POE & ASSOCIATES, INC.
5940 E. Central, Suite 200
Wichita, Kansas 67208

CONSULTING ENGINEERS
(316) 685-4114
FAX: (316) 685-4444

TRANSMITTAL

DATE 10/8/13	JOB NO.: 101986
TO: Mr. Scott Lindebak	
RE: Nahola Addition – Drainage Study	

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via U.S. Mail the following items:

☐ Shop drawings ☐ Prints ☒ Plans ☐ Ownership List ☐ Tract Maps

☐ Copy of letter ☐ Change order ☒ Drainage Study

NO.	DATE	COPIES	DESCRIPTION
	8-6-13	1	Preliminary Drainage Study

THESE ARE TRANSMITTED as checked below

☒ For approval ☐ Approved as submitted ☐ For your use ☐ Approved as noted

☐ As requested ☐ Approved ☐ Not Approved

☐ Other

☒ Comments: For your review and approval. The one step final plat for this development has been submitted to the planning department.

SIGNED: _____

Scott R. Servis, P.E.

POE & ASSOCIATES, INC.

NAHOLA ADDITION

DRAINAGE REPORT

SCOTT R. SERVIS
LICENSED
17374
KANSAS
PROFESSIONAL ENGINEER
10/4/13

POE & ASSOCIATES, INC.
CONSULTING ENGINEERS
5940 E. Central, Suite 200 ■ Wichita, KS 67208-4242
Phone 316/685-4114 ■ FAX 316/685-4444

OCTOBER 2013

City of Wichita/Sedgwick County
Subdivision Drainage Plan Checklist

Submit completed forms to:
City of Wichita Public Works & Utilities, 455 N. Main 8th Floor, Wichita KS 67202; or
Sedgwick County Stormwater Management, 1144 S. Seneca, Wichita KS 67213.

Project Name:	NAHOLA Addition				
Total Area of Project:	4.7 **acres**				
Development Type:	Other	**Other:**	Mixed Use P.U.D.		
Developer Name:		**Contact:**		**Phone:**	
Email:					
Engineer Name:	Poe and Associates, Inc.	**Contact:**	Scott R. Servis, P.E.	**Phone:**	(316) 685-4114
Email:	scott.servis@poeandassociates.com (5940 East Central, Suite #200, Wichita, KS 67208)				

Directions:

(1) Fill-out this checklist completely and include it with the Drainage Plan submittal. This checklist should be included in the bound copy, behind the cover sheet for the submittal. Incomplete Drainage Plans and checklists will not be accepted.

*(2) Indicate whether a plan element is included or not included in the submittal by choosing **"Yes"** or **"No"** from the dropdown list in the **"Element Included?"** column. The question must be answered for every plan element for this checklist to be considered complete. An explanation must be provided for all **"No"** answers.*

Drainage Plan Checklist

#	Plan Element Description	Element Included?	Explanation/Notes
1.0	**General**		
1.1	Digital copy of drainage plan, including preliminary Master Grading Plan, preliminary plat and proposed plat, in PDF format and one half size, bound, paper copy.		
1.2	Professional Engineer's seal, signature and date on plan cover.		
1.3	Site location map, using color ortho-imagery and showing the project boundaries, a north arrow and an accurate scale.		
1.4	Narrative of the development type, existing conditions and proposed impacts on stormwater runoff, wetlands, riparian zones and floodplains/floodways.		
1.5	Discussion of off-site conditions surrounding the proposed development.		
1.6	Summary table of runoff calculations (pre/post development).		
1.7	Narrative description of the type and function of the permanent structural stormwater management facilities.		
2.0	**Existing Conditions Information**		
2.1	**Existing Conditions Drainage Map**		
2.1.1	On-site and off-site topography: NAVD 88 datum, one-foot contours with spot elevations.		
2.1.2	On-site and off-site drainage features, including perennial and intermittent streams (with names labeled), conveyance systems such as open channels, ditches, swales and areas of overland flow. Flow direction must be indicated by arrows.		
2.1.3	Storm sewer system components, including storm drains, inlets, catch basins, gutters, manholes, headwalls, pipes and culverts. Material and size must be noted for all pipes and culverts.		
2.1.4	Location and boundaries of natural features such as wetlands, lakes, ponds with the normal water elevation noted, rock outcroppings, wooded areas and tree rows.		
2.1.5	Location, dimensions and elevations of existing bridges and culvert crossings.		
2.1.6	Location of existing utilities (e.g., water, sewer, gas, electric, cable, etc.) with labels and easement boundaries.		
2.1.7	Groundwater elevations, if applicable.		
2.1.8	Delineation of predominant soil based on USDA soil surveys and/or on-site soil borings; indicate NRCS soil name and Hydrologic Soil Group for undisturbed surface soils.		
2.1.9	Land use types per NRCS nomenclature.		
2.1.10	Footprint of existing impervious areas (labeled, area given in acres).		
2.1.11	Internal drainage subbasin boundaries used for hydrologic calculations (labeled with ID, total area in acres, impervious area in acres and curve number).		
2.1.12	Time of concentration flow paths. Indicate and label each segment separately (i.e., overland flow, shallow concentrated, channel1, channel2, etc.). For each segment, provide the appropriate data to calculate Tc (e.g., length, slope, cover type, paved/unpaved, roughness parameters, geometric properties, etc.).		
2.2	**Existing Conditions Hydrology and Hydraulics Analysis**		
2.2.1	Narrative of the hydrologic analysis methodology used (e.g., unit hydrograph or other approved methods).		

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
2.2.2	A summary table of drainage subbasin hydrologic parameters (subbasin ID, area in acres, curve number, Tc, etc.).		
2.2.3	Table of existing condition runoff curve numbers with supporting data and calculations.		
2.2.4	Table of existing condition times of concentration with supporting data and calculations.		
2.2.5	A summary table of rainfall data used in the hydrologic analysis, and a reference for the source of the data.		
2.2.6	Cross-sections and other diagrams of existing open channels, bridge and culvert sections and other hydraulic features as required to illustrate the basis for hydraulic analysis.		
2.2.7	Hydrologic and hydraulic analyses for runoff rates, volumes, velocities and elevations. Provide supporting data not specified above and identify assumptions. Include detailed calculations for the 2, 5, 10, 25 & 100-year, 24-hour storm events. Provide results in a tabular form. Provide digital copies of any computer files and models used.		
3.0	**postdevelopment Conditions Information**		
3.1	**postdevelopment Conditions Drainage Map**		
3.1.1	Proposed project boundary.		
3.1.2	on-site and off-site topography: NAVD 88 datum, one-foot contours with spot elevations.		
3.1.3	Existing on-site and off-site drainage features that are to remain after development, including perennial and intermittent streams (with names labeled), conveyance systems such as open channels, ditches, swales and areas of overland flow. Flow direction must be indicated by arrows.		
3.1.4	Location and description of off-site through-drainage conveyances which are confined to an easement, dedication and/or reserve.		
3.1.5	Footprint of proposed impervious areas, including roads, parking lots, buildings and other structures.		
3.1.6	Location of proposed utilities (e.g., water, sewer, gas, electric, cable, etc.) with labels and easement boundaries.		
3.1.7	Delineation of predominant soils, based on anticipated soil textures and NRCS guidelines if different from predevelopment soil conditions; indicate NRCS soil name and Hydrologic Soil Group for surface soils.		
3.1.8	Land use cover per NRCS nomenclature.		
3.1.9	Internal drainage subbasin boundaries used for hydrologic calculations (labeled with ID, total area in acres, impervious area in acres and curve number).		
3.1.10	Proposed limits of land disturbing activity (i.e., grading limits).		
3.1.11	Time of concentration flow paths. Indicate and label each segment separately (i.e., overland flow, shallow concentrated, channel1, channel2, etc.). For each segment, provide the appropriate data to calculate Tc (e.g., length, slope, cover type, paved/unpaved, roughness parameters, geometric properties, etc.).		
3.2	**Proposed Conveyances Map**		
3.2.1	on-site and off-site drainage features, including perennial and intermittent streams (with names labeled), proposed conveyance systems (such as open channels, ditches, swales and areas of overland flow, including backyard drainage). Flow direction must be indicated by arrows.		
3.2.2	Storm sewer system components, including storm drains, inlets, catchbasins, gutters, manholes, headwalls, pipes and culverts. Material and size must be noted for all pipes and culverts.		
3.2.3	For any subbasin or drainage area > 40 acres, show that the stormwater flow is confined to an open channel with required side benches and freeboard, or conformance to applicable policy and design requirements if partially enclosed.		
3.2.4	Location(s) of stormwater management facilities and any associated drainage easements.		
3.2.5	Proposed energy dissipaters and other channel protection devices.		
3.2.6	Location(s) and dimension(s) of proposed channel, bridge and culvert crossings.		
3.2.7	Normal pool and 100-year pool elevations for ponds and lakes.		
3.2.8	Permanent concrete outfall control structure(s) for ponds.		
3.2.9	Emergency overflow spillways and top of berm elevations for ponds and other volume/peak discharge control facilities.		
3.2.10	Floodplains, ponds, and stormwater management facilities located in reserves.		
3.3	**postdevelopment Conditions Hydrology & Hydraulics**		
3.3.1	Narrative of the hydrologic analysis methodology used (e.g., unit hydrograph or other approved methods).		
3.3.2	A summary table of drainage subbasin hydrologic parameters (subbasin ID, area in acres, curve number, Tc, etc.).		
3.3.3	Table of postdevelopment condition runoff curve numbers with supporting data and calculations.		

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
3.3.4	Table of postdevelopment condition times of concentration with supporting data and calculations.		
3.3.5	Cross-sections and other diagrams of existing open channels, bridge and culvert sections and other hydraulic features as:		
3.3.6	Hydrologic and hydraulic analyses for runoff rates, volumes, velocities and elevations. Provide supporting data not specified above and identify assumptions. Include detailed calculations for the 2, 5, 10, 25 & 100-year, 24-hour storm events. Provide results in a tabular form. Provide digital copies of any computer files and models used.		
3.3.7	Downstream peak discharge assessment (10% Rule) results and supporting data and calculations. Provide digital copies of any computer files and models used.		
3.3.8	Stage-storage-discharge or other outlet rating curves and inflow/outflow hydrographs for all ponds.		
3.3.9	Demonstrate that the pond contours on the master grading plan and the stage-storage-discharge data are consistent for all ponds.		
3.3.10	Demonstrate that all ponds have one foot of freeboard above the 100-year, 24-hour high water level.		
3.3.11	Demonstrate that runoff from the proposed project site is discharged in the same manner as prior to development, using level spreaders, energy dissipaters, other devices or grading as required, or identify an appropriate flowage easement.		
3.4	**Stormwater Quantity Control Sizing**		
3.4.1	Hydraulic sizing calculations for all stormwater management controls.		
3.4.2	Table(s) listing all stormwater management controls. Present the types, sizes, elevations, flows, velocities and depths for each control, as applicable. Verify that velocities are self-cleaning and non-erosive.		
3.4.3	Typical details (including cross-sections where applicable) for outlet structures, embankments, spillways, grade control structures, conveyance channels, etc.		
3.5	**Stormwater Quality Management Facilities**		
3.5.1	Table(s) listing all stormwater management facilities. Present the description, % TSS removal value, water quality volume handled, contributing drainage area in acres and contributing impervious area in acres.		
3.5.2	Indicate the responsible party for maintenance, as shown in the plat text (i.e., Home Owners Association, Lot Owners Association, property owner, etc.).		
3.5.3	Water quality volume (total and by facility), with supporting data and calculations.		
3.5.4	% TSS removal value (total and by facility) with supporting data and calculation. Must be equal to or greater than 80%.		
3.5.5	Channel protection volume with supporting data and calculations.		
3.5.6	Water quality volume and channel protection volume orifice size calculations.		
3.5.7	Other calculations required for each stormwater management facility as specified in the Wichita/Sedgwick County Stormwater Manual.		
3.5.8	Typical details (including cross-sections where applicable) for outlet structures, embankments, internal grading, forebays and other siltation prefilters, filtration/infiltration media, vegetation, check dams, operational controls, etc.		
4.0	**Floodplains**		
4.1	Reference the source of flood profile, floodplain, floodway and stream discharge information.		
4.2	Delineation of nearest base flood elevations.		
4.3	Delineation of predevelopment regulatory floodplain/floodway limits using FEMA's current GIS database; limits to be per elevation and scaled location.		
4.4	Delineation of postdevelopment regulatory floodplain/floodway limits; limits to be per elevation and scaled location, with project limits shown.		
4.5	Floodway data table and discharges.		
4.6	Hydrologic and hydraulic study information for local floodplain analysis, unnumbered Zone A elevation determinations and floodplain map revisions or required permits.		
4.7	Regulatory floodway and four natural profile models (10, 50, 100 and 500-year) for existing and postdevelopment conditions.		
4.8	Floodplains and floodways located within a reserve, where necessary.		
4.9	Floodplain cut and fill calculations for volume sensitive basins.		
4.10	Demonstrate that floodway elevations and velocities do not increase due to construction in the floodway ("No Rise Certification").		
5.0	**Federal, State and Local Permits**		
5.1	US Army Corps of Engineers regulatory program permits (Section 404 permit).		

Drainage Plan Checklist			
#	Plan Element Description	Element Included?	Explanation/Notes
5.2	Kansas Department of Agriculture - Division of Water Resources Permits (Stream Obstruction, Channel Change, Floodplain Fill, Levee, Water Appropriations, Dam Safety permit, etc.)		
5.3	FEMA letters of map change/revision - LOMA, LOMR, LOMR-f, CLOMR, etc., shall be included and approved when project modifies the limits of the floodplain/floodway.		
6.0	**Half Scale Preliminary Master Grading Plan**		
6.1	One set of plans and associated PDF of plans.		
6.2	Professional Engineer's seal, signature and date.		
6.3	Title block including subdivision name and phase and dated revision documentation.		
6.4	Future phases shown but cross-hatched as information only.		
6.5	Scale, not greater than 1-inch = 60 feet.		
6.6	North arrow.		
6.7	Index or legend key.		
6.8	Benchmarks (minimum of 2) used for site control (NAVD 88 vertical datum).		
6.9	Existing contours of entire site with contour interval of one foot.		
6.10	Proposed contours for channels, ponds, and other permanent stormwater management facilities, with contour interval of one foot.		
6.11	Spot elevations shown to the nearest tenth of a foot for critical locations, including lot and property boundaries.		
6.12	Proposed lot and street layout.		
6.13	Locations of underground storm drains.		
6.14	Overflow locations for storms exceeding storm drain capacity, with elevations.		
6.15	Top elevations of storm drains at all inlets, manholes, and flow line elevations for all outfalls.		
6.16	Locations of open ditches and lakes.		
6.17	Flow direction arrows.		
6.18	Proposed flow line elevations of all open ditches at maximum 100 foot intervals, and 100-year flood elevations thereon.		
6.19	Ponds: Location, bottom elevation, normal pool elevation, 100-year flood elevation, emergency overflow elevation.		
6.20	Proposed top-of-curb elevations at points where drainage will be required to flow over the curb.		
6.21	Platted minimum building opening elevation for each lot, in table form for all lots (excluding basement floor elevations).		
6.22	Standard foundation and elevation detail for slab on grade, full basement, view-out, partial view-out and/or walk-out construction.		
6.23	Top of foundation elevation for each lot.		
6.24	Notation for builders for each lot as to the type of structure that may be constructed and the view-out, walk-out or pad elevation, as applicable.		
6.25	Indicate that all lots are above the 100-year flood elevation.		
6.26	Indicate that grading around structures conforms to perimeter drainage requirements.		
6.27	Indicate that backyard drainage grading conforms to backyard drainage requirements.		
6.28	Adjacent subdivision lot lines, with lot labels and subdivision names.		
6.29	Boundaries and labels for all easements, rights-of-way and reserves.		
6.30	Statement on proposed final plat: "*A drainage plan has been developed for the subdivision and all drainage easements, rights-of-way, or reserves shall remain at the established grades and remain unobstructed to allow for the conveyance of stormwater.*"		
End of Checklist			

1.0 General Information

1.1 Drainage Plan Files

See enclosed CD and paper copies of Drainage Plan (Exhibit 1-1), Preliminary Grading Plan (Exhibit 1-2), and One-Step Final Plat (Exhibit 1-3).

1.2 Professional Engineer's Seal

Final report includes sealed and signed cover sheet along with sealed and signed final drainage plan sheet.

1.3 Site Location Map

See Exhibit 1-4 for USGS Map and 1-5 for Aerial Photo of this area. The NAHOLA Addition is a 4.69-acre tract of land located in the Southwest Quarter of Section 14-T27S-R1W in the City of Wichita, Sedgwick County, Kansas. The area is currently platted at Mission Addition to The City of Wichita, Sedgwick County, Kansas. The site is bounded on the north by Murdock Avenue, on the east by residential lots and Doris Street, on the south by Central Avenue, and on the west by residential lots and Elder Street.

1.4 Narrative of Development

The property is currently zoned to allow Single Family use and other uses allowed under a P.U.D. on file with the City of Wichita (refer to Exhibit 1-6 for Zoning information). It is anticipated that this site will be developed as a daycare and single family subdivision through a P.U.D. A proposed detention pond shall occupy the central portion of the property. Discharge shall be routed to existing storm sewer at the intersection of Central and Elder or the intersection of Elm and Doris. Overland flows in larger rainfall events will be routed to Elm Street through private drives.

Presently, the northern two-thirds of the site remains vacant prior to any future development, with the southern one-third occupied by an existing day care facility. As shown in the Drainage Plan (Exhibit 1-1), the drainage consists of two primary areas. Run-off from the property traverses over land routes to the adjacent Central Avenue Right-of-Way before discharging to the Big Ditch to the west. Off-site runoff drains to existing roadway ditches in Elder, Doris and Murdock Streets and is routed around the site to the north, west and east through roadside ditches. Off-site runoff to the south drains to existing storm sewer in Central Avenue and is routed to the big ditch to the west. According to the NRCS Soil Survey, the predominant soil type within the property is Urban land-Canadian Complex series material. See Exhibit 1-8 for NRCS Soil Survey map and information showing existing soil types and descriptions.

The site is levee protected and lies east of a FEMA Floodway (refer to Exhibit 1-9 for FIRM Panel 335, Wichita, Sedgwick County, Kansas, February 2, 2007. No impact on storm water

shall be addressed in the summary of runoff calculations text. The site does not contain wetland or riparian areas, and thus the development has no impact in that regard.

1.5 Discussion of Off-Site Conditions

Single-family areas are located directly east, west and north of this site. Limited Commercial uses lie to the south (See Exhibit 1-6). The original, modern land use for the site was a mixture of limited commercial and undeveloped uses.

Total developed on-site drainage area equals 4.69 acres. The site development would route off-site drainage around the site through a series of existing ditches in Murdock, Elder and Doris Streets and existing storm sewer in Central Avenue. Land use within the drainage basins varies between open space, single family and commercial in character. The existing grades convey storm water away from the subject property. Storm water is presently conveyed off-site through the previously discussed storm water sewer systems and overland flow channels (See Exhibit 1-1).

1.6 Summary of Runoff Calculations

	OS-1 Existing Conditions (24-Hour Storm)						OS-1 Proposed Conditions (24-Hour Storm)					
	CN= 75.0		Tc(min)= 16.9		Area(Ac)= 1.74		CN= 75.0		Tc(min)= 16.9		Area(Ac)= 1.74	
	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
Flow (cfs)	1.68	2.7	4.2	5.4	7.05	9.58	1.68	2.7	4.2	5.4	7.05	9.58

	OS-2 Existing Conditions (24-Hour Storm)						OS-2 Proposed Conditions (24-Hour Storm)					
	CN= 75.0		Tc(min)= 16.9		Area(Ac)= 1.61		CN= 75.0		Tc(min)= 16.9		Area(Ac)= 1.61	
	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
Flow (cfs)	1.55	2.49	3.89	4.99	6.52	8.67	1.55	2.49	3.89	4.99	6.52	8.67

	OS-3 Existing Conditions (24-Hour Storm)						OS-3 Proposed Conditions (24-Hour Storm)					
	CN= 75.0		Tc(min)= 23.8		Area(Ac)= 0.57		CN= 75.0		Tc(min)= 23.8		Area(Ac)= 0.57	
	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
Flow (cfs)	0.46	0.74	1.15	1.48	1.94	2.64	0.46	0.74	1.15	1.48	1.94	2.64

	OS-4 Existing Conditions (24-Hour Storm)						OS-4 Proposed Conditions (24-Hour Storm)					
	CN= 75.0		Tc(min)= 18.3		Area(Ac)= 0.66		CN= 75.0		Tc(min)= 18.3		Area(Ac)= 0.66	
	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
Flow (cfs)	0.46	0.74	1.15	1.48	1.94	2.64	0.46	0.74	1.15	1.48	1.94	2.64

	Area "A" Existing Conditions (24-Hour Storm)						Area "A" Proposed Conditions (24-Hour Storm)					
	CN= 69.0		Tc(min)= 88.3		Area(Ac)= 3.12		CN= 85.0		Tc(min)= 31.6		Area(Ac)= 3.12	
	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
Flow (cfs)	0.62	1.15	2.00	2.70	3.70	5.28	3.93	5.58	7.86	9.58	11.89	15.36

	Area "B" Existing Conditions (24-Hour Storm)						Area "B" Proposed Conditions (24-Hour Storm)					
	CN= 92.0		Tc(min)= 8.3		Area(Ac)= 1.62		CN= 92.0		Tc(min)= 8.3		Area(Ac)= 1.62	
	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
Flow (cfs)	5.12	6.72	8.85	10.44	12.54	15.67	5.12	6.72	8.85	10.44	12.54	15.67

Using the SCS Method, calculations were made to determine the existing flows from this site. Both the existing and proposed site drainage consists of two areas as shown on the attached Drainage Plan, Exhibit 1-1. Off-site drainage is considered, and shall be routed around the north and east property line through a series of existing ditches and does not enter this study site. Each area is evaluated based on existing and proposed conditions.

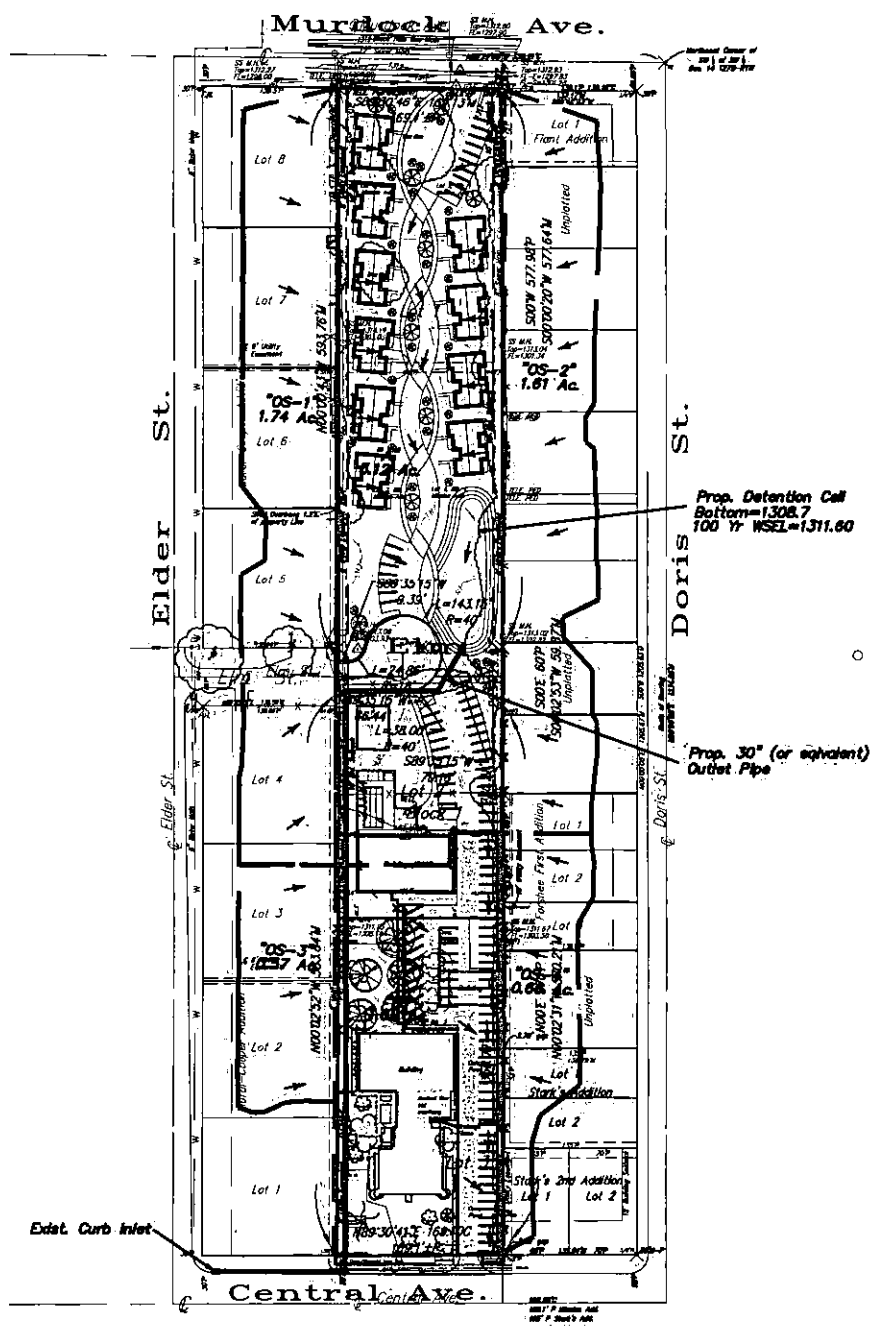
Off-site time of concentration was estimated for all separated drainage areas as shown in the table above. The OS-1 area's T_c was estimated to be approximately 16.9 minutes based upon the TR-55 method. This T_c does not change for the post-developed condition as this basin in already developed. The OS-2 area's T_c was estimated to be approximately 16.9 minutes based upon the TR-55 method. This T_c does not change for the post-developed condition as this basin in already developed. The OS-3 area's T_c was estimated to be approximately 23.8 minutes based upon the TR-55 method. This T_c does not change for the post-developed condition as this basin in already developed. The OS-4 area's T_c was estimated to be approximately 18.3 minutes based upon the TR-55 method. This T_c does not change for the post-developed condition as this basin in already developed. On-site time of concentration was estimated for all separate drainage areas as shown in the summary table above as well. The Area "A" area's T_c was estimated to be approximately 88.3 minutes based upon the TR-55 method and that becomes 31.6 minutes for the post-developed condition. The Area "B" area's T_c was estimated to be approximately 8.3 minutes based upon the TR-55 method. This T_c does not change for the post-developed condition as this basin in already developed. On-site detention to meet storage requirements as shown on the drainage plan shall be designed for the final development. It is assumed that immediate downstream capacities are adequate to handle current flows leaving this site. The final design of on-site drainage systems shall comply with current City of Wichita design criteria.

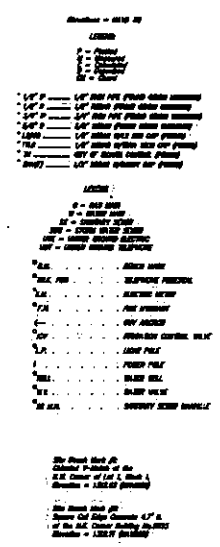
1.7 Narrative Description of Permanent Best Management Practices

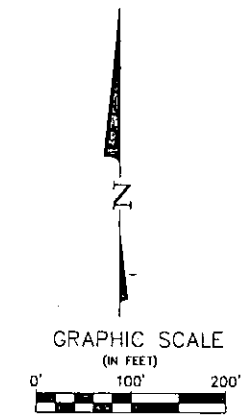
The contractor shall provide stabilized construction entrance prior to any street paving. A buffer of 10 feet of undisturbed native vegetation shall be maintained around perimeter of site where possible. Earthwork stockpiles shall be maintained away from any ponds. Fuel storage and refueling of equipment shall not be allowed around any ponds, drainage channels, or other waterways. Sediment barriers will be placed at storm sewer inlets and rock rip-rap at outlets. Sediment barriers (type determined by owner or contractor) shall be used to prevent sediment from flowing off site. Disturbed earth shall be stabilized where construction activity ceases for at least 14 days with owner's choice of mulch, temporary seed (Rye grass) during the planting season or other suitable BMP device. BMP devices shall be in place until there is a good stand of grass. Disturbed portions of the site where construction activities permanently cease shall be stabilized with permanent seed no later than 14 days after the last construction activity in that area (during the planting season only). The permanent seed shall consist of fescue or grass chosen by the owner. BMP devices shall be used at back of curb/edge of pavement until vegetation is 75% established.

NAHOLA ADDITION

EXHIBIT 1-1







NOTES:

1. Cross-drainage agreements shall be required at the time of platting.
2. All outlets to Elder Street, Elm Street, Murdock and Central Avenue or other off site areas shall conform to City of Wichita water quality requirements.
3. Detailed site grading and final drainage plans to be designed by a licensed professional engineer at the time of building permit.
4. Storm sewer easements will be provided at the time of building permit only as needed to allow drainage to discharge across adjacent lots.
5. Any revised drainage plan must be approved by storm water engineer prior to building permits being issued.
6. Any storm water detention areas required may be revised when the final plans for the development are completed but the runoff amounts will be at or below the pre-development discharge rates. The filed final drainage report shall show discharge rates and stage/storage/discharge curves for any on-site detention areas.
7. The detention pond as shown is proposed. The final pond location, configuration, and design will need to be resolved at the time of building permit.
8. A drainage reserve or easement for the proposed detention cell will be dedicated by Separte Instrument during final site design.

