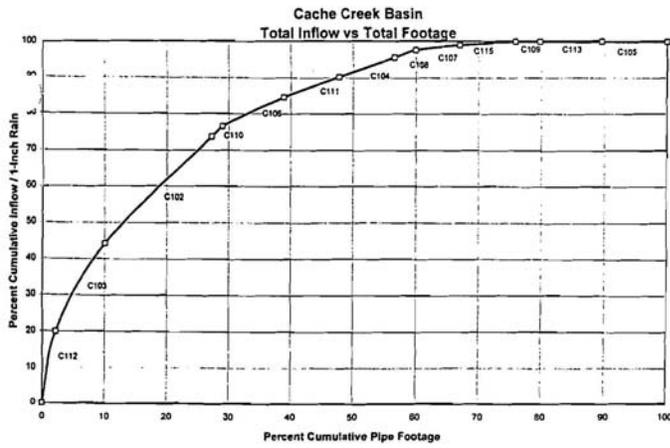


Figure 2.5
Cache Creek Basin

Figure 2.6
Squaw Creek Basin

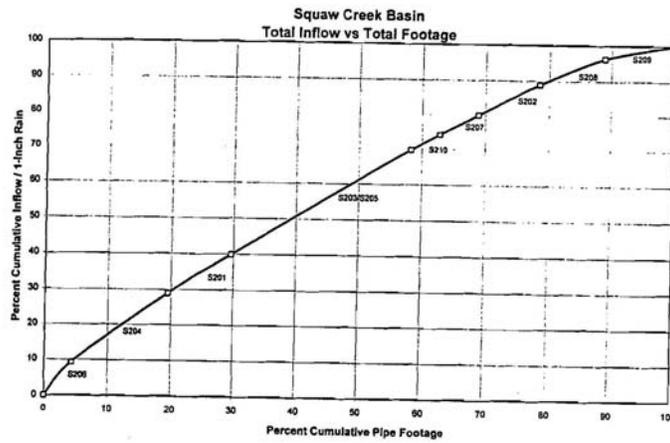
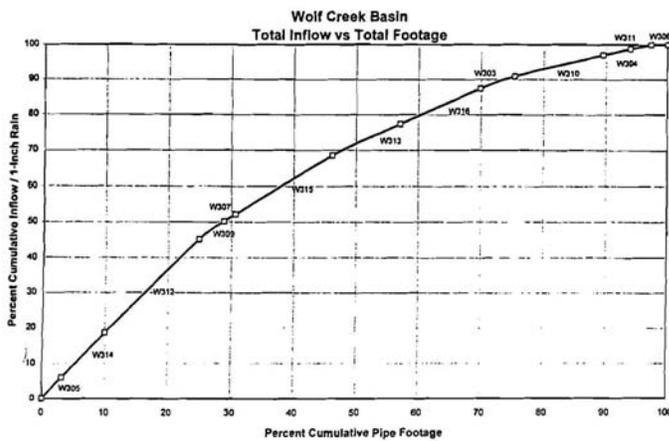


Figure 2.7
Wolf Creek Basin



degree of deterioration. Figures 2.8 and 2.9 present photographs of manholes and conditions encountered.

2.4 Smoke Testing

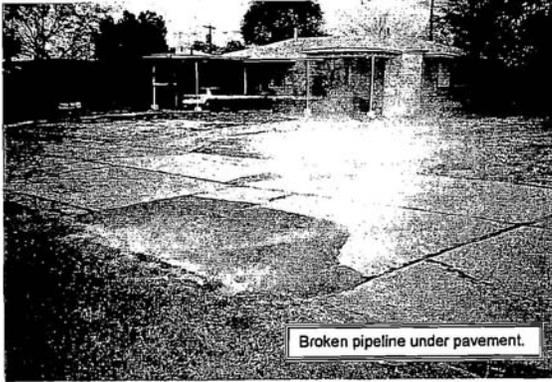
Smoke testing was undertaken on approximately 1,614,000 linear feet of gravity sewer. The observations for each line segment smoke tested were recorded on a standard smoke testing field data form. A completed smoke testing field form will contain minimal basic information, such as upstream and downstream manhole numbers to define the line segment. The remainder of the form details the defect(s) found during smoke testing. This form is supplemented by two additional sheets to provide a defect location sketch and photograph log. This information is valuable for specifying rehabilitation methods as well as for routine maintenance and contracting the rehabilitation work.

Copies of all the completed smoke testing forms are provided in Volume Four. High capacity smoke blowers were used to pressurize the test section and thereby identify system deficiencies. Figures 2.8 and 2.9 show various defects identified during the smoke testing phase of the project. The majority of defects identified during this study were located during the smoke testing phase of the project.

2.5 Internal Television Inspection

Inspection of pipes by Closed Circuit Television (CCTV) was recommended for approximately 111,000 linear feet of sewer. These lines are those where a significant or severe defect was found on a mainline during physical inspection or smoke testing.

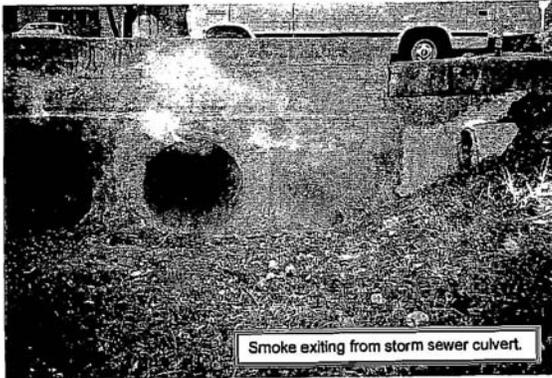
TV logs and video tapes are provided in Volume Five. Major repairs, including the installation of liners or line replacement, has been recommended based upon the results of this work. These repairs are necessitated as a combined result of years of normal use, corrosion, and bad soil conditions evidenced by misaligned joints and "dips" in the pipe. The concrete pipeline inspected showed the most severe deterioration due to hydrogen sulfide corrosion. As the photograph in Figure 2.8 shows, much of the concrete lines have deteriorated to the point that reinforcing steel is visible and/or collapse has occurred. Figure 2.10 presents an example T.V. Log schematic diagram that visually shows the location of each observation. A pictorial review of the defects without viewing each videotape greatly improves the review and determination of repairs. Note in Figure 2.10 that the 8 inch concrete pipe has numerous cracks, offset joints, broken pipe, and at 436.9 feet the pipe transitions from 8 inch to 6 inch.



Broken pipeline under pavement.



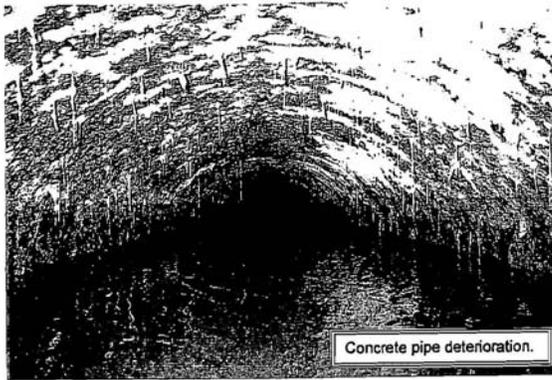
Non-standard manhole construction. Manhole S041004M



Smoke exiting from storm sewer culvert.



Casting separated from cone. Manhole W095009M



Concrete pipe deterioration.

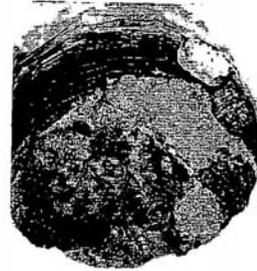


Broken manhole casting. Manhole W036009M

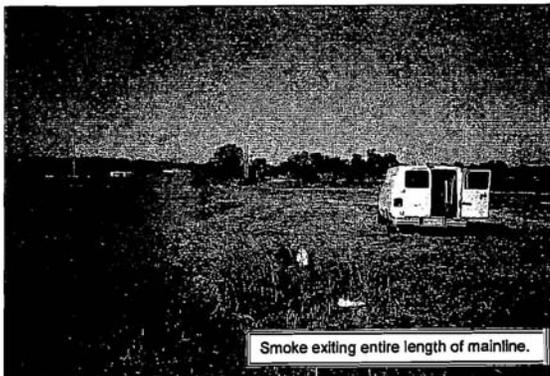
Figure 2.8
Typical Defect Photographs



Exposed mainline in field. Smoked entire length.
Segment C055003M to C055002M



Heavy debris & grease. Manhole S026166M



Smoke exiting entire length of mainline.



Manhole S042014M fabricated from concrete pipe.
Missing manhole lid.



Smoke exiting from storm sewer catch basin.

