SOUTHEAST QUADRANT DEVELOPMENT
29TH STREET NORTH AND MAIZE ROAD
CITY OF WICHITA

SITE DEVELOPMENT STORMWATER MANAGEMENT REPORT:

Construction of new buildings, access roads, and parking lots associated with commercial development is planned near the southeast quadrant of 29th Street North and Maize Road, Section 5 Township 27 South Range 1 West located within Sedgwick County. The construction is located within the Cadillac Lake drainage basin and is subject to City of Wichita stormwater requirements. The total property area is approximately 73 acres, of which a total of 30.5 acres is planned for development. The remaining 42.5 acres will be reserved for wetlands and stormwater management. See Exhibit 1 – Project Area Map. Wetlands are known to exist on site and delineation has been completed by GSI Engineering. The existing wetland delineation and required mitigation caused by development are not discussed in detail within this report. The purpose of this Stormwater Management Report is to consider floodplain impacts and stormwater management of the increased peak runoff rates and volumes caused by development.

A majority of the site is contained within the designated floodplain and is generally characterized by minimal to moderate slopes and elevation available, as well as consisting primarily of an even distribution of Hydrologic Soil Groups B and D. The majority of stormwater runoff from the property is directed to Cadillac Lake consisting of wet and dry interconnected ponds which effectively receives over 2000 acres of drainage. For the purposes of this report, only impacts caused by the proposed development were considered. Additional information on the area is available in the Cadillac Lake Drainage Study available upon request.

The proposed development consists of West and East development sites, 26.5 acres and 4.0 acres, respectively. As mentioned, a majority of the area of development is contained with the existing 100-year floodplain. To accommodate development, several considerations must be made for site fill and stormwater management. See Table 1 below for summary of site development areas which includes proposed areas for building based on the current concept plan.

TABLE 1: DEVELOPMENT AREA SUMMARY

	Total Area (AC)	Building Area (AC)	Total Impervious Area (AC)	Floodplain Area (AC)	Building Area in Floodplain (AC)
WEST DEVELOPMENT	26.5	3.9	23.9	22.4	3.4
EAST DEVELOPMENT	4.0	2.0	3.6	3.8	2.0
TOTAL DEVELOPMENT	**30.5**	**5.9**	**27.5**	**26.2**	**5.4**

CITY REQUIREMENTS:

The City of Wichita adopted Storm Water Ordinances on January 1, 2011. These new ordinances specifically include regulations regarding water quality, channel bank protection, and on-site detention.

The first requirement specified in the new Ordinances requires solids removal from any storm water flow leaving the project site. The solids, described as Total Suspended Solids (TSS), includes any sediment, debris, etc. that could become trapped in water. This requirement is known as Water Quality. The City of Wichita requires 80% TSS removal for 100% of new construction located on a virgin site. Per City regulations, water quality treatment is required when a project site disturbs 1 or more acres. As previously discussed, the proposed project is drains to Cadillac Lake, a regional stormwater management facility

which adequately addresses water quality without additional requirements being imposed upon the development. However, access to a regional facility does not alleviate the developer of the responsibility of discharging stormwater relatively clean of trash, debris, and miscellaneous material which could be received by the regional facility. The project will ultimately require submittal to and review by the City of Wichita prior to construction. On site best management practices should be considered at that time and implemented into the project as necessary for general water quality concerns.

Channel Bank Protection is an additional requirement by the City of Wichita. This regulation regards the more frequent storm events being the primary cause of downstream erosion. Efforts must be made to detain and control release of water from these frequent annual storm events. Proposed site stormwater BMP's must be designed such that the time lapse between the centroids of the inflow and outflow hydrographs meets or exceed 24 hours for the annual storm event. Per City regulations, channel bank protection is required when a project site disturbs 5 or more acres. Upon initial review of the project, on-site detention capable of achieving the requirements associated with channel bank protection prior to discharge into the regional stormwater management facility, Cadillac Lake, is not technically feasible. This regulation should be reviewed with the City of Wichita Stormwater staff prior to construction plan development to discuss waiving the requirement or an alternative solution.