CALCULATION NOTES:

1. Determination of Q's was made using the SCS method.
2. Curve Numbers weighted based on hydrologic soil groups.

Existing Conditions (24-Hour Storm)								
Site	Area	CN	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
Area "OS-1"	1.74	75.0	1.68	2.70	4.20	5.40	7.05	9.58
Area "OS-2"	1.61	75.0	1.55	2.49	3.89	4.99	6.52	8.67
Area "OS-3"	0.57	75.0	0.46	0.74	1.15	1.48	1.94	2.64
Area "OS-4"	0.65	75.0	0.46	0.74	1.15	1.48	1.94	2.64
Area "A"	3.12	69.0	0.62	1.15	2.00	2.70	3.70	5.28
Area "B"	1.62	92.0	5.12	6.72	8.85	10.44	12.54	15.67

Proposed Conditions (24-Hour Storm)								
Site	Area	CN	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
Area "OS-1"	1.74	75.0	1.68	2.70	4.20	5.40	7.05	9.58
Area "OS-2"	1.61	75.0	1.55	2.49	3.89	4.99	6.52	8.67
Area "OS-3"	0.57	75.0	0.46	0.74	1.15	1.48	1.94	2.64
Area "OS-4"	0.65	75.0	0.46	0.74	1.15	1.48	1.94	2.64
Area "A"	3.12	85.0	3.93	5.58	7.86	9.58	11.89	15.36
Area "B"	1.62	92.0	5.12	6.72	8.85	10.44	12.54	15.67

Stage-Storage Discharge Table		
Stage (elev)	Storage (acre-ft)	Discharge (cfs)
1308.70	0.000	0.000
1309.00	0.038	0.625
1310.00	0.180	9.485
1311.00	0.353	17.930
1312.00	0.556	28.890

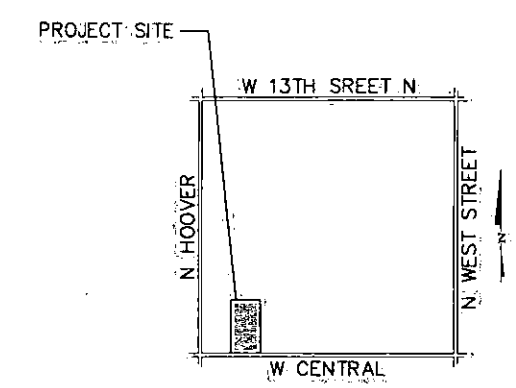
BENCH MARKS

SBM #1:
Chiseled V-Notch at the NW corner of Lot 1, Block 1

Elevation= 1312.62 (NAVD88)

SBM #2:
Square Cut on edge of concrete 4.7' N of the NE corner of building no. 5223

Elevation= 1312.11 (NAVD88)



LOCATION MAP
No Scale

NAHOLA ADDITION

A TRACT IN SECTION 14-T27S-R1W
WICHITA, SEDGWICK COUNTY, KANSAS

PROPOSED DRAINAGE PLAN

2013

PROPERTY OWNER/ SUBDIVIDER:

DONALDSON-LOESCHER LIVING TRUST
5226 W. CENTRAL AVENUE
WICHITA, KS 67212
(316) 978-9220

POE & ASSOCIATES, INC.
5940 E. Central, Suite 200 □ Wichita, KS 67208-4242
Phone 316/685-4114 □ FAX 316/685-4444

NAHOLA ADDITION

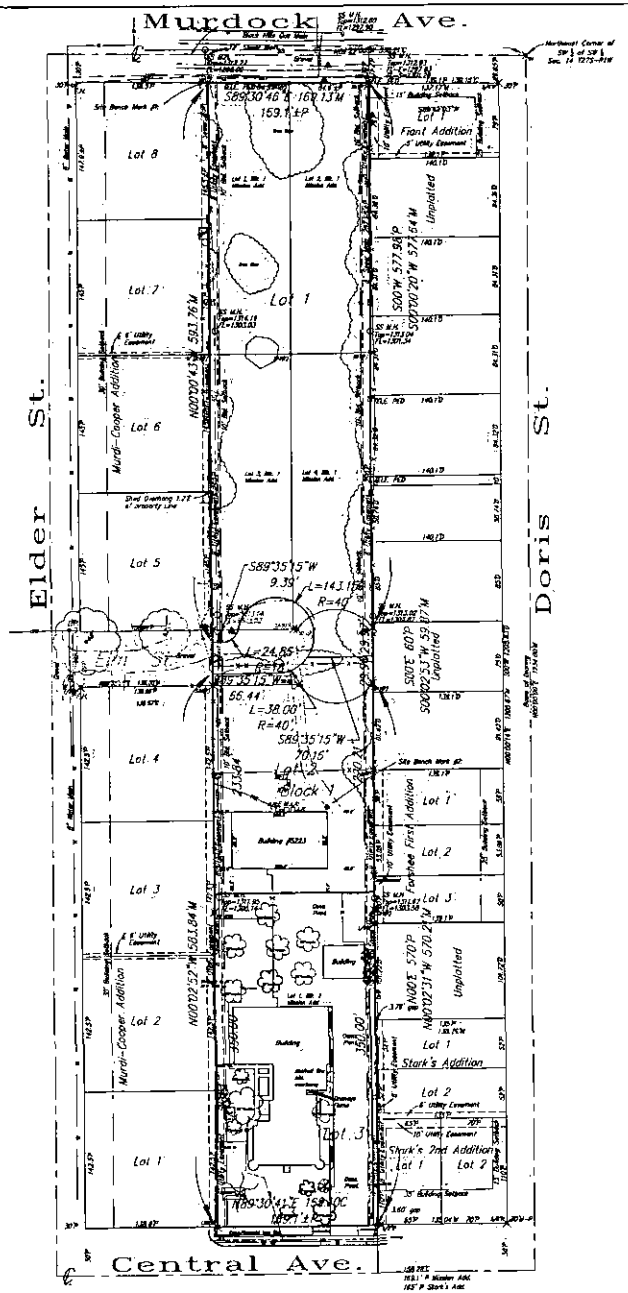
EXHIBIT 1-2

A master grading plan will be developed and submitted for approval once site selection is better defined.

NAHOLA ADDITION

EXHIBIT 1-3

ONE STEP FINAL PLAT OF
NAHOLA ADDITION
WICHITA, SEDGWICK COUNTY, KANSAS



GRAPHIC SCALE

(IN FEET)
1 inch = 60 feet

N

LEGEND:

B = Bearing
M = Measured
P = Platted
D = Described
CH = Chord

* 1/2" IP _____ 1/2" IRON PIPE (FOUND ORIGIN UNKNOWN)
* 1/2" R _____ 1/2" REBAR (FOUND ORIGIN UNKNOWN)
* 3/4" IP _____ 3/4" IRON PIPE (FOUND ORIGIN UNKNOWN)
* 5/8" R _____ 5/8" REBAR (FOUND ORIGIN UNKNOWN)
* LS660 _____ 1/2" REBAR W/LS 660 CAP (FOUND)
* PE3 _____ 1/2" REBAR W/PE3 ROH CAP (FOUND)
* By _____ CITY OF WICHITA CONTROL (FOUND)
* SMITH _____ 1/2" REBAR W/SMITH CAP (FOUND)

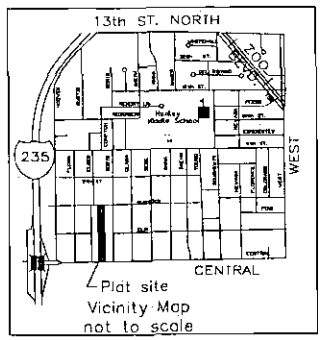
LEGEND

G = GAS MAIN
W = WATER MAIN
SAS = SANITARY SEWER
UGE = UNDER GROUND ELECTRIC
UGT = UNDER GROUND TELEPHONE

B.M. — BENCH MARK
TELE. PED — TELEPHONE PEDESTAL
E.M. — ELECTRIC METER
F.H. — FIRE HYDRANT
S.V. — SUT ANCHOR
I.C.V. — IRRIGATION CONTROL VALVE
L.P. — LIGHT POLE
P — POWER POLE
WELL — WATER WELL
W.V. — WATER VALVE
S.S. M.H. — SANITARY SEWER MANHOLE

Site Bench Mark #1:
Chiseled in-Section of the N.W. Corner of Lot 1, Block 1,
Elevation = 1312.02 (NAVD88)

Site Bench Mark #2:
Square Cut Edge Concrete 4.7' N. of the S.E. Corner Building No.5223
Elevation = 1312.11 (NAVD88)



State of Kansas)
Sedgwick County) SS

I, the undersigned Licensed Land Surveyor in aforesaid county and state, do hereby certify that, under the supervision of the undersigned, we, Poe & Associates, Inc., have surveyed and platted "NAHOLA ADDITION", Wichita, Sedgwick County Kansas and that the accompanying plat is a true and correct exhibit of the property surveyed, described as follows:

All of Lots 1, 2, 3 and 4, Block 1, and Lot 1, Block 2, all in Mission Addition to Wichita, Kansas, ALSO, The vacated Elm Street right-of-way.

Existing public dedications, rights-of-way, and easements being vacated by virtue of K.S.A. 17-5120(j), as amended.

LICENSED LS-798 KANSAS WILLIAM P. FOX

_____, Surveyor
William P. Fox #798
Poe & Associates, Inc.

State of Kansas)
Sedgwick County) SS

Know all men by these presents that we, the undersigned, have caused the land described in the surveyor's certificate to be replatted into Lots and a Block to be known as "NAHOLA ADDITION", Wichita, Sedgwick County, Kansas. Rights-of-way as shown are hereby dedicated to the public for road purposes. Access openings shall be in accordance with minimum spacing requirements of the Wichita/Sedgwick County Access Management Standards unless otherwise noted. A drainage plan has been developed for the plat. All drainage easements, rights-of-way, or reserves shall remain of established grades or as modified with the approval of the City Stormwater Engineer to allow the unobstructed conveyance of stormwater. The drainage plan is on file with the City Stormwater Engineer.

Owner, _____
Nancy J. Loescher

Owner, Donaldson-Loescher Living Trust

By _____
Nancy J. Loescher

Title, Managing Member

State of Kansas)
Sedgwick County) SS

The foregoing instrument acknowledged before me, this

_____ day of _____ 2013, by Nancy J. Loescher.

_____ Notary Public

My Ap't. Exp. _____

State of Kansas)
Sedgwick County) SS

The foregoing instrument acknowledged before me, this

_____ day of _____ 2013, by _____

Managing Member, Donaldson-Loescher Living Trust.

_____ Notary Public

My Ap't. Exp. _____

State of Kansas)
Sedgwick County) SS

We, the undersigned holders of a mortgage on the above described property, do hereby consent to the plat of "NAHOLA ADDITION, WICHITA, SEDGWICK COUNTY, KANSAS".

Bank of America, N.A.

_____ _____
Title

State of Kansas)
Sedgwick County) SS

The foregoing instrument acknowledged before me, this

_____ day of _____ 2013, by _____

_____ of Bank of America, N.A., on behalf of the Bank.

_____ Notary Public

My Ap't. Exp. _____

This plat of "NAHOLA ADDITION", Wichita, Sedgwick County, Kansas has been submitted to and approved by the Wichita-Sedgwick County Metropolitan Area Planning Commission, Wichita, Kansas.

Dated this _____ day of _____, 2013.

Wichita-Sedgwick County Metropolitan Area Planning Commission

By _____ Chair
Don Klaumeyer

Attest _____ Secretary
John L. Schlegel

This plat approved and all dedications shown hereon, accepted by the City Council of the City of Wichita, Kansas, this _____ day of _____, 2013.

At the Direction of the City Council

_____ Mayor
Carl Brewer

Attest _____ City Clerk
Karen Sublett

Reviewed in accordance with K.S.A. 58-2005

this _____ day of _____, 2013

_____ Deputy County Surveyor
Sedgwick County Kansas
Travis L. Rickelle, LS #246

Entered on the transfer record

this _____ day of _____, 2013

_____ County Clerk
Kelly B. Arnold

State of Kansas)
Sedgwick County) SS
This is to certify that this plat has been filed for record in the office of the Register of Deeds, this _____ day of _____, 2013, at _____ o'clock M and is duly recorded.

_____ Register of Deeds
Bill Meek

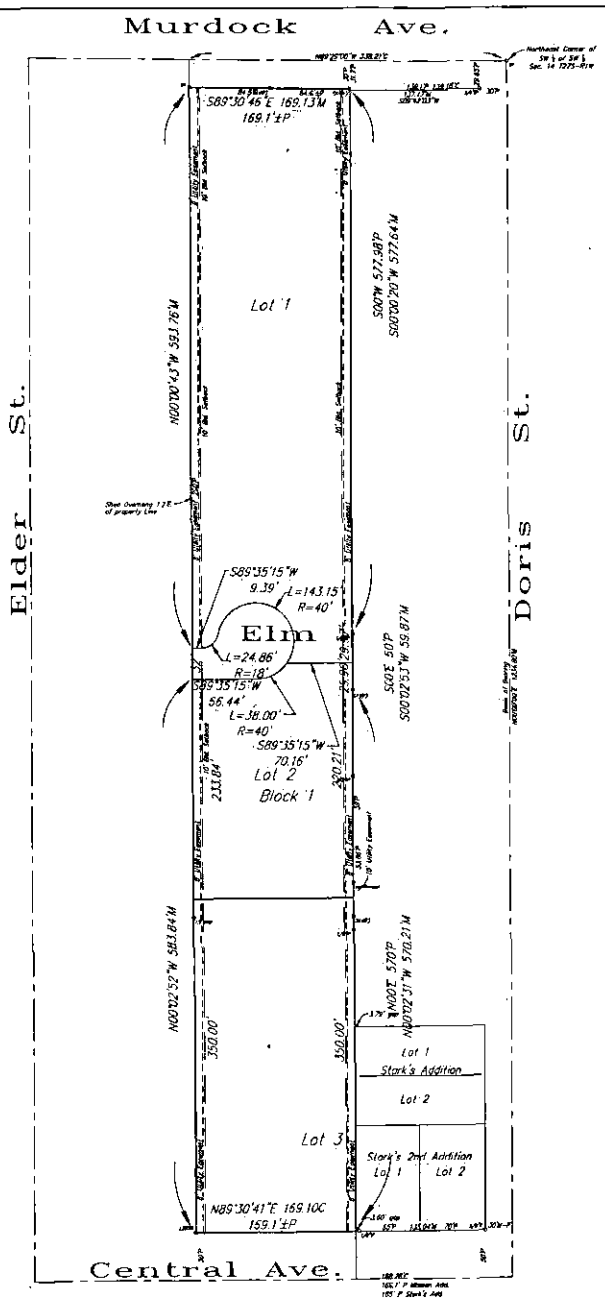
_____ Deputy
Tanya Buckingham

ELEVATIONS = NAVD88

Minimum Low Opening Elevation		
Lot	Block	Elevation
1, 2 & 3	1	1313.50

POE & ASSOCIATES, INC.
CONSULTING ENGINEERS
5940 E. Central, Suite 200 • Wichita, KS 67208-4242
Phone 316/685-4114 • FAX 316/685-4444
F:\APPS\DCA\P\101986\Plat.dwg
Plat Date:10/1/2013

ONE STEP FINAL PLAT OF
NAHOLA ADDITION
WICHITA, SEDGWICK COUNTY, KANSAS



GRAPHIC SCALE

(IN FEET)
1 inch = 50 feet

N

LEGEND

P - Platted
M - Measured
C - Calculated
D - Described
CH - Chord

1/2" IP	1/2" IRON PIPE (FOUND ORIGIN UNKNOWN)
1/2" R	1/2" REBAR (FOUND ORIGIN UNKNOWN)
3/4" IP	3/4" IRON PIPE (FOUND ORIGIN UNKNOWN)
5/8" R	5/8" REBAR (FOUND ORIGIN UNKNOWN)
LS688	1/2" REBAR W/AL5 688 CAP (FOUND)
TRS	1/2" REBAR W/TRS 8101 CAP (FOUND)
IN	CITY OF WICHITA CONTROL (FOUND)
SW(P)	1/2" REBAR W/SURVEY CAP (FOUND)

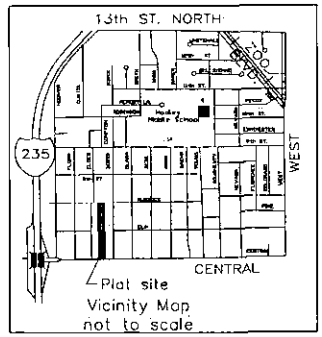
LEGEND

G - GAS MAIN
W - WATER MAIN
SS - SANITARY SEWER
SWS - STORM WATER SEWER
UGE - UNDER GROUND ELECTRIC
UGT - UNDER GROUND TELEPHONE

BM	BENCH MARK
TELE. PED	TELEPHONE PEDESTAL
EM	ELECTRIC METER
FH	FIRE HYDRANT
A	GUY ANCHOR
IRV	IRRIGATION CONTROL VALVE
LP	LIGHT POLE
PP	POWER POLE
WELL	WATER WELL
WV	WATER VALVE
SS M.H.	SANITARY SEWER MANHOLE

Site Bench Mark #1
Chiseled X-Hatch at the
N.W. Corner of Lot 1, Block 1.
Elevation = 1312.82 (NAVD88)

Site Bench Mark #2
Square Cut Edge Concrete 4.7' N.
of the N.E. Corner Building No.1223
Elevation = 1312.11 (NAVD88)



State of Kansas)
Sedgwick County(s) SS

I, the undersigned Licensed Land Surveyor in aforesaid county and state, do hereby certify that, under the supervision of the undersigned, we, Poe & Associates, Inc., have surveyed and platted "NAHOLA ADDITION", Wichita, Sedgwick County, Kansas and that the accompanying plat is a true and correct exhibit of the property surveyed, described as follows:

All of Lots 1, 2, 3 and 4, Block 1, and, Lot 1, Block 2, all in Mission Addition to Wichita, Kansas, ALSO, The vacated Elm Street right-of-way.

Existing public dedications, rights-of-way, and easements being vacated by virtue of K.S.A. 12-512(b), as amended.

LICENSED LS-700 KANSAS LAND SURVEYOR

_____, Surveyor
William P. Fox #791
Poe & Associates, Inc.

State of Kansas)
Sedgwick County(s) SS

Know all men by these presents that we, the undersigned, have caused the land described in the surveyor's certificate to be replatted into Lots and a Block to be shown as "NAHOLA ADDITION", Wichita, Sedgwick County, Kansas. Rights-of-way as shown are hereby dedicated to the public for road purposes. Access openings shall be in accordance with minimum spacing requirements of the Wichita/Sedgwick County Access Management Standards unless otherwise noted. A drainage plan has been developed for the plat. All rights-of-way, shall remain at established grades or as modified with the approval of the City Stormwater Engineer to allow the unobstructed conveyance of stormwater. The drainage plan is on file with the City Stormwater Engineer.

Owner, _____
Nancy J. Loescher

Owner, Donaldson-Loescher Living Trust

By, _____
Nancy J. Loescher

Title, Managing Member

State of Kansas)
Sedgwick County) SS

The foregoing instrument acknowledged before me, this

_____ day of _____, 2013, by Nancy J. Loescher.

_____ Notary Public

My App't. Exp. _____

State of Kansas)
Sedgwick County) SS

The foregoing instrument acknowledged before me, this

_____ day of _____, 2013, by _____

Managing Member, Donaldson-Loescher Living Trust.

_____ Notary Public

My App't. Exp. _____

State of Kansas)
Sedgwick County) SS

We, the undersigned holders of a mortgage on the above described property, do hereby consent to the plat of "NAHOLA ADDITION, WICHITA, SEDGWICK COUNTY, KANSAS".

Bank of America, N.A.

_____ _____
Title

State of Kansas)
Sedgwick County) SS

The foregoing instrument acknowledged before me, this

_____ day of _____, 2013, by _____

_____ of Bank of America, N.A., on behalf of the Bank.

_____ Notary Public

My App't. Exp. _____

This plat of "NAHOLA ADDITION", Wichita, Sedgwick County, Kansas has been submitted to and approved by the Wichita-Sedgwick County Metropolitan Area Planning Commission, Wichita, Kansas.

Dated this _____ day of _____, 2013.

Wichita-Sedgwick County Metropolitan Area Planning Commission

By _____ Chair
Dan Kleweneyer

Attest _____ Secretary
John L. Schlegel

This plat approved and all dedications shown hereon, accepted by the City Council of the City of Wichita, Kansas, this _____ day of _____, 2013.

At the Direction of the City Council

_____ Mayor
Carl Brewer

Attest _____ City Clerk
Karen Sublett

Reviewed in accordance with K.S.A. 58-2005

this _____ day of _____, 2013.

_____ Deputy County Surveyor
Sedgwick County Kansas
Ricki L. Robello, LS #1246

Entered on the transfer record

this _____ day of _____, 2013.

_____ County Clerk
Kelly B. Arnold

State of Kansas)
Sedgwick County) SS
This is to certify that this plat has been filed for record in the office of the Register of Deeds, this _____ day of _____, 2013, at _____ o'clock _____ M and is duly recorded.

_____ Register of Deeds
Bill Weak

_____ Deputy
Tonya Buckingham

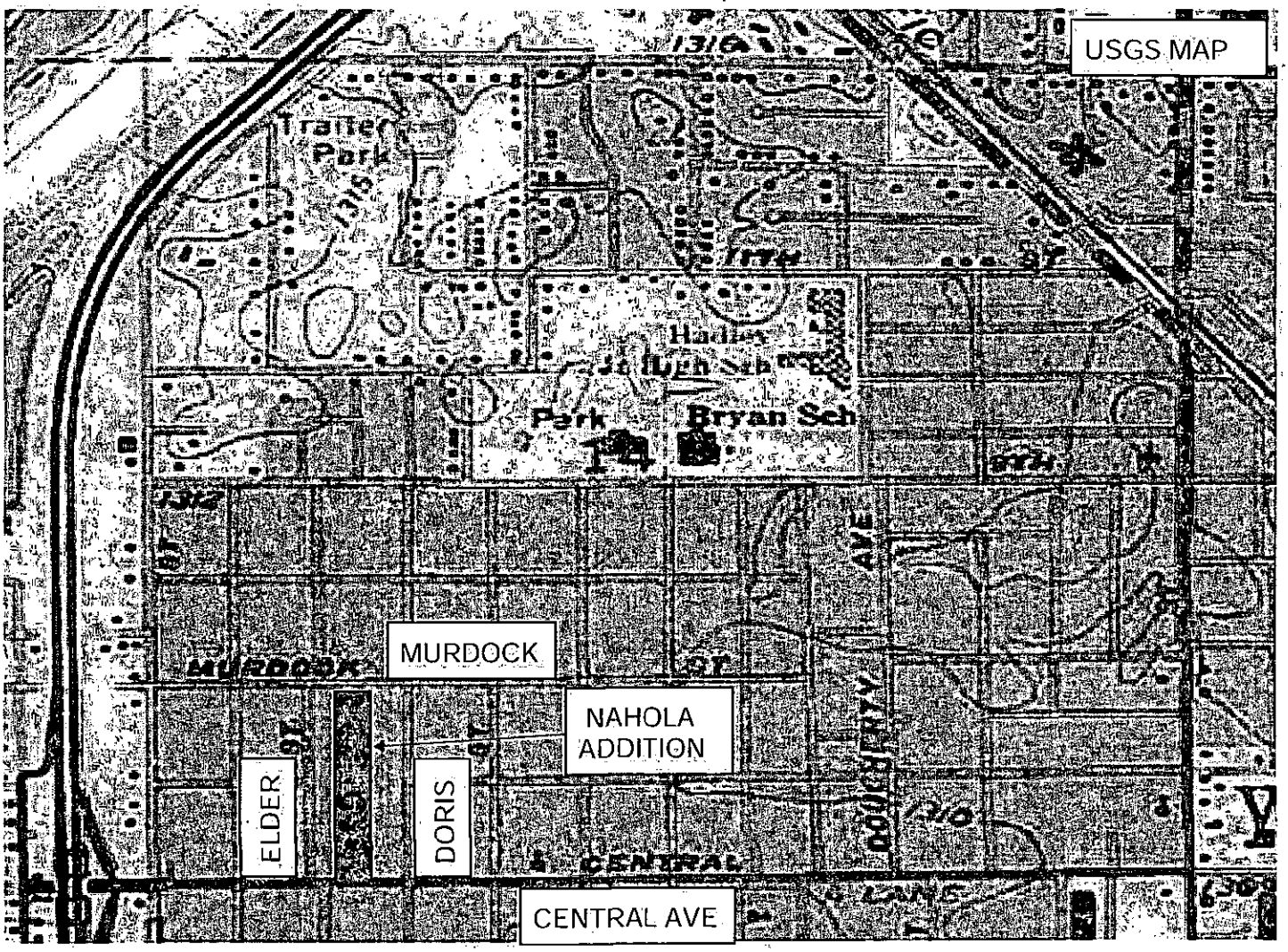
ELEVATIONS - NAVD88

Minimum Low Opening Elevation		
Lot	Block	Elevation
1, 2 & 3	1	1,313.50

POE & ASSOCIATES, INC.
CONSULTING ENGINEERS
5840 E. Central, Suite 200 • Wichita, KS ; 67208-4242
Phone 316/685-4114 • FAX 316/685-4444
F:\APPS\DCA\P\101986\Plat.dwg
Plat Date:10/1/2013

NAHOLA ADDITION

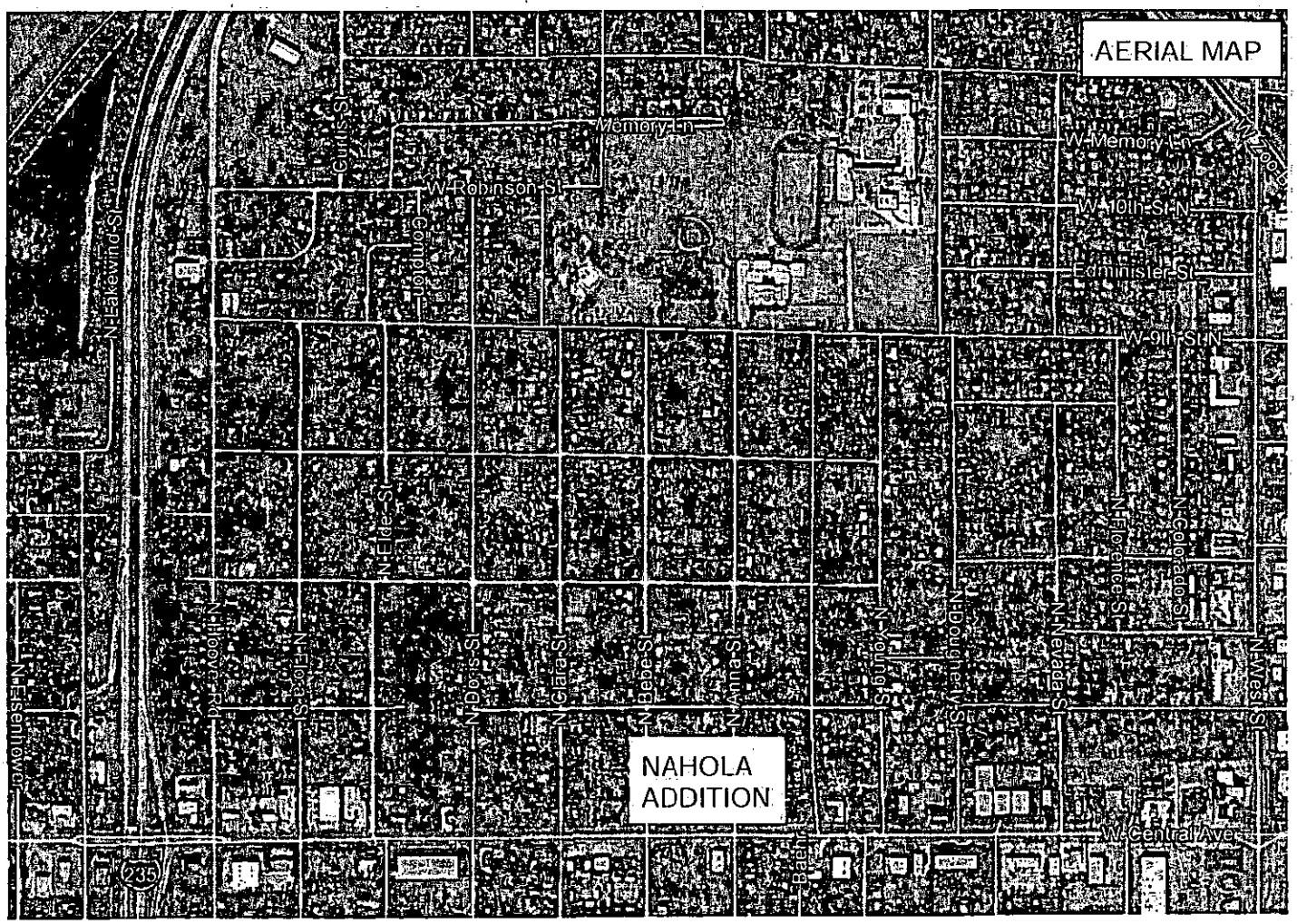
EXHIBIT 1-4



POE & ASSOCIATES, INC.
CONSULTING ENGINEERS
5940 E. Central, Suite 200 ■ Wichita, KS 67208-4242
Phone 316/685-4114 ■ FAX 316/685-4444

NAHOLA ADDITION

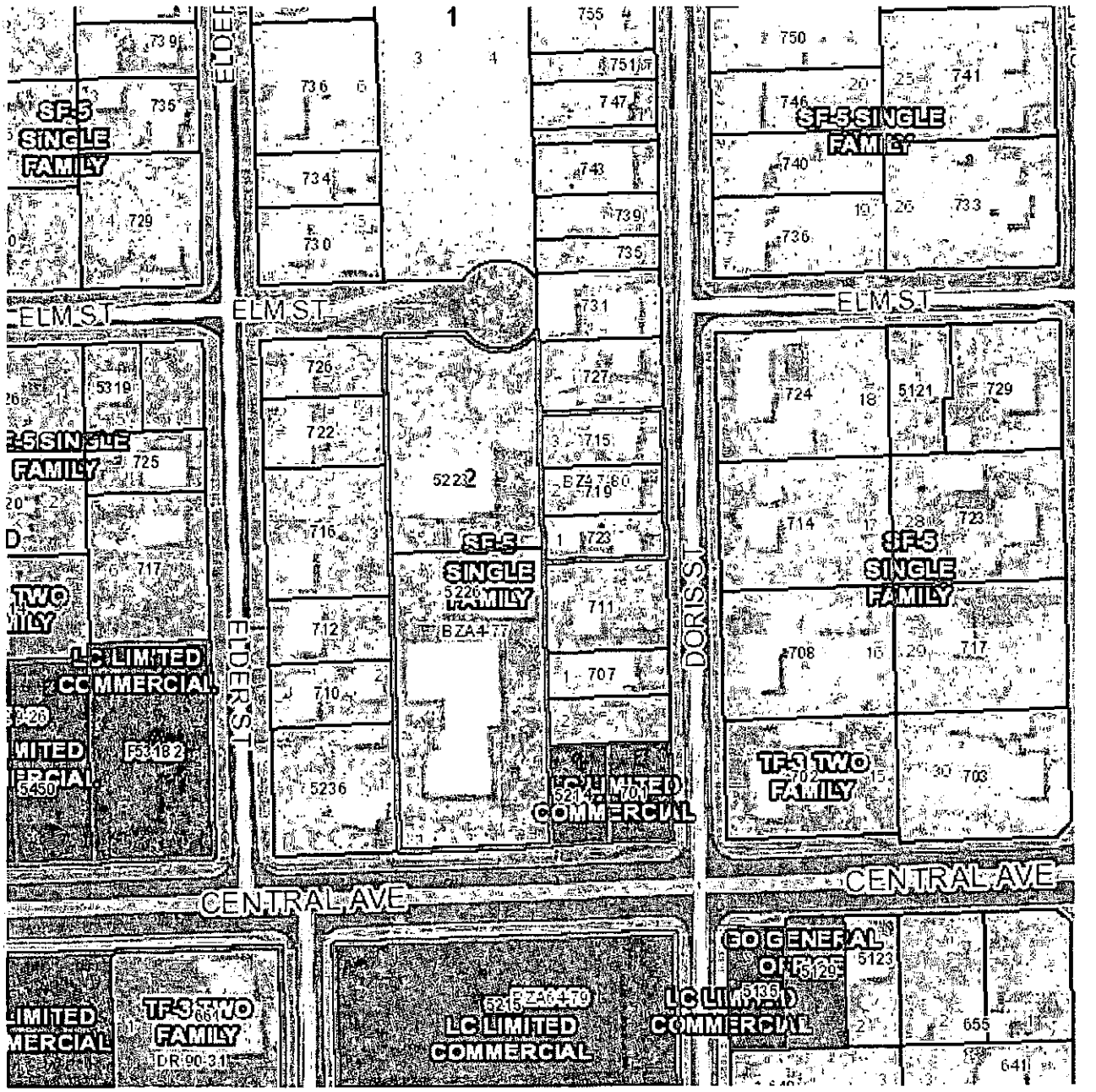
EXHIBIT 1-5



POE & ASSOCIATES, INC.
CONSULTING ENGINEERS
5940 E. Central, Suite 200 ■ Wichita, KS 67208-4242
Phone 316/685-4114 ■ FAX 316/685-4444

