KENSINGTON ROAD DRAINAGE PROJECT
PHASE 2

PRESENTED TO THE

CITY OF AVONDALE ESTATES

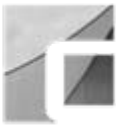
BOARD OF MAYOR AND COMMISSIONERS

February 23, 2011

Clark Patterson Lee
DESIGN PROFESSIONALS

GOALS RECAP

- ANALYZE COBBS CREEK DRAINAGE TO EXISTING FLOODPLAIN DOWNSTREAM OF MEMORIAL DRIVE.
- IDENTIFY CAPITAL IMPROVEMENT AND POLICY OPTIONS.
- REPORT TO CITIZENS, BOARD OF MAYOR AND COMMISSIONERS AND STAFF.



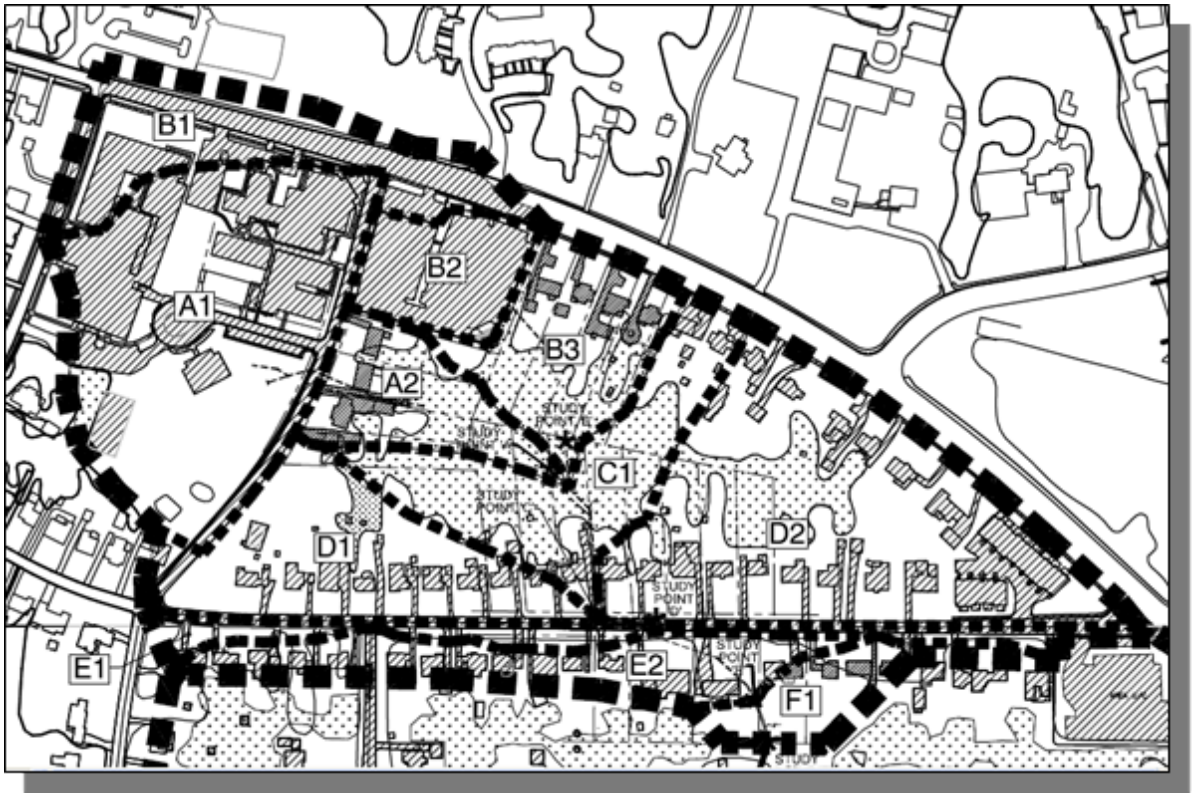
WHEN YOU LEAVE TONIGHT

- YOU SHOULD UNDERSTAND THE EXISTING DRAINAGE SITUATION IN FRONT OF YOUR HOUSE
- YOU SHOULD BE AWARE OF WAYS THAT THE CITY AND YOU CAN ADDRESS THE PROBLEM

ANALYSIS

- THREE AREAS
  - PHASE 1 AREA
  - PIPE SYSTEM IMMEDIATELY DOWNSTREAM OF PHASE 1 FROM POINT F TO WYNN DRIVE
  - COBBS CREEK OPEN CHANNEL PUNCTUATED BY A SERIES OF DRIVEWAY CULVERTS ALONG HESS DRIVE