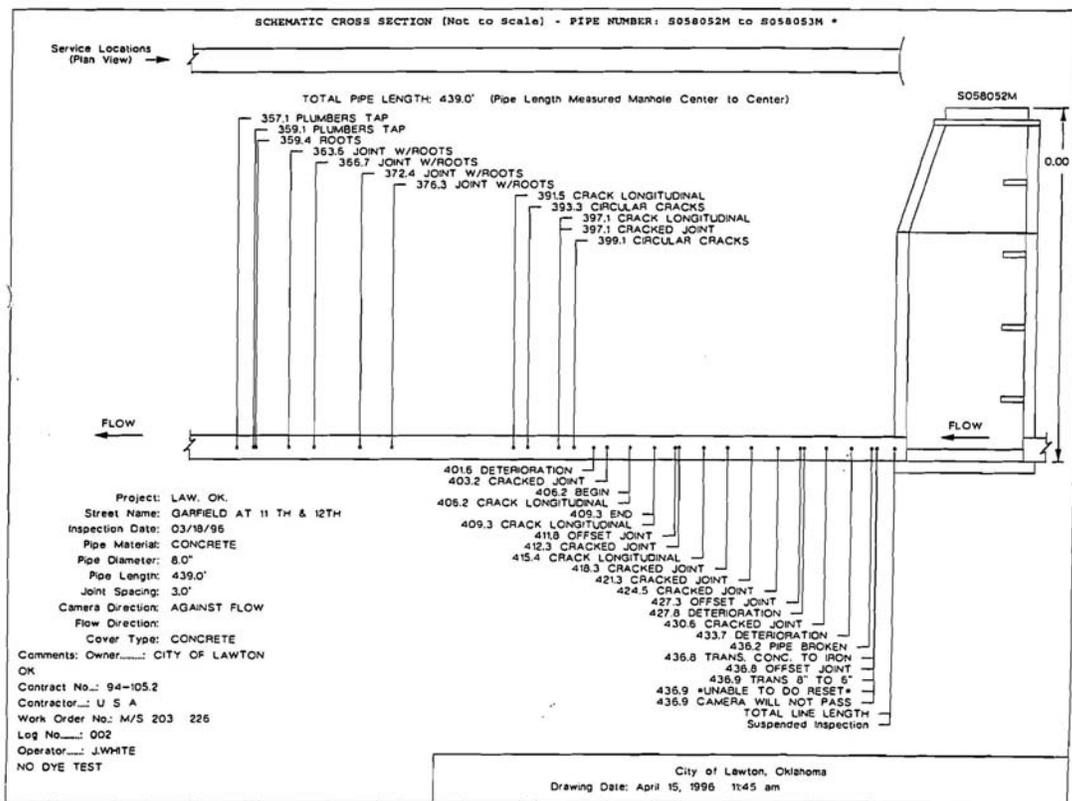


Root intrusion. Manhole S026221M

Figure 2.9
Typical Defect Photographs

Figure 2.10

Internal Television Observation Schematic Diagram



2.6 Rehabilitation Methods Description

Rehabilitation methods for this project were chosen based upon the type of defects discovered, the size of the project, and the most effective methods suitable for the area. The rehabilitation methods in some instances may require specialized equipment, but most rehabilitation methods can be performed by qualified utility contractor. The conditions that determine which method should be used are found on the field forms completed during the inspections and testing. Other circumstances were considered in making a final determination on an individual asset basis for selecting the rehabilitation method, such as other rehabilitation work in close proximity to the asset being considered.

Comments placed on the field forms and photographs also provided very important information to assist in determining the most appropriate rehabilitation method. Whenever a defect was identified twice or more during different phases of the work, for example, sewer line inspection, or smoke testing, only the most complete and effective rehabilitation method was chosen between the two or more methods indicated by the different phases of the work.

The rehabilitation methods (RM) ,by reference number, are listed below with a brief description. The rehabilitation methods described are only intended to identify typical methods used in the construction industry. Specific design of these rehabilitation methods will be provided by the City's Staff Engineers or Consulting Engineer.

A. Rehabilitation Methods for Manholes

1000. Locate and Expose Manhole - Whenever Byrd Forbes Associates ("BFA") field crews cannot find a manhole this method will be recommended to let the client know that the manhole needs to be found or exposed for inspection. There is no construction cost associated with this item but it does require an expenditure of funds to accomplish, so a nominal amount per each is assessed.

1001. Locate and Raise Casting To or Above Grade - Whenever BFA field crews find a manhole that is buried this method will be recommended to let the client know that the manhole needs to be exposed for inspection. The cost basis for this rehabilitation method will be a price per each.

1010. Install Manhole Insert - Manufactured inserts should be installed below the lid of the manholes identified to prevent ponded rainwater from entering the manhole through vents in the lid. The cost basis for this rehabilitation method will be a price per each.

1020. Realign and grout casting - The casting has been loosened from the

chimney or cone. The casting should be positioned properly over the chimney or cone and grouted back in place, sealing the connection to prevent leaks. In some cases the casting will be broken and should be replaced, but that condition(s) is covered below in RM 1022 and RM 1024. The cost basis for this rehabilitation method will be a price per each.

1022. Replace Casting (Frame and Lid) - This means to remove the existing casting, if one exist, and install a new one. The cost basis for this rehabilitation method will be a price per each.

1024. Replace Casting (Lid Only) - A new lid should be installed to replace a broken or missing lid. The cost basis for this rehabilitation method will be a price per each.

1030. Raise Casting To or Above Grade - This is required when a manhole is below grade, especially if it is subject to ponding or inundation. The casting should be raised to the height that would prevent it from being under significant ponding whenever possible. The amount to be raised will vary with specific site conditions. The estimated ponding depth is recorded on the Manhole Inspection Form for reference in preparation of bid request for the work. The work will consist of detaching the casting from the existing chimney or cone; constructing a new or additional chimney section a specified height; resetting the casting; and, grouting everything in place. The cost basis for this rehabilitation method will be a price per each.

1040. Clean Manhole, Repair as Needed & Coat - This is required due to missing mortar or brick, and/or severe deterioration of the manhole or a significant component of the manhole. Prior to repairs the manhole should be cleaned using a high pressure washer or manually washed to remove grease or dirt that would prevent the repair materials from adhering to the interior surface of the manhole. Repairs may consist of replacing bricks or patching concrete with a patch mix or grout. After repairs are made, the entire interior surface should be coated with special purpose waterproofing materials that are resistant to chemical degradation common to sanitary sewers. The cost basis for this rehabilitation method will be a price per vertical foot.

1042. Clean Manhole, Repair Manhole Bottom & Coat to 1' Above Pipe Crown - This is required due to missing mortar or brick around pipe penetrations or the bench, and/or deterioration of the bench, trough or pipe penetration into the manhole. Rehabilitation will be similar to RM1040 above except that it applies only to the Bench, Trough and Pipe Seal. The cost basis for this rehabilitation method will be a price per each.

1050. Stop I/I, Clean Manhole, Repair as Needed & Coat Entire Manhole - This

is required when leaks are evident in the manhole; and, usually has missing mortar or brick, and/or may have severe deterioration of the manhole or a significant component of the manhole. Rehabilitation will be similar to RM1040 above except that the leaks must be stopped using packing material, chemical grout or applying exterior waterproofing compounds. The cost basis for this rehabilitation method will be a price per vertical foot.

1052. Stop I/I, Clean Manhole, Repair Manhole Bottom & Coat to 1' above Pipe Crown - This is required when leaks are evident at the Bench, Trough or Pipe Seal; and, there may be severe deterioration in that part of the manhole. Rehabilitation will be similar to RM1050 above except that it applies only to the Bench, Trough and Pipe Seal. The cost basis for this rehabilitation method will be a price per each.

1060. Remove Roots, Clean Manhole, Repair as Needed & Coat - This is required when roots are evident in the manhole; usually has missing mortar or brick, and/or may have severe deterioration of the manhole or a significant component of the manhole; and, usually leaks are evident in the manhole. Rehabilitation will be similar to RM 1040 or RM 1050 above except that the roots should be removed and a root inhibitor applied before the other repairs are made. The cost basis for this rehabilitation method will be a price per vertical foot.

1062. Remove Roots, Clean Manhole, Repair Manhole Bottom & Coat to 1' above Pipe Crown - This is required when roots are evident at the Bench, Trough or Pipe Seal; there may be severe deterioration in that part of the manhole; and, usually leaks are evident. Rehabilitation will be similar to RM1060 above except that it applies only to the Bench, Trough and Pipe Seal. The cost basis for this rehabilitation method will be a price per each.

1110. Construct or Reconstruct Manhole Invert - This is required whenever the invert has been severely deteriorated or was never constructed originally. It requires the placement and finishing of concrete while the sewage flow is being bypassed or temporarily stopped. The cost basis for this rehabilitation method will be a price per each.

1205. Structurally Repair MH Chimney and Coat Internally - Repair to the manhole chimney is required in order to restore structural integrity and internal coating is recommended to inhibit infiltration/inflow. The cost basis for this rehabilitation method will be a price per each.

1210. Structurally Repair or Replace Manhole - This is recommended for manholes that have sufficient dimension to receive the internal liner and not severely diminish access into the manhole. The City's Engineer or Consulting

Engineer may, however, elect to replace a significant part of the manhole. The cost basis for this rehabilitation method will be a price per vertical foot.

B. Rehabilitation Methods for Private Service Lines

3320. Disconnect Roof Leader - When smoke exits from the roof drains, it means that there is a direct connection of the roof drains to the service line. Normally smoke will be seen coming from the roof vents, but not the roof drains. The roof drain should be disconnected at ground level and the roof drain redirected away from the house. In addition, the disconnected portion of the roof drain should be permanently plugged. The cost for disconnecting roof drains will be a price per occurrence.

3330. Replace Missing Cleanout Cap on Private Service Line - Replace a cleanout cap that is missing. The cost basis for this rehabilitation method will be a price per each.

3340. Repair Broken Cleanout on Service Line- This applies to private service lines that have been broken and need to be repaired. It may require minor excavation to expose a section of the riser that would include the installation of a cap. The cost basis for this rehabilitation method will be a price per each.

3350. Disconnect Abandoned Service Line at Main Line - In most instances this repair method is associated with vacant property that has a service line still connected to the sanitary sewer. The abandoned service line acts as a storm drain and should be disconnected at the main line. The cost for this repair will be a price per each.

