Lab 2 Answer Key - Flood Hazard Analysis

Part 1. Buffalo Creek Study

1. Describe what happens to the overall peak flood-wave discharge as the dam-burst event progresses down-stream.

Flood peak Q diminishes as it progresses down stream with time.

2. Describe what happens to the velocity of the peak flood-wave as it passes downstream.

Peak flood wave velocity remains constant at ~9 ft/sec between Stowe and Accoville, but drastically slows at Man (1.36 ft/sec)

3. Provide several hypotheses as to why you think the peak flood-wave discharge decreases so dramatically from Saunders (near the dam break) to the other stations? (think about what is happening to the river channel and the water in the channel).

-Loss of discharge due to infiltration into valley sediments

4. Based on Table 3 and Table 4, why does the flood-wave travel velocity diminish so significantly between Accoville and Man? (look at the data and think about the continuity equation and valley geometry).

-Flood wave travel velocity diminishes because the valley widens dramatically at Man (from ~1000 sq. ft to about 6000 sq. ft). A wider valley results in greater cross-sectional area, and decreased velocity.

5. Which town along Buffalo Creek do you think sustained the most death and destruction? Explain your answer in detail (why?).

The upstream localities suffered the highest peak Q over the least amount of cross-sectional area. It seems that the upstream towns would have been hardest hit. Also the travel time after dam burst is least upstream... less time for evacuation.

6. What would be the best way to save lives in Man, WV, compared to Saunders**...** again look at the data in Table 3.

-Man is farthest downstream, with the flood wave traveling over 4 hours following dam burst. A warning / evacuation would have dramatically saved lives. Saunders had little warning with no time for evacuation... likely the highest no. of casualties.

7. Discuss what you know about flood hazards and how this catastrophe could have been avoided or otherwise mitigated.

-appropriate construction and monitoring of the coal-refuse dam
-a warning system with respect to rainfall-runoff conditions and dam levels
-planning and restriction of building on low-lying floodplains in valley
-others?...

Part 2. Mission Creek Study

8. Based on Table 5, what climate conditions in Southern California are most commonly associated with the highest recorded flood events on Mission Creek.

-El Nino Years are the most flood prone

9. What climate conditions are the lowest annual peak discharges associated with?

-Drought years

10. During the low peak-discharge years, the risk of flood hazard is minimized. Hypothesize what hazards you would face in coastal southern California during the low peak discharge years, other than flood.

-Drought years = fire hazard
-Drought followed by El Nino = drought/fire + devegetated hillslopes + El Nino Rains = rapid runoff floods, slope failure and debris flow

11. What is the recurrence interval of the highest flood discharge recorded in the 25 year record? What is the R.I. of the lowest discharge recorded? Create a general statement regarding the magnitude of a flood event relative to it's frequency over time.

R.I. of highest Q = 26 years, R.I. of lowest Q = 1.04 yrs

Magnitude is inversely proportional to frequency of flood (big floods occur less frequently than smaller floods)

12. Based on the talk by Ann Beier from the State Dept. of Lands, discuss why the 100 year floodplain is important to the citizens of Oregon (What is the 100-yr floodplain and how is it delineated?).

100 Year floodplain is the critical area surrounding stream valleys that is subject to planning ordinances

Method of 100 yr floodplain delineation

-look at historical peak Q flood discharge data
- conduct Log Pearson Type III analysis and determine 100 discharge (extrapolated statistically)
- examine the valley topography in the context of discharge and cross-sectional drainage area
- determine the depths to which the 100 year flood will cover the landscape and create a floodplain hazard map.

