

# STORMWATER AND FLOODPLAIN MANAGEMENT

## INTRODUCTION:

This document describes the Stormwater and Floodplain criteria and shall hereafter be known, cited and referred to as the Stormwater and Floodplain Management Criteria Manual (Manual) for the City of Wagoner, Oklahoma.

This Manual shall comply with the most recent adoption of the City of Wagoner, Oklahoma Code of Ordinances for Flood Damage Protection (Floodplain Management) (Section 5-1001 - 5-1071 of Chapter 10) and the Stormwater Ordinance and Management Act, Section 5-1101 to 1182 of Chapter 11.

## STORMWATER MANAGEMENT:

### 1.1 RAINFALL DATA:

Total rainfall depths shall be specific to the City of Wagoner based upon the general site location.

- 1.1.1 Rainfall intensity values for durations greater than one (1) hour shall be developed in accordance with the procedures identified and the rainfall frequency atlases provided in the United States Department of Commerce (USDOC) and National Weather Bureau (NWS) Technical Publication No. 40 (TP-40), May 1961 edition.
- 1.1.2 Rainfall intensity values for durations of one (1) hour or less shall be developed in accordance with the procedures identified the National Oceanic and Atmospheric Administration (NOAA) and National Weather Service (NWS) Technical Memorandum entitled Hydro-35, June 1977 edition.
- 1.1.3 The totalized rainfall depth with respect to a specific time duration event for a given return frequency shall be equal to or greater than the minimum rainfall values provided in Appendix A, Exhibit A.

### 1.2 STORMWATER RUNOFF:

- 1.2.1 The approved stormwater runoff methods that shall be used to determine total and/or peak stormwater runoff rates, which subsequently may be used for the design of the individual components of the stormwater drainage system, are provided in Appendix A, Exhibit B. All other methods for determining peak runoff and corresponding storage volume must be approved in advance by the Local Stormwater Manager. These approved methods include the following:

- A. The Rational Method;
- B. The SCS Method;
- C. The Snyder's Method with Tulsa Modifiers; and
- D. Unit Volume Method.

1.2.2 Rational Method. The Rational Method may be used to determine peak flows for design of the stormwater drainage system in accordance with the limitations prescribed herein. However, the Rational Method shall not be allowed for stormwater detention storage volume calculations. Determination of the Rational Method runoff coefficient (C) requires the professional to exercise good engineering judgment. In an effort to facilitate good judgment, Appendix A, Exhibit D presents the recommended range of C values for specific land uses and surface characteristics that should be used. The principles detailed in the United States Department of Transportation, Federal Highway Administration Hydraulic Engineering Circular Number 22 (HEC-22): Urban Drainage Manual, second edition, dated August 2001 shall govern with respect to the application of the Rational Method, except where specifically modified herein.

1.2.3 Soil Conservation Service (SCS) Method. The SCS Method may be used to determine peak flows for design of the stormwater drainage system in accordance with the limitations prescribed herein. In addition, the SCS Method shall be allowed for stormwater detention storage volume calculations as prescribed herein as well. Determination of the SCS curve number (CN) requires the professional to exercise good engineering judgment. County soil maps shall be used in the determination of the corresponding curve number values in association with the specific land uses and surface characteristics that exist or that are proposed. The principles detailed in the United States Department of Transportation, Federal Highway Administration Hydraulic Engineering Circular Number 22 (HEC-22): Urban Drainage Manual, second edition, dated August 2001 shall govern with respect to the application of the SCS Method, except where specifically modified herein.

### 1.3 TIME OF CONCENTRATION:

Appendix A, Exhibit E presents the overland flow velocities for various ground covers to determine the sheet flow and shallow concentrated flow portions of travel time calculations. Manning's Formula shall be used to determine the velocity for travel time calculations for concentrated flow within swales, ditches, channels, and storm sewers.

### 1.4 STORMWATER DRAINAGE SYSTEM:

The stormwater drainage system shall individually or collectively include: the stormwater collection system, the stormwater conveyance system, the stormwater storage system, and the stormwater discharge system.

1.4.1 Stormwater Transmission System – shall include the individual elements that transmit stormwater runoff to a collection point. These elements shall generally be privately owned and shall include, but not be limited to, the following:

- A. Overland and sheet surface stormwater flow areas from both private and/or public property;
- B. Below land groundwater flow areas from both private and/or public property;
- C. Upstream water ways.

1.4.2 Stormwater Collection System – shall include the individual elements that receive and collect stormwater from both private and public property. These elements shall include, but not be limited to, the following items:

- A. Street inlets
- B. Area inlets;
- C. Median drains;
- D. Pipe inlets.

1.4.3 Stormwater Conveyance System – shall include the individual elements that convey stormwater to a discharge point or a storage facility. These elements shall include, but not be limited to, the following items:

- A. Roadway surface drainage system;
- B. Underground pipe network;
- C. Extended box structure network;
- D. Open channel systems:
  - 1. Improved channels;
  - 2. Natural drainage ways;
  - 3. Borrow ditches;
- E. Connection network:
  - 1. Junction boxes;
  - 2. Manholes.

1.4.4 Stormwater Storage System – shall include all on-line and/or off-line at-grade or below grade stormwater detention facilities as well as stormwater retention facilities.

- A. Dry stormwater detention facilities. Dry stormwater detention facilities shall be provided with underground drainage or a concrete trickle channel or a Low Impact Development (LID) grass lined channel to eliminate standing water after storm periods. These types of facilities may be used for recreational purposes and other approved uses to the

maximum extent possible when not functioning as a stormwater detention facility.

- B. Wet stormwater detention facilities. Wet stormwater detention facilities may be used on a limited basis and shall be approved only when the pond inflow and pond depth is sufficient to maintain pond water surface levels and to preclude the water from stagnating and/or developing excessive aquatic vegetation (cat-tails, lily-pads, etc).
- C. Underground stormwater detention facilities. Underground stormwater detention facilities may consist of basins, tanks, and/or oversized piping networks.
- D. Parking lot stormwater detention. Parking lot stormwater detention may be used provided the maximum 1% chance (100-year) stormwater depth is twelve (12) inches or less. Any repaving of the parking lot shall be evaluated for impact on volume and release rates and are subject to approval by the Local Stormwater Manager. All parking lot stormwater detention areas shall have a minimum of two signs posted identifying the stormwater detention pond area. The signs shall have a minimum of 1.5 square feet and contain the following message:

**WARNING**  
This area is a Stormwater detention  
Facility and is subject to periodic  
flooding to a depth of (provide 1%  
chance storm design depth).

Any suitable materials and geometry of the sign is permissible, subject to approval by the Local Stormwater Manager.

- E. Retention facilities: Stormwater retention facilities may be used when the existing conditions runoff from a watershed would exceed the capacities of downstream facilities. The retention facility shall contain the 1% chance (100-year) 24-hour stormwater runoff and release shall be by evaporation, infiltration or slow release at outflow rates less than existing levels.

1.4.5 Stormwater Discharge System – shall include all outfall control structures as well as any corresponding energy dissipaters.

- A. Outfall control structures shall include, but not be limited to, the following items:
  - 1. Weir structures;
  - 2. Orifice flow device structures;
  - 3. Flume structures;
  - 4. Open channel flow structures;
  - 5. Pressurized flow structures;
  - 6. Spillway structures.

B. Energy dissipaters shall include, but not be limited to, the following items:

1. Riprap;
2. Pre-manufactured revetment;
3. Concrete stilling and energy dissipation structures;
4. Stilling basins.

## **1.5 STORMWATER DRAINAGE SYSTEM GENERAL REQUIREMENTS:**

- 1.5.1 The stormwater drainage system shall be designed to receive and pass the runoff from a 1% chance (100-year) storm under proposed Project urbanization. In areas regulated by the FEMA Regulatory Floodplain Area, that data shall govern. In areas not covered by the FEMA Regulatory Flood Area, the owner shall have a registered professional engineer prepare and submit a study area. The Project urbanized flow shall be confined within the said stormwater drainage system unless it is a Regional Stormwater Drainage system which shall be designed to ultimate urbanized conditions. In the event a Regional stormwater detention system is considered the conveyance system between the Project area and the proposed or existing Regional Stormwater Detention Facility shall be constructed by the Project Developer to convey the 1% (100-year) storm regardless of the timing of construction of the Regional Stormwater Detention Facility.
- 1.5.2 A minimum of the 1% chance (100-year) and the 20% chance (5-year) storm events shall be evaluated when designing the individual elements of the stormwater collection and conveyance systems and their subsequent stormwater discharge system.
- 1.5.3 A minimum of the 1% chance (100-year), 2% chance (50-year), 10% chance (10-year), 20% chance (5-year), 50% chance (2-year), and the 100% chance (1-year) storm events shall be evaluated when designing the individual elements of the stormwater storage system and its subsequent stormwater discharge system. Appendix A, Exhibit F presents storm frequency terminology for better clarification.
- 1.5.4 Site grading shall provide surface water drainage directly into a storm sewer, natural drainage course, improved channel, or paved street without crossing more than four (4) adjacent lots.
- 1.5.5 No inlets shall be designed for placement within driveways or entries unless individually approved by the Local Stormwater Manager.
- 1.5.6 Driveway approaches shall be designed and constructed so that the runoff from the 1% chance (100-year) storm shall not leave the roadway except in locations where the driveway is designed as part of the drainage system.

