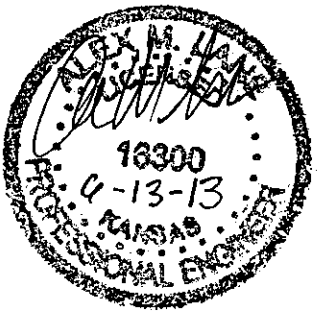
SUPPLEMENTAL DRAINAGE REPORT
FOR
BELLECHASE 3RD ADDITION
WICHITA, SEDGWICK COUNTY, KANSAS

March 14, 2013



Bellechase 3rd Addition
DRAINAGE ANALYSIS
October 12, 2007

INTRODUCTION

This report contains supporting documentation and calculations for modification of the existing detention ponds to provide water quality and channel protection for Bellechase 3rd Addition. The plat is located at the northeast corner of 21st Street North and Greenwich. A drainage plan was completed for the addition was prepared by Ruggles & Bohm and dated February 2008.

HYDROLOGY

The original drainage plan used the SCS method to model the drainage system and to design the detention pond with HEC_HMS. Therefore, the SCS method was also used in this analysis to replicate the results and perform the additional calculations to provide the water quality and channel protection volumes. An additional pond located in Reserve "A" of Bellechase 2nd is incorporated into the model to provide both water quality volume and channel protection volume

The post development target runoffs are taken from the February 2008 drainage plan with an additional tributary area added for the Reserve "A" pond and are as follows;

Undeveloped Runoff	Proposed Runoff
2-yr = 239.8 cfs	2-yr = 227.7
5-yr = 339.3 cfs	5-yr =321.5
10-yr = 421.6 cfs	10-yr =404.8
25-yr = 501.1	25-yr =484.5
100-yr = 673.4 cfs	100-yr =637.9

Pond Routing Information:

The existing ponds shall be modified to provide water quality and channel protection volumes. The outlets of the existing ponds in Reserves A and B of Bellechase Third Addition shall be modified to provide the water quality and channel protection volumes. The existing pond in Reserve B shall be have a 4" orifice at Elev. = 1313.5 while the primary outlet begins at Elev. = 1315.0. The pond in Reserve A will have a 4" orifice at Elev.=1312.0 and a primary inlet at Elev.=1313.5. Additionally the existing pond located in Reserve A Bellechase Second Addition will be modified The table below shows the contour area and outlets flow of the modified outlet.

Stage	Area (sq-ft)	Outlet (cfs)
1306	0.86	0
1307	0.93	0.68
1308	1.19	25.6
1309	1.30	133.2

The water quality outlet of the pond is a 4" orifice placed at an elevation of 1306.0 while the primary outlet of a 25' broad crested weir begins at Elev.=1307.0.

The existing pond located in Reserve B and shared with the adjacent parcel will be modified to provide detention, water quality and channel protection volume. The west bank of the pond located shall be excavated to increase the detention storage of the pond and also compensate for the additional runoff generated by the development of Bellechase. The increase in volume of runoff into the pond due to development is app. 1.2 acre-ft. while the volume of the west bank excavation is approximately 1.7 ac.-ft. The outlet of the pond will be modified to a 4inch orifice located at Elev.=1313.5 and a 37' sharp crested weir located at 1314.5. The following table shows a comparison of the existing and proposed condition of the pond. Additionally the entire eastern tributary including pond discharge and areas that bypass the pond and enter the downstream pond or channel show no increase in peak runoff.

	Inflow (cfs)		Outflow (cfs)		W.S. Elev.	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
2-year	195.1	195.3	191.2	189.4	1316.5	1315.8
5-year	251.9	251.8	249	244.5	1316.6	1316.1
10-year	298.4	298.1	295.2	289.5	1316.7	1316.3
25-year	345.1	344.3	341.3	334.6	1316.8	1316.4
100-year	444.2	442.7	440.7	429.7	1317	1316.8

Water Quality / Channel Protection Volume

The water quality volume was calculated to be 2.03 ac.-ft. and the channel protection volume is 3.97 ac.-ft. The water quality volume is nested within the channel protection volume and both are provided between the water quality and the primary outlets of the ponds described above. The ponds that are intended

to provide the water quality and channel protection volumes are already constructed and in use as detention structures. Consequently the ponds will be modified to the extent possible to provide water quality treatment. It is not possible to modify the existing ponds enough to fully provide the channel protection volume. With the modifications above it is possible to provide 2.4 ac.-ft.of storage, greater than the water quality volume but less than the 3.97 ac.-ft. of channel protection volume.