3360. Point Repair on Service Line - This is for correcting a problem on a private service line. Problems requiring this method of rehabilitation are identified by a well defined hole (flow channel) in the ground to the pipe defect revealed during smoke testing. The pipe defect(s) may include cracks in the pipe, broken pipe, dropped joint, offset joint, open joint, the invasion of roots or a defective service line connection; and may fall into one of four levels of severity (light, medium, heavy and severe). Repair consist of excavating down to the pipe and one or more of the following - replace a section (up to 15 feet) of pipe; install a sealable repair clamp; or, encase the pipe in concrete for a minimum of five feet either side of the problem(s) after sealing the problem from water leakage. Included in this RM is the proper disposal of excavated waste material such as broken pipe contaminated by the sewage. The extent of repair will be determined by the pipe depth (which is assumed to be no more than 4 feet in the cost estimates), severity of the problem and original materials of construction. The City's Engineer or Consulting Engineer will determine which type repair is most appropriate for the varying conditions locally. The

cost basis for this rehabilitation method will be a price per each and will vary depending on depth.

3370. Point Repair on Service Line Under Pavement - This is for correcting a problem on a private service line; and, is exactly the same as RM 3360 above except that the repair is located under pavement which must be removed and replaced. The same conditions apply otherwise. The cost basis for this rehabilitation method will be a price per each.

3382. TV Main Line, Dye Test and Disconnect Storm Drain on Service Line - In this situation smoke exiting a surface drain may be originating from a broken service line or direct connection. In order to establish the exact repair location, it is recommended that the mainline be internally inspected while the storm drain is dye flooded. The appearance of dye in the mainline can be traced by the TV inspection crew to the service line that is defective and/or has a cross-connection with the storm sewer. Actual repair costs will be based on the price per each.

3392. TV Main Line, Dye Test and Disconnect Storm Drain on Service Line Under Pavement - This is the same repair method as described in RM3382 with the addition of cost to include excavating and repairing under pavement.

3400. Replace Section of Service Line - This is for correcting a problem on a municipal or private service sewer line. Problems requiring this method of rehabilitation are identified by multiple leaks revealed during smoke testing. The pipe defects may include cracks in the pipe, broken pipe, dropped joints, offset joints, open joints, the invasion of roots or defective service line connections; and may fall into one of four levels of severity (light, medium, heavy and severe). The rehabilitation method required is exactly the same as RM 3360 above except that the length of pipe requiring replacement is greater. The same conditions apply otherwise. The cost basis for this rehabilitation method will be a price per each and allows for the replacement of up to 50 feet of service line.

3410. Replace Section of Service Line Under Pavement - This is for correcting a problem on a municipal or private sewer line; and, is exactly the same as RM 3360 above except that the repair is located under pavement which must be removed and replaced. The same conditions apply otherwise. The cost basis for this rehabilitation will be a price per each and allows for the replacement of up to 50 feet of service line.

C. Rehabilitation Methods for Mainlines

4330. Replace Missing Cleanout Cap on Main Line - Replace a cleanout cap that is missing. The cost basis for this rehabilitation method will be a price per each.

4340. Repair Broken Cleanout on Service Line - This applies to private service lines that have been broken and need to be repaired that are located on municipal right-of-way. It may require minor excavation to expose a section of the riser that would include the installation of a cap. The cost basis for this rehabilitation method will be a price per each.

4350. Disconnect Abandoned Service Line - Whenever a house or mobile home is moved or demolished the service line is often not considered. The service line should be exposed at the right-of-way or easement line and plugged. Also included in this RM is the proper disposal of excavated waste material such as broken pipe contaminated by the sewage. The cost basis for this rehabilitation method will be a price per each.

4360. Point Repair on Municipal Line - This is for correcting a problem on a mainline or municipal service line by repairing or replacing a length of pipe less than 15 feet as in RM 3360 above except that the pipe size will usually be larger and the depth for excavation will be greater. Also included in this RM is the proper disposal of excavated waste material such as broken pipe contaminated by the sewage. The same conditions apply otherwise. The cost basis for this rehabilitation method will be a price per each and will vary depending on depth.

4370. Point Repair on Municipal Line Under Pavement - This is for correcting a problem on a mainline or municipal service line and is exactly the same as RM 4360 above except that pavement must be removed and replaced. The same conditions apply otherwise. The cost basis for this rehabilitation method will be a price per each and will vary depending on depth.

4382. TV Line, Dye Test and Disconnect Storm Drain on Mainline - In this situation smoke exiting a surface drain may be originating from a broken mainline or direct connection. In order to establish the exact repair location, it is recommended that the mainline be internally inspected while the storm drain is dye flooded. The appearance of dye in the mainline can be traced by the TV inspection crew to the defect and/or cross-connection with the storm sewer. Actual repair costs will be based on the price per each.

4392. TV Main Line, Dye Test and Disconnect Storm Drain Under Pavement - This is the same repair method as described in RM4382 with the addition of

cost to include excavating and repairing under pavement.

4410. Replace Section of Municipal Service Line (Up to 50 feet) - This is for correcting a problem on a private service line that is on municipal right-of-way; and, is exactly the same as RM 3360. The cost basis for this rehabilitation method will be a price per each.

4420. Replace Section of Municipal Service Line Under Pavement (Up to 50 feet) - This is for correcting a problem on a private service line; and, is exactly the same as RM 3360 above except that the repair is located under pavement which must be removed and replaced. The same conditions apply otherwise. The cost basis for this rehabilitation method will be a price per each.

4430. Replace Entire Mainline - This is for correcting numerous problems on a mainline by replacing the entire line segment as determined from smoke testing or CCTV inspection. Re-connection of service lines is addressed in RM4435 below. The cost basis for this rehabilitation method will be a price per foot and will vary depending on depth.

4435. Reconnect Service Lines to Relayed Mainline - This work is required in association with RM4430 and includes the stub-out and short section of pipe for reconnecting service lines while the mainline is being relayed. The cost basis for this rehabilitation method will be a price per each.

4440. Replace Entire Mainline Under Pavement - This is for correcting numerous problems on a mainline by replacing the entire line segment as determined from smoke testing or CCTV inspection. This repair is the same as RM4430 except pavement must be removed and replaced. Re-connection of service lines is addressed in RM4435. The cost basis for this rehabilitation method will be a price per foot and will vary depending on depth.

4510. Clean Line, Install Cured-In-Place Pipe Liner and Open Service Connections - This RM is specified for those lines with numerous defects, as identified from internally televising the line, in congested areas where it is not desired or appropriate to excavate and relay a sewer line; and, when it is more economical than replacing the existing pipe. However, it should be recognized that any preexisting alignment flaws will not be corrected using this method of rehabilitation. Furthermore, structural deficiencies will not be eliminated or compensated for using this method. This method may be used in combination with RM 4360 or RM 4370 to eliminate impasses or severe misalignments in the pipe line in order to minimize the amount of excavation required in congested areas. This RM should only be attempted by contractors with proven experience with this specific application. The cost estimate includes the installation of the liner, including all preparatory work, and opening service

connections by a remotely operated internal cutting device. The cost basis for this rehabilitation method will be a price per linear foot of pipe which will vary depending upon the pipe size, number of service connections per line segment, and restraining site conditions.

4515. Open Service Connections to CIP Liner - This includes opening service connections by a remotely operated internal cutting device after a CIP liner has been installed. The cost basis for this rehabilitation method will be a price per each.

4530. Clean Line, Install Pipe Liner By Pipe Bursting and Open Service Connections - This is a trenchless pipe replacement process where the existing pipe is hydraulically busted and the opening is enlarged to receive the same diameter or larger pipe. This RM should only be attempted by contractors with proven experience with this specific application. The cost estimate includes the installation of the liner, including all preparatory work (including pits), and reconnecting service connections. The cost basis for this rehabilitation method will be a price per linear foot of pipe which will vary depending upon the pipe size, number of service connections, restraining site conditions and the amount of roots present.

4535. Reconnect Service Lines to New Mainline - This includes reconnecting service connections by excavating down to the pipe. This RM is a point repair and is exactly the same as RM 4435. The cost basis for this rehabilitation method will be a price per each and will vary depending on depth.

5010. Clean Line and TV to Determine Line Condition and Assess Defects - This is necessary for those lines that were attempted to be televised but could not be completed due to heavy debris and/or roots. The line should be cleaned by water jetting, mechanical cutters or bucket machines, chemicals, or other means to remove debris to allow the line to be televised. The cost basis for this rehabilitation method will be a price per linear foot of pipe which will vary depending upon the pipe size, site restrictions and the amount of debris present.

3.0 System Modeling and Hydraulic Analysis

A practical method of analyzing a sewer system as large and complex as the City of Lawton's system is to develop a computer model which closely simulates the actual system. A calibrated computer model provides an efficient means to assess the existing system and is also beneficial in determining methods of upgrading the system and planning for future system expansions.

The computer model chosen for the City of Lawton's study was the HydroWorks

Software. This software can model complex networks of nodes (manholes), links (pipes), and structures (pump, weirs), in addition to simulating full backwater effects, reverse flow, and collection system overflows.

Hydraulic behavior in sanitary sewer systems is principally a function of the following parameters:

- Physical Characteristics of the system network (e.g., pipe length, pipe slope, pipe diameter)
- Pipe Material
- System Configuration
- Sewer Service Basin size and orientation
- Type and Locations of System Defects

To model and analyze the existing sewer system, a network of all 10 inch and larger lines was constructed from data obtained through physical inspection and field surveys. The information included pipe diameter, pipe length, pipe invert elevation, manhole rim elevation, and manhole depth.

