Considerations regarding Partial Accreditation of Dike, Drainage, and Irrigation District 12 Levee System

Chal Martin, P.E.
Public Works Director
City of Burlington

SKAGIT COUNTY
BOARD OF COMMISSIONERS

DON MUNKS, First District
KENNETH A. DAHLSTEDT, Second District
SHARON D. DILLON, Third District

June 16, 2008

Mayor Ed Brunz
City of Burlington
833 South Spruce Street
Burlington, WA 98233

RE: Memorandum of Understanding
Co-lead on Phased Environmental Review

Mayor Brunz:

We have your letter dated May 13, 2008, requesting that the County participate as co-lead in phased environmental review of a flood protection and land use project. It is our understanding that the City desires to plan for a standalone flood control project for the City of Burlington. As explained to County staff, it is our understanding this would involve levee setback and certification, a ring dike around the City, and a moderate expansion of the City's Urban Growth Area (UGA).

As you are aware, the Board of County Commissioners has charged the Flood Control Zone District (FCZD) advisory committee with basin-wide flood control planning. The FCZD advisory group sets up a carefully balanced stakeholder process involving representatives of cities, dike districts, environmental and agricultural groups, business interests, tribes, and state and federal agencies.

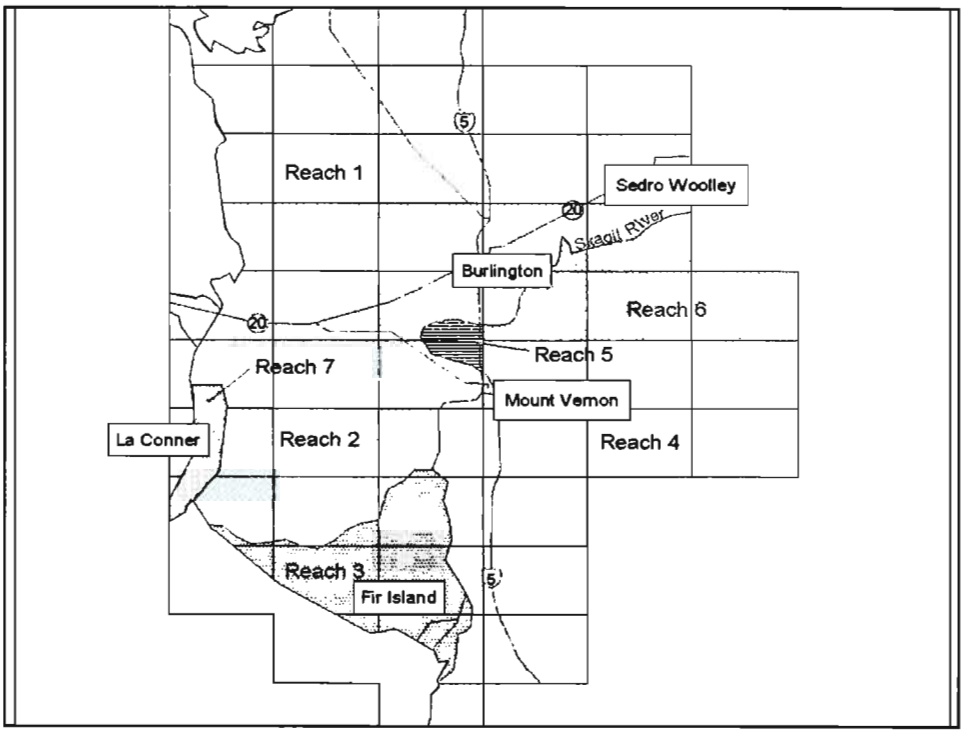
The Board of Commissioners intends to heavily rely on recommendations from the FCZD committees in flood planning going forward. Flood control projects within a river basin are necessarily interrelated. Accordingly, it is vitally important that the FCZD body furnish holistic flood control recommendations and plans that work for the entire community.