The summaries of the detention ponds in the 100-yr storm are as follows;

Reserve A Pond	Reserve B Pond	Reserve A Pond (2nd Addition)
Peak Inflow- 99.7 cfs	Peak Inflow- 444.9 cfs	Peak Inflow- 102.2 cfs
Peak Outflow – 46.5 cfs	Peak Outflow – 426.3 cfs	Peak Outflow –88.1 cfs
Peak W.S. – 1316.3	Peak W.S. – 1316.5	Peak W.S. – 1308.6
Peak Storage – 3.7 cf	Peak Storage – 7.6 cf	Peak Storage – 2.7 cf

The minimum pad elevations for the lots adjacent to the Reserve B pond, Lots 1-11 Block 5, are 1319.0 , while the 100-year water surface is 1316.5, providing 2.5 feet of freeboard. Lots 12-20 Blk 5 have a minimum pad elevation of 1318.3 for a freeboard of 2.0'. the final pond located in Reserve A of Bellechase 2nd Addition has a 100-year W.S. elevation of 1308.6 while the adjacent lots, Lot 17-21 Blk 2 Bellechase 2nd Addition, have a min. pad elevation set at 1313.0 which leaves 4.4' of freeboard.

HYDROLOGIC OUTPUT

6/12/13

Bellechase 3-4 Water Quality AMYL

A = 51.5 - 8.09 = 43.41 , 8.09 acres to be treated by water quality inlet.

% Imp. = .35 5.48 ac. in Reserves

⇒ Und = 0% Dev. = 69% Imp. = 31%

Eq 4-24 $R_v = R_{vu}U + R_{vD}D + R_{vI}I =$

$R_{vu} = 0.05$, $R_{vD} = 0.25$, $R_{vI} = 0.95$

$(0.05)(0) + (0.25)(.69) + (0.95)(0.31) = 0.467$

$WQ_v = \frac{PR_vA}{12} = \frac{1.2(.467)(43.41)}{12} = 2.03$ ac.-ft.

WET DETENTION PONDS

WQv Provided

EXISTING POND (RESERVE A 3rd Add.)

NO MODIFICATIONS POSSIBLE

RESERVE A POND (2nd Add.)

1306	0.86	= 0.90 ac.-ft.
1307	0.93	

RESERVE B POND

1313.5	1.34	= 1.50 ac.-ft.
1314.5	1.65	

2.40 ac.-ft. > 2.03 ac.-ft. Requ.

Project: 4019 Simulation Run: Exist 002 yr

Start of Run: 01Jan2009, 00:00 Basin Model: Existing Basin
End of Run: 15Jan2009, 00:10 Meteorologic Model: 2 year
Compute Time: 30May2013, 16:38:15 Control Specifications: Control 2

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Country Hollow	0.2010	178.8	01Jan2009, 12:41	37.5
Belle Chase 2nd East	0.0145	15.4	01Jan2009, 12:11	1.4
Adjacent Lot	0.0110	13.3	01Jan2009, 12:08	1.1
Clear Creek	0.0142	9.3	01Jan2009, 12:31	1.4
Existing Pond	0.2407	191.2	01Jan2009, 12:46	41.5
Belle Chase 2nd West	0.1088	101.4	01Jan2009, 12:15	10.8
Res. A Trib.	0.0213	32.8	01Jan2009, 12:03	2.1
Res A Pond	0.0213	5.3	01Jan2009, 12:29	2.1
Spring Creek	0.3708	239.3	01Jan2009, 12:30	54.4