Once the network was constructed, a continuity check was performed to ensure that all pipes were properly connected and accounted for in the model.

The model consists of 1,476 line segments of 10" and larger diameter pipe for a total of approximately 493,000 linear feet.

3.1 System Dry Weather Capacity (Existing)

In order to evaluate the existing system on an average dry weather day (no wet weather inflow), the system was sectorized into 220 service areas. Utilizing Lawton's 1990 Census Data, the population density (persons/acre) was determined for each service area. In addition, each service area was assigned one of five land use categories designated as 100% - 0% residential to 0% - 100% commercial. This land use category was then used to develop a dry weather hydrograph for each of the service areas.

From flow meter data, the flow per capita was determined for each of the five land use categories, and the flow was input into the model utilizing the dry weather hydrographs.

Calibration of the model was accomplished by adjusting the hydrographs and/or the per capita flow, to match the actual field measured flow data at each metering site.

The model showed that during dry weather conditions, the existing system has

adequate capacity to convey the wastewater to the treatment plant without overflows. However, it should be noted that a few of the line segments are at capacity or operate in a surcharge condition. (Figure 2-Appendix "A"). Typically, if a line segment has flow at or above its carrying capacity, the line segment immediately upstream of it will show to be surcharged. In addition, lines with reverse grades will also show as being surcharged.

3.2 System Dry Weather Capacity (2020 Plan)

Utilizing the 2020 Plan prepared by the City of Lawton, additional dry weather flows were input into selected portions of the system based on projected population and industrial growth within the City.

An average residential flow of 110 gallons per capita per day (GPCD) was added for population increases and an average of 900 gallons per acre per day (GPAD) was added for future industrial growth. These additional flows were input through the dry weather hydrographs to evaluate the collection system capacity as the City grows from its current population of 86,800 to the projected population of 110,000 in the year 2020.

The model showed that the existing system with future flows has adequate capacity to convey the wastewater to the treatment plant without collection system overflows. However, portions of the system along the South Wolf Creek Basin trunk main will be operating at capacity and in surcharged conditions. (Figure 3-Appendix "A").

Because no sewer collection system is totally unaffected by wet weather conditions, it is desirable to have excess system capacity during normal dry weather flow conditions so that any extraneous water entering the system during wet weather can be conveyed without overflows.

3.3 System Wet Weather Capacity (2-Year/24-Hour)

To evaluate the impact that wet weather has on the collection system, measured flows were analyzed from three storm events that had the greatest impact on the system. These storms occurred on May 5-7, 1995, June 4, 1995 and June 10, 1995, with rainfall ranging from 1.2 inches to 3.0 inches in a 24 hour period.

With the June 4, 1995 storm showing to have the greatest impact on the system, the flow data from this storm was selected for wet weather calibration of the model.

Inflow hydrographs were developed and utilized to input wet weather flows into

the model. The measured inflow volume for each metered sub-basin was represented by a runoff percentage factor based on the total area of the sub-basin. For example, a one percent runoff factor could result in one percent of the measured sub-basin rainfall entering the sewer collection system.

The measured inflow volume from each sub-basin was then distributed throughout the system on a weighted basis depending on the size of the contributing service area. The model was calibrated for wet weather flows by adjusting the run-off factor to match the actual field measured data at each metering site for the June 4, 1995 event.

In an attempt to determine a reasonable level of protection relative to system wet weather overflows, ten years of historical rainfall data was analyzed for the Lawton area. It was determined that only on three occasions since January, 1987 did the maximum 24-Hour rainfall exceed a total of 3.69 inches (Figure 4-Appendix "A"). This total is statistically the 2-Year 24-Hour storm event.

Based on this historical information, it was recommended that the collection system be capable of conveying wet weather flows induced by 3.69 inches of rain over a 24-Hour period. This recommendation was agreed to by the City of Lawton and on December 31, 1996 a meeting was held in the offices of the Oklahoma Department of Environmental Quality (ODEQ) for the purpose of obtaining approval for the selected storm. As a result of this meeting, ODEQ granted the City approval for a 2-Year 24-Hour design storm.

To model this condition, rainfall amounts were increased within each sub-basin to 3.69 inches in a 24 hour period with the runoff factors remaining the same as utilized in the calibrated wet weather model.

The model showed that during this storm event more than 75% of the modelled system is at capacity or under surcharged conditions. More significant is the fact that there are more than twenty-eight (28) overflow areas within the collection system (Figure 5-Appendix "A").

3.4 System Design Storm Capacity (2-Year/24-Hour & 2020 Plan)

For the purpose of recommending collection system improvements, the system was modelled under the ODEQ approved storm in addition to projected future flows based on the 2020 Plan.

This selected "Design Storm" simulation showed that more than 80% of the modelled system is at capacity or surcharged. (Figure 6-Appendix "A")

Under the design storm conditions the existing collection system cannot convey

wastewater to the treatment plant without experiencing sewage overflows in over thirty (30) areas throughout the system. (Figure 7-Appendix "A")

4.0 System Rehabilitation Recommendations

In an attempt to reduce the total system wet weather inflow by 25% to 30% and to enhance the long-term structural integrity of the existing system, an extensive rehabilitation and repair program is recommended to specifically address public collection system mainlines, collection system manholes, and private service lines.

In the past, a detailed cost-effective analysis was performed relative to repair or replacement. However, due to the conditions of the existing system and the lack of capacity, the recommended repair virtually provides for replacement of the collection lines as the repair method. Therefore, a cost-effective analysis is not applicable.

With a very aggressive public/private rehabilitation program, it is possible to achieve the follow inflow reduction percentages.

Public Mainlines -	26% Inflow Reduction
Private Service Lines -	21 % Inflow Reduction
Manholes -	5% Inflow Reduction

However, past experience has shown that cities will not expend public funds to repair private service lines, and they have not been insistent on the property owners properly repairing the private service defects. Consequently, system inflow reduction rates (volume) typically range from 25% to 30%.

From the field investigation results of the physical inspection, smoke testing, and internal T.V. inspection, system defects which act as sources of wet weather inflow were identified. With priority given to eliminating the modelled overflows shown in Figure 7- Appendix "A", it is recommended that all rehabilitation work be completed first in Squaw Creek Basin, then in Wolf Creek Basin, and finally in Cache Creek Basin.

Only those defects which were determined to contribute to system overflows have been scheduled for repair. However, as funds become available the City should repair the hundreds of other documented defects before they become inflow sources. Also, shown in Appendix "E" is a listing of high maintenance line segments. A number of the segments are already scheduled for repair, however, those that are not scheduled should be addressed by the City.

In addition it is recommended that the City of Lawton establish and maintain an aggressive preventative sewer maintenance program so that every line in the collection is cleaned/T.V. inspected on a 5 year cycle. With 2,300,000 linear feet of sewer line, this will require the City to clean/T.V. inspect over 400,000 linear feet of line per year.

A map showing the sub-basins and the rehabilitation program phases is included in Figure 8- Appendix "A".

4.1 Manhole Rehabilitation

It is estimated that defective manholes may count for approximately 10% of the wet weather inflow into the collection system.

The recommended methods for repair and rehabilitation of selected manholes include complete replacement, lid/frame repair, lid replacement, coating/waterproofing of walls, cones, and chimneys, and manhole patching.

Approximately 1625 manholes are recommended for rehabilitation/repair throughout the collection system.

In Appendix "B" detailed Rehabilitation Tables provide a listing of each manhole to be repaired, depth of manhole material, recommended rehabilitation method, priority ranking, and construction cost for repair. This analysis should be used as a guide and as detailed rehabilitation/repair plans and specifications are prepared, each manhole should be inspected to validate the recommended repair method.

It is recommended that each of the 1625 manholes as outlined in Appendix "B" be rehabilitated/repared to remove the potential for wet weather inflow into the collection system.

4.2 Main Collection Lines Rehabilitation

It is estimated that 50% of the wet weather inflow may enter the collection system through defective portions of the public mainline system. The recommended methods for repair and rehabilitation include complete replacement, partial line segment replacement, point repair, and liner installation.

Portions of approximately 973 mainline segments throughout the system are recommended for rehabilitation/repair. Therefore approximately 191,000 linear feet of mainline will require some form of repair work.

In Appendix "C" detailed Mainline Rehabilitation Tables provide a listing of each line segment to be repaired, the pipe size, pipe length, pipe material, priority ranking, the recommended rehabilitation method, and construction cost for the repair. This analysis should be used as a guide, and as detailed rehabilitation/repair plans and specifications are prepared, each line segment should be inspected or re-evaluated to validate the recommended repair method.

It is recommended that each of the 973 mainline segments as outlined in Appendix "C" be rehabilitated/repared to remove the potential for wet weather inflow into the collection system.

4.3 Private Service Lines Rehabilitation

It is estimated that 40% of the wet weather inflow may enter the collection system through defective portions of private service lines. The recommended methods for repair include partial line replacement, point repairs, plugging abandoned services, installing cleanout caps, and disconnecting roof drains.

Approximately 2,109 private lines throughout the system are recommended for rehabilitation/repair.

In Appendix "D" detailed Rehabilitation Tables provide a listing for each private service line segment to be repaired, the recommended repair method, and construction cost for repairs.

Private service defects should be addressed to reduce the volume of extraneous water entering the system. Notification of the various private residents to make the necessary repairs should be performed diplomatically, yet with emphasis on the importance of each repair. Quality control and proper follow-up is recommended to ensure that repairs are made according to the recommendations. Private property owners that refuse to make the necessary repairs and/or make improper repairs should be addressed by the appropriate authority of the City.