The third requirement by the City of Wichita is on-site detention. Hydrologic analysis was completed to illustrate that peak runoff rates for varying storm events are not increased, or adversely affected, by the proposed site conditions in comparison to the existing site conditions. Per City regulations, on-site detention is required when a project site disturbs 1 or more acres, but may be waived by the City if the proposed site includes less than 0.5 acres of new impervious area. Based on these regulations and the proposed development, on-site detention will be required. Upon discussion with the City of Wichita Stormwater Staff, direct discharge to Cadillac Lake, without restriction of peak runoff rate, will be acceptable under the condition that additional detention volume is created via excavation of the existing lake. Additional detention volume created within Cadillac Lake shall be equivalent to the total increased runoff volume from the 100-year 24-hour storm event. As recommended in the Wichita Stormwater Manual, Technical Release 55 (TR-55) Urban Hydrology for Small Watersheds was used for stormwater volumetric runoff computations.

Weighted Curve Numbers (CN) were calculated using TR-55. A pervious CN of 80 was used with consideration to hydrologic soil group D open space in good condition. An impervious CN of 98 was used with consideration of buildings, paved parking lots, roofs, driveways, etc. For the purposes of this report, the calculations are provided for the overall site. See also Table 1 for supporting information.

$$Existing\ Weighted\ CN\ = \frac{(30.5\ AC)(80) + (0\ AC)(98)}{30.5\ AC}\ =\ 80.0$$

$$Proposed\ Weighted\ CN = \frac{(30.5 - 27.5\ AC)(80) + (27.5\ AC)(98)}{30.5\ AC}\ =\ 96.2$$

Time of Concentration (ToC) may also be calculated using TR-55. However, total volumetric runoff computations are independent of the ToC with respect to Equation 2-1. ToC for both the existing and proposed development area were not calculated with this report. To calculate the total direct runoff only the weighted curve number and 100-year 24-hour point rainfall depth (7.83 inches) is considered.

TABLE 2: VOLUMETRIC RUNOFF COMPUTATIONS (100-YEAR 24-HOUR STORM)					
TOTA L DEVELOPMENT (AREA = 31.7 AC)	**CN**	**S**	**Ia**	**P 100 (inches)**	**Q (inches)**
EXISTING CONDITIONS	80	2.50	0.50	7.83	5.47
PROPOSED CONDITIONS	96.2	0.40	0.08	7.83	7.38
TOTAL INCREASED DIRECT RUNOFF (INCHES)					1.91
TOTAL INCREASED DIRECT RUNOFF VOLUME (CUBIC YARDS)					**7,830**
(AREA * TOTAL INCREASED DIRECT RUNOFF INCHES)					

$$Q = \frac{(P - Ia)^2}{(P - Ia) + S} \qquad [TR - 55\ Equation\ 2 - 1]$$

$Where$

$Q = Direct\ Runoff\ (inches)$

$P = Rainfall\ (inches)$

$S = Potential\ Maximum\ Retention\ After\ Runoff\ Begins\ (inches)$

$$S = \frac{1000}{CN} - 10 \qquad [TR - 55\ Equation\ 2 - 4]$$

$Ia = Initial\ Abstraction\ (inches)$

$$Ia = 0.2 * S \qquad [TR - 55\ Equation\ 2 - 2\}$$

In addition to the 7,830 cubic yards of stormwater detention volume required as a result site development, the City of Wichita has indicated that an additional 10% storage volume will be required given the high profile drainage area and historic drainage issues in the area. An additional 10% equates to 783 cubic yards, for a grand total of 8,613 cubic yards of stormwater detention volume as a result of site development.

FLOODPLAIN FILL:

A large area of site development occurs in a designated 100-year floodplain. As a result of development, compacted fill will be placed on-site to raise the proposed buildings above the established 100-year floodplain elevation of 1350.7 NAVD88 established in the Cadillac Lake Drainage Study. Under normal conditions of development, the City of Wichita would require proposed building finished floor or low opening elevations 3 feet above the 100-year floodplain elevation. After discussions with City of Wichita Stormwater Staff, it was agreed that proposed building finished floor or low opening elevations 2 feet above the 100-year floodplain elevation (1352.7 NAVD88) would be acceptable given the significant level of drainage study completed in the area.

Compacted fill placed on-site and within the established 100-year floodplain will occupy detention volume previous available during larger storm events. The developer will be responsible for creating additional detention volume within the existing Cadillac Lake via excavation to compensate for the floodplain volume being filled as a result of development. Although proposed building areas will be required to be 2 feet above the 100-year floodplain elevation as previously discussed, a degree of flooding can be considered acceptable in other site areas, specifically parking lots, in order to minimize site fill as a

result floodplain volume compensation. Upon discussions with the developer, it was agreed that 6 inches (0.5 feet) of flooding in site areas outside of building pads would be considered acceptable, resulting in a minimum elevation of 1350.2 NAVD88 (1350.7 – 0.5 feet) for the remainder of the site grading outside of buildings.

