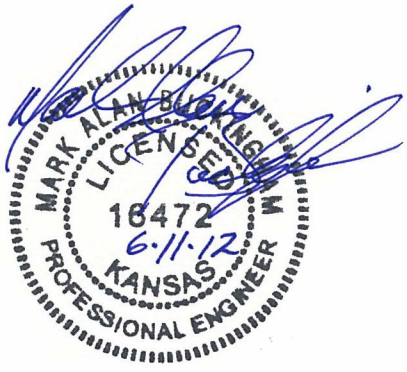
DRAINAGE REPORT

FOR

INDUSTRIAL PARK COMPLEX SECOND ADDITION
Wichita, Kansas



June 2011

Tab 1. General

Introduction

The purpose of this report is to evaluate storm water runoff from proposed future improvements to the Spirit AeroSystems production facilities, and to determine what improvements are necessary in order that no adverse impact occurs to the surrounding landowners or downstream drainage systems. The evaluation area will encompass the parcel to be platted as Industrial Park Complex Second Addition. Although Phase 1 of the improvements is planned at this time, this report will focus on the drainage improvements required for a full build-out condition. It is desired to construct full build-out drainage improvements with the Phase 1 expansion. This report will also show compliance with Sedgwick County storm water management regulations, and will detail drainage improvements required to meet these standards.

The Industrial Park Complex Second Addition is located on the east side of Highway K-15 (Southeast Blvd), north of East 47th Street and south of East MacArthur Road. The proposed development will consist of expansion to the west of the existing production facilities. Storm sewer pipe and inlets will also be included. Appendix A contains a site plan showing the site and proposed Phase 1 development.

Tab 2. Existing Conditions

Full build-out development (including Phase 1) will occur on vacant ground immediately adjacent to the west of the existing Spirit AeroSystems facilities. The north part of this property previously contained animal shelter facilities, although these structures have been removed. The remaining south part is covered with well established grass and a few scattered trees. Appendix B contains a survey of the site USGS Quad Map, and an aerial showing existing conditions. Appendix B also contains the NRCS soils report for the site, indicating Class B soils over the entire part of the property.

The existing site drains westward to a low point on the east side of K-15, and through a 52" x 72" concrete arched culvert. This drainage area includes a large part of the existing Spirit AeroSystems facilities, including impervious roof area and pavement. The only on-site area which is not tributary to the K-15 culvert is a small part at the northwest corner of the property. This part drains northwest into another watershed. No proposed improvements are planned for this area. A small area south of Technology Drive drains north through a culvert under Technology Drive, and then flows into the low point on the east side of K-15. This low point on the east side of K-15 provides existing, on-site compensatory storm water storage.

Runoff through the 52" x 72" concrete arched culvert flows under K-15 and to the west. Discharge from the K-15 culvert continues to flow west, through a culvert under the railroad tracks, and into a residential subdivision west of the tracks. Appendix C contains a display showing the existing, pre-development watersheds.

As can be seen in Appendix C, runoff is conveyed through the subdivision with a concrete channel north of Sunview Avenue. This downstream storm system includes culverts under Clifton Avenue, Cumberland Street, Englewood Street, and Greenhaven Street. West of Greenhaven Street, an open channel conveys the upstream runoff into the Arkansas River. At the point of discharge into the Arkansas River, the site of the proposed expansion (Area G) is less than 10% of the total watershed tributary to the Arkansas River at that point. Appendix C also contains a display showing the existing, on-site compensatory storm water storage in the low area east of K-15.

Tab 3. Proposed Conditions

Appendix D contains a display of the proposed watersheds. As can be seen, the proposed development will alter only Area G. When fully developed, Area G will contain a retention basin and green space at the northwest corner, while the remaining part will be impervious roof and pavement (North Area). The area south of Technology Drive will remain the same, as well as the right-of-way on the east side of K-15 (South Area). The North Area will be directly tributary to the proposed detention basin, while the South Area will by-pass the detention basin and will drain directly to the K-15 Culvert. The remaining downstream watersheds (Areas A to F) will not be altered.

The existing low area on the east side of K-15 will also be altered. Part of the low area east of the right-of-way will be filled in to level the site for development. This filling in will reduce the on-site storm water storage capacity of the low area. Appendix D contains a display showing this low area under proposed conditions.

Appendix D also contains the pre- and post-developed runoff calculations for Area G using SCS TR-55. With increased impervious area and shortened times of concentration, peak runoff rates will increase in post-developed conditions. For example, the North area alone will have a 100-year peak discharge rate of 237.77-cfs which is more than the pre-developed 100-year peak discharge rate of 189.46-cfs for all of Area G. In order to reduce these peak flow rates in developed conditions, provide water quality protection volume (WQv), and a downstream channel protection volume (CPv), a storm water retention pond is proposed for Area G.

Tab 4. Retention Facilities

As noted above, a retention basin will be located at northwest corner of Area G, and will collect all of the runoff from the post-developed area (North area). This retention basin is designed to compensate for the on-site compensatory storage lost when part of the existing low area east of K-15 is filled in.

Appendix E contains the stage-storage-discharge relationships and hydraulic calculations for the proposed retention basin. The WQv calculations are also included.

A permanent pool of water (dead storage) equal to the WQv will be provided in the bottom of this facility. The normal pool elevation of this water surface will be 1306. The primary outlet system consists of a 5-inch orifice located at the top of the normal pool elevation, with a 27.25-ft long broad-crested weir spillway located further up. The orifice equation was used to develop the stage-discharge relationship for the orifice, and the broad-crested weir equation was used to develop the stage –discharge relationship for the upper spillway. Discharge from the 5-inch orifice is carried by an 18-inch RCP. This pipe will discharge at an elevation of 1305 which is above the 100-year headwater elevation of the K-15 culvert (1304.88).

The top of the dam structure will be at an elevation of 1312, and the flowline of the upper spillway is set at 1309. Appendix E contains a display showing the layout of the retention basin. Below the normal pool elevation of 1306 will be an aquatic bench 10-ft wide with an inner elevation of 1305, 1-ft below normal pool. Further excavation down to 1295 (bottom) will provide 3.64-ac.ft of water quality volume which is more than the 2.88-ac.ft required. All interior slopes are 5:1 while the exterior slopes are 3:1.

A HEC-HMS model of the proposed retention basin was created and post-developed runoff hydrographs from the North area were routed through the basin. The SCS TR-55 watershed parameters for the North area (Appendix D) were used to generate these post-development runoff hydrographs into the basin. Appendix E contains the results for this routing, while Table 1 below provides a summary:

Table 1 - Retention Basin Routing Results

Description	Storm Event						
	1 Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Pre-Dev. Area G (cfs)	25.76	44.49	74.87	101.49	128.67	160.76	189.46
South Area (Post-Dev.)	4.57	7.50	12.12	16.08	20.19	24.90	29.15
Allowable Release (cfs)	21.19	36.99	62.75	85.41	108.48	135.86	160.31
Basin Outflow (cfs)	1.10	9.00	34.10	56.80	82.20	115.60	143.10
Peak Basin Elevation (ft)	1309.00	1309.10	1309.50	1309.80	1310.10	1310.30	1310.50
Peak Basin Storage (ac-ft)	4.40	4.70	5.60	6.30	7.00	7.80	8.30

As can be seen in Table 1 above, the peak discharge rate from the retention basin is less than the allowable release rate for all storm events. Allowable release rates for the basin were determined by subtracting the peak flows from the South area which is not detained from the pre-development peak flow rates for Area G.

Of particular interest was the 1-year storm event. Appendix E contains a plot of the inflow and outflow hydrograph for the 1-year event, and shows that the centroids of the inflow and outflow

hydrographs are separated by 24-hours. Thus, the proposed retention basin provides the channel protection volume required by County standards.

Appendix E also contains the calculations for the emergency spillway. This structure consists of a 175-ft long broad crested weir at the top of the basin berm with a flowline elevation of 1310.50. A stage-storage discharge relationship was developed using just this emergency spillway, and the 100-year storm event was routed through the retention basin. The results indicate that under this scenario, a water surface elevation of 1311 in the basin and through the emergency spillway results. Since the top of the dam is at 1312, 1-ft of freeboard is provided as required by County standards.

Tab 5. Downstream Hydrograph Routing

A HEC-HMS model was set up for the downstream system. Runoff hydrographs were routed through the model for both pre- and post-development conditions. Runoff hydrographs were developed for each sub-area using the SCS method with the TR-55 watershed parameters as inputs. The HEC-HMS analysis also included modeling the existing paved ditch and other downstream open channels as reaches. LIDAR and field survey information was used to obtain information for the downstream watersheds and reaches.

The low area east of K-15 was also considered in the model. For pre-development conditions, the full storage capacity of this low area and the K-15 culvert which drains it were modeled like a detention basin, through which runoff from Area G was routed. For post-developed conditions, the reduced capacity of the low area was accounted for by adjusting the stage-storage relationship in the model. Discharge from the proposed retention basin and from the South area was than routed through the modified low area. Appendix F contains the HEC-HMS model inputs, results and a full summary for the downstream routing. Table 2 below summarizes these routing results for the 1, 10 and 100-year storm events:

Table 2 - Downstream HEC-HMS Routing Results (cfs)

Location	1-Year		10-Year		100-Year	
	Pre-	Post-	Pre-	Post-	Pre-	Post-
K-15	26.6	5.5	92.6	60.1	148.6	142.4
Railroad	37.4	15.7	118.1	75.2	187.4	170.8
Clifton Ave.	39.4	18.2	125.2	78.8	201.3	178.5
Cumberland St.	42.4	21.8	134.1	83.1	218.2	187.6
Englewood St.	47.6	29.8	151.3	97.0	252.7	215.0
Greenhaven St.	58.8	40.4	190.6	133.7	323.4	286.5
Arkansas River	71.1	52.4	243.1	185.1	422.9	386.3

As can be seen in Table 2 above, for each storm event the pre-development peak flow rates are lower than post-development peak flow rates.

Tab 6. On-Site Culverts

Two culverts were studied for this report. The first was the K-15 culvert. The main concern with this culvert was its maximum headwater elevation, so that the outlet of proposed retention basin could be located to avoid any tailwater conditions that might impede its operation. The second culvert studied was a new culvert for the Phase 1 expansion. Appendix G contains the FHWA HY-8 hydraulic calculations for these culverts.

The K-15 culvert is a 52" x 72" concrete arched culvert, which are not standard sized dimensions for this type of culvert. Furthermore, the shape is not typical of an arch or elliptical culvert. Consequently, for the HY-8 analysis a standard elliptical culvert 48" x 76" was used to approximate its performance. This analysis was supplemented with a HydraFlow Express culvert analysis which can evaluate an elliptical shaped culvert with any rise or span dimension. This allowed a comparison with the HY-8 results using an arch type concrete culvert with the exact 52" x 72" dimensions. Tailwater for the K-15 culvert was also considered. The analysis was run without tailwater, and with a tailwater caused by the next downstream culvert's headwater (4-ft steel pipe). The highest headwater elevation obtained during the 100-year storm event was 1304.88 (1304.58 per HY-8).

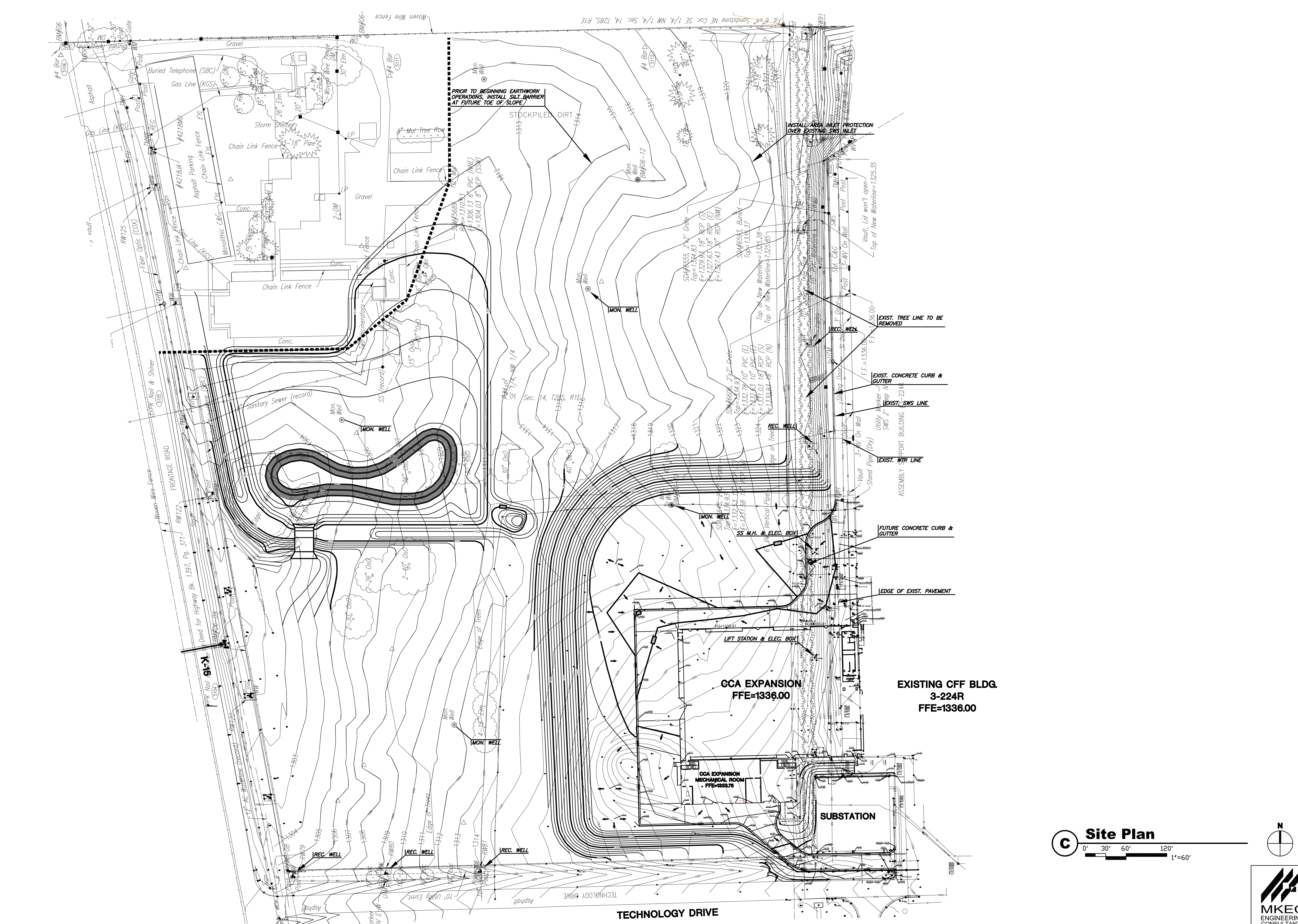
The proposed driveway culvert on the south side of the Phase 1 expansion was also analyzed using the FHWA HY-8 program. Appendix G also contains a map showing this culvert's watershed and hydrology. As may be seen from this data, the proposed 18-inch RCP culvert with end section can convey the 100-year storm event without overtopping the entrance or Technology Drive.

Tab 7. Conclusions

The proposed development will alter the existing on-site drainage patterns and peak runoff rates. Increases in impervious area and reductions in times of concentration will cause these higher runoff rates. However, a wet-bottomed retention basin will intercept runoff from the developed site, and will reduce the peak flow rates off-site to below existing conditions. The retention basin will also include a permanent pool of water (dead storage) equal to the WQv, and will detain the 1-year storm event sufficient to meet CPv requirements. Consequently, the proposed development and drainage improvements will not cause an adverse impact to the surrounding landowners or downstream drainage systems.

Appendix A

Proposed Site Plan



C **Site Plan**

0' 30' 60' 120'

1"=60'

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	DATE	DESCRIPTION	BY	APPROVED
1	06/01/11	PARTIAL RELEASE #1 MASS GRADING		

FIRE PROTECTION REVIEW

☐ APPROVED

☐ NOT REQUIRED

DATE

ACCEPTABILITY THIS DESIGN AND/OR SPECIFICATION IS APPROVED

NAME | DEPT. | DATE

SPIRIT AEROSYSTEMS

GLMV Architecture

P.E. CONTACT: LINDA WADE (316) 523-0917

INDUSTRIAL PARK COMPLEX
SECOND ADDITION

BLDG. 3-224R/01

Facilities Engineering

WICHITA

Job Number: 1101060200

Designed by: MAB

Drawn by: SPE

Date: 05/20/2012

MKEC ENGINEERING CONSULTANTS WICHITA, KS

Project No: 1615203

Sheet Name: SITE PLAN

Sheet: C2.