Project: 4019 Simulation Run: Exist 005 yr

Start of Run: 01Jan2007, 00:00 Basin Model: Existing Basin
End of Run: 02Jan2007, 00:02 Meteorologic Model: 5 year
Compute Time: 30May2013, 16:38:21 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Country Hollow	0.2010	228.2	01Jan2007, 12:42	47.7
Belle Chase 2nd East	0.0145	22.2	01Jan2007, 12:12	2.1
Adjacent Lot	0.0110	19.1	01Jan2007, 12:08	1.6
Clear Creek	0.0142	13.5	01Jan2007, 12:30	2.0
Existing Pond	0.2407	249.0	01Jan2007, 12:44	50.9
Belle Chase 2nd West	0.1088	147.0	01Jan2007, 12:16	15.7
Res. A Trib.	0.0213	47.0	01Jan2007, 12:02	3.1
Res A Pond	0.0213	17.3	01Jan2007, 12:16	2.2
Spring Creek	0.3708	338.7	01Jan2007, 12:28	68.9

Project: 4019 Simulation Run: Exist 010 yr

Start of Run: 01Jan2007, 00:00 Basin Model: Existing Basin
End of Run: 02Jan2007, 00:02 Meteorologic Model: 10 year
Compute Time: 30May2013, 16:38:26 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Country Hollow	0.2010	268.7	01Jan2007, 12:42	5.24
Belle Chase 2nd East	0.0145	28.0	01Jan2007, 12:10	3.43
Adjacent Lot	0.0110	24.1	01Jan2007, 12:08	3.43
Clear Creek	0.0142	17.1	01Jan2007, 12:30	3.40
Existing Pond	0.2407	295.2	01Jan2007, 12:44	4.74
Belle Chase 2nd West	0.1088	185.5	01Jan2007, 12:16	3.42
Res. A Trib.	0.0213	59.1	01Jan2007, 12:02	3.44
Res A Pond	0.0213	29.0	01Jan2007, 12:12	2.64
Spring Creek	0.3708	420.9	01Jan2007, 12:24	4.23

Project: 4019 Simulation Run: Exist 025 yr

Start of Run: 01Jan2007, 00:00 Basin Model: Existing Basin
End of Run: 02Jan2007, 00:02 Meteorologic Model: 25 Year
Compute Time: 30May2013, 16:38:31 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Country Hollow	0.2010	309.3	01Jan2007, 12:42	64.6
Belle Chase 2nd East	0.0145	33.9	01Jan2007, 12:10	3.2
Adjacent Lot	0.0110	29.1	01Jan2007, 12:08	2.4
Clear Creek	0.0142	20.8	01Jan2007, 12:30	3.1
Existing Pond	0.2407	341.3	01Jan2007, 12:44	70.9
Belle Chase 2nd West	0.1088	224.6	01Jan2007, 12:14	24.1
Res. A Trib.	0.0213	71.3	01Jan2007, 12:02	4.7
Res A Pond	0.0213	44.1	01Jan2007, 12:10	3.8
Spring Creek	0.3708	500.4	01Jan2007, 12:22	98.8

Project: 4019 Simulation Run: Exist 100yr

Start of Run: 01Jan2007, 00:00 Basin Model: Existing Basin
End of Run: 02Jan2007, 00:02 Meteorologic Model: 100 year
Compute Time: 30May2013, 16:38:36 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Country Hollow	0.2010	395.5	01Jan2007, 12:42	82.6
Belle Chase 2nd East	0.0145	46.5	01Jan2007, 12:10	4.5
Adjacent Lot	0.0110	39.8	01Jan2007, 12:08	3.4
Clear Creek	0.0142	28.5	01Jan2007, 12:30	4.3
Existing Pond	0.2407	440.7	01Jan2007, 12:42	92.2
Belle Chase 2nd West	0.1088	308.2	01Jan2007, 12:14	33.4
Res. A Trib.	0.0213	97.3	01Jan2007, 12:02	6.6
Res A Pond	0.0213	71.5	01Jan2007, 12:08	5.6
Spring Creek	0.3708	672.6	01Jan2007, 12:20	131.1