ANALYSIS



KENSINGTON RD PHASE 1 DRAINAGE AREA

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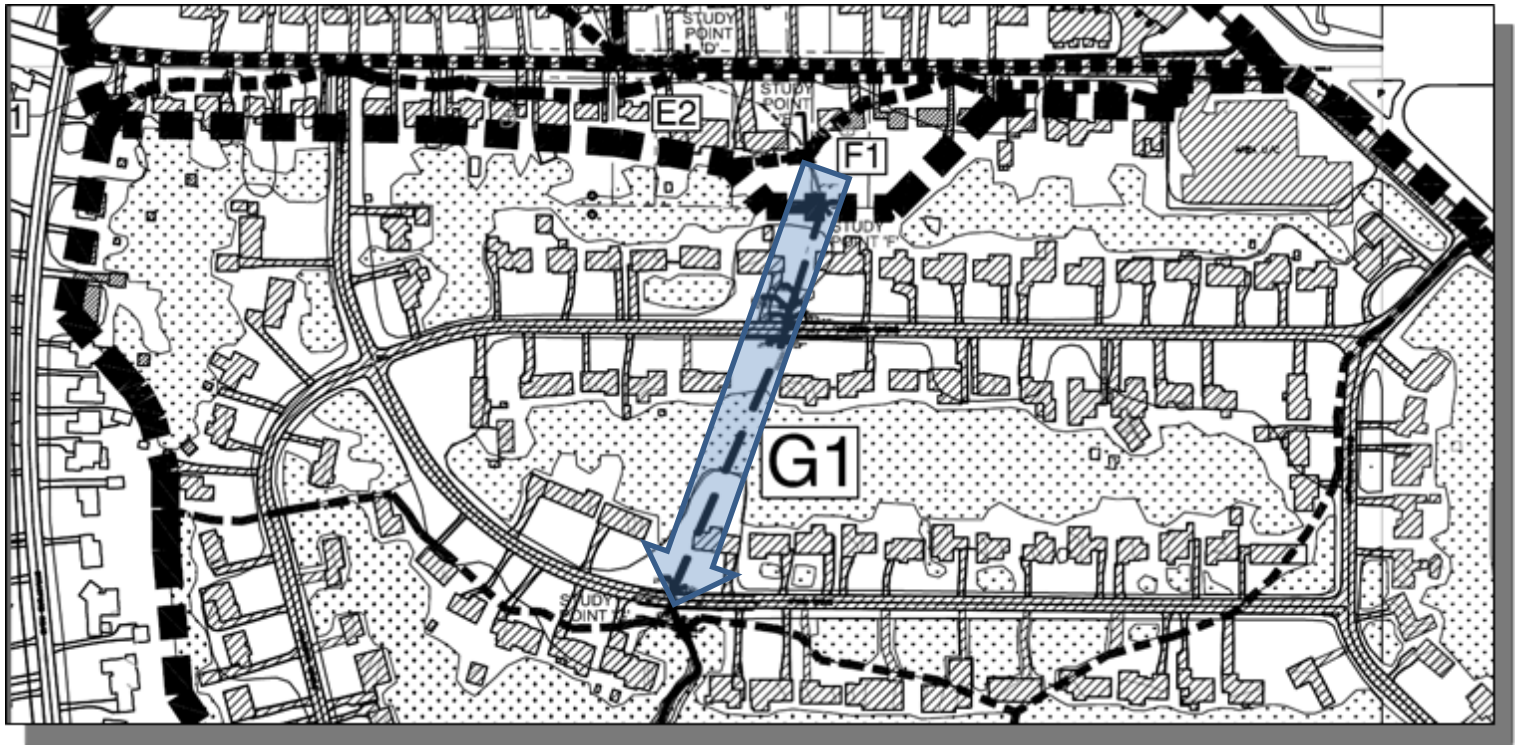
ANALYSIS

PIPE SYSTEM IMMEDIATELY DOWNSTREAM OF PHASE 1 FROM POINT F TO WYNN DRIVE



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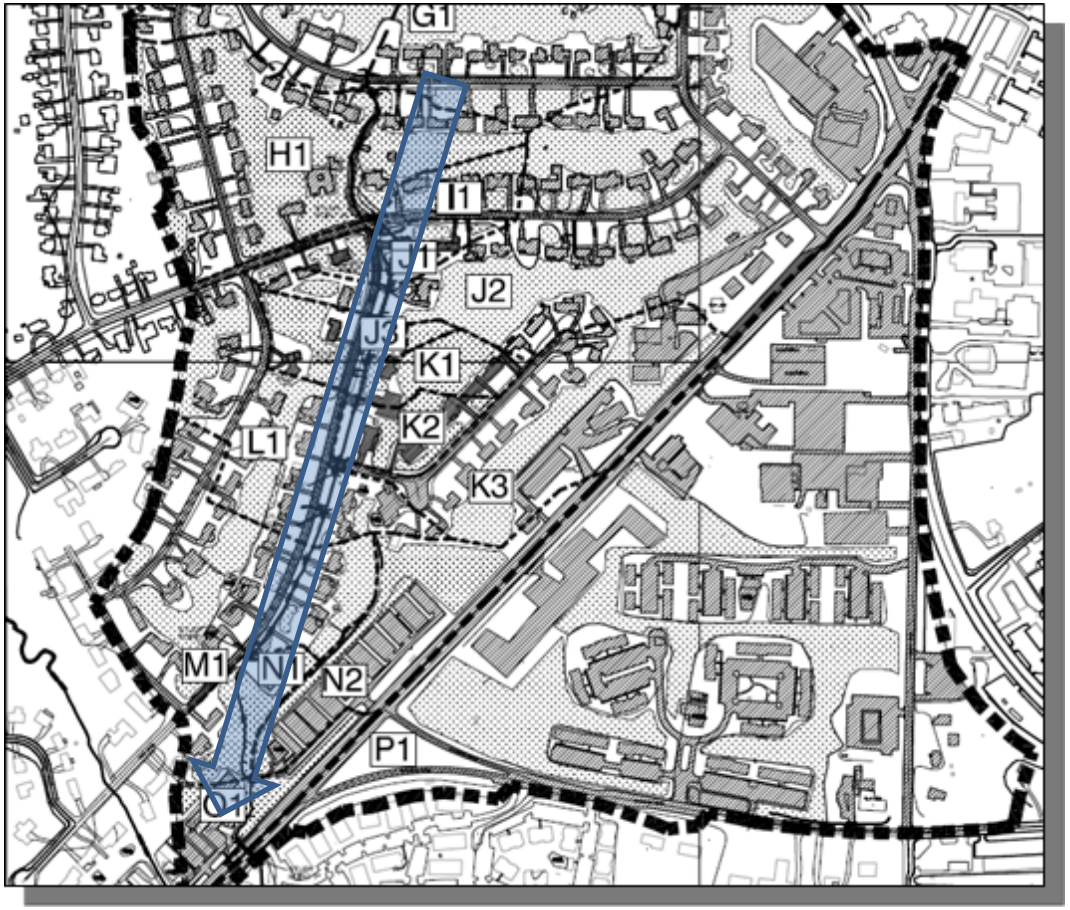
ANALYSIS



COBBS CREEK OPEN CHANNEL PUNCTUATED BY A SERIES OF DRIVEWAY CULVERTS ALONG HESS DRIVE

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ANALYSIS

- ANALYZED DRAINAGE WITH AND WITHOUT PROPOSED PHASE 1 DETENTION
- USED HEC-RAS (HYDRAULIC MODELING SOFTWARE) TO DETERMINE PONDING DEPTH IN COBBS CREEK CHANNEL WITH AND WITHOUT CULVERTS AND WITH AND WITHOUT THE PROPOSED PHASE 1 DETENTION