Drawing No: 31G- 105

Appendix B

Survey and NRCS Soils Report

SCALE: 1" = 1000'

1000 0 1000 2000

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SECTION 14
TOWNSHIP 28S
RANGE 1E

MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

INDUSTRIAL PARK COMPLEX SECOND ADDTION
PROJECT NAME

AERIAL MAP
SHEET TITLE

KLA	CMJ	GJA
DESIGN BY:	DRAWN BY:	CHECKED BY:
JUNE 2012	11200	1 / 1
DATE	JOB NO.	SHEET/OF

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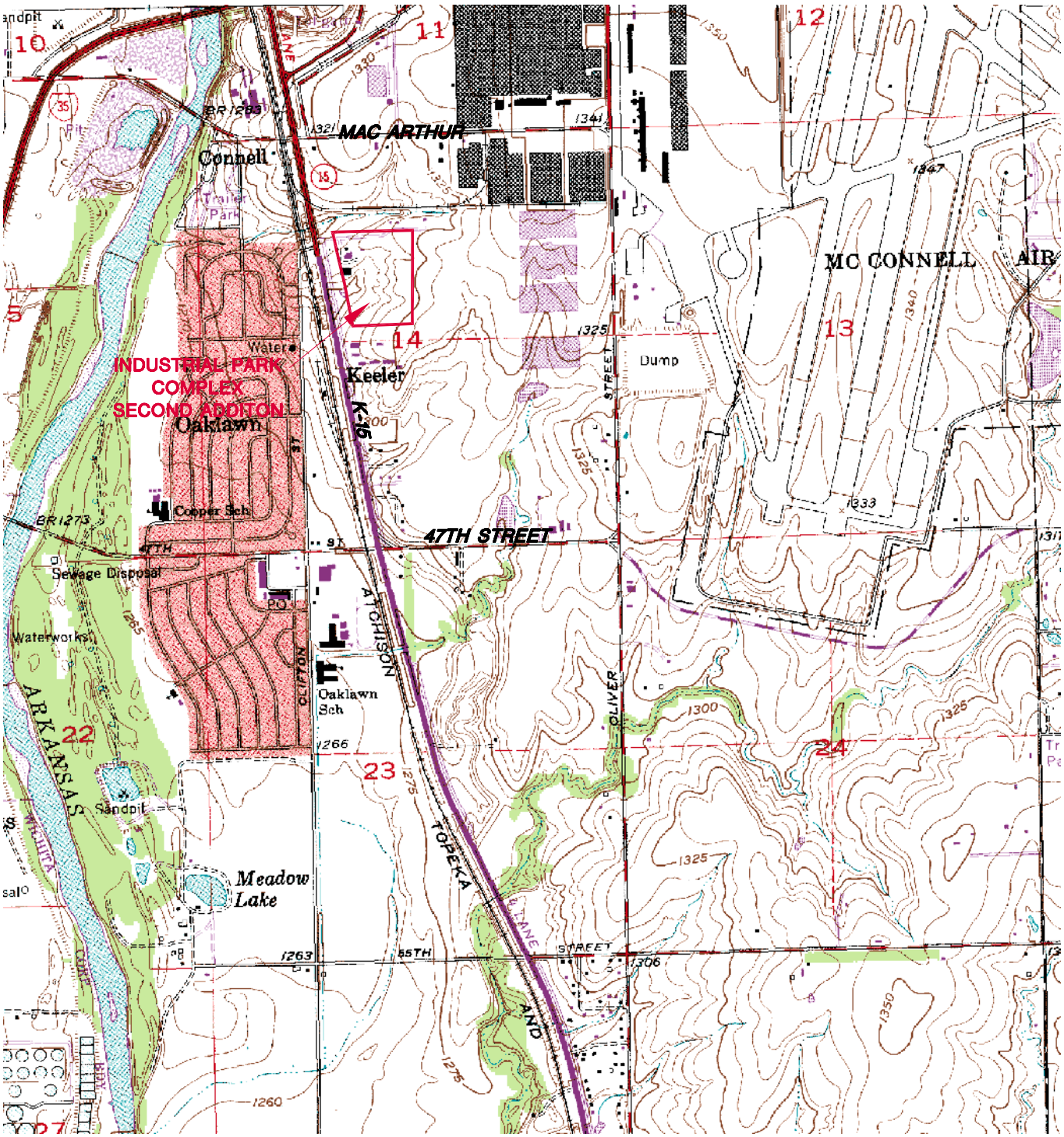

SCALE: 1" = 2000'

2000 0 2000 4000

N

SECTION 14
TOWNSHIP 28S
RANGE 1E

MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

INDUSTRIAL PARK COMPLEX SECOND ADDTION
PROJECT NAME

QUAD MAP
SHEET TITLE

KLA	CMJ	GJA
DESIGN BY:	DRAWN BY:	CHECKED BY:
JUNE 2012	11200	1 / 1
DATE	JOB NO.	SHEET/OF

K:\PROJECTS\2011\11010600200_Spirit_Wichita_Southwest CCA Expansion - CFF\5-Civil\CAD\Drainage\Drawing\11200_QUAD.dwg

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Sedgwick County, Kansas

11200 Spirit Areo Systems

April 4, 2011

Preface

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

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

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

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

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

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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How Soil Surveys Are Made

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

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

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

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

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

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

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

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

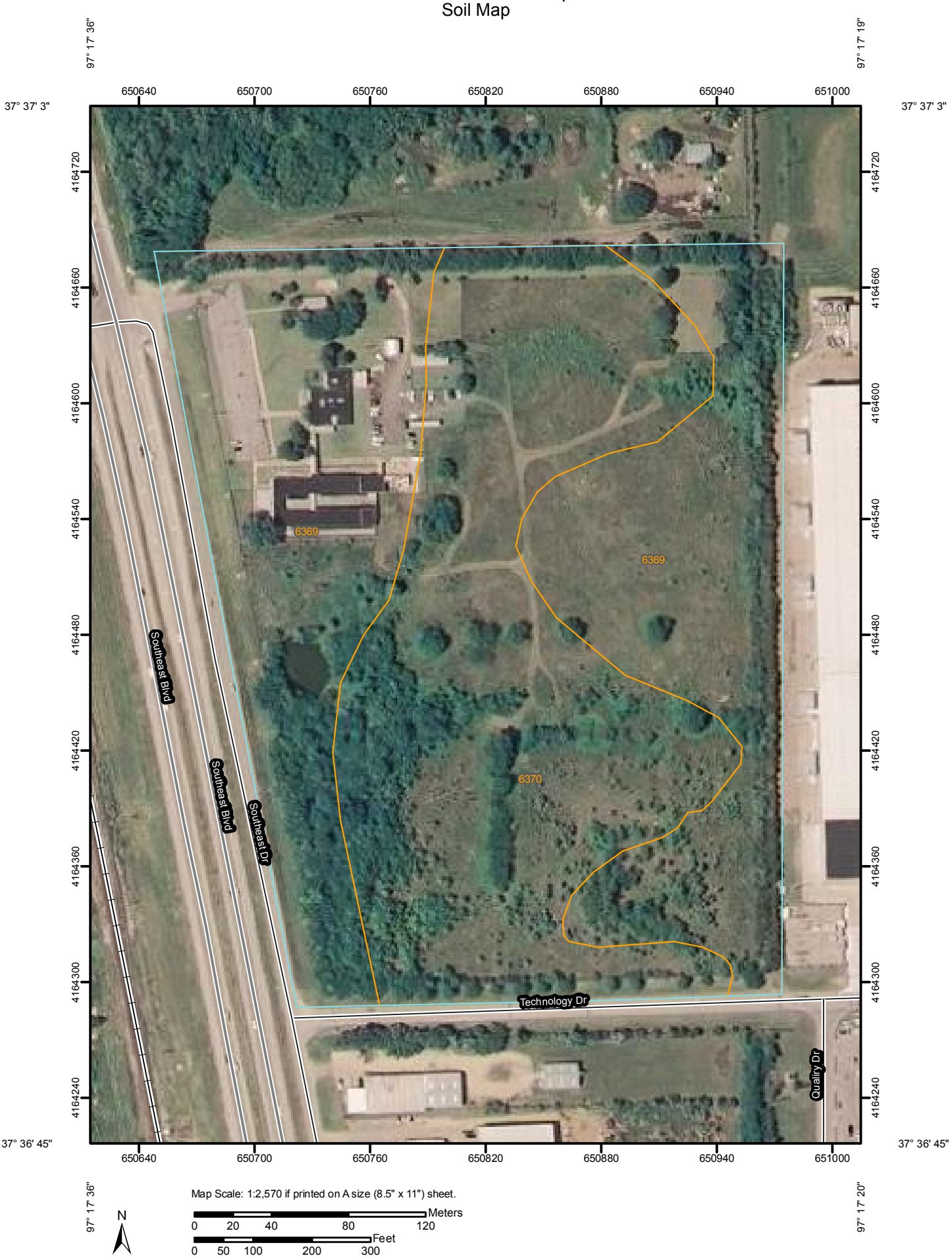
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

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

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:2,570 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 14N NAD83

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

Soil Survey Area: Sedgwick County, Kansas
Survey Area Data: Version 7, Nov 30, 2010

Date(s) aerial images were photographed: 6/20/2006

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

Map Unit Legend

Sedgwick County, Kansas (KS173)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
6369	Milan loam, 1 to 3 percent slopes	15.2	54.4%
6370	Milan loam, 3 to 6 percent slopes	12.8	45.6%
Totals for Area of Interest		**28.0**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

Sedgwick County, Kansas

6369—Milan loam, 1 to 3 percent slopes

Map Unit Setting

Elevation: 750 to 1,500 feet
Mean annual precipitation: 24 to 31 inches
Mean annual air temperature: 45 to 66 degrees F
Frost-free period: 195 to 225 days

Map Unit Composition

Milan and similar soils: 100 percent
Minor components: 0 percent

Description of Milan

Setting

Landform: Paleoterraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability (nonirrigated): 2e
Ecological site: Loamy Upland (PE 24-32) (R080AY015KS)

Typical profile

0 to 11 inches: Loam
11 to 60 inches: Clay loam

Minor Components

Aquolls

Percent of map unit: 0 percent
Landform: Depressions, drainageways, hillslopes
Down-slope shape: Concave
Across-slope shape: Concave

6370—Milan loam, 3 to 6 percent slopes

Map Unit Setting

Elevation: 750 to 1,500 feet
Mean annual precipitation: 24 to 31 inches
Mean annual air temperature: 45 to 66 degrees F
Frost-free period: 195 to 225 days

Map Unit Composition

Milan and similar soils: 100 percent
Minor components: 0 percent

Description of Milan

Setting

Landform: Paleoterraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: High (about 11.1 inches)

Interpretive groups

Land capability (nonirrigated): 3e
Ecological site: Loamy Upland (PE 24-32) (R080AY015KS)

Typical profile

0 to 11 inches: Loam
11 to 60 inches: Clay loam

Minor Components

Aquolls

Percent of map unit: 0 percent
Landform: Depressions, drainageways, hillslopes
Down-slope shape: Concave
Across-slope shape: Concave

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group (11200 Spirit Aero Systems)

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

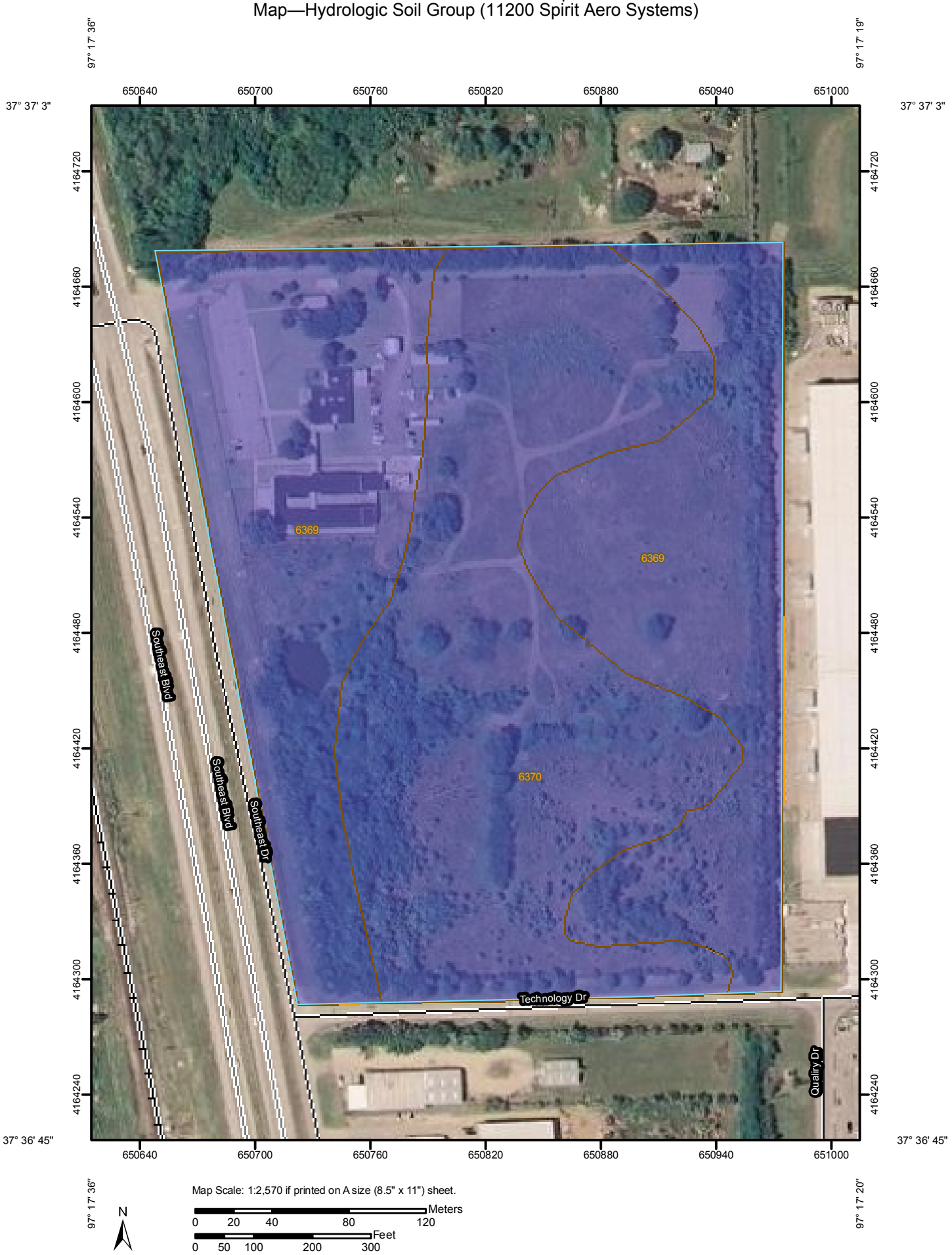
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report
Map—Hydrologic Soil Group (11200 Spirit Aero Systems)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

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

MAP INFORMATION

Map Scale: 1:2,570 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 14N NAD83

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

Soil Survey Area: Sedgwick County, Kansas
Survey Area Data: Version 7, Nov 30, 2010

Date(s) aerial images were photographed: 6/20/2006

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

Table—Hydrologic Soil Group (11200 Spirit Aero Systems)

Hydrologic Soil Group— Summary by Map Unit — Sedgwick County, Kansas				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
6369	Milan loam, 1 to 3 percent slopes	B	15.2	54.4%
6370	Milan loam, 3 to 6 percent slopes	B	12.8	45.6%
Totals for Area of Interest			**28.0**	**100.0%**

Rating Options—Hydrologic Soil Group (11200 Spirit Aero Systems)

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie.

The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be

considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Lower

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

References

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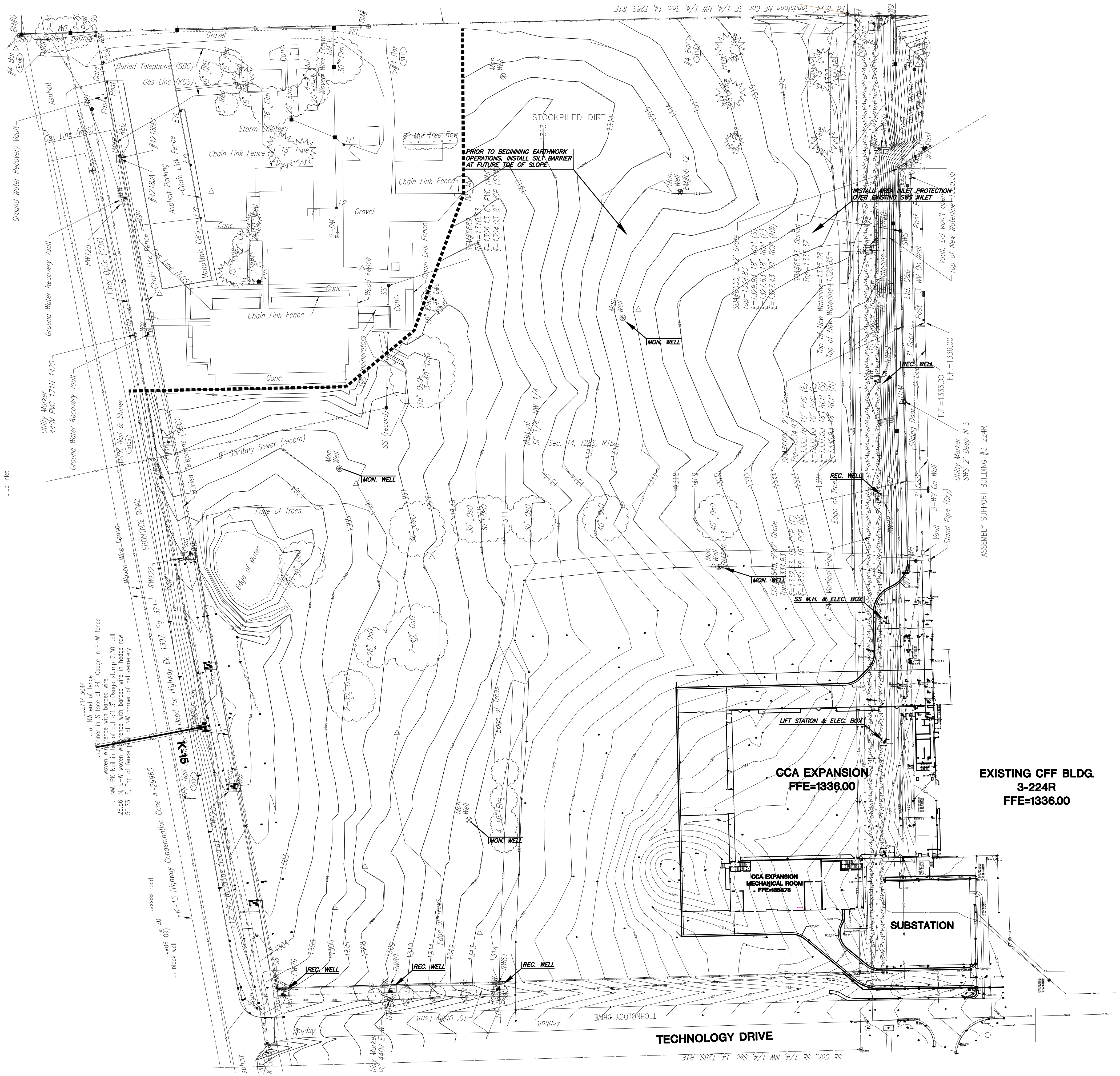