NAHOLA ADDITION

EXHIBIT 1-6

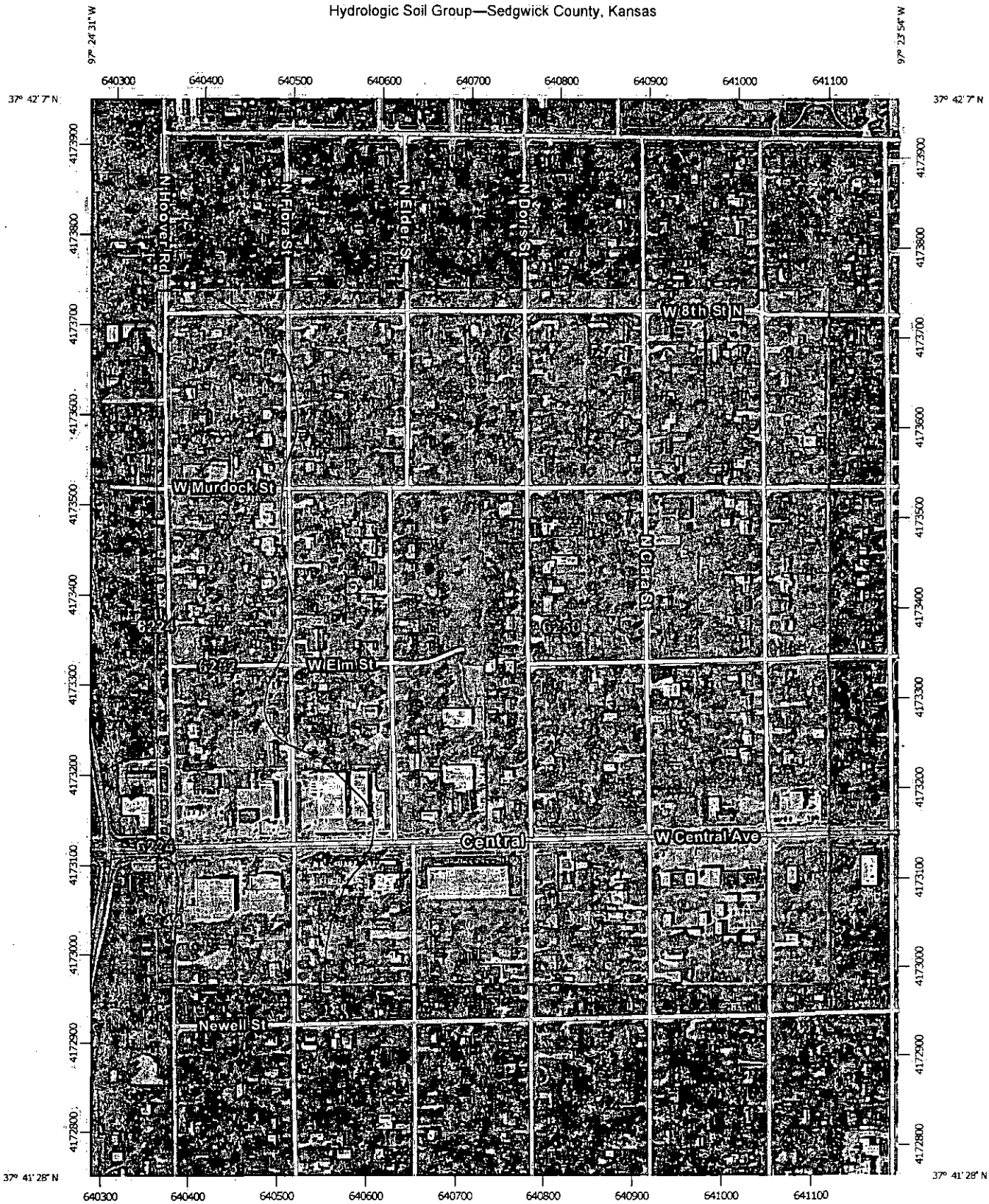

1
ELM ST
ELDER ST
DORIS ST
CENTRAL AVE
SF-5 SINGLE FAMILY
LC LIMITED COMMERCIAL
TF-3 TWO FAMILY
GO GENERAL OFFICE
BZA 4-77
BZA 4-79
DR 90-31

NAHOLA ADDITION

EXHIBIT 1-7

NAHOLA ADDITION

EXHIBIT 1-8



Map Scale: 1:5,850 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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 8, Sep 20, 2012

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 18, 2010—Sep 27, 2011

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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Sedgwick County, Kansas (KS173)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
6224	Canadian fine sandy loam, rarely flooded	B	0.1	0.1%
6244	Elandco silt loam, rarely flooded	B	0.8	0.5%
6250	Urban land-Canadian complex, 0 to 3 percent slopes		113.2	78.2%
6252	Urban land-Elandco complex, 0 to 1 percent slopes		30.6	21.2%
Totals for Area of Interest			**144.7**	**100.0%**

Description

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.

Rating Options

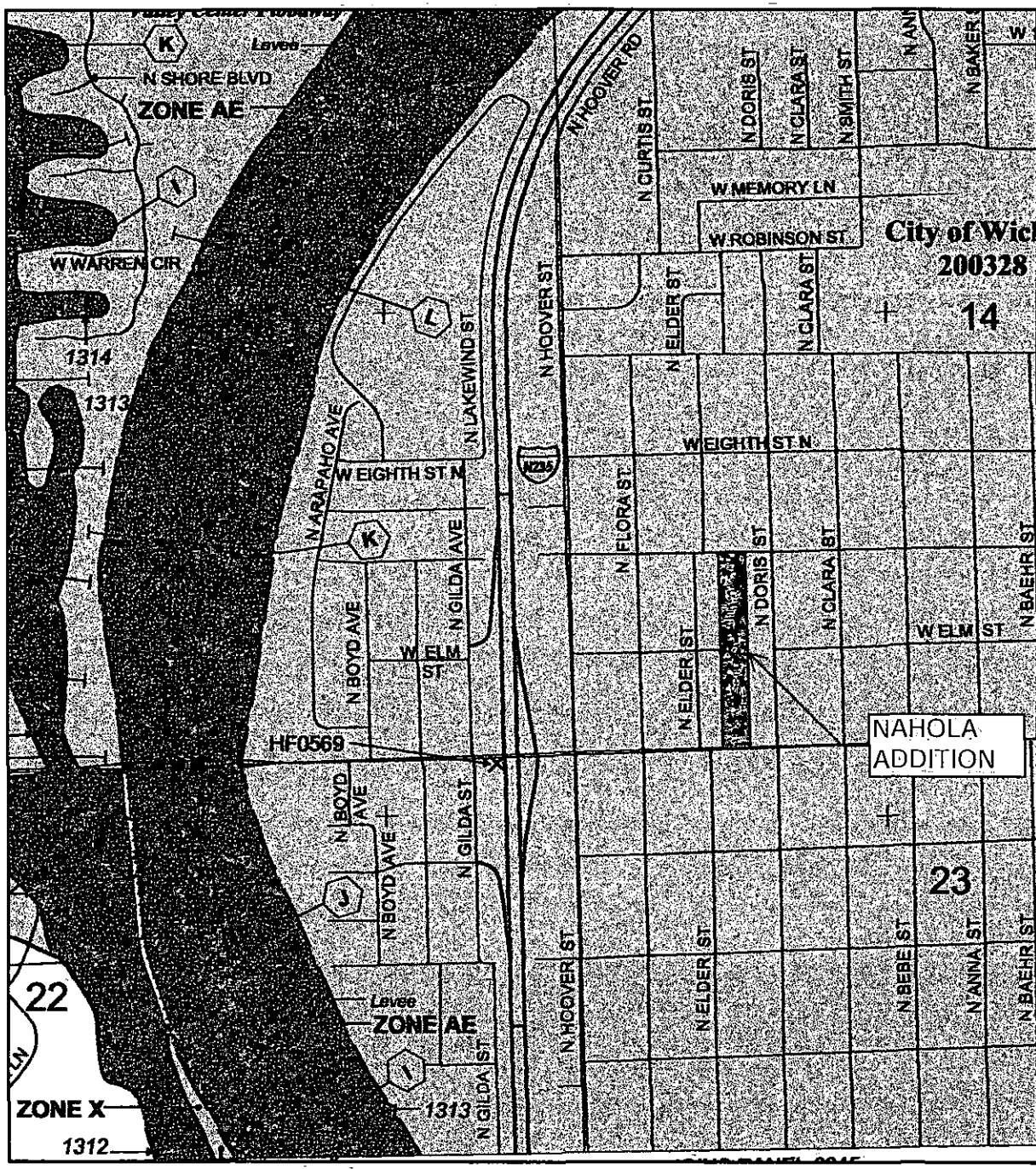
Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

NAHOLA ADDITION

EXHIBIT 1-9



MAP SCALE 1" = 1000'

1000 2000 FEET

0 300 600 METERS

PANEL 0335E

FIRM

FLOOD INSURANCE RATE MAP

SEDGWICK COUNTY, KANSAS

AND INCORPORATED AREAS

PANEL 335 OF 700

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SEDGWICK COUNTY	200321	0335	E
WICHITA, CITY OF	200328	0335	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
20173C0335E

EFFECTIVE DATE
FEBRUARY 2, 2007

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

2.0 Existing Conditions Information

2.1 Existing Conditions Drainage Map

See Existing Conditions Drainage Map on Exhibit 2-1.

2.1.1 On-Site and Off-Site Topography

The existing topography is shown on Exhibit 2-1.

2.1.2 On-Site and Off-Site Drainage Features

Exhibit 2-1 shows any water features within the site.

2.1.3 Storm Sewer System Components

Flow within the site is carried by overland flow, of which a majority is sheet flow, as well as a proposed private storm sewer system. Roadway ditches along the north and south side of Murdock Street drain this street to roadway ditches in Elder and Doris Street. Flow in Central Avenue is contained by a piped storm sewer system and the roadway itself. This flow ultimately discharges into the Big Ditch west of the site.

2.1.4 Location and Boundaries of Natural Features

The site does not contain wetlands or lakes. A dry detention pond is proposed at the central portion of the property.

2.1.5 Location, Dimensions, and Elevations of Existing Bridges and Culvert Crossings

There are no bridges or culvert crossings within the boundaries of this site. However, a series of ditches and culverts in Elder Street west of this development, Murdock Street north of this development and Doris Street to the east of this development carry storm runoff from offsite properties to Central Avenue south of this site. Flow within Central Avenue is intercepted by a piped storm sewer system and ultimately discharges to the Big Ditch west of the site.

2.1.6 Location of Existing Utilities

Locates shall be called in prior to any excavation in this area. The site contains various utilities along all sides of the property. Gas and water mains run along the north side of Central Avenue just south of the south property line. Sewer and telephone lines were found at the rear of the residential lots just east of the east property line. Sewer, overhead power, underground telephone and water lines are present in the rear of the lots just west of the west property line and in the adjoining Elder Street Right-of-Way to the west. Underground telephone and gas lines were found in the Murdock Avenue Right-of-Way to the north.

2.1.7 Groundwater Elevations

This property is in a zone identified by the Kansas Geologic Survey as likely to have groundwater at some or all times within 14 feet of the ground surface elevation. Building with specially engineered foundations or with the lowest floor opening above groundwater is recommended, and owners seeking building permits on this property will be similarly advised. More detailed information on recorded groundwater elevations in the vicinity of this property is available in the City Engineers' office.

2.1.8 Delineation of Predominate Soils Based on USDA Soil Surveys

The predominant soil type is an Urban land-Canadian complex (6250) series material, which is found in 100% of the overall existing drainage areas. See Exhibit 1-6 for NRCS Soil Survey map and information showing existing soil types and descriptions. These soils are classified as Hydrologic Group B soils. The Hydrologic Groups are used to select curve numbers for the runoff calculations in both the existing and developed conditions.

2.1.9 Land Use Types per NRCS Nomenclature

The current land use type can be classified as undeveloped, single family residential and commercial. Previous use of the land included similar uses.

2.1.10 Footprint of Existing Impervious Areas

Currently, the portion of the property to be developed is completely cleared for development. The existing day care facility, outdoor play areas and associated accessory buildings will remain on site and maintain their current use after development.

2.1.11 Internal Drainage Sub-Basin Boundaries

The total area of NAHOLA Addition encompasses 4.69 acres. The north basin denoted as Area "A" is approximately 3.1 acres and runs across the northern two-thirds of the property as shown on the existing plan. The south basin denoted as Area "B" is approximately 1.6 acres and runs across the southern one-third of the property.

2.1.12 Time of Concentration Flow Paths

The existing condition drainage plan shows the general flow paths for each drainage area in the basin. The site drainage is all collected in the proposed on-site detention area will exit the site to the south through a proposed outlet pipe and associated overland flow swale. The flow to these areas is mostly sheet flow with minor concentrated flow at the lower ends of the basins.

2.2 Existing Conditions Hydrology and Hydraulics Analysis

2.2.1 Narrative of the Hydrologic Analysis Methodology

The runoff method used to determine storm water flows was the SCS method. Supporting data and calculation results are shown on Exhibit 2-2. The analysis was completed using the SCS method. The 1, 2, 5, 10, 25, & 100 year, 24-hour storm events were evaluated.

2.2.2 Summary Table of Drainage Sub-Basin Hydrologic Parameters

Drainage Basin	Area (Acres)	Curve Number	T_c (min)
OS-1	1.74	75.0	16.9
OS-2	1.61	75.0	16.9
OS-3	0.57	75.0	23.8
OS-4	0.66	75.0	18.3
Area "A"	3.12	69.0	88.3
Area "B"	1.62	92.0	8.3

2.2.3 Table of Existing Condition Runoff Curve Numbers

For the existing condition, the curve numbers were weighted based on area of their respective hydrologic soil groups over the site. The results are shown in the table below.

OS-1		Hydrologic	Area		% of Area	CN
Soil #	Soil Information	Group	Square Feet	Acres	%	Proposed
6250	Urban land-Canadian complex, 0 to 3% slopes	B	75794.40	1.740	100.00%	75.0
		TOTALS	75794.40	1.740	100.00%	75.0

OS-2		Hydrologic	Area		% of Area	CN
Soil #	Soil Information	Group	Square Feet	Acres	%	Proposed
6250	Urban land-Canadian complex, 0 to 3% slopes	B	70131.60	1.610	100.00%	75.0
		TOTALS	70131.60	1.610	100.00%	75.0

OS-3		Hydrologic	Area		% of Area	CN
Soil #	Soil Information	Group	Square Feet	Acres	%	Proposed
6250	Urban land-Canadian complex, 0 to 3% slopes	B	24829.20	0.570	100.00%	75.0
		TOTALS	24829.20	0.570	100.00%	75.0

OS-4		Hydrologic	Area		% of Area	CN
Soil #	Soil Information	Group	Square Feet	Acres	%	Proposed
6250	Urban land-Canadian complex, 0 to 3% slopes	B	28749.60	0.660	100.00%	75.0
		TOTALS	28749.60	0.660	100.00%	75.0

Area "A"		Hydrologic	Area		% of Area	CN
Soil #	Soil Information	Group	Square Feet	Acres	%	Proposed
6250	Urban land-Canadian complex, 0 to 3% slopes	B	135907.20	3.120	100.00%	69.0
		TOTALS	135907.20	3.120	100.00%	69.0

Area "B"		Hydrologic	Area		% of Area	CN
Soil #	Soil Information	Group	Square Feet	Acres	%	Proposed
6250	Urban land-Canadian complex, 0 to 3% slopes	B	70567.20	1.620	100.00%	92.0
		TOTALS	70567.20	1.620	100.00%	92.0

2.2.4 Table of Existing Condition Times of Concentration

Area	T_c (min)
OS-1	16.9
OS-2	16.9
OS-3	23.8
OS-4	18.3
Area "A"	88.3
Area "B"	8.3

Supporting data and calculations are found on the time of concentration worksheet attached as Exhibit 2-3.

2.2.5 Summary Table of Rainfall Data

Rainfall information shown in Exhibit 2-4.

2.2.6 Cross-Section Data of Existing Open Channels

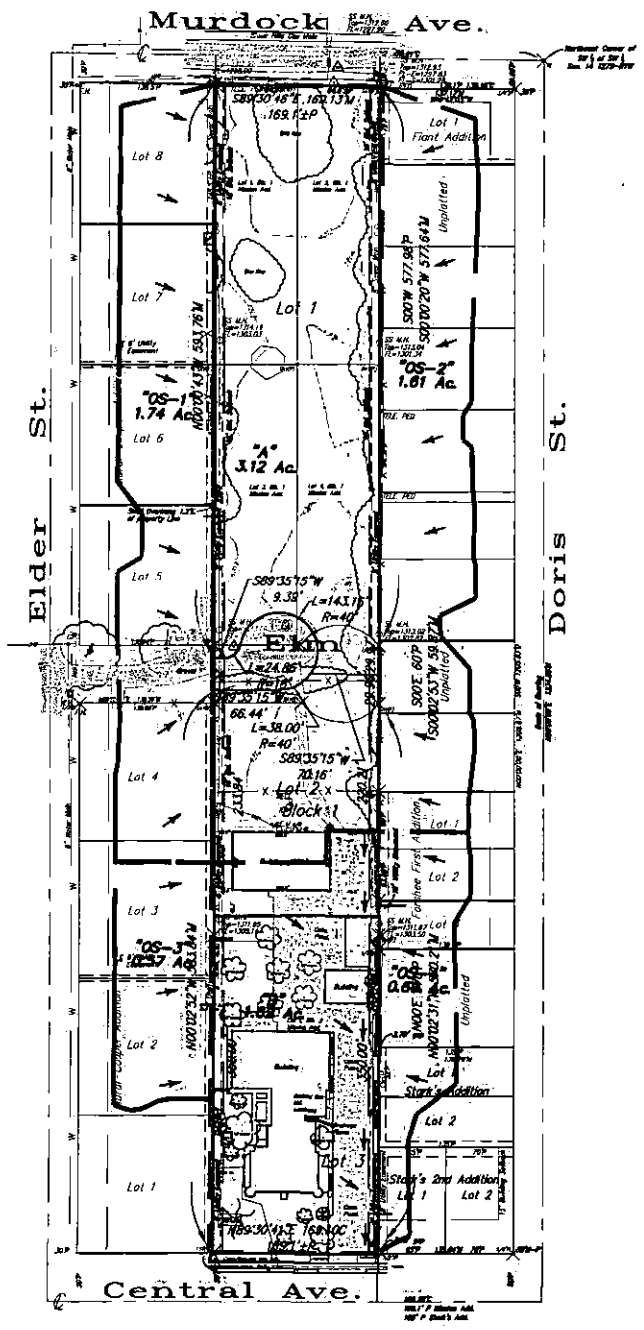
Located north of the north property line; the Murdock Avenue ditch is a roughly 3'-wide flat-bottom channel with typical 5:1 side slopes ultimately draining to the Big Ditch. Located west of the west property line; the Elder Street ditch is a v-bottom channel with typical 3:1 side slopes draining to the Big Ditch. Site flows will not be discharged to these ditches. Instead, the proposed site flows will be routed to existing storm sewer in Central Avenue. As a result, the capacity of these offsite ditches has not been analyzed as part of this study.

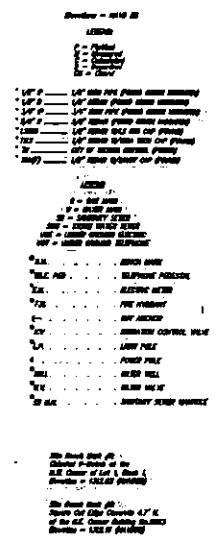
2.2.7 Existing Condition Hydrologic and Hydraulic Analyses

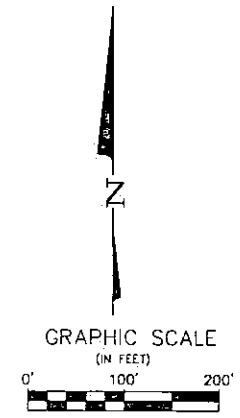
Existing condition analysis report attached as Exhibit 2-2.

NAHOLA ADDITION

EXHIBIT 2-1







NOTES:

1. *Cross-drainage agreements shall be required at the time of platting.*
2. *All outlets to Elder Street, Elm Street, Murdock and Central Avenue or other off site areas shall conform to City of Wichita water quality requirements.*
3. *Detailed site grading and final drainage plans to be designed by a licensed professional engineer at the time of building permit.*
4. *Storm sewer easements will be provided at the time of building permit only as needed to allow drainage to discharge across adjacent lots.*
5. *Any revised drainage plan must be approved by storm water engineer prior to building permits being issued.*
6. *Any storm water detention areas required may be revised when the final plans for the development are completed but the runoff amounts will be at or below the pre-development discharge rates. The filed final drainage report shall show discharge rates and stage/storage/discharge curves for any on-site detention areas.*
7. *The detention pond as shown is proposed. The final pond location, configuration, and design will need to be resolved at the time of building permit.*
8. *A drainage reserve or easement for the proposed detention cell will be dedicated by Separte Instrument during final site design.*

CALCULATION NOTES:

1. *Determination of Q's was made using the SCS method.*
2. *Curve Numbers weighted based on hydrologic soil groups.*

Existing Conditions (24-Hour Storm)								
Site	Area	CN	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
Area "OS-1"	1.74	75.0	1.68	2.70	4.20	5.40	7.05	9.58
Area "OS-2"	1.61	75.0	1.55	2.49	3.89	4.99	6.52	8.67
Area "OS-3"	0.57	75.0	0.46	0.74	1.15	1.48	1.94	2.64
Area "OS-4"	0.66	75.0	0.46	0.74	1.15	1.48	1.94	2.64
Area "A"	3.12	69.0	0.62	1.15	2.00	2.70	3.70	5.28
Area "B"	1.62	92.0	5.12	6.72	8.85	10.44	12.54	15.67

Proposed Conditions (24-Hour Storm)								
Site	Area	CN	1-Year	2-Year	5-Year	10-Year	25-Year	100-Year
Area "OS-1"	1.74	75.0	1.68	2.70	4.20	5.40	7.05	9.58
Area "OS-2"	1.61	75.0	1.55	2.49	3.89	4.99	6.52	8.67
Area "OS-3"	0.57	75.0	0.46	0.74	1.15	1.48	1.94	2.64
Area "OS-4"	0.66	75.0	0.46	0.74	1.15	1.48	1.94	2.64
Area "A"	3.12	85.0	3.93	5.58	7.86	9.58	11.89	15.36
Area "B"	1.62	92.0	5.12	6.72	8.85	10.44	12.54	15.67

Stage-Storage Discharge Table		
Stage (elev)	Storage (acre-ft)	Discharge (cfs)
1308.70	0.000	0.000
1309.00	0.038	0.625
1310.00	0.180	9.485
1311.00	0.353	17.930
1312.00	0.556	28.890

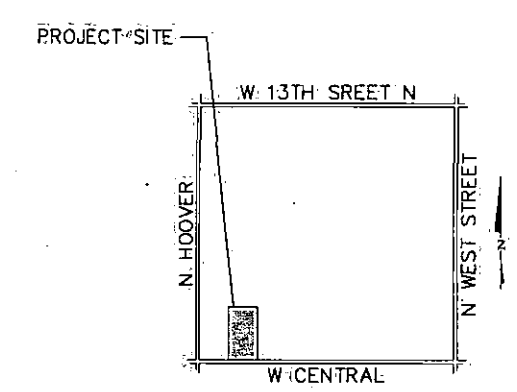
BENCH MARKS

SBM #1:
Chiseled V-Notch at the NW corner of Lot 1, Block 1

Elevation= 1312.62 (NAVD88)

SBM #2:
Square Cut on edge of concrete 4.7' N of the NE corner of building no. 5223

Elevation= 1312.11 (NAVD88)



LOCATION MAP
No Scale

NAHOLA ADDITION

A TRACT IN SECTION 14-T27S-R1W
WICHITA, SEDGWICK COUNTY, KANSAS

EXISTING DRAINAGE PLAN

2013

PROPERTY OWNER/ SUBDIVIDER:

DONALDSON-LOESCHER LIVING TRUST
5226 W. CENTRAL AVENUE
WICHITA, KS 67212
(316) 978-9220

POE & ASSOCIATES, INC.
5940 E. Central, Suite 200 □ Wichita, KS 67208-4242
Phone 316/685-4114 □ FAX 316/685-4444

NAHOLA ADDITION

EXHIBIT 2-2

Hydraflow Table of Contents

P:\101986\Drainage\Proposed Flows.gpw

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Legend

Hyd.	Origin	Description
1	SCS Runoff	OS-1
2	SCS Runoff	OS-2
3	SCS Runoff	OS-3
4	SCS Runoff	OS-4
5	SCS Runoff	Area A
6	SCS Runoff	Area B

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	1.678	2.695	------	4.201	5.398	7.046	8.308	9.583	OS-1
2	SCS Runoff	------	1.552	2.494	------	3.887	4.994	6.519	7.687	8.867	OS-2
3	SCS Runoff	------	0.455	0.737	------	1.150	1.480	1.935	2.284	2.637	OS-3
4	SCS Runoff	------	0.636	1.022	------	1.593	2.047	2.673	3.151	3.635	OS-4
5	SCS Runoff	------	3.928	5.583	------	7.855	9.581	11.89	13.63	15.36	Area A
6	SCS Runoff	------	5.115	6.721	------	8.850	10.44	12.54	14.11	15.67	Area B

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.678	2	726	5,578	------	------	------	OS-1
2	SCS Runoff	1.552	2	726	5,162	------	------	------	OS-2
3	SCS Runoff	0.455	2	730	1,799	------	------	------	OS-3
4	SCS Runoff	0.636	2	726	2,116	------	------	------	OS-4
5	SCS Runoff	3.928	2	734	17,063	------	------	------	Area A
6	SCS Runoff	5.115	2	718	12,043	------	------	------	Area B

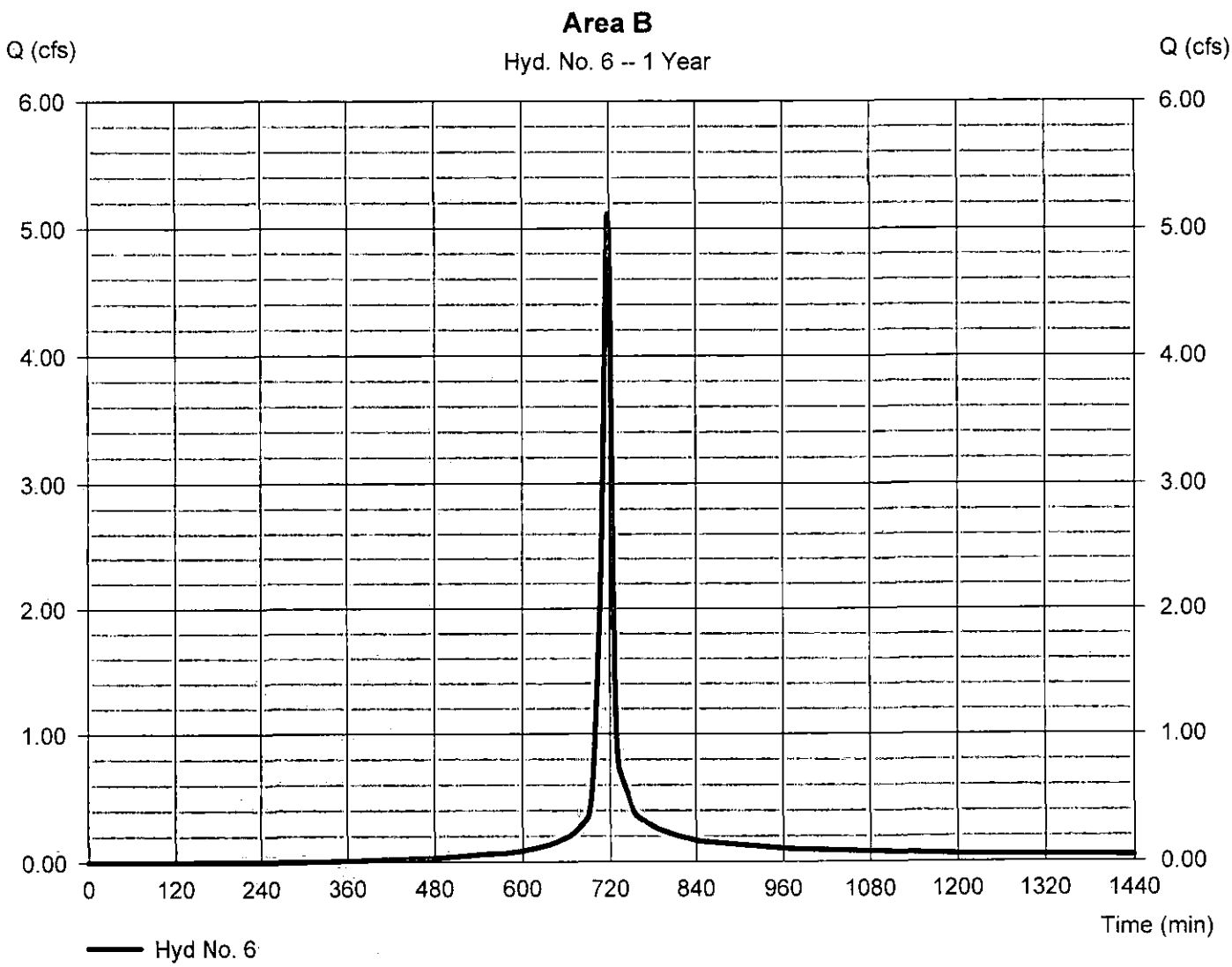
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Tuesday, 09 / 10 / 2013

Hyd. No. 6

Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 5.115 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 12,043 cuft
Drainage area	= 1.620 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.30 min
Total precip.	= 2.88 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.695	2	726	8,672	------	------	------	OS-1
2	SCS Runoff	2.494	2	726	8,025	------	------	------	OS-2
3	SCS Runoff	0.737	2	730	2,797	------	------	------	OS-3
4	SCS Runoff	1.022	2	726	3,290	------	------	------	OS-4
5	SCS Runoff	5.583	2	732	24,124	------	------	------	Area A
6	SCS Runoff	6.721	2	718	16,069	------	------	------	Area B