It is recommended that each of the 2,109 private lines as outlined in Appendix "D" be rehabilitated/repared by the private property owners to remove the potential for wet weather inflow into the collection system.

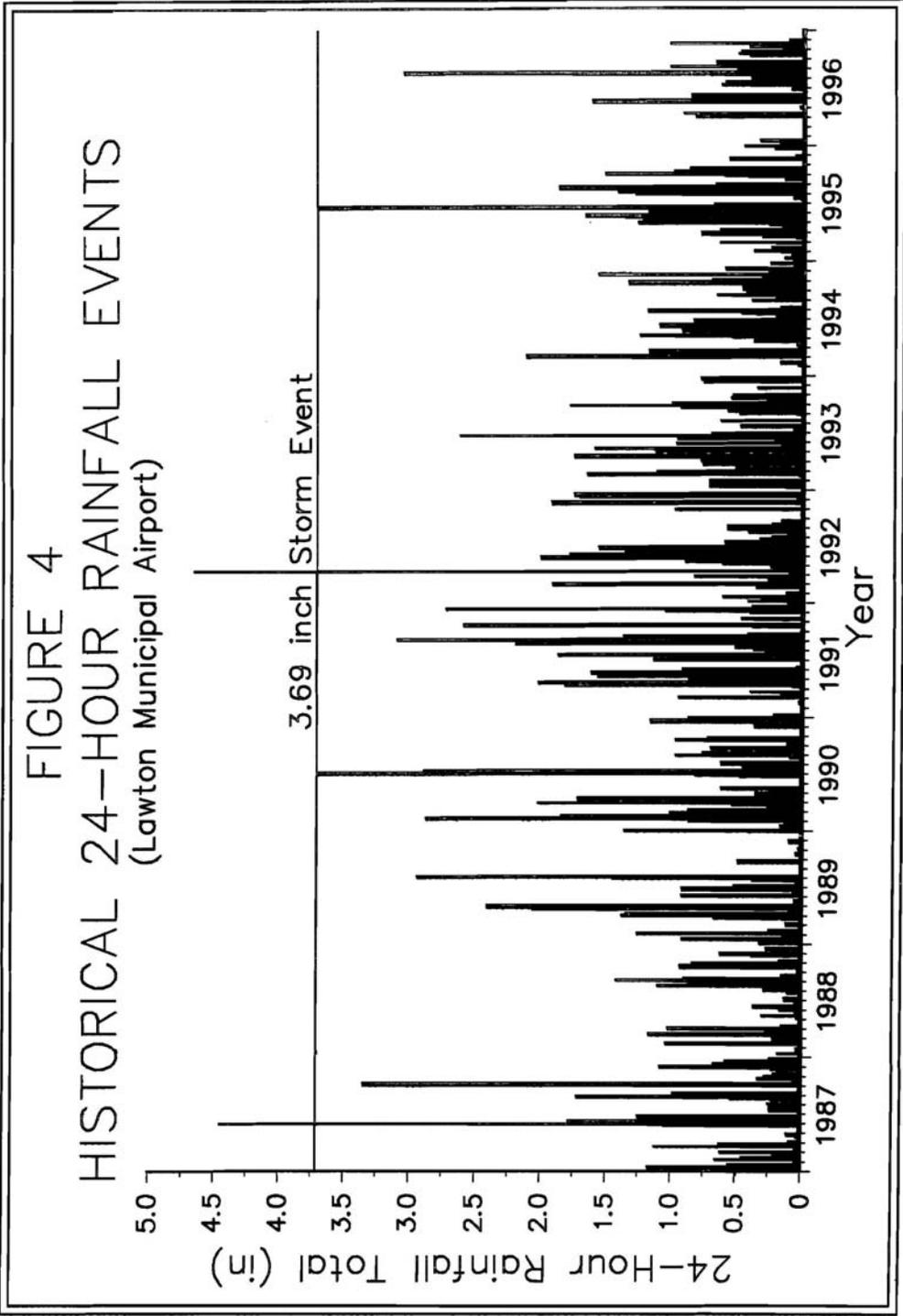
5.0 System Expansion Recommendations

Based on the hydraulic model, the existing collection system under Design Storm Conditions (2-Year, 24-Hour & 2020 Plan), cannot convey the wastewater to the treatment plant without widespread collection system overflows. Even with 25% to 30% inflow reduction taken for the extensive rehabilitation program, additional line capacity will be required to convey the remaining post-rehabilitation design storm flows in addition to providing for future growth based on the City's 2020 plan. Approximately 92,500 linear feet of line throughout various portions of the system is recommended for expansion/upgrade.

It should be emphasized that the hydraulic model is based on the modelled lines being clean with no deposition within the pipe inverts. If the lines are not maintained and cleaned periodically the model results may not be accurate.

Also, with the increased collection system capacity as a result of the upgrade and expansion projects, it is recommended that a new 15,000,000 gallon wet weather facility be constructed at the existing wastewater plant to accommodate wet weather flows entering the plant. This new facility will have the capacity to handle flows based on a 5-Year storm in accordance with ODEQ requirements.

On the following page in priority order is a summary description of each recommended expansion/upgrade project and the new wet weather facility. Also a map showing the proposed system expansion/upgrade improvements and the wet weather facility is included as Figure 9-Appendix "A".



SYSTEM EXPANSION/UPGRADE PROJECTS

Project Name	Location (Manhole to Manhole)	Description	Estimated Construction Cost
1. Bishop Rd. Interceptor	S057019M to C056027M	Construct New 36" Line	\$ 525,000
2. Park Ave. Upgrade	S040122M to S042055M	Upgrade 18" to 27" Line	950,000
3. Carver St. Upgrade	C024046M to C024037M	Upgrade 12" to 15" Line	250,000
4. Arnold Park Expansion	C024037M to S024323M	Parallel 12" w/15" Line	300,000
5. Sheridan Rd. Upgrade 1	S026091M to S040122M	Upgrade 15" to 21" Line	350,000
6. Wet Weather Facility	Treatment Plant	15MG Wet Weather Facility	2,250,000
7. Sheridan Rd. Upgrade 2	S011025M to S026091M S026178M to S026091M	Upgrade 10" to 12" Line	400,000
8. S.W. 24th Upgrade	S027854M to S040122M	Upgrade 18"/21" to 24"/27" Line	525,000
9. Arlington Ave. Upgrade	S027177M to S027105M	Upgrade 10" to 12" Line	350,000
10. N.W. 23rd/26th St. Upgrade	S010210M to S027232M S010014M to S026091M	Upgrade 10"/12" to 12"/15"/18" Line	675,000
11. West Gore Blvd. Upgrade	W039175M to W028002M	Upgrade 10" to 12" Line	225,000
12. N.W. 62nd St. Upgrade	W029152M to W029049M	Upgrade 10" to 12" Line	225,000
13. N.W. 43rd St. Upgrade	W009105M to W009020M	Upgrade 10" to 12" Line	300,000
14. N.E. Rogers Lane Upgrade	C011214M to C013657M	Upgrade 10" to 12"/15" Line	600,000
15. S.E. "D" Ave. Upgrade	C043047M to C043046M	Upgrade 8" to 10" Line	175,000
16. N.W. 75th St. Upgrade	W007122M to W007097M W007005M to W030033M	Upgrade 12"/15" to 15"/18" Line	650,000
17. South Wolf Creek Trunk Expansion 1	W085012M to C096014M	Parallel 36" w/ 42" Line	2,600,000
18. South Wolf Creek Trunk Expansion 2	W086009M to W085012M	Parallel 27"/30" w/30"/36" Line	1,850,000
19. North Wolf Creek Interceptor	W069018M to W069004M	Construct New 27" Line	450,000
20. North Wolf Creek Expansion 1	W039013M to W069018M	Parallel 36"/30" w/24" Line	1,350,000
21. North Wolf Creek Expansion 2	W028021M to W039013M	Parallel 30" w/24" Line	1,400,000
22. North Wolf Creek Expansion 3	W030031M to W028021M	Parallel 18"/21"/24" w/ 18"/24" Line	1,400,000
23. Rock Island R.R. Upgrade	S058005M to S042012M	Upgrade 10" to 15"/18" Line	950,000
24. South Wolf Creek Expansion 3	W086012M to W086009M	Parallel 27" w/ 30" Line	1,500,000
25. South Wolf Creek Expansion 4	W038097M to W006012M	Parallel 21"/18" w/30"/24" Line	1,350,000
26. South Wolf Creek Expansion 5	W036009M to W038097M	Parallel 18" w/ 24" Line	1,350,000
TOTAL ESTIMATED CONSTRUCTION COST			\$ 22,950,000

6.0 Final Report Closure

Throughout a twenty-two month period, beginning in April, 1995, extensive field tests were performed in an effort to define, identify, and document deficiencies within the City's sewer collection system.