C Existing Conditions

0' 30' 60' 120'
1"=60'

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△	DATE	DESCRIPTION	BY	APPROVED
1	06/01/11	PARTIAL RELEASE #1 MASS GRADING		

FIRE PROTECTION REVIEW
☐ APPROVED
☐ NOT REQUIRED
DATE ____

ACCEPTABILITY
THIS DESIGN AND/OR SPECIFICATION IS APPROVED
NAME | DEPT. | DATE

SPIRIT AEROSYSTEMS

GLMV Architecture

P.E. CONTACT: LINDA WADE (316) 523-0917

INDUSTRIAL PARK COMPLEX
SECOND ADDITION

BLDG. 3-224R/01
Facilities Engineering
WICHITA
Designed by: MAB
Drawn by: SPE
Job Number: 1101060200
Date: 05/20/2012

MKEC ENGINEERING CONSULTANTS WICHITA, KS

Project No: 1615203
Sheet Name: EXISTING CONDITIONS PLAN
Sheet: C2._
Drawing No: 31G-105

Appendix C

Existing Watershed Map & Runoff

Existing Low Area
Stage - Storage - Discharge

Elevation (ft)	Area (sq.ft.)	Incremental Storage (cubic ft)	Cumulative Storage (cubic Ft)	Cumulative Storage (ac-ft)	K-15 Discharge (cfs)
1298.2	0	0	0	0.0000	0.00
1299	168	67	67	0.0015	6.10
1300	1,201	685	752	0.0173	28.20
1301	8,819	5,010	5,762	0.1323	62.50
1302	21,476	15,148	20,910	0.4800	100.00
1303	35,732	28,604	49,514	1.1367	139.20
1304	52,684	44,208	93,722	2.1516	175.00
1305	96,780	74,732	168,454	3.8672	204.10
1306	130,777	113,779	282,233	6.4792	238.30

C **Existing Low Area Display**
0′ 30′ 60′ 120′
1″=60′

N

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	DATE	DESCRIPTION	BY	APPROVED
1	06/01/11	PARTIAL RELEASE #1 MASS GRADING		

FIRE PROTECTION REVIEW
☐ APPROVED
☐ NOT REQUIRED
DATE:

ACCEPTABILITY TO CERTIFICATION SPECIFICATIONS APPROVED

NAME	DEPT.	DATE

SPIRIT AEROSYSTEMS

P.E. CONTACT: LINDA WADE (316) 523-0917

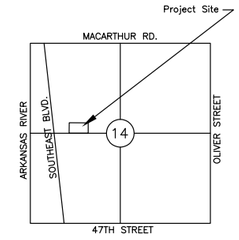
MKEC ENGINEERING CONSULTANTS WICHITA, KS

GLMV ARCHITECTURE
420 W. Douglas, Suite 110, Wichita, KS 67202
316.315.2626
125 S. Rhode Island, Wichita, KS 67202
316.315.2626
www.glmv.com

INDUSTRIAL PARK COMPLEX
SECOND ADDITION
BLDG. 3-224R/01 Facilities Engineering WICHITA

Designed by: MAB
Drawn by: SPE
Job Number: 1101060200
Date: 05/20/2012

Project No: 1615203
Sheet Name: EXISTING LOW AREA DISPLAY
Sheet: C2.__
Drawing No: 31G- 105



VICINITY MAP

LEGEND

- CONIFEROUS TREE
- DECIDUOUS TREE
- SIGN
- POWER POLE
- ELECTRIC BOX
- LIGHT POLE
- FIRE HYDRANT
- WATER VALVE
- WATER METER
- SECTION CORNER
- BENCHMARK
- EASEMENT
- BUILDING SETBACK
- FENCE
- STORM SEWER PIPE
- WATER LINE
- SANITARY SEWER LINE
- GAS LINE
- GAS PIPELINE
- TELEPHONE LINE
- UNDERGROUND ELEC.
- OVERHEAD ELECTRIC
- FIBER OPTIC CABLE
- DRAINAGE SUB BASIN
- DRAINAGE BASIN
- FLOW ARROW
- AREA FOR SWS SIZING

NOTE: WATERSHEDS A THROUGH F ARE REMAINING THE SAME.

N

SCALE: 1" = 200'

200 0 200 400

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MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

INDUSTRIAL PARK COMPLEX SECOND ADDITION

WICHITA, KANSAS

EXISTING WATERSHED MAP

DATE: June 2012

REVISED

DESIGN BY: WB

DRAWN BY: CMJ

CHECKED BY: MAB

SHEET NUMBER: 1

Appendix D

Proposed Watershed Map & Runoff

Post-Developed Low Area
Stage - Storage - Discharge

Elevation (ft)	Area (sq.ft.)	Incremental Storage (cubic ft)	Cumulative Storage (cubic Ft)	Cumulative Storage (ac-ft)	K-15 Discharge (cfs)
1298.2	0	0	0	0.0000	0.00
1299	168	67	67	0.0015	6.10
1300	1,201	685	752	0.0173	28.20
1301	5,170	3,186	3,938	0.0904	62.50
1302	10,652	7,911	11,849	0.2720	100.00
1303	16,519	13,586	25,435	0.5839	139.20
1304	22,433	19,476	44,911	1.0310	175.00
1305	28,668	25,551	70,462	1.6176	204.10
1306	39,316	33,992	104,454	2.3979	238.30

C **Proposed Low Area Display**
0′ 30′ 60′ 120′
1″=60′

N

P.E. CONTACT: LINDA WADE (316) 523-0917

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NO.	DATE	DESCRIPTION	BY	APPROVED
1	06/01/11	PARTIAL RELEASE #1 MASS GRADING		

FIRE PROTECTION REVIEW
☐ APPROVED
☐ NOT REQUIRED
DATE

ACCEPTABILITY TO CONFORM TO SPECIFICATIONS APPROVED
NAME | DEPT. | DATE

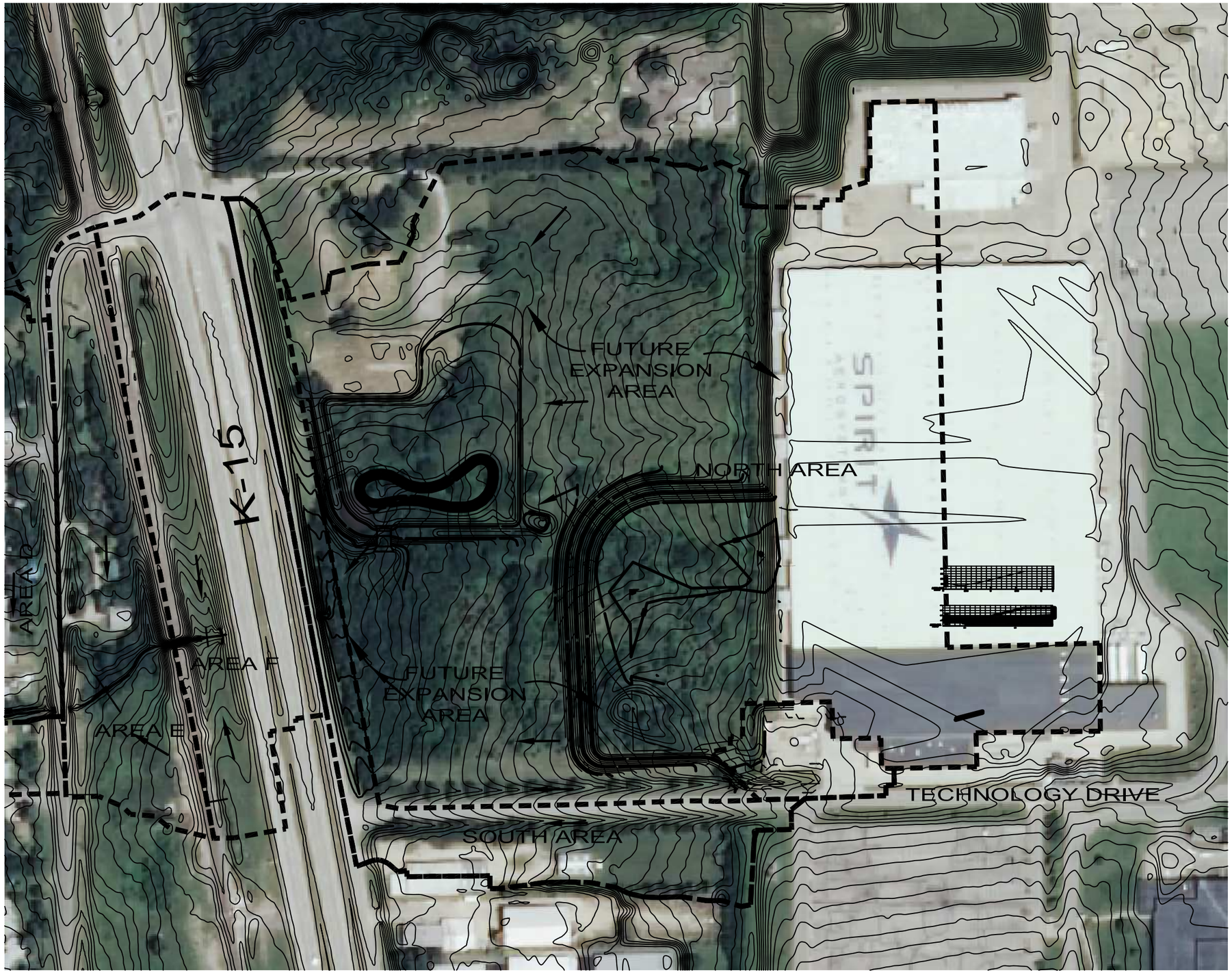
SPIRIT AEROSYSTEMS

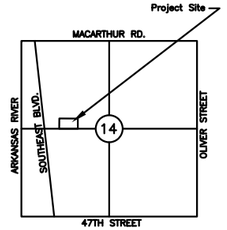
GLMV Architecture
125 S. Woodlawn, Wichita, KS 67208
(316) 262-2682
www.glmv.com

INDUSTRIAL PARK COMPLEX
SECOND ADDITION
BLDG. 3-224R/01 Facilities Engineering WICHITA
Designed by: MAB | Job Number: 1101060200
Drawn by: SPE | Date: 05/20/2012

MKEC ENGINEERING CONSULTANTS WICHITA, KS

Project No: 1615203
Sheet Name: PROPOSED LOW AREA DISPLAY
Sheet: C2.__
Drawing No: 31G- 105





VICINITY MAP

LEGEND

- CONIFEROUS TREE
- DECIDUOUS TREE
- SIGN
- POWER POLE
- ELECTRIC BOX
- LIGHT POLE
- FIRE HYDRANT
- WATER VALVE
- WATER METER
- SECTION CORNER
- BENCHMARK
- EASEMENT
- BUILDING SETBACK
- FENCE
- STORM SEWER PIPE
- WATER LINE
- SANITARY SEWER LINE
- GAS LINE
- GAS PIPELINE
- TELEPHONE LINE
- UNDERGROUND ELEC.
- OVERHEAD ELECTRIC
- FIBER OPTIC CABLE
- DRAINAGE SUB BASIN
- DRAINAGE BASIN
- FLOW ARROW

A17 - AREA FOR SWS SIZING

NOTE: WATERSHEDS A THROUGH F REMAIN UNCHANGED IN PROPOSED CONDITIONS.

N

SCALE: 1" = 100'

100 0 100 200

MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

INDUSTRIAL PARK COMPLEX SECOND ADDITION

WICHITA, KANSAS

PROPOSED WATERSHED MAP

DATE: June 2012

REVISED

DESIGN BY: WB

DRAWN BY: CMJ

CHECKED BY: MAB

SHEET NUMBER: 1

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WinTR-55 Current Data Description

--- Identification Data ---

User: WRB
Project: 11200
SubTitle: Spirit AreoSystems
State: Kansas
County: Sedgwick
Filename: P:\PROJECTS\2011\1101060200_Spirit_Aero\5-Civil\CAD\Drainage\TR-55\11200 Spirit Aero.w55

Date: 5/20/2011
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
Pre-Dev	existing cond.	Outlet	40.39	72	0.375
South	proposed cond.	Outlet	4.86	74	0.234
North	proposed cond.	Outlet	35.52	91	0.358

Total area: 80.77 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.5	4.5	5.3	6.1	7.0	7.8	2.8

Storm Data Source: Sedgwick County, KS (NRCS)
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

WRB

11200
Spirit AreoSystems
Sedgwick County, Kansas

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Pre-Dev	Open space; grass cover > 75% (good)	B	27.883	61
	Paved parking lots, roofs, driveways	B	12.505	98
	Total Area / Weighted Curve Number		40.39	72
South	Open space; grass cover > 75% (good)	B	3.207	61
	Paved parking lots, roofs, driveways	B	1.657	98
	Total Area / Weighted Curve Number		4.86	74
North	Open space; grass cover > 75% (good)	B	6.628	61
	Paved parking lots, roofs, driveways	B	28.896	98
	Total Area / Weighted Curve Number		35.52	91

WRB

11200
Spirit AreoSystems
Sedgwick County, Kansas

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Pre-Dev							
SHEET	100	0.0075	0.240				0.337
SHALLOW	157	0.0159	0.050				0.021
SHALLOW	209	0.0443	0.050				0.017
					Time of Concentration		0.375
South							
SHEET	100	0.0525	0.240				0.155
SHALLOW	223	0.0348	0.050				0.021
CHANNEL	895					4.280	0.058
					Time of Concentration		0.234
North							
SHEET	100	0.0075	0.240				0.337
SHALLOW	157	0.0159	0.050				0.021
					Time of Concentration		0.358

11200
Spirit AreoSystems
Sedgwick County, Kansas

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)	1-Yr (cfs)
SUBAREAS							
Pre-Dev	44.49	74.87	101.49	128.67	160.76	189.46	25.76
South	7.50	12.12	16.08	20.19	24.90	29.15	4.57
North	94.25	127.84	154.36	181.31	211.00	237.77	70.56

Appendix E

Retention Basin

Water Quality Volume
Stage - Storage

Elevation (ft)	Area (sq.ft.)	Incremental Storage (cubic ft)	Cumulative Storage (cubic ft)	Cumulative Storage (ac-ft)
1295	8,257	0	0	0.00
1305	19,027	136,420	136,420	3.13
1306	25,354	22,191	158,611	3.64

Notes:

1. Normal Pool = 1306
2. Aquatic Bench = 1305
3. Bottom = 1295

Proposed Retention Basin
Stage - Storage - Discharge

Elevation (ft)	Area (sq.ft.)	Incremental Storage (cubic ft)	Cumulative Storage (cubic Ft)	Cumulative Storage (ac-ft)	Orifice Discharge (cfs)	Weir Discharge (cfs)	Total Discharge (cfs)
1306	25,354	0	0	0.0000	0.00	na	0.00
1307	54,117	39,736	39,736	0.9122	0.58	na	0.58
1308	79,002	66,560	106,296	2.4402	0.88	na	0.88
1309	95,979	87,491	193,787	4.4487	1.10	na	1.10
1310	112,981	104,480	298,267	6.8473	1.28	71.67	72.95
1311	129,635	121,308	419,575	9.6321	1.44	202.71	204.15
1312	144,179	136,907	556,482	12.7751	1.58	372.40	373.98

Notes:

1. Top of Berm = 1312
2. Flowline of Upper Spillway = 1309
3. Flowline of Lower Orifice = 1306
4. Normal Pool = 1306
5. Aquatic bench = 1306
6. Bottom = 1295

LOCATION: SPIRIT AERO

REFERENCE: WATER QUALITY VOLUME

$$R_V = R_{VU}\,U + R_{VD}\,D + R_{VI}\,I$$

$R_{VU} \rightarrow 0$

WILL HAVE NO UNDISTURBED WOODED, MEADOW, OR AGRICULTURAL COVER

GRASS : $\frac{6.628}{35.52} = D$

IMPERVIOUS : $\frac{28.896}{35.52} = I$

AND : $R_{VD} = 0.20$

$R_{VI} = 0.95$ (CLASS B SOILS)

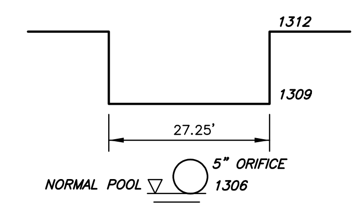
$$R_V = 0.20\left(\frac{6.628}{35.52}\right) + 0.95\left(\frac{28.896}{35.52}\right)$$

$R_V = 0.81$

$$WQ_V = \frac{P\,(R_V)\,A}{12}$$

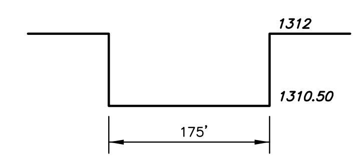
$$WQ_V = \frac{(1.2")(0.81)(35.52)}{12}$$

$WQ_V = 2.88$ AC·ft



PRINCIPAL OUTLETS

N.T.S.



EMERGENCY SPILLWAY

N.T.S.