RESULTS

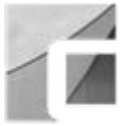
EXISTING CONDITIONS

Basin	Cross section & Station	Storm Event 2	5	10	25	50	100
A+B	(Phase 1)	34.50	49.88	61.91	78.36	90.92	99.37
C	(Phase 1)	35.64	52.52	65.87	84.29	98.43	107.98
D	(Phase 1)	16.96	26.86	34.80	45.89	54.54	60.39
E	(Phase 1)	58.79	89.56	114.05	147.97	174.08	191.73
F	(Phase 1)	60.66	92.69	118.22	153.58	180.83	199.24
G	(Phase 2 pipes)	89.06	142.37	185.37	245.50	292.12	323.75
H	(Phase 2 pipes)	104.71	169.35	221.75	295.22	352.29	391.05
I	#44, sta 27+65.98	109.47	176.67	231.02	307.15	366.27	406.40
J	#36, sta 24+35.36	172.82	268.76	345.64	452.40	534.74	590.42
K	#29, sta 19+84.29	206.24	321.72	414.33	544.29	644.66	712.59
L	#27, sta 18+28.40	213.45	333.95	430.32	564.67	669.26	740.08
M	#11, sta 12+27.28	230.72	361.15	466.47	613.69	727.44	804.45
N	#4, sta 7+07.15	246.49	386.74	499.92	657.43	779.10	861.47
O	#2, sta 4+67.51	253.63	398.33	514.22	675.40	799.84	884.06
P	#1, sta 3+54.04	399.29	611.36	779.60	1011.98	1190.46	1310.88

WITH UPSTREAM DETENTION

Basin	Cross section & Station	Storm Event 2	5	10	25	50	100
A+B	(Phase 1)	5.00	8.86	12.06	27.41	39.63	46.56
C	(Phase 1)	6.94	12.72	17.54	33.19	50.05	58.73
D	(Phase 1)	16.96	26.86	34.80	45.89	54.54	60.39
E	(Phase 1)	32.10	52.16	68.42	91.20	115.20	138.43
F	(Phase 1)	33.85	55.07	72.26	96.34	119.44	144.15
G	(Phase 2 pipes)	67.53	111.54	147.31	197.59	252.76	289.55
H	(Phase 2 pipes)	83.50	138.85	183.93	247.37	310.78	356.64
I	#44, sta 27+65.98	88.11	145.76	192.65	258.58	323.88	371.02
J	#36, sta 24+35.36	127.00	207.74	273.92	366.84	455.19	514.44
K	#29, sta 19+84.29	151.04	247.03	324.81	433.88	532.60	602.38
L	#27, sta 18+28.40	158.26	259.25	341.14	456.00	559.25	632.11
M	#11, sta 12+27.28	175.53	286.46	376.29	502.47	613.96	692.57
N	#4, sta 7+07.15	191.29	310.78	408.64	546.21	661.72	745.65
O	#2, sta 4+67.51	198.36	322.18	422.95	564.18	680.33	768.24
P	#1, sta 3+54.04	343.38	535.20	688.32	900.76	1070.94	1195.06

**Flows from Basins A & B are combined, providing detention for a portion of each*



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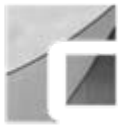
RESULTS

THE PROPOSED DETENTION POND IN PHASE 1 WILL HAVE THE CORRESPONDING BENEFICIAL AFFECT AT THE FOLLOWING CROSS SECTION

REDUCTION IN BASIN FLOWS							
		Storm Event					
Basin	Cross section & Station	2	5	10	25	50	100
A+B	(Phase 1)	86%	82%	81%	65%	56%	53%
C	(Phase 1)	81%	76%	73%	61%	49%	46%
D	(Phase 1)	0%	0%	0%	0%	0%	0%
E	(Phase 1)	45%	42%	40%	38%	34%	28%
F	(Phase 1)	44%	41%	39%	37%	34%	28%
G	(Phase 2 pipes)	24%	22%	21%	20%	13%	11%
H	(Phase 2 pipes)	20%	18%	17%	16%	12%	9%
I	#44, sta 27+65.98	20%	17%	17%	16%	12%	9%
J	#36, sta 24+35.36	27%	23%	21%	19%	15%	13%
K	#29, sta 19+84.29	27%	23%	22%	20%	17%	15%
L	#27, sta 18+28.40	26%	22%	21%	19%	16%	15%
M	#11, sta 12+27.28	24%	21%	19%	18%	16%	14%
N	#4, sta 7+07.15	22%	20%	18%	17%	15%	13%
O	#2, sta 4+67.51	22%	19%	18%	16%	15%	13%
P	#1, sta 3+54.04	14%	12%	12%	11%	10%	9%