After a thorough analysis and evaluation of all the results and findings from the study, the following observations and conclusions are offered:

- Dry weather capacity problems do exist; however, with the exception of frequent line stop-ups, dry weather flows are conveyed to the treatment plant without overflows.
- Wet weather inflow entering defective portions of the collection system does impact the system and causes sanitary sewer overflows.
- The City should initiate, as outlined in this study report, an aggressive and comprehensive rehabilitation/repair program in an attempt to reduce the wet weather inflow by 25% to 30%.
- Sanitary sewer overflows cannot be eliminated by system rehabilitation/repair work alone.
- The City should provide for selected area expansion/upgrade of lines, as outlined in this study report, to adequately convey the ODEQ approved Design Storm (2 Year/24-Hour & 2020 Plan).
- All recommended collection system rehabilitation/repair work should be completed throughout the system by December, 2014.
- Flow monitoring should be conducted periodically throughout the rehabilitation/repair program to assess and document the inflow reduction results.
- Along with the collection system rehabilitation/repair program, the recommended system expansion/upgrade lines should be constructed.
- All recommended collection system expansion/upgrade lines should be completed and in operation by December, 2018.
- The City should begin by May 1, 1997 their preventative sewer maintenance program so that the complete system is cleaned at least every 5 years.
- As funds become available the City should address the high maintenance line segments listed in Appendix "E". Consideration should be given to replacement of these lines.

7.0 Cost Estimates and Schedule

A comprehensive rehabilitation and expansion program has been defined in the previous sections of this report. With the recommended scope of work generally consisting of extensive city-wide collection system rehabilitation followed by field flow

monitoring for confirmation of adequate repairs as well as major system expansion/upgrade construction, it is imperative that the City adopt a realistic multi-year financial plan and construction schedule.

To assist in developing a financial plan, cost estimates were prepared for all recommended rehabilitation and system expansion/upgrade work. These cost estimates which include construction, design engineering, inspection, and contingencies are presented in the following portion of this report section.

Additionally, a multi-year improvements schedule was developed which established completion dates for various phases of the work. In preparing the schedule, priority was given to completing all the rehabilitation work in areas that experience the most frequent overflows.

However, it must be understood that as field conditions change or additional information is gathered from the cleaning program, the City should make necessary schedule modifications.

The majority of rehabilitation work to repair collection system defects for the reduction of wet weather inflow is scheduled for completion within the first 12 years, with the remaining inflow reduction work completed by the year 2014. The expansion/upgrade projects will be done in conjunction with the rehabilitation program and all expansion/upgrade work be completed by the year 2018.

In developing the improvements schedule, serious consideration was given to the impact that this large amount of construction work would have on the City staff, construction costs, and the local community. It was determined that scheduling the work over a twenty-year period would be the most beneficial due to the following:

- The City could provide the necessary construction administration and inspection, with a minimal staff increase.
- Community disruption due to the construction work could be kept to a tolerable level.
- Construction work could be uniformly distributed, thereby providing a basis to help maintain stable construction costs.
- Additional field flow monitoring could be performed to confirm results of the rehabilitation/repair work and adjust scope of work as necessary.

Based on the above, it is recommended that the City of Lawton adopt the Sanitary Sewer Overflow ("S.S.O.") Abatement Schedule as presented in this report section.

**SYSTEM REHABILITATION/EXPANSION
COST SUMMARY**

SYSTEM REHABILITATION/EXPANSION COST SUMMARY

Item	Quantity	Estimated Cost
Manhole Rehabilitation	1,625 EA	\$ 698,000
Mainline Rehabilitation	191,000 LF	18,986,000
System Expansion/Upgrade	92,500 LF	20,700,000
Wet Weather Facility	15MG 1-EA	2,250,000
Sub-Total (Construction)		\$ 42,634,000
Engineering and Inspection	LS	4,466,000
Contingencies	LS	5,460,000
Sub-Total (Engineering and Contingencies)		\$ 9,926,000
City Maintenance Identified Rehabilitation	LS	7,500,000
Administration of Private Service Rehabilitation	LS	680,000
Flow Monitoring Assessment	LS	510,000
Estimated Grand Total		\$ 61,250,000

SYSTEM REHABILITATION/EXPANSION ANNUAL COST SUMMARY

Year	Manhole Rehabilitation (Const. Cost)	Mainline Rehabilitation (Const. Cost)	Private Service Rehabilitation Administration	Expansion/Upgrade (Const. Cost)	City Maintenance Identified Rehabilitation	Flow Monitoring Assessments	Engineering/Inspection/Contingencies	Total Estimated Annual Cost
1998	\$ 3,000	\$ 764,000	\$ 85,000	\$ 1,475,000	\$ 375,000	\$ 0	\$ 519,000	\$ 3,221,000
1999	42,000	1,542,000	85,000	0	375,000	30,000	376,000	2,450,000
2000	44,000	1,687,000	85,000	0	375,000	30,000	428,000	2,649,000
2001	19,000	1,169,000	85,000	550,000	375,000	30,000	420,000	2,648,000
2002	22,000	750,000	85,000	2,600,000	375,000	30,000	786,000	4,648,000
2003	20,000	1,590,000	85,000	400,000	375,000	30,000	481,000	2,981,000
2004	54,000	2,231,000	85,000	0	375,000	30,000	536,000	3,311,000
2005	74,000	1,493,000	85,000	525,000	375,000	30,000	488,000	3,070,000
2006	56,000	1,780,000	0	350,000	375,000	30,000	510,000	3,101,000
2007	86,000	1,233,000	0	675,000	375,000	30,000	467,000	2,866,000
2008	74,000	687,000	0	750,000	375,000	30,000	351,000	2,267,000
2009	16,000	444,000	0	775,000	375,000	30,000	286,000	1,926,000
2010	17,000	1,158,000	0	650,000	375,000	30,000	422,000	2,652,000
2011	47,000	742,000	0	2,600,000	375,000	30,000	790,000	4,584,000
2012	33,000	413,000	0	2,300,000	375,000	30,000	639,000	3,790,000
2013	13,000	436,000	0	1,350,000	375,000	30,000	375,000	2,579,000
2014	78,000	867,000	0	1,400,000	375,000	30,000	544,000	3,294,000
2015	0	0	0	1,400,000	375,000	30,000	322,000	2,127,000
2016	0	0	0	2,450,000	375,000	0	564,000	3,389,000
2017	0	0	0	1,350,000	375,000	0	311,000	2,036,000
2018	0	0	0	1,350,000	0	0	311,000	1,661,000
TOTAL	\$ 698,000	\$ 18,986,000	\$ 680,000	\$ 22,950,000	\$ 7,500,000	\$ 510,000	\$ 9,926,000	\$ 61,250,000



City of Lawton

Sewer Construction Division

E-mail: cityof.lawton.ok.us
Telephone 580-581-3405
Fax 580-581-3488

Mailing Address: 103 Southwest
Shipping Address: 2100 South
Lawton, Oklahoma

March 9, 1999

Paul Hodge
Assistant Chief
Financial Assistance Division
State of Oklahoma
Water Resources Board
3800 North Classen Boulevard
Oklahoma City Oklahoma 73118

Dear Mr. Hodge:

Enclosed please find the following:

- "Revised" Cost Effective Analysis of the Citywide Sanitary Sewer Collection System Rehabilitation as requested.
- ODEQ Permit No. SL000016991252 - includes projects 98-1 SSES (FY 98/99 CDBG); 98-2 SSES (Bishop Road 36"); 98-5 SSES & 98-6 SSES (Sub-basin 206 Rehab); and 98-7 SSES (NW 75th Street Emergency Upgrade).

If you have any questions or require any additional information, please contact me at 580-581-3324.

Sincerely,

Roger L. Bridges, P.E.
SSTD Civil Engineer

Enclosure

cc: Jerry Ihler
Rusty Whisenhunt
Steve Livingston



City of Lawton

Sewer Construction Division

E-mail: cityof.lawton.ok.us
Telephone 580-581-3406
Fax 580-581-3488

Mailing Address: 103 Southwest
Shipping Address: 2100 Sou
Lawton, Oklah

Cost Analysis

The cost analysis used to determine the best method for preventing sanitary sewer system over flow as required by the EPA Administrative Order and the ODEQ Consent Order is as follows:

The SSES Final Report identified that an additional 28,000,000 gallons of extraneous water is received at the treatment plant during a 2" to 3.7" rain event in a 24 hour period. During flow monitoring of the collection system, it was determined that flow did increase due to I&I by 28,000,000 mg during a storm event on June 4, 1995 of 2.9 inches. After negotiations with ODEQ and EPA, it was agreed that the City of Lawton would design its improvements to accommodate a 2 year/24 hour storm event of 3.64 inches (Figure 4 in SSES Report). Figure 5 of the SSES Report shows locations of the sewer system overflow areas (approximately 28) with much of the system surcharged. From the report, information obtained indicated a cost analysis could be performed to determine the most economical method of correcting the City of Lawton I&I problem.

Option I

Inflow and infiltration reduction 0%
 Current capacity of WWTP 10 mgd
 Current average day flow 9.5 mgd

Conclusion: To treat the I&I at the treatment plant, capacity would have to be increased to 38 mgd average daily flow (ADF).

Cost for Expansion of 28 MGD

Design of expansion, 6% of construction cost	\$3,780,000
*Construction cost \$2.25/gallon x 28,000,000	\$63,000,000
Purchase of land, 20 acres @ \$1,500/acre	\$30,000
Operation cost over 20 year period	
Annual operation cost \$1.5 million/year	
Assume annual inflation rate of 2.5% and annual interest rate of 5% which provides a net of 2.5% (5% - 2.5%).	
PW = 1,500,000 x (1-(1+2.5%) ⁻²⁰)/2.5%	\$23,383,743
Transportation Cost	\$22,950,000
All expansion projects listed in the SSES report would be required to transport flow	_____
Total cost to treat and transport with 0% reduction of I&I	\$113,143,743

Note: \$2.25/gallon is the cost obtained from the current expansion project at the Wastewater Treatment Plant. \$1,500/acre is the appraised value of land adjacent to the current plant operation. Transportation cost is estimated in the SSES Final Report.