Project: 4019 Simulation Run: Dev 002 yr

Start of Run: 01Jan2009, 00:00 Basin Model: Developed
End of Run: 15Jan2009, 00:10 Meteorologic Model: 2 year
Compute Time: 30May2013, 17:10:54 Control Specifications: Control 2

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Country Hollow	0.20100	178.8	01Jan2009, 12:41	37.5
Onsite Exist Pond	0.01720	27.1	01Jan2009, 12:08	2.2
Clear Creek	0.01420	9.3	01Jan2009, 12:31	1.4
Existing Pond Adjacent	0.00960	12.1	01Jan2009, 12:08	1.0
Existing Pond	0.24200	189.4	01Jan2009, 12:47	42.2
Onsite Southeast	0.01260	19.9	01Jan2009, 12:08	1.6
East Trib.	0.25460	192.4	01Jan2009, 12:47	43.8
Onsite West	0.07500	106.5	01Jan2009, 12:10	9.8
Res. A Pond Trib.	0.02500	39.4	01Jan2009, 12:08	3.3
Developed Pond	0.02500	6.6	01Jan2009, 12:44	3.3
Pond Basin	0.01116	17.6	01Jan2009, 12:08	1.5
Res. A Ex. Pond	0.03616	7.8	01Jan2009, 13:06	4.7
Spring Creek	0.36576	227.4	01Jan2009, 12:14	58.3

Project: 4019 Simulation Run: Dev 005 yr

Start of Run: 01Jan2007, 00:00 Basin Model: Developed
End of Run: 02Jan2007, 00:02 Meteorologic Model: 5 year
Compute Time: 30May2013, 17:11:00 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Country Hollow	0.20100	228.2	01Jan2007, 12:42	47.7
Onsite Exist Pond	0.01720	36.4	01Jan2007, 12:08	3.1
Clear Creek	0.01420	13.5	01Jan2007, 12:30	2.0
Existing Pond Adjacent	0.00960	17.2	01Jan2007, 12:08	1.4
Existing Pond	0.24200	244.5	01Jan2007, 12:46	52.6
Onsite Southeast	0.01260	26.7	01Jan2007, 12:08	2.3
East Trib.	0.25460	248.7	01Jan2007, 12:46	54.9
Onsite West	0.07500	143.7	01Jan2007, 12:10	13.5
Res. A Pond Trib.	0.02500	52.9	01Jan2007, 12:08	4.5
Developed Pond	0.02500	14.7	01Jan2007, 12:32	3.4
Pond Basin	0.01116	23.6	01Jan2007, 12:08	2.0
Res. A Ex. Pond	0.03616	18.3	01Jan2007, 12:42	4.5
Spring Creek	0.36576	311.1	01Jan2007, 12:16	72.9

Project: 4019 Simulation Run: Dev 010 yr

Start of Run: 01Jan2007, 00:00 Basin Model: Developed
End of Run: 02Jan2007, 00:02 Meteorologic Model: 10 year
Compute Time: 30May2013, 17:11:05 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Country Hollow	0.20100	268.7	01Jan2007, 12:42	56.1
Onsite Exist Pond	0.01720	44.3	01Jan2007, 12:08	3.8
Clear Creek	0.01420	17.1	01Jan2007, 12:30	2.6
Existing Pond Adjacent	0.00960	21.6	01Jan2007, 12:08	1.8
Existing Pond	0.24200	289.5	01Jan2007, 12:46	62.7
Onsite Southeast	0.01260	32.4	01Jan2007, 12:08	2.8
East Trib.	0.25460	294.7	01Jan2007, 12:46	65.5
Onsite West	0.07500	174.8	01Jan2007, 12:10	16.6
Res. A Pond Trib.	0.02500	64.3	01Jan2007, 12:08	5.5
Developed Pond	0.02500	22.1	01Jan2007, 12:28	4.4
Pond Basin	0.01116	28.7	01Jan2007, 12:08	2.5
Res. A Ex. Pond	0.03616	29.0	01Jan2007, 12:34	5.9
Spring Creek	0.36576	386.3	01Jan2007, 12:16	88.0