Table 2. Answer Sheet for Buffalo Creek Calculations. *1 cu. m = 35.31 cu. ft*

At SaundersWV			At Stowe, WV			At Accoville, WV			At Man, WV		
Q (cu. Ft/sec)	Q (cu m /sec)	Time (min)	Q (cu. Ft/sec)	Q (cu m /sec)	Time (min)	Q (cu. Ft/sec)	Q (cu m /sec)	Time (min)	Q (cu. Ft/sec)	Q (cu m /sec)	Time (min)
500	14.2	0	500	14.2	0	500	14.2	0	500	14.2	0
500	14.2	5	500	14.2	5	500	14.2	5	500	14.2	5
500	14.2	10	500	14.2	10	500	14.2	10	500	14.2	10
32000	906.3	15	500	14.2	15	500	14.2	15	500	14.2	15
50000	1416.0	17	500	14.2	20	500	14.2	20	500	14.2	20
25000	708.0	20	500	14.2	25	500	14.2	25	500	14.2	25
3000	85.0	25	500	14.2	30	500	14.2	30	500	14.2	30
500	14.2	30	500	14.2	35	500	14.2	35	500	14.2	35
500	14.2	35	500	14.2	40	500	14.2	40	500	14.2	40
500	14.2	40	500	14.2	45	500	14.2	45	500	14.2	45
500	14.2	45	2000	56.6	50	500	14.2	50	500	14.2	50
500	14.2	50	3000	85.0	55	500	14.2	55	500	14.2	55
500	14.2	55	6000	169.9	60	500	14.2	60	500	14.2	60
500	14.2	60	9000	254.9	65	500	14.2	65	500	14.2	65
500	14.2	65	12000	339.8	70	500	14.2	70	500	14.2	70
500	14.2	70	9000	254.9	75	500	14.2	75	500	14.2	75
500	14.2	75	8000	226.6	80	500	14.2	80	500	14.2	80
500	14.2	80	5000	141.6	85	500	14.2	85	500	14.2	85
500	14.2	85	2000	56.6	90	1000	28.3	90	500	14.2	90
500	14.2	90	500	14.2	95	2000	56.6	95	500	14.2	95
500	14.2	95	500	14.2	100	3000	85.0	100	500	14.2	100
500	14.2	100	500	14.2	105	5000	141.6	105	500	14.2	105
500	14.2	105	500	14.2	110	6000	169.9	110	500	14.2	110
500	14.2	110	500	14.2	115	7000	198.2	115	500	14.2	115
500	14.2	115	500	14.2	120	9000	254.9	120	500	14.2	120
500	14.2	120	500	14.2	125	8000	226.6	125	500	14.2	125
500	14.2	125	500	14.2	130	7000	198.2	130	500	14.2	130
500	14.2	130	500	14.2	135	5000	141.6	135	600	17.0	135
500	14.2	135	500	14.2	140	3000	85.0	140	700	19.8	140
500	14.2	140	500	14.2	145	2500	70.8	145	800	22.7	145
500	14.2	145	500	14.2	150	2000	56.6	150	900	25.5	150
500	14.2	150	500	14.2	155	1500	42.5	155	1000	28.3	155
500	14.2	155	500	14.2	160	850	24.1	160	1100	31.2	160
500	14.2	160	500	14.2	165	500	14.2	165	1500	42.5	165
500	14.2	165	500	14.2	170	500	14.2	170	2000	56.6	170
500	14.2	170	500	14.2	175	500	14.2	175	2500	70.8	175
500	14.2	175	500	14.2	180	500	14.2	180	3000	85.0	180
500	14.2	180	500	14.2	185	500	14.2	185	5000	141.6	185
500	14.2	185	500	14.2	190	500	14.2	190	8000	226.6	190
500	14.2	190	500	14.2	195	500	14.2	195	7500	212.4	195
500	14.2	195	500	14.2	200	500	14.2	200	5500	155.8	200
500	14.2	200	500	14.2	205	500	14.2	205	4500	127.4	205
500	14.2	205	500	14.2	210	500	14.2	210	4000	113.3	210
500	14.2	210	500	14.2	215	500	14.2	215	3000	85.0	215
500	14.2	215	500	14.2	220	500	14.2	220	2500	70.8	220
500	14.2	220	500	14.2	225	500	14.2	225	2000	56.6	225
500	14.2	225	500	14.2	230	500	14.2	230	1800	51.0	230
500	14.2	230	500	14.2	235	500	14.2	235	1000	28.3	235
500	14.2	235	500	14.2	240	500	14.2	240	800	22.7	240
500	14.2	240	500	14.2	245	500	14.2	245	650	18.4	245
500	14.2	245	500	14.2	250	500	14.2	250	500	14.2	250
500	14.2	250									