1.5.7 Submittals for Streets and Drainage Systems shall include the following required items for approval of street and drainage plans:

- A. Subgrade plasticity test results
- B. Geotechnical Engineer's report
- C. Pavement design report
- D. Hydrology and Hydraulics report (drainage) including all computer models.
- E. Storm sewer and drainage plans including as a minimum, tabulation sheet, plan sheets, profile sheets, drainage structure summary sheets, and standard details.
- F. Street plans including as a minimum, plan sheets, profile sheets, cross-sections, and standard details.

**1.6 STORMWATER CONVEYANCE SYSTEM DESIGN REQUIREMENTS:**

- 1.6.1 The overland flow portion of the drainage system shall be confined to dedicated rights-of-way, or drainage easements to assure the stormwater can pass through the development without inundating the lowest level of any building, dwelling, or structure.
- 1.6.2 An overland drainage easement shall be required for overland flows that immediately drain to a collection point and that are located outside of public right-of-way. No overland flows shall be allowed to adversely affect other private or public structures.
- 1.6.3 No overland or sheet flow conveyance system, such as a side yard or a backyard swale shall be graded in such a manner as to trap stormwater which in turn may potentially damage a building, dwelling, or structure.

**1.7 STORMWATER COLLECTION SYSTEM DESIGN REQUIREMENTS:**

- 1.7.1 The stormwater collection system shall be designed either:
  - A. To pass a minimum of the runoff from a 20% chance (5-year) storm in a pipe network together with an overland flow path (overland drainage easement required) with capacities so that the combination of the two will pass the stormwater runoff from a 1% chance (100-year) storm under ultimate urbanized conditions without exceeding the natural or regulatory floodplain width; or
  - B. To pass the entire stormwater runoff from 1% chance (100-year) storm in the pipe network. Should the entire runoff from a 1% chance (100-year) storm be conveyed in an enclosed drainage network, grading shall be designed to convey the runoff from the 1% chance (100-year) storm overland in the event of inlet or storm sewer blockage or bypass.

- 1.7.2 In either case, an overland drainage easement shall be required for overland flows that immediately drain to a collection point and that are located outside of public right-of-way. No overland flows shall be allowed to adversely affect other private or public structures.
- 1.7.3 In areas where ultimate flows are not planned for conveyance to a regional stormwater detention facility, the Local Stormwater Manager may reduce the capacity requirement to the existing or project condition flows.
- 1.7.4 The distance between inlets, as well as the distance to the first inlet on a street shall be determined by the lesser of the following:
- A. Water depth due to runoff shall not exceed the top of the curb for the 1% chance storm (100-year); or
  - B. 600 feet or less depending on roadway slope design.
- 1.7.5 At sump locations, the water depth shall not exceed six (6) inches above the top of curb, or twelve (12) inches above the top of grate, whichever is less, for the 1% chance (100-year) storm. Where sump collection systems are used, an overflow route shall be provided in the event of a complete blockage of the inlet of pipe. If the inlets and pipe are sized for the 1% chance (100-year) storm, a sod overflow can be used. If a 20% chance (5-year) storm inlet and pipe system is designed, the overflow area shall be concrete lined. When a sod overflow structure is constructed, it shall be lined with Bermuda grass or approved equal and shall contain energy dissipators, if required at the outflow point.
- 1.7.6 Stormwater runoff from areas greater than one half (1/2) acre outside the roadway of arterial and collector streets shall be collected before it reaches the roadway. In no circumstance shall concentrated flows be allowed to discharge into arterial streets. Parking lots shall have internal drainage systems so as to reduce concentrated flow onto public streets. This requirement shall not apply to residential lots used as single-family residences. The Local Stormwater Manager may approve sheet flows to the subject streets when connecting to an underground storm sewer system is not economical. In sheet flow instances, the developer must prove no adverse impact to the traveling public, and that the street drainage system is capable of conveying the increased flows.

## **1.8 STORMWATER CONVEYANCE SYSTEM DESIGN REQUIREMENTS:**

- 1.8.1 Open channel and/or ditch elements shall comply with the following requirements:
- A. In areas where overland flows may cause problems, the Local Stormwater Manager may require that the entire runoff from the 1%

chance (100-year) storm shall be conveyed through an enclosed drainage network.

- B. Trapezoidal channels shall be designed with a hard lined flow channel, such as concrete or rock unless the channel is designed in accordance with LID criteria. The low flow channel shall branch off to pick up any storm sewers discharging into the channel. The top of the sides of the low flow channel shall be a minimum of six (6) inches lower than the adjacent main channel bottom, to ensure that the drainage runs over and into the low flow channel and does not erode around it. The minimum cross slope on the bottom of the trapezoidal channel shall be 2%. The easement for the trapezoidal channel shall include a ten (10) foot width on the top of one bank for an access road.
- C. Borrow ditches, when allowed, shall not exceed four (4) feet in depth. Culverts shall be sized to adequately convey the borrow ditch flow. Borrow ditches shall be designed to convey the runoff from the 10% chance (10-year) storm as a minimum. The ditch side slopes shall be three (3) feet horizontal to one (1) foot vertical or flatter.
- D. Side slopes for grass-lined channels shall be 3:1 or flatter. Side slopes for concrete lined channels shall be 1:1 or flatter for concrete placed against an existing slope or vertical or flatter where the side wall is formed.
- E. Culverts in borrow ditches shall be sized, as a minimum, to pass the 10% chance (10-year) storm. The minimum culvert size shall be no less than eighteen (18) inches in diameter. In no case shall the stormwater runoff be purposefully permitted to flood a public or private street.
- F. The street side of a culvert will be no closer than four (4) feet from the edge of pavement or back of curb, closest to the culvert.
- G. A storm sewer discharging into or collecting water from a borrow ditch shall be no closer than four (4) feet from the edge of pavement or back of curb, closest to the culvert.
- H. Roughness coefficients for channel design shall be as listed as in Tables 5-5 and 5-6, Figure 5-5, pages 109 through 123, of Open Channel Hydraulics by Ven te Chow, published by McGraw-Hill Book Company, 1959 edition or an approved equivalent.
- I. The maximum velocity in an unlined ditch or grass-lined improved channel shall be five (5) feet per second (fps) for the 1% chance (100-year) storm event unless the soils are naturally erodible at lower velocities. When the 1% chance (100-year) storm velocity in a drainage channel/ditch exceeds five (5) fps, erosion control measures such as energy dissipators and/or channel lining shall be placed in the area where the velocity exceeds five (5) fps.
- J. Concrete lined drainage channels shall include the entire channel flow depth and one (1) foot above the peak 1% chance (100-year) storm water surface. When the lining is designed to be constructed with separate sides and bottom, the design shall include the requirement for



the bottom to be placed last and it shall cover a minimum of four (4) inches of the sides.

- K. The centerline radius of a curve on an improved channel shall be a minimum of three (3) times the top width at the design flow or 100 feet, whichever is greater.
- L. All improved channels shall be provided with a minimum of one (1) foot of freeboard above peak 1% chance (100-year) storm water surface.
- M. At all bends in improved channels, the amount of freeboard on the outside wall shall be increased by the following equation:

$$H = V^2(b)/64.4r$$

where:

H is height of freeboard in feet;

V is the average velocity in feet per second;

b is the width of the channel at the design water surface in feet;  
and

r is the radius of curvature of the channel centerline in feet.

- N. The increased freeboard height shall be maintained a minimum of one (1) channel width upstream and downstream of the bend.

1.8.2 Closed conduit system elements shall comply with the following requirements:

- A. Storm sewer piping shall be constructed of reinforced concrete pipe (RCP), high density polyethylene pipe (HDPE), coated steel pipe, or double wall polyethylene corrugated pipe dependent upon the corresponding soil and loading conditions, unless otherwise approved in writing by the Local Stormwater Manager. Minimum pipe size shall be 18-inch diameter.
- B. When RCP is specified, it shall be furnished with omni-flex joints or equivalent. When RCP is specified in a non-cohesive soil, such as sugar sand, and the storm drain is within fifteen (15) feet of a structure that would sustain damage from sinkholes, the City may require wrapping of joints with a non-woven geotextile 6-ounce fabric.
- E. Where RCP storm sewers cross streets, they shall be backfilled with either Oklahoma Department of Transportation, Type A, aggregate base or flowable fill concrete. Where metal or polyethylene storm sewers cross streets, they shall be backfilled with flowable fill concrete.
- F. Pipe and box culverts shall comply with the design requirements established in the United States Department of Transportation, Federal Highway Administration's Hydraulic Design Series Publication Number 5: Hydraulic Design of Highway Culverts. Culverts shall be examined for both inlet controlled and outlet controlled conditions for the design flows. The slope used for the design shall be based on the slope of the invert of the culvert pipe.