C Detention Basin

0' 30' 60' 120'
1"=60'

N

	DATE	DESCRIPTION	BY	APPROVED
1	06/01/11	PARTIAL RELEASE #1 MASS GRADING		

K:\PROJECTS\2011\1101060200_Spirit_Wichita_Southwest CCA Expansion – CFF\5-Civil\CAD\Drainage\Drawing\11200_DETENTION-BASIN.dwg

FIRE PROTECTION REVIEW
☐ APPROVED
☐ NOT REQUIRED
DATE___

ACCEPTABILITY
THIS DESIGN AND/OR SPECIFICATION IS APPROVED
NAME | DEPT. | DATE

SPIRIT AEROSYSTEMS

GLMV Architecture
420 S. Emporia, Wichita, KS 67202 Tel: (316) 265-9367
125 S. Washington, Wichita, KS 67202 Tel: (316) 262-0451
www.glmv.com

P.E. CONTACT: LINDA WADE (316) 523-0917

INDUSTRIAL PARK COMPLEX
SECOND ADDITION

BLDG. 3-224R/01
Facilities Engineering
WICHITA
Designed by: MAB
Job Number: 1101060200
Drawn by: SPE
Date: 05/20/2012

MKEC ENGINEERING CONSULTANTS WICHITA, KS

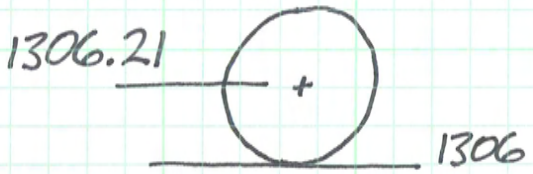
Project No: 1615203
Sheet Name: DETENTION BASIN DISPLAY
Sheet: C2._
Drawing No: 31G- 105

Proj. No. 1120
By WRB Date 5.20.11
Chkd. By Date
Sheet 1 Of 1

LOCATION: SPIRIT - AERO

REFERENCE: 5" ORIFICE : STAGE - DISCHARGE

5" ORIFICE



FOR STEEL PLATE :
$C = 0.60$ (p. 5-95)

$$A = \frac{\pi D^2}{4} = \frac{\pi(5)^2}{4} = 19.635 \text{ in}^2$$
OR 0.1364 ft^2

$$Q = CA\sqrt{2gh}$$

$$Q = (0.60)(0.1364)\sqrt{2(32.2)h}$$

$$Q = 0.0818\sqrt{(64.4)h}$$

ELEV.	h	Q	WEIR	TOTAL
1306	0	0		0
1307	0.79	0.58		0.58
1308	1.79	0.88	WIEIR	0.88
1309	2.79	1.10	0	1.10
1310	3.79	1.28	71.67	72.95
1311	4.79	1.44	202.71	204.15
1312	5.79	1.58	372.40	373.98

MKEC ENGINEERING CONSULTANTS, INC.

KANSAS CITY OKLAHOMA CITY WICHITA

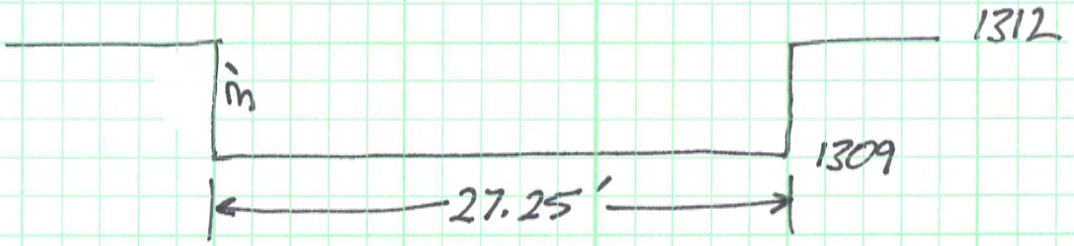
CALCULATIONS & SKETCHES

Proj. No. 1120
By WRB Date 5.21.11
Chkd. By Date
Sheet 1 Of 1

LOCATION: SPIRIT - AERO

REFERENCE: BROAD-CRESTED WEIR : STAGE - DISCHARGE

C = 2.63 (TABLE 5-15)
32' WIDE @ 1309



$Q = C L H^{1.5}$

$Q = (2.63)(27.25)(H)^{1.5}$

$Q = 71.6675(H)^{1.5}$

ELEV.	H	Q
1309	0	0
1310	1	71.67
1311	2	202.71
1312	3	372.40

ALLOWABLE RELEASE IN 100YR IS 160.31 cfs

$Q = C L H^{1.5}$

$160.31 = (2.63) L (1.71)^{1.5}$

$27.26' = L$

SAY : 27.25'

1YR WSEL

1.71' = 1309 TO 1310.71

ESTIMATED 100YR STORAGE VOLUME OCCURS AT THIS EL.

11200 SPIRIT AERO

Channel Report 5" ORIFICE: DISCHARGE PIPE

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Tuesday, May 24 2011

<Name>

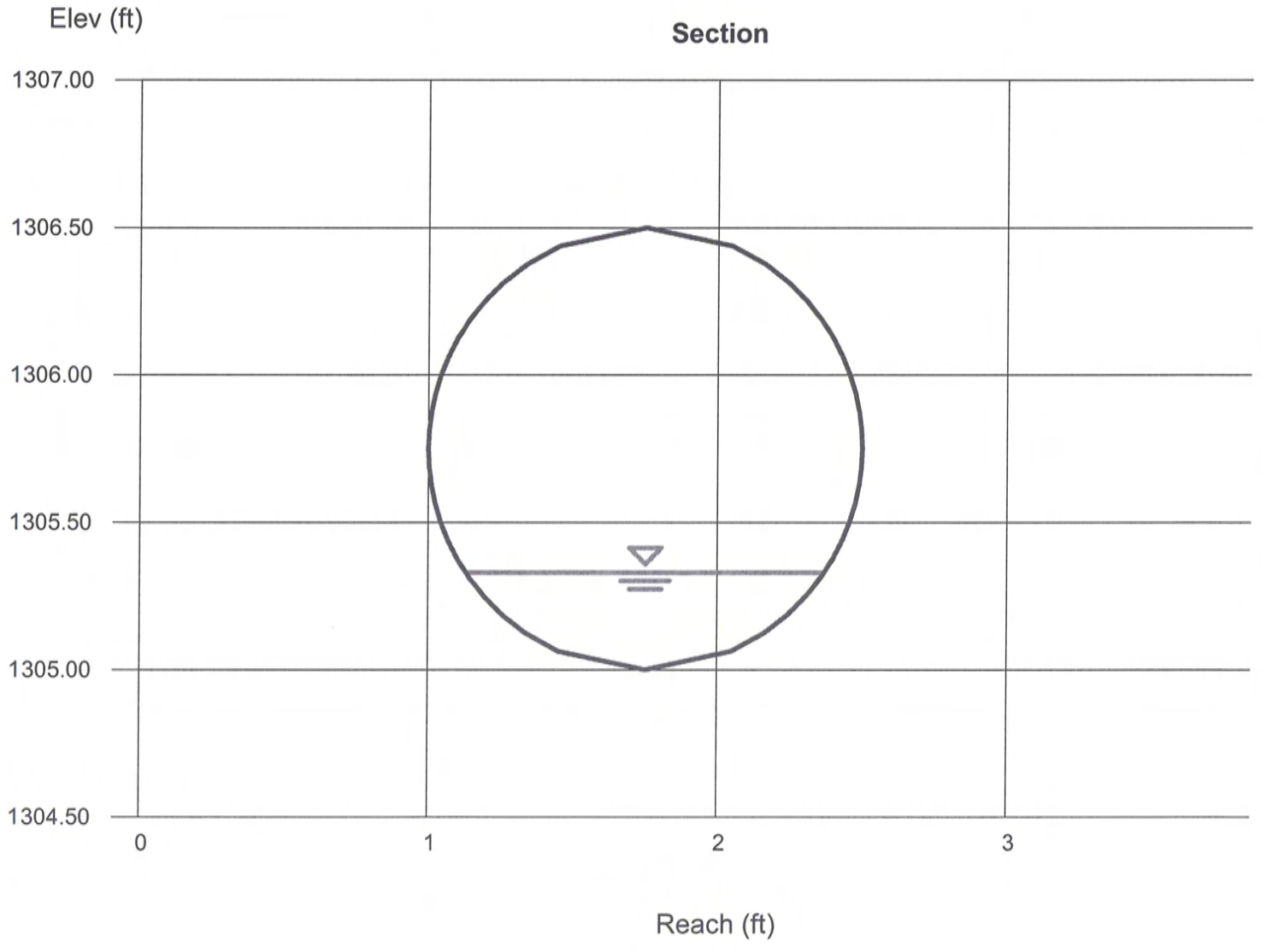
Circular
Diameter (ft) = 1.50 — 18"

Invert Elev (ft) = 1305.00
Slope (%) = 1.69
N-Value = 0.012 — RCP

Calculations
Compute by: Known Q
Known Q (cfs) = 1.58 — MAX THEORETICAL @ HW EL = 1312 (TOP OF DAM)

Highlighted — 4"
Depth (ft) = 0.33
Q (cfs) = 1.580 — MAX THEORETICAL
Area (sqft) = 0.29
Velocity (ft/s) = 5.43
Wetted Perim (ft) = 1.47
Crit Depth, Yc (ft) = 0.48
Top Width (ft) = 1.25
EGL (ft) = 0.79

L = 59'
1306 UP
1305 DN
S = 1.69%



Project: 11200
Simulation Run: 1-YR Final Reservoir: Final Basin

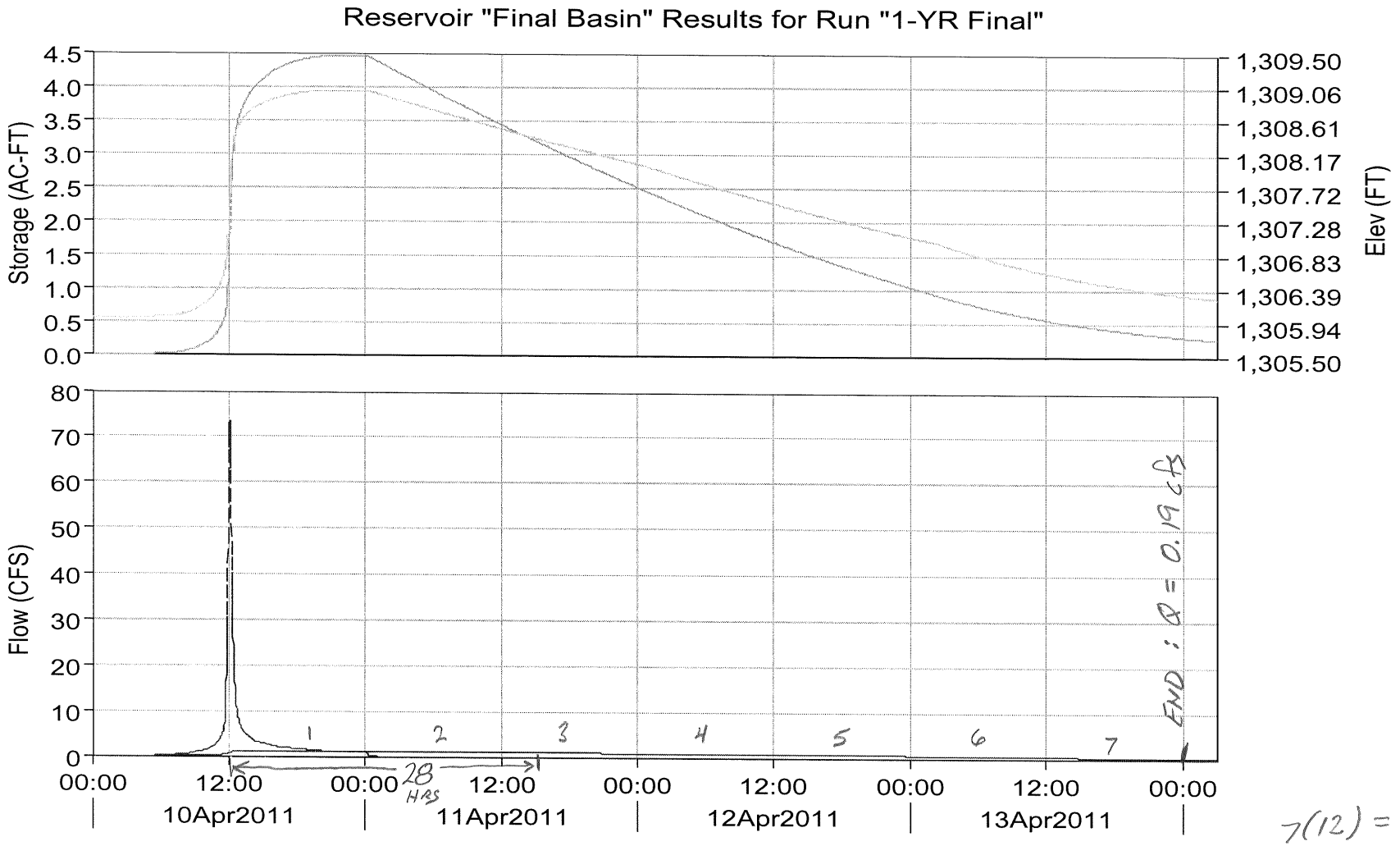
Start of Run:	10Apr2011, 00:00	Basin Model:	Final
End of Run:	14Apr2011, 03:00	Meteorologic Model:	1-Year
Compute Time:	20May2011, 18:49:21	Control Specifications:	Control 1

Volume Units: IN

Computed Results

Peak Inflow :	73.3 (CFS)	Date/Time of Peak Inflow :	10Apr2011, 12:06
Peak Outflow :	1.1 (CFS)	Date/Time of Peak Outflow :	10Apr2011, 22:32
Total Inflow :	1.89 (IN)	Peak Storage :	4.4 (AC-FT)
Total Outflow :	1.80 (IN)	Peak Elevation :	1309.0 (FT)

CREEK PROTECTION VOLUME CPV



$7(12) = 84$ HRS

$\frac{84}{3} = 28$ HRS

CENTROID OF TRIANGLE IS 1/3 OF BASE

Project: 11200
Simulation Run: 1-YR Final Reservoir: Final Basin

Start of Run:	10Apr2011, 00:00	Basin Model:	Final
End of Run:	14Apr2011, 03:00	Meteorologic Model:	1-Year
Compute Time:	21May2011, 08:31:53	Control Specifications:	Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow :	73.3 (CFS)	Date/Time of Peak Inflow :	10Apr2011, 12:06
Peak Outflow :	1.1 (CFS)	Date/Time of Peak Outflow :	10Apr2011, 22:32
Total Inflow :	5.6 (AC-FT)	Peak Storage :	4.4 (AC-FT)
Total Outflow :	5.3 (AC-FT)	Peak Elevation :	1309.0 (FT)

Project: 11200
Simulation Run: 2-YR Final Reservoir: Final Basin

Start of Run:	10Apr2011, 00:00	Basin Model:	Final
End of Run:	14Apr2011, 03:00	Meteorologic Model:	2-Year
Compute Time:	21May2011, 09:29:51	Control Specifications:	Control 1

Volume Units: IN

Computed Results

Peak Inflow :	97.7 (CFS)	Date/Time of Peak Inflow :	10Apr2011, 12:06
Peak Outflow :	9.0 (CFS)	Date/Time of Peak Outflow :	10Apr2011, 13:00
Total Inflow :	2.54 (IN)	Peak Storage :	4.7 (AC-FT)
Total Outflow :	2.46 (IN)	Peak Elevation :	1309.1 (FT)

Project: 11200
Simulation Run: 5-YR Final Reservoir: Final Basin

Start of Run:	10Apr2011, 00:00	Basin Model:	Final
End of Run:	14Apr2011, 03:00	Meteorologic Model:	5-Year
Compute Time:	21May2011, 09:22:49	Control Specifications:	Control 1

Volume Units: IN

Computed Results

Peak Inflow :	132.6 (CFS)	Date/Time of Peak Inflow :	10Apr2011, 12:05
Peak Outflow :	34.1 (CFS)	Date/Time of Peak Outflow :	10Apr2011, 12:28
Total Inflow :	3.50 (IN)	Peak Storage :	5.6 (AC-FT)
Total Outflow :	3.41 (IN)	Peak Elevation :	1309.5 (FT)

Project: 11200
Simulation Run: 10-YR Final Reservoir: Final Basin

Start of Run:	10Apr2011, 00:00	Basin Model:	Final
End of Run:	14Apr2011, 03:00	Meteorologic Model:	10-Year
Compute Time:	21May2011, 09:17:51	Control Specifications:	Control 1

Volume Units: IN

Computed Results

Peak Inflow :	160.5 (CFS)	Date/Time of Peak Inflow :	10Apr2011, 12:05
Peak Outflow :	56.8 (CFS)	Date/Time of Peak Outflow :	10Apr2011, 12:23
Total Inflow :	4.27 (IN)	Peak Storage :	6.3 (AC-FT)
Total Outflow :	4.19 (IN)	Peak Elevation :	1309.8 (FT)

Project: 11200

Simulation Run: 25-YR Final Reservoir: Final Basin

Start of Run:	10Apr2011, 00:00	Basin Model:	Final
End of Run:	14Apr2011, 03:00	Meteorologic Model:	25-Year
Compute Time:	21May2011, 09:14:53	Control Specifications:	Control 1

Volume Units: IN

Computed Results

Peak Inflow :	188.2 (CFS)	Date/Time of Peak Inflow :	10Apr2011, 12:05
Peak Outflow :	82.2 (CFS)	Date/Time of Peak Outflow :	10Apr2011, 12:20
Total Inflow :	5.06 (IN)	Peak Storage :	7.0 (AC-FT)
Total Outflow :	4.97 (IN)	Peak Elevation :	1310.1 (FT)

Project: 11200

Simulation Run: 50-YR Final Reservoir: Final Basin

Start of Run:	10Apr2011, 00:00	Basin Model:	Final
End of Run:	14Apr2011, 03:00	Meteorologic Model:	50-Year
Compute Time:	21May2011, 09:08:39	Control Specifications:	Control 1