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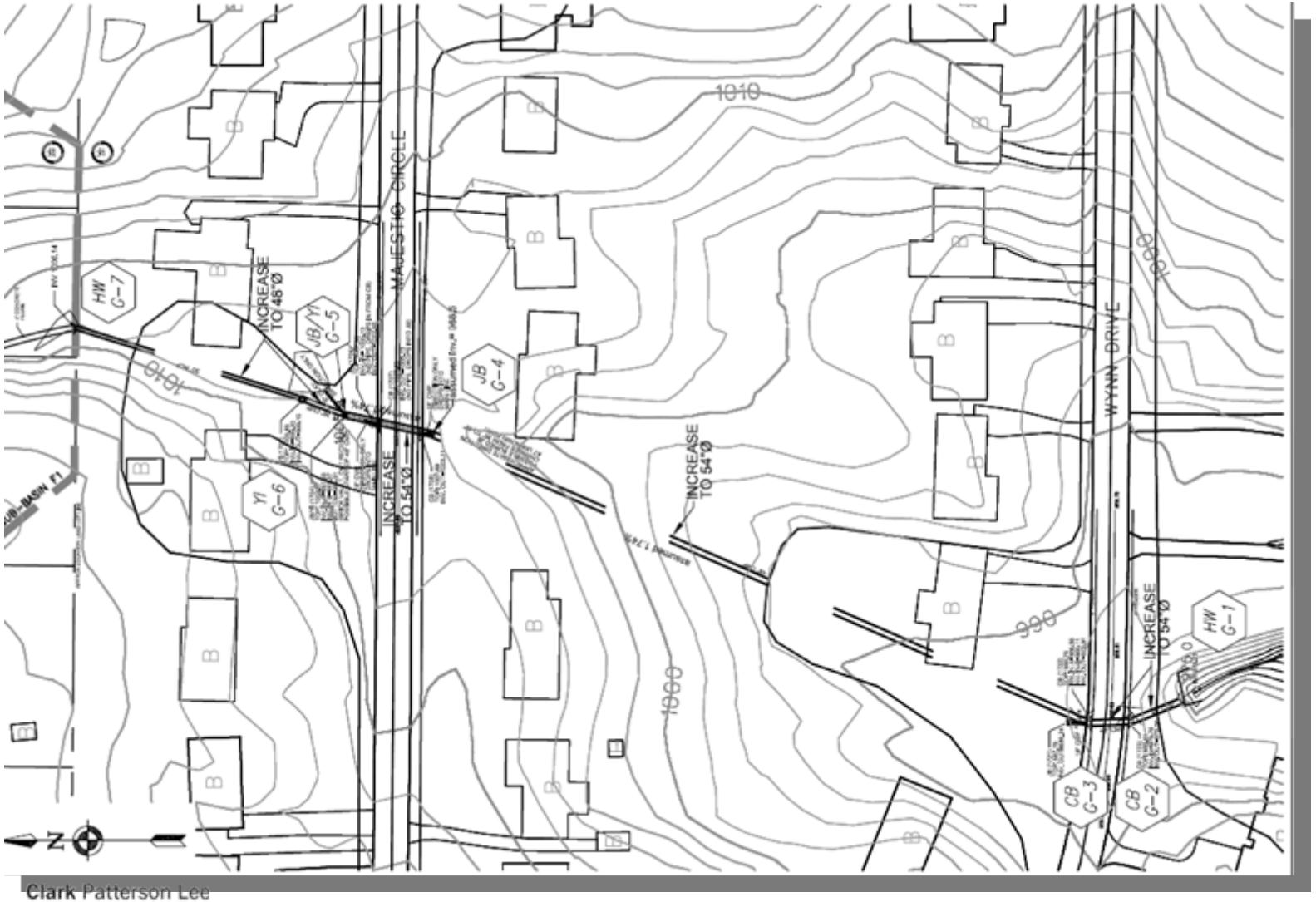
RESULTS

- FLOWS ARE REDUCED BUT WHAT DOES THIS MEAN?
- LOOKED AT PIPE SYSTEMS ‘G’ AND ‘I’, AND CHANNEL ‘H’.

PIPE SYSTEM ANALYSIS

- ANALYSIS INDICATES THAT SYSTEM ‘G’ IS UNDERSIZED IN 25 YEAR STORM, BUT CAN BE REPLACED WITH A LARGER SIZE THAT WILL ACCOMMODATE THE 25-YEAR STORM.