- G. The Manning's Roughness Coefficient (n) value shall be 0.013 for reinforced concrete pipe (RCP) and 0.012 for smooth wall corrugated polyethylene pipe and high density polyethylene pipe (HDPE). Manning's Roughness Coefficient (n) value for coated steel or metal pipe shall be approved by the Local Stormwater Manager.
- H. No pipe shall be installed downstream having a diameter smaller than the pipe from which it is receiving flow unless otherwise approved by the Local Stormwater Manager for stormwater detention facility purposes.
- I. When stormwater detention outlet pipes require a diameter smaller than an 18-inch pipe the designer shall use bolted on orifice plates.
- J. Capacity of stormwater conveyance systems located downstream from any proposed development that produces a measurable increase in stormwater runoff shall be thoroughly investigated. Replacement, modifications or adjustments of the existing downstream conveyance system may be required by the City to convey the increased flow from the proposed development. Any downstream conveyance systems shall be designed on based on the 1% frequency storm event.
- K. Junctions between different pipe sizes shall be made with the top inside of the downstream pipe no higher than the top inside of the upstream pipe.
- L. A manhole or junction box shall be required at all changes of grade, changes in alignment, and junction between two (2) or more different pipe sizes.
- M. The horizontal distance between pipes being placed in the same trench shall be a minimum of  $2T + 6"$ . This would include multiple pipe crossings for culvert purposes.
- N. Radius pipes may be used only on locations within conveyance systems that have a diameter of 36 inches or larger. The radius of the curve shall be no less than five (5) times the diameter of the pipe. The degree of deflection shall be no greater than  $7 \frac{1}{2}$  degrees per joint of radius pipe, or the pipe manufacturer's recommendation, whichever is less. The City may require radius pipe as a requirement to these provisions should the energy loss within the system become excessive and, thereby, considered to be detrimental to the system.
- O. A minimum of six (6) inches cover shall be provided over conveyance system pipes and box culverts to the bottom of the subgrade, except when the box culvert structure is designed to transmit vehicular loading with the top at grade.
- P. Maximum spacing between manholes or junction boxes shall not exceed 400 feet for pipes of eighteen (18) inches in diameter and shall not exceed 500 feet for pipe sizes over eighteen (18) inches in diameter.
- R. All junction boxes and manholes shall be designed with the standard manhole ring and cover at grade in pavement areas and at least a minimum of 2" above grade outside of pavement areas.

- S. A manhole or junction box shall be constructed at the Point of Curvature or Point of Tangency for all curves in conveyance systems.
- T. All storm sewers shall be shown in profile, showing, size, type, grade, and 1% chance (100-year) storm flow rates and velocities. Profiles shall show the natural and proposed ground line at the center of the storm sewer. Energy grade line and hydraulic grade line shall be calculated and clearly shown. Stationing shall start at 0+00.00 and shall be continuous through manholes, along the main (trunk) line, to the top of the system. Branch lines shall be stationed starting from X0+00.00 from their connection with the main line. Lines shall be stationed on the profile drawing from left to right increasing upstream.
- U. The radius of curve for a box structure shall be a minimum of three (3) times the maximum width of the box structure, but not less than 50 feet.

1.8.3 Cross street conveyance system structures shall comply with the following requirements:

- A. Bridges - New span bridges shall have adequate capacity to pass the 1% chance (100-year) storm ultimate urbanized flows with one (1) foot of freeboard under the low chord. A backwater analysis shall be provided to illustrate compliance with this requirement and to insure there are no adverse downstream or upstream impacts.
- B. Culverts - New culverts under public roads shall have adequate capacity to pass the 1% chance (100-year) storm ultimate urbanized flows with a maximum water surface elevation not exceeding 6 inches below the lowest pavement (or gutter) elevation in the roadway sump. A backwater analysis shall be provided to illustrate compliance with this requirement and ensure there are no adverse downstream or upstream impacts.
- C. Reinforced concrete pipe (RCP) located under streets shall not be less than C-76 Class III. For back and side yard installations of RCP, Class II may be used. Corrugated metal pipes shall meet Oklahoma Department of Transportation gauge requirements in accordance with the subsequent fill height, and shall be bituminous-coated and lined. Polyethylene corrugated pipe placed under streets shall meet the requirements of AASHTO M294.

1.8.4 Stub street conveyance systems shall comply with the following requirements: When a stub street is included in a subdivision design, it shall include provisions for drainage of the stub street until such time as the stub street is connected to the extended street system. Design of stub streets will contain the following minimum provisions for drainage:

- A. Stub streets which drain into the development under design will not require special drainage structures.

- B. Stub streets which drain away from the development will require a drainage easement on the adjoining property with a 1% chance (100-year) storm flow capacity ditch to a point of natural drainage or concrete curb and gutter across the end of the street, with storm inlets tied to an operational storm sewer system.

## **1.9 STORMWATER STORAGE SYSTEM DESIGN REQUIREMENTS:**

### **1.9.1 General Storage requirements shall comply with the following:**

- A. Stormwater Detention storage shall be required to accommodate excess runoff from all storms from the 20% chance (5-year) storm up to the 1% chance (100-year) storm. Excess runoff is that runoff generated due to urbanization which is greater than the runoff historically generated under existing conditions, for a given frequency storm. Stormwater detention facilities shall be designed so that the peak rate of discharge does not exceed that of the existing conditions both at the point of discharge and confirmation that the lag from the peak discharge is not coincident with main stem flows at a location downstream.
- B. Peak release rates from private developments shall not exceed the existing runoff that occurred before private development for all storm frequencies up to and including the 1% chance (100-year) storm. The 100% chance (1-year), 50% chance (2-year), 20% chance (5-year), 10% chance (10-year), 4% (25-year), 2% chance (50-year), and 1% chance (100-year) storms shall be investigated at a minimum. Appendix A, Exhibit F presents storm frequency terminology for better clarification.
- C. Public regional stormwater detention facilities shall be designed with 1% chance (100-year) storm outflow rates equal to or lower than pre-development values with possible increased flow rates for the 20% chance (5-year), 10% chance (10-year), and 2% chance (50-year) storms from pre-development flow rates under those conditions where downstream areas are not adversely impacted.
- D. If the development is situated in such a manner that the stormwater is discharged into a stormwater system that has the capacity of the 1% (100-year) storm and which the Local Stormwater Manager determines will not be adversely affected, the developer may make a monetary payment (fee-in-lieu) or some other form of valuable consideration to the City in lieu of constructing an on-site stormwater detention facility.
- E. Changes may be made to streams or channels within the Regulatory Flood Fringe Area; subject to approval of the Local Floodplain Administrator, provided that:
  - 1. The volume of floodwater storage is not reduced;
  - 2. Neither downstream nor upstream water surface elevations are adversely increased;

3. All required permits are obtained prior to starting work; and
4. There is no conflict with the City of Wagoner Floodplain Ordinance.

1.9.2 Stormwater detention Facility design shall comply with the following criteria:

- A. The design storm for stormwater detention facilities shall be a 24-hour storm.
- B. The three allowed methods for stormwater detention facility design are SCS Method, Snyder's Method with approved Tulsa-area Modifiers and Unit Volume Relationship Method. See Appendix A, Exhibit B to determine applicability of each method.
- C. The time increment used in developing the rainfall distribution shall be rounded off to the nearest whole time interval or to the nearest time increment. For the 24-hour storm, the maximum time increment shall be 5 minutes.
- D. The rainfall patterns shall be used in accordance with the modeling technique selected.
- E. For Snyder's Method with Tulsa-area Modifiers, the loss rates in determining the runoff/hydrograph shall be an initial loss of 0.5 inches and a uniform loss of 0.08 inches per hour for the subsequent hours once the initial losses are satisfied.
- F. All calculations for stormwater detention facilities shall be submitted for review by the City. The submittal shall include:
  1. The 100% chance, 50% chance, 20% chance, 10% chance, 2% chance, and 1% chance storm hydrographs for the proposed development and all upstream areas draining through the proposed development for existing and post-project conditions shall be determined. The stormwater detention facility and stormwater drainage system shall be designed to convey any offsite runoff that drains to it. The 0.2% chance storm shall be routed through the stormwater detention facility to assure there is a minimum of 1 foot of freeboard to prevent overtopping of the berm dike.
  2. Stormwater detention facility stage/area/outflow or stage/volume/outflow relationships.
  3. A stage versus time analysis through the stormwater detention facility.
  4. Outlet structure details.
  5. Applicable orifice or weir flow calculations for outlet structure and overflow spillway.
  6. Existing conditions and post-project conditions drainage area maps.
  7. For SCS Method, list soil classifications, curve number assumptions, and time of concentration/lag time calculations.

8. For Snyder's Method, list time to peak (TL), peaking coefficient (Cp), and peak of unit hydrograph flow rate (qp) calculations.
9. Supporting documentation to include HEC computer runs, a list of assumptions, and other data required to validate the information provided.
10. All dikes and spillways on stormwater detention facilities shall have typical cross sections shown on the plans.
11. Side slopes on stormwater detention facilities shall not be steeper than 3:1 (Horizontal:Vertical).
12. Stormwater detention facilities shall be provided with a concrete trickle channel or LID grass-lined channel from the inlet(s) to the outlet structure to transmit low flows. The minimum slope of the bottom of the stormwater detention facility and trickle channel shall be 0.50%.
13. The stormwater detention area shall be identified as a separate platted area; as appropriate, it may consist of one or more platted lots, a separate block, a reserve area, or it may be dedicated by separate instrument. No stormwater detention facilities will be allowed in off-tract areas without written agreement between affected property owners and said agreement must be filed and recorded in County land records.
14. Provision for the maintenance responsibility of private stormwater detention facilities shall appear among the plat's restrictive covenants, or applicable law.
15. In the event a stormwater detention facility, as a result of drainage improvements, becomes unnecessary, the facility by action of the City Council may be vacated as provided for in the covenants or under applicable law.
16. An access way at least twenty (20) feet wide shall be provided to any stormwater detention area. Access may be provided by frontage on a dedicated public street or by an access easement from a public street to the stormwater detention area. The access road shall have a maximum grade of twelve percent (12%).
17. If a stormwater detention facility is approved by the City to serve areas outside the development in which it is located, such additional areas shall be specifically identified in the provision for stormwater detention.
18. Any dam or berm constructed shall be designed by an Oklahoma Registered Professional Engineer and all drawings shall be signed and sealed.
19. Any dam constructed for the purpose of storing water and under the jurisdiction of the Oklahoma Water Resources Board shall be designed in accordance with the State of Oklahoma Administrative Code, Section 785.