For these reasons, we would request that the City of Burlington present the concept of its proposal to the FCZD for their discussion, consideration and recommendation prior to County staff taking any action in furtherance of the City's proposal.

Overview

- Selected Information from COE / FEMA Work Products
- Hydrology: Corps vs. City/DD position
  - Update on latest investigation/modeling
- Levee certification concepts for Burlington
  - Critical affect of hydrology
- Questions

Selected COE / FEMA Work Products



COE Theoretical Non-Damaging Flood Intervals (April 2006)

Reach	Average Years Between Damaging Flood
1	9
2	9
3	50
4	41
5	500
6	5
7	9
8	160
9	13
10	10

Expected Annual Damages

Expected Annual Damage for the Without Project Condition

(Damage in $1,000's)

(Analysis is based upon 5.375% discount rate, 2004 price level, and 50 year period of analysis)

	Damage Categories										
	Residential			Public Assistance	TRA	Non-Residential			Agricultural Damages	Traffic Delays	Total
	Structure	Content	Cleanup			Structure	Content	Cleanup			
Reach 1	11,296	6,249	1,885	1,859	547	7,860	7,760	1,141	864	2,296	41,757
Reach 2	3,674	2,018	548	538	160	112	95	18	1,236	0	8,399
Reach 3	40	23	10	12	3	9	7	1	25	0	130
Reach 4	4,511	2,467	662	667	196	3,081	3,466	777	127	0	15,954
Reach 5	21	11	2	2	1	25	28	4	1	0	95
Reach 6	1,671	915	249	251	74	106	117	21	406	0	3,810
Reach 7	624	359	168	165	48	541	457	118	11	0	2,491
Reach 8	466	252	59	52	15	72	15	3	6	2	942
Reach 9	349	196	47	38	11	34	31	0	96	25	827
Reach 10	615	290	102	1,414	42	52	43	3	55	0	2,616
Road Damages											278
TOTAL	23,267	12,780	3,732	4,998	1,097	11,892	12,019	2,086	2,827	2,323	77,299

COE Flood Damage Assessment Hydrology Inputs

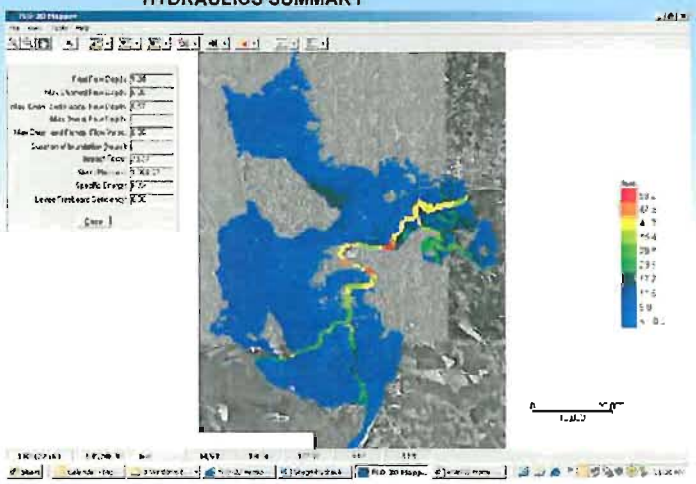
Exceedance Probability	Discharge (cfs)
0.9990	25,000
0.5000	72,900
0.2000	93,900
0.1000	120,400
0.0400	158,000
0.0200	192,100
0.0133	215,500
0.0100	235,400
0.0040	320,200
0.0020	386,900
0.0010	450,000

Equivalent Record Length: 106 years

*"Economic Flood Damage Assessment of Without Project Conditions" Seattle District, U.S. Army Corps of Engineers Draft Report, April 2006