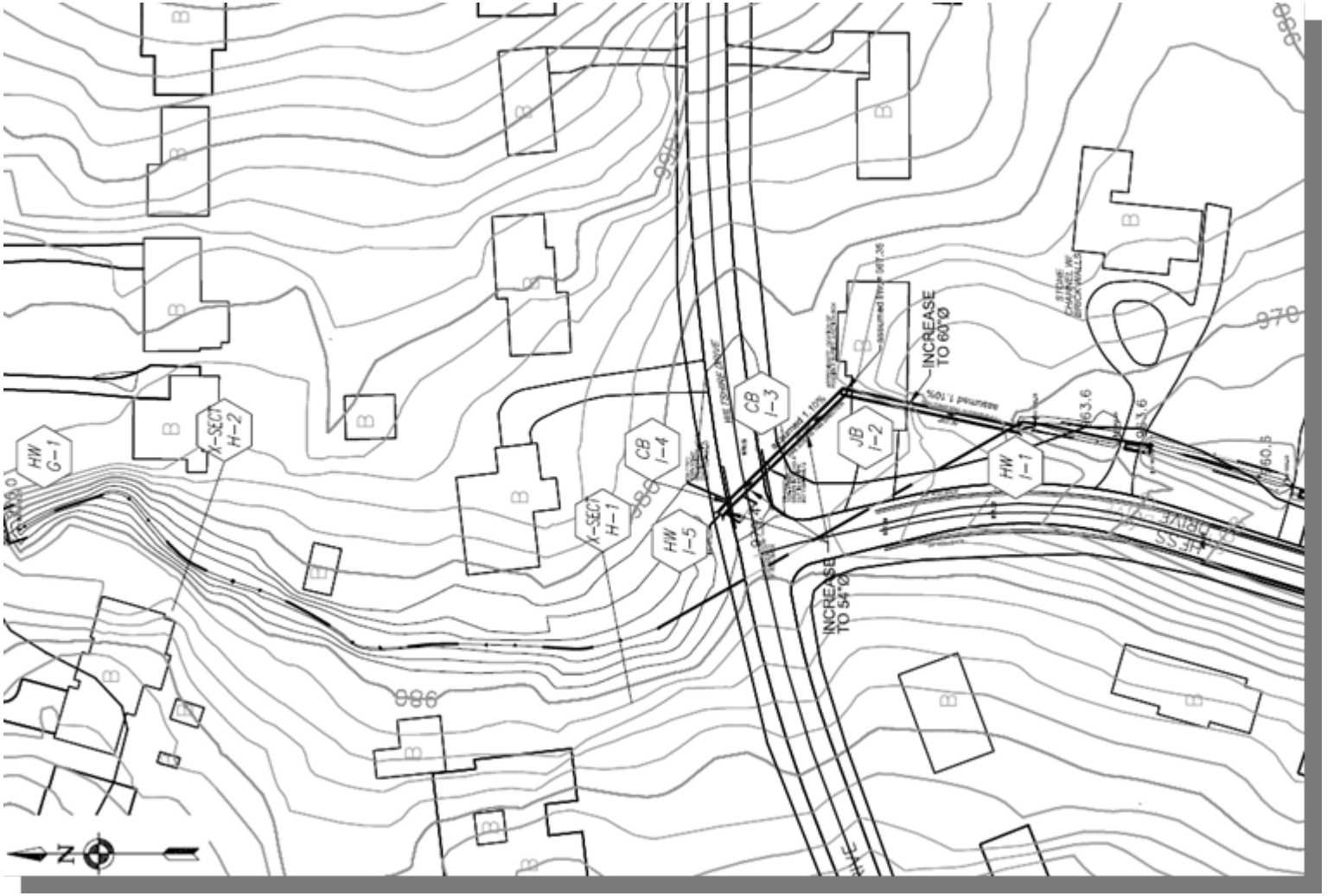
PIPE SYSTEM ANALYSIS



PIPE SYSTEM ANALYSIS

- CHANNEL ‘H’ WAS ANALYZED AND WILL ACCOMMODATE THE 25-YEAR STORM WITHOUT OVERFLOWING, IF IMPROVEMENTS ARE MADE TO PIPES UNDER WILTSHIRE
- SYSTEM ‘I’ AT WILTSIRE IS UNDERSIZED, BUT CAN BE REPLACED TO ACCOMMODATE THE 25-YEAR STORM

PIPE SYSTEM ANALYSIS



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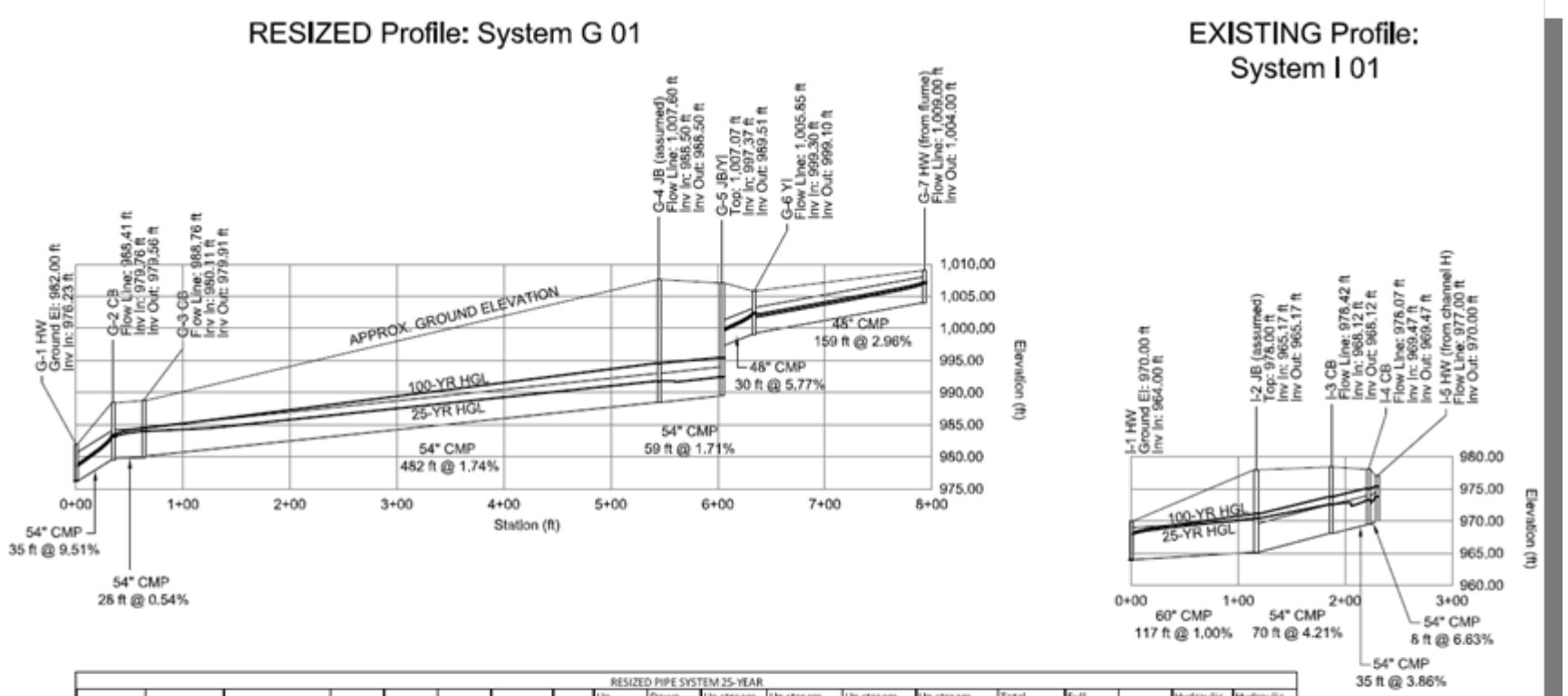
PIPE SYSTEM ANALYSIS