20. All stormwater detention dams or dikes shall be constructed as earth filled and non-overflow type dams. Embankment slopes shall not be steeper than 3:1. Earthen portions of the dam structure shall have a minimum of one foot of freeboard above the 0.2% chance storm event. Flows above the 1% chance storm event are not required to be detained. Freeboard requirements may be adjusted for stormwater detention facilities not utilizing earthen berm dams by the Local Stormwater Manager.
21. All stormwater detention facilities shall be constructed with an emergency spillway structure designed to pass the flow from the 1% chance flood event in the event of blockage of the outlet structure. Erosion control in the form of concrete lining, rip-rap, dissipator blocks, etc. shall be provided where deemed necessary by the Local Stormwater Manager.
22. All earth slopes and areas subject to erosion, such as, adjacent to trickle channels, inlet structures, and outlet structures, shall be slab sodded with Bermuda sod or protected with other erosion control measures. All other earth surfaces, within the designated stormwater detention area, shall have an established growth of Bermuda grass. All grass covered areas shall be fertilized, watered and in an established growing condition prior to completion and approval of the stormwater detention facility.
23. Construction of the stormwater detention facility shall occur before or in concurrence with construction of other proposed impervious areas onsite including buildings and parking lots.
24. Appendix A, Exhibit C presents a simplified unit volume stormwater detention curve that may be used to size the stormwater detention storage volume required for developments two (2) acres or smaller.
25. In the event the stormwater detention facility is located in a floodplain fringe area, the top of the stormwater detention facility shall be above the Base Flood Elevation (BFE) and compensatory storage, located in the immediate vicinity, shall be provided equivalent to the volume of the stormwater detention facility below the BFE.

## **1.10 STORMWATER DISCHARGE SYSTEM DESIGN REQUIREMENTS:**

### **1.10.1 Outfall/Discharge structures shall comply with the following design requirements:**

- A. All drainage structures that discharge directly into a waterway shall have a concrete headwall/wingwall and apron. Precast concrete end

treatments may be used with approval of the Local Stormwater Manager.

- B. All hydraulic control devices, such as weirs, orifices, and flumes shall comply with the design requirements identified in the United States Department of the Interior, Bureau of Reclamation Water Measurement Manual, 2001 revised reprint edition.

1.10.2 Permanent erosion control measures for discharge structures shall comply with the following requirements:

- A. When the 1% chance (100-year) storm outfall velocity at the discharge structure exceeds five (5) fps, permanent erosion control measures shall be installed.
- B. Riprap design shall comply with the requirements of United States Department of Transportation, Hydraulic Engineering Circular Number 14 (HEC-14): Hydraulic Design of Energy Dissipators for Culverts and Channels, third edition, dated July 2006.

## **1.11 MISCELLANEOUS STORMWATER REQUIREMENTS:**

The following section of the Manual covers fee-in-lieu of stormwater detention, stormwater development permits, floodplain development permits, floodplain development permit certificates of compliance, earth change permits, and state or federal stormwater related permits.

1.11.1 Fee in-lieu of stormwater detention requirements:

When approved by the Local Stormwater Manager, a developer may make a monetary payment or some other form of valuable consideration in lieu of building an on-site stormwater detention facility. The developer or its engineer shall fill out and turn in a "Fee-In-Lieu of Stormwater Detention Determination Form" as included in Appendix A, Exhibit H to the Local Stormwater Manager. The Local Stormwater Manager shall make the determination of whether fee in-lieu of stormwater detention will be allowed based upon the capacity of the receiving stormwater drainage system and whether regional stormwater detention facilities are either proposed or in place. The amount of the fee shall be based on the number of square feet of impervious area added to the property. The developer shall provide the Local Stormwater Manager calculations of the number of square feet of increased impervious area and the Local Stormwater Manager shall prepare a bill for payment in-lieu of stormwater detention. For increased impervious area calculations, existing impervious area may be considered provided it was in place within the past five (5) years of the time of the proposed development and can be documented by the developer and confirmed by the Local Stormwater Manager. The square footage of increased impervious areas for proposed residential developments shall be determined from the "Residential Housing Density vs. Impervious Area" graph shown in Appendix A, Exhibit I.



To determine the impervious area, obtain the total added impervious area, including building structures, asphalt or concrete parking areas, sidewalks, out buildings, canopies, or other types of added imperious areas. The square footage of increased impervious area shall be shown immediately above the title block in the lower right hand corner of both the site plan and engineering plan cover sheet for both residential and non-residential projects. The fee per square foot of added impervious area shall be determined by the City Council, based on recommendations from the Local Stormwater Manager. The fee shall be paid at the time the final plat is released for residential developments. The fee shall be paid prior to issuance of building permit for non-residential developments. When these fees are collected, they shall be deposited into a Stormwater Capital Improvements Fund, which will be used for future or ongoing stormwater improvement and regional stormwater detention projects. The developer shall be required to provide a stormwater conveyance channel capable of conveying the 1% stormwater runoff from the proposed development to the proposed regional stormwater detention facility.

#### 1.11.2 Permit Requirements:

- A. Stormwater Development Permit – A Stormwater Development Permit shall be obtained prior to any development on projects that require platting, site plan approval or alterations to existing public stormwater drainage systems. The Stormwater Development Permit fee set by ordinance shall be submitted with the permit application. A copy of the "Stormwater Development Permit" form is included in Appendix A, Exhibit J. The minimum submittal requirements are as follows:
1. Name and address of legal owner.
  2. Legal description of property.
  3. Boundary line survey.
  4. A location map at 1" = 2000' scale shown on plans.
  5. Title of project or property shown on plans.
  6. Existing and proposed contours at 1-foot or 2-foot intervals or spot elevations with drainage arrows.
  7. Existing storm sewer and natural features on site and on adjacent properties within (50) fifty feet of the site boundary line.
  8. Manhole top of rim elevations to be shown on plans. If needed, show manhole adjusted to grade with proposed elevation.
  9. Silt fence, wattles, ditch checks, and any necessary erosion control shall be shown on plans with details and notes and shall be in accordance with currently effective ODEQ regulations.
  10. Permanent erosion control on the plans in areas of concentrated flows.
  11. Plans to show no increase of stormwater runoff unless development is within a subdivision with an approved stormwater detention facility or fee in-lieu of stormwater detention has been approved. A table comparing existing

- conditions to proposed conditions with drainage areas clearly labeled shall be included.
12. Runoff will be conveyed to a storm sewer system before entering public streets per Section 1.7.6. Profiles of storm pipe with 1% chance peak flow rates and velocities shall be included.
  13. Three sets of the grading, drainage, and storm sewer design plans will be signed and sealed by an Oklahoma Registered Professional Engineer and submitted to the Local Stormwater Manager.
  14. The Local Stormwater Manager shall have the right to waive sections of the permit requirements, subject to the developer providing adequate proof, to the Local Stormwater Manager, the development does not cause adverse impact to the community.

#### 1.11.3 Earth Change Permit Requirements:

- A. An Earth Change Permit is required for any project within the City of Wagoner. Requirements for the Earth Change Permit Application are shown in Appendix A, Exhibit N.

### **FLOODPLAIN MANAGEMENT:**

#### 1.12 Floodplain Ordinance

- A. Any development in a FEMA designated Special Flood Hazard Area shall be in accordance with the National Flood Insurance Program standards or City of Wagoner "higher standards" in accordance with Chapter 10 of the City of Wagoner Flood Damage Prevention Ordinance.

#### 1.13 Floodplain Permitting

- A. Floodplain Development Permit – A Floodplain Development Permit shall be required to assure conformity with the provisions of the Flood Damage Prevention Ordinance and to insure that new development is constructed in a manner that minimizes exposure to flooding. A Floodplain Development Permit shall be obtained before construction or development begins in any area in the Regulatory Floodplain Area established in Chapter 10, Section 5-1043, Flood Damage Prevention of the Code of Ordinances of Wagoner, Oklahoma. Application for a Floodplain Development Permit shall be made on forms furnished by the Local Floodplain Administrator. Application for a "Floodplain Development Permit" shall be made on the form included in Appendix A, Exhibit K. The Floodplain Development Permit fee and submittal requirements set by ordinance shall be submitted to the Local Floodplain Administrator with the permit application. The "Floodplain

**APPENDIX A:**  
**STORMWATER and FLOODPLAIN MANAGEMENT**  
**DOCUMENTS**

# EXHIBIT A

## RAINFALL DEPTHS AND INTENSITIES RATIONAL METHOD

RAINFALL DEPTHS						
Rainfall Duration	Return Period					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
5-Minute	0.492	0.575	0.637	0.729	0.802	0.875
10-Minute	0.821	0.960	1.064	1.220	1.342	1.464
15-Minute	1.050	1.228	1.362	1.560	1.717	1.873
30-Minute	1.440	1.747	1.969	2.292	2.544	2.795
60-Minute	1.845	2.287	2.601	3.053	3.405	3.755

Source: National Weather Service Hydro 35 and Department of Commerce and National Weather Bureau Technical Publication No. 40.