For the purposes of this report and floodplain fill earthwork computations, AutoCAD Civil 3D 2013 surface models were created for existing ground and the proposed minimum elevations as noted above. The AutoCAD drawing and LandXML surface model files are available upon request. AutoCAD Civil 3D was used to calculate proposed volumetric differences, summarized below.

TABLE 3: FLOODPLAIN FILL VOLUME SUMMARY

	Site Fill to Elev. 1350.2 (Cubic Yards)	Bldg. Fill to Elev. 1352.7 (Cubic Yards)	Total Floodplain Fill (Cubic Yards)
WEST DEVELOPMENT	73,400	13,750	87,150
EAST DEVELOPMENT	14,850	8,070	22,920
TOTAL DEVELOPMENT	**88,250**	**21,820**	**110,070**

In addition to the 110,070 cubic yards of floodplain fill compensatory volume required for site development, the City of Wichita has indicated that an additional 10% storage volume will be required given the high profile drainage area and historic drainage issues in the area. An additional 10% equates to 11,007 cubic yards, for a grand total of 121,077 cubic yards of floodplain fill compensatory volume as a result of site development.

STORMWATER DETENTION EXCAVATION:

As a result of the City of Wichita requirements for stormwater runoff volume detention and floodplain fill compensation, the developer will be required to create a total of 129,690 cubic yards (8,613 + 121,077) of stormwater detention volume within Cadillac Lake as a result of site development.

The primary area of consideration for creating the required detention volume is in the southeast portion of the property. An existing dry detention pond interconnected to the Cadillac Lake detention is currently located directly south of the eastern perimeter of the property. Upon discussions with City of Wichita Stormwater staff, it was agreed that this dry detention area could be extended to the north, onto the development property, in order to generate site fill material and the required detention volume. The developer has expressed further desire to create low pockets within the dry detention area which can be utilized as enhanced wetland areas, thus creating additional detention volume. In addition to the enhanced wetland areas, a wet stormwater pond will be created directly south of the proposed east development as an amenity to the site. Stormwater volume below the proposed static level of the pond was not considered in detention and floodplain compensation calculations as no additional stormwater storage volume is created during rain events. Additional Division of Water Resources permitting may be required for the wet pond, but was not considered in this report. Permitting requirements should be confirmed prior to the development of construction plans. An AutoCAD Civil 3D 2013 surface model was used for the purposes of calculating available volume with the extension of the dry detention pond. See Exhibit 2 – Stormwater Excavation. By extension of the dry detention and created wetlands pocket, 129,050 cubic yards of excavated material or detention volume.

The central portion of the property is located between two existing interconnected wet ponds and is generally classified as floodplain with portions of wetland. By excavating this area, but maintaining a

minimum elevation at above the static water elevation (1347.0 NAVD88) of the existing wet ponds, additional stormwater detention volume can be created as well as enhancing the existing wetlands determined to exist in the area. Surface model calculations have determined that excavation in this area to the approximate static pond level will create an additional 9,330 cubic yards of detention volume.

To summarize, central grading improvements in addition to the 129,050 cubic yards of detention volume created with the dry detention extension on the eastern portion of the property, a total of 138,380 cubic yards (129,050 + 9,330) of detention volume is created with the proposed grading. This volume adequately satisfies the required total detention volume of 129,690 cubic yards based on stormwater runoff detention volume and floodplain fill compensation. Within the required volume compensation of 129,690 is an additional 10% which the City has specified in addition to the actual floodplain and stormwater detention volume affected. The actual affected volume with the proposed project is 117,900 cubic yards (7,830 Detention + 110,070 Floodplain). By creating stormwater storage above the minimum required, the proposed development will actually result in a 17% additional storage volume ((138,380 - 117,900) / 117,900), 7% above required and a quantifiable benefit to the City of Wichita and surrounding developments.

