

**CONQUEST NORTH 2ND ADDITION  
WICHITA, SEDGWICK COUNTY, KANSAS  
DRAINAGE REPORT  
JANUARY 2006**

**INTRODUCTION**

The subject property is in northeast Wichita in Sedgwick County, Kansas. The property is located west of Hillside between 21<sup>st</sup> N and Grove Park. It is primarily in the north half of Section 3, Township 27 South, Range 1 East. There is approximately 14 acres in the development that will be subdivided into 53 residential lots. The drainage plan for this report covers the entire addition.

**PREDEVELOPED CONDITIONS**

The site is currently not being used in any capacity. USGS maps indicate that 0.05 square miles drain to the site. There is an existing network of storm sewer that carries runoff through the site. There is also an existing subdivision, Conquest North, that contributes runoff to the storm sewer network.

There is an adjacent channel that runs along the east and north sides of the addition. The channel has a 5' flat bottom with 4:1 sideslopes. The channel terminates at a 36" rcp at the street that runs through Grove Park. USGS map shows that a drainage area of approximately 0.37 square miles drains into the adjacent channel.

**DEVELOPED CONDITIONS**

The site will eventually be subdivided into 53 residential lots. There are two detention ponds and a drainage channel proposed with this project. They will provide detention for on-site flows.

The channel will be improved to a minimum width of 10' with side slopes no steeper than 4:1. Fill will be placed to property lines to bring each lot approximately 1.0' above the anticipated 100 year water surface. An erosion control plan will be prepared prior to construction to limit silt transport.

**HYDROLOGY & HYDRAULICS**

First, a study was done looking at onsite flows only to verify that the detention ponds would detain a locally concentrated storm to pre-developed runoff levels. Second, the entire basin system was analyzed. HEC-HMS 2.2.2 was used to perform hydrologic modeling of this project. Output is included in the appendix.

## **CONCLUSIONS**

The pre-developed peak outflow was determined to be 237.9 cfs and the post-developed peak outflow was determined to be 229.4 cfs. The site provides enough storage so that the developed peak outflow is less than the pre-developed peak outflow.

The existing East and Northeast basins generate 151 cfs routed into the existing channel to the east and north of the Conquest North 2<sup>nd</sup> site. Combined with the flow from the Conquest North 2<sup>nd</sup>, 357 cfs of flow is routed to a 36" RCP to outlet the drainage channel. The 36" RCP is rated at a capacity of 52.5 cfs when the ditch is running completely full. This RCP is clearly inadequate to handle the amount of water routed to it. The plan elevation of the curb above the outlet pipe is 141.31. When the outlet pipe is overwhelmed, the curb will then be overtopped and any excess flow will then be diverted into the street and into additional storm sewer networks. There should not be a negative impact on our site as the peak elevation of the onsite channel is a 142.4.

## **RECOMMENDATIONS**

It was observed in the field that the natural drainage path for the East Offsite Basin, an area of depressed curb, has been blocked by a build up of silt. This blockage diverts flow from its natural drainage path onto the proposed site. It is recommended that the drainage path be cleared to restore the basins natural storm water path.

## **Pre-Developed Basins**

HEC-HMS was used to determine existing onsite drainage discharge. Drainage areas for the basin were determined by using USGS quad maps and field observation. Velocity method was used in determining the times of concentration. The data input for each basin follows:

### West Basin

Area = 30.7 acres = 0.048 square miles  
CN = 83, 30% Impervious  
Time of concentration = 23 minutes  
SCS Type II Storm, Depth = 7.8"  
 $Q_{100} = 155.5$  cfs

### Conquest North

Area = 2.0 acres = 0.0031 square miles  
CN = 83, 30% Impervious  
Time of concentration = 15 minutes  
SCS Type II Storm, Depth = 7.8"  
 $Q_{100} = 11.8$  cfs

### Existing Onsite

Area = 15.4 acres = 0.024 square miles  
CN = 75, 0% Impervious  
Time of concentration = 15 minutes  
SCS Type II Storm, Depth = 7.8"  
 $Q_{100} = 74.4$  cfs

### East Basin

Area = 25.0 acres = 0.039 square miles  
CN = 83, 30% Impervious  
Time of concentration = 30 minutes  
SCS Type II Storm, Depth = 7.8"  
 $Q_{100} = 97.4$  cfs

### Northeast Basin

Area = 21.1 acres = 0.033 square miles  
CN = 75, 0% Impervious  
Time of concentration = 40 minutes  
SCS Type II Storm, Depth = 7.8"  
 $Q_{100} = 54.1$  cfs

The only offsite basins to contribute flow to the site are the West and Conquest North basins. The East and Northeast basins were studied to study the existing drainage channel that flows around the east and north sides of the site. Generated results are included in the "HEC-HMS Data" of this report:

## **Post Developed Basins**

### West Basin

Area = 30.7 acres = 0.048 square miles

CN = 83, 30% Impervious

Time of concentration = 23 minutes

SCS Type II Storm, Depth = 7.8"

$Q_{100} = 155.5$  cfs

### Conquest North

Area = 2.0 acres = 0.0031 square miles

CN = 83, 30% Impervious

Time of concentration = 15 minutes

SCS Type II Storm, Depth = 7.8"

$Q_{100} = 11.8$  cfs

### Onsite West

Area = 1.7 acres = 0.0027 square miles

CN = 83, 30% Impervious

Time of concentration = 15 minutes

SCS Type II Storm, Depth = 7.8"

$Q_{100} = 10.3$  cfs

### Onsite North

Area = 7.0 acres = 0.011 square miles

CN = 83, 30% Impervious

Time of concentration = 15 minutes

SCS Type II Storm, Depth = 7.8"

$Q_{100} = 41.8$  cfs

### Onsite East

Area = 1.3 acres = 0.0021 square miles

CN = 83, 30% Impervious

Time of concentration = 15 minutes

SCS Type II Storm, Depth = 7.8"

$Q_{100} = 8.0$  cfs

### Onsite Undetained

Area = 5.1 acres = 0.0079 square miles

CN = 83, 30% Impervious

Time of concentration = 15 minutes

SCS Type II Storm, Depth = 7.8"

$Q_{100} = 30.1$  cfs

## Post Developed Conditions

### Existing SWS Network

First, the flow diverted through across the site through an existing storm water sewer network must be determined. (assume full flow in all pipes)

Hydraulic grade in upstream 30" pipe = 142.33

Hydraulic grade in downstream 36" pipe = 138.75

Distance from upstream inlet to downstream inlet = 1093'

Slope on hydraulic grade line =  $3.6'/1093' = 0.33\%$

From Table 111: Circular Concrete & Corrugated Metal Pipe from American Concrete Pipe Association's Design Data 4:

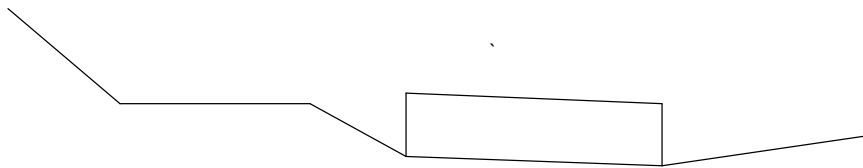
$$K = 410.1$$

$$Q = K * (S)^{1/2} = 410.1 * (0.033)^{1/2} = 23.6 \text{ cfs}$$

This flow will be diverted from the south pond basin through the existing sws pipe network.

### South East Pond

Initial flows will route through a 30" RCP under the existing roadway and into a proposed channel.



Using the “Hydraulic Charts for the Selection of Highway Culverts” the flow through the 30” RCP was found to be: (Inlet control assumed)

Elevation	Head	HW/D	Q (cfs)
144.0	3.1	1.24	30
144.5	3.6	1.44	34
145.0	4.1	1.64	37
145.5	4.6	1.84	42

(D = 2.5 ft, 30” RCP)

Once the water surface reaches an elevation of 144.3 the pond is able to overtop the roadway. The flow will then cross the road into the proposed channel. The shape of the pond restricts the ability of the pond to discharge. The outlet will be considered as weir flow with a length of 57.0 feet.

#### Weir Output Rating

Elev	Depth	Q (cfs)
144.3	0.0	0.0
144.5	0.2	17.7
145.0	0.7	116.0
145.5	1.2	260.5

#### Proposed Channel

The detention capacity calculations for the proposed channel are shown on the spreadsheet on the following page:

Using Autodesk LDD integrated hydrologic calculators the capacity of the proposed channel is calculated and given in the following table:  
(Manning's n = 0.02)

Elevation	Flow Depth	Q (cfs)
140.5	0.0	0.0
141.0	0.1	1.3
141.5	0.6	27.8
142.0	1.1	83.2
142.5	1.6	169.3
143.0	2.1	289.4
143.5	2.6	446.8
144.0	3.1	644.8

### Northwest Pond

The northwest pond first discharges into a storm water sewer manhole with a beehive top. Once the water surface elevation reaches 144.5 the pond is able to discharge via weir flow into an existing channel. The capacity of the beehive inlet is determined using orifice flow equations, then once the water surface reaches 144.5 weir flow controls. The effective length of the weir is 150'.

Elevation	Area (acres)	Q (cfs)
143.0	0.56	0
143.5	0.59	13.8
144.0	0.63	19.5
144.5	0.66	24.0
145.0	0.69	184

This information for the post-developed site conditions was put into HEC-HMS to calculate the drainage condition. Generated results are included in the "HEC-HMS Data" of this report.