RAINFALL INTENSITIES						
Rainfall Duration	Return Period					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
5-Minute	5.900	6.896	7.641	8.753	9.629	10.500
10-Minute	4.927	5.762	6.386	7.318	8.052	8.781
15-Minute	4.200	4.913	5.446	6.241	6.867	7.490
30-Minute	2.879	3.494	3.938	4.583	5.088	5.590
60-Minute	1.845	2.287	2.601	3.053	3.405	3.755

Source: National Weather Service Hydro 35 and Department of Commerce and National Weather Bureau Technical Publication No. 40.

## RAINFALL DEPTHS SCS METHOD

24-Hr Duration						
Location	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Broken Arrow	4.02	5.22	6.15	7.14	8.05	9.00

Sources: Soil Conservation Service Technical Release No. 55 and U.S. Weather Bureau Rainfall Atlas of the United States.

## EXHIBIT "B"

### APPROVED RUNOFF METHODS

Method	Applicable For		Min. Drainage Area (Acres)	Max. Drainage Area (Acres)
	Peak Flow Calcs	Volume Calcs		
Rational Method	Yes	No	0	200
SCS Method	Yes	Yes	0	2000
Snyder's Method With Tulsa Modifiers	Yes	Yes	10	None
Unit Volume Table	No	Yes	0	2

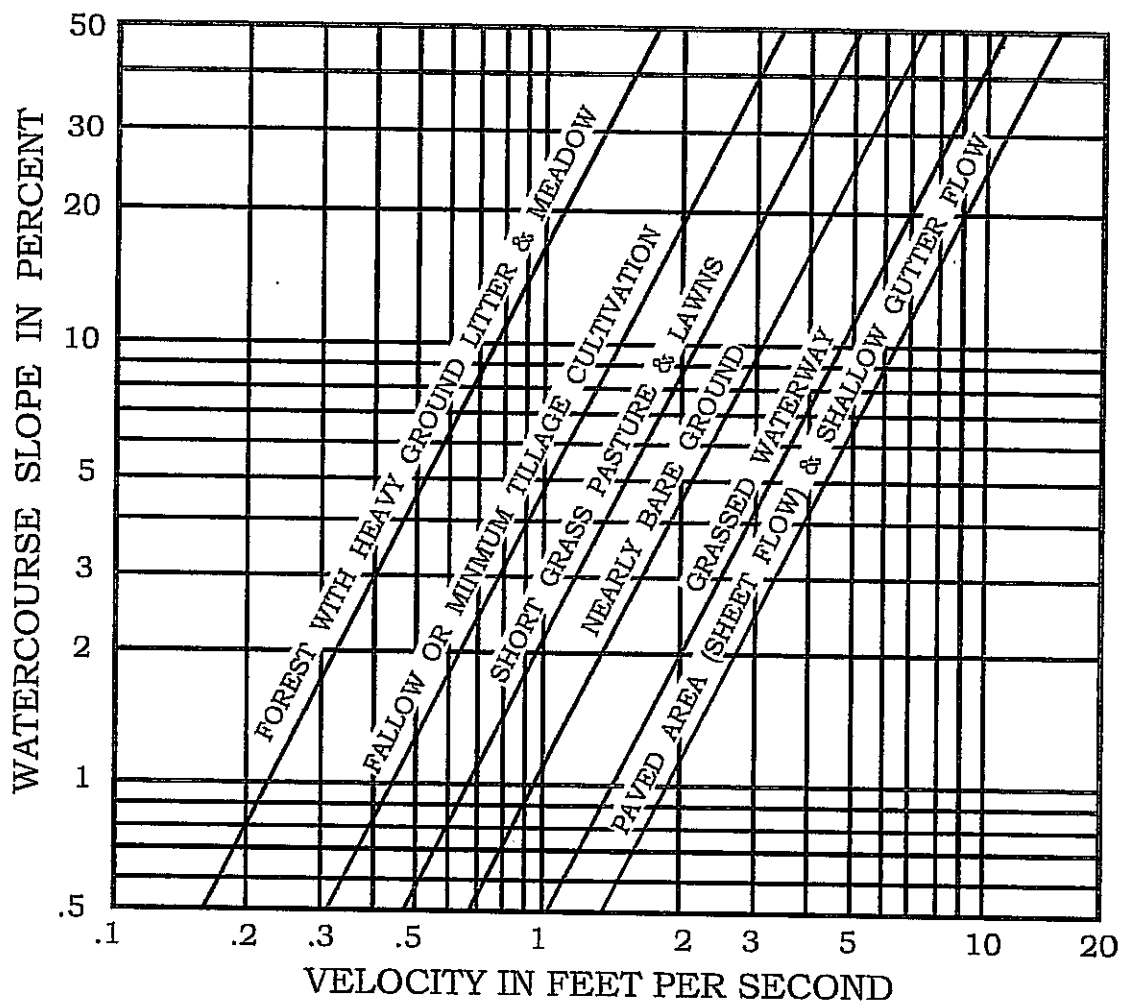
## EXHIBIT "D"

RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUSNESS		
Land Use Or Surface Characteristic	Percent Imperviousness	Runoff Coefficients
<b>BUSINESS:</b>		
Commercial Areas	70 to 95	0.70 to 0.95
Neighborhood Areas	60 to 80	0.50 to 0.70
<b>RESIDENTIAL</b>		
Single Family	30 to 60	0.30 to 0.60
Multi-unit (detached)	45 to 55	0.40 to 0.60
Multi-unit (attached)	65 to 75	0.60 to 0.75
½ acre lot or larger	25 to 40	0.25 to 0.40
Apartments	65 to 75	0.50 to 0.70
<b>INDUSTRIAL</b>		
Light uses	70 to 80	0.50 to 0.80
Heavy Uses	80 to 90	0.60 to 0.90
<b>PARKS, CEMETERIES</b>	4 to 8	0.10 to 0.25
<b>PLAYGROUNDS</b>	10 to 20	0.20 to 0.35
<b>SCHOOLS</b>	40 to 60	0.50 to 0.60
<b>RAILROAD YARDS</b>	35 to 45	0.20 to 0.35
<b>UNDEVELOPED AREAS</b>		
Cultivated	30 to 70	0.35 to 0.60
Pasture	20 to 60	0.25 to 0.50
Woodland	5 to 40	0.10 to 0.40
Offsite flow analysis (land use not defined)	35 to 55	0.45 to 0.65
<b>STREETS</b>		
Paved	90 to 100	0.80 to 0.90
Gravel	50 to 70	0.55 to 0.65
<b>DRIVES AND WALKS</b>	90 to 100	0.80 to 0.90
<b>ROOFS</b>	85 to 95	0.80 to 0.90
<b>LAWNS</b>		
Sandy soils	5 to 10	0.10 to 0.20
Clayey soils	10 to 30	0.13 to 0.35