Project: 4019 Simulation Run: Dev 025 yr

Start of Run: 01Jan2007, 00:00 Basin Model: Developed
End of Run: 02Jan2007, 00:02 Meteorologic Model: 25 Year
Compute Time: 30May2013, 17:11:10 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Country Hollow	0.20100	309.3	01Jan2007, 12:42	64.6
Onsite Exist Pond	0.01720	52.1	01Jan2007, 12:08	4.5
Clear Creek	0.01420	20.8	01Jan2007, 12:30	3.1
Existing Pond Adjacent	0.00960	26.0	01Jan2007, 12:08	2.2
Existing Pond	0.24200	334.6	01Jan2007, 12:46	72.8
Onsite Southeast	0.01260	38.1	01Jan2007, 12:08	3.3
East Trib.	0.25460	340.6	01Jan2007, 12:46	76.1
Onsite West	0.07500	205.8	01Jan2007, 12:10	19.7
Res. A Pond Trib.	0.02500	75.7	01Jan2007, 12:08	6.6
Developed Pond	0.02500	29.9	01Jan2007, 12:26	5.4
Pond Basin	0.01116	33.8	01Jan2007, 12:08	2.9
Res. A Ex. Pond	0.03616	41.7	01Jan2007, 12:28	7.4
Spring Creek	0.36576	462.4	01Jan2007, 12:16	103.1

Project: 4019 Simulation Run: Dev 100yr

Start of Run: 01Jan2007, 00:00 Basin Model: Developed
End of Run: 02Jan2007, 00:02 Meteorologic Model: 100 year
Compute Time: 10Jun2013, 11:31:13 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Country Hollow	0.20100	395.5	01Jan2007, 12:42	82.6
Onsite Exist Pond	0.01720	68.6	01Jan2007, 12:08	6.0
Clear Creek	0.01420	28.5	01Jan2007, 12:30	4.3
Existing Pond Adjacent	0.00960	35.3	01Jan2007, 12:08	3.0
Existing Pond	0.24200	429.7	01Jan2007, 12:46	94.3
Onsite Southeast	0.01260	50.2	01Jan2007, 12:08	4.4
East Trib.	0.25460	437.5	01Jan2007, 12:46	98.7
Onsite West	0.07500	271.3	01Jan2007, 12:10	26.3
Res. A Pond Trib.	0.02500	99.7	01Jan2007, 12:08	8.8
Developed Pond	0.02500	46.5	01Jan2007, 12:24	7.6
Pond Basin	0.01116	44.5	01Jan2007, 12:08	3.9
Res. A Ex. Pond	0.03616	67.5	01Jan2007, 12:22	10.5
Spring Creek	0.36576	628.9	01Jan2007, 12:14	135.5

Project: 4019

Simulation Run: Dev 100yr Reservoir: Existing Pond

Start of Run:	01Jan2007, 00:00	Basin Model:	Developed
End of Run:	02Jan2007, 00:02	Meteorologic Model:	100 year
Compute Time:	10Jun2013, 11:31:13	Control Specifications:	Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow :	442.7 (CFS)	Date/Time of Peak Inflow :	01Jan2007, 12:38
Peak Outflow :	429.7 (CFS)	Date/Time of Peak Outflow :	01Jan2007, 12:46
Total Inflow :	96.0 (AC-FT)	Peak Storage :	8.4 (AC-FT)
Total Outflow :	94.3 (AC-FT)	Peak Elevation :	1316.8 (FT)

Project: 4019

Simulation Run: Dev 100yr Reservoir: Developed Pond

Start of Run:	01Jan2007, 00:00	Basin Model:	Developed
End of Run:	02Jan2007, 00:02	Meteorologic Model:	100 year
Compute Time:	10Jun2013, 11:31:13	Control Specifications:	Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow :	99.7 (CFS)	Date/Time of Peak Inflow :	01Jan2007, 12:08
Peak Outflow :	46.5 (CFS)	Date/Time of Peak Outflow :	01Jan2007, 12:24
Total Inflow :	8.8 (AC-FT)	Peak Storage :	3.7 (AC-FT)
Total Outflow :	7.6 (AC-FT)	Peak Elevation :	1316.3 (FT)