Volume Units: IN

Computed Results

Peak Inflow :	219.2 (CFS)	Date/Time of Peak Inflow :	10Apr2011, 12:05
Peak Outflow :	115.6 (CFS)	Date/Time of Peak Outflow :	10Apr2011, 12:17
Total Inflow :	5.94 (IN)	Peak Storage :	7.8 (AC-FT)
Total Outflow :	5.85 (IN)	Peak Elevation :	1310.3 (FT)

Project: 11200

Simulation Run: 100-YR Final Reservoir: Final Basin

Start of Run:	10Apr2011, 00:00	Basin Model:	Final
End of Run:	14Apr2011, 03:00	Meteorologic Model:	100-Year
Compute Time:	21May2011, 08:34:09	Control Specifications:	Control 1

Volume Units: AC-FT

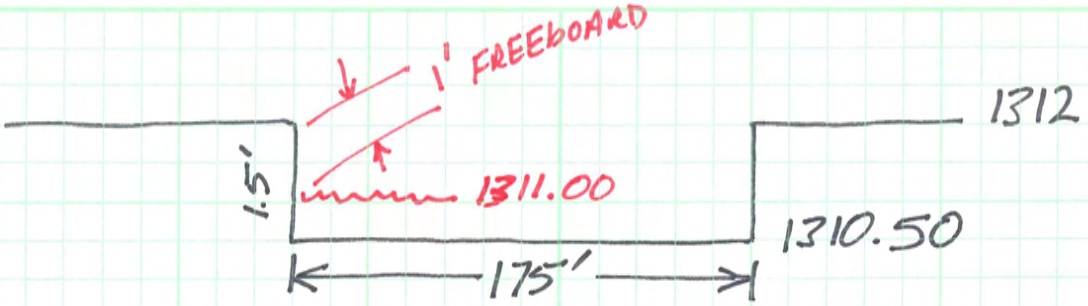
Computed Results

Peak Inflow :	246.7 (CFS)	Date/Time of Peak Inflow :	10Apr2011, 12:05
Peak Outflow :	143.1 (CFS)	Date/Time of Peak Outflow :	10Apr2011, 12:16
Total Inflow :	19.9 (AC-FT)	Peak Storage :	8.3 (AC-FT)
Total Outflow :	19.7 (AC-FT)	Peak Elevation :	1310.5 (FT)

MKEC ENGINEERING CONSULTANTS, INC.
KANSAS CITY OKLAHOMA CITY WICHITA
CALCULATIONS & SKETCHES

Proj. No. 1120
By LWB Date 5.21.11
Chkd. By Date
Sheet 1 Of 1

LOCATION: SPIRIT AERO
REFERENCE: EMERGENCY OVERFLOW CONDITIONS



$$Q = C L H^{1.5}$$

$$Q = (2.63)(175) H^{1.5}$$

$$Q = 460.25 (H)^{1.5}$$

ELEV.	H (ft)	Q (cfs)	CUMULATIVE STORAGE (AC. ft)
1306	–	0	0
1307	–	0	0.9122
1308	–	0	2.4402
1309	–	0	4.4487
1310	–	0	6.8473
1310.5	–	0	8.2397
1311	0.5	162.7	9.6321
1312	1.5	845.5	12.7751

STAGE - STORAGE - DISCHARGE FOR BASIN UNDER EMERGENCY SPILLWAY CONDITIONS

Project: 11200
Simulation Run: Emergency Reservoir: Emergency Basin

Start of Run:	10Apr2011, 00:00	Basin Model:	Emergency
End of Run:	14Apr2011, 03:00	Meteorologic Model:	100-Year
Compute Time:	21May2011, 13:44:46	Control Specifications:	Control 1

Volume Units: IN

Computed Results

Peak Inflow :	246.7 (CFS)	Date/Time of Peak Inflow :	10Apr2011, 12:05
Peak Outflow :	154.9 (CFS)	Date/Time of Peak Outflow :	10Apr2011, 12:15
Total Inflow :	6.73 (IN)	Peak Storage :	9.6 (AC-FT)
Total Outflow :	3.94 (IN)	Peak Elevation :	1311.0 (FT)

Appendix F

Downstream HEC-HMS Routing

WinTR-55 Current Data Description

--- Identification Data ---

User: WRB
Project: 11200 Downstream
SubTitle: Spirit AeroSystems - Downstream Watersheds
State: Kansas
County: Sedgwick
Filename: P:\PROJECTS\2011\1101060200_Spirit_Aero\5-Civil\CAD\Drainage\TR-55\11200 Downstream.w55

Date: 4/26/2011
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
Area A	levee	Outlet	24.74	71	0.489
Area B	Greenhaven St.	Outlet	14.47	75	0.411
Area C	Englewood St	Outlet	8.95	75	0.178
Area D	Cumberland St	Outlet	3.69	75	0.273
Area E	Clifton Ave	Outlet	4.88	68	0.239
Area F	railroad	Outlet	7.23	86	0.428

Total area: 63.96 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.5	4.5	5.3	6.1	7.0	7.8	2.8

Storm Data Source: Sedgwick County, KS (NRCS)
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

11200 Downstream
Spirit AeroSystems - Downstream Watersheds
Sedgwick County, Kansas

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Area A	Open space; grass cover > 75%	(good)	B	7.076	61
	Residential districts (1/4 acre)		B	17.659	75
	Total Area / Weighted Curve Number			24.74	71
Area B	Residential districts (1/4 acre)		B	14.467	75
	Total Area / Weighted Curve Number			14.47	75
Area C	Residential districts (1/4 acre)		B	8.947	75
	Total Area / Weighted Curve Number			8.95	75
Area D	Residential districts (1/4 acre)		B	3.685	75
	Total Area / Weighted Curve Number			3.69	75
Area E	Open space; grass cover > 75%	(good)	B	2.364	61
	Residential districts (1/4 acre)		B	2.517	75
	Total Area / Weighted Curve Number			4.88	68
Area F	Open space; grass cover > 75%	(good)	B	2.363	61
	Paved parking lots, roofs, driveways		B	4.867	98
	Total Area / Weighted Curve Number			7.23	86

11200 Downstream
Spirit AeroSystems - Downstream Watersheds
Sedgwick County, Kansas

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Area A							
SHEET	100	0.0051	0.240				0.393
SHALLOW	295	0.0051	0.050				0.071
SHALLOW	45	0.0220	0.050				0.005
CHANNEL	342					4.800	0.020
					Time of Concentration		0.489
Area B							
SHEET	100	0.0200	0.240				0.227
SHALLOW	801	0.0112	0.050				0.130
SHALLOW	249	0.0040	0.025				0.054
					Time of Concentration		0.411
Area C							
SHEET	53	0.0189	0.240				0.140
SHALLOW	78	0.0385	0.050				0.007
SHALLOW	188	0.0106	0.050				0.031
					Time of Concentration		0.178
Area D							
SHEET	100	0.0330	0.240				0.186
SHALLOW	74	0.0541	0.050				0.005
SHALLOW	712	0.0140	0.025				0.082
					Time of Concentration		0.273
Area E							
SHEET	100	0.0250	0.240				0.208
SHALLOW	279	0.0323	0.050				0.027
CHANNEL	83					5.510	0.004
					Time of Concentration		0.239
Area F							
SHEET	100	0.0050	0.240				0.396
SHALLOW	249	0.0241	0.050				0.028
CHANNEL	74					5.510	0.004
					Time of Concentration		0.428

WRB

11200 Downstream
Spirit AeroSystems - Downstream Watersheds
Sedgwick County, Kansas

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)	1-Yr (cfs)
SUBAREAS							
Area A	21.72	37.41	51.28	65.62	82.42	97.56	12.19
Area B	18.04	29.02	38.47	48.16	59.49	69.38	11.06
Area C	15.75	25.07	32.98	41.15	50.53	58.95	9.83
Area D	5.67	9.06	11.97	14.95	18.38	21.45	3.51
Area E	5.15	9.20	12.78	16.54	21.00	25.07	2.73
Area F	14.68	20.93	25.86	30.99	36.62	41.56	10.42

N

SCALE: 1" = 100'

100 0 100 200

ARKANSAS RIVER

AREA A

AREA B

AREA C

AREA D

AREA E

AREA F

AREA G

NORTH AREA

SOUTH AREA

EXISTING POND

LOW AREA

JUNCTION A

JUNCTION B

JUNCTION C

JUNCTION D

JUNCTION E

JUNCTION F

REACH A

REACH B

REACH C

REACH D

REACH E

REACH F

GREENHAVEN ST

ENGLEWOOD

CUMBERLAND

CLIFTON

RAILROAD

K-15

K:\PROJECTS\2011\110106200_Intl_North_Southwest CCA Expansion - CFHS\Civil CAD\Drainage Drawing\110200_HEC-HMS.dwg

MKEC ENGINEERING CONSULTANTS, INC.

411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

INDUSTRIAL PARK COMPLEX SECOND ADDITION

WICHITA, KANSAS

HEC-HMS MAP

DATE
June 2012

REVISED

DESIGN BY
WB

DRAWN BY
CMJ

CHECKED BY
MAB

SHEET NUMBER
1

Project: 11200_A Simulation Run: 1-Yr Existing

Start of Run: 26Apr2011, 00:00 Basin Model: Existing
End of Run: 27Apr2011, 03:00 Meteorologic Model: 1-Year
Compute Time: 24May2011, 11:20:42 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Existing Site	0.0631	26.6	26Apr2011, 12:08	0.69
Low Area	0.0631	26.6	26Apr2011, 12:09	0.69
Reach-F	0.0631	26.6	26Apr2011, 12:09	0.69
Area F	0.0113	10.8	26Apr2011, 12:08	1.49
Junction-F	0.0744	37.4	26Apr2011, 12:09	0.81
Reach-E	0.0744	37.3	26Apr2011, 12:09	0.81
Area E	0.0076	2.8	26Apr2011, 12:04	0.53
Junction-E	0.0820	39.4	26Apr2011, 12:09	0.79
Reach-D	0.0820	39.4	26Apr2011, 12:09	0.79
Area D	0.0058	3.7	26Apr2011, 12:04	0.83
Junction-D	0.0878	42.4	26Apr2011, 12:09	0.79
Reach-C	0.0878	42.3	26Apr2011, 12:09	0.79
Area C	0.0140	10.4	26Apr2011, 12:01	0.83
Junction-C	0.1018	47.6	26Apr2011, 12:08	0.80
Reach-B	0.1018	47.3	26Apr2011, 12:09	0.80
Area B	0.0226	11.4	26Apr2011, 12:09	0.83
Junction-B	0.1244	58.8	26Apr2011, 12:09	0.80
Reach-A	0.1244	58.5	26Apr2011, 12:12	0.80
Area A	0.0387	12.6	26Apr2011, 12:12	0.65
Junction-A	0.1631	71.1	26Apr2011, 12:12	0.77

Project: 11200_A Simulation Run: 2-Yr Existing

Start of Run: 26Apr2011, 00:00
End of Run: 27Apr2011, 03:00
Compute Time: 24May2011, 11:18:50

Basin Model: Existing
Meteorologic Model: 2-Year
Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Existing Site	0.0631	46.1	26Apr2011, 12:08	1.12
Low Area	0.0631	44.7	26Apr2011, 12:10	1.12
Reach-F	0.0631	44.7	26Apr2011, 12:10	1.12
Area F	0.0113	15.2	26Apr2011, 12:08	2.10
Junction-F	0.0744	59.6	26Apr2011, 12:10	1.27
Reach-E	0.0744	59.6	26Apr2011, 12:10	1.27
Area E	0.0076	5.4	26Apr2011, 12:03	0.90
Junction-E	0.0820	63.1	26Apr2011, 12:10	1.24
Reach-D	0.0820	63.0	26Apr2011, 12:10	1.24
Area D	0.0058	5.9	26Apr2011, 12:04	1.30
Junction-D	0.0878	67.6	26Apr2011, 12:09	1.24
Reach-C	0.0878	67.5	26Apr2011, 12:10	1.24
Area C	0.0140	16.7	26Apr2011, 12:01	1.30
Junction-C	0.1018	75.3	26Apr2011, 12:08	1.25
Reach-B	0.1018	75.0	26Apr2011, 12:09	1.25
Area B	0.0226	18.7	26Apr2011, 12:08	1.30
Junction-B	0.1244	93.7	26Apr2011, 12:09	1.26
Reach-A	0.1244	93.4	26Apr2011, 12:11	1.26
Area A	0.0387	22.5	26Apr2011, 12:12	1.06
Junction-A	0.1631	115.9	26Apr2011, 12:11	1.21

Project: 11200_A Simulation Run: 5-Yr Existing

Start of Run: 26Apr2011, 00:00 Basin Model: Existing
End of Run: 27Apr2011, 03:00 Meteorologic Model: 5-Year
Compute Time: 24May2011, 11:16:40 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Existing Site	0.0631	77.8	26Apr2011, 12:07	1.82
Low Area	0.0631	71.0	26Apr2011, 12:11	1.82
Reach-F	0.0631	71.0	26Apr2011, 12:11	1.82
Area F	0.0113	21.7	26Apr2011, 12:08	3.00
Junction-F	0.0744	92.0	26Apr2011, 12:10	2.00
Reach-E	0.0744	91.8	26Apr2011, 12:11	2.00
Area E	0.0076	9.6	26Apr2011, 12:03	1.53
Junction-E	0.0820	97.6	26Apr2011, 12:10	1.96
Reach-D	0.0820	97.6	26Apr2011, 12:10	1.96
Area D	0.0058	9.5	26Apr2011, 12:03	2.05
Junction-D	0.0878	104.9	26Apr2011, 12:09	1.96
Reach-C	0.0878	104.8	26Apr2011, 12:09	1.96
Area C	0.0140	26.6	26Apr2011, 12:00	2.05
Junction-C	0.1018	120.4	26Apr2011, 12:06	1.98
Reach-B	0.1018	119.7	26Apr2011, 12:07	1.97
Area B	0.0226	30.1	26Apr2011, 12:08	2.05
Junction-B	0.1244	149.6	26Apr2011, 12:07	1.99
Reach-A	0.1244	149.1	26Apr2011, 12:09	1.99
Area A	0.0387	38.8	26Apr2011, 12:11	1.75
Junction-A	0.1631	187.6	26Apr2011, 12:10	1.93

Project: 11200_A Simulation Run: 10-Yr Existing

Start of Run: 26Apr2011, 00:00 Basin Model: Existing
End of Run: 27Apr2011, 03:00 Meteorologic Model: 10-Year
Compute Time: 24May2011, 11:14:43 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Existing Site	0.0631	105.1	26Apr2011, 12:07	2.43
Low Area	0.0631	92.6	26Apr2011, 12:12	2.43
Reach-F	0.0631	92.6	26Apr2011, 12:12	2.43
Area F	0.0113	26.9	26Apr2011, 12:08	3.75
Junction-F	0.0744	118.1	26Apr2011, 12:11	2.63
Reach-E	0.0744	117.9	26Apr2011, 12:11	2.63
Area E	0.0076	13.3	26Apr2011, 12:03	2.10
Junction-E	0.0820	125.2	26Apr2011, 12:10	2.58
Reach-D	0.0820	125.2	26Apr2011, 12:11	2.58
Area D	0.0058	12.5	26Apr2011, 12:03	2.69
Junction-D	0.0878	134.1	26Apr2011, 12:09	2.59
Reach-C	0.0878	134.0	26Apr2011, 12:10	2.59
Area C	0.0140	35.0	26Apr2011, 12:00	2.69
Junction-C	0.1018	151.3	26Apr2011, 12:06	2.60
Reach-B	0.1018	150.9	26Apr2011, 12:07	2.60
Area B	0.0226	39.9	26Apr2011, 12:08	2.69
Junction-B	0.1244	190.6	26Apr2011, 12:08	2.62
Reach-A	0.1244	190.2	26Apr2011, 12:09	2.62
Area A	0.0387	53.0	26Apr2011, 12:11	2.35
Junction-A	0.1631	243.1	26Apr2011, 12:10	2.55

Project: 11200_A Simulation Run: 25-Yr Existing

Start of Run: 26Apr2011, 00:00
End of Run: 27Apr2011, 03:00
Compute Time: 24May2011, 11:11:11

Basin Model: Existing
Meteorologic Model: 25-Year
Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Existing Site	0.0631	133.6	26Apr2011, 12:07	3.08
Low Area	0.0631	111.2	26Apr2011, 12:13	3.08
Reach-F	0.0631	111.2	26Apr2011, 12:13	3.08
Area F	0.0113	32.1	26Apr2011, 12:08	4.50
Junction-F	0.0744	141.1	26Apr2011, 12:11	3.29
Reach-E	0.0744	140.9	26Apr2011, 12:12	3.29
Area E	0.0076	17.3	26Apr2011, 12:02	2.70
Junction-E	0.0820	150.5	26Apr2011, 12:10	3.24
Reach-D	0.0820	150.4	26Apr2011, 12:10	3.24
Area D	0.0058	15.7	26Apr2011, 12:03	3.37
Junction-D	0.0878	162.1	26Apr2011, 12:08	3.25
Reach-C	0.0878	162.1	26Apr2011, 12:09	3.25
Area C	0.0140	43.7	26Apr2011, 12:00	3.37
Junction-C	0.1018	186.2	26Apr2011, 12:06	3.26
Reach-B	0.1018	185.4	26Apr2011, 12:07	3.26
Area B	0.0226	49.9	26Apr2011, 12:08	3.37
Junction-B	0.1244	235.2	26Apr2011, 12:07	3.28
Reach-A	0.1244	234.6	26Apr2011, 12:09	3.28
Area A	0.0387	67.9	26Apr2011, 12:11	2.98
Junction-A	0.1631	301.8	26Apr2011, 12:09	3.21