RESIZED PIPE SYSTEM 25-YEAR

Label	Down stream Node	Up stream Node	Length (ft)	Section Size	Material	Mannings n	Slope (ft/ft)	Up stream Invert	Down stream Invert	Up stream Inlet Area (acres)	Up stream Inlet Rational Coefficient	Up stream Calculated System CA	Up stream Inlet Rational Flow (cfs)	Total System Flow (cfs)	Full Capacity (cfs)	Velocity Out (ft/s)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
P-1g	G-1 HW	G-2 CB	35	54 inch	CMP	0.024	0.0951	979.56	976.23	9.9	0.48	16.66	33.15	144.05	328.54	17.33	983.09	978.56
P-2g	G-2 CB	G-3 CB	28	54 inch	CMP	0.024	0.0054	979.91	979.76	4.1	0.48	11.9	13.73	129.94	77.96	10.22	984	983.12
P-3g	G-3 CB	G-4 JB (assumed)	482	54 inch	CMP	0.024	0.0174	988.5	980.11	13.9	0.48	9.94	46.54	125.53	140.53	8.6	991.82	984
P-4g	G-4 JB (assumed)	G-5 JB/YI	59	54 inch	CMP	0.024	0.0171	989.51	988.5	N/A	N/A	3.26	N/A	104.52	139.36	8.32	992.52	991.82
P-5g	G-5 JB/YI	G-6 YI	30	48 inch	CMP	0.024	0.0577	999.1	997.37	6.8	0.48	3.26	10.4	104.54	186.83	13.87	1,002.20	999.68
P-6g	G-6 YI	G-7 HW (from flume)	159	48 inch	CMP	0.024	0.0296	1,004.00	999.3	0	0	0	0	94.14	133.77	11.53	1,006.94	1,001.77
P-1i (assumed)	I-1 HW	I-2 JB (assumed)	117	60 inch	CMP	0.024	0.01	965.17	964	N/A	N/A	9.29	N/A	187.48	141.07	11.36	970.44	967.92
P-2i (assumed)	I-2 JB (assumed)	I-3 CB	70	54 inch	CMP	0.024	0.0421	968.12	965.17	1.45	0.58	9.29	4.3	187.61	218.66	11.8	972.61	970.44
P-3i	I-3 CB	I-4 CB	35	54 inch	CMP	0.024	0.0386	969.47	968.12	1.45	0.58	8.45	4.3	183.73	209.19	11.55	973.39	972.61
P-4i	I-4 CB	I-5 HW (from channel H)	8	54 inch	CMP	0.024	0.0663	970	969.47	16.9	0.45	7.6	35.75	179.78	274.15	12.24	973.88	973.39

RESULTS

- CONTINUED ANALYSIS DOWNSTREAM OF WILTSHIRE USING HEC-RAS TO DETERMINE WATER SURFACE ELEVATIONS FOR 10, 50 AND 100-YEAR STORMS.
- PLOTTED RESULTS ON A TOPOGRAPHIC MAP TABULATED RESULTS IN A SPREADSHEET

RESULTS

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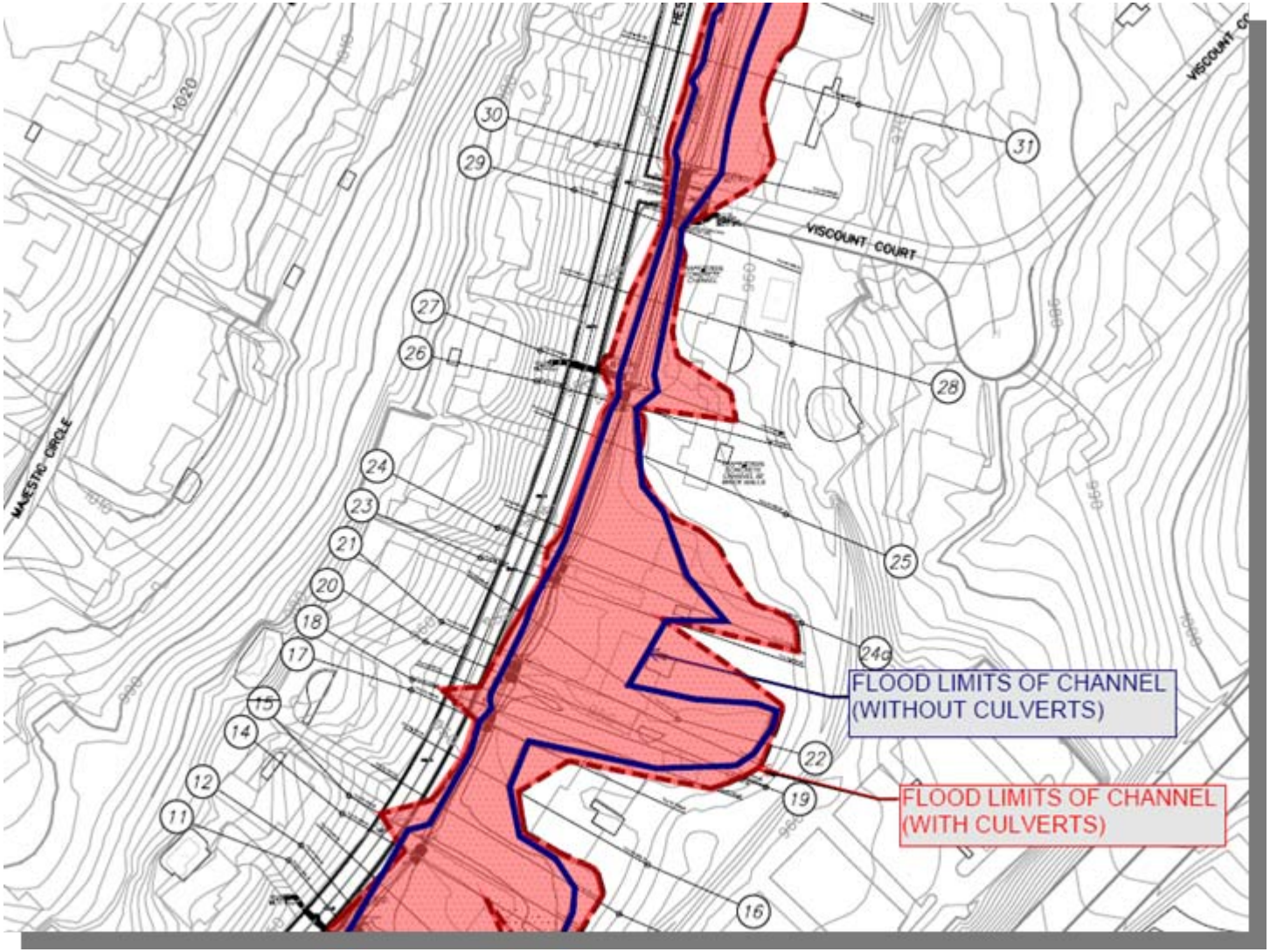
RESULTS