Project: 4019

Simulation Run: Dev 100yr Reservoir: Res. A Ex. Pond

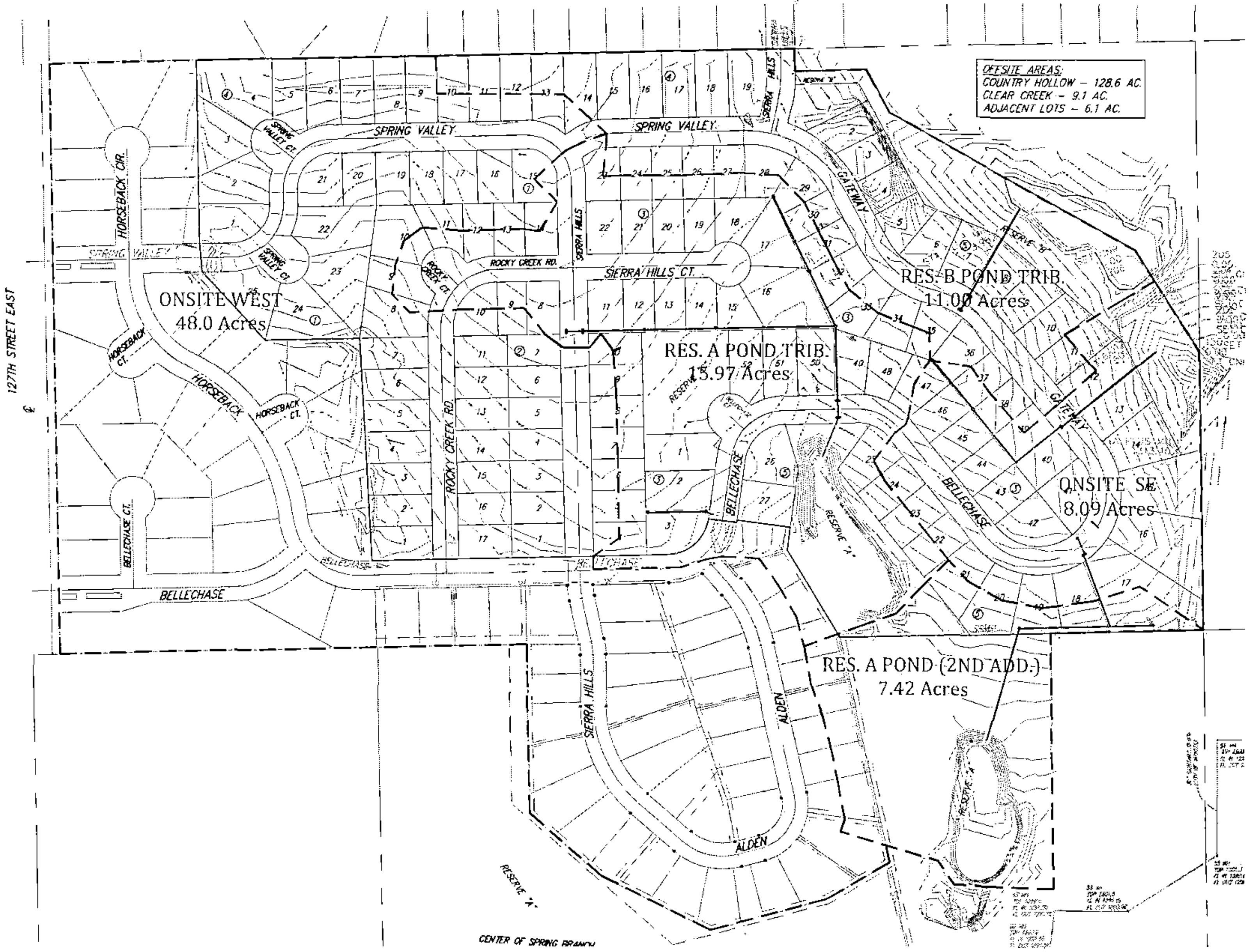
Start of Run:	01Jan2007, 00:00	Basin Model:	Developed
End of Run:	02Jan2007, 00:02	Meteorologic Model:	100 year
Compute Time:	10Jun2013, 11:31:13	Control Specifications:	Control 1