With the site benefitting detention volume and floodplain fill, the water surface elevation during the 100-year 24-hour storm event can be considered for the proposed construction with updated storage volumes. Recently, the City of Wichita has completed the Cadillac Lake Drainage Study which included HEC-HMS modeling for Cadillac Lake and the surrounding area. The model generated with this study was used with updated storage volume for the purposes of quantifying a floodplain profile affect within the area of Cadillac Lake. To update the HEC-HMS model, additional storage volume was added to the stage storage curve for detention basin “EP-P1” which represents Cadillac Lake. An additional 20,480 cubic yards (138,380 Created - 7,830 Detention - 110,070 Floodplain) is created. The 10% additional volume for floodplain and detention volume by regulation was not counted against created storage volume as the purpose of the model is to simulate the proposed condition with respect to the existing condition. Given the size of the drainage basin exceeding 2,000 acres, the projected water surface level in the 100-year 24-hour rain event is reduced by approximately 0.1’. Final calculations will be conducted upon completion of the construction documents for the proposed development. With respect to the known flooding issues in the area, this benefit to the surrounding area is a reduced risk of flooding homes and businesses in a developed and heavily populated area.

WETLANDS MITIGATION:

Geotechnical Services, Inc. (GSI) has performed a Wetlands Delineation Study for the project site. At the present time, there are 44.46 acres of uplands, 14.96 acres of wetlands, 3.21 acres of partial wetlands (at 67% level) and 9.45 acre of open water.

It is proposed to remove 4.93 acres of these wetlands and 1.86 acres of partial wetlands for development or for excavation for stormwater detention. It is further proposed that new wetlands be created in the area between the two acres of open water and in the bottom of the newly excavated area or the east side of the project (total of 5.69 acres).

Wetlands enhancement will be performed on the existing wetlands in the area between the two acres of open water and on the existing potential wetlands located on the side of the eastern body of open water.

A summary of the wetlands removed and the wetlands mitigation is as follows:

WETLANDS REMOVED

• Wetlands Removed		=	4.93 Ac.
• Partial Wetlands Removed	= 1.86 Ac. x 0.67	=	1.25 Ac.
TOTAL EQUIVALENT WETLANDS REMOVED		=	6.18 Ac.

WETLANDS MITIGATION (ON-SITE)

• Wetlands to be Enhanced	= 4.13 Ac. x 0.50	=	2.06 Ac.
• Partial Wetlands to be Enhanced	= 1.35 Ac. x 0.33	=	0.45 Ac.
• New Wetlands to be Created		=	5.69 Ac.
TOTAL EQUIVALENT WETLANDS CREATED		=	8.20 Ac.

RATIO (CREDITS / REMOVAL)	= 8.20 / 6.18	=	1.33

A permit will be prepared for U.S. Army Corps of Engineers review and approval based on the enclosed exhibits. It is proposed that the wetland area be platted as a reserve for open space, Wetlands, drainage, City park and wildlife preserve. Coordination with City of Wichita Stormwater and Parks Divisions will be done to ensure public safety and minimal require maintenance.

EXHIBIT 1 - PROJECT AREA MAP

PEC
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
303 SOUTH TOPEKA WICHITA, KS 67202
316-262-2691 www.pec1.com

PLAT/PUD

PARCEL 1	2.32 ACRES
PARCEL 2	1.40 ACRES
PARCEL 3	9.53 ACRES
PARCEL 4	1.49 ACRES
PARCEL 5	1.64 ACRES
PARCEL 6	1.31 ACRES
PARCEL 7	0.91 ACRES
PARCEL 8	1.45 ACRES
PARCEL 9	2.84 ACRES
PARCEL 10	3.60 ACRES
PARCEL 11	3.86 ACRES
RESERVE	41.73 ACRES
TOTAL	72.08 ACRES

EXISTING CONDITIONS

UPLANDS	44.46 ACRES
WETLANDS	14.96 ACRES
PARTIAL (67%) WETLANDS	3.21 ACRES
OPEN WATER	9.45 ACRES
TOTAL	72.08 ACRES

PROPOSED CONDITIONS

UPLANDS TO REMAIN	37.87 ACRES
WETLANDS TO REMAIN	5.89 ACRES
WETLANDS TO BE REMOVED	4.93 ACRES
WETLANDS TO BE ENHANCED	4.13 ACRES
WETLANDS TO BE CREATED	5.69 ACRES
OPEN WATER	9.45 ACRES
NEW OPEN WATER	0.91 ACRES
PARTIAL (67%) WETLANDS TO BE ENHANCED	1.35 ACRES
PARTIAL (67%) WETLANDS TO BE REMOVED	1.86 ACRES
TOTAL	72.08 ACRES

0 100 200
SCALE IN FEET

EXHIBIT 2 - STORMWATER EXCAVATION

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