Project: 11200_A Simulation Run: 50-Yr Existing

Start of Run: 26Apr2011, 00:00
End of Run: 27Apr2011, 03:00
Compute Time: 24May2011, 11:04:53

Basin Model: Existing
Meteorologic Model: 50-Year
Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Existing Site	0.0631	166.6	26Apr2011, 12:07	3.83
Low Area	0.0631	132.8	26Apr2011, 12:13	3.83
Reach-F	0.0631	132.7	26Apr2011, 12:13	3.83
Area F	0.0113	37.9	26Apr2011, 12:08	5.37
Junction-F	0.0744	167.2	26Apr2011, 12:12	4.06
Reach-E	0.0744	167.1	26Apr2011, 12:12	4.06
Area E	0.0076	21.9	26Apr2011, 12:02	3.41
Junction-E	0.0820	178.1	26Apr2011, 12:11	4.00
Reach-D	0.0820	178.0	26Apr2011, 12:11	4.00
Area D	0.0058	19.3	26Apr2011, 12:03	4.15
Junction-D	0.0878	191.5	26Apr2011, 12:09	4.01
Reach-C	0.0878	191.4	26Apr2011, 12:10	4.01
Area C	0.0140	53.6	26Apr2011, 12:00	4.15
Junction-C	0.1018	221.7	26Apr2011, 12:05	4.03
Reach-B	0.1018	220.9	26Apr2011, 12:06	4.03
Area B	0.0226	61.5	26Apr2011, 12:08	4.15
Junction-B	0.1244	281.7	26Apr2011, 12:07	4.05
Reach-A	0.1244	281.1	26Apr2011, 12:08	4.05
Area A	0.0387	85.3	26Apr2011, 12:10	3.72
Junction-A	0.1631	365.5	26Apr2011, 12:09	3.97

Project: 11200_A Simulation Run: 100-Yr Existing

Start of Run: 26Apr2011, 00:00
End of Run: 27Apr2011, 03:00
Compute Time: 24May2011, 10:46:50

Basin Model: Existing
Meteorologic Model: 100-Year
Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Existing Site	0.0631	196.5	26Apr2011, 12:07	4.52
Low Area	0.0631	148.6	26Apr2011, 12:14	4.52
Reach-F	0.0631	148.6	26Apr2011, 12:14	4.52
Area F	0.0113	43.1	26Apr2011, 12:08	6.14
Junction-F	0.0744	187.4	26Apr2011, 12:11	4.77
Reach-E	0.0744	187.3	26Apr2011, 12:12	4.77
Area E	0.0076	26.1	26Apr2011, 12:02	4.07
Junction-E	0.0820	201.3	26Apr2011, 12:10	4.70
Reach-D	0.0820	201.3	26Apr2011, 12:10	4.70
Area D	0.0058	22.5	26Apr2011, 12:03	4.86
Junction-D	0.0878	218.2	26Apr2011, 12:09	4.71
Reach-C	0.0878	218.2	26Apr2011, 12:09	4.71
Area C	0.0140	62.5	26Apr2011, 12:00	4.86
Junction-C	0.1018	252.7	26Apr2011, 12:05	4.73
Reach-B	0.1018	252.0	26Apr2011, 12:06	4.73
Area B	0.0226	71.9	26Apr2011, 12:08	4.86
Junction-B	0.1244	323.4	26Apr2011, 12:07	4.76
Reach-A	0.1244	322.8	26Apr2011, 12:08	4.75
Area A	0.0387	101.1	26Apr2011, 12:10	4.41
Junction-A	0.1631	422.9	26Apr2011, 12:09	4.67

Project: 11200_A Simulation Run: 1-Yr Proposed

Start of Run: 26Apr2011, 00:00 Basin Model: Proposed
End of Run: 27Apr2011, 03:00 Meteorologic Model: 1-Year
Compute Time: 24May2011, 11:39:24 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Proposed Site	0.0555	73.3	26Apr2011, 12:06	1.89
Proposed Basin	0.0555	1.1	26Apr2011, 22:32	0.47
South Area	0.0076	4.8	26Apr2011, 12:03	0.78
Modified Low Area	0.0631	5.5	26Apr2011, 12:03	0.51
Reach-F	0.0631	5.5	26Apr2011, 12:04	0.51
Area F	0.0113	10.8	26Apr2011, 12:08	1.49
Junction-F	0.0744	15.7	26Apr2011, 12:06	0.66
Reach-E	0.0744	15.7	26Apr2011, 12:07	0.65
Area E	0.0076	2.8	26Apr2011, 12:04	0.53
Junction-E	0.0820	18.2	26Apr2011, 12:06	0.64
Reach-D	0.0820	18.2	26Apr2011, 12:07	0.64
Area D	0.0058	3.7	26Apr2011, 12:04	0.83
Junction-D	0.0878	21.8	26Apr2011, 12:06	0.66
Reach-C	0.0878	21.7	26Apr2011, 12:07	0.65
Area C	0.0140	10.4	26Apr2011, 12:01	0.83
Junction-C	0.1018	29.8	26Apr2011, 12:04	0.68
Reach-B	0.1018	29.4	26Apr2011, 12:06	0.68
Area B	0.0226	11.4	26Apr2011, 12:09	0.83
Junction-B	0.1244	40.4	26Apr2011, 12:07	0.71
Reach-A	0.1244	40.2	26Apr2011, 12:10	0.71
Area A	0.0387	12.6	26Apr2011, 12:12	0.65
Junction-A	0.1631	52.4	26Apr2011, 12:10	0.69

Project: 11200_A Simulation Run: 2-Yr Proposed

Start of Run: 26Apr2011, 00:00
End of Run: 27Apr2011, 03:00
Compute Time: 24May2011, 11:34:19

Basin Model: Proposed
Meteorologic Model: 2-Year
Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Proposed Site	0.0555	97.7	26Apr2011, 12:06	2.54
Proposed Basin	0.0555	9.0	26Apr2011, 13:00	1.12
South Area	0.0076	7.8	26Apr2011, 12:03	1.24
Modified Low Area	0.0631	9.7	26Apr2011, 12:59	1.13
Reach-F	0.0631	9.7	26Apr2011, 12:59	1.13
Area F	0.0113	15.2	26Apr2011, 12:08	2.10
Junction-F	0.0744	23.0	26Apr2011, 12:06	1.28
Reach-E	0.0744	23.0	26Apr2011, 12:07	1.28
Area E	0.0076	5.4	26Apr2011, 12:03	0.90
Junction-E	0.0820	27.8	26Apr2011, 12:06	1.24
Reach-D	0.0820	27.8	26Apr2011, 12:06	1.24
Area D	0.0058	5.9	26Apr2011, 12:04	1.30
Junction-D	0.0878	33.5	26Apr2011, 12:05	1.25
Reach-C	0.0878	33.5	26Apr2011, 12:06	1.25
Area C	0.0140	16.7	26Apr2011, 12:01	1.30
Junction-C	0.1018	47.0	26Apr2011, 12:04	1.25
Reach-B	0.1018	46.5	26Apr2011, 12:05	1.25
Area B	0.0226	18.7	26Apr2011, 12:08	1.30
Junction-B	0.1244	64.3	26Apr2011, 12:06	1.26
Reach-A	0.1244	63.9	26Apr2011, 12:09	1.26
Area A	0.0387	22.5	26Apr2011, 12:12	1.06
Junction-A	0.1631	85.8	26Apr2011, 12:09	1.21

Project: 11200_A Simulation Run: 5-Yr Proposed

Start of Run: 26Apr2011, 00:00 Basin Model: Proposed
End of Run: 27Apr2011, 03:00 Meteorologic Model: 5-Year
Compute Time: 24May2011, 11:32:16 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Proposed Site	0.0555	132.6	26Apr2011, 12:05	3.50
Proposed Basin	0.0555	34.1	26Apr2011, 12:28	2.07
South Area	0.0076	12.7	26Apr2011, 12:02	1.97
Modified Low Area	0.0631	36.2	26Apr2011, 12:29	2.06
Reach-F	0.0631	36.2	26Apr2011, 12:29	2.06
Area F	0.0113	21.7	26Apr2011, 12:08	3.00
Junction-F	0.0744	45.0	26Apr2011, 12:23	2.20
Reach-E	0.0744	45.0	26Apr2011, 12:24	2.20
Area E	0.0076	9.6	26Apr2011, 12:03	1.53
Junction-E	0.0820	47.1	26Apr2011, 12:23	2.14
Reach-D	0.0820	47.1	26Apr2011, 12:23	2.14
Area D	0.0058	9.5	26Apr2011, 12:03	2.05
Junction-D	0.0878	51.9	26Apr2011, 12:05	2.13
Reach-C	0.0878	51.8	26Apr2011, 12:05	2.13
Area C	0.0140	26.6	26Apr2011, 12:00	2.05
Junction-C	0.1018	74.0	26Apr2011, 12:03	2.12
Reach-B	0.1018	73.2	26Apr2011, 12:05	2.12
Area B	0.0226	30.1	26Apr2011, 12:08	2.05
Junction-B	0.1244	101.8	26Apr2011, 12:05	2.11
Reach-A	0.1244	101.3	26Apr2011, 12:08	2.11
Area A	0.0387	38.8	26Apr2011, 12:11	1.75
Junction-A	0.1631	138.5	26Apr2011, 12:08	2.02

Project: 11200_A Simulation Run: 10-Yr Proposed

Start of Run: 26Apr2011, 00:00
End of Run: 27Apr2011, 03:00
Compute Time: 24May2011, 11:30:30

Basin Model: Proposed
Meteorologic Model: 10-Year
Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Proposed Site	0.0555	160.5	26Apr2011, 12:05	4.27
Proposed Basin	0.0555	56.8	26Apr2011, 12:23	2.84
South Area	0.0076	16.9	26Apr2011, 12:02	2.61
Modified Low Area	0.0631	60.1	26Apr2011, 12:23	2.82
Reach-F	0.0631	60.1	26Apr2011, 12:23	2.82
Area F	0.0113	26.9	26Apr2011, 12:08	3.75
Junction-F	0.0744	75.2	26Apr2011, 12:18	2.96
Reach-E	0.0744	75.2	26Apr2011, 12:19	2.96
Area E	0.0076	13.3	26Apr2011, 12:03	2.10
Junction-E	0.0820	78.8	26Apr2011, 12:18	2.88
Reach-D	0.0820	78.8	26Apr2011, 12:18	2.88
Area D	0.0058	12.5	26Apr2011, 12:03	2.69
Junction-D	0.0878	83.1	26Apr2011, 12:17	2.87
Reach-C	0.0878	83.1	26Apr2011, 12:17	2.86
Area C	0.0140	35.0	26Apr2011, 12:00	2.69
Junction-C	0.1018	97.0	26Apr2011, 12:03	2.84
Reach-B	0.1018	96.1	26Apr2011, 12:04	2.84
Area B	0.0226	39.9	26Apr2011, 12:08	2.69
Junction-B	0.1244	133.7	26Apr2011, 12:05	2.81
Reach-A	0.1244	133.3	26Apr2011, 12:08	2.81
Area A	0.0387	53.0	26Apr2011, 12:11	2.35
Junction-A	0.1631	185.1	26Apr2011, 12:09	2.70

Project: 11200_A Simulation Run: 25-Yr Proposed

Start of Run: 26Apr2011, 00:00
End of Run: 27Apr2011, 03:00
Compute Time: 24May2011, 11:28:47

Basin Model: Proposed
Meteorologic Model: 25-Year
Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Proposed Site	0.0555	188.2	26Apr2011, 12:05	5.06
Proposed Basin	0.0555	82.2	26Apr2011, 12:20	3.62
South Area	0.0076	21.2	26Apr2011, 12:02	3.27
Modified Low Area	0.0631	85.1	26Apr2011, 12:22	3.58
Reach-F	0.0631	85.1	26Apr2011, 12:23	3.58
Area F	0.0113	32.1	26Apr2011, 12:08	4.50
Junction-F	0.0744	103.0	26Apr2011, 12:19	3.72
Reach-E	0.0744	103.0	26Apr2011, 12:19	3.72
Area E	0.0076	17.3	26Apr2011, 12:02	2.70
Junction-E	0.0820	107.6	26Apr2011, 12:18	3.63
Reach-D	0.0820	107.5	26Apr2011, 12:19	3.63
Area D	0.0058	15.7	26Apr2011, 12:03	3.37
Junction-D	0.0878	115.7	26Apr2011, 12:10	3.61
Reach-C	0.0878	115.5	26Apr2011, 12:11	3.61
Area C	0.0140	43.7	26Apr2011, 12:00	3.37
Junction-C	0.1018	132.4	26Apr2011, 12:08	3.58
Reach-B	0.1018	132.2	26Apr2011, 12:09	3.58
Area B	0.0226	49.9	26Apr2011, 12:08	3.37
Junction-B	0.1244	182.0	26Apr2011, 12:08	3.54
Reach-A	0.1244	181.6	26Apr2011, 12:10	3.54
Area A	0.0387	67.9	26Apr2011, 12:11	2.98
Junction-A	0.1631	249.5	26Apr2011, 12:10	3.40

Project: 11200_A Simulation Run: 50-Yr Proposed

Start of Run: 26Apr2011, 00:00
End of Run: 27Apr2011, 03:00
Compute Time: 24May2011, 11:26:23

Basin Model: Proposed
Meteorologic Model: 50-Year
Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Proposed Site	0.0555	219.2	26Apr2011, 12:05	5.94
Proposed Basin	0.0555	115.6	26Apr2011, 12:17	4.51
South Area	0.0076	26.1	26Apr2011, 12:02	4.04
Modified Low Area	0.0631	116.6	26Apr2011, 12:21	4.45
Reach-F	0.0631	116.6	26Apr2011, 12:22	4.45
Area F	0.0113	37.9	26Apr2011, 12:08	5.37
Junction-F	0.0744	139.7	26Apr2011, 12:17	4.59
Reach-E	0.0744	139.6	26Apr2011, 12:18	4.59
Area E	0.0076	21.9	26Apr2011, 12:02	3.41
Junction-E	0.0820	146.0	26Apr2011, 12:16	4.48
Reach-D	0.0820	146.0	26Apr2011, 12:16	4.48
Area D	0.0058	19.3	26Apr2011, 12:03	4.15
Junction-D	0.0878	154.7	26Apr2011, 12:13	4.46
Reach-C	0.0878	154.5	26Apr2011, 12:13	4.46
Area C	0.0140	53.6	26Apr2011, 12:00	4.15
Junction-C	0.1018	178.4	26Apr2011, 12:05	4.42
Reach-B	0.1018	177.3	26Apr2011, 12:06	4.41
Area B	0.0226	61.5	26Apr2011, 12:08	4.15
Junction-B	0.1244	238.3	26Apr2011, 12:07	4.37
Reach-A	0.1244	237.6	26Apr2011, 12:09	4.37
Area A	0.0387	85.3	26Apr2011, 12:10	3.72
Junction-A	0.1631	322.3	26Apr2011, 12:09	4.21

Project: 11200_A Simulation Run: 100-Yr Proposed

Start of Run: 26Apr2011, 00:00 Basin Model: Proposed
End of Run: 27Apr2011, 03:00 Meteorologic Model: 100-Year
Compute Time: 21May2011, 17:13:51 Control Specifications: Control 1