U.S. Army Corps of Engineers
Seattle District

SKAGIT RIVER BASIN, WASHINGTON
REVISED FLOOD INSURANCE STUDY
HYDRAULICS SUMMARY



SKAGIT COUNTY, WA

Prepared For: Federal Emergency Management Agency
1 MAY 2008

Major Concern for Burlington: Base Flood Elevations and Floodway

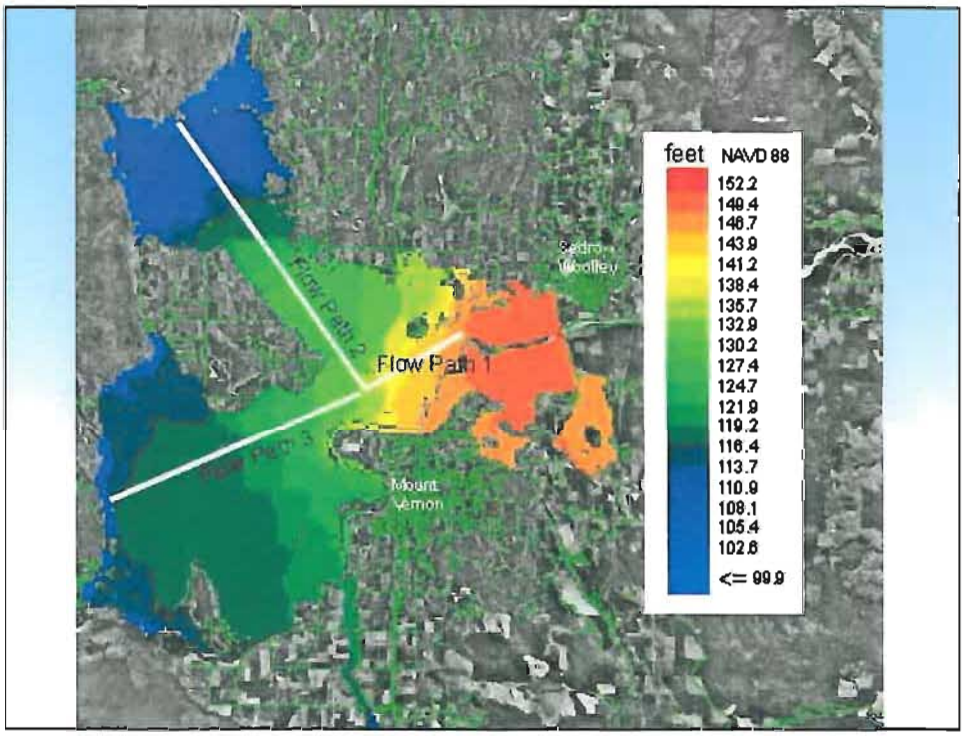
(From COE Revised Flood Insurance Study, Hydraulics Summary)

The 1984 study did not finalize a **floodway** on the Skagit River downstream of Sedro-Woolley. A reason for this is the complexity in determining the proper positioning and methodology for this downstream floodway when using a one-dimensional model when flows can head north to Samish Bay, south to Skagit Bay and West to Swinomish Slough and Padilla Bay. With the development of the two-dimensional FLO-2D model for this study, a floodway analysis is possible.

There are two approaches that will initially be attempted for the floodway analysis. The first is similar to the upstream methodology where an attempt will be made to do an equal conveyance floodway surrounding the existing river channel. A second approach will look at routing the water through the most logical overbank flow paths and determine the level of encroachments that can be made around these. This work will be done in the next phase and is not a part of this release.