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Tuesday, 09 / 10 / 2013

Hyd. No. 6

Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 6.721 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 16,069 cuft
Drainage area	= 1.620 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
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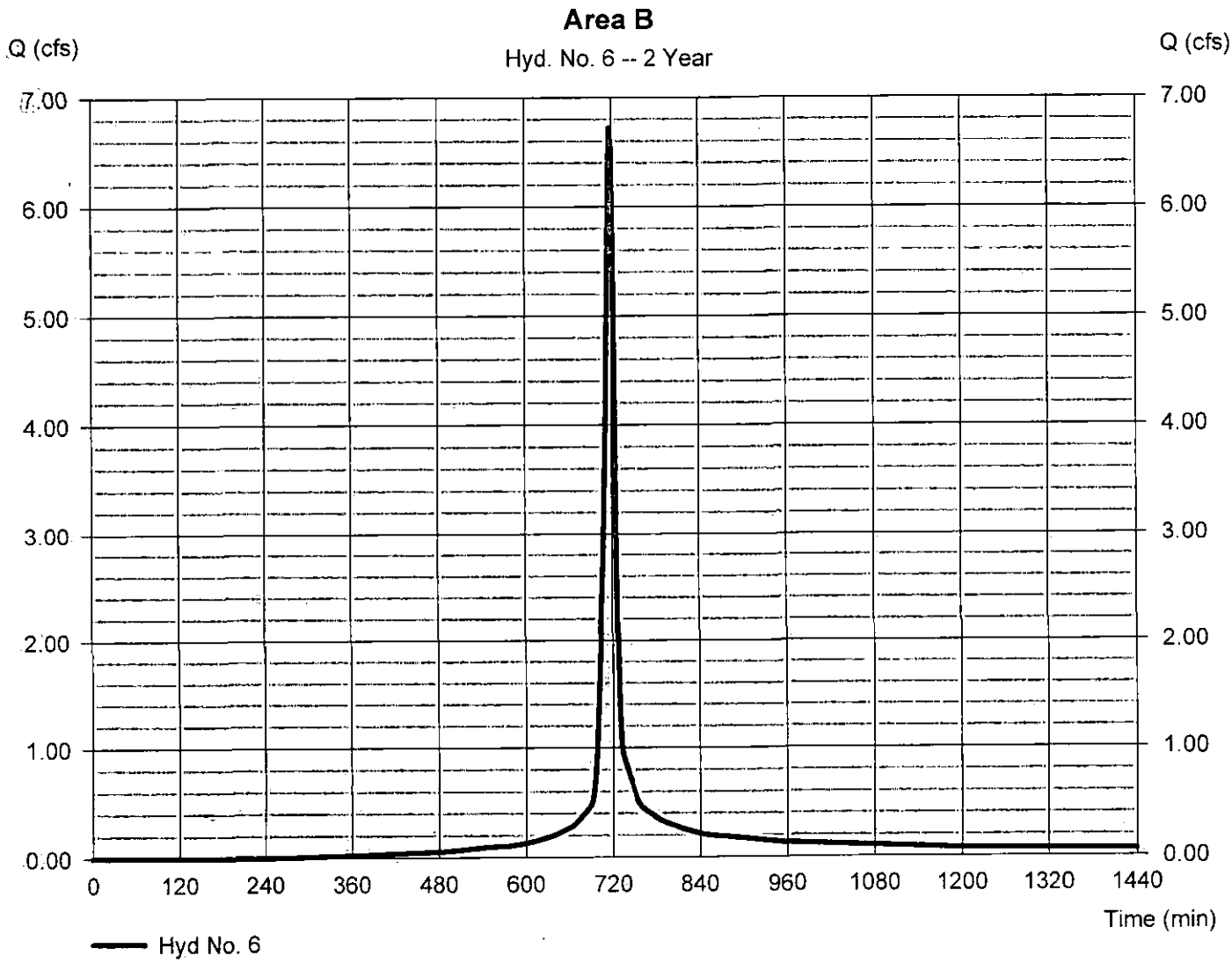
Total precip.	= 3.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.201	2	724	13,248	------	------	------	OS-1
2	SCS Runoff	3.887	2	724	12,259	------	------	------	OS-2
3	SCS Runoff	1.150	2	728	4,272	------	------	------	OS-3
4	SCS Runoff	1.593	2	724	5,025	------	------	------	OS-4
5	SCS Runoff	7.855	2	732	33,987	------	------	------	Area A
6	SCS Runoff	8.850	2	718	21,525	------	------	------	Area B

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Tuesday, 09 / 10 / 2013

Hyd. No. 6

Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 8.850 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 21,525 cuft
Drainage area	= 1.620 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
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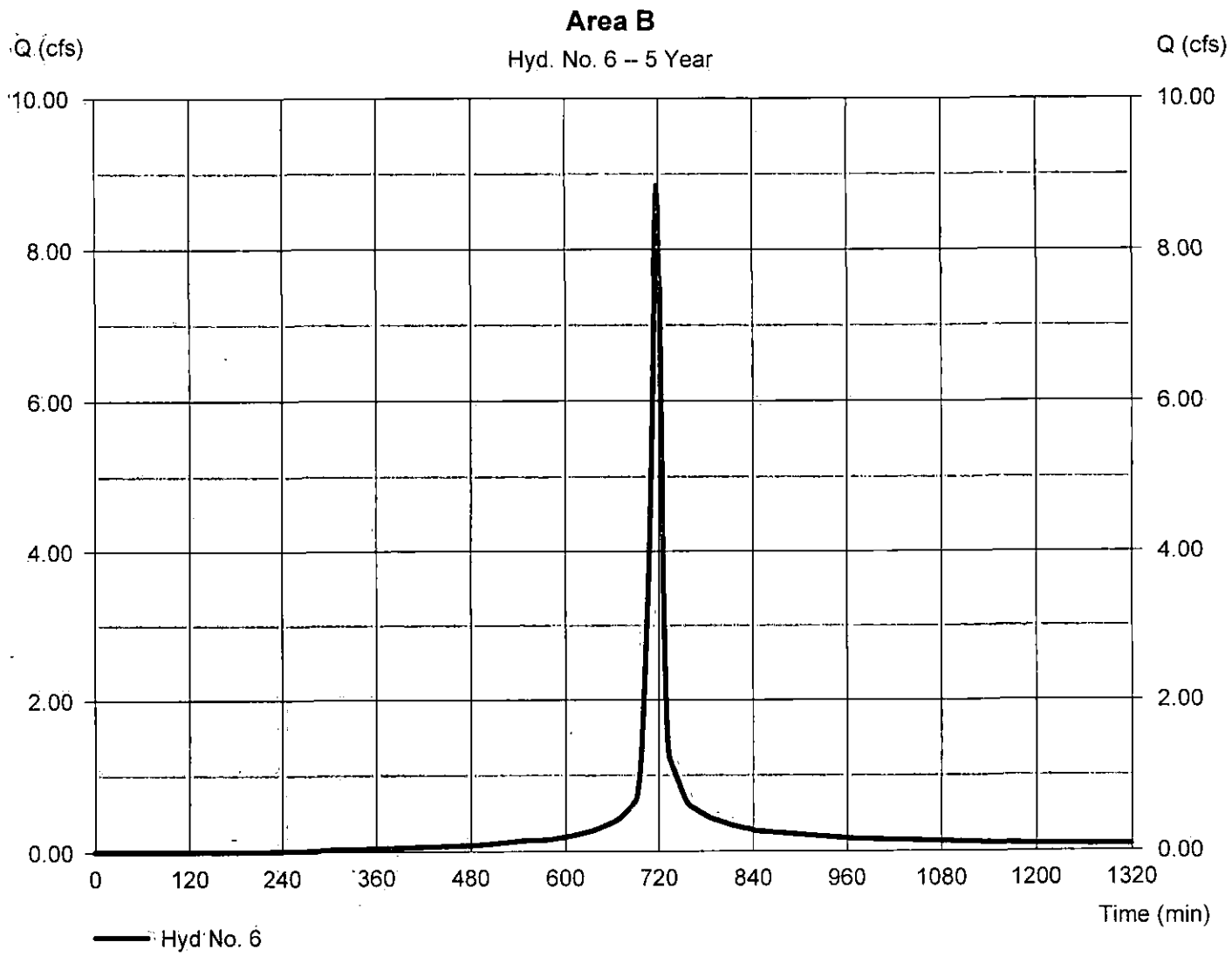
Total precip.	= 4.56 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	5.398	2	724	16,916	------	------	------	OS-1
2	SCS Runoff	4.994	2	724	15,652	------	------	------	OS-2
3	SCS Runoff	1.480	2	728	5,455	------	------	------	OS-3
4	SCS Runoff	2.047	2	724	6,416	------	------	------	OS-4
5	SCS Runoff	9.581	2	732	41,600	------	------	------	Area A
6	SCS Runoff	10.44	2	718	25,657	------	------	------	Area B

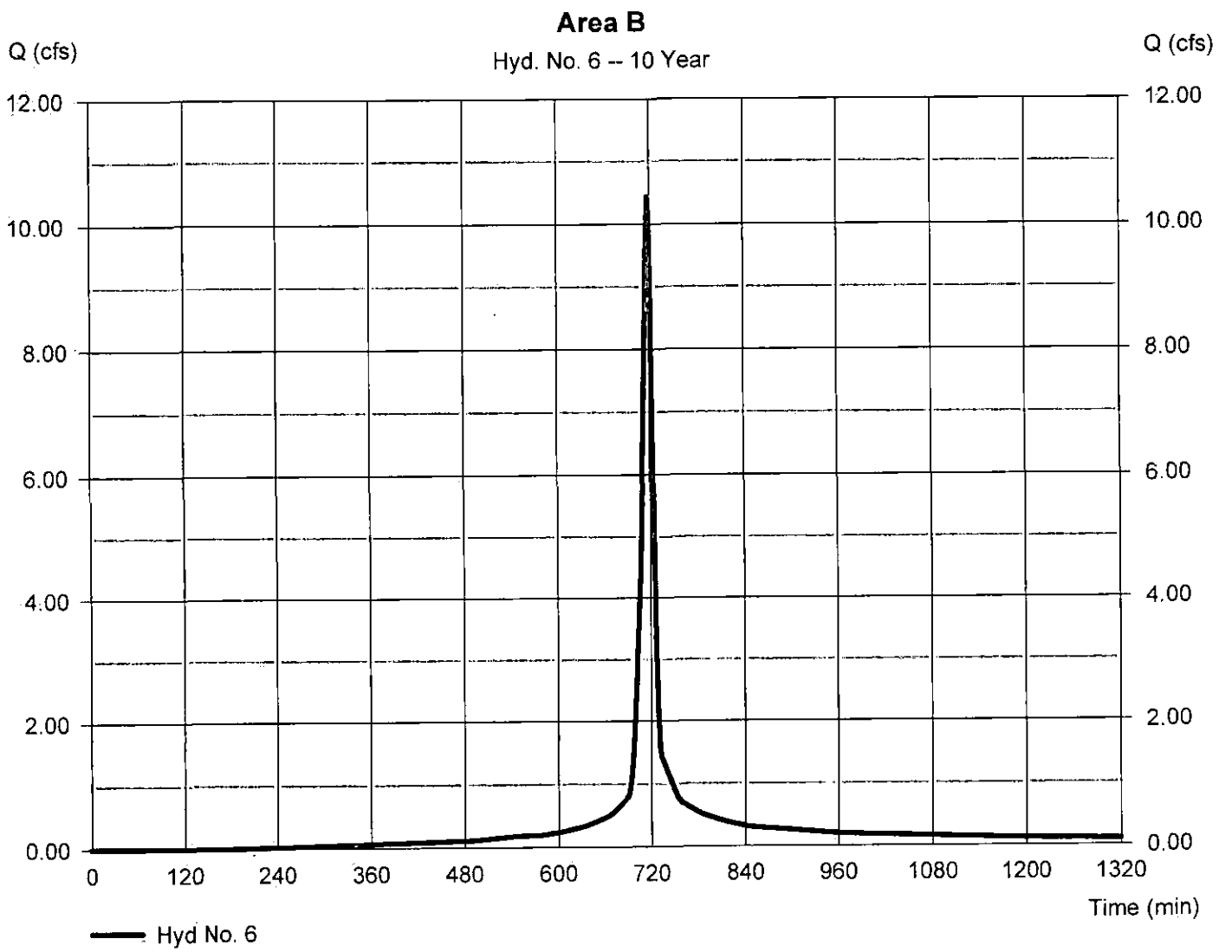
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Tuesday, 09 / 10 / 2013

Hyd. No. 6

Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 10.44 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 25,657 cuft
Drainage area	= 1.620 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.30 min
Total precip.	= 5.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	7.046	2	724	22,028	------	------	------	OS-1
2	SCS Runoff	6.519	2	724	20,382	------	------	------	OS-2
3	SCS Runoff	1.935	2	728	7,103	------	------	------	OS-3
4	SCS Runoff	2.673	2	724	8,355	------	------	------	OS-4
5	SCS Runoff	11.89	2	732	51,939	------	------	------	Area A
6	SCS Runoff	12.54	2	718	31,200	------	------	------	Area B

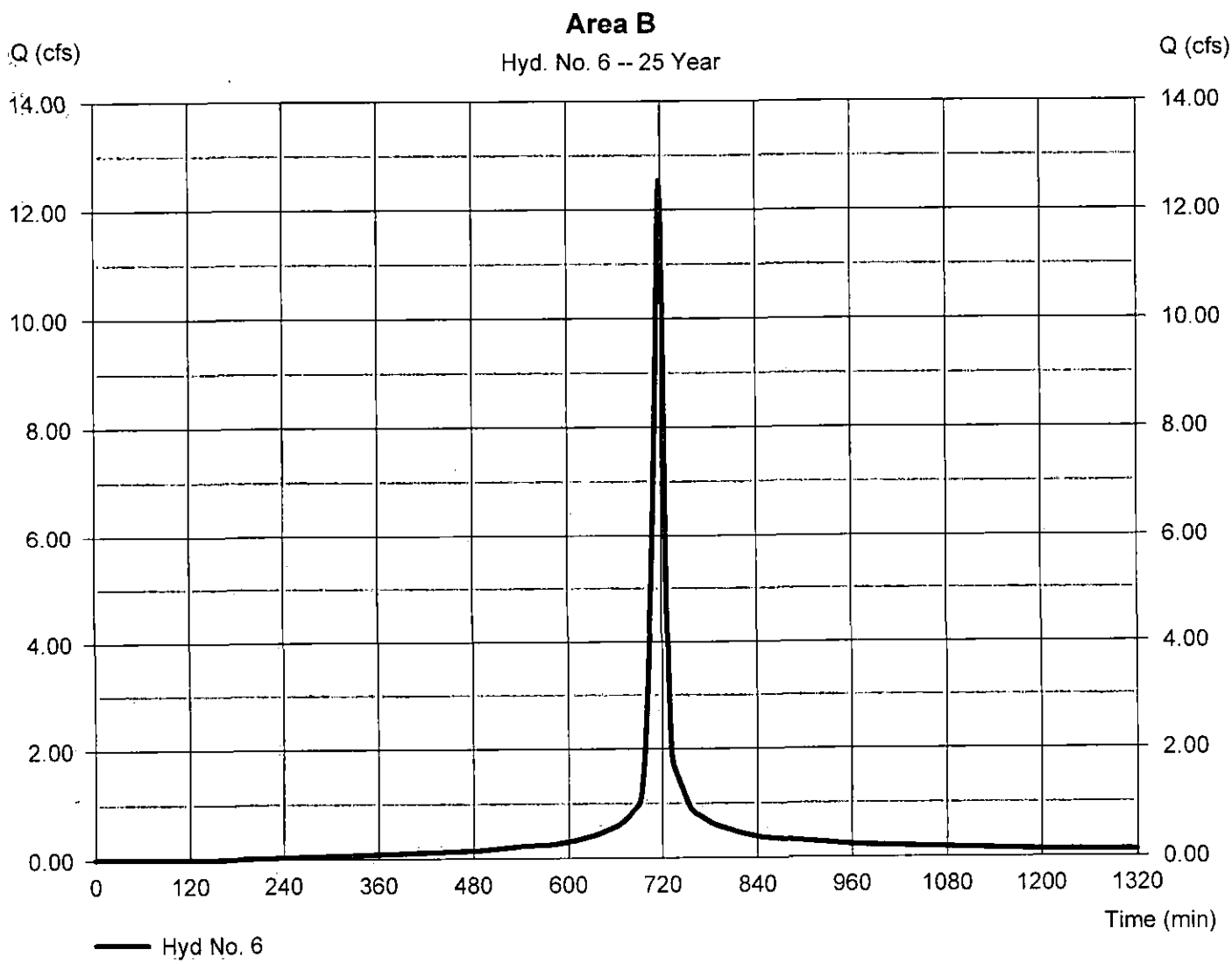
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Tuesday, 09 / 10 / 2013

Hyd. No. 6

Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 12.54 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 31,200 cuft
Drainage area	= 1.620 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.30 min
Total precip.	= 6.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	8.308	2	724	25,986	------	------	------	OS-1
2	SCS Runoff	7.687	2	724	24,045	------	------	------	OS-2
3	SCS Runoff	2.284	2	728	8,380	------	------	------	OS-3
4	SCS Runoff	3.151	2	724	9,857	------	------	------	OS-4
5	SCS Runoff	13.63	2	732	59,794	------	------	------	Area A
6	SCS Runoff	14.11	2	718	35,374	------	------	------	Area B

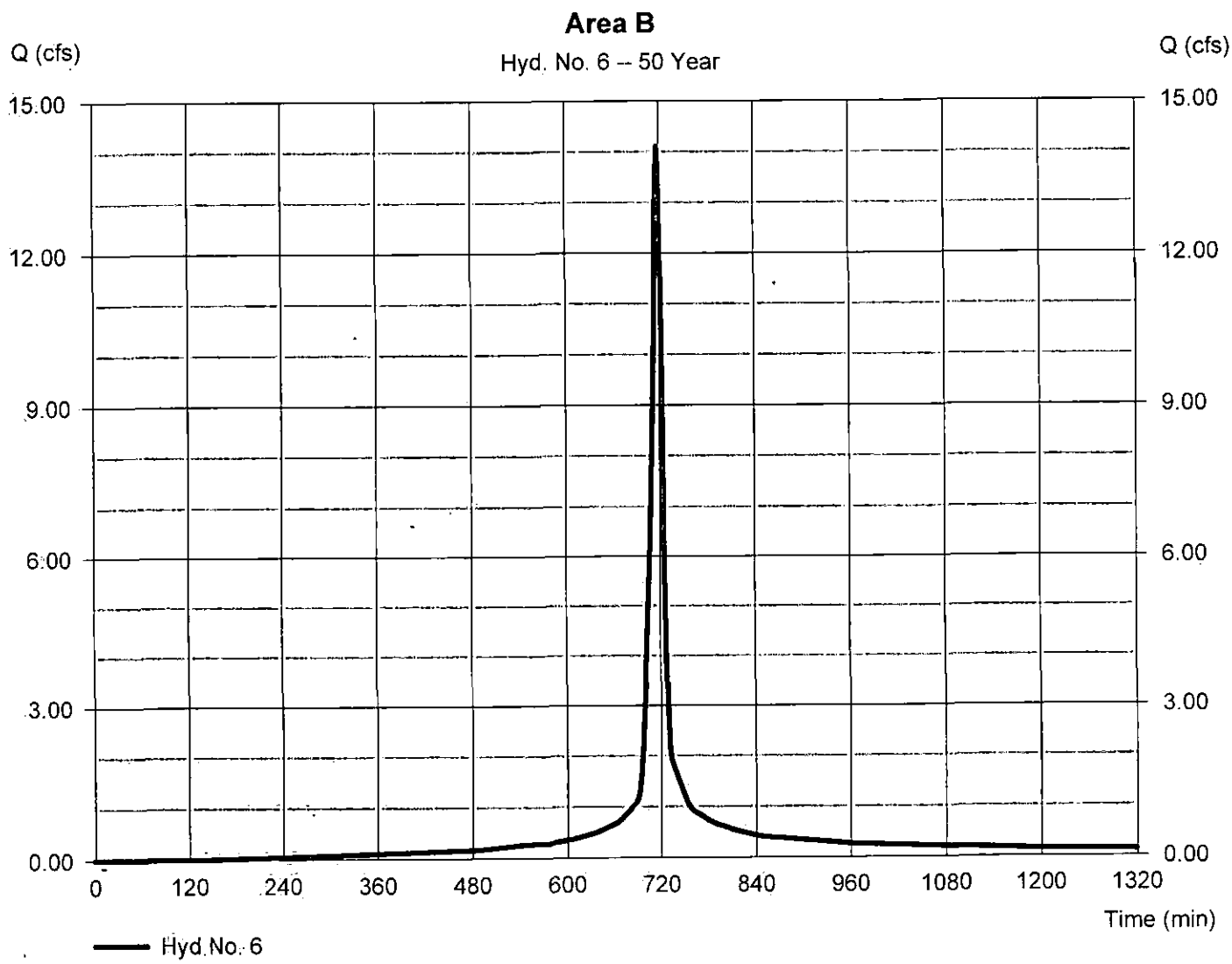
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Tuesday, 09 / 10 / 2013

Hyd. No. 6

Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 14.11 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 35,374 cuft
Drainage area	= 1.620 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.30 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	9.583	2	724	30,026	------	------	------	OS-1
2	SCS Runoff	8.867	2	724	27,783	------	------	------	OS-2
3	SCS Runoff	2.637	2	728	9,683	------	------	------	OS-3
4	SCS Runoff	3.635	2	724	11,389	------	------	------	OS-4
5	SCS Runoff	15.36	2	732	67,712	------	------	------	Area A
6	SCS Runoff	15.67	2	718	39,558	------	------	------	Area B

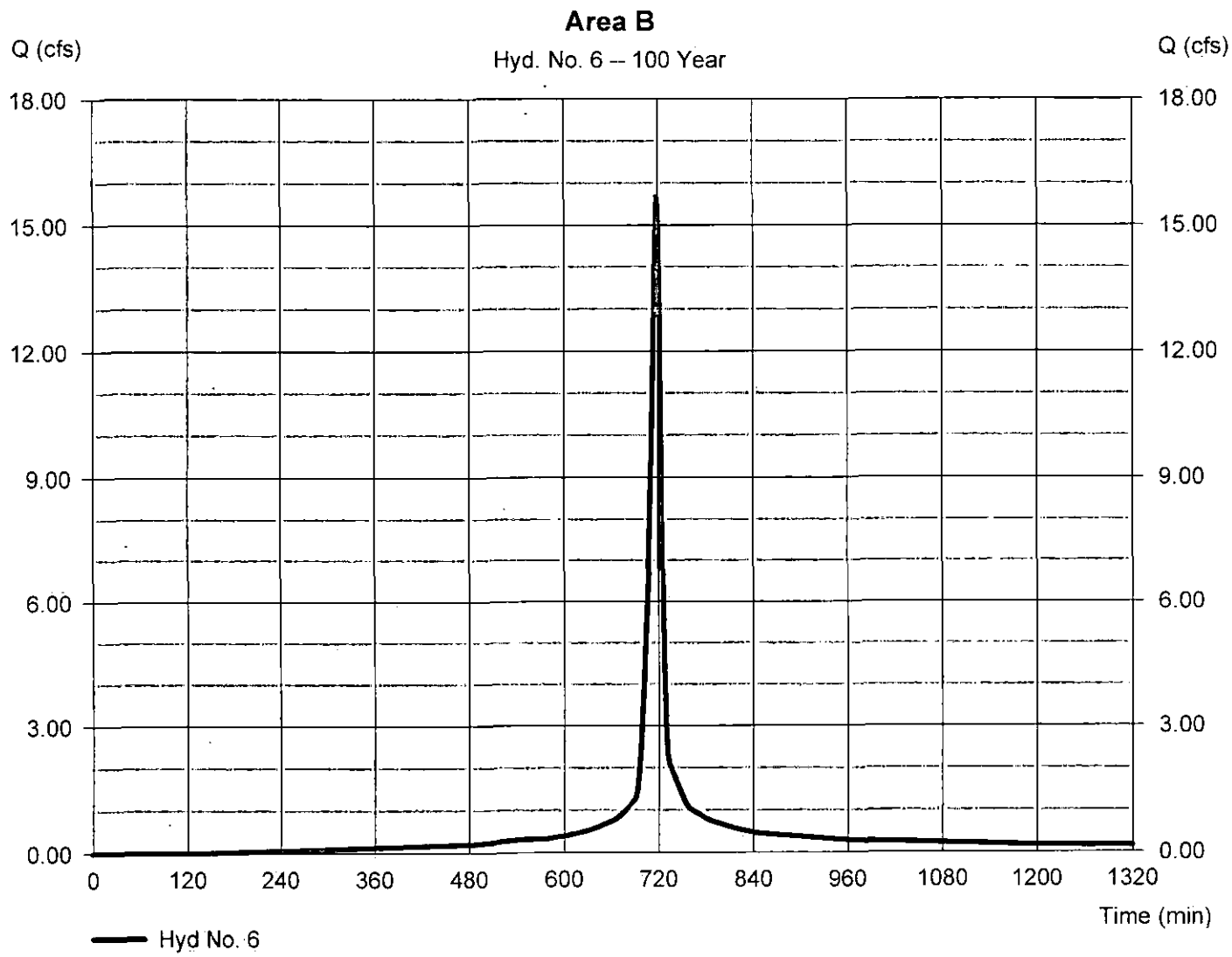
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Tuesday, 09 / 10 / 2013

Hyd. No. 6

Area B

Hydrograph type	= SCS Runoff	Peak discharge	= 15.67 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 39,558 cuft
Drainage area	= 1.620 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.30 min
Total precip.	= 7.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	41.0543	10.4000	0.7875	--------
2	50.0005	11.6000	0.7849	--------
3	0.0000	0.0000	0.0000	--------
5	64.6695	13.4000	0.7859	--------
10	79.3896	14.8000	0.7987	--------
25	97.1176	15.9000	0.8040	--------
50	114.6780	16.8000	0.8146	--------
100	126.7670	17.2000	0.8131	--------

File name: SedgwickCo.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	4.77	3.82	3.21	2.79	2.47	2.23	2.03	1.87	1.74	1.62	1.53	1.44
2	5.51	4.48	3.81	3.33	2.96	2.68	2.45	2.26	2.10	1.97	1.85	1.75
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.56	5.43	4.66	4.10	3.68	3.34	3.07	2.84	2.64	2.48	2.34	2.21
10	7.31	6.11	5.28	4.66	4.19	3.81	3.50	3.24	3.03	2.84	2.67	2.53
25	8.43	7.10	6.16	5.46	4.92	4.48	4.12	3.82	3.57	3.35	3.16	2.99
50	9.32	7.87	6.85	6.08	5.48	5.00	4.60	4.27	3.99	3.74	3.53	3.34
100	10.19	8.64	7.53	6.70	6.05	5.52	5.09	4.72	4.41	4.14	3.91	3.70

Tc = time in minutes. Values may exceed 60.

Precip. file name: SedgwickCo.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.88	3.60	0.00	4.56	5.28	6.24	6.96	7.68
SCS 6-Hr	1.98	2.52	0.00	3.30	3.90	4.68	5.28	5.88
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

NAHOLA ADDITION

EXHIBIT 2-3

Project	NAHOLA ADDITION
Feature	EXISTING DRAINAGE
Analyst	Scott R. Servis, P.E.
Version	20110418
Notes	notes

Sheet	Subbasin	Number of Segments	Sheet Flow (mins)	Shallow Concentrated Flow (mins)	Open Channel Ditch Flow (mins)	Open Channel Pipe Flow (mins)	Open Channel General Flow (mins)	Other (mins)	Total Tc (mins)	Length (feet)	Drop (feet)	Avg. Slope (%)	Avg. Vel. (fps)	Lag (mins)	Lag (hours)	Area (acres)
1	OS-1	1	16.9	0.0	0.0	0.0	0.0	0.0	16.9	95	1	1.05	0.09	10.2	0.169	1.74
2	OS-2	1	16.9	0.0	0.0	0.0	0.0	0.0	16.9	95	1	1.05	0.09	10.2	0.169	1.61
3	OS-3	1	23.8	0.0	0.0	0.0	0.0	0.0	23.8	100	1	0.50	0.07	14.3	0.238	25.24
4	0S-4	1	18.3	0.0	0.0	0.0	0.0	0.0	18.3	90	1	0.78	0.08	11.0	0.183	500
5	Area "A"	6	81.3	2.4	0.1	0.2	0.1	4.2	88.3	1600	29	1.78	0.30	53.0	0.883	550
6	Area "B"	2	23.8	7.8	0.0	0.0	0.0	0.0	31.6	550	2	0.27	0.29	19.0	0.316	500
7	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
8	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
9	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
10	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
11	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
12	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
13	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
14	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	0.00	0.82	16.4	0.273	500
15	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
16	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
17	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
18	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
19	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
20	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
21	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
22	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
23	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
24	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
25	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
26	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500

Subbasin Name	OS-1
Drainage Area (ac)	1.74
Drainage Area (sq mi)	0.00271875

Sheet Flow

selected>>						Total
Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	95	1	1	1	1	95 feet length
Top Elevation (ft)	1314	1	1	1	1	
Bottom Elevation (ft)	1313	1	1	1	1	
Cover	0.24 Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Sheet Flow "n" (dim)	0.240	0.000	0.000	0.000	0.000	
2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0105	0.0000	0.0000	0.0000	0.0000	
Slope (%)	1.05	0.00	0.00	0.00	0.00	
Velocity (fps)	0.09					
Travel Time (hrs)	0.282					
Travel Time (mins)	16.93					16.9 mins travel

Shallow Concentrated Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	490	1	1	1	1	0 feet length
Top Elevation (ft)	1313.5	1	1	1	1	
Bottom Elevation (ft)	1313	1	1	1	1	
Cover	15 Grassed waterway	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "K"						
Surface Coeff (dim)	15.00	0.00	0.00	0.00	0.00	
Drop (ft)	1	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0020	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.20	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Open Channel Ditch Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	490	1052	1	1	1	0 feet length
Top Elevation (ft)	1312.5	1264.23	1	1	1	
Bottom Elevation (ft)	1310	1263.32	1	1	1	
Channel Lining	0.03 Grassed	0.03 Grassed	Choose Lining Type	Choose Lining Type	Choose Lining Type	
Bottom Width (ft)	6.00	8.00	1.00	1.00	1.00	
Left Side Slope (H:V)	4.00	4.00	1.00	1.00	1.00	
Right Side Slope (H:V)	4.00	4.00	1.00	1.00	1.00	
Depth (ft)	6.00	5.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.030	0.030	0.000	0.000	0.000	
Drop (ft)	3	1	0	0	0	0 feet drop
Slope (ft/ft)	0.0051	0.0009	0.0000	0.0000	0.0000	
Slope (%)	0.51	0.09	0.00	0.00	0.00	
Flow Area (sq ft)	180.00	140.00	2.00	2.00	2.00	
Wet Perimeter (ft)	55.48	49.23	3.83	3.83	3.83	
Hydraulic Radius (ft)	3.24	2.84	0.52	0.52	0.52	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	131	400	404	215	168	0 feet length
Top Elevation (ft)	1267.9	1267.02	66.48	65.96	1265.23	
Bottom Elevation (ft)	1267.02	1266.48	66.2	65.7	1264.23	
Pipe Material	0.014 Concrete w/some debris	0.014 Concrete w/some debris	0.014 Concrete w/some debris	0.014 Concrete w/some debris	0.024 Corrugated Metal	
Diameter (ins)	18.00	24.00	30.00	36.00	48.00	
Flow Depth (ins)	18.00	24.00	30.00	36.00	48.00	
Specify alternate "n"						
Manning "n" (dim)	0.014	0.014	0.014	0.014	0.024	
Drop (ft)	1	1	0	0	1	0 feet drop
Slope (ft/ft)	0.0067	0.0013	0.0007	0.0012	0.0060	
Slope (%)	0.67	0.13	0.07	0.12	0.60	
Theta (radians)	6.283	6.283	6.283	6.283	6.283	
Flow Area (sq ft)	1.77	3.14	4.91	7.07	12.57	
Wet Perimeter (ft)	4.71	6.28	7.85	9.42	12.57	
Hydraulic Radius (ft)	0.38	0.50	0.63	0.75	1.00	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel General Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	490	1	1	1	1	0 feet length
Top Elevation (ft)	1310.30	1	1	1	1	
Bottom Elevation (ft)	1	1	1	1	1	
Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	1.00	
Channel Lining	0.025 Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
Drop (ft)	4	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0082	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.82	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Other (Computed Separately)