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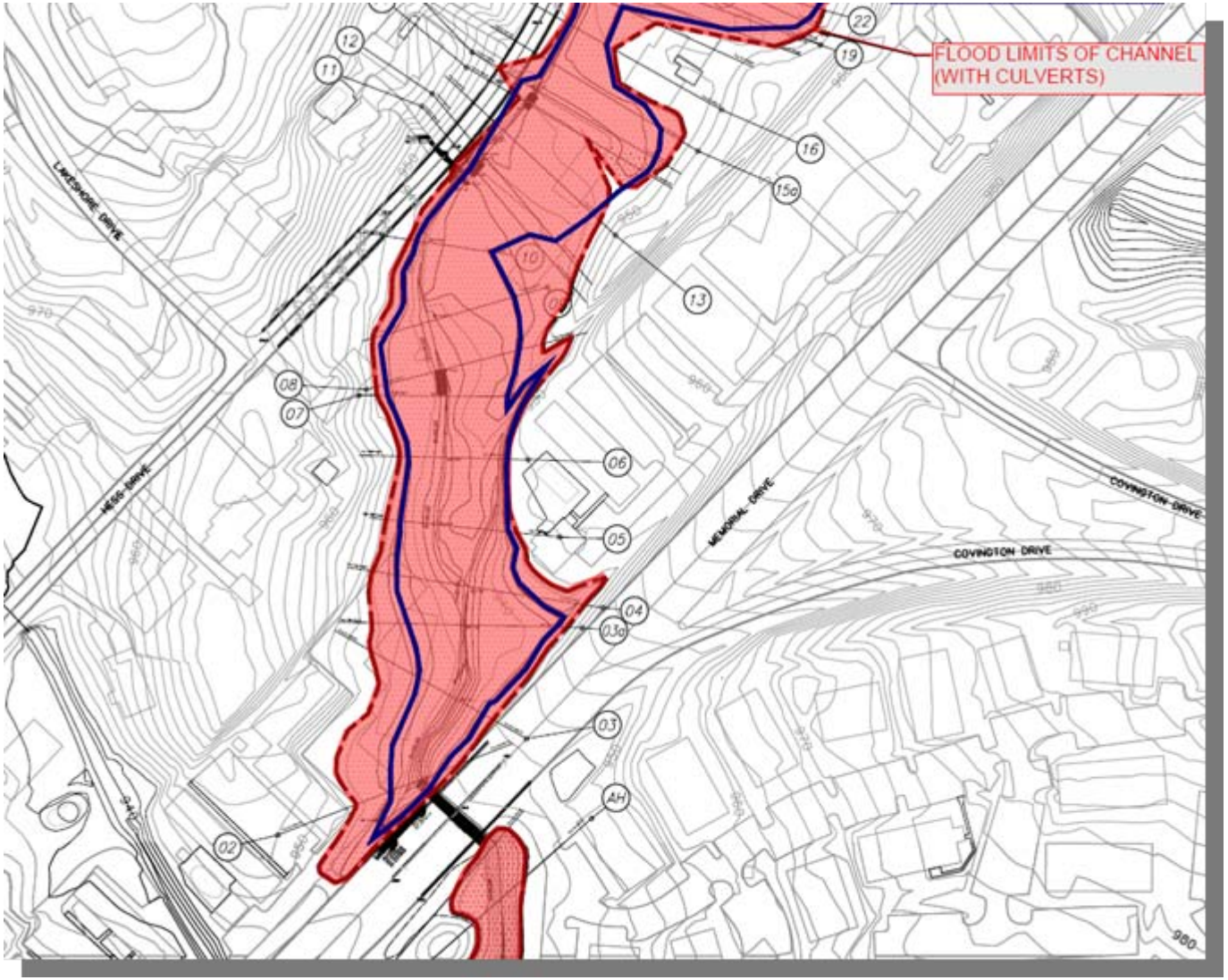
RESULTS



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RESULTS

- For Cobbs Creek channel, what is the best case scenario? Best case would be removal of channel constrictions (existing driveway culverts).

FLOOD STUDY DATA AND RESULTS

10-YEAR STORM EVENT

		Existing Channel (No Culverts)			Existing Channel With Culverts			Results					
Cross Section	River Sta	Q Total (cfs)	Hyd. Depth (ft)	Vel Chnl (ft/s)	Q Total (cfs)	Hyd. Depth (ft)	Vel Chnl (ft/s)	Change in Flow		Change in Depth		Change in Velocity	
								(cfs)	(%)	(ft)	(%)	(ft/s)	(%)
44	2765.98	231.02	2.38	8.81	231.02	2.54	7.53	0.00	0%	0.16	6.72%	-1.28	-15%
43	2735.8	231.02	2.73	9.42	231.02	1.99	2.51	0.00	0%	-0.74	-27.11%	-6.91	-73%
42	2708.34	231.02	2.95	7.91	231.02	2.21	2.04	0.00	0%	-0.74	-25.08%	-5.87	-74%
48" CMP	2695.85				Culvert								
41	2683.54	231.02	1.90	5.66	231.02	3.54	4.8	0.00	0%	1.64	86.32%	-0.86	-15%
40	2643.26	231.02	2.10	6.59	231.02	1.74	2.64	0.00	0%	-0.36	-17.14%	-3.95	-60%
39	2594.85	231.02	2.95	9.78	231.02	2.08	1.88	0.00	0%	-0.87	-29.49%	-7.90	-81%
48" CMP	2580.42				Culvert								
38	2563.83	231.02	1.91	7.86	231.02	2.96	4.85	0.00	0%	1.05	54.97%	-3.01	-38%
37	2504.92	231.02	2.66	3.99	231.02	2.69	2.88	0.00	0%	0.03	1.13%	-1.11	-28%
36	2435.36	345.64	1.89	7.81	345.64	2.4	3.12	0.00	0%	0.51	26.98%	-4.69	-60%
60" CMP	2427.07				Culvert								
35	2407.77	345.64	1.56	7.18	345.64	2.8	4.23	0.00	0%	1.24	79.49%	-2.95	-41%
34	2353.72	345.64	1.60	5.20	345.64	3	1.85	0.00	0%	1.40	87.50%	-3.35	-64%
33	2279.67	345.64	2.04	2.94	345.64	3.24	1.03	0.00	0%	1.20	58.82%	-1.91	-65%
72" CMP	2261.15				Culvert								
32	2240.99	345.64	2.18	3.19	345.64	6.31	3.91	0.00	0%	4.13	189.45%	0.72	23%
31	2147.92	345.64	2.58	3.30	345.64	2.92	1.68	0.00	0%	0.34	13.18%	-1.62	-49%
30	2046.26	345.64	3.62	2.11	345.64	3.19	1.22	0.00	0%	-0.43	-11.88%	-0.89	-42%
48" CMP	2012.79				Culvert								
29	1984.29	414.33	2.50	10.86	414.33	3.62	10.7	0.00	0%	1.12	44.80%	-0.16	-1%
28	1910.2	414.33	2.05	8.12	414.33	2.23	4.08	0.00	0%	0.18	8.78%	-4.04	-50%