## EXHIBIT "E"

### TRAVEL TIME VELOCITIES FOR OVERLAND FLOW

FOR TC - RATIONAL METHOD  
FOR T1 - SCS METHOD



REFERENCE: URBAN HYDROLOGY FOR SMALL WATERSHEDS  
TECHNICAL RELEASE Number 55, SCS - January 1975

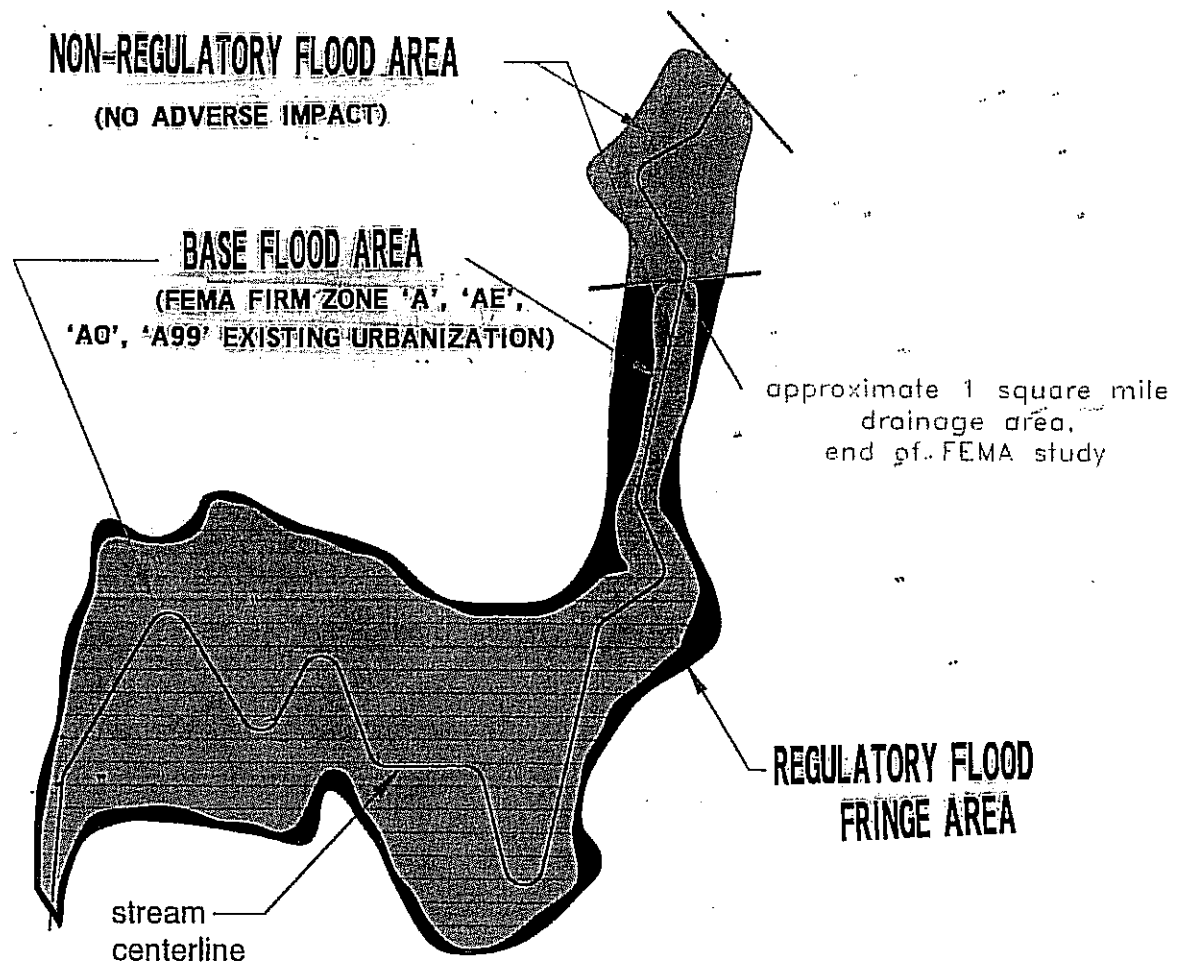
## EXHIBIT "F"

### STORM FREQUENCY TERMINOLOGY TABLE

Modern Terminology	Past Terminology
0.2% Chance Storm	500 – Year Storm
1% Chance Storm	100 – Year Storm
2% Chance Storm	50 – Year Storm
10% Chance Storm	10 – Year Storm
20% Chance Storm	5 – Year Storm



## Example Regulatory Floodplain



City Staff to complete this section

Determination Number: \_\_\_\_\_

**FEE-IN-LIEU OF DETENTION  
DETERMINATION FORM**

**EXHIBIT "H"**

Project Name: \_\_\_\_\_

Project Contact: \_\_\_\_\_ Phone Number: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Legal Description of Property: \_\_\_\_\_

Section/Township/Range \_\_\_\_\_ Legal Description (Attach Legal and Vicinity Map if Required) \_\_\_\_\_

County Parcel Number: \_\_\_\_\_

Is this property part of a P.U.D. or Plat? ☐ Yes ☐ No

If yes, provide name and number: \_\_\_\_\_

Nature of Proposed Project: (Check All That Apply)

☐ Residential Plat

☐ Commercial/Industrial Plat

☐ Commercial/Industrial Site Plan

☐ Other (describe) \_\_\_\_\_

Approximate area of site: \_\_\_\_\_ acres.

Approximate area of proposed development: \_\_\_\_\_ acres.

**THE LOCAL ADMINISTRATOR IS TO COMPLETE THE BELOW SECTION:**

Drainage Basin: ☐ : ☐ ☐

☐ : ☐ ,

Is there a constructed facility affecting this project? ☐ Yes ☐ No

Is there a planned facility affecting this project? ☐ Yes ☐ No

☐ Fee-In-Lieu of Detention will be required on this project.\*

☐ Fee-In-Lieu of Detention will be allowed on this project. \*

☐ On Site Detention will be required on this project.

\_\_\_\_\_  
LOCAL ADMINISTRATOR

\_\_\_\_\_  
DATE

An approved fee-in-lieu of detention determination form is valid for one year after the date signed. If no development plans are submitted within that time frame, a new determination will be required.

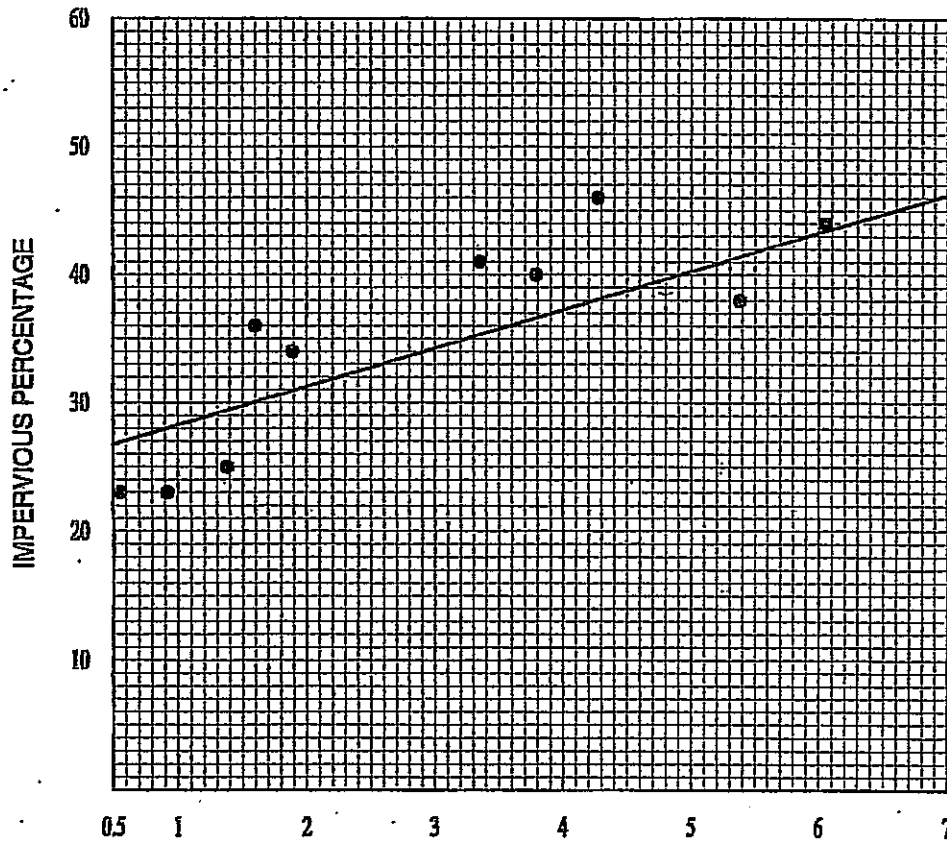
\*Developments designated fee-in-lieu of detention must show that stormwater can be conveyed to downstream stormwater drainage systems without adversely impacting offsite properties or creating a public safety hazard.

# EXHIBIT "I"

## RESIDENTIAL HOUSING DENSITY AND IMPERVIOUS AREA

RAW DATA	
UNITS PER ACRE	IMPERVIOUS %
4.27	46
1.38	25
1.60	36
1.89	34
3.79	40
5.38	28
3.35	41
6.05	44
0.55	23
0.92	23

LINEAR REGRESSION MODEL	
UNITS PER ACRE	IMPERVIOUS %
0.0	25.24
1.00	28.24
2.00	31.24
3.00	34.25
4.00	37.25
5.00	40.25
6.00	43.25



\* BASED ON 10 SINGLE-FAMILY HOUSING UNITS PER ACRE  
SUBDIVISIONS WITHIN TOWN OF KIEFER



DRAFTER  
DATE  
DRAWING

**STORMWATER DEVELOPMENT  
PERMIT APPLICATION**

**EXHIBIT "J"**

This application is in conformance with provisions of Ordinance No. \_\_\_\_\_  
Stormwater Development Permit Application is \$25.00.

The fee for a

Proposed Subdivision Name: \_\_\_\_\_  
Legal Property Owner or Applicant: \_\_\_\_\_  
Mailing Address: \_\_\_\_\_  
Phone Number: \_\_\_\_\_  
Fax Number: \_\_\_\_\_

Tract Acreage: \_\_\_\_\_ County Parcel Number: \_\_\_\_\_

Legal Description of Property: \_\_\_\_\_  
Section/Township/Range Subdivision Block No. Lot No.

If Property Not located in a Platted Subdivision: (Attach legal description)

Nature of Proposed Construction: (Check All That Apply)

- ☐ Residential      ☐ Commercial      ☐ Industrial      ☐ Placement of Fill  
☐ Alteration of Existing Public Stormwater Drainage System      ☐ Other

Description of Proposed Construction:

Permit Certification:

I Certify that I am one of the following:

- ☐ Owner or lessee of the property on which permit work is to be performed.  
☐ Agent of the property owner or lessee for which permit work is to be performed.  
(Please attach notarized agreement.)  
☐ Licensed Engineer or Architect employed in connection with the work.