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	500	1	1	1	1	0 feet length
Drop (ft)	10	1	1	1	1	0 feet drop
Velocity (fps)	2.00	1.00	1.00	1.00	1.00	
Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
Slope (%)	2.00	100.00	100.00	100.00	100.00	
Travel Time (mins)						0.0 mins travel

Total for Subbasin

Segments	1
Length (ft)	95
Drop (ft)	1
Slope (ft/ft)	0.0105

Subbasin Name	CS-2
Drainage Area (ac)	1.61
Drainage Area (sq mi)	0.002515625

selected>>

Sheet Flow

						Total
Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	95	1	1	1	1	95 feet length
Top Elevation (ft)	1313	1	1	1	1	
Bottom Elevation (ft)	1312	1	1	1	1	
Cover	0.24 Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Sheet Flow "n" (dim)	0.240	0.000	0.000	0.000	0.000	
2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0105	0.0000	0.0000	0.0000	0.0000	
Slope (%)	1.05	0.00	0.00	0.00	0.00	
Velocity (fps)	0.09					
Travel Time (hrs)	0.282					
Travel Time (mins)	16.93					16.9 mins travel

Shallow Concentrated Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	550	1	1	1	1	0 feet length
Top Elevation (ft)	1312.5	1	1	1	1	
Bottom Elevation (ft)	1311	1	1	1	1	
Cover	15 Grassed waterway	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "K"						
Surface Coeff (dim)	15.00	0.00	0.00	0.00	0.00	
Drop (ft)	2	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0027	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.27	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Open Channel Ditch Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	550	1145	1	1	1	0 feet length
Top Elevation (ft)	1312.5	64.23	1	1	1	
Bottom Elevation (ft)	1311	62.8	1	1	1	
Channel Lining	0.03 Grassed	0.05 Rough Natural Stream	Choose Lining Type	Choose Lining Type	Choose Lining Type	
Bottom Width (ft)	6.00	8.00	1.00	1.00	1.00	
Left Side Slope (H:V)	4.00	3.00	1.00	1.00	1.00	
Right Side Slope (H:V)	3.00	3.00	1.00	1.00	1.00	
Depth (ft)	6.00	8.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.030	0.050	0.000	0.000	0.000	
Drop (ft)	2	1	0	0	0	0 feet drop
Slope (ft/ft)	0.0027	0.0012	0.0000	0.0000	0.0000	
Slope (%)	0.27	0.12	0.00	0.00	0.00	
Flow Area (sq ft)	162.00	256.00	2.00	2.00	2.00	
Wet Perimeter (ft)	49.71	58.60	3.83	3.83	3.83	
Hydraulic Radius (ft)	3.26	4.37	0.52	0.52	0.52	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	131	400	352	215	182	0 feet length
Top Elevation (ft)	67.9	67.02	66.48	65.96	65.23	
Bottom Elevation (ft)	67.02	66.48	66.2	65.7	64.23	
Pipe Material	0.017 Rough concrete	0.017 Rough concrete	0.017 Rough concrete	0.017 Rough concrete	0.024 Corrugated Metal	
Diameter (ins)	18.00	24.00	30.00	36.00	48.00	
Flow Depth (ins)	18.00	24.00	30.00	36.00	48.00	
Specify alternate "n"						
Manning "n" (dim)	0.017	0.017	0.017	0.017	0.024	
Drop (ft)	1	1	0	0	1	0 feet drop
Slope (ft/ft)	0.0067	0.0013	0.0008	0.0012	0.0055	
Slope (%)	0.67	0.13	0.08	0.12	0.55	
Theta (radians)	6.283	6.283	6.283	6.283	6.283	
Flow Area (sq ft)	1.77	3.14	4.91	7.07	12.57	
Wet Perimeter (ft)	4.71	6.28	7.85	9.42	12.57	
Hydraulic Radius (ft)	0.38	0.50	0.63	0.75	1.00	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel General Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	150	1	1	1	1	0 feet length
Top Elevation (ft)	30	1	1	1	1	
Bottom Elevation (ft)	26	1	1	1	1	
Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	1.00	
Channel Lining	0.025 Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
Drop (ft)	4	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0267	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.67	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Other (Computed Separately)

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	500	1	1	1	1	0 feet length
Drop (ft)	10	1	1	1	1	0 feet drop
Velocity (fps)	2.00	1.00	1.00	1.00	1.00	
Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
Slope (%)	2.00	100.00	100.00	100.00	100.00	
Travel Time (mins)						0.0 mins travel

Total for Subbasin

Segments	1
Length (ft)	95
Drop (ft)	1
Slope (ft/ft)	0.0105

Subbasin Name	OS-3
Drainage Area (ac)	25.24
Drainage Area (sq mi)	0.0394375

Sheet Flow

selected>>						Total
Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	100	1	1	1	1	100 feet length
Top Elevation (ft)	1312	1	1	1	1	
Bottom Elevation (ft)	1312	1	1	1	1	
Cover	0.24 Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Sheet Flow "n" (dim)	0.240	0.000	0.000	0.000	0.000	
2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0050	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.50	0.00	0.00	0.00	0.00	
Velocity (fps)	0.07					
Travel Time (hrs)	0.396					
Travel Time (mins)	23.76					23.8 mins travel

Shallow Concentrated Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	320	1	1	1	1	0 feet length
Top Elevation (ft)	1312.5	1	1	1	1	
Bottom Elevation (ft)	1312	1	1	1	1	
Cover	15 Grassed waterway	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "K"						
Surface Coeff (dim)	15.00	0.00	0.00	0.00	0.00	
Drop (ft)	1	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0031	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.31	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Open Channel Ditch Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	880	1	1	1	1	0 feet length
Top Elevation (ft)	1270	1	1	1	1	
Bottom Elevation (ft)	1260	1	1	1	1	
Channel Lining	0.03 Grassed	Choose Lining Type	Choose Lining Type	Choose Lining Type	Choose Lining Type	
Bottom Width (ft)	25.00	0.00	1.00	1.00	1.00	
Left Side Slope (H:V)	4.00	1:00	1:00	1:00	1:00	
Right Side Slope (H:V)	4.00	1:00	1:00	1:00	1:00	
Depth (ft)	5.00	1:00	1:00	1:00	1:00	
Specify alternate "n"						
Manning "n" (dim)	0.030	0.000	0.000	0.000	0.000	
Drop (ft)	10	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0114	0.0000	0.0000	0.0000	0.0000	
Slope (%)	1.14	0.00	0.00	0.00	0.00	
Flow Area (sq ft)	225.00	1.00	2.00	2.00	2.00	
Wet Perimeter (ft)	66.23	2.83	3.83	3.83	3.83	
Hydraulic Radius (ft)	3.40	0.35	0.52	0.52	0.52	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	100	1	1	1	1	0 feet length
Top Elevation (ft)	20	1	1	1	1	
Bottom Elevation (ft)	18	1	1	1	1	
Pipe Material	0.017 Rough concrete	Choose Material Type	Choose Material Type	Choose Material Type	Choose Material Type	
Diameter (ins)	24.00	1:00	1:00	1:00	1:00	
Flow Depth (ins)	24.00	1:00	1:00	1:00	1:00	
Specify alternate "n"						
Manning "n" (dim)	0.017	0.000	0.000	0.000	0.000	
Drop (ft)	2	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0200	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.00	0.00	0.00	0.00	0.00	
Theta (radians)	6.283	6.283	6.283	6.283	6.283	
Flow Area (sq ft)	3.14	0.01	0.01	0.01	0.01	
Wet Perimeter (ft)	6.28	0.26	0.26	0.26	0.26	
Hydraulic Radius (ft)	0.50	0.02	0.02	0.02	0.02	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel General Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	150	1	1	1	1	0 feet length
Top Elevation (ft)	30	1	1	1	1	
Bottom Elevation (ft)	26	1	1	1	1	
Hydraulic Radius (ft)	2.30	1:00	1:00	1:00	1:00	
Channel Lining	0.025 Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
Drop (ft)	4	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0267	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.67	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Other (Computed Separately)

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	500	1	1	1	1	0 feet length
Drop (ft)	10	1	1	1	1	0 feet drop
Velocity (fps)	2.00	1:00	1:00	1:00	1:00	
Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
Slope (%)	2.00	100.00	100.00	100.00	100.00	
Travel Time (mins)						0.0 mins travel

Total for Subbasin

Segments	1
Length (ft)	100
Drop (ft)	1
Slope (ft/ft)	0.0050

Subbasin Name	OS-4
Drainage Area (ac)	500
Drainage Area (sq mi)	0.78125

Sheet Flow

selected>>						Total
Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	90	1	1	1	1	90 feet length
Top Elevation (ft)	1312	1	1	1	1	
Bottom Elevation (ft)	1312	1	1	1	1	
Cover	0.24 Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Sheet Flow "n" (dim)	0.240	0.000	0.000	0.000	0.000	
2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0078	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.78	0.00	0.00	0.00	0.00	
Velocity (fps)	0.08					
Travel Time (hrs)	0.305					
Travel Time (mins)	18.30					18.3 mins travel

Shallow Concentrated Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	200	1	1	1	1	0 feet length
Top Elevation (ft)	30	1	1	1	1	
Bottom Elevation (ft)	22	1	1	1	1	
Cover	7 Short grass pasture	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "K"						
Surface Coeff (dim)	7.00	0.00	0.00	0.00	0.00	
Drop (ft)	8	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0400	0.0000	0.0000	0.0000	0.0000	
Slope (%)	4.00	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Open Channel Ditch Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	100	1	1	1	1	0 feet length
Top Elevation (ft)	50	1	1	1	1	
Bottom Elevation (ft)	47	1	1	1	1	
Channel Lining	0.03 Grassed	Choose Lining Type	Choose Lining Type	Choose Lining Type	Choose Lining Type	
Bottom Width (ft)	25.00	1.00	1.00	1.00	1.00	
Left Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
Right Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
Depth (ft)	3.00	1.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.030	0.000	0.000	0.000	0.000	
Drop (ft)	3	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0300	0.0000	0.0000	0.0000	0.0000	
Slope (%)	3.00	0.00	0.00	0.00	0.00	
Flow Area (sq ft)	102.00	1.00	2.00	2.00	2.00	
Wet Perimeter (ft)	43.97	2.83	3.83	3.83	3.83	
Hydraulic Radius (ft)	2.32	0.35	0.52	0.52	0.52	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	100	1	1	1	1	0 feet length
Top Elevation (ft)	20	1	1	1	1	
Bottom Elevation (ft)	18	1	1	1	1	
Pipe Material	0.017 Rough concrete	Choose Material Type	Choose Material Type	Choose Material Type	Choose Material Type	
Diameter (ins)	24.00	1.00	1.00	1.00	1.00	
Flow Depth (ins)	24.00	1.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.017	0.000	0.000	0.000	0.000	
Drop (ft)	2	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0200	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.00	0.00	0.00	0.00	0.00	
Theta (radians)	6.283	6.283	6.283	6.283	6.283	
Flow Area (sq ft)	3.14	0.01	0.01	0.01	0.01	
Wet Perimeter (ft)	6.28	0.26	0.26	0.26	0.26	
Hydraulic Radius (ft)	0.50	0.02	0.02	0.02	0.02	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel General Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	150	1	1	1	1	0 feet length
Top Elevation (ft)	30	1	1	1	1	
Bottom Elevation (ft)	26	1	1	1	1	
Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	1.00	
Channel Lining	0.025 Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
Drop (ft)	4	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0267	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.67	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Other (Computed Separately)

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	500	1	1	1	1	0 feet length
Drop (ft)	10	1	1	1	1	0 feet drop
Velocity (fps)	2.00	1.00	1.00	1.00	1.00	
Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
Slope (%)	2.00	100.00	100.00	100.00	100.00	
Travel Time (mins)						0.0 mins travel

Total for Subbasin

Segments	1
Length (ft)	90
Drop (ft)	1
Slope (ft/ft)	0.0078

Subbasin Name	Area "A"
Drainage Area (ac)	550
Drainage Area (sq mi)	0.859375

Sheet Flow

						Total
selected>>	Select (0 or 1)	1	0	0	0	0	1 segments
	Length (ft)	550	1	1	1	1	550 feet length
	Top Elevation (ft)	1312	1	1	1	1	
	Bottom Elevation (ft)	1311	1	1	1	1	
	Cover	0.15 Short grass prairie	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
	Specify alternate "n"						
	Sheet Flow "n" (dim)	0.150	0.000	0.000	0.000	0.000	
	2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
	Drop (ft)	2	0	0	0	0	2 feet drop
	Slope (ft/ft)	0.0027	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	0.27	0.00	0.00	0.00	0.00	
	Velocity (fps)	0.11					
	Travel Time (hrs)	1.355					
	Travel Time (mins)	81.30					81.3 mins travel

Shallow Concentrated Flow

						Total
selected>>	Select (0 or 1)	1	0	0	0	0	1 segments
	Length (ft)	200	1	1	1	1	200 feet length
	Top Elevation (ft)	30	1	1	1	1	
	Bottom Elevation (ft)	22	1	1	1	1	
	Cover	7 Short grass pasture	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
	Specify alternate "K"						
	Surface Coeff (dim)	7.00	0.00	0.00	0.00	0.00	
	Drop (ft)	8	0	0	0	0	8 feet drop
	Slope (ft/ft)	0.0400	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	4.00	0.00	0.00	0.00	0.00	
	Velocity (fps)	1.40					
	Travel Time (mins)	2.38					2.4 mins travel

Open Channel Ditch Flow

						Total
selected>>	Select (0 or 1)	1	0	0	0	0	1 segments
	Length (ft)	100	1	1	1	1	100 feet length
	Top Elevation (ft)	50	1	1	1	1	
	Bottom Elevation (ft)	47	1	1	1	1	
	Channel Lining	0.03 Grassed	Choose Lining Type	Choose Lining Type	Choose Lining Type	Choose Lining Type	
	Bottom Width (ft)	25.00	0.00	1.00	1.00	1.00	
	Left Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
	Right Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
	Depth (ft)	3.00	1.00	1.00	1.00	1.00	
	Specify alternate "n"						
	Manning "n" (dim)	0.030	0.000	0.000	0.000	0.000	
	Drop (ft)	3	0	0	0	0	3 feet drop
	Slope (ft/ft)	0.0300	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	3.00	0.00	0.00	0.00	0.00	
	Flow Area (sq ft)	102.00	1.00	2.00	2.00	2.00	
	Wet Perimeter (ft)	43.97	2.83	3.83	3.83	3.83	
	Hydraulic Radius (ft)	2.32	0.35	0.52	0.52	0.52	
	Velocity (fps)	15.07					
	Normal Flow (cfs)	1537.6					
selected>>	Travel Time (mins)	0.11					0.1 mins travel

Open Channel Pipe Flow

						Total
	Select (0 or 1)	1	0	0	0	0	1 segments
	Length (ft)	100	1	1	1	1	100 feet length
	Top Elevation (ft)	20	1	1	1	1	
	Bottom Elevation (ft)	18	1	1	1	1	
	Pipe Material	0.017 Rough concrete	Choose Material Type	Choose Material Type	Choose Material Type	Choose Material Type	
	Diameter (ins)	24.00	1.00	1.00	1.00	1.00	
	Flow Depth (ins)	24.00	1.00	1.00	1.00	1.00	
	Specify alternate "n"						
	Manning "n" (dim)	0.017	0.000	0.000	0.000	0.000	
	Drop (ft)	2	0	0	0	0	2 feet drop
	Slope (ft/ft)	0.0200	0.0000	0.0000	0.0000	0.0000	
	Slope (%)	2.00	0.00	0.00	0.00	0.00	
	Theta (radians)	6.283	6.283	6.283	6.283	6.283	
	Flow Area (sq ft)	3.14	0.01	0.01	0.01	0.01	
	Wet Perimeter (ft)	6.28	0.26	0.26	0.26	0.26	
	Hydraulic Radius (ft)	0.50	0.02	0.02	0.02	0.02	
	Velocity (fps)	7.81					
selected>>	Normal Flow (cfs)	24.5					
	Travel Time (mins)	0.21					0.2 mins travel

Open Channel General Flow

						Total
	Select (0 or 1)	1	0	0	0	0	1 segments
	Length (ft)	150	1	1	1	1	150 feet length
	Top Elevation (ft)	30	1	1	1	1	
	Bottom Elevation (ft)	25	1	1	1	1	
	Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	1.00	
	Channel Lining	0.025 Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
	Specify alternate "n"						
	Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
	Drop (ft)	4	0	0	0	0	4 feet drop
	Slope (ft/ft)	0.0267	0.0000	0.0000	0.0000	0.0000	
selected>>	Slope (%)	2.67	0.00	0.00	0.00	0.00	
	Velocity (fps)	16.96					
	Travel Time (mins)	0.15					0.1 mins travel

Other (Computed Separately)

						Total
	Select (0 or 1)	1	0	0	0	0	1 segments
	Length (ft)	500	1	1	1	1	500 feet length
	Drop (ft)	10	1	1	1	1	10 feet drop
	Velocity (fps)	2.00	1.00	1.00	1.00	1.00	
	Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
	Slope (%)	2.00	100.00	100.00	100.00	100.00	
	Travel Time (mins)	4.17					4.2 mins travel

Total for Subbasin

Segments	6
Length (ft)	1600
Drop (ft)	29
Slope (ft/ft)	0.0178

Subbasin Name	Area "B"
Drainage Area (ac)	500
Drainage Area (sq mi)	0.78125

Sheet Flow

selected>>						Total
Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	100	1	1	1	1	100 feet length
Top Elevation (ft)	1312	1	1	1	1	
Bottom Elevation (ft)	1312	1	1	1	1	
Cover	0.24 Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Sheet Flow "n" (dim)	0.240	0.000	0.000	0.000	0.000	
2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0050	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.50	0.00	0.00	0.00	0.00	
Velocity (fps)	0.07					
Travel Time (hrs)	0.396					
Travel Time (mins)	23.76					23.8 mins travel

Shallow Concentrated Flow

selected>>						Total
Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	450	1	1	1	1	450 feet length
Top Elevation (ft)	1311.5	1	1	1	1	
Bottom Elevation (ft)	1311	1	1	1	1	
Cover	20.3 Paved	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "K"						
Surface Coeff (dim)	20.30	0.00	0.00	0.00	0.00	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0022	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.22	0.00	0.00	0.00	0.00	
Velocity (fps)	0.96					
Travel Time (mins)	7.84					7.8 mins travel

Open Channel Ditch Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	100	1	1	1	1	0 feet length
Top Elevation (ft)	50	1	1	1	1	
Bottom Elevation (ft)	47	1	1	1	1	
Channel Lining	0.03 Grassed	Choose Lining Type	Choose Lining Type	Choose Lining Type	Choose Lining Type	
Bottom Width (ft)	25.00	0.00	1.00	1.00	1.00	
Left Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
Right Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
Depth (ft)	3.00	1.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.030	0.000	0.000	0.000	0.000	
Drop (ft)	3	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0300	0.0000	0.0000	0.0000	0.0000	
Slope (%)	3.00	0.00	0.00	0.00	0.00	
Flow Area (sq ft)	102.00	1.00	2.00	2.00	2.00	
Wet Perimeter (ft)	43.97	2.83	3.83	3.83	3.83	
Hydraulic Radius (ft)	2.32	0.35	0.52	0.52	0.52	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	100	1	1	1	1	0 feet length
Top Elevation (ft)	20	1	1	1	1	
Bottom Elevation (ft)	18	1	1	1	1	
Pipe Material	0.017 Rough concrete	Choose Material Type	Choose Material Type	Choose Material Type	Choose Material Type	
Diameter (ins)	24.00	1.00	1.00	1.00	1.00	
Flow Depth (ins)	24.00	1.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.017	0.000	0.000	0.000	0.000	
Drop (ft)	2	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0200	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.00	0.00	0.00	0.00	0.00	
Theta (radians)	6.283	6.283	6.283	6.283	6.283	
Flow Area (sq ft)	3.14	0.01	0.01	0.01	0.01	
Wet Perimeter (ft)	6.28	0.26	0.26	0.26	0.26	
Hydraulic Radius (ft)	0.50	0.02	0.02	0.02	0.02	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel General Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	150	1	1	1	1	0 feet length
Top Elevation (ft)	30	1	1	1	1	
Bottom Elevation (ft)	26	1	1	1	1	
Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	1.00	
Channel Lining	0.025 Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
Drop (ft)	4	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0267	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.67	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Other (Computed Separately)

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	500	1	1	1	1	0 feet length
Drop (ft)	10	1	1	1	1	0 feet drop
Velocity (fps)	2.00	1.00	1.00	1.00	1.00	
Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
Slope (%)	2.00	100.00	100.00	100.00	100.00	
Travel Time (mins)						0.0 mins travel

Total for Subbasin

Segments	2
Length (ft)	550
Drop (ft)	2
Slope (ft/ft)	0.0027

NAHOLA ADDITION

EXHIBIT 2-4

1988 Drainage Criteria Manual
City of Wichita, Kansas
Rainfall Intensity Table for Sedgwick County, KS

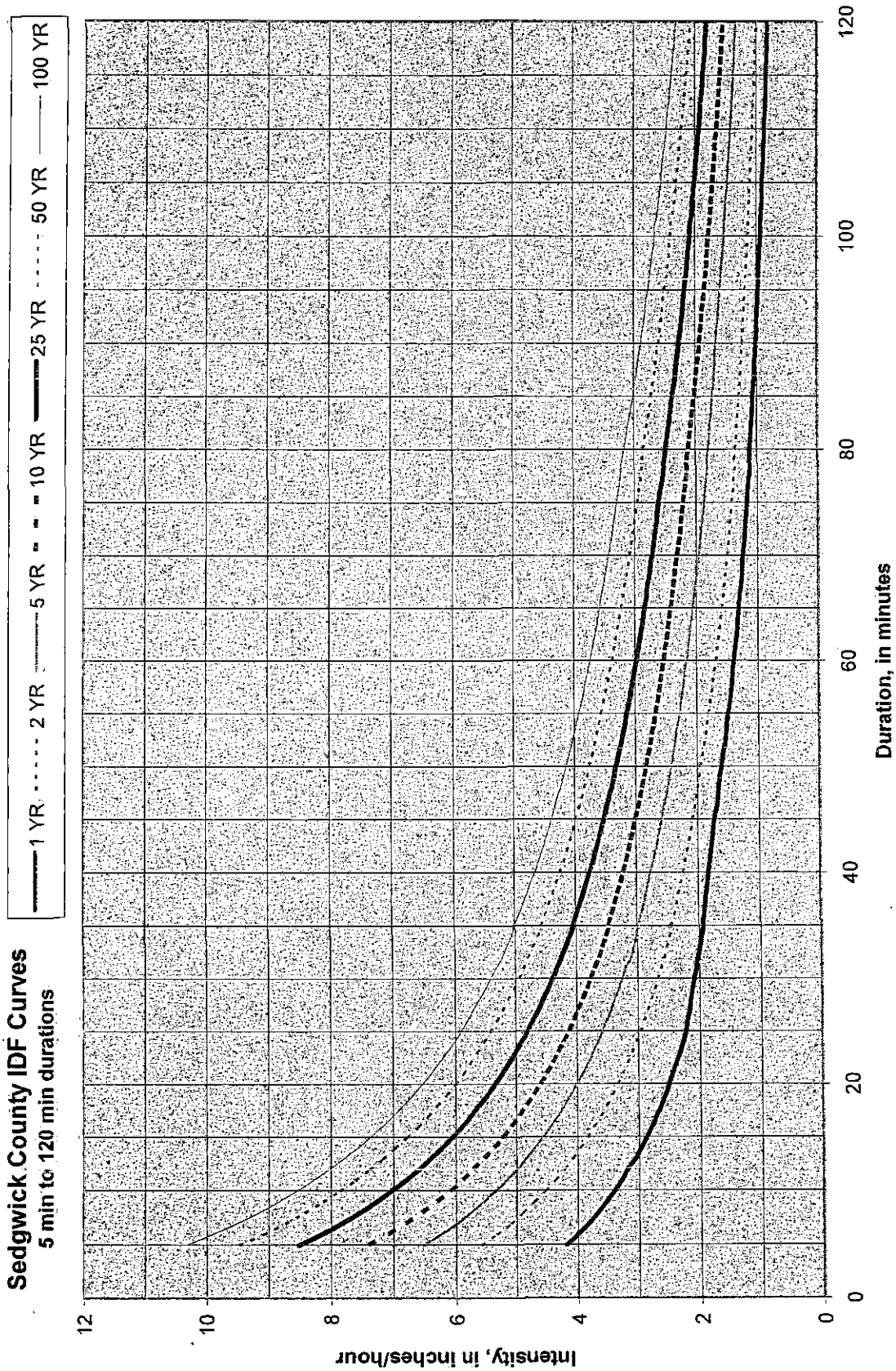
The following tabulation contains rainfall intensity in inches per hour as derived from ESSA Weather Bureau Technical Paper 40 Modified to NWS Hydro-35, 1977 During First Hour.

Table 1 Rainfall Intensity Table (Duration 15 min – 120 min)

DURATION, in hours	DURATION, in minutes	RETURN PERIOD						
		1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
0.0833	5	4.18	5.57	6.53	7.41	8.52	9.48	10.32
0.1000	6	3.99	5.32	6.25	7.09	8.16	9.09	9.89
0.1167	7	3.81	5.09	5.99	6.81	7.84	8.74	9.50
0.1333	8	3.66	4.89	5.75	6.55	7.55	8.42	9.15
0.1500	9	3.52	4.70	5.54	6.31	7.28	8.13	8.83
0.1667	10	3.39	4.52	5.34	6.09	7.04	7.86	8.54
0.1833	11	3.27	4.36	5.16	5.89	6.81	7.61	8.27
0.2000	12	3.18	4.21	4.99	5.71	6.60	7.38	8.02
0.2167	13	3.05	4.08	4.84	5.53	6.41	7.17	7.79
0.2333	14	2.96	3.95	4.69	5.37	6.23	6.97	7.57
0.2500	15	2.87	3.83	4.56	5.22	6.06	6.78	7.37
0.2667	16	2.78	3.72	4.43	5.08	5.90	6.60	7.18
0.2833	17	2.71	3.61	4.31	4.95	5.75	6.44	7.00
0.3000	18	2.63	3.51	4.20	4.83	5.61	6.29	6.84
0.3167	19	2.56	3.42	4.10	4.71	5.47	6.14	6.68
0.3333	20	2.50	3.33	4.00	4.60	5.35	6.00	6.53
0.3500	21	2.44	3.25	3.90	4.50	5.23	5.87	6.39
0.3667	22	2.38	3.17	3.81	4.40	5.12	5.75	6.26
0.3833	23	2.32	3.10	3.73	4.31	5.01	5.63	6.13
0.4000	24	2.27	3.03	3.65	4.22	4.91	5.52	6.01
0.4167	25	2.22	2.96	3.57	4.13	4.81	5.41	5.90
0.4333	26	2.20	2.90	3.50	4.05	4.72	5.31	5.79
0.4500	27	2.16	2.84	3.43	3.98	4.63	5.21	5.69
0.4667	28	2.14	2.78	3.37	3.90	4.55	5.12	5.59
0.4833	29	2.11	2.72	3.30	3.83	4.47	5.03	5.49
0.5000	30	2.08	2.67	3.24	3.76	4.39	4.94	5.40
0.5167	31	2.05	2.62	3.19	3.70	4.32	4.86	5.32
0.5333	32	2.02	2.57	3.10	3.63	4.25	4.79	5.22
0.5500	33	1.99	2.52	3.05	3.57	4.18	4.71	5.14
0.5667	34	1.96	2.48	3.01	3.51	4.11	4.63	5.07
0.5833	35	1.93	2.44	2.98	3.46	4.05	4.56	5.00
0.6000	36	1.91	2.39	2.93	3.41	3.99	4.50	4.93
0.6167	37	1.89	2.35	2.88	3.36	3.93	4.43	4.86
0.6333	38	1.87	2.32	2.84	3.31	3.87	4.37	4.79
0.6500	39	1.85	2.28	2.80	3.26	3.82	4.31	4.73
0.6667	40	1.83	2.24	2.76	3.22	3.76	4.25	4.66
0.6833	41	1.81	2.21	2.72	3.17	3.71	4.19	4.60
0.7000	42	1.79	2.18	2.68	3.13	3.66	4.13	4.54
0.7167	43	1.77	2.14	2.64	3.09	3.61	4.08	4.49
0.7333	44	1.75	2.11	2.61	3.05	3.57	4.03	4.43

DURATION in hours	DURATION in minutes	RETURN PERIOD 1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
0.7500	45	1.73	2.08	2.57	3.01	3.52	3.98	4.38
0.7667	46	1.70	2.05	2.54	2.97	3.48	3.93	4.33
0.7833	47	1.67	2.02	2.50	2.93	3.44	3.88	4.28
0.8000	48	1.66	2.00	2.47	2.90	3.39	3.84	4.23
0.8167	49	1.64	1.97	2.44	2.86	3.35	3.79	4.18
0.8333	50	1.61	1.95	2.41	2.83	3.32	3.75	4.13
0.8500	51	1.59	1.92	2.38	2.79	3.28	3.71	4.09
0.8667	52	1.56	1.89	2.35	2.76	3.24	3.67	4.05
0.8833	53	1.54	1.86	2.33	2.73	3.20	3.63	4.00
0.9000	54	1.52	1.84	2.30	2.70	3.17	3.59	3.96
0.9167	55	1.50	1.81	2.27	2.67	3.14	3.55	3.92
0.9333	56	1.47	1.79	2.25	2.64	3.10	3.51	3.88
0.9500	57	1.45	1.76	2.22	2.61	3.07	3.48	3.84
0.9667	58	1.43	1.74	2.20	2.59	3.04	3.44	3.81
0.9833	59	1.42	1.72	2.18	2.56	3.01	3.41	3.77
1.0000	60	1.40	1.69	2.15	2.53	2.98	3.37	3.73
1.0167	61	1.38	1.67	2.13	2.51	2.95	3.34	3.70
1.0333	62	1.36	1.65	2.11	2.48	2.92	3.31	3.67
1.0500	63	1.34	1.63	2.09	2.46	2.89	3.28	3.63
1.0667	64	1.33	1.61	2.07	2.44	2.86	3.25	3.60
1.0833	65	1.31	1.59	2.05	2.41	2.84	3.22	3.57
1.1000	66	1.30	1.57	2.03	2.39	2.81	3.19	3.54
1.1167	67	1.28	1.56	2.01	2.37	2.79	3.16	3.51
1.1333	68	1.26	1.54	1.99	2.35	2.76	3.13	3.48
1.1500	69	1.25	1.52	1.97	2.33	2.74	3.10	3.45
1.1667	70	1.24	1.50	1.95	2.31	2.71	3.08	3.42
1.1833	71	1.22	1.49	1.93	2.28	2.69	3.05	3.39
1.2000	72	1.21	1.47	1.92	2.26	2.67	3.02	3.36
1.2167	73	1.20	1.46	1.90	2.25	2.64	3.00	3.34
1.2333	74	1.18	1.44	1.88	2.23	2.63	2.98	3.31
1.2500	75	1.17	1.43	1.86	2.21	2.61	2.95	3.29
1.2667	76	1.16	1.41	1.85	2.19	2.58	2.93	3.26
1.2833	77	1.15	1.40	1.83	2.17	2.55	2.90	3.24
1.3000	78	1.13	1.38	1.82	2.15	2.53	2.88	3.22
1.3167	79	1.12	1.37	1.80	2.14	2.50	2.86	3.19
1.3333	80	1.11	1.36	1.79	2.12	2.48	2.84	3.16
1.3500	81	1.10	1.34	1.77	2.10	2.46	2.82	3.13
1.3667	82	1.09	1.33	1.76	2.08	2.43	2.79	3.10
1.3833	83	1.08	1.32	1.74	2.06	2.41	2.76	3.07
1.4000	84	1.07	1.31	1.73	2.04	2.39	2.74	3.04
1.4167	85	1.07	1.30	1.72	2.02	2.37	2.71	3.01
1.4333	86	1.05	1.28	1.70	2.00	2.34	2.69	2.99
1.4500	87	1.04	1.27	1.69	1.99	2.32	2.66	2.96
1.4667	88	1.03	1.26	1.68	1.97	2.30	2.64	2.93
1.4833	89	1.02	1.25	1.68	1.95	2.28	2.62	2.91
1.5000	90	1.01	1.24	1.66	1.93	2.26	2.59	2.88
1.5167	91	1.00	1.23	1.65	1.92	2.24	2.57	2.86
1.5333	92	1.00	1.22	1.63	1.90	2.22	2.55	2.83
1.5500	93	0.99	1.21	1.62	1.89	2.20	2.53	2.81
1.5667	94	0.98	1.20	1.61	1.87	2.19	2.51	2.79
1.5833	95	0.97	1.19	1.59	1.85	2.17	2.49	2.76

DURATION in hours	DURATION in minutes	RETURN PERIOD 1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
1.6000	96	0.96	1.18	1.58	1.84	2.15	2.46	2.74
1.6167	97	0.96	1.17	1.57	1.82	2.13	2.44	2.72
1.6333	98	0.95	1.16	1.56	1.81	2.12	2.42	2.70
1.6500	99	0.94	1.15	1.54	1.80	2.10	2.41	2.67
1.6667	100	0.93	1.14	1.53	1.78	2.08	2.39	2.65
1.6833	101	0.93	1.13	1.52	1.77	2.08	2.39	2.65
1.7000	102	0.92	1.13	1.51	1.75	2.05	2.35	2.61
1.7167	103	0.91	1.12	1.50	1.74	2.04	2.33	2.59
1.7333	104	0.90	1.11	1.49	1.73	2.02	2.31	2.57
1.7500	105	0.90	1.10	1.47	1.72	2.01	2.30	2.55
1.7667	106	0.89	1.09	1.46	1.70	1.99	2.28	2.54
1.7833	107	0.88	1.09	1.45	1.69	1.98	2.26	2.52
1.8000	108	0.88	1.08	1.44	1.68	1.96	2.25	2.50
1.8167	109	0.87	1.07	1.43	1.67	1.95	2.23	2.48
1.8333	110	0.87	1.06	1.42	1.65	1.93	2.21	2.46
1.8500	111	0.86	1.06	1.41	1.64	1.92	2.20	2.45
1.8667	112	0.85	1.05	1.40	1.63	1.91	2.18	2.43
1.8833	113	0.85	1.04	1.39	1.62	1.89	2.17	2.41
1.9000	114	0.84	1.03	1.38	1.61	1.88	2.15	2.40
1.9167	115	0.84	1.03	1.37	1.60	1.87	2.14	2.38
1.9333	116	0.83	1.02	1.36	1.59	1.86	2.12	2.36
1.9500	117	0.82	1.01	1.36	1.58	1.84	2.11	2.35
1.9667	118	0.82	1.01	1.35	1.57	1.83	2.09	2.33
1.9833	119	0.81	1.00	1.34	1.56	1.82	2.08	2.32
2.0000	120	0.81	0.99	1.33	1.55	1.81	2.07	2.30


Sedgwick County IDF Curves
5 min to 120 min durations
1 YR
2 YR
5 YR
10 YR
25 YR
50 YR
100 YR
Intensity, in inches/hour
0
2
4
6
8
10
12
Duration, in minutes
0
20
40
60
80
100
120

NAHOLA ADDITION

EXHIBIT 2-5

3.0 Post-Development Conditions Information

3.1 Post-Development Conditions Drainage Map

3.1.1 Proposed Project Boundary

The one-step final plat showing property boundaries is included as Exhibit 1-3.