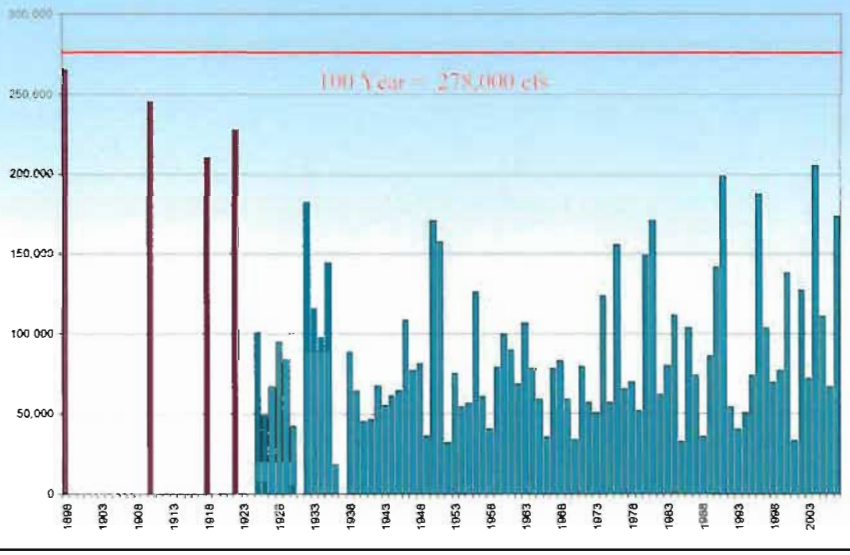
C. Floodplain Flow Paths

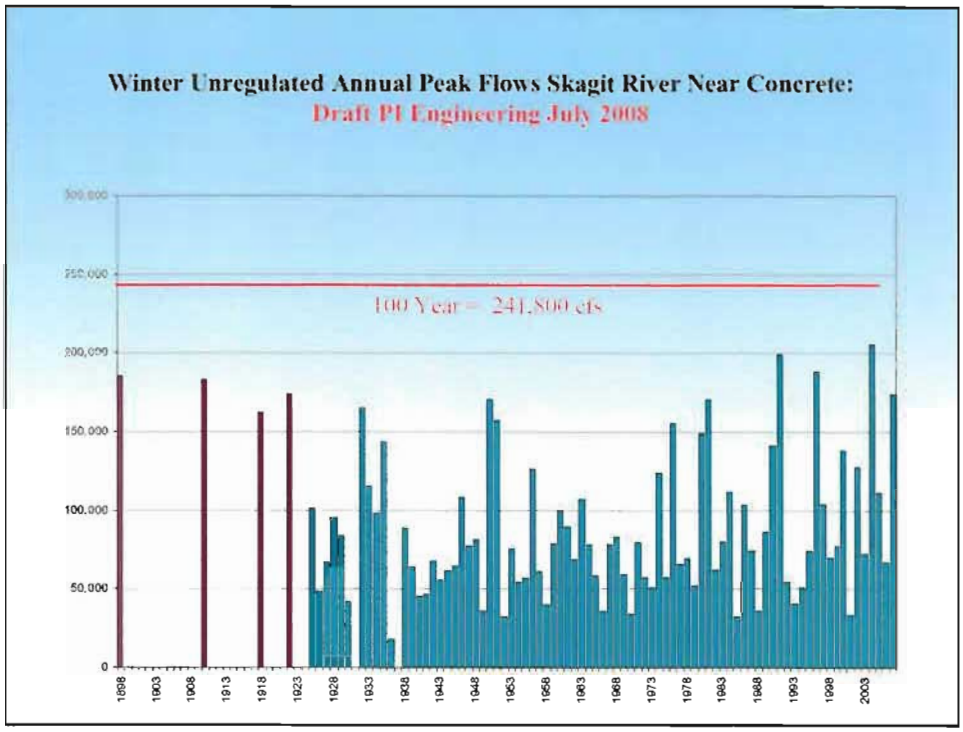
There are 5 floodplain flow paths that are used to develop water surface profiles in the overbank areas in the lower basin below Sedro-Woolley. Figures 24, 25, and 26 show the locations of these flow paths. These flow paths are delineated by attempting to follow the quickest drop to the sea which defines the most likely path the overbank flows will follow.



