SOUTHWEST PASSAGE ADDITION

WICHITA, SEDGWICK COUNTY, KANSAS

DRAINAGE REPORT

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INTRODUCTION

The subject property is in southwest Wichita in Sedgwick County, Kansas. The property is located south of Pawnee between 119th and 135th Streets West. It is primarily in the north half of Section 1, Township 28 South, Range 2 West. There is approximately 114 acres in the development that will be subdivided into 218 residential lots in separate phases. The drainage plan for this report primarily covers the first phase. Since storm water runoff from future development will be routed into the ponds, a portion of the future plat was included in the hydrologic calculations of this report. The project is proposed to have one crossing of the primary channel to provide access to the lots in the south half of the addition.

PREDEVELOPED CONDITIONS

The site is currently being used in an agricultural capacity. There is one large channel that affects this phase of the development. The channel runs east-west along the south side of the proposed addition. The channel is poorly developed and lined with trees in places. The channel is approximately 12 feet across at the bottom, approximately 7 feet deep, with nearly vertical side slopes.

The Firm map indicates that a drainage area of approximately 0.65 square miles drains under 23rd Street and across the subject property. A review of site conditions indicates that the street ditch on the north side of Pawnee carries the majority of that flow with only a 50% plugged 24" CMP available to carry water under the roadway. Photographs of that pipe crossing are included in this report.

DEVELOPED CONDITIONS

The site will eventually be subdivided into 218 residential lots. There are two detention ponds proposed with this project. They will provide detention for on-site flows, but are not large enough to have any impact on 100 year events for the entire basin. These ponds, combined with improving stream channels inside the property, reduce the 100 year water surface 1.5' to 2.5'.

The channels will be improved to a minimum width of 10' with side slopes no steeper than 3:1. Fill will be placed to property lines to bring each lot approximately 1.0' above the anticipated 100 year water surface. Storm Sewers will be installed along rear lines of lots to provide drainage. An erosion control plan will be prepared prior to construction to limit silt transport.

To provide adequate detention to detain localized storm events, a notched concrete weir will be constructed on the downstream side of the lower pond to restrict flows. A wider 29' trapezoidal weir will be provided above the notch to provide capacity for larger flows generated by the larger basins. It will feature a concrete bottom with rip-rap sides laid back at 3:1.

HYDROLOGY & HYDRAULICS

This site is bisected by a major tributary of Dry Creek that has upstream drainage area of 3.6 square miles. Due to the large size of these basins, any detention effects for the onsite ponds will be negligible with regards to the 100 year storm. As such, two different scenarios were reviewed when sizing the detention ponds for this project. 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.

Onsite storm sewer has been designed to carry the 100 year storm event. StormCAD output and profiles are included in the appendix of this report. The rational method was used to determine flow rates for each pipe in the system. Please refer to the Drainage Plan for basin and flow information.

CONCLUSIONS

The detention ponds and storm sewer have been sized to convey and detain the 100 year storm to pre-developed levels. A FEMA C-LOMR application has been filed and will result in a modified SFHA upon approval. All proposed lots will be clear of the Flood Hazard Area upon approval of the application. A copy of the FEMA application will be included with the submittal of this report.

One area of particular importance is the contingent street dedication that has been set aside at the south line of the project. It will be critical that the design engineer for that project provide a structure that does not raise the 100 year water surface in that area without doing an extensive study of the developed conditions to verify that no danger is presented to this site.

The onsite ponds will provide adequate detention capacity for on-site storms but will have little affect on peak flows for events that affect the entire drainage basin of each tributary.

Drainage Basin Information
Southwest Passage Addition
November 2005

OFFSITE SCS LAG CALCULATIONS

North Offsite

$T_{lag} = L * (1000/(CN - 10) +1)^{0.7} / (1900 *S^{0.5})$

$T_{lag} = 19744 * (1000/(80 - 10) +1)^{0.7} / (1900 *(0.61)^{0.5}) = 3.75$ hours = 225 minutes

EXISTING BASINS

Onsite (for overall model)

59.4 acres = 0.093 sq. mi.
CN = 80, 0% Impervious
SCS Lag = 25 minutes
7.8" Type II Storm
Q100 = 199.7 cfs

North Offsite (for overall model)