3.1.2 On-Site and Off-Site Topography

Topography in the area is shown on the drainage plan, Exhibit 1-1.

3.1.3 Existing On-Site and Off-Site Drainage Features Remaining

A proposed detention pond shall be constructed near the central portion of the property and serve as detention for the proposed development. The storm sewer and ditch systems along Elder, Murdock, Doris and Central will remain unchanged. The storm sewer and ditch systems along Elder, Murdock, Doris and Central will continue to route flow around the site to the west, north, east and south.

A reserve will be dedicated or an easement recorded to accommodate the proposed detention cell upon final site design once site geometrics are better defined.

3.1.4 Location and Description of Off-Site Through-Drainage Conveyances

All offsite flows will continue to be routed around the site to the west, north, east and south by storm sewer and ditch systems in Elder, Murdock, Doris and Central. Required drainage improvements within these road right-of-ways due to this development is anticipated to be minimal.

3.1.5 Footprint of Proposed Impervious Areas

The total impervious area for the area to be developed, estimated based on actual land use, is estimated at 40% of the drainage areas. Therefore, the total impervious area on the entire site to be developed could be up to 1.25 acres. The total impervious area for the existing developed area within the platted boundary, estimated based on actual land use, is estimated at 85% of the drainage area. Therefore, the total impervious area on the existing portion of the site already developed is estimated to be 1.38 acres.

3.1.6 Location of Proposed Utilities

Proposed utilities shall be laid out as part of future construction plans to be submitted to the City for review. This shall include the extension of water mains to serve the proposed development and run in public utility easements. Storm sewer extensions to convey drainage within the site will be designed and submitted to the City for review once lot and easement lines are determined. The plat (Exhibit 1-3) shows proposed easements, which will be the

location for any future utilities. Additional utility easements likely will be dedicated by separate instrument as final site configuration is determined.

3.1.7 Delineation of Predominant Soils

The predominant soil type is discussed in section 2.1.8. See Exhibit 1-6 for NRCS Soil Survey map and information showing existing soil types and descriptions.

3.1.8 Land Use Cover per NRCS Nomenclature

All undisturbed areas within the site currently have fair grass cover. The dry detention area along the east property line contains minimal tree cover.

3.1.9 Internal Drainage Sub-Basin Boundaries

The proposed drainage plan (Exhibit 1-1) delineates the proposed internal sub-basins and Exhibit 3-1 shows a table of the areas.

3.1.10 Proposed Limits of Land Disturbing Activity

Clearing and grading shall be done only as needed for development and will be established upon any submittal for site improvements.

3.1.11 Time of Concentration Flow Paths

The proposed drainage plan in Exhibit 1-1 shows the general flow paths for each drainage area in the six main basins. The sub-basin site drainage will be collected in proposed storm sewer systems and drain into the proposed detention pond located at to the east central portion of the property. Overflow beyond the design level of the pond flows to an existing parking lot and Elm Street right-of-way and ultimately will discharge to the Big Ditch west of the property. The flow to these areas is mostly sheet flow with minor concentrated flow at the lower ends of the basins. Offsite drainage flows around the site to the west, north, east and south in roadside ditches and piped storm sewer systems in Elder, Murdock, Doris and Central. These roadways and the site ultimately discharges to the Big Ditch west of the site.

3.2 Proposed Conveyances Map

3.2.1 On-Site and Off-Site Drainage Features Proposed

Existing conveyance systems are shown on Exhibit 1-1.

3.2.2 Storm Sewer System Components

Proposed changes to existing systems are discussed in Section 3.1.11 and further lot development would include adding grated or curb inlets at sump areas as needed in proposed parking areas or common access drives discharging to the Elder Street and Murdock Street

Ditches or the proposed detention cell near the east property line. The drainage plan shows the location of the proposed detention pond. Any additional storm sewer designs shall comply with the latest City of Wichita design criteria to convey any added site runoff.

3.2.3 Stormwater Flow for Sub-Basin or Drainage Area > 40 Acres

Proposed drainage areas and sub-basin do not exceed 40 acres.

3.2.4 Location of Stormwater Management Facilities

A proposed detention area located in the east central portion of the site shall be constructed to reduce proposed run-off and outlet in a manner similar to the existing flows controls.

3.2.5 Proposed Energy Dissipaters and Other Channel Protection Devices

The outlet for the proposed detention pond shall be piped to tie into existing storm sewer to eliminate erosion.

3.2.6 Locations and Dimensions of Proposed Channel, Bridge, and Culvert Crossings

A pumped pond outlet will be located near the east central portion of the property and discharge to the existing storm sewer in Central Avenue or at the intersection of Doris and Elm.

3.2.7 Normal Pool and 100-Year Pool Elevations for Ponds and Lakes

The dry detention pond shall have a 100 year design water surface elevation of 1311.6. A series of gravel filled French Drains will drain the proposed detention cell to the water table which is anticipated to be found at an elevation of 1298+/-. See Exhibit 1-1 for layout of the pond. Ponding will remain within the confines of the proposed detention cell and will not enter adjoining lots in the 100 year rainfall event.

3.2.8 Permanent Concrete Outfall Control Structures for Ponds

Since all runoff routed to the proposed detention cell is to be drained to the water table, a permanent concrete outfall control structure is not included as part of this detention cell design.

3.2.9 Emergency Overflow Spillways and Top of Berm Elevations for Ponds

Overflow from the pond shall continue past the overflow weirs and into the existing parking lot that drains to the Elm Street ditches and Central Avenue storm sewer system. The top of berm elevation around to pond shall be no less than a 1312.00.

3.2.10 Floodplains, Ponds, and Stormwater Management Facilities Located in Reserves

This site is not within the limits of a delineated FEMA Floodplain. The proposed detention pond shall be within a reserve as shown by the plat. The Drainage Plan shows this proposed reserve area for the pond as well. It is expected that the final location of the pond be determined as part of the final design and grading plans for the property. Changes to this Drainage Plan must be approved by the appropriate governing body prior to issuing any building permit to ensure that drainage requirements are met.

3.3 Post-Development Conditions Hydrology and Hydraulics

3.3.1 Narrative of the Hydrologic Analysis Methodology

The analysis was completed using the SCS Hydrograph method. The 1, 2, 5, 10, 25, & 100 year, 24-hour storm events were evaluated. The analysis information appears in Exhibit 3-2.

3.3.2 Summary Table of Drainage Sub-Basin Hydrologic Parameters

Drainage Basin	Area (Acres)	Curve Number	T_c (min)
OS-1	1.74	75.0	16.9
OS-2	1.61	75.0	16.9
OS-3	0.57	75.0	23.8
OS-4	0.66	75.0	18.3
Area "A"	3.12	85.0	31.6
Area "B"	1.62	92.0	8.3

3.3.3 Table of Post-Development Condition Runoff Curve Numbers

For the post-development condition, the curve numbers were weighted based on area of their respective hydrologic soil groups over the site and include adjustment for impervious areas. The results are shown in the table below.

OS-1		Hydrologic	Area		% of Area	CN
Soil #	Soil Information	Group	Square Feet	Acres	%	Proposed
6250	Urban land-Canadian complex, 0 to 3% slopes	B	75794.40	1.740	100.00%	75.0
		TOTALS	75794.40	1.740	100.00%	75.0

OS-2		Hydrologic	Area		% of Area	CN
Soil #	Soil Information	Group	Square Feet	Acres	%	Proposed
6250	Urban land-Canadian complex, 0 to 3% slopes	B	70131.60	1.610	100.00%	75.0
		TOTALS	70131.60	1.610	100.00%	75.0

OS-3		Hydrologic	Area		% of Area	CN
Soil #	Soil Information	Group	Square Feet	Acres	%	Proposed
6250	Urban land-Canadian complex, 0 to 3% slopes	B	24829.20	0.570	100.00%	75.0
		TOTALS	24829.20	0.570	100.00%	75.0

OS-4		Hydrologic	Area		% of Area	CN
Soil #	Soil Information	Group	Square Feet	Acres	%	Proposed
6250	Urban land-Canadian complex, 0 to 3% slopes	B	28749.60	0.660	100.00%	75.0
		TOTALS	28749.60	0.660	100.00%	75.0

Area "A"		Hydrologic	Area		% of Area	CN
Soil #	Soil Information	Group	Square Feet	Acres	%	Proposed
6250	Urban land-Canadian complex, 0 to 3% slopes	B	135907.20	3.120	100.00%	85.0
		TOTALS	135907.20	3.120	100.00%	85.0

Area "B"		Hydrologic	Area		% of Area	CN
Soil #	Soil Information	Group	Square Feet	Acres	%	Proposed
6250	Urban land-Canadian complex, 0 to 3% slopes	B	70567.20	1.620	100.00%	92.0
		TOTALS	70567.20	1.620	100.00%	92.0

3.3.4 Table of Post-Development Condition Times of Concentration

Area	T_c (min)
OS-1	16.9
OS-2	16.9
OS-3	23.8
OS-4	18.3
Area "A"	31.6
Area "B"	8.3

Supporting data and calculations are found on the time of concentration worksheet attached as Exhibit 3-3.

3.3.5 Cross-Sections and Other Diagrams of Hydraulic Features

All proposed channels/ditches shall have maximum side slopes of 4:1.

3.3.6 Hydrologic and Hydraulic Analyses

Post-development condition analysis report attached as Exhibit 3-2.

3.3.7 Downstream Peak Discharge Assessment (10% Rule)

Runoff from this site, with the exception of those areas that are already developed and are not planned for redevelopments, will be routed to a proposed detention/retention pond and then allowed to infiltrate to the water table or drained to existing storm sewer systems or roadside ditches in adjoining public streets.

3.3.8 Stage-Storage-Discharge Curves

Storage curve was computed for the volume of water that could be stored for proposed runoff within the drainage area "A". Exhibit 3-2 includes design information for the detention pond along with all hydrograph data. The resulting stage-storage-discharge table is shown on the Drainage Plan as well (Exhibit 1-1). All storm events' proposed outflow through the pond give a significant decrease in post-developed flows in relation to existing flows as discussed for an overall reduction of flows to the adjoining property to the south.

3.3.9 Pond Contours on the Master Grading Plan

The detention pond and proposed location is shown on the Drainage Plan (Exhibit 1-1). The pond shall be constructed with the initial phase of development and will be shown as part of the master grading plan.

3.3.10 One Foot of Freeboard Above the 100-Year, 24-Hour High Water Level

The freeboard for the detention facility is a minimum of one foot (1') above the proposed high water surface elevation. The top of the pond in the design calculations was set to an elevation of 1312. The HWL designed for the pond is 1311.6. Proposed parking lots, sidewalks and structures adjoining the detention facility will be set to an elevation of 1313.6 minimum to provide 2' of freeboard between the 100 year water surface elevation and the adjoining structures.

3.3.11 Runoff Discharge Comparison

No relevant impacts are noted from this analysis. With the dry detention system, flows are not increasing out of that system and therefore have no impact on the downstream existing channel.

3.4 Stormwater Quantity Control Sizing

3.4.1 Hydraulic Sizing Calculations

Storm water controls will include appropriate inlet and pipe networks at locations to be finalized as part of the construction plans. No proposed layouts of storm sewer networks have been included as part of this drainage study, as final site configuration of this property has yet to be determined. Pipe networks to convey the five-year storm at a minimum will be designed as the residential users come online. Sump locations in specific drainage areas will have flows routed overland to other low points and carried through the remainder of the system.

3.4.2 Table of Stormwater Quantity Management Controls

A summary table of the proposed storm sewer networks has not been included in this report as final site configurations are not known at this time. A supplementary drainage study will be submitted including these calculations once lot configuration is better defined.

3.4.3 Typical Details

All structures shall conform to City of Wichita standards.

3.5 Stormwater Quality Management Facilities

3.5.1 Table of Stormwater Quality Management Facilities

Facilities are listed in Exhibit 3-5.

3.5.2 Maintenance Responsibility of Stormwater Management Facilities

The maintenance of storm water management facilities shall be the responsibility of the owner and shall be transferred to new owner upon the sale of any part thereof.

3.5.3 Water Quality Volume

Water quality volume calculated on Exhibit 3-6. All future lot developments shall address specific water quality requirements for each outlet to the downstream receiving channels and ultimately the Big Ditch.

3.5.4 % TSS Removal Value

Values for each basin shown on Exhibit 3-5.

3.5.5 Channel Protection Volume

An equivalent 30" outlet pipe will be used to drain the basin. The outlet pipe will be connected to the existing storm sewer system in Central Avenue. Channel protection will not be provided since this basin will outlet to existing storm sewer in the adjoining arterial street.

3.5.6 Water Quality Volume and Channel Protection Volume Orifice Sizing

Sizing and design of water quality measures will be addressed in a supplemental study once site configuration and lot layout is better defined.

3.5.7 Additional Calculations

No additional calculations at this time.

3.5.8 Typical Details

All structures shall conform to City of Wichita standards.

NAHOLA ADDITION

EXHIBIT 3-1

NAHOLA ADDITION SUB-BASIN AREAS

EXISTING			PROPOSED		
Parcel Name	**Square Feet**	**Acres**	**Parcel Name**	**Square Feet**	**Acres**
OS-1	75,794.40	1.74	OS-1	75,794.40	1.74
OS-2	70,131.60	1.61	OS-2	70,131.60	1.61
OS-3	24,829.20	0.57	OS-3	24,829.20	0.57
OS-4	28,749.60	0.66	OS-4	28,749.60	0.66
Area "A"	135,907.20	3.12	Area "A"	135,907.20	3.12
Area "B"	70,567.20	1.62	Area "B"	70,567.20	1.62
	OS-1	1.74		OS-1	1.74
	OS-2	1.61		OS-2	1.61
	OS-3	0.57		OS-3	0.57
	OS-4	0.66		OS-4	0.66
	Area "A"	3.12		Area "A"	3.12
	Area "B"	1.62		Area "B"	1.62
	Total	9.32		Total	9.32

NAHOLA ADDITION

EXHIBIT 3-2

Hydraflow Table of Contents

Det Cell Analysis.gpw

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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10 - Year
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25 - Year
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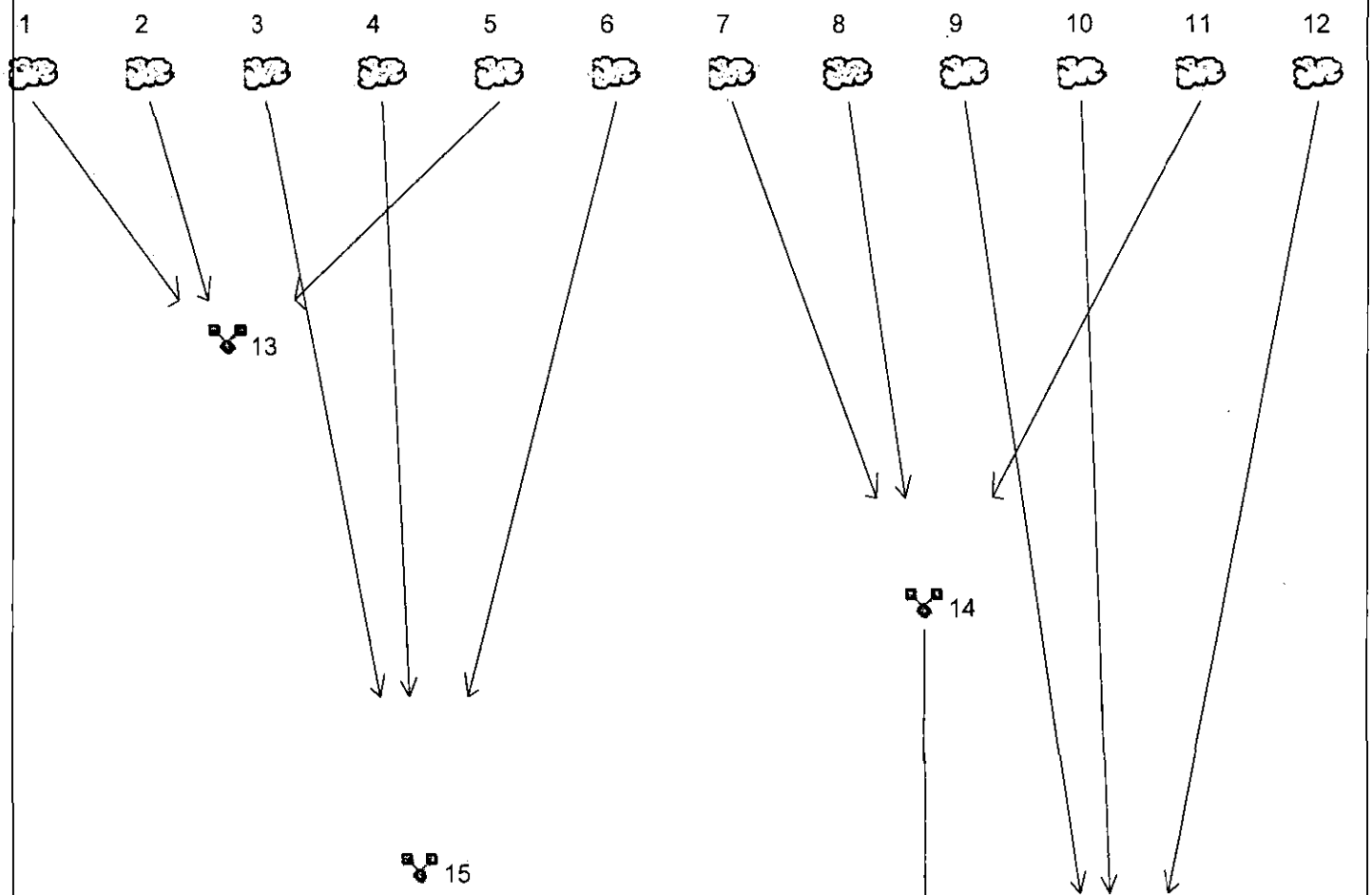
IDF Report 17

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10



Legend

Hyd.	Origin	Description
1	SCS Runoff	Exist OS-1
2	SCS Runoff	Exist OS-2
3	SCS Runoff	Exist. OS-3
4	SCS Runoff	Exist. OS-4
5	SCS Runoff	Exist. Area A
6	SCS Runoff	Exist. Area B
7	SCS Runoff	Prop. OS-1
8	SCS Runoff	Prop. OS-2
9	SCS Runoff	Prop. OS-3
10	SCS Runoff	Prop. OS-4
11	SCS Runoff	Prop. Area A
12	SCS Runoff	Prop. Area B
13	Combine	Combined Exist. Flows to Det. Cell
14	Combine	Comb. Prop. Flows to Det. Cell
15	Combine	Comb. Exist. Flows to Central
16	Combine	Comb. Prop. Flows to Central
17	Reservoir	Routing to Det. Cell

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	1.678	2.695	-------	4.201	5.398	7.046	8.308	9.583	Exist OS-1
2	SCS Runoff	------	1.552	2.494	-------	3.887	4.994	6.519	7.687	8.867	Exist OS-2
3	SCS Runoff	------	0.455	0.737	-------	1.150	1.480	1.935	2.284	2.637	Exist. OS-3
4	SCS Runoff	------	0.636	1.022	-------	1.593	2.047	2.673	3.151	3.635	Exist. OS-4
5	SCS Runoff	------	0.615	1.148	-------	1.998	2.700	3.697	4.477	5.278	Exist. Area A
6	SCS Runoff	------	5.115	6.721	-------	8.850	10.44	12.54	14.11	15.67	Exist. Area B
7	SCS Runoff	------	1.678	2.695	-------	4.201	5.398	7.046	8.308	9.583	Prop. OS-1
8	SCS Runoff	------	1.552	2.494	-------	3.887	4.994	6.519	7.687	8.867	Prop. OS-2
9	SCS Runoff	------	0.455	0.737	-------	1.150	1.480	1.935	2.284	2.637	Prop. OS-3
10	SCS Runoff	------	0.636	1.022	-------	1.593	2.047	2.673	3.151	3.635	Prop. OS-4
11	SCS Runoff	------	3.928	5.583	-------	7.855	9.581	11.89	13.63	15.36	Prop. Area A
12	SCS Runoff	------	5.115	6.721	-------	8.850	10.44	12.54	14.11	15.67	Prop. Area B
13	Combine	1, 2, 5,	3.362	5.479	-------	8.635	11.17	14.71	17.44	20.21	Combined Exist. Flows to Det. Cell
14	Combine	7, 8, 11,	6.735	10.14	-------	14.97	18.79	23.98	27.93	31.89	Comb. Prop. Flows to Det. Cell
15	Combine	3, 4, 6,	5.796	7.901	-------	10.78	12.97	15.91	18.13	20.35	Comb. Exist. Flows to Central
16	Combine	9, 10, 12,	5.796	7.901	-------	10.78	12.97	15.91	18.13	20.35	Comb. Prop. Flows to Central
17	Reservoir	14	5.149	8.197	-------	11.95	14.71	17.83	20.21	23.95	Routing to Det. Cell

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.678	2	726	5,578	------	------	------	Exist OS-1
2	SCS Runoff	1.552	2	726	5,162	------	------	------	Exist OS-2
3	SCS Runoff	0.455	2	730	1,799	------	------	------	Exist. OS-3
4	SCS Runoff	0.636	2	726	2,116	------	------	------	Exist. OS-4
5	SCS Runoff	0.615	2	772	6,868	------	------	------	Exist. Area A
6	SCS Runoff	5.115	2	718	12,043	------	------	------	Exist. Area B
7	SCS Runoff	1.678	2	726	5,578	------	------	------	Prop. OS-1
8	SCS Runoff	1.552	2	726	5,162	------	------	------	Prop. OS-2
9	SCS Runoff	0.455	2	730	1,799	------	------	------	Prop. OS-3
10	SCS Runoff	0.636	2	726	2,116	------	------	------	Prop. OS-4
11	SCS Runoff	3.928	2	734	17,063	------	------	------	Prop. Area A
12	SCS Runoff	5.115	2	718	12,043	------	------	------	Prop. Area B
13	Combine	3.362	2	726	17,608	1, 2, 5,	------	------	Combined Exist. Flows to Det. Cell
14	Combine	6.735	2	728	27,803	7, 8, 11,	------	------	Comb. Prop. Flows to Det. Cell
15	Combine	5.796	2	720	15,958	3, 4, 6,	------	------	Comb. Exist. Flows to Central
16	Combine	5.796	2	720	15,958	9, 10, 12,	------	------	Comb. Prop. Flows to Central
17	Reservoir	5.149	2	738	27,778	14	1309.60	5,371	Routing to Det. Cell

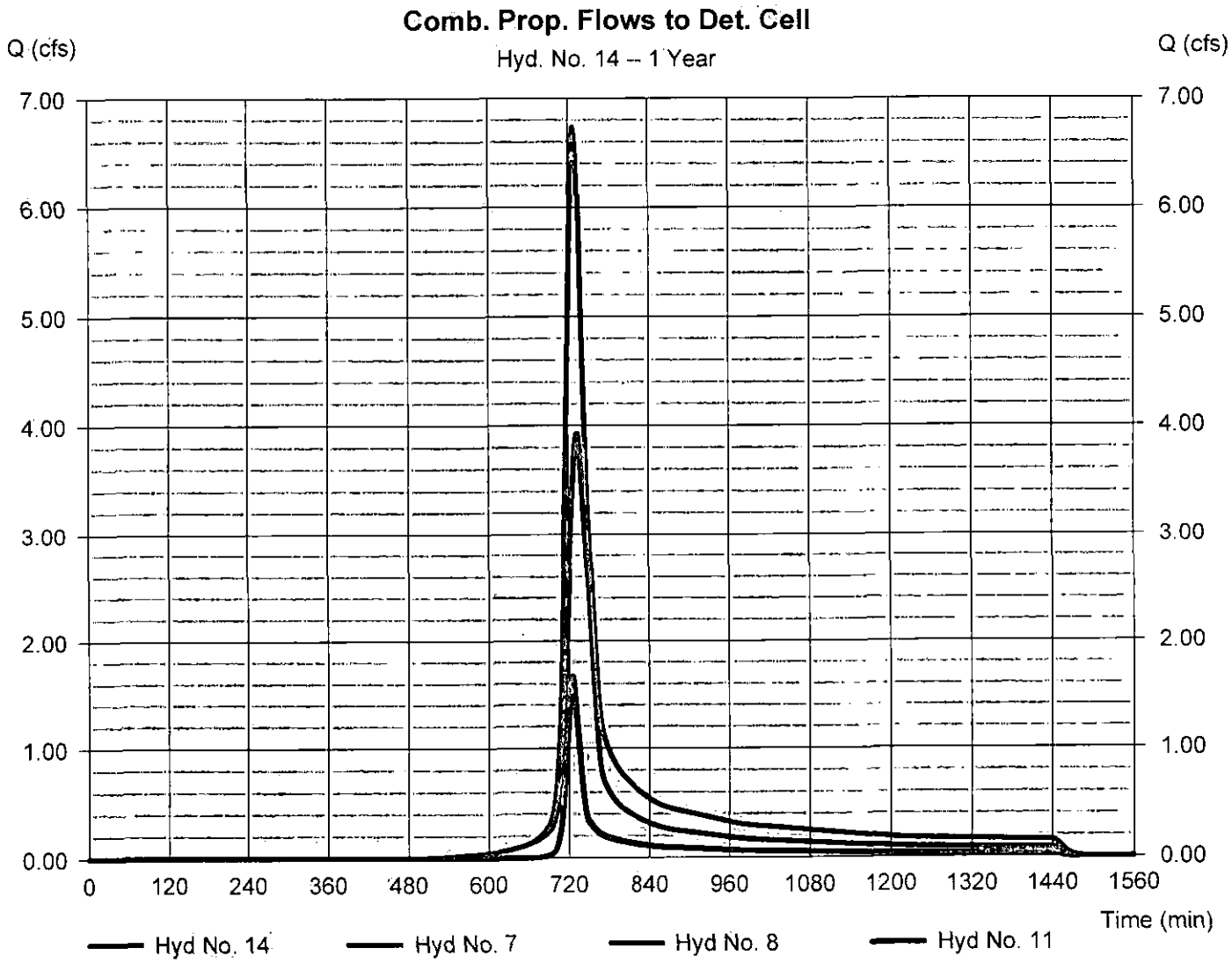
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 09 / 12 / 2013