Hydrology

Skagit River <u>Winter Unregulated</u> Annual Peak Flows
Concrete – COE Frequency Distribution (April 2008)

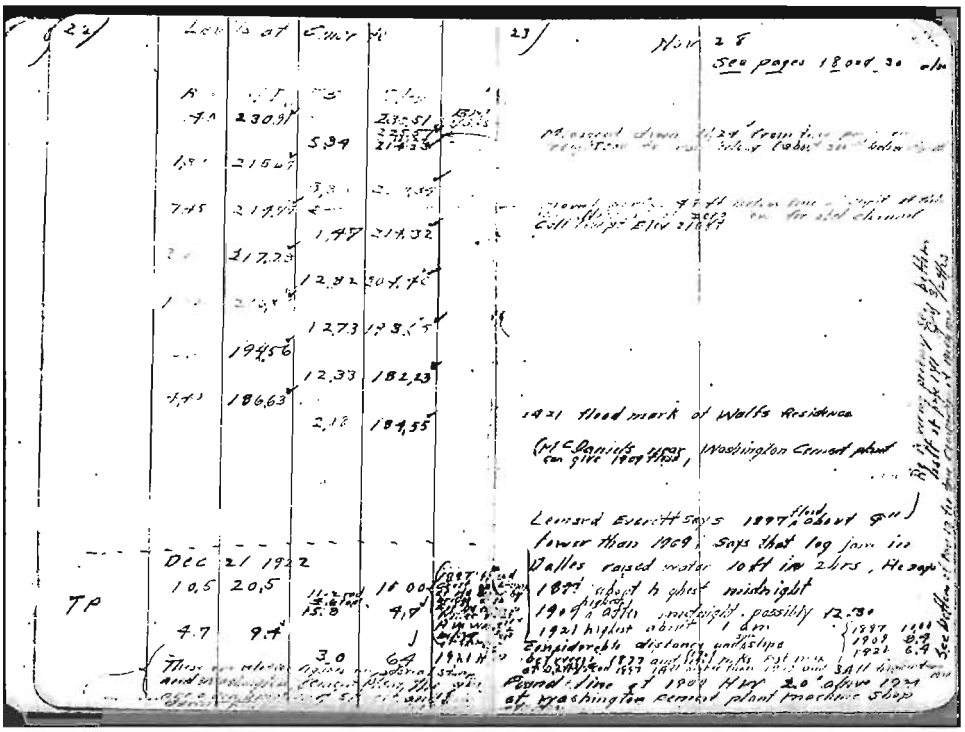




Concept

Investigation of the Historic Floods in the Crofoot's Addition to Concrete

- Build on Stewart's observed and documented high water marks of the historic floods (1922 field notes)
- Combine Stewart's 1922 interview/survey data with today's hydraulic modeling methods to determine the historic discharges
- Supplement the hydraulic modeling with a forensic investigation



1921, Concrete Herald Newspaper

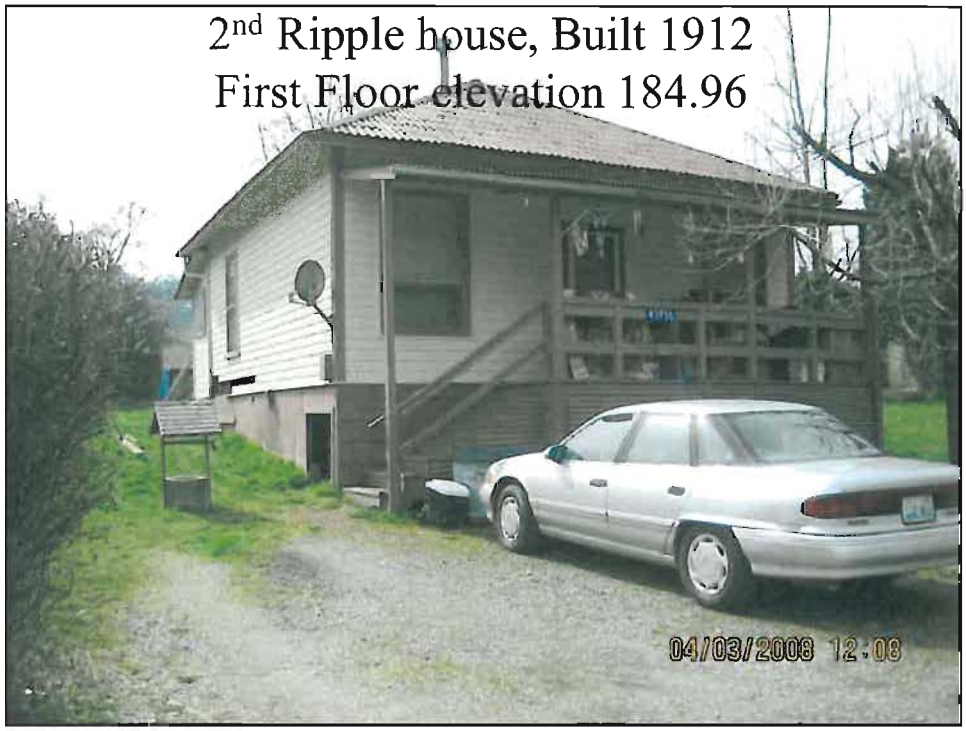
"About three o'clock in the afternoon it went over the banks in Crofoot addition and the residents of that part of town began to move out … The waters also crept up around some of the dwellings in East Concrete, and some of the residents moved out for the night. **In Crofoot addition** only three residences remained above the high water mark, **the water being to a depth of an inch to 14 inches in the others**. No particular damage was done, except for small articles outside being washed away, and the job of cleaning out the mud left by the flood. … **In East Concrete practically no damage was done.**" *Dec. 17, 1921 Concrete Herald "Skagit River Goes On Wild Rampage; Light Damage Here"*