Flood Hydrograph for the February 26, 1972
Buffalo Creek, WV Dam Break

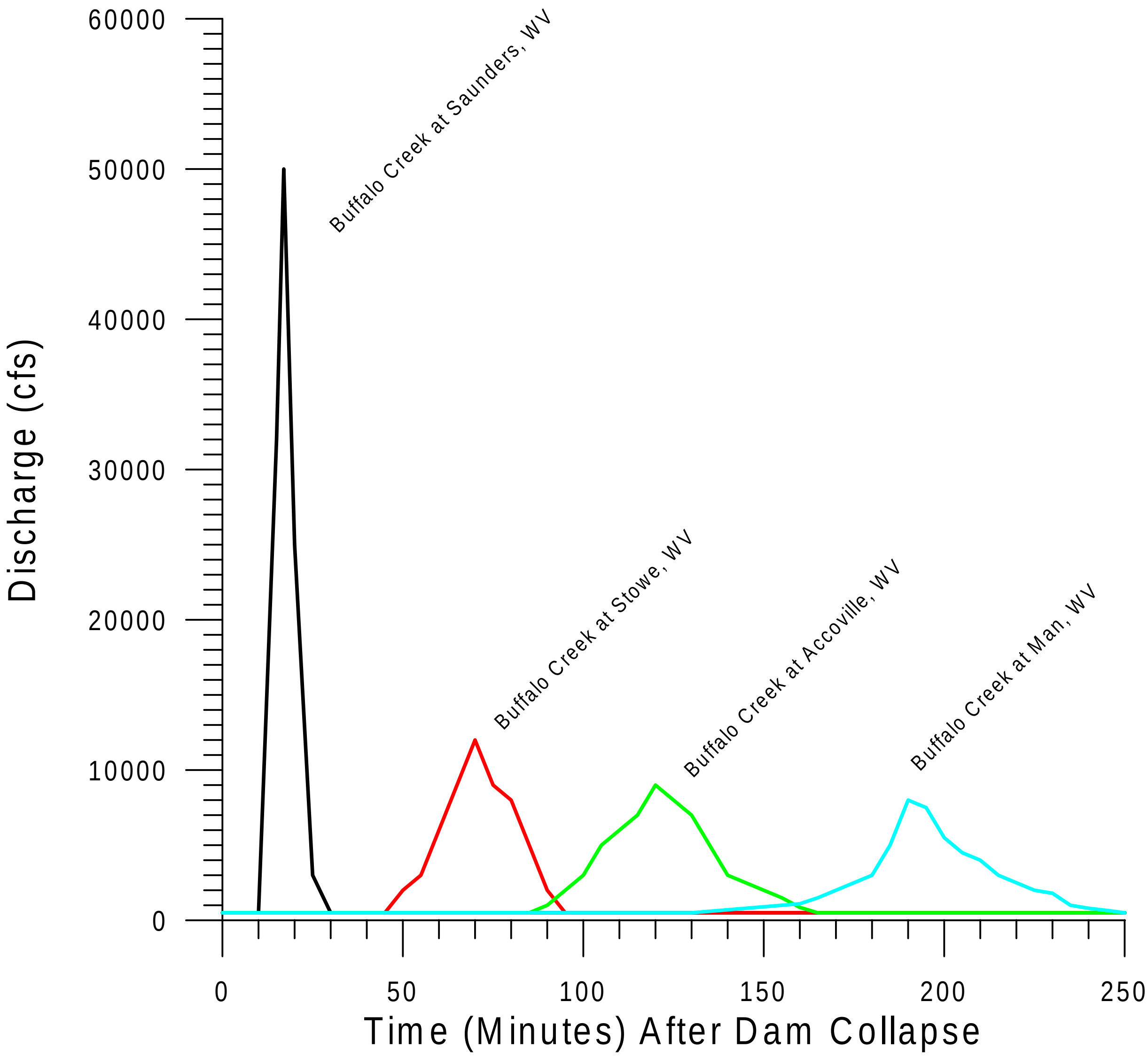

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Table 3. Flood Wave Velocity Calculations