Hyd. No. 14

Comb. Prop. Flows to Det. Cell

Hydrograph type	= Combine	Peak discharge	= 6.735 cfs
Storm frequency	= 1 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 27,803 cuft
Inflow hyds.	= 7, 8, 11	Contrib. drain. area	= 6.470 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.695	2	726	8,672	------	------	------	Exist OS-1
2	SCS Runoff	2.494	2	726	8,025	------	------	------	Exist OS-2
3	SCS Runoff	0.737	2	730	2,797	------	------	------	Exist. OS-3
4	SCS Runoff	1.022	2	726	3,290	------	------	------	Exist. OS-4
5	SCS Runoff	1.148	2	770	11,489	------	------	------	Exist. Area A
6	SCS Runoff	6.721	2	718	16,069	------	------	------	Exist. Area B
7	SCS Runoff	2.695	2	726	8,672	------	------	------	Prop. OS-1
8	SCS Runoff	2.494	2	726	8,025	------	------	------	Prop. OS-2
9	SCS Runoff	0.737	2	730	2,797	------	------	------	Prop. OS-3
10	SCS Runoff	1.022	2	726	3,290	------	------	------	Prop. OS-4
11	SCS Runoff	5.583	2	732	24,124	------	------	------	Prop. Area A
12	SCS Runoff	6.721	2	718	16,069	------	------	------	Prop. Area B
13	Combine	5.479	2	726	28,186	1, 2, 5,	------	------	Combined Exist. Flows to Det. Cell
14	Combine	10.14	2	728	40,821	7, 8, 11,	------	------	Comb. Prop. Flows to Det. Cell
15	Combine	7.901	2	720	22,155	3, 4, 6,	------	------	Comb. Exist. Flows to Central
16	Combine	7.901	2	720	22,155	9, 10, 12,	------	------	Comb. Prop. Flows to Central
17	Reservoir	8.197	2	736	40,795	14	1309.88	7,079	Routing to Det. Cell

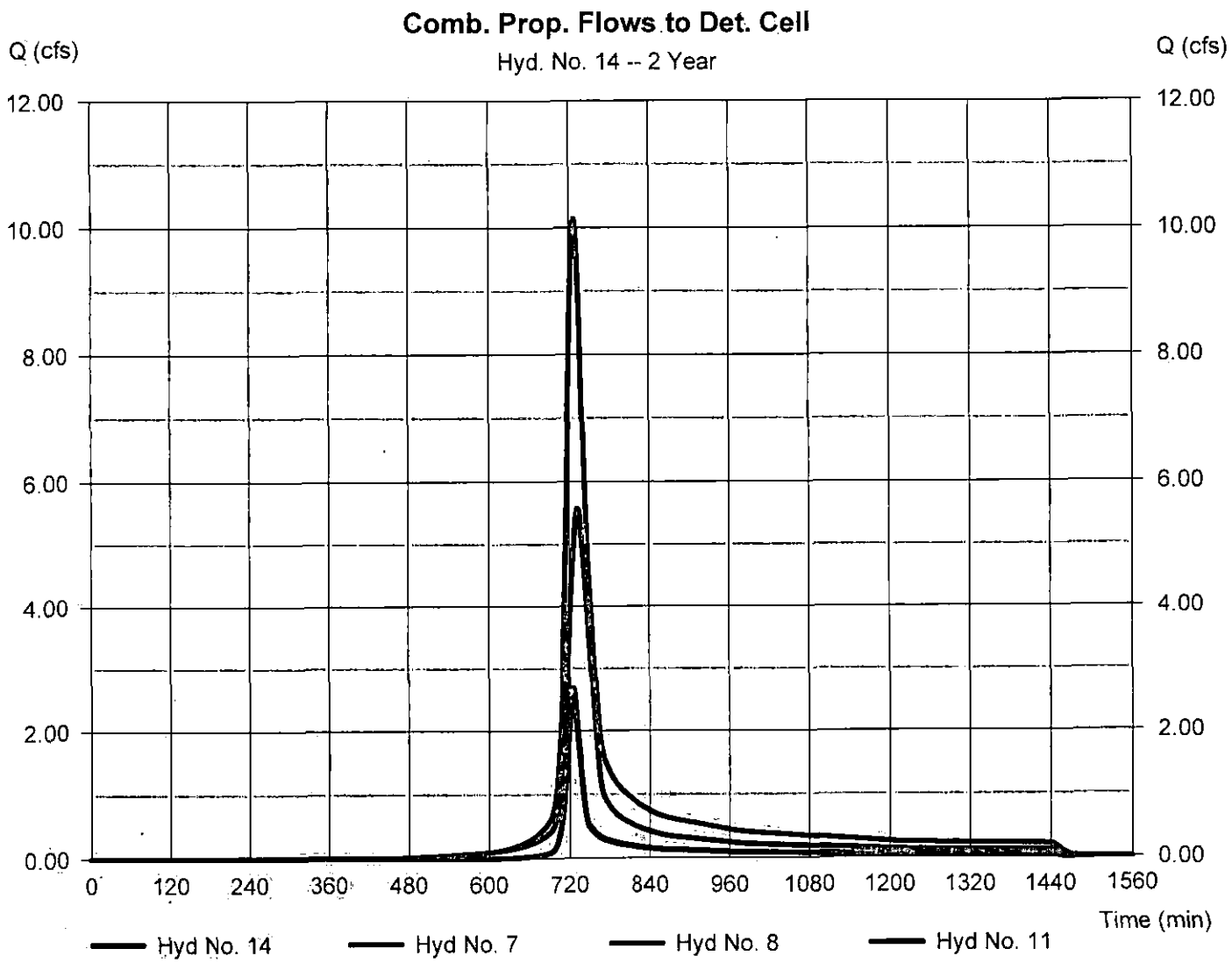
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 09 / 12 / 2013

Hyd. No. 14

Comb. Prop. Flows to Det. Cell

Hydrograph type	= Combine	Peak discharge	= 10.14 cfs
Storm frequency	= 2 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 40,821 cuft
Inflow hyds.	= 7, 8, 11	Contrib. drain. area	= 6.470 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.201	2	724	13,248	------	------	------	Exist OS-1
2	SCS Runoff	3.887	2	724	12,259	------	------	------	Exist OS-2
3	SCS Runoff	1.150	2	728	4,272	------	------	------	Exist. OS-3
4	SCS Runoff	1.593	2	724	5,025	------	------	------	Exist. OS-4
5	SCS Runoff	1.998	2	770	18,620	------	------	------	Exist. Area A
6	SCS Runoff	8.850	2	718	21,525	------	------	------	Exist. Area B
7	SCS Runoff	4.201	2	724	13,248	------	------	------	Prop. OS-1
8	SCS Runoff	3.887	2	724	12,259	------	------	------	Prop. OS-2
9	SCS Runoff	1.150	2	728	4,272	------	------	------	Prop. OS-3
10	SCS Runoff	1.593	2	724	5,025	------	------	------	Prop. OS-4
11	SCS Runoff	7.855	2	732	33,987	------	------	------	Prop. Area A
12	SCS Runoff	8.850	2	718	21,525	------	------	------	Prop. Area B
13	Combine	8.635	2	726	44,127	1, 2, 5,	------	------	Combined Exist. Flows to Det. Cell
14	Combine	14.97	2	726	59,494	7, 8, 11,	------	------	Comb. Prop. Flows to Det. Cell
15	Combine	10.78	2	720	30,823	3, 4, 6,	------	------	Comb. Exist. Flows to Central
16	Combine	10.78	2	720	30,823	9, 10, 12,	------	------	Comb. Prop. Flows to Central
17	Reservoir	11.95	2	736	59,468	14	1310.24	9,680	Routing to Det. Cell

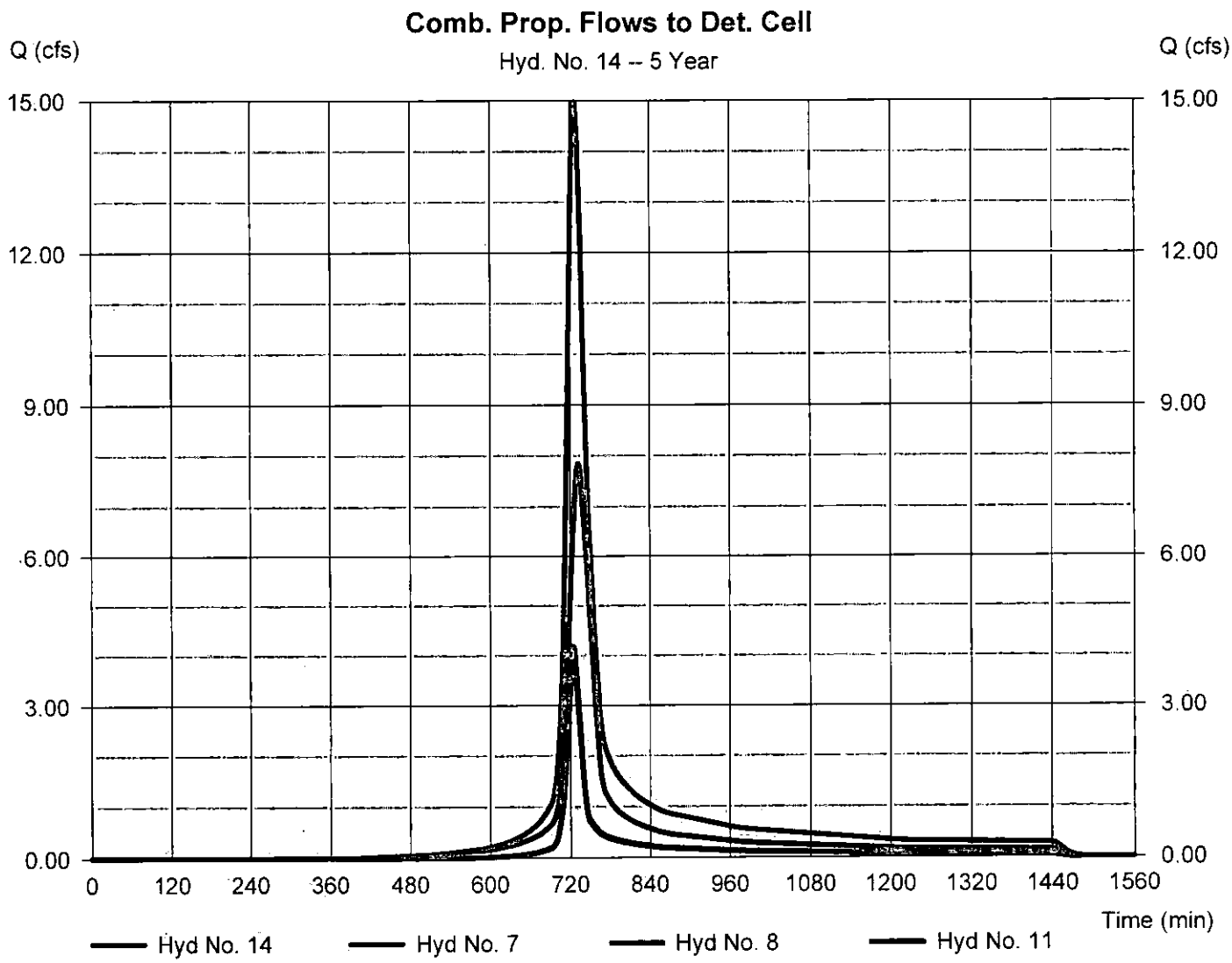
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 09 / 12 / 2013

Hyd. No. 14

Comb. Prop. Flows to Det. Cell

Hydrograph type	= Combine	Peak discharge	= 14.97 cfs
Storm frequency	= 5 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 59,494 cuft
Inflow hyds.	= 7, 8, 11	Contrib. drain. area	= 6.470 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	5.398	2	724	16,916	------	------	------	Exist OS-1
2	SCS Runoff	4.994	2	724	15,652	------	------	------	Exist OS-2
3	SCS Runoff	1.480	2	728	5,455	------	------	------	Exist. OS-3
4	SCS Runoff	2.047	2	724	6,416	------	------	------	Exist. OS-4
5	SCS Runoff	2.700	2	768	24,500	------	------	------	Exist. Area A
6	SCS Runoff	10.44	2	718	25,657	------	------	------	Exist. Area B
7	SCS Runoff	5.398	2	724	16,916	------	------	------	Prop. OS-1
8	SCS Runoff	4.994	2	724	15,652	------	------	------	Prop. OS-2
9	SCS Runoff	1.480	2	728	5,455	------	------	------	Prop. OS-3
10	SCS Runoff	2.047	2	724	6,416	------	------	------	Prop. OS-4
11	SCS Runoff	9.581	2	732	41,600	------	------	------	Prop. Area A
12	SCS Runoff	10.44	2	718	25,657	------	------	------	Prop. Area B
13	Combine	11.17	2	724	57,068	1, 2, 5,	------	------	Combined Exist. Flows to Det. Cell
14	Combine	18.79	2	726	74,168	7, 8, 11,	------	------	Comb. Prop. Flows to Det. Cell
15	Combine	12.97	2	720	37,529	3, 4, 6,	------	------	Comb. Exist. Flows to Central
16	Combine	12.97	2	720	37,529	9, 10, 12,	------	------	Comb. Prop. Flows to Central
17	Reservoir	14.71	2	736	74,143	14	1310.54	11,874	Routing to Det. Cell

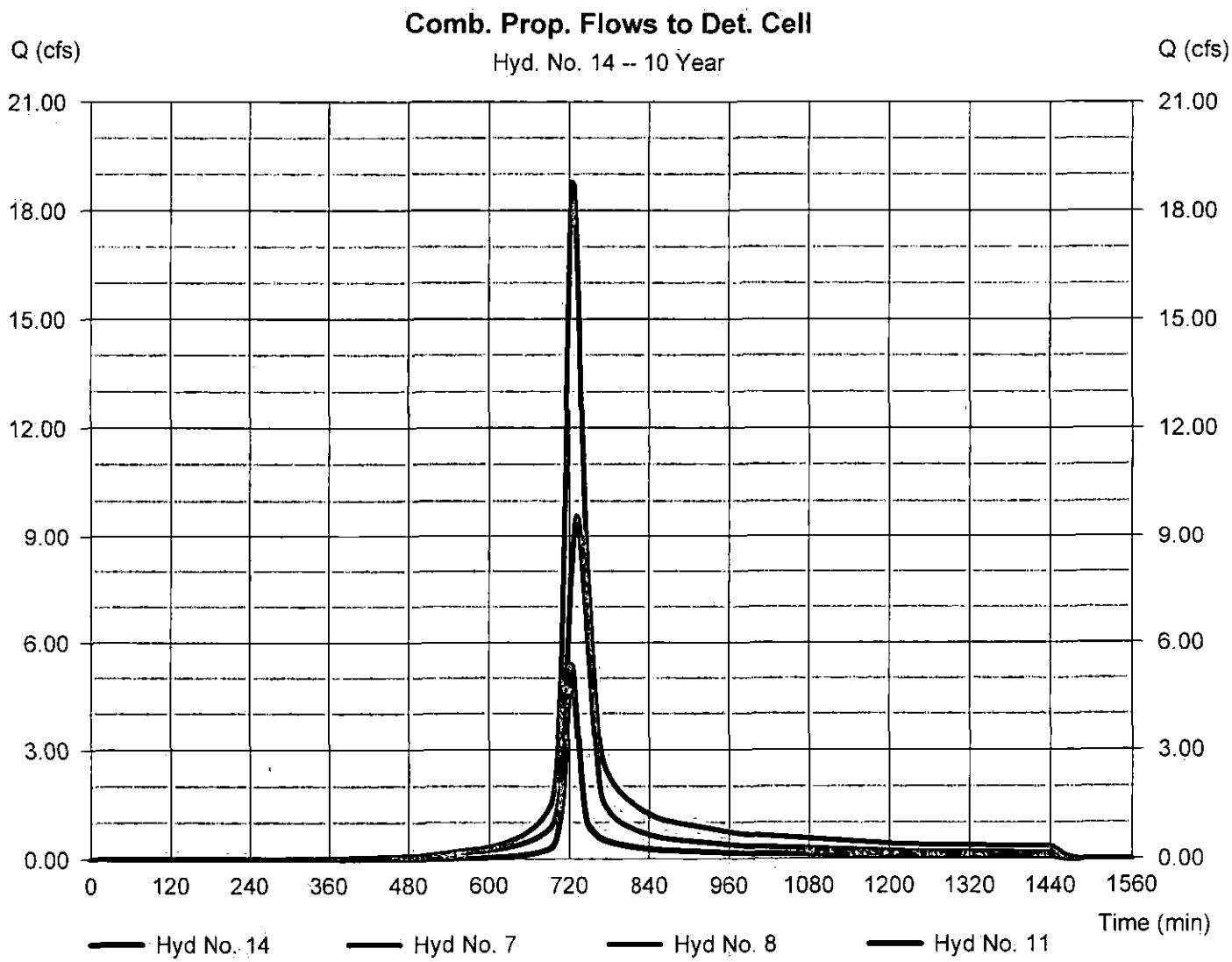
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 09 / 12 / 2013

Hyd. No. 14

Comb. Prop. Flows to Det. Cell

Hydrograph type	= Combine	Peak discharge	= 18.79 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 74,168 cuft
Inflow hyds.	= 7, 8, 11	Contrib. drain. area	= 6.470 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

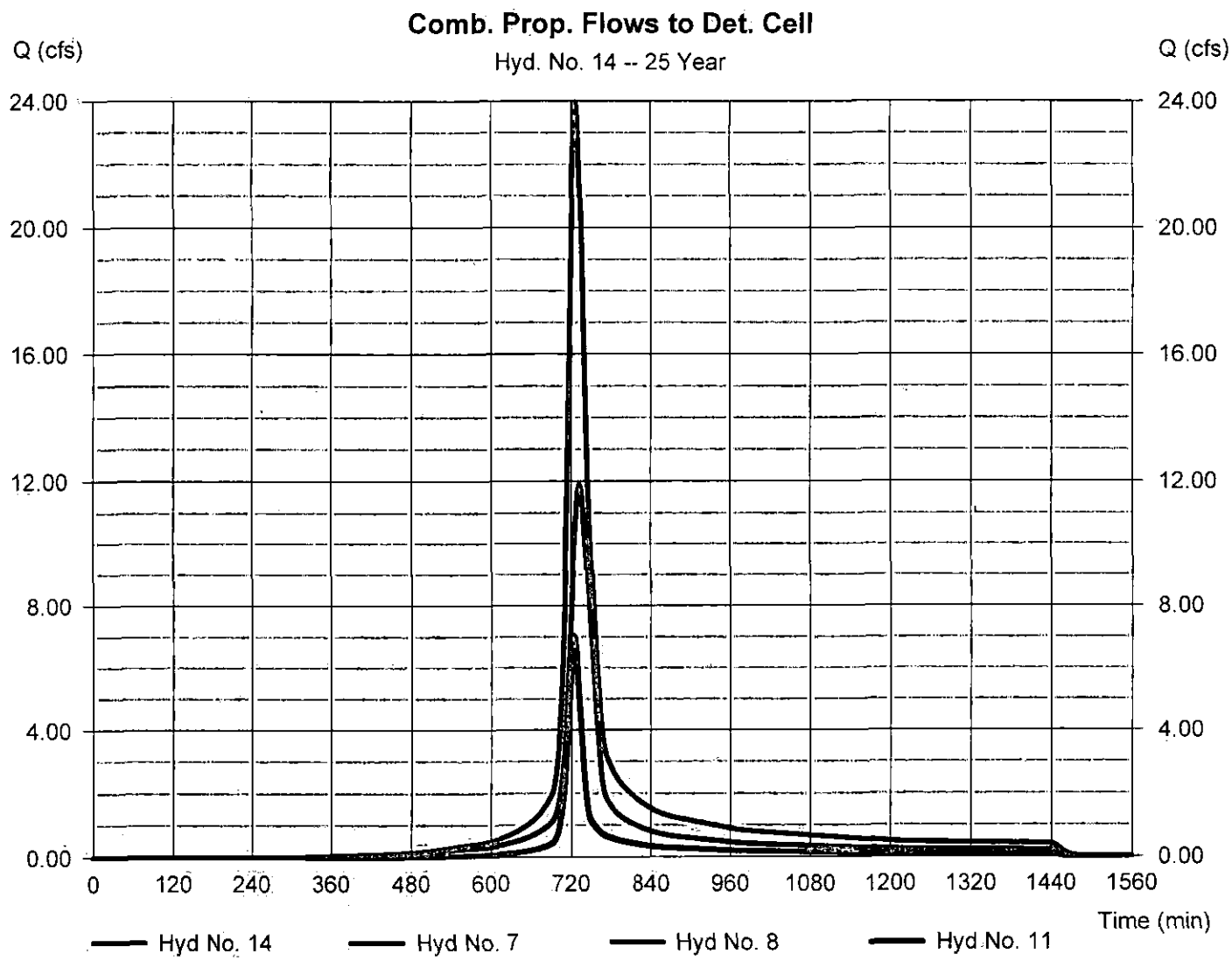
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	7.046	2	724	22,028	------	------	------	Exist OS-1
2	SCS Runoff	6.519	2	724	20,382	------	------	------	Exist OS-2
3	SCS Runoff	1.935	2	728	7,103	------	------	------	Exist. OS-3
4	SCS Runoff	2.673	2	724	8,355	------	------	------	Exist. OS-4
5	SCS Runoff	3.697	2	768	32,858	------	------	------	Exist. Area A
6	SCS Runoff	12.54	2	718	31,200	------	------	------	Exist. Area B
7	SCS Runoff	7.046	2	724	22,028	------	------	------	Prop. OS-1
8	SCS Runoff	6.519	2	724	20,382	------	------	------	Prop. OS-2
9	SCS Runoff	1.935	2	728	7,103	------	------	------	Prop. OS-3
10	SCS Runoff	2.673	2	724	8,355	------	------	------	Prop. OS-4
11	SCS Runoff	11.89	2	732	51,939	------	------	------	Prop. Area A
12	SCS Runoff	12.54	2	718	31,200	------	------	------	Prop. Area B
13	Combine	14.71	2	724	75,268	1, 2, 5,	------	------	Combined Exist. Flows to Det. Cell
14	Combine	23.98	2	726	94,348	7, 8, 11,	------	------	Comb. Prop. Flows to Det. Cell
15	Combine	15.91	2	720	46,658	3, 4, 6,	------	------	Comb. Exist. Flows to Central
16	Combine	15.91	2	720	46,658	9, 10, 12,	------	------	Comb. Prop. Flows to Central
17	Reservoir	17.83	2	738	94,323	14	1310.99	15,222	Routing to Det. Cell

Hydrograph Report

Hyd. No. 14

Comb. Prop. Flows to Det. Cell

Hydrograph type	= Combine	Peak discharge	= 23.98 cfs
Storm frequency	= 25 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 94,348 cuft
Inflow hyds.	= 7, 8, 11	Contrib. drain. area	= 6.470 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	8.308	2	724	25,986	------	------	------	Exist OS-1
2	SCS Runoff	7.687	2	724	24,045	------	------	------	Exist OS-2
3	SCS Runoff	2.284	2	728	8,380	------	------	------	Exist. OS-3
4	SCS Runoff	3.151	2	724	9,857	------	------	------	Exist. OS-4
5	SCS Runoff	4.477	2	768	39,427	------	------	------	Exist. Area A
6	SCS Runoff	14.11	2	718	35,374	------	------	------	Exist. Area B
7	SCS Runoff	8.308	2	724	25,986	------	------	------	Prop. OS-1
8	SCS Runoff	7.687	2	724	24,045	------	------	------	Prop. OS-2
9	SCS Runoff	2.284	2	728	8,380	------	------	------	Prop. OS-3
10	SCS Runoff	3.151	2	724	9,857	------	------	------	Prop. OS-4
11	SCS Runoff	13.63	2	732	59,794	------	------	------	Prop. Area A
12	SCS Runoff	14.11	2	718	35,374	------	------	------	Prop. Area B
13	Combine	17.44	2	724	89,457	1, 2, 5,	------	------	Combined Exist. Flows to Det. Cell
14	Combine	27.93	2	726	109,824	7, 8, 11,	------	------	Comb. Prop. Flows to Det. Cell
15	Combine	18.13	2	720	53,610	3, 4, 6,	------	------	Comb. Exist. Flows to Central
16	Combine	18.13	2	720	53,610	9, 10, 12,	------	------	Comb. Prop. Flows to Central
17	Reservoir	20.21	2	738	109,799	14	1311.34	18,359	Routing to Det. Cell

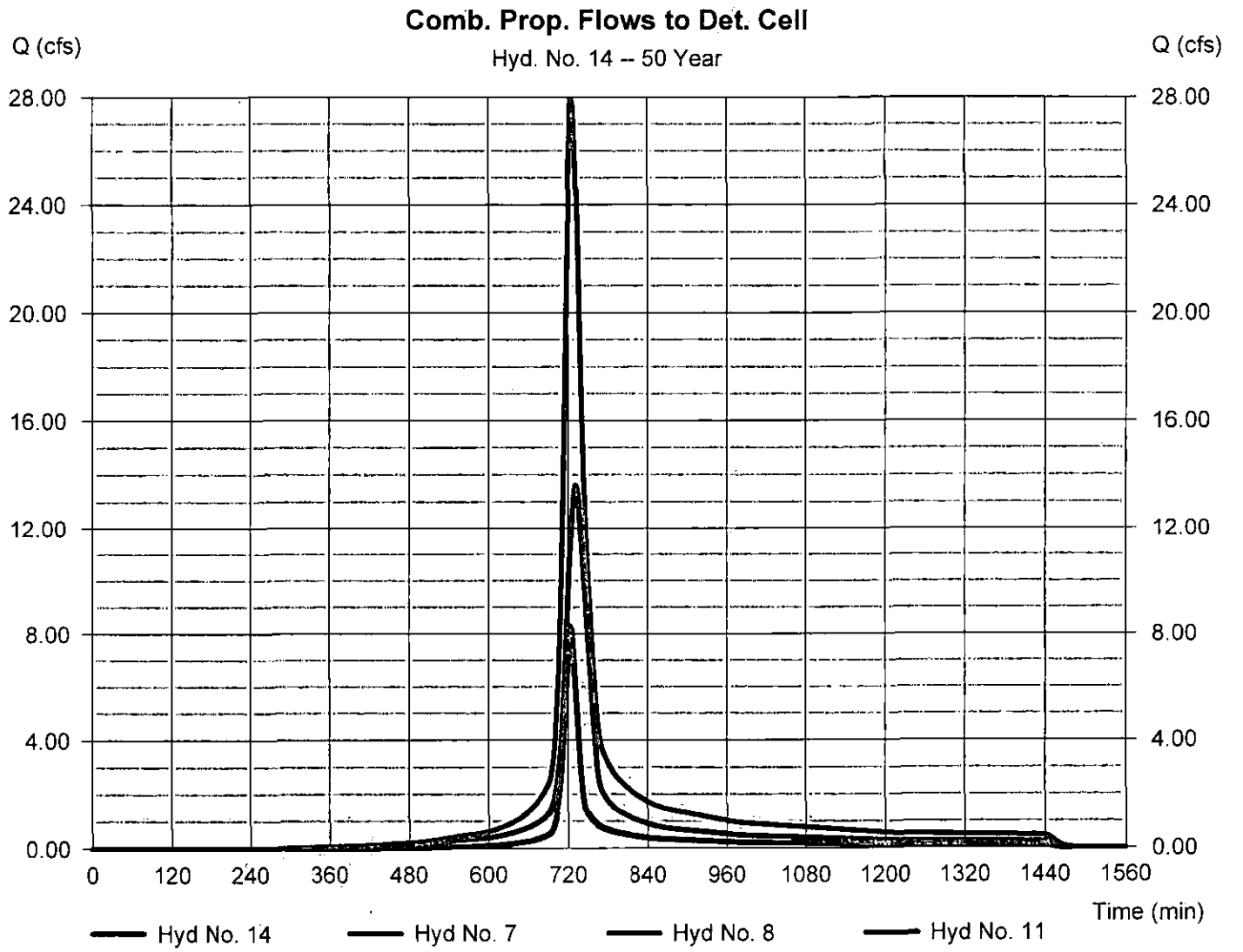
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 09 / 12 / 2013

Hyd. No. 14

Comb. Prop. Flows to Det. Cell

Hydrograph type	= Combine	Peak discharge	= 27.93 cfs
Storm frequency	= 50 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 109,824 cuft
Inflow hyds.	= 7, 8, 11	Contrib. drain. area	= 6.470 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	9.583	2	724	30,026	-----	------	------	Exist OS-1
2	SCS Runoff	8.867	2	724	27,783	------	------	------	Exist OS-2
3	SCS Runoff	2.637	2	728	9,683	------	------	------	Exist. OS-3
4	SCS Runoff	3.635	2	724	11,389	------	------	------	Exist. OS-4
5	SCS Runoff	5.278	2	768	46,198	------	------	------	Exist. Area A
6	SCS Runoff	15.67	2	718	39,558	------	------	------	Exist. Area B
7	SCS Runoff	9.583	2	724	30,026	------	------	------	Prop. OS-1
8	SCS Runoff	8.867	2	724	27,783	------	------	------	Prop. OS-2
9	SCS Runoff	2.637	2	728	9,683	------	------	------	Prop. OS-3
10	SCS Runoff	3.635	2	724	11,389	------	------	------	Prop. OS-4
11	SCS Runoff	15.36	2	732	67,712	------	------	------	Prop. Area A
12	SCS Runoff	15.67	2	718	39,558	------	------	------	Prop. Area B
13	Combine	20.21	2	724	104,007	1, 2, 5,	------	------	Combined Exist. Flows to Det. Cell
14	Combine	31.89	2	726	125,522	7, 8, 11,	------	------	Comb. Prop. Flows to Det. Cell
15	Combine	20.35	2	720	60,630	3, 4, 6,	------	------	Comb. Exist. Flows to Central
16	Combine	20.35	2	720	60,630	9, 10, 12,	------	------	Comb. Prop. Flows to Central
17	Reservoir	23.95	2	736	125,497	14	1311.60	20,635	Routing to Det. Cell

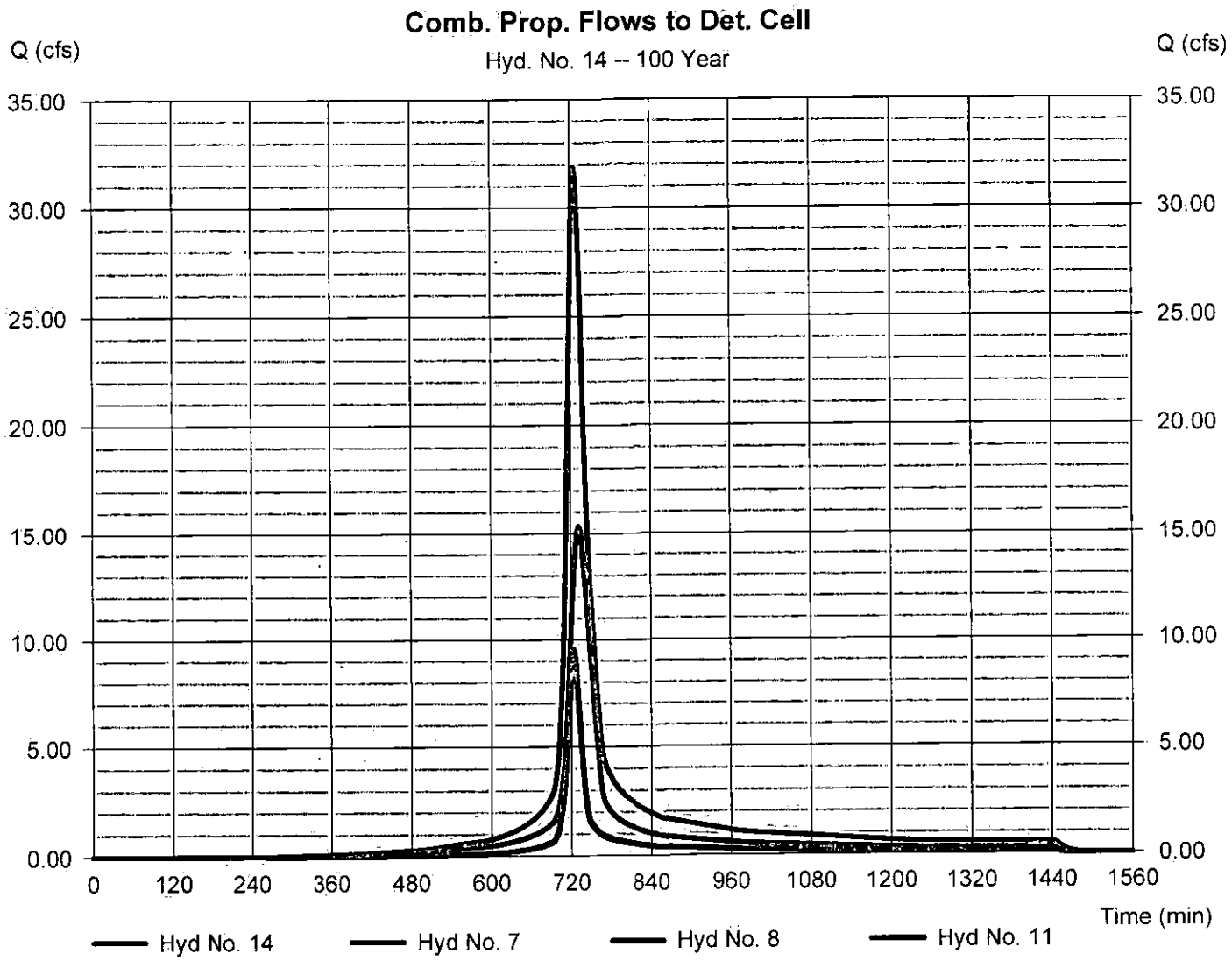
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 09 / 12 / 2013

Hyd. No. 14

Comb. Prop. Flows to Det. Cell

Hydrograph type	= Combine	Peak discharge	= 31.89 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 125,522 cuft
Inflow hyds.	= 7, 8, 11	Contrib. drain. area	= 6.470 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	41.0543	10.4000	0.7875	--------
2	50.0005	11.6000	0.7849	--------
3	0.0000	0.0000	0.0000	--------
5	64.6695	13.4000	0.7859	--------
10	79.3896	14.8000	0.7987	--------
25	97.1176	15.9000	0.8040	--------
50	114.6780	16.8000	0.8146	--------
100	126.7670	17.2000	0.8131	--------

File name: SedgwickCo.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	4.77	3.82	3.21	2.79	2.47	2.23	2.03	1.87	1.74	1.62	1.53	1.44
2	5.51	4.48	3.81	3.33	2.96	2.68	2.45	2.26	2.10	1.97	1.85	1.75
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.56	5.43	4.66	4.10	3.68	3.34	3.07	2.84	2.64	2.48	2.34	2.21
10	7.31	6.11	5.28	4.66	4.19	3.81	3.50	3.24	3.03	2.84	2.67	2.53
25	8.43	7.10	6.16	5.46	4.92	4.48	4.12	3.82	3.57	3.35	3.16	2.99
50	9.32	7.87	6.85	6.08	5.48	5.00	4.60	4.27	3.99	3.74	3.53	3.34
100	10.19	8.64	7.53	6.70	6.05	5.52	5.09	4.72	4.41	4.14	3.91	3.70

Tc = time in minutes. Values may exceed 60.