Operation cost of \$1,500,000 is based on the actual budget expense for the City of Lawton's existing Wastewater Treatment Plant. The increase of 28 mgd will require a second complete plant operation, not upgrade of the existing plant facility.

Option II

Inflow and infiltration reduction of 25%

Increase treatment capacity to 18 mgd average daily flow. This work was already required due to current capacity at 95% of ADF.

Design cost, 6% of construction cost	\$1,100,000
Cost of expansion of 8 mgd	\$17,600,000
No purchase of land necessary	\$0
Annual operation cost over 20 years @ \$200,000/year	
Assume annual inflation rate of 2.5% and annual interest rate of 5%, which provides a net rate of 2.5% (5% - 2.5%).	
$PW = 200,000 \times (1 - (1 + 2.5\%)^{-20}) / 2.5\%$	\$3,117,800
Transportation cost and upgrade cost	<u>\$61,250,000</u>
Total Cost	\$83,067,800

Note: \$17,600,000 is the actual contract amount for the expansion of the plant to 18 mgd ADF. The \$200,000/year operation cost is due to the increase in electrical power demand. No other additional cost is projected over current operation budget. Transportation cost and upgrade cost is the amount estimated in the SSES Final Report.

Option III

Inflow and infiltration reduction 50%

The increase in treatment capacity to minimum 15 mgd average daily flow is required due to current treatment capacity of 95% ADF.

Design Cost, 6% of construction cost	\$1,000,000
Cost of expansion of 5 mgd	\$15,600,000
No purchase of land necessary	\$0
Annual operation cost over 20 years @ \$180,000/year	
Assume annual inflation rate of 2.5% and annual interest rate of 5%, which provides a net rate of 2.5% (5% - 2.5%).	
PW = $180,000 \times (1 - (1 + 2.5\%)^{-20}) / 2.5\%$	\$2,806,050
Transportation cost and upgrade cost	
previously identified 250,000 lf of line	\$61,250,000
Additional line rehabilitation 400,000 lf of line	<u>\$40,000,000</u>
Total cost	\$120,656,050

Note: The expansion costs used were costs provided by CH2M Hill, Inc. to increase the existing plant capacity to 15 mgd ADF. Cost to rehabilitate line @ \$100/lf, size range is 8" to 24". Operation cost of \$180,000 is based on additional operation cost projected for upgrade of the existing Wastewater Treatment Plant.

Option IV

Inflow reduction of 75%

Increase of treatment capacity to 15 mgd average daily flow is required due to current treatment capacity of 95% ADF.

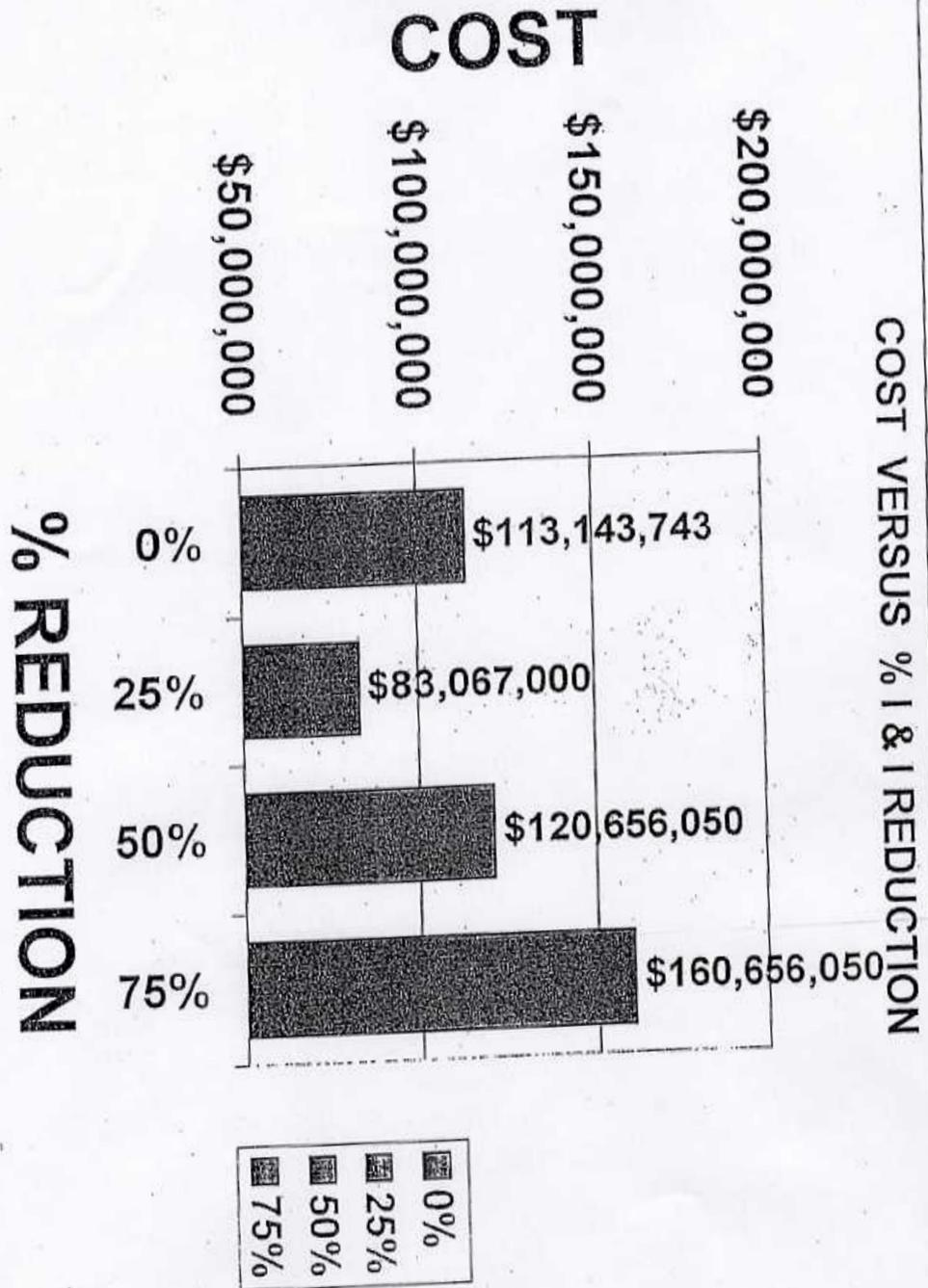
Design cost, 6% of construction cost	\$1,000,000
Cost of expansion of 5 mgd	\$15,600,000
No purchase of land necessary	\$0
Annual operation cost over 20 years @ \$180,000/year	
Assume annual inflation rate of 2.5% and annual interest rate of 5%, which provides a net rate of 2.5% (5% - 2.5%).	
PW = $180,000 \times (1 - (1 + 2.5\%)^{-20}) / 2.5\%$	\$2,806,050
Transportation cost and upgrade cost	
previously identified 250,000 lf of line	\$61,250,000
Additional line rehabilitation 800,000 lf of line	<u>\$80,000,000</u>
Total cost	\$160,656,050

Note: Current plant operating at 95% ADF. Actual cost estimate for 15 mgd capacity by CH2M Hill, Inc. Cost to rehabilitate line @ \$100/lf, size range is 8" to 24". The operation cost of \$180,000 is based on the additional operation cost projected for upgrade of the existing Wastewater Treatment Plant.

Conclusion

From the graph showing reduction of I&I versus cost, the most economical I&I reduction is 25%. The 25% reduction rehabilitation method is outlined in the SSES report as the recommended rehabilitation method.

The City of Lawton has submitted the SSES Final Report to ODEQ and received authorization to proceed with design and construction. The increased capacity of the existing Wastewater Treatment Plant is scheduled for completion in July of 1999.



APPENDIX E
RANGELAND PRODUCTIVITY AND PLANT COMPOSITION

Rangeland Productivity and Plant Composition

Comanche County, Oklahoma

[Only the soils that support rangeland vegetation suitable for grazing are rated. This report shows only the major soils in each map unit]

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland composition
		Favorable year	Normal year	Unfavorable year		
		<i>Lb/ac</i>	<i>Lb/ac</i>	<i>Lb/ac</i>		<i>Pct</i>
VeC: Vernon	Clay prairie (South) PE 31-44	2,500	1,700	1,000	Sideoats grama Buffalograss Tobosa Other perennial grasses Blue grama Hairy grama Other annual forbs Other perennial forbs Other shrubs Silver bluestem Vine mesquite	25 15 15 10 5 5 5 5 5 5 5

Rangeland Productivity and Plant Composition

In areas that have similar climate and topography, differences in the kind and amount of rangeland or forest understory vegetation are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

This table shows, for each soil that supports vegetation suitable for grazing, the ecological site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. An explanation of the column headings in the table follows.

An "ecological site" is the product of all the environmental factors responsible for its development. It has characteristic soils that have developed over time throughout the soil development process; a characteristic hydrology, particularly infiltration and runoff that has developed over time; and a characteristic plant community (kind and amount of vegetation). The hydrology of the site is influenced by development of the soil and plant community. The vegetation, soils, and hydrology are all interrelated. Each is influenced by the others and influences the development of the others. The plant community on an ecological site is typified by an association of species that differs from that of other ecological sites in the kind and/or proportion of species or in total production. Descriptions of ecological sites are provided in the Field Office Technical Guide, which is available in local offices of the Natural Resources Conservation Service (NRCS).