From USGS, 3.62 sq. mi.
CN = 85, 0% Impervious
SCS Lag = 225 minutes
7.8" Type II Storm
Q100 = 1964.4 cfs

West Pond Onsite

13.0 acres = 0.020 sq. mi.
CN = 80, 30% Impervious
SCS Lag = 25 minutes
7.8" Type II Storm
Q100 = 48.2 cfs

East Pond Onsite

44.0 acres = 0.069 sq. mi.
CN = 80, 30% Impervious
SCS Lag = 15 minutes
7.8" Type II Storm
Q100 = 166.2 cfs

Total onsite runoff (Existing Onsite model) = 224.5 cfs
Total including offsite (Existing Overall model) = 1976.8 cfs

DEVELOPED BASINS

West Pond Onsite
13.0 acres = 0.020 sq. mi.
CN = 80, 30% Impervious
SCS Lag = 15 minutes
7.8" Type II Storm
Q100 = 68.0 cfs

East Pond Onsite
44.0 acres = 0.069 sq. mi.
CN = 80, 30% Impervious
SCS Lag = 15 minutes
7.8" Type II Storm
Q100 = 234.7 cfs

North Offsite
From USGS, 3.62 sq. mi.
CN = 85, 1% Impervious
SCS Lag = 225 minutes
7.8" Type II Storm
Q100 = 1964.4 cfs

Undetained Runoff
2.4 acres = 0.004 sq. mi.
CN = 80, 5% Impervious
SCS Lag = 20 minutes
7.8" Type II Storm
Q100 = 10.5 cfs

Total onsite runoff (Proposed model) = 173.3 cfs < 224.5 cfs **OK**
Total including offsite (Proposed Overall model) = 1973.8 cfs < 1976.8 cfs **OK**

Scott,

Attached are the follow-ups to your comments. Thanks for looking at this for me and let me know if you have any additional questions.

1. Submit the necessary electronic data including pdfs of the report, HEC-HMS, and HEC-RAS modeling.

CD is included with this submittal.

2. The Grading Plan should include minimum pad elevations, street grades (Tc, HP), inlet grades, drainage flow arrows, pond data, HWL, block numbers etc.

Grading Plan updated as requested.

3. The drainage and grading plan should show the entrance culvert, size, flowline elevations, and calculations.

Entrance culvert information added to plans.

4. The grading plan does not have 1% cross slope on the rear lots of 6 thru 12, block 4. Spot elevations should be shown between lots 4&5, blk 4 and lots 5&6, blk 5 for an emergency overflow route.

Grading has been revised to provide minimum 1% slope. Additional callouts added.

5. The proposed pond and ditch contouring with elevations labeled should be shown for reserves B, C, D, E & F.

Added additional contour information.

6. The drainage plan should show how the existing stormwater pipe is draining from the north of Pawnee and any impacts in the Monument road entrance.

Existing pipe added. Pipe is east of Monument road entrance and does not impact this phase of the development. Most of the flow from that pipe is carried in the north ditch, which has been reworked in the past couple years. The existing pipe is over 50% plugged but future street crossings in the east half of this development will be sized to handle the flow from the 24" pipe.

7. The drainage plan does not locate the outfall weir locations, existing flood boundary, proposed flood boundary, floodway boundary, the south pond, min. pad elevations, drainage offsite drainage flow patterns, 23rd Street ditch drainage patterns, existing culvert data, and existing spot elevations.

Added weir location to north pond. Added existing and proposed floodplain boundaries, minimum pad elevations and existing culvert data. The south pond is not shown since it is not part of this plat. It will be addressed when the southern area is platted. Due to the extreme size of offsite drainage areas, they cannot effectively be shown on the drainage plan. An exhibit is included in the report showing offsite drainage areas. In order to promote clarity of information on the drainage plan, no spot elevations are included. Please refer to the grading plan for spot elevations.

8. An exhibit should be provided that delineates both the floodplain by scaled location and by your existing conditions model. This will be used by OCI to flag the lots from being permitted with basements below the BFE, prior to the LOMR being approved.

An exhibit with coordinates will be provided to OCI outlining the existing floodplain and the areas being removed with the LOMR-F Application.

9. Should the culvert under Monument be routed using HY-8 rather than using the weir equation?

The culvert was analyzed with Land Desktop's culvert calculator. Output is included in the report.