Signature of Applicant: \_\_\_\_\_

Date: \_\_\_\_\_

# EXHIBIT 'K'

## DEVELOPMENT PERMIT APPLICATION

For Proposed Development on  
LANDS LOCATED IN FLOODPLAIN AREAS

### INSTRUCTIONS

**TO COMPLY WITH FLOODPLAIN MANAGEMENT REGULATIONS AND TO MINIMIZE POTENTIAL FLOOD DAMAGE, IF YOU ARE BUILDING WITHIN AN IDENTIFIED FLOOD HAZARD AREA, YOU MUST AGREE TO CONSTRUCT YOUR PROPOSED DEVELOPMENT IN ACCORDANCE WITH THE FOLLOWING SPECIAL PROVISIONS:**

#### SPECIAL FLOODPLAIN PROVISIONS

1. For RESIDENTIAL structures, the lowest floor (including basement) must be elevated 1 foot above the base flood elevation (100-year flood elevation) as delineated in this community's floodplain management regulations or ordinances. See provisions for manufactured homes in local regulations.
2. For NON-RESIDENTIAL structures, the lowest floor must be elevated 1 foot above the base flood elevation, or floodproofed to withstand the flood depths, pressures, velocities, impact and uplift forces associated with the 100-year flood as delineated in this community's floodplain management regulations or ordinances.
3. For ALL STRUCTURES, the foundation and the materials used must be constructed to withstand the pressures, velocities, impact and uplift forces associated with the 100-year flood.
4. All utility supply lines, outlets, switches and equipment must be installed and elevated at or above the BFE so as to minimize damage from potential flooding. Water and sewer connections must have automatic back flow devices installed.
5. You must submit certification on the attached form(s) from a REGISTERED ENGINEER, ARCHITECT or LAND SURVEYOR, that the floor elevation and/or floodproofing requirements have been met. Failure to provide the required certification is a violation of this permit.
6. Other Provisions - See attached list \_\_\_\_\_ None \_\_\_\_\_

### AUTHORIZATION

I have read or had explained to me and understand the above special provisions for flood plain development. Authorization is hereby granted the permitting authority and their agents or designees, singularly or jointly, to enter upon the above-described property during daylight hours for the purpose of making inspections or for any reason consistent with the issuing authority's floodplain management regulation. I further verify that the above information is true and accurate to the best of my knowledge and belief.

---

Signature of Applicant

---

Date

**FLOODPLAIN DEVELOPMENT APPLICATION**  
**(For Proposed Development in Floodplain Areas)**

Date: \_\_\_\_\_ Permit Number: \_\_\_\_\_

NOI Fee Collected: Yes ☐ No ☐ Amount: \_\_\_\_\_

Applicant/Developer: \_\_\_\_\_

Address: \_\_\_\_\_

City, State & Zip: \_\_\_\_\_

Telephone Number: \_\_\_\_\_ Email Address: \_\_\_\_\_

Contact Name: \_\_\_\_\_

List Type and Purpose of Development: \_\_\_\_\_

Located At: \_\_\_\_\_

Flood Zone Type: \_\_\_\_\_

If property will be located in an identified Special Flood Hazard Area complete the following and require certified elevation of proposed lowest floor (including basement) & lowest adjacent grade.

Name of Community: \_\_\_\_\_ NFIP Community Number: \_\_\_\_\_

Applicant Requests to:

- ☐ Construct    ☐ Mine    ☐ Construct Addition    ☐ Remodel    ☐ Elevate  
☐ Drilling    ☐ Demolish    ☐ Add Fill    ☐ Manufactured Housing (Placement)  
☐ Storage (Equipment or Supplies)

Base Flood Elevation: \_\_\_\_\_ Proposed Lowest Floor Elevation: \_\_\_\_\_

Flood Map Effective Date: \_\_\_\_\_ Community Panel Number: \_\_\_\_\_

Permit Fee: \_\_\_\_\_ Permit Fee Collected: Yes ☐ No ☐

Plans, specifications and elevation certificate filed by the applicant shall constitute by reference, a part of this permit.

**FOR OFFICIAL USE ONLY**

This application reviewed by: \_\_\_\_\_

Signature \_\_\_\_\_

Date \_\_\_\_\_

This application is considered complete and complies with the local floodplain ordinance or set of regulations.

Are other local, state or federal permits required? Yes ☐ No ☐

If 'Yes' list type(s): \_\_\_\_\_

Print Form

## EXHIBIT "L"

### FLOODPLAIN DEVELOPMENT PERMIT

DATE: \_\_\_\_\_

PERMIT # \_\_\_\_\_

Name of Applicant \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_

Doing business as \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_

The above stated person(s) is hereby granted a Floodplain Development Permit

for \_\_\_\_\_ activities located at

\_\_\_\_\_ in compliance with in compliance  
with Flood Damage Protection (Floodplain Management) (Section 5-1001 - 5-  
1071 of Chapter 10 the re-codified Ordinance Book, and as previously adopted  
by the City of Wagoner on May 18, 2009

Note: Receipt of this permit in no way relieves the applicant of any liability  
incurred as a result of civil suit filed by surrounding landowners for property  
damage claims.

\_\_\_\_\_  
Signature of Applicant

\_\_\_\_\_  
Floodplain Administrator

# EXHIBIT 'M'

## CERTIFICATE OF COMPLIANCE FOR DEVELOPMENT IN THE REGULATORY FLOOD AREA (OWNER MUST RETAIN THIS CERTIFICATE)

FLOODPLAIN DEVELOPMENT PERMIT NO. \_\_\_\_\_  
PERMIT DATE \_\_\_\_\_

PREMISES LOCATED AT:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

OWNERS NAME AND ADDRESS:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

CHECK ONE:

- ☐ NEW STRUCTURE
- ☐ EXISTING STRUCTURE
- ☐ FLOOD TOLERANT LAND USE
- ☐ CHANNEL IMPROVEMENT
- ☐ OTHER- Describe: \_\_\_\_\_

THE LOCAL ADMINISTRATOR IS TO COMPLETE THE SECTION BELOW.

A. COMPLIANCE IS HEREBY CERTIFIED WITH THE REQUIREMENTS OF LOCAL  
STORMWATER MANAGEMENT ORDINANCE NO.

SIGNED: \_\_\_\_\_ DATED: \_\_\_\_\_



# EXHIBIT 'N'

## EARTH CHANGE PERMIT APPLICATION

This application is in conformance with the provisions of Ordinance No.  
The fee for an Earth Change permit is **\$25** ?

Earth Change permits are required for any project.

Project Name: \_\_\_\_\_

Address of Property: \_\_\_\_\_

Subdivision: \_\_\_\_\_ Sec/Township/Range: \_\_\_\_\_

Name of Applicant: \_\_\_\_\_

Applicants address: \_\_\_\_\_ Zip Code: \_\_\_\_\_

Contact Person: \_\_\_\_\_ Telephone: \_\_\_\_\_

Engineer: \_\_\_\_\_

### Please include the following:

- ☐ A vicinity sketch of the site for which a permit is required, including a legal description of such property, and a boundary line survey.
- ☐ Site drawings indicating each separate land area to be excavated, filled, graded, or leveled, the finished depth of each separate land cut or fill, the present and future (as completed) points of entry and discharge for surface water on the subject property, and identification of all temporary or permanent structures or other devices to be erected or established for the purpose of controlling or regulating surface water and erosion on such property.
- ☐ The applicant's plans for controlling on-site erosion and off-site sedimentation for the purpose of minimizing the deposit of sediment from the tract under application upon any other off-site public or private property or watercourse during all phases of project construction.
- ☐ The applicant's plans for receipt of surface water on his property and discharge of surface water from his property during periods of construction and a statement specifying the anticipated time period for completion of all drainage improvements.

Permit approval recommended: \_\_\_\_\_ Date: \_\_\_\_\_  
Stormwater Manager

Permit Approved: \_\_\_\_\_ Date: \_\_\_\_\_  
PUBLIC WORKS DIRECTOR

Permit Issued: \_\_\_\_\_ Date: \_\_\_\_\_  
PUBLIC WORKS DIRECTOR

Permit Issue Date: \_\_\_\_\_ by \_\_\_\_\_

Permit Number: \_\_\_\_\_ Dev. Number: \_\_\_\_\_





MAP SCALE 1" = 1000'



PANEL USTUW

# FIRM

FLOOD INSURANCE RATE MAP  
WAGONER COUNTY,  
OKLAHOMA  
AND INCORPORATED AREAS

PANEL 310 OF 325

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

EXPIRATION  
DATE  
11/1/11

WAGONER COUNTY  
OKLAHOMA

WAGONER COUNTY  
OKLAHOMA

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OKLAHOMA



Federal Emergency Management Agency

MAP NUMBER  
401450310H

EFFECTIVE DATE  
APRIL 17, 2012

This is Official Copy of a portion of the above referenced Flood Map. It is not a Flood Map. The map does not reflect changes in the flood hazard area. For the latest product information about National Flood Insurance Program Flood Maps check the FEMA Flood Map Store at [www.fema.gov](http://www.fema.gov)

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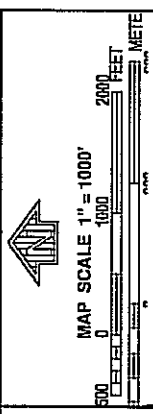
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28° 22' 30.0"