L.E. Wolfe Residence, 1922

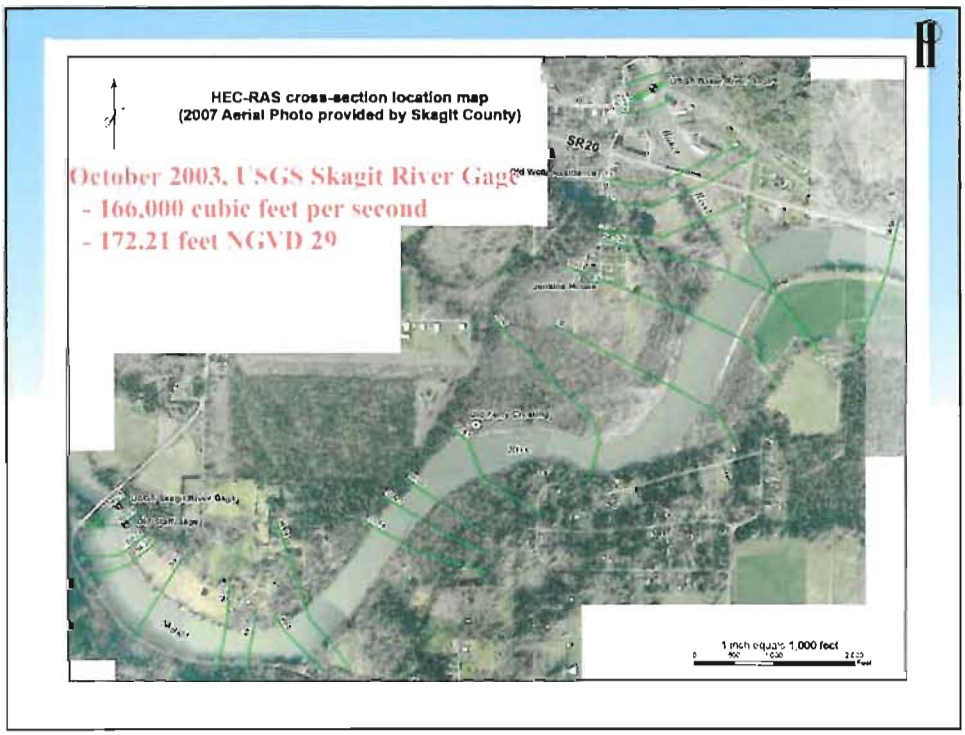
At Concrete, Crofoot's Addition


04/03/2008 11:22

2nd Ripple house, Built 