RESULTS

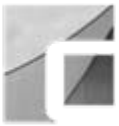
- How does the Proposed Detention Pond (from phase 1 study), affect the depth of water in front of my house?

FLOOD STUDY DATA AND RESULTS
10-YEAR STORM EVENT

		Existing Channel & Culverts			With Upstream Detention			Results					
Cross Section	River Sta	Q Total (cfs)	Hyd. Depth (ft)	Vel Chnl (ft/s)	Q Total (cfs)	Hyd. Depth (ft)	Vel Chnl (ft/s)	Change in Flow		Change in Depth		Change in Velocity	
								(cfs)	(%)	(ft)	(%)	(ft/s)	(%)
44	2765.98	231.02	2.54	7.53	192.65	2.52	6.45	-38.37	-17%	-0.02	-0.79%	-1.08	-14%
43	2735.8	231.02	1.99	2.51	192.65	1.91	2.31	-38.37	-17%	-0.08	-4.02%	-0.20	-8%
42	2708.34	231.02	2.21	2.04	192.65	2.19	1.85	-38.37	-17%	-0.02	-0.90%	-0.19	-9%
48" CMP	2695.85	Culvert			Culvert								
41	2683.54	231.02	3.54	4.8	192.65	3.4	4.24	-38.37	-17%	-0.14	-3.95%	-0.56	-12%
40	2643.26	231.02	1.74	2.64	192.65	1.73	2.45	-38.37	-17%	-0.01	-0.57%	-0.19	-7%
39	2594.85	231.02	2.08	1.88	192.65	2.06	1.69	-38.37	-17%	-0.02	-0.96%	-0.19	-10%
48" CMP	2580.42	Culvert			Culvert								
38	2563.83	231.02	2.96	4.85	192.65	2.57	4.65	-38.37	-17%	-0.39	-13.18%	-0.20	-4%
37	2504.92	231.02	2.69	2.88	192.65	2.64	2.74	-38.37	-17%	-0.05	-1.86%	-0.14	-5%
36	2435.36	345.64	2.4	3.12	273.92	2.31	2.86	-71.72	-21%	-0.09	-3.75%	-0.26	-8%
60" CMP	2427.07	Culvert			Culvert								
35	2407.77	345.64	2.8	4.23	273.92	2.59	3.71	-71.72	-21%	-0.21	-7.50%	-0.52	-12%
34	2353.72	345.64	3	1.85	273.92	2.84	1.61	-71.72	-21%	-0.16	-5.33%	-0.24	-13%
33	2279.67	345.64	3.24	1.03	273.92	3.09	0.9	-71.72	-21%	-0.15	-4.63%	-0.13	-13%
72" CMP	2261.15	Culvert			Culvert								
32	2240.99	345.64	6.31	3.91	273.92	5.86	3.34	-71.72	-21%	-0.45	-7.13%	-0.57	-15%
31	2147.92	345.64	2.92	1.68	273.92	2.79	1.54	-71.72	-21%	-0.13	-4.45%	-0.14	-8%
30	2046.26	345.64	3.19	1.22	273.92	3.19	1.1	-71.72	-21%	0.00	0.00%	-0.12	-10%
48" CMP	2012.79	Culvert			Culvert								
29	1984.29	414.33	3.62	10.7	324.81	3.77	8.07	-89.52	-22%	0.15	4.14%	-2.63	-25%

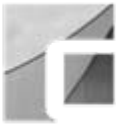
CIP RECOMMENDATIONS

- Install proposed detention pond from phase 1 study.
- Replace phase 1 storm drain system and phase 2 storm drain system north of Wiltshire
  - Why? It benefits all of the properties downstream, but especially those north of Wiltshire (eliminates flooding from the 25-year storm event north of Wiltshire)
  - Cannot replace storm drain without detention
    - Why? It shifts flooding problem downstream.



CIP RECOMMENDATIONS

- Replace certain driveway culverts along Hess Drive to prevent increases in water surface elevations.
- Study feasibility of additional detention. Basin J-2 is a candidate for a detention pond. (38 acres, has a location for a pond, drainage comes to central point in the basin).
- Consider paving the channel. We can tell you where.
- Actively maintain the channel.
  - Remove debris from channel and driveway culverts.

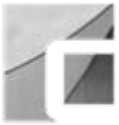


POLICY RECOMMENDATIONS

- Everyone along Hess Drive should consider purchasing Flood Insurance, if they don't already have it. You will get the cheapest rate.

SUMMARY

- PIPES DOWNSTREAM TO WILTSHIRE ARE UNDERSIZED, BUT CAN BE REPLACED WITH ADEQUATELY SIZED CULVERTS
- CHANNEL UPSTREAM HAS ADEQUATE CAPACITY
- CHANNEL DOWNSTREAM IS ENCUMBERED WITH DRIVEWAY CULVERTS THAT RESTRICT FLOW.
- CAPITAL IMPROVEMENTS WILL SOLVE DRAINAGE PROBLEM NORTH OF WILTSHIRE, IMPROVE FLOODING SITUATION IN MOST LOCATIONS ALONG COBBS CREEK.



QUESTIONS?

Clark Patterson Lee
DESIGN PROFESSIONALS