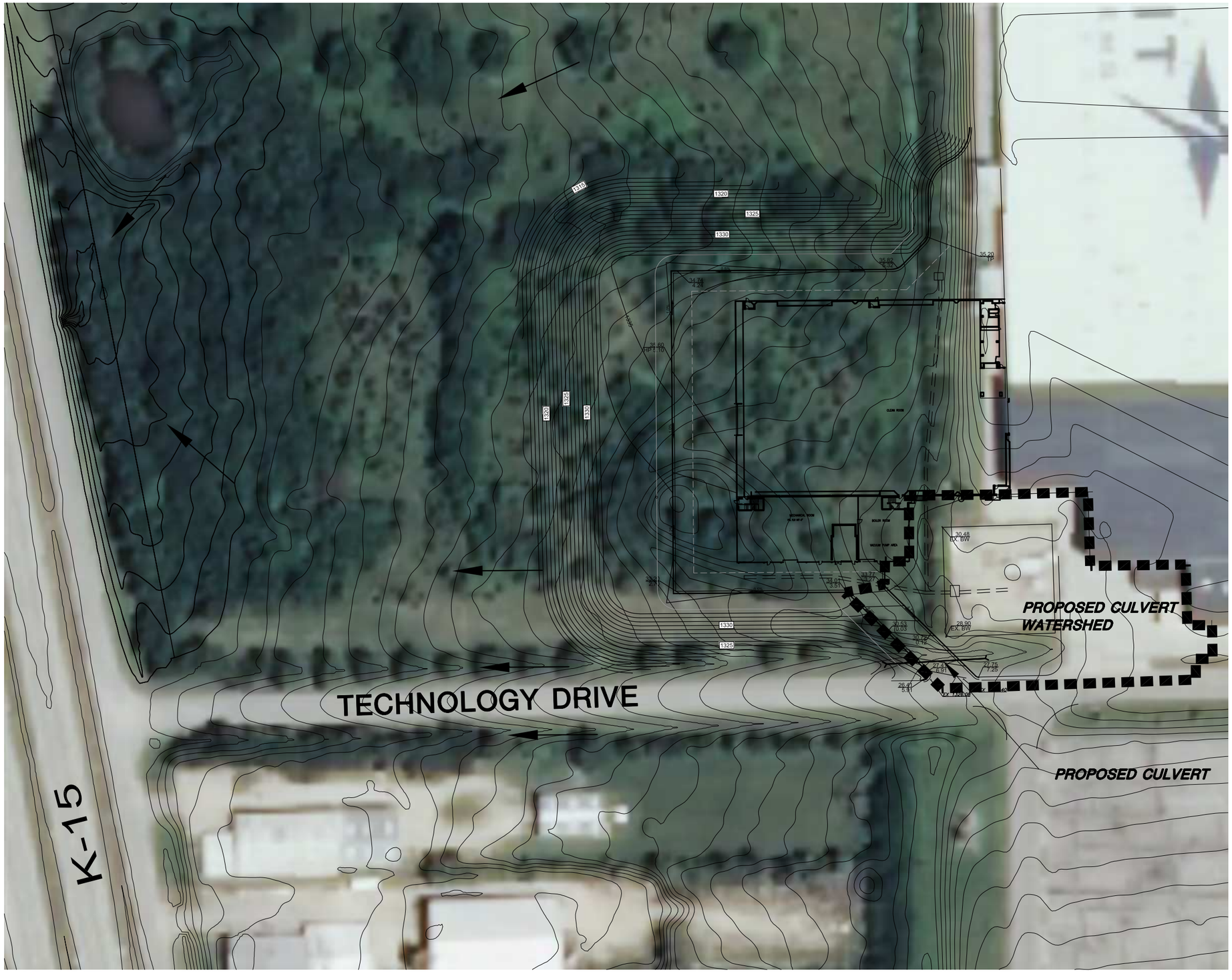
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Proposed Site	0.0555	246.7	26Apr2011, 12:05	6.73
Proposed Basin	0.0555	143.1	26Apr2011, 12:16	5.29
South Area	0.0076	30.6	26Apr2011, 12:02	4.75
Modified Low Area	0.0631	142.4	26Apr2011, 12:21	5.23
Reach-F	0.0631	142.4	26Apr2011, 12:21	5.23
Area F	0.0113	43.1	26Apr2011, 12:08	6.14
Junction-F	0.0744	170.8	26Apr2011, 12:16	5.37
Reach-E	0.0744	170.7	26Apr2011, 12:17	5.37
Area E	0.0076	26.1	26Apr2011, 12:02	4.07
Junction-E	0.0820	178.5	26Apr2011, 12:16	5.24
Reach-D	0.0820	178.4	26Apr2011, 12:16	5.24
Area D	0.0058	22.5	26Apr2011, 12:03	4.86
Junction-D	0.0878	187.6	26Apr2011, 12:14	5.22
Reach-C	0.0878	187.6	26Apr2011, 12:14	5.22
Area C	0.0140	62.5	26Apr2011, 12:00	4.86
Junction-C	0.1018	215.0	26Apr2011, 12:06	5.17
Reach-B	0.1018	214.6	26Apr2011, 12:07	5.17
Area B	0.0226	71.9	26Apr2011, 12:08	4.86
Junction-B	0.1244	286.5	26Apr2011, 12:07	5.11
Reach-A	0.1244	285.9	26Apr2011, 12:09	5.11
Area A	0.0387	101.1	26Apr2011, 12:10	4.41
Junction-A	0.1631	386.3	26Apr2011, 12:09	4.94

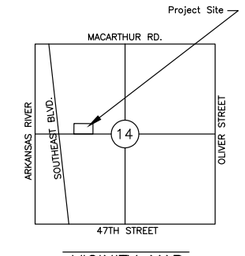
Table 2 - Downstream HEC-HMS Routing Results (cfs)

Location	1-Year		2-Year		5-Year		10-Year		25-Year		50-Year		100-Year	
	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-
K-15	26.6	5.5	44.7	9.7	71.0	36.2	92.6	60.1	111.2	85.1	132.7	116.6	148.6	142.4
Railroad	37.4	15.7	59.6	23.0	92.0	45.0	118.1	75.2	141.1	103.0	167.2	139.7	187.4	170.8
Clifton Ave.	39.4	18.2	63.1	27.8	97.6	47.1	125.2	78.8	150.5	107.6	178.1	146.0	201.3	178.5
Cumberland St.	42.4	21.8	67.6	33.5	104.9	51.9	134.1	83.1	162.1	115.7	191.5	154.7	218.2	187.6
Englewood St.	47.6	29.8	75.3	47.0	120.4	74.0	151.3	97.0	186.2	132.4	221.7	178.4	252.7	215.0
Greenhaven St.	58.8	40.4	93.7	64.3	149.6	101.8	190.6	133.7	235.2	182.0	281.7	238.3	323.4	286.5
Arkansas River	71.1	52.4	115.9	85.8	187.6	138.5	243.1	185.1	301.8	249.5	365.5	322.3	422.9	386.3

Appendix G

HY-8 Culvert Analysis



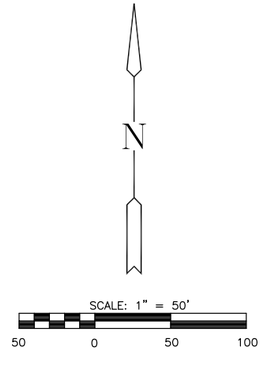


VICINITY MAP

LEGEND

- 6IN - CONIFEROUS TREE
- 3IN - DECIDUOUS TREE
- SN - SIGN
- PP - POWER POLE
- ELEC BOX - ELECTRIC BOX
- LP - LIGHT POLE
- FH - FIRE HYDRANT
- WV - WATER VALVE
- WM - WATER METER
- SECTION CORNER
- BM - BENCHMARK
- EASEMENT
- BUILDING SETBACK
- X — X — FENCE
- STORM SEWER PIPE
- W — W — WATER LINE
- SANITARY SEWER LINE
- G — G — GAS LINE
- P — P — GAS PIPELINE
- UGT — UGT — TELEPHONE LINE
- UGE — UGE — UNDERGROUND ELEC.
- OHE — OHE — OVERHEAD ELECTRIC
- FOC — FOC — FIBER OPTIC CABLE
- DRAINAGE SUB BASIN
- DRAINAGE BASIN
- FLOW ARROW
- A17 - AREA FOR SWS SIZING

NOTE: WATERSHEDS A THROUGH F REMAIN UNCHANGED IN PROPOSED CONDITIONS.



MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

INDUSTRIAL PARK COMPLEX SECOND ADDITION

WICHITA, KANSAS

SOUTH CULVERT WATERSHED MAP

DATE: June 2012

REVISED

DESIGN BY: WB

DRAWN BY: CMJ

CHECKED BY: MAB

SHEET NUMBER: 1

K:\PROJECTS\2011\1101060200_Spirit_Wichita_Southwest CCA Expansion - CFF\5-Civil\CAD\Drainage\Drawing\11200_SOUTH CULVERT.dwg

HY-8 Culvert Analysis Report

April 23, 2011
11200 Spirit AeroSystems
K-15 Culvert

Table 1 - Summary of Culvert Flows at Crossing: K-15 Culvert

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1298.20	0.00	0.00	0.00	1
1299.57	20.00	20.00	0.00	1
1300.15	40.00	40.00	0.00	1
1300.70	60.00	60.00	0.00	1
1301.20	80.00	80.00	0.00	1
1301.68	100.00	100.00	0.00	1
1302.17	120.00	120.00	0.00	1
1302.69	140.00	140.00	0.00	1
1303.25	160.00	160.00	0.00	1
1303.88	180.00	180.00	0.00	1
1304.58	200.00	200.00	0.00	1

100YR →

↑ SAY: 1305.00

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	1298.20	0.000	0.000	0-NF	0.000	0.000	0.000	0.270	0.000	0.000
20.00	20.00	1299.57	1.368	0.000	1-S2n	0.584	0.981	0.601	0.270	9.562	0.000
40.00	40.00	1300.15	1.952	0.000	1-S2n	0.850	1.407	0.856	0.270	11.681	0.000
60.00	60.00	1300.70	2.501	0.000	1-S2n	1.023	1.736	1.058	0.270	12.793	0.000
80.00	80.00	1301.20	3.003	0.000	1-S2n	1.196	2.107	1.235	0.270	13.797	0.000
100.00	100.00	1301.68	3.483	0.000	1-S2n	1.318	2.556	1.371	0.270	14.663	0.000
120.00	120.00	1302.17	3.971	0.000	1-S2n	1.439	2.756	1.507	0.270	15.370	0.000
140.00	140.00	1302.69	4.489	0.000	5-S2n	1.561	2.930	1.640	0.270	15.950	0.000
160.00	160.00	1303.25	5.054	0.000	5-S2n	1.663	3.098	1.745	0.270	16.578	0.000
180.00	180.00	1303.88	5.680	0.000	5-S2n	1.757	3.247	1.770	0.270	18.270	0.000
200.00	200.00	1304.58	6.377	0.000	5-S2n	1.851	3.368	1.932	0.270	17.920	0.000

****

Inlet Elevation (invert): 1298.20 ft, Outlet Elevation (invert): 1294.27 ft

Culvert Length: 200.77 ft, Culvert Slope: 0.0196

****

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1298.20 ft

Outlet Station: 200.73 ft → PER SURVEY

Outlet Elevation: 1294.27 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Elliptical

Barrel Span: 76.00 in — 72" PER SURVEY

Barrel Rise: 48.00 in — 52" PER SURVEY

Barrel Material: Concrete

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall — ASSUMED

Inlet Depression: None

Water Surface Profile Plot for Culvert: Culvert 1

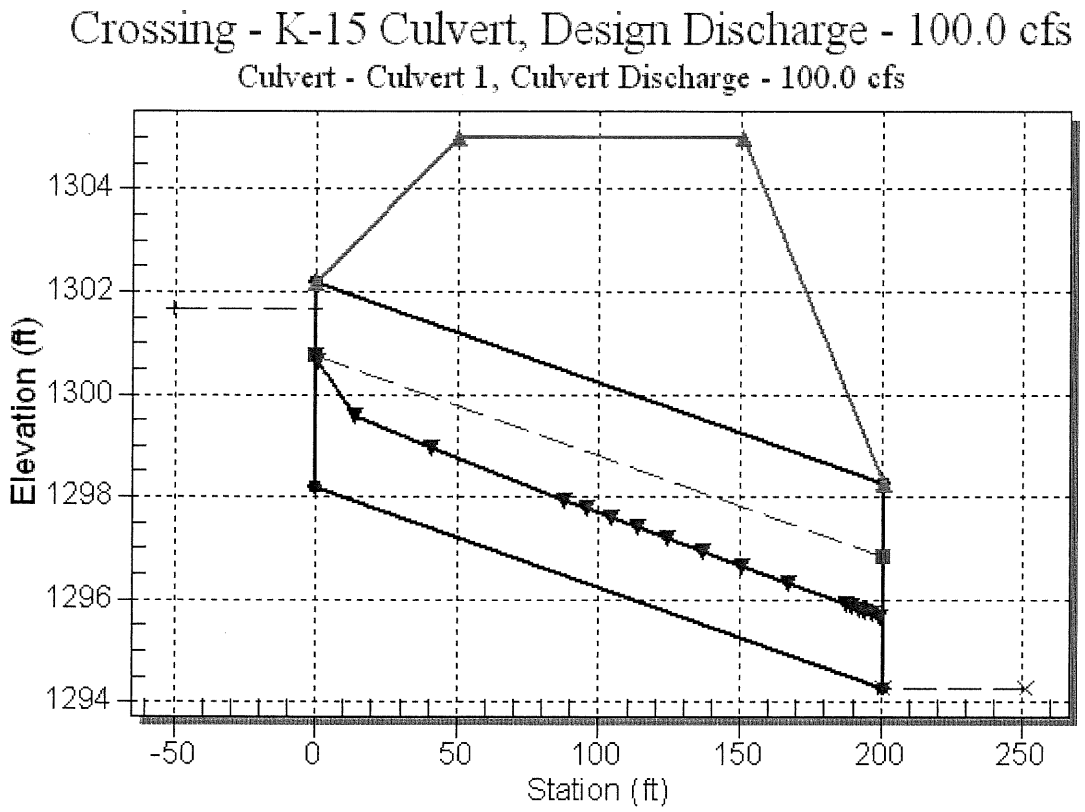


Table 3 - Downstream Channel Rating Curve (Crossing: K-15 Culvert)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	1294.27	0.27
20.00	1294.27	0.27
40.00	1294.27	0.27
60.00	1294.27	0.27
80.00	1294.27	0.27
100.00	1294.27	0.27
120.00	1294.27	0.27
140.00	1294.27	0.27
160.00	1294.27	0.27
180.00	1294.27	0.27
200.00	1294.27	0.27

Tailwater Channel Data - K-15 Culvert

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 1294.27 ft

Roadway Data for Crossing: K-15 Culvert

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 500.00 ft

Crest Elevation: 1305.00 ft

Roadway Surface: Paved

Roadway Top Width: 100.00 ft

Culvert Report K-15 CULVERT TAILWATER DOWNSTREAM

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Apr 27 2011

Ell Culvert

PRE-DEV ON-SITE 100 YR 189.46

Invert Elev Dn (ft)	=	1294.27
Pipe Length (ft)	=	200.73
Slope (%)	=	1.96
Invert Elev Up (ft)	=	1298.20
Rise (in)	=	52.0
Shape	=	Ell
Span (in)	=	72.0
No. Barrels	=	1
n-Value	=	0.012
Inlet Edge	=	Sq Edge
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

CAUSED BY DOWNSTREAM CULVERT →

Calculations

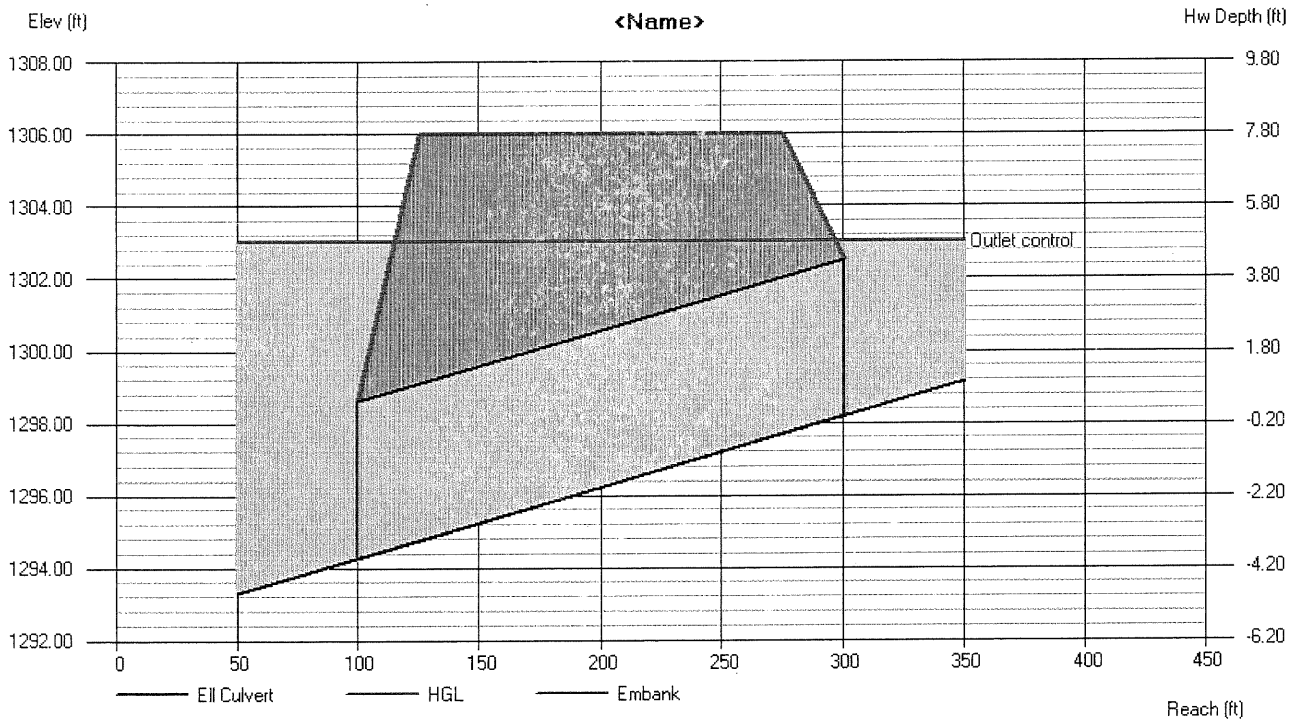
Qmin (cfs)	=	0.00
Qmax (cfs)	=	200.00
Tailwater Elev (ft)	=	1303.00

Embankment

Top Elevation (ft)	=	1306.00
Top Width (ft)	=	150.00
Crest Width (ft)	=	520.00

Highlighted

Qtotal (cfs)	=	20.00
Qpipe (cfs)	=	20.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	0.98
Veloc Up (ft/s)	=	0.98
HGL Dn (ft)	=	1303.00
HGL Up (ft)	=	1303.01
Hw Elev (ft)	=	1303.02
Hw/D (ft)	=	1.11
Flow Regime	=	Outlet Control



Q			Veloc		Depth		HGL			
Total	Pipe	Over	Dn	Up	Dn	Up	Dn	Up	Hw	Hw/D
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)	
20.00	20.00	0.00	0.98	0.98	52.00	52.00	1303.00	1303.01	1303.02	1.11
40.00	40.00	0.00	1.96	1.96	52.00	52.00	1303.00	1303.04	1303.07	1.12
60.00	60.00	0.00	2.94	2.94	52.00	52.00	1303.00	1303.08	1303.15	1.14
80.00	80.00	0.00	3.92	3.92	52.00	52.00	1303.00	1303.15	1303.27	1.17
100.00	100.00	0.00	4.90	4.90	52.00	52.00	1303.00	1303.23	1303.42	1.20
120.00	120.00	0.00	5.88	5.88	52.00	52.00	1303.00	1303.33	1303.60	1.25
140.00	140.00	0.00	6.86	6.86	52.00	52.00	1303.00	1303.45	1303.82	1.30
160.00	160.00	0.00	7.84	7.84	52.00	52.00	1303.00	1303.59	1304.07	1.35
180.00	180.00	0.00	8.81	8.81	52.00	52.00	1303.00	1303.75	1304.35	1.42
200.00	200.00	0.00	9.79	9.79	52.00	52.00	1303.00	1303.92	1304.88	1.54