10. The weir details do not include the top elevation. In addition, the outlet control should be modeled using the 2 foot low flow weir. I would recommend the rating tables include the discharge flow at elevation 1328.22 and 1330.5 for the northeast and south pond.

The weir details have been updated.

11. The detention ponds should be evaluated for the 2- and 5- year storm events and supply a comparison tables for both pre-developed and post-developed conditions for all ranges of storm events, including the 100- year.

Comparison tables have been added.

12. The hydraulic modeling prepared for FEMA should be included in the overall drainage report submitted to the City.

A copy of the FEMA drainage report, including modeling has been submitted with the drainage plan.

13. I would recommend using calculated flow rates from new Hydrology, rather than prorating the Hydrologic data from the FIS. I do not know if FEMA would approve this methodology.

For the FEMA report, we have chosen to use the pro-rated data since it is slightly more conservative than the output we developed out of HEC-HMS. 100 year water surfaces for each lot were set from the FEMA model.

14. I think FEMA is going to require this model to be tied into the d/s cross section at US54. At the minimum, I believe they may not accept your starting water surface elevation. They will want a cross section 100'+/- d/s of the Pawnee using a starting water surface elevation calculated by normal depth. I would like to see the model in digital form to make additional comments. FEMA will require a CD of the models and workmaps in CAD.

The last four sections of the north model are actually derived from the Turkey Creek model prepared by MKEC. We feel that there is adequate modeling downstream of the bridge on 23rd to normalize the model.

15. The FEMA workmap should be a two full sized plans, with elevations labeled, on showing pre-project flood boundary limits and the other showing post-project flood boundary limits. The model should include a floodway to demonstrate equal conveyance on both sides of the creek. The cross sections should include the BFE on the pre-project model, and both the BFE for the pre-project and post-project on the post-project workmap. A legend should be included that denotes the different line types and labeling.

Updated Workmaps as suggested.

16. Is the river stationing used for the study, the same stationing used in the effective model? Station 22790 at US54. Show an exhibit on how this stationing was determined.

Stationing is based on Turkey Creek model, which was derived from station at US-54. Did not make an exhibit, but it is discussed in report.

17. I would recommend showing the property boundary's and ownership within the study limits.

Added property owner names for adjacent property owners.

18. A table should be included that compares the pre-project and post-project water surface elevations. This can be completed through HEC-RAS

Table added as suggested.

19. I have signed the MT-2 form and will place the flood study in your box, please forward the Community Acknowledgement Form.

No comment necessary.

Culvert Calculator

All calculator output should be verified prior to design use

Entered Data:

Shape	Rectangular
Number of Barrels	4
Solving for	Headwater
Chart Number	8
Scale Number	1
Chart Description	BOX CULVERT WITH FLARED WINGWALLS; NO INLET TOP EDGE BEVEL
Scale Description	WINGWALLS FLARED 30 TO 75 DEGREES
Overtopping	Off
Flowrate	2115.0000 cfs
Manning's n	0.0120
Roadway Elevation	1336.0000 ft
Inlet Elevation	1328.0000 ft
Outlet Elevation	1327.5000 ft
Height	6.0000 ft
Width	12.0000 ft
Length	100.0000 ft
Entrance Loss	0.0000
Tailwater	0.8155 ft

Computed Results:

Headwater	1334.3362 ft Inlet Control
Slope	0.0050 ft/ft
Velocity	14.1431 fps

Messages:

Inlet head > Outlet head.
Computing Inlet Control headwater.
Solving Inlet Equation 26.
Solving Inlet Equation 28.
Headwater: 1334.3362 ft