Precip. file name: SedgwickCo.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.88	3.60	0.00	4.56	5.28	6.24	6.96	7.68
SCS 6-Hr	1.98	2.52	0.00	3.30	3.90	4.68	5.28	5.88
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

NAHOLA ADDITION

EXHIBIT 3-3

Project	NAHOLA ADDITION
Feature	PROPOSED DRAINAGE
Analyst	Scott R. Servis, P.E.
Version	20110418
Notes	notes

Sheet	Subbasin	Number of Segments	Sheet Flow (mins)	Shallow Concentrated Flow (mins)	Open Channel Ditch Flow (mins)	Open Channel Pipe Flow (mins)	Open Channel General Flow (mins)	Other (mins)	Total Tc (mins)	Length (feet)	Drop (feet)	Avg. Slope (%)	Avg. Vel. (fps)	Lag (mins)	Lag (hours)	Area (acres)
1	OS-1	1	16.9	0.0	0.0	0.0	0.0	0.0	16.9	95	1	1.05	0.09	10.2	0.169	1.74
2	OS-2	1	16.9	0.0	0.0	0.0	0.0	0.0	16.9	95	1	1.05	0.09	10.2	0.169	1.61
3	OS-3	1	23.8	0.0	0.0	0.0	0.0	0.0	23.8	100	1	0.50	0.07	14.3	0.238	25.24
4	0S-4	1	18.3	0.0	0.0	0.0	0.0	0.0	18.3	90	1	0.78	0.08	11.0	0.183	500
5	Area "A"	3	19.1	12.3	0.0	0.2	0.0	0.0	31.6	813	4	0.49	0.43	19.0	0.316	3.12
6	Area "B"	2	23.8	7.8	0.0	0.0	0.0	0.0	31.6	550	2	0.27	0.29	19.0	0.316	1.62
7	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
8	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
9	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
10	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
11	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
12	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
13	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
14	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	0.00	0.82	16.4	0.273	500
15	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
16	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
17	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
18	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
19	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
20	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
21	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
22	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
23	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
24	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
25	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500
26	0	6	20.3	2.4	0.1	0.2	0.1	4.2	27.3	1350	47	3.48	0.82	16.4	0.273	500

Subbasin Name	OS-1
Drainage Area (ac)	1.74
Drainage Area (sq mi)	0.00271875

Sheet Flow

selected>>						Total
Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	95	1	1	1	1	95 feet length
Top Elevation (ft)	1314	1	1	1	1	
Bottom Elevation (ft)	1313	1	1	1	1	
Cover	0.24 Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Sheet Flow "n" (dim)	0.240	0.000	0.000	0.000	0.000	
2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0105	0.0000	0.0000	0.0000	0.0000	
Slope (%)	1.05	0.00	0.00	0.00	0.00	
Velocity (fps)	0.09					
Travel Time (hrs)	0.282					
Travel Time (mins)	16.93					16.9 mins travel

Shallow Concentrated Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	490	1	1	1	1	0 feet length
Top Elevation (ft)	1313.5	1	1	1	1	
Bottom Elevation (ft)	1313	1	1	1	1	
Cover	15 Grassed waterway	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "K"						
Surface Coeff (dim)	15.00	0.00	0.00	0.00	0.00	
Drop (ft)	1	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0020	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.20	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Open Channel Ditch Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	490	1052	1	1	1	0 feet length
Top Elevation (ft)	1312.5	1264.23	1	1	1	
Bottom Elevation (ft)	1310	1263.32	1	1	1	
Channel Lining	0.03 Grassed	0.03 Grassed	Choose Lining Type	Choose Lining Type	Choose Lining Type	
Bottom Width (ft)	6.00	8.00	1.00	1.00	1.00	
Left Side Slope (H:V)	4.00	4.00	1.00	1.00	1.00	
Right Side Slope (H:V)	4.00	4.00	1.00	1.00	1.00	
Depth (ft)	6.00	5.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.030	0.030	0.000	0.000	0.000	
Drop (ft)	3	1	0	0	0	0 feet drop
Slope (ft/ft)	0.0051	0.0009	0.0000	0.0000	0.0000	
Slope (%)	0.51	0.09	0.00	0.00	0.00	
Flow Area (sq ft)	180.00	140.00	2.00	2.00	2.00	
Wet Perimeter (ft)	55.48	49.23	3.83	3.83	3.83	
Hydraulic Radius (ft)	3.24	2.84	0.52	0.52	0.52	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	131	400	404	215	168	0 feet length
Top Elevation (ft)	1267.9	1267.02	66.48	65.96	1265.23	
Bottom Elevation (ft)	1267.02	1266.48	66.2	65.7	1264.23	
Pipe Material	0.014 Concrete w/some debris	0.014 Concrete w/some debris	0.014 Concrete w/some debris	0.014 Concrete w/some debris	0.024 Corrugated Metal	
Diameter (ins)	18.00	24.00	30.00	36.00	48.00	
Flow Depth (ins)	18.00	24.00	30.00	36.00	48.00	
Specify alternate "n"						
Manning "n" (dim)	0.014	0.014	0.014	0.014	0.024	
Drop (ft)	1	1	0	0	1	0 feet drop
Slope (ft/ft)	0.0067	0.0013	0.0007	0.0012	0.0060	
Slope (%)	0.67	0.13	0.07	0.12	0.60	
Theta (radians)	6.283	6.283	6.283	6.283	6.283	
Flow Area (sq ft)	1.77	3.14	4.91	7.07	12.57	
Wet Perimeter (ft)	4.71	6.28	7.85	9.42	12.57	
Hydraulic Radius (ft)	0.38	0.50	0.63	0.75	1.00	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel General Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	490	1	1	1	1	0 feet length
Top Elevation (ft)	30	1	1	1	1	
Bottom Elevation (ft)	26	1	1	1	1	
Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	1.00	
Channel Lining	0.025 Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
Drop (ft)	4	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0082	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.82	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Other (Computed Separately)

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	500	1	1	1	1	0 feet length
Drop (ft)	10	1	1	1	1	0 feet drop
Velocity (fps)	2.00	1.00	1.00	1.00	1.00	
Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
Slope (%)	2.00	100.00	100.00	100.00	100.00	
Travel Time (mins)						0.0 mins travel

Total for Subbasin

Segments	1
Length (ft)	95
Drop (ft)	1
Slope (ft/ft)	0.0105

Subbasin Name	OS-2
Drainage Area (ac)	1.61
Drainage Area (sq mi)	0.002515625

selected>>

Sheet Flow

						Total
Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	95	1	1	1	1	95 feet length
Top Elevation (ft)	1313	1	1	1	1	
Bottom Elevation (ft)	1312	1	1	1	1	
Cover	0.24; Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Sheet Flow "n" (dim)	0.240	0.000	0.000	0.000	0.000	
2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0105	0.0000	0.0000	0.0000	0.0000	
Slope (%)	1.05	0.00	0.00	0.00	0.00	
Velocity (fps)	0.09					
Travel Time (hrs)	0.282					
Travel Time (mins)	16.93					16.9 mins travel

Shallow Concentrated Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	550	1	1	1	1	0 feet length
Top Elevation (ft)	1312.5	1	1	1	1	
Bottom Elevation (ft)	1311	1	1	1	1	
Cover	15; Grassed waterway	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "K"						
Surface Coeff (dim)	15.00	0.00	0.00	0.00	0.00	
Drop (ft)	2	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0027	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.27	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Open Channel Ditch Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	550	1145	1	1	1	0 feet length
Top Elevation (ft)	1312.5	64.23	1	1	1	
Bottom Elevation (ft)	1311	62.8	1	1	1	
Channel Lining	0.03; Grassed	0.05; Rough Natural Stream	Choose Lining Type	Choose Lining Type	Choose Lining Type	
Bottom Width (ft)	6.00	8.00	1.00	1.00	1.00	
Left Side Slope (H:V)	4.00	3.00	1.00	1.00	1.00	
Right Side Slope (H:V)	3.00	3.00	1.00	1.00	1.00	
Depth (ft)	6.00	8.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.030	0.050	0.000	0.000	0.000	
Drop (ft)	2	1	0	0	0	0 feet drop
Slope (ft/ft)	0.0027	0.0012	0.0000	0.0000	0.0000	
Slope (%)	0.27	0.12	0.00	0.00	0.00	
Flow Area (sq ft)	162.00	256.00	2.00	2.00	2.00	
Wet Perimeter (ft)	49.71	58.60	3.83	3.83	3.83	
Hydraulic Radius (ft)	3.26	4.37	0.52	0.52	0.52	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	131	400	352	215	182	0 feet length
Top Elevation (ft)	67.9	67.02	66.48	65.96	65.23	
Bottom Elevation (ft)	67.02	66.48	66.2	65.7	64.23	
Pipe Material	0.017; Rough concrete	0.017; Rough concrete	0.017; Rough concrete	0.017; Rough concrete	0.024; Corrugated Metal	
Diameter (ins)	18.00	24.00	30.00	36.00	48.00	
Flow Depth (ins)	18.00	24.00	30.00	36.00	48.00	
Specify alternate "n"						
Manning "n" (dim)	0.017	0.017	0.017	0.017	0.024	
Drop (ft)	1	1	0	0	1	0 feet drop
Slope (ft/ft)	0.0067	0.0013	0.0008	0.0012	0.0055	
Slope (%)	0.67	0.13	0.08	0.12	0.55	
Theta (radians)	6.283	6.283	6.283	6.283	6.283	
Flow Area (sq ft)	1.77	3.14	4.91	7.07	12.57	
Wet Perimeter (ft)	4.71	6.28	7.85	9.42	12.57	
Hydraulic Radius (ft)	0.38	0.50	0.63	0.75	1.00	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel General Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	150	1	1	1	1	0 feet length
Top Elevation (ft)	30	1	1	1	1	
Bottom Elevation (ft)	26	1	1	1	1	
Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	1.00	
Channel Lining	0.025; Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
Drop (ft)	4	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0267	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.67	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Other (Computed Separately)

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	500	1	1	1	1	0 feet length
Drop (ft)	10	1	1	1	1	0 feet drop
Velocity (fps)	2.00	1.00	1.00	1.00	1.00	
Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
Slope (%)	2.00	100.00	100.00	100.00	100.00	
Travel Time (mins)						0.0 mins travel

Total for Subbasin

Segments	1
Length (ft)	95
Drop (ft)	1
Slope (ft/ft)	0.0105

Subbasin Name	OS-3
Drainage Area (ac)	25.24
Drainage Area (sq mi)	0.0394375

Sheet Flow

selected>>						Total
Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	100	1	1	1	1	100 feet length
Top Elevation (ft)	1312	1	1	1	1	
Bottom Elevation (ft)	1312	1	1	1	1	
Cover	0.24 Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Sheet Flow "n" (dim)	0.240	0.000	0.000	0.000	0.000	
2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0050	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.50	0.00	0.00	0.00	0.00	
Velocity (fps)	0.07					
Travel Time (hrs)	0.396					
Travel Time (mins)	23.76					23.8 mins travel

Shallow Concentrated Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	320	1	1	1	1	0 feet length
Top Elevation (ft)	1312.5	1	1	1	1	
Bottom Elevation (ft)	1312	1	1	1	1	
Cover	15 Grassed waterway	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "K"						
Surface Coeff (dim)	15.00	0.00	0.00	0.00	0.00	
Drop (ft)	1	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0031	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.31	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Open Channel Ditch Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	1880	1	1	1	1	0 feet length
Top Elevation (ft)	1270	1	1	1	1	
Bottom Elevation (ft)	1260	1	1	1	1	
Channel Lining	0.03 Grassed	Choose Lining Type	Choose Lining Type	Choose Lining Type	Choose Lining Type	
Bottom Width (ft)	25.00	0.00	1.00	1.00	1.00	
Left Side Slope (H:V)	4.00	1.00	1.00	1.00	1.00	
Right Side Slope (H:V)	4.00	1.00	1.00	1.00	1.00	
Depth (ft)	5.00	1.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.030	0.000	0.000	0.000	0.000	
Drop (ft)	10	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0114	0.0000	0.0000	0.0000	0.0000	
Slope (%)	1.14	0.00	0.00	0.00	0.00	
Flow Area (sq ft)	225.00	1.00	2.00	2.00	2.00	
Wet Perimeter (ft)	66.23	2.83	3.83	3.83	3.83	
Hydraulic Radius (ft)	3.40	0.35	0.52	0.52	0.52	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	100	1	1	1	1	0 feet length
Top Elevation (ft)	20	1	1	1	1	
Bottom Elevation (ft)	18	1	1	1	1	
Pipe Material	0.017 Rough concrete	Choose Material Type	Choose Material Type	Choose Material Type	Choose Material Type	
Diameter (ins)	24.00	1.00	1.00	1.00	1.00	
Flow Depth (ins)	24.00	1.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.017	0.000	0.000	0.000	0.000	
Drop (ft)	2	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0200	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.00	0.00	0.00	0.00	0.00	
Theta (radians)	6.283	6.283	6.283	6.283	6.283	
Flow Area (sq ft)	3.14	0.01	0.01	0.01	0.01	
Wet Perimeter (ft)	6.28	0.26	0.26	0.26	0.26	
Hydraulic Radius (ft)	0.50	0.02	0.02	0.02	0.02	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel General Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	150	1	1	1	1	0 feet length
Top Elevation (ft)	30	1	1	1	1	
Bottom Elevation (ft)	26	1	1	1	1	
Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	1.00	
Channel Lining	0.025 Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
Drop (ft)	4	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0267	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.67	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Other (Computed Separately)

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	500	1	1	1	1	0 feet length
Drop (ft)	10	1	1	1	1	0 feet drop
Velocity (fps)	2.00	1.00	1.00	1.00	1.00	
Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
Slope (%)	2.00	100.00	100.00	100.00	100.00	
Travel Time (mins)						0.0 mins travel

Total for Subbasin

Segments	1
Length (ft)	100
Drop (ft)	1
Slope (ft/ft)	0.0050

Subbasin Name	OS-4
Drainage Area (ac)	500
Drainage Area (sq mi)	0.78125

Sheet Flow

selected>>

						Total
Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	90	1	1	1	1	90 feet length
Top Elevation (ft)	1312	1	1	1	1	
Bottom Elevation (ft)	1312	1	1	1	1	
Cover	0.24; Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Sheet Flow "n" (dim)	0.240	0.000	0.000	0.000	0.000	
2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0078	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.78	0.00	0.00	0.00	0.00	
Velocity (fps)	0.08					
Travel Time (hrs)	0.305					
Travel Time (mins)	18.30					18.3 mins travel

Shallow Concentrated Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	200	1	1	1	1	0 feet length
Top Elevation (ft)	30	1	1	1	1	
Bottom Elevation (ft)	22	1	1	1	1	
Cover	7; Short grass pasture	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "K"						
Surface Coeff (dim)	7.00	0.00	0.00	0.00	0.00	
Drop (ft)	8	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0400	0.0000	0.0000	0.0000	0.0000	
Slope (%)	4.00	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Open Channel Ditch Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	100	1	1	1	1	0 feet length
Top Elevation (ft)	50	1	1	1	1	
Bottom Elevation (ft)	47	1	1	1	1	
Channel Lining	0.03; Grassed	Choose Lining Type	Choose Lining Type	Choose Lining Type	Choose Lining Type	
Bottom Width (ft)	25.00	0.00	1.00	1.00	1.00	
Left Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
Right Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
Depth (ft)	3.00	1.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.030	0.000	0.000	0.000	0.000	
Drop (ft)	3	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0300	0.0000	0.0000	0.0000	0.0000	
Slope (%)	3.00	0.00	0.00	0.00	0.00	
Flow Area (sq ft)	102.00	1.00	2.00	2.00	2.00	
Wet Perimeter (ft)	43.97	2.83	3.83	3.83	3.83	
Hydraulic Radius (ft)	2.32	0.35	0.52	0.52	0.52	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	100	1	1	1	1	0 feet length
Top Elevation (ft)	20	1	1	1	1	
Bottom Elevation (ft)	18	1	1	1	1	
Pipe Material	0.017; Rough concrete	Choose Material Type	Choose Material Type	Choose Material Type	Choose Material Type	
Diameter (ins)	24.00	1.00	1.00	1.00	1.00	
Flow Depth (ins)	24.00	1.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.017	0.000	0.000	0.000	0.000	
Drop (ft)	2	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0200	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.00	0.00	0.00	0.00	0.00	
Theta (radians)	6.283	6.283	6.283	6.283	6.283	
Flow Area (sq ft)	3.14	0.01	0.01	0.01	0.01	
Wet Perimeter (ft)	6.28	0.26	0.26	0.26	0.26	
Hydraulic Radius (ft)	0.50	0.02	0.02	0.02	0.02	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel General Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	150	1	1	1	1	0 feet length
Top Elevation (ft)	30	1	1	1	1	
Bottom Elevation (ft)	26	1	1	1	1	
Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	1.00	
Channel Lining	0.025; Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
Drop (ft)	4	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0267	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.67	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Other (Computed Separately)

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	600	1	1	1	1	0 feet length
Drop (ft)	10	1	1	1	1	0 feet drop
Velocity (fps)	2.00	1.00	1.00	1.00	1.00	
Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
Slope (%)	2.00	100.00	100.00	100.00	100.00	
Travel Time (mins)						0.0 mins travel

Total for Subbasin

Segments	1
Length (ft)	90
Drop (ft)	1
Slope (ft/ft)	0.0078

Subbasin Name	Area "A"
Drainage Area (ac)	3.12
Drainage Area (sq mi)	0.004875

Sheet Flow

						Total
selected>> Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	105	1	1	1	1	105 feet length
Top Elevation (ft)	1314	1	1	1	1	
Bottom Elevation (ft)	1313	1	1	1	1	
Cover	0.24 Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Sheet Flow "n" (dim)	0.240	0.000	0.000	0.000	0.000	
2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0095	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.95	0.00	0.00	0.00	0.00	
Velocity (fps)	0.09					
Travel Time (hrs)	0.318					
Travel Time (mins)	19.09					19.1 mins travel

Shallow Concentrated Flow

						Total
selected>> Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	608	1	1	1	1	608 feet length
Top Elevation (ft)	1313	1	1	1	1	
Bottom Elevation (ft)	1312	1	1	1	1	
Cover	20.3 Paved	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "K"						
Surface Coeff (dim)	20.30	0.00	0.00	0.00	0.00	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0016	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.16	0.00	0.00	0.00	0.00	
Velocity (fps)	0.82					
Travel Time (mins)	12.31					12.3 mins travel

Open Channel Ditch Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	100	1	1	1	1	0 feet length
Top Elevation (ft)	50	1	1	1	1	
Bottom Elevation (ft)	47	1	1	1	1	
Channel Lining	0.03 Grassed	Choose Lining Type	Choose Lining Type	Choose Lining Type	Choose Lining Type	
Bottom Width (ft)	25.00	0.00	1.00	1.00	1.00	
Left Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
Right Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
Depth (ft)	3.00	1.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.030	0.000	0.000	0.000	0.000	
Drop (ft)	3	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0300	0.0000	0.0000	0.0000	0.0000	
Slope (%)	3.00	0.00	0.00	0.00	0.00	
Flow Area (sq ft)	102.00	1.00	2.00	2.00	2.00	
Wet Perimeter (ft)	43.97	2.83	3.83	3.83	3.83	
Hydraulic Radius (ft)	2.32	0.35	0.52	0.52	0.52	
Velocity (fps)						
Normal Flow (cfs)						
selected>> Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow

						Total
Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	100	1	1	1	1	100 feet length
Top Elevation (ft)	20	1	1	1	1	
Bottom Elevation (ft)	18	1	1	1	1	
Pipe Material	0.017 Rough concrete	Choose Material Type	Choose Material Type	Choose Material Type	Choose Material Type	
Diameter (ins)	24.00	1.00	1.00	1.00	1.00	
Flow Depth (ins)	24.00	1.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.017	0.000	0.000	0.000	0.000	
Drop (ft)	2	0	0	0	0	2 feet drop
Slope (ft/ft)	0.0200	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.00	0.00	0.00	0.00	0.00	
Theta (radians)	6.283	6.283	6.283	6.283	6.283	
Flow Area (sq ft)	3.14	0.01	0.01	0.01	0.01	
Wet Perimeter (ft)	6.28	0.26	0.26	0.26	0.26	
Hydraulic Radius (ft)	0.50	0.02	0.02	0.02	0.02	
Velocity (fps)	7.81					
Normal Flow (cfs)	24.5					
Travel Time (mins)	0.21					0.2 mins travel

Open Channel General Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	150	1	1	1	1	0 feet length
Top Elevation (ft)	30	1	1	1	1	
Bottom Elevation (ft)	26	1	1	1	1	
Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	1.00	
Channel Lining	0.025 Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
Drop (ft)	4	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0267	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.67	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Other (Computed Separately)

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	500	1	1	1	1	0 feet length
Drop (ft)	10	1	1	1	1	0 feet drop
Velocity (fps)	2.00	1.00	1.00	1.00	1.00	
Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
Slope (%)	2.00	100.00	100.00	100.00	100.00	
Travel Time (mins)						0.0 mins travel

Total for Subbasin

Segments	3
Length (ft)	813
Drop (ft)	4
Slope (ft/ft)	0.0049

Subbasin Name	Area "B"
Drainage Area (ac)	1.62
Drainage Area (sq mi)	0.00253125

Sheet Flow

selected>>						Total
Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	100	1	1	1	1	100 feet length
Top Elevation (ft)	1312	1	1	1	1	
Bottom Elevation (ft)	1312	1	1	1	1	
Cover	0.24; Dense grasses	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Sheet Flow "n" (dim)	0.240	0.000	0.000	0.000	0.000	
2-yr, 24-hr Rainfall (ins)	3.50	3.50	3.50	3.50	3.50	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0050	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.50	0.00	0.00	0.00	0.00	
Velocity (fps)	0.07					
Travel Time (hrs)	0.396					
Travel Time (mins)	23.76					23.8 mins travel

Shallow Concentrated Flow

selected>>						Total
Select (0 or 1)	1	0	0	0	0	1 segments
Length (ft)	450	1	1	1	1	450 feet length
Top Elevation (ft)	1311.5	1	1	1	1	
Bottom Elevation (ft)	1311	1	1	1	1	
Cover	20.3; Paved	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "K"						
Surface Coeff (dim)	20.30	0.00	0.00	0.00	0.00	
Drop (ft)	1	0	0	0	0	1 feet drop
Slope (ft/ft)	0.0022	0.0000	0.0000	0.0000	0.0000	
Slope (%)	0.22	0.00	0.00	0.00	0.00	
Velocity (fps)	0.96					
Travel Time (mins)	7.84					7.8 mins travel

Open Channel Ditch Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	100	1	1	1	1	0 feet length
Top Elevation (ft)	50	1	1	1	1	
Bottom Elevation (ft)	47	1	1	1	1	
Channel Lining	0.03; Grassed	Choose Lining Type	Choose Lining Type	Choose Lining Type	Choose Lining Type	
Bottom Width (ft)	25.00	0.00	1.00	1.00	1.00	
Left Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
Right Side Slope (H:V)	3.00	1.00	1.00	1.00	1.00	
Depth (ft)	3.00	1.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.030	0.000	0.000	0.000	0.000	
Drop (ft)	3	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0300	0.0000	0.0000	0.0000	0.0000	
Slope (%)	3.00	0.00	0.00	0.00	0.00	
Flow Area (sq ft)	102.00	1.00	2.00	2.00	2.00	
Wet Perimeter (ft)	43.97	2.83	3.83	3.83	3.83	
Hydraulic Radius (ft)	2.32	0.35	0.52	0.52	0.52	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel Pipe Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	100	1	1	1	1	0 feet length
Top Elevation (ft)	20	1	1	1	1	
Bottom Elevation (ft)	18	1	1	1	1	
Pipe Material	0.017; Rough concrete	Choose Material Type	Choose Material Type	Choose Material Type	Choose Material Type	
Diameter (ins)	24.00	1.00	1.00	1.00	1.00	
Flow Depth (ins)	24.00	1.00	1.00	1.00	1.00	
Specify alternate "n"						
Manning "n" (dim)	0.017	0.000	0.000	0.000	0.000	
Drop (ft)	2	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0200	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.00	0.00	0.00	0.00	0.00	
Theta (radians)	6.283	6.283	6.283	6.283	6.283	
Flow Area (sq ft)	3.14	0.01	0.01	0.01	0.01	
Wet Perimeter (ft)	6.28	0.26	0.26	0.26	0.26	
Hydraulic Radius (ft)	0.50	0.02	0.02	0.02	0.02	
Velocity (fps)						
Normal Flow (cfs)						
Travel Time (mins)						0.0 mins travel

Open Channel General Flow

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	150	1	1	1	1	0 feet length
Top Elevation (ft)	30	1	1	1	1	
Bottom Elevation (ft)	26	1	1	1	1	
Hydraulic Radius (ft)	2.30	1.00	1.00	1.00	1.00	
Channel Lining	0.025; Clean Earth	Choose Cover Type	Choose Cover Type	Choose Cover Type	Choose Cover Type	
Specify alternate "n"						
Manning "n" (dim)	0.025	0.000	0.000	0.000	0.000	
Drop (ft)	4	0	0	0	0	0 feet drop
Slope (ft/ft)	0.0267	0.0000	0.0000	0.0000	0.0000	
Slope (%)	2.67	0.00	0.00	0.00	0.00	
Velocity (fps)						
Travel Time (mins)						0.0 mins travel

Other (Computed Separately)

						Total
Select (0 or 1)	0	0	0	0	0	0 segments
Length (ft)	500	1	1	1	1	0 feet length
Drop (ft)	10	1	1	1	1	0 feet drop
Velocity (fps)	2.00	1.00	1.00	1.00	1.00	
Slope (ft/ft)	0.0200	1.0000	1.0000	1.0000	1.0000	
Slope (%)	2.00	100.00	100.00	100.00	100.00	
Travel Time (mins)						0.0 mins travel

Total for Subbasin

Segments	2
Length (ft)	550
Drop (ft)	2
Slope (ft/ft)	0.0027

NAHOLA ADDITION

EXHIBIT 3-4

Pipe Network Design not included in this drainage study.

Supplemental Calculations will be submitted once final Site Configuration is determined.

NAHOLA ADDITION

EXHIBIT 3-5

TSS Removals have been intentionally excluded from this report. TSS Removal measures will be addressed in a supplementary study once site layout is better defined.

NAHOLA ADDITION

EXHIBIT 3-6

4.0 Floodplains

4.1 Source of Flood Profile

Current FEMA mapping attached as Exhibit 1-9.

4.2 Nearest Base Flood Elevations

Existing base flood elevations are not applicable as this site is Levee Protected.

4.3 Delineation of Pre-Development Regulatory Floodplain/Floodway Limits

Current FEMA mapping attached as Exhibit 1.9.

4.4 Delineation of Post-Development Regulatory Floodplain/Floodway Limits

Site development will not affect current FEMA mapping.

4.5 Floodplain Data Table and Discharges

This site is outside the mapped FEMA Floodplain and is Levee Protected.

4.6 Hydrologic and Hydraulic Study Information

This site is outside the mapped FEMA Floodplain and is Levee Protected.

4.7 Provide regulatory floodway and four natural profile models (10, 50, 100, & 500-yr) for existing and future watershed conditions

This site is outside the mapped FEMA Floodplain and is Levee Protected.

4.8 Floodplains and Floodways Located within a Reserve

Not applicable to this development.

NAHOLA ADDITION

EXHIBIT 4-1

5.0 Federal, State, and Local Permits

5.1 US Army Corps of Engineers Regulatory Program Permits

Not applicable to this development.

5.2 Kansas Department of Agriculture Division of Water Resources Permits

Not applicable to this development.

5.3 Federal Emergency Management Agency (FEMA) Letter of Map Changes

Not applicable to this development.

6.0 Preliminary Master Grading Plan

See Exhibit 1-2 for Preliminary Grading Plan.