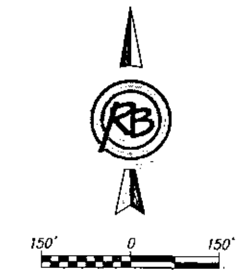
Volume Units: AC-FT

Computed Results

Peak Inflow :	78.4 (CFS)	Date/Time of Peak Inflow :	01Jan2007, 12:12
Peak Outflow :	67.5 (CFS)	Date/Time of Peak Outflow :	01Jan2007, 12:22
Total Inflow :	11.5 (AC-FT)	Peak Storage :	2.4 (AC-FT)
Total Outflow :	10.5 (AC-FT)	Peak Elevation :	1308.4 (FT)

DRAINAGE MAP





TREATMENT TRAINS & SITE TREATMENT TOTAL

ONSITE WEST
AREA= 48 ACRES

1. FILTER STRIP TSS= 50%
2. GRASS LINED SWALE TSS= 50%

$TSStrain_{1-2} = 50 + 50 - \frac{(50 \times 50)}{100} = 75\%$

RESERVE A POND TRIB.
AREA= 15.97 ACRES

1. FILTER STRIP TSS= 50%
2. GRASS LINED SWALE TSS= 50%
3. DRY DETENTION TSS= 60%
4. WET DETENTION TSS= 80%

$TSStrain_{1-2} = 50 + 50 - \frac{(50 \times 50)}{100} = 75\%$

$TSStrain_{2-3} = 75 + 50 - \frac{(75 \times 60)}{100} = 90\%$

$TSStrain_{3-4} = 90 + 80 - \frac{(90 \times 80)}{100} = 98\%$

RESERVE A POND TRIB. (2ND ADDITION)
AREA= 7.42 ACRES

1. FILTER STRIP TSS= 50%
2. GRASS LINED SWALE TSS= 50%
3. WET DETENTION TSS= 80%

$TSStrain_{1-2} = 50 + 50 - \frac{(50 \times 50)}{100} = 75\%$

$TSStrain_{2-3} = 75 + 80 - \frac{(75 \times 80)}{100} = 95\%$

RESERVE B POND TRIB.
AREA= 11.00 ACRES

1. FILTER STRIP TSS= 50%
2. GRASS LINED SWALE TSS= 50%
3. WET DETENTION TSS= 80%

$TSStrain_{1-2} = 50 + 50 - \frac{(50 \times 50)}{100} = 75\%$

$TSStrain_{2-3} = 75 + 80 - \frac{(75 \times 80)}{100} = 95\%$

ONSITE WEST
AREA= 8.09 ACRES

1. FILTER STRIP TSS= 50%
2. GRASS LINED SWALE TSS= 50%
3. WATER QUALITY INLET TSS= 80%

$TSStrain_{1-2} = 50 + 50 - \frac{(50 \times 50)}{100} = 75\%$

$TSStrain_{2-3} = 75 + 80 - \frac{(75 \times 80)}{100} = 95\%$

SITE TREATMENT TOTAL

$TSS\ SITE = \frac{48(75)+15.97(98)+7.42(95)+11(95)+8.09(95)}{93.26} = 82\%$

Bellechase 3rd Addition

Drainage Map

SEAL

RUGGLES & BOHM

ENGINEERING | SURVEYING | LANDSCAPE ARCHITECTURE | GOVERNMENT

PROJECT NUMBER:	RB JOB NO. 4019P	DWG. SCALE 1"=150'	
DRAWING FILE SURVEY BASE (Drainage Map)			

DATE May 9, 2013
DESIGN AML
DRAWN AML
REVIEW –
SHEET 1 OF 1