28° 22' 30.0"



PANEL 0350H

# FIRM

FLOOD INSURANCE RATE MAP  
WAGONER COUNTY,  
OKLAHOMA  
AND INCORPORATED AREAS

PANEL 310 OF 525

USE MAP INDEX FOR FIRM PANEL LAYOUT

## EXPLANATION

UNINCORPORATED AREAS  
INCORPORATED AREAS  
WAGONER COUNTY  
WAGONER COUNTY  
WAGONER COUNTY

MADE BY: The United States Army Corps of Engineers  
DATE: 1985  
REVISION: 1985

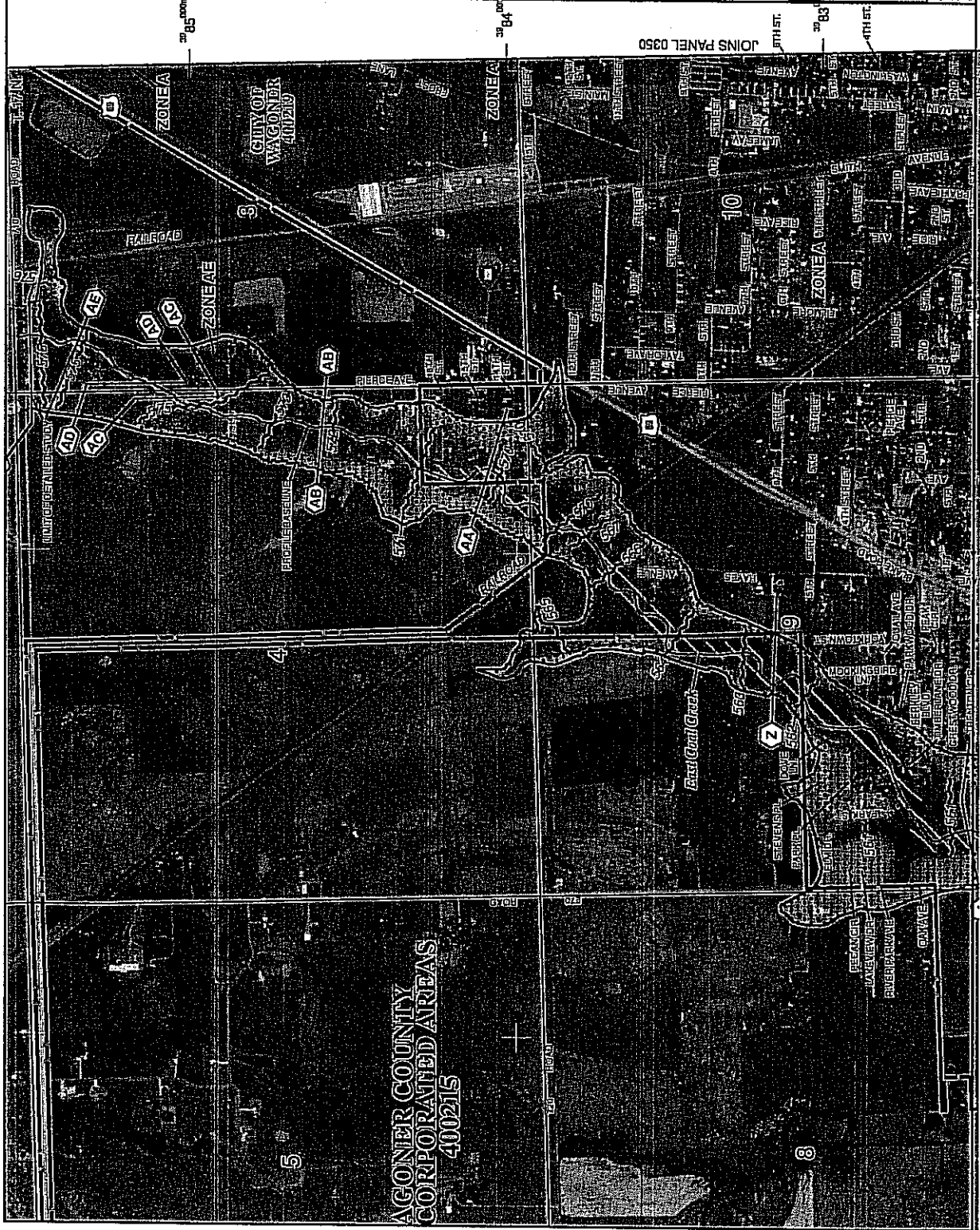
MAP NUMBER  
40145C0350H

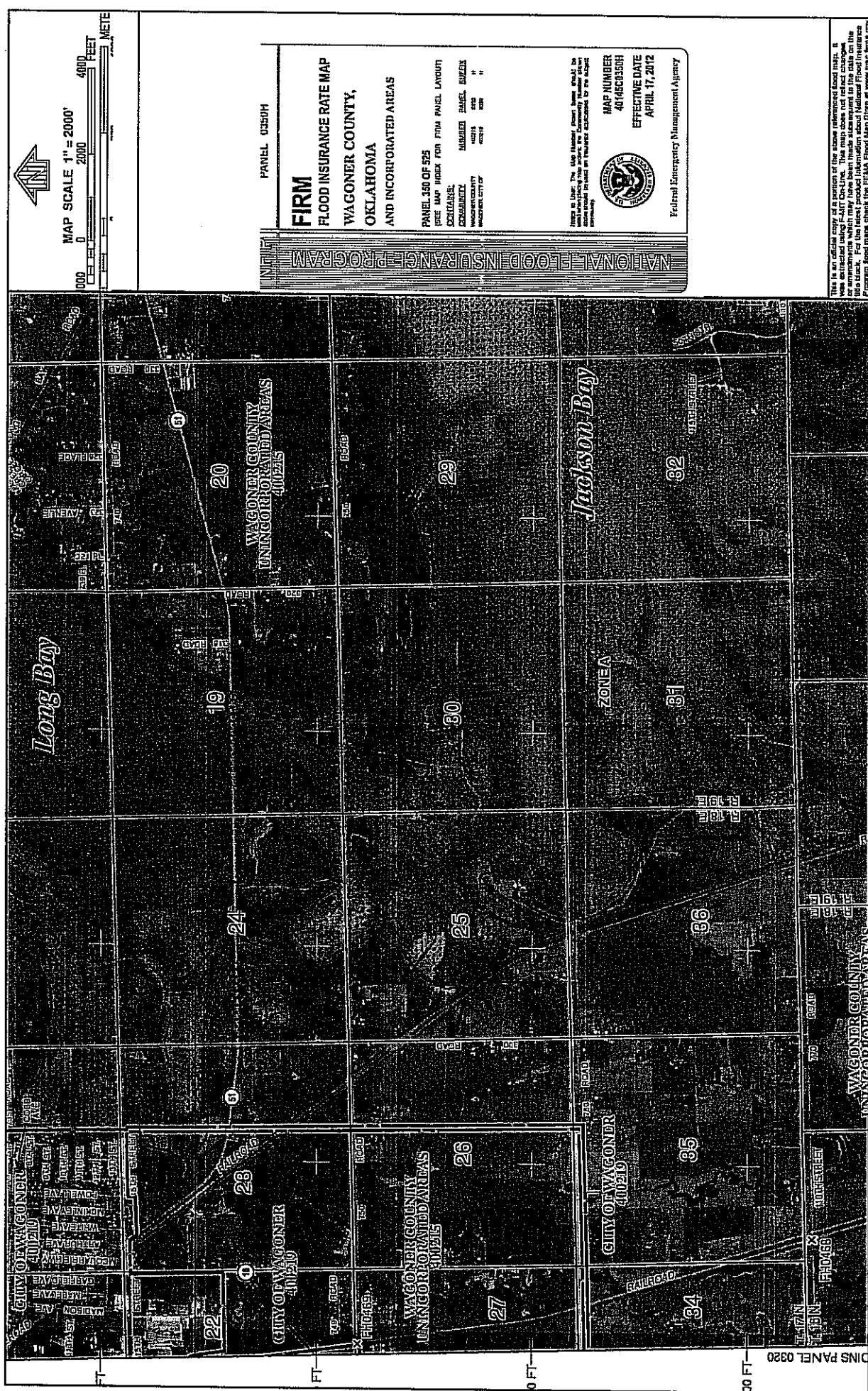
EFFECTIVE DATE  
APRIL 17, 2012



Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It is not to be used for any purpose other than that for which it was prepared. For the latest product information about National Flood Insurance Program flood maps, check the FEMA Flood Map Store at [www.fema.gov](http://www.fema.gov).









PANEL 0350H

**FIRM**  
**FLOOD INSURANCE RATE MAP**  
**WAGONER COUNTY,**  
**OKLAHOMA**  
**AND INCORPORATED AREAS**

PANEL 350 OF 525  
SEE MAP INDEX FOR FIRM PANEL LAYOUT

CONTAINS:  
WAGONER COUNTY  
WAGONER COUNTY  
WAGONER COUNTY

WAGONER COUNTY  
WAGONER COUNTY  
WAGONER COUNTY

MAP NUMBER  
4045C0350H  
EFFECTIVE DATE  
APRIL 17, 2012



Federal Emergency Management Agency

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