100YR →

↑

Culvert Report

K-15 CULVERT N.D. DOWNSTREAM

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Saturday, Apr 23 2011

Ell Culvert

Invert Elev Dn (ft)	=	1294.27
Pipe Length (ft)	=	200.73
Slope (%)	=	1.96
Invert Elev Up (ft)	=	1298.20
Rise (in)	=	52.0 — 4.33'
Shape	=	Ell
Span (in)	=	72.0 — 6'
No. Barrels	=	1
n-Value	=	0.012
Inlet Edge	=	Sq Edge
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

Top Elevation (ft)	=	~~1305.00~~ 1306
Top Width (ft)	=	150.00
Crest Width (ft)	=	500.00

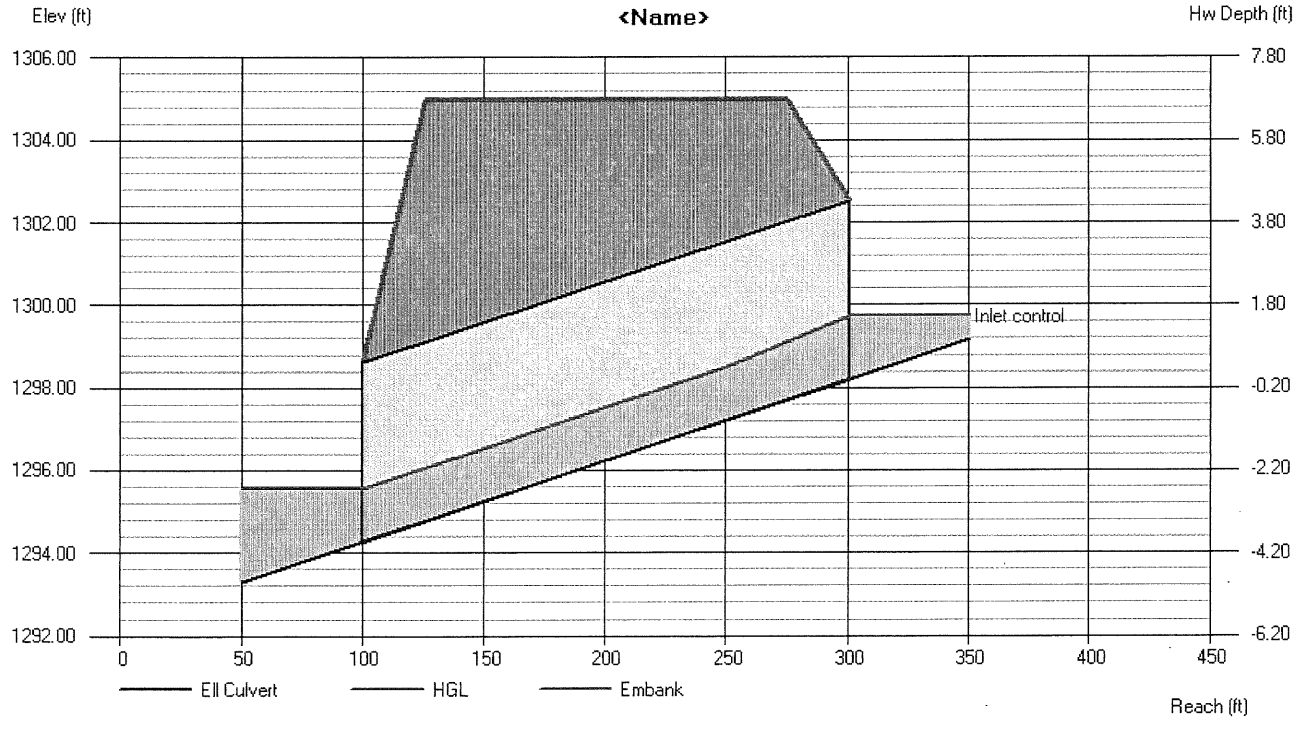
Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	200.00
Tailwater Elev (ft)	=	Normal

DKE - DeV ON-SITE 100YR 189.46

Highlighted

Qtotal (cfs)	=	20.00
Qpipe (cfs)	=	20.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.78
Veloc Up (ft/s)	=	3.78
HGL Dn (ft)	=	1295.57
HGL Up (ft)	=	1299.50
Hw Elev (ft)	=	1299.73
Hw/D (ft)	=	0.35
Flow Regime	=	Inlet Control



Q			Veloc		Depth		HGL			
Total	Pipe	Over	Dn	Up	Dn	Up	Dn	Up	Hw	Hw/D
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)	
20.00	20.00	0.00	3.78	3.78	15.60	15.60	1295.57	1299.50	1299.73	0.35
40.00	40.00	0.00	5.20	5.20	20.80	20.80	1296.00	1299.93	1300.39	0.51
60.00	60.00	0.00	6.71	6.71	23.40	23.40	1296.22	1300.15	1300.93	0.63
80.00	80.00	0.00	6.98	6.98	28.60	28.60	1296.65	1300.58	1301.49	0.76
100.00	100.00	0.00	7.86	7.86	31.20	31.20	1296.87	1300.80	1302.00	0.88
120.00	120.00	0.00	8.60	8.60	33.80	33.80	1297.09	1301.02	1302.51	0.99
140.00	140.00	0.00	9.25	9.25	36.40	36.40	1297.30	1301.23	1303.02	1.11
160.00	160.00	0.00	9.82	9.82	39.00	39.00	1297.52	1301.45	1303.55	1.23
180.00	180.00	0.00	10.35	10.35	41.60	41.60	1297.74	1301.67	1304.15	1.37
200.00	200.00	0.00	10.86	10.86	44.20	44.20	1297.95	1301.88	1304.88	1.54

100YR

↑

11200
SPIRIT AERO

Culvert Report

RAILROAD 4' STEEL PIPE CULVERT

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc.

Wednesday, Apr 27 2011

SITE → 189.46
AREA F → 41.56
231.02 cfs

Cir Culvert

Invert Elev Dn (ft)	=	1291.45
Pipe Length (ft)	=	56.78
Slope (%)	=	1.02
Invert Elev Up (ft)	=	1292.03
Rise (in)	=	48.0 — 4'
Shape	=	Cir
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.012 NO HEADWALLS
Inlet Edge	=	Projecting NO END SECTIONS
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1302.00
Top Width (ft)	=	54.00
Crest Width (ft)	=	10.00

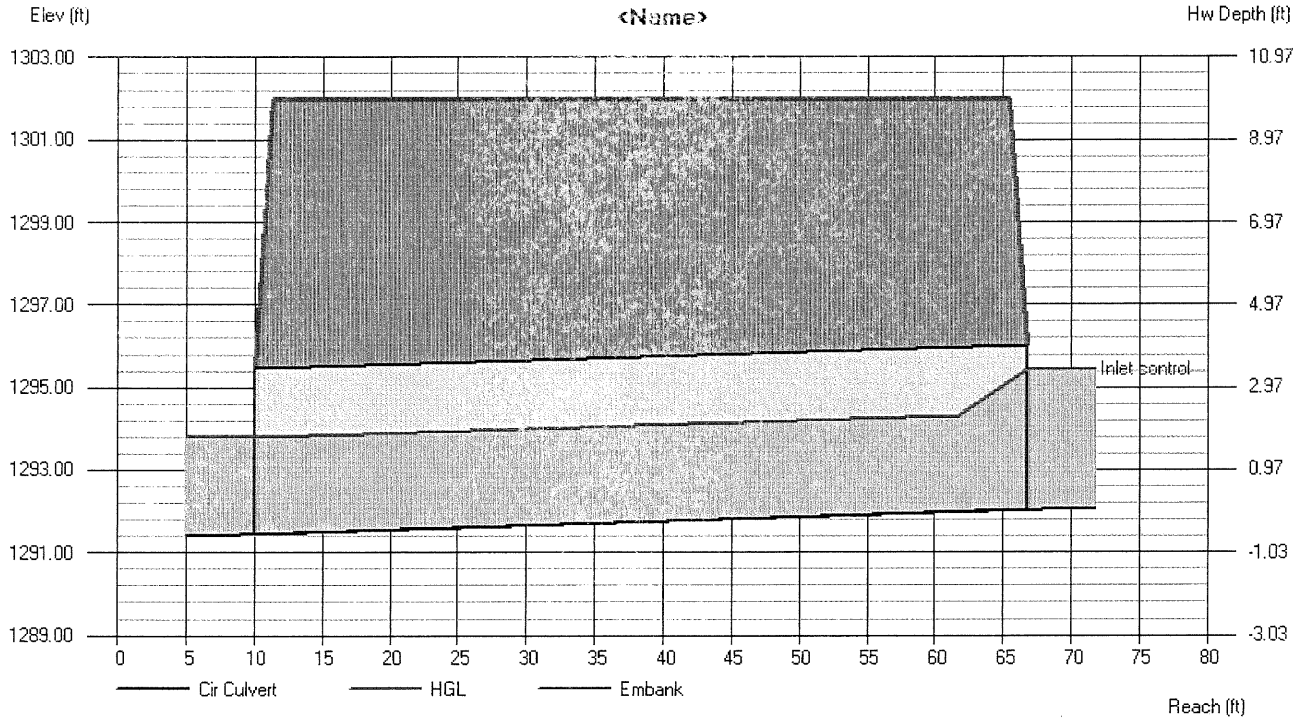
OVERFLOW DITCH SECTION TO SOUTH

Calculations

Qmin (cfs)	=	60.00
Qmax (cfs)	=	240.00
Tailwater Elev (ft)	=	Normal ← 1291.50± OUT SOUTH

Highlighted

Qtotal (cfs)	=	60.00
Qpipe (cfs)	=	60.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.83
Veloc Up (ft/s)	=	7.83
HGL Dn (ft)	=	1293.80
HGL Up (ft)	=	1294.38
Hw Elev (ft)	=	1295.43
Hw/D (ft)	=	0.85
Flow Regime	=	Inlet Control



Q			Veloc		Depth		HGL			
Total	Pipe	Over	Dn	Up	Dn	Up	Dn	Up	Hw	Hw/D
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)	
60.00	60.00	0.00	7.83	7.83	28.16	28.16	1293.80	1294.38	1295.43	0.85
80.00	80.00	0.00	8.79	8.79	32.66	32.66	1294.17	1294.75	1296.13	1.03
100.00	100.00	0.00	9.77	9.77	36.43	36.43	1294.49	1295.07	1296.84	1.20
120.00	120.00	0.00	10.81	10.81	39.63	39.63	1294.75	1295.33	1297.66	1.41
140.00	140.00	0.00	11.97	11.97	42.18	42.18	1294.97	1295.55	1298.70	1.67
160.00	160.00	0.00	13.25	13.25	44.05	44.05	1295.12	1295.70	1299.91	1.97
180.00	180.00	0.00	14.33	14.32	48.00	48.00	1295.45	1296.21	1301.27	2.31
200.00	194.14	5.86	15.45	15.45	48.00	48.00	1295.45	1296.34	1302.34	2.58
220.00	199.54	20.46	15.88	15.88	48.00	48.00	1295.45	1296.39	1302.76	2.68
240.00	203.89	36.11	16.23	16.23	48.00	48.00	1295.45	1296.43	1303.12	2.77

230

1302.94

DITCH SECTION OVERFLOW SOUTH

SAY 1303.00

HY-8 Culvert Analysis Report

May 13, 2011
11200 Spirit Aero
New South Entrance Culvert

Table 1 - Summary of Culvert Flows at Crossing: Crossing 1

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1323.55	0.00	0.00	0.00	1
1324.18	1.50	1.50	0.00	1
1324.50	3.00	3.00	0.00	1
1324.76	4.50	4.50	0.00	1
1325.10	6.00	6.00	0.00	1
1325.32	7.50	7.50	0.00	1
1325.58	9.00	9.00	0.00	1
1326.12	10.50	10.50	0.00	1
1326.32	11.00	11.00	0.00	1
1327.34	13.50	13.50	0.00	1
1328.00	15.00	14.86	0.00	50

100Yr Rational Method
Area = 1.109 ac
Tc = 5 min. (assumed)
I = 10.32 in/hr (100yr)
C = 0.93 (all impervious)
Q = 10.64 cfs (100yr)
Use = 11 cfs for design
Low Point Upstream = 1327.75

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	1323.55	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
1.50	1.50	1324.18	0.632	0.000	1-S2n	0.436	0.458	0.437	0.326	3.493	2.359
3.00	3.00	1324.50	0.947	0.000	1-S2n	0.632	0.655	0.634	0.422	4.234	2.806
4.50	4.50	1324.76	1.215	0.000	1-S2n	0.801	0.811	0.801	0.491	4.690	3.105
6.00	6.00	1325.10	1.462	1.546	2-M2c	0.966	0.943	0.943	0.547	5.121	3.337
7.50	7.50	1325.32	1.726	1.772	2-M2c	1.149	1.060	1.060	0.595	5.617	3.528
9.00	9.00	1325.58	2.032	2.030	2-M2c	1.500	1.157	1.157	0.637	6.165	3.693
10.50	10.50	1326.12	2.394	2.574	7-M2c	1.500	1.238	1.238	0.675	6.711	3.838
11.00	11.00	1326.32	2.529	2.771	7-M2c	1.500	1.261	1.261	0.687	6.962	3.882
13.50	13.50	1327.34	3.309	3.788	7-M2c	1.500	1.374	1.374	0.742	7.937	4.086
15.00	14.86	1328.00	3.805	4.448	7-M2c	1.500	1.436	1.436	0.772	8.601	4.195

****

Inlet Elevation (invert): 1323.55 ft, Outlet Elevation (invert): 1323.00 ft

Culvert Length: 110.00 ft, Culvert Slope: 0.0050

****

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1323.55 ft

Outlet Station: 110.00 ft (assumed)

Outlet Elevation: 1323.00 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 1.50 ft (18")

Barrel Material: Concrete

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall (or End Section)

Inlet Depression: None

Water Surface Profile Plot for Culvert: Culvert 1

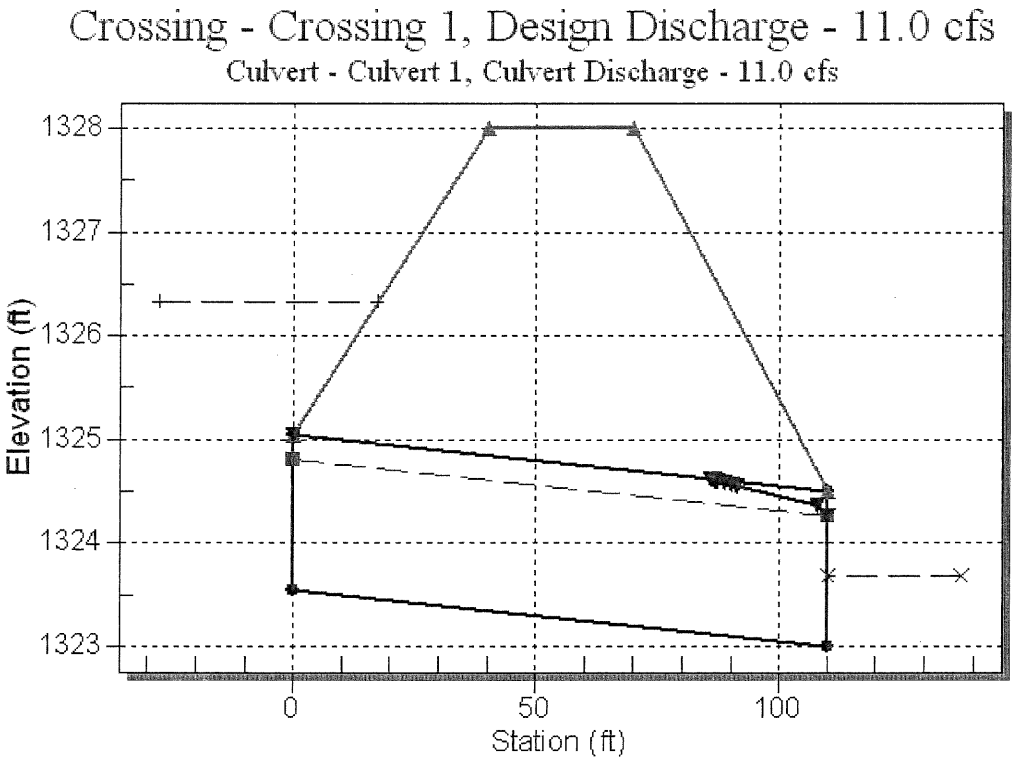


Table 3 - Downstream Channel Rating Curve (Crossing: Crossing 1)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	1323.00	0.00	0.00	0.00	0.00
1.50	1323.33	0.33	2.36	0.53	1.03
3.00	1323.42	0.42	2.81	0.68	1.08
4.50	1323.49	0.49	3.11	0.80	1.10
6.00	1323.55	0.55	3.34	0.89	1.12
7.50	1323.60	0.60	3.53	0.97	1.14
9.00	1323.64	0.64	3.69	1.03	1.15
10.50	1323.68	0.68	3.84	1.10	1.16
11.00	1323.69	0.69	3.88	1.11	1.17
13.50	1323.74	0.74	4.09	1.20	1.18
15.00	1323.77	0.77	4.20	1.25	1.19

Tailwater Channel Data - Crossing 1

Tailwater Channel Option: Triangular Channel (Downstream Ditch)

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.0260 (1323 to 1321 in 77')

Channel Manning's n: 0.0300 (grass)

Channel Invert Elevation: 1323.00 ft

Roadway Data for Crossing: Crossing 1

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft (assumed)

Crest Elevation: 1328.00 ft (at centerline of culvert)

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

(no overtopping occurs for 100yr event)

Crossing Front View (Roadway Profile): Crossing 1