conversion factors: 1hr = 60 min, 1 mi = 1609 m

Stream Segment	Distance (mi)	Time (min)	Time (hr)	Velocity (mi /hr)	Velocity (ft/sec)
Saunders-Stowe	5.5	52	0.87	6.35	9.31
Stowe-Accoville	5.25	50	0.83	6.30	9.24
Accoville-Man	1.1	71	1.18	0.93	1.36
Total Average: Saunders-Man	11.85	173	2.88	4.11	6.03

Continuity Equation: $Q = AV$

Table 4. Cross-Sectional Flow Area Calculation.

Station	Velocity (ft /sec)	Peak Floodwave Q (cfs)	Cross-Sectional Area of Flow (sq. ft)
Stowe	9.31	12000	1289.26
Accoville	9.24	8500	919.91
Man	1.36	8000	5867.77

Table 6. Mission Creek - Log-Pearson type III distribution.

Year	M	R.I. (years)	Qp	Q' = logQp	$(Q'-Q'_{avg})$	$(Q'-Q'_{avg})^2$	$(Q'-Q'_{avg})^3$
1995	1	26.00	3800	3.5798	0.8141	0.6627	0.5395
1973	2	13.00	2580	3.4116	0.6459	0.4172	0.2695
1978	3	8.67	2500	3.3979	0.6322	0.3997	0.2527
1983	4	6.50	2300	3.3617	0.5960	0.3553	0.2117
1972	5	5.20	1420	3.1523	0.3866	0.1495	0.0578
1980	6	4.33	1300	3.1139	0.3482	0.1213	0.0422
1975	7	3.71	1130	3.0531	0.2874	0.0826	0.0237
1992	8	3.25	1129	3.0527	0.2870	0.0824	0.0236
1993	9	2.89	838	2.9232	0.1575	0.0248	0.0039
1984	10	2.60	681	2.8331	0.0675	0.0045	0.0003
1979	11	2.36	667	2.8241	0.0584	0.0034	0.0002
1986	12	2.17	626	2.7966	0.0309	0.0010	0.0000
1987	13	2.00	625	2.7959	0.0302	0.0009	0.0000
1977	14	1.86	569	2.7551	-0.0106	0.0001	0.0000
1974	15	1.73	519	2.7152	-0.0505	0.0026	-0.0001
1991	16	1.63	468	2.6702	-0.0954	0.0091	-0.0009
1971	17	1.53	360	2.5563	-0.2094	0.0438	-0.0092
1976	18	1.44	353	2.5478	-0.2179	0.0475	-0.0103
1981	19	1.37	302	2.4800	-0.2857	0.0816	-0.0233
1994	20	1.30	207	2.3160	-0.4497	0.2023	-0.0910
1982	21	1.24	186	2.2695	-0.4962	0.2462	-0.1222
1989	22	1.18	168	2.2253	-0.5404	0.2920	-0.1578
1988	23	1.13	139	2.1430	-0.6227	0.3877	-0.2414
1985	24	1.08	128	2.1072	-0.6585	0.4336	-0.2855
1990	25	1.04	115	2.0607	-0.7050	0.4970	-0.3504
			SUM	**69.1424**	**0.00000**	**4.5488**	**0.1332**

Total N	25	
Q'_{avg}	2.7657	
Q'_{stdev}	0.4354	
G	0.0731	
K_{100}	2.378	(by linear extrapolation)
$logQ_{100}$	3.800971	
Q_{100} (cfs)	6324	