"Total dry-weight production" is the amount of vegetation that can be expected to grow annually in a well managed area that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture. Yields are adjusted to a common percent of air-dry moisture content.

"Characteristic vegetation" (the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil) is listed by common name. Under "rangeland composition," the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range similarity index and rangeland trend. Range similarity index is determined by comparing the present plant community with the potential natural plant community on a particular rangeland ecological site. The more closely the existing community resembles the potential community, the higher the range similarity index. Rangeland trend is defined as the direction of change in an existing plant community relative to the potential natural plant community. Further information about the range similarity index and rangeland trend is available in the "National Range and Pasture Handbook," which is available in local offices of NRCS or on the Internet.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, an area with a range similarity index somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Reference:

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. (<http://www.nrcs.usda.gov/technical/range.html>)

Rangeland Productivity and Plant Composition

Comanche County, Oklahoma

[Only the soils that support rangeland vegetation suitable for grazing are rated. This report shows only the major soils in each map unit]

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland composition
		Favorable year	Normal year	Unfavorable year		
		<i>Lb/ac</i>	<i>Lb/ac</i>	<i>Lb/ac</i>		
Pc: Ashport	Loamy bottomland PE 44-64	8,500	6,100	4,500	Big bluestem Indiangrass Other perennial grasses Switchgrass Little bluestem Other perennial forbs Eastern gamagrass Other trees	25 15 15 15 10 10 5 5

APPENDIX F
PUBLIC COMMENTS



DEPARTMENT OF ARMY
CORPS OF ENGINEERS, TULSA DISTRICT
1645 SOUTH 101ST EAST AVENUE
TULSA, OKLAHOMA 74128-4609

20 August 2007

Planning and Environmental Division
Environmental Analysis and Compliance Branch

TO INTERESTED PARTIES

The Tulsa District has assessed the environmental impacts of a sanitary sewer expansion/upgrade project in the city of Lawton, Oklahoma designed to increase the carrying capacity of the existing system. The project would help bring the city of Lawton into compliance with its NPDES permit pertaining to overflows of the sewer collection system. The project provides for the new parallel installation of approximately 37,000 linear feet of existing sanitary sewer trunk line as outlined in the Sewer System Evaluation Study presented to the city of Lawton in April 1997. The project has been agreed to by the city of Lawton under Oklahoma Department of Environmental Quality, Division of Water Quality Consent Order No. 02-0397, issued January 17, 2004, to remediate sanitary sewer overflows by increasing the carrying capacity of the existing collection system. This assessment was prepared in accordance with U.S. Army Corps of Engineers Regulations, Part 230, Policy and Procedures for Implementing the National Environmental Policy Act. It has been determined from the enclosed environmental assessment that the project will have no significant adverse effects on the natural or human environment.

The Draft Environmental Assessment is enclosed for your review and comments. Comments should be submitted within 30 days from the date of this letter to the Tulsa District, Corps of Engineers, ATTN: Environmental Analysis and Compliance Branch, 1645 S. 101st East Ave, Tulsa, Oklahoma 74128.

Sincerely,

Stephen L. Nolen
Chief, Environmental Analysis and
Compliance Branch

Enclosures



The National Park Service reviewed this project,
and determined that no parks will be affected;
therefore, we have no comments.

Signed: Date: 8/28/07

APPENDIX G
NEWSPAPER PUBLIC NOTICE

**PROOF OF PUBLICATION
THE LAWTON CONSTITUTION
P. O. Box 2069-L, Lawton, OK 73502 :(580) 353-0620**

IN THE _____ COURT OF COMANCHE COUNTY, OKLAHOMA

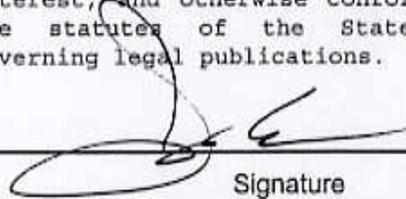
Case No. Notice STATE OF OKLAHOMA, COUNTY OF COMANCHE

Public Works Notice

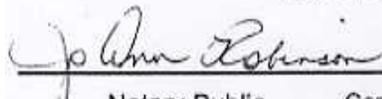
I, James E Cottingham, of lawful age, being duly sworn upon oath, deposes and says: That I am the Business Manager of The Lawton Constitution, a daily newspaper printed and published in the city of Lawton, County of Comanche, and state of Oklahoma, and that the advertisement above referred to, a true and printed copy of which is here unto attached, was published in said newspaper for 1 consecutive days (or weeks), the first publication being on 5/25/2005 ; and the last day of publication being on 5/25/2005

1st Insertion. 5/25/2005
 2nd Insertion. ___/___/20___
 3rd Insertion. ___/___/20___
 4th Insertion. ___/___/20___
 Final Insertion. 5/25/2005

That said newspaper has been published continuously and uninterruptedly in said county during a period of one hundred and four consecutive weeks prior to the publication of the attached notice or advertisement: that it has been admitted to the United States mail as second-class mail matter, that it has a general paid circulation, and publishes news of general interest, and otherwise conforms with all of the statutes of the State of Oklahoma governing legal publications.



 Signature
 SUBSCRIBED and sworn to before me this day of
 May 31, 2005



 Notary Public Comm#: 98006871
 My commission expires April 27, 2006

(Attached Copy of Notice)

Published in
 The Lawton Constitution
 May 25, 2005
NOTICE OF PUBLIC HEARING PUBLIC WORKS AUTHORITY
 The Lawton Water Authority will hold a public hearing at 6:00 P.M. on July 12, 2005 in the Council Chambers of the Wayne Gilley City Hall. The hearing is to discuss proposed improvements to the Authority's wastewater collection and treatment facilities, alternatives to the proposed improvements and their associated costs. One purpose of the hearing is to discuss the potential environmental impacts of the project and the alternatives to it. The proposed project is identified in the Planning and Environmental Information Document and consists of the following major elements:
 1. South Wolf Creek Expansion Upgrade Project. This project will parallel or modify the existing sanitary sewer lines that were installed in the mid 1970's. The Planning document which includes environmental information is on file and available for public inspection at the City Clerk's Office, Wayne Gilley City Hall at 104 SW 4th Street, Lawton, Oklahoma 73501. These documents provide a detailed description of the project cost, financing information, cost to users, alternatives considered and environmental effects. The public is invited to attend.
 Authority Chairman
 Traci Hushback,
 Secretary
 SEAL

312659

**PROOF OF PUBLICATION
THE LAWTON CONSTITUTION
P. O. Box 2069-L, Lawton, OK 73502 :(580) 353-0620**

IN THE _____ COURT OF COMANCHE COUNTY, OKLAHOMA
Case No. Sewer STATE OF OKLAHOMA, COUNTY OF COMANCHE

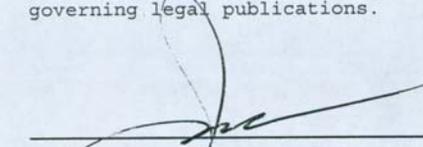
Sewer Draft Upgrade

I, James E Cottingham, of lawful age, being duly sworn upon oath, deposes and says: That I am the Business Manager of The Lawton Constitution, a daily newspaper printed and published in the city of Lawton, County of Comanche, and state of Oklahoma, and that the advertisement above referred to, a true and printed copy of which is here unto attached, was published in said newspaper for

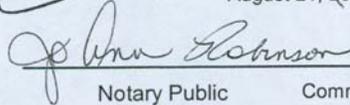
1 consecutive days (or weeks), the first publication being on 8/17/2007 ; and the last day of publication being on 8/17/2007

1st Insertion. 8/17/2007
2nd Insertion. ___/___/20___
3rd Insertion. ___/___/20___
4th Insertion. ___/___/20___
Final Insertion. 8/17/2007

That said newspaper has been published continuously and uninterruptedly in said county during a period of one hundred and four consecutive weeks prior to the publication of the attached notice or advertisement: that it has been admitted to the United States mail as second-class mail matter, that it has a general paid circulation, and publishes news of general interest, and otherwise conforms with all of the statutes of the State of Oklahoma governing legal publications.



Signature
SUBSCRIBED and sworn to before me this day of
August 21, 2007


Notary Public Comm#: 02004515
My commission expires April 27, 2010

(Attached Copy of Notice) Published in The Lawton Constitution August 17, 2007 Announcing: COMMENT PERIOD DRAFT ENVIRONMENTAL ASSESSMENT as related to the South Wolf Creek Sanitary Sewer Expansion/Upgrade Project Lawton, Oklahoma in compliance with The National Environmental Policy Act FORMAL COMMENT PERIOD August 20, 2007 through September 18, 2007 The Draft Environmental Assessment addresses the environmental effects of a sanitary sewer expansion/upgrade project in the city of Lawton, Oklahoma designed to increase the carrying capacity of the existing system. The project would help bring the city of Lawton into compliance with its NPDES permit pertaining to overflows of the sewer collection system. The comment period is a continuation of public involvement used to develop the draft assessment. The public is invited to review the draft assessment and make comments. A copy of the assessment is available at: Lawton Public Library 110 SW 4th Street Lawton, Oklahoma All written comments and questions will be addressed in the Final Environmental Assessment. To be included in the final assessment, comments and questions must be received prior to the close of the formal comment period. Comments and questions about the draft assessment or the comment process can be directed to: Mr. Stephen L. Nolen Chief, Environmental Analysis and Compliance Branch U.S. Army Corps of Engineers, Tulsa District 1645 S. 101st East Avenue ATTN: CESWT-PE-E Tulsa, Oklahoma 74128 Phone: 918-659-7660 e-mail:

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