DISCHARGE Flow cfs	HEADWATER ELEV. ft	INLET CONTROL DEPTH ft	OUTLET CONTROL DEPTH ft	FLOW TYPE	NORMAL DEPTH ft	CRITICAL DEPTH ft	OUTLET VEL. fps	OUTLET DEPTH ft	TAILWATER VEL. fps	TAILWATER DEPTH ft
100.00	1328.78	0.78	0.56	NA	0.43	0.51	4.80	0.43	9.04	0.13
200.00	1329.25	1.25	0.99	NA	0.67	0.81	6.24	0.67	11.80	0.20
300.00	1329.65	1.65	1.35	NA	0.86	1.07	7.25	0.86	13.76	0.26
400.00	1330.01	2.01	1.69	NA	1.03	1.29	8.06	1.03	15.33	0.31
500.00	1330.35	2.35	2.00	NA	1.19	1.50	8.73	1.19	16.65	0.35
600.00	1330.66	2.66	2.28	NA	1.34	1.69	9.32	1.34	17.81	0.39
700.00	1330.95	2.95	2.56	NA	1.48	1.88	9.83	1.48	18.85	0.43
800.00	1331.24	3.24	2.82	NA	1.62	2.05	10.30	1.62	19.78	0.46
900.00	1331.51	3.51	3.07	NA	1.75	2.22	10.72	1.75	20.64	0.50
1000.00	1331.78	3.78	3.31	NA	1.87	2.38	11.11	1.87	21.44	0.53
1100.00	1332.03	4.03	3.55	NA	2.00	2.54	11.47	2.00	22.18	0.56
1200.00	1332.28	4.28	3.78	NA	2.12	2.69	11.81	2.12	22.88	0.59
1300.00	1332.53	4.53	4.00	NA	2.23	2.84	12.12	2.23	23.54	0.61
1400.00	1332.76	4.76	4.22	NA	2.35	2.98	12.42	2.35	24.16	0.64
1500.00	1333.00	5.00	4.43	NA	2.46	3.12	12.70	2.46	24.75	0.67
1600.00	1333.22	5.22	4.64	NA	2.57	3.26	12.96	2.57	25.31	0.69
1700.00	1333.45	5.45	4.84	NA	2.68	3.39	13.22	2.68	25.85	0.72
1800.00	1333.67	5.67	5.04	NA	2.79	3.52	13.46	2.79	26.37	0.74
1900.00	1333.88	5.88	5.23	NA	2.89	3.65	13.68	2.89	26.86	0.77
2000.00	1334.10	6.10	5.43	NA	3.00	3.78	13.90	3.00	27.34	0.79
2100.00	1334.31	6.31	5.61	NA	3.10	3.90	14.11	3.10	27.80	0.81
2200.00	1334.51	6.51	5.80	NA	3.20	4.03	14.31	3.20	28.25	0.83

Culvert Calculator

All calculator output should be verified prior to design use

Entered Data:

Shape	Circular
Number of Barrels	1
Solving for	Headwater
Chart Number	1
Scale Number	1
Chart Description	CONCRETE PIPE CULVERT; NO BEVELED RING ENTRANCE
Scale Description	SQUARE EDGE ENTRANCE WITH HEADWALL
Overtopping	Off
Flowrate	5.0000 cfs
Manning's n	0.0130
Roadway Elevation	1339.2000 ft
Inlet Elevation	1335.2000 ft
Outlet Elevation	1335.0000 ft
Diameter	1.0000 ft
Length	50.0000 ft
Entrance Loss	0.0000
Tailwater	1.0000 ft

Computed Results:

Headwater	1337.6098 ft Outlet Control
Slope	0.0040 ft/ft
Velocity	6.3662 fps

Messages:

Outlet head > Inlet head.
Computing Outlet Control headwater.
Outlet submerged.
Full flow.
Headwater depth computed using FHWA equation.
Headwater: 1337.6098 ft

DISCHARGE Flow cfs	HEADWATER ELEV. ft	INLET CONTROL DEPTH ft	OUTLET CONTROL DEPTH ft	FLOW TYPE	NORMAL DEPTH ft	CRITICAL DEPTH ft	OUTLET VEL. fps	OUTLET DEPTH ft	TAILWATER VEL. fps	TAILWATER DEPTH ft
1.00	1336.06	0.59	0.86	NA	0.47	1.00	1.27	1.00	0.00	1.00
2.00	1336.26	0.92	1.06	NA	0.73	1.00	2.55	1.00	0.00	1.00
3.00	1336.58	1.32	1.38	NA	1.00	1.00	3.82	1.00	0.00	1.00
4.00	1337.03	1.70	1.83	NA	1.00	1.00	5.09	1.00	0.00	1.00
5.00	1337.61	2.28	2.41	NA	1.00	1.00	6.37	1.00	0.00	1.00
6.00	1338.32	2.99	3.12	NA	1.00	1.00	7.64	1.00	0.00	1.00
7.00	1339.16	3.83	3.96	NA	1.00	1.00	8.91	1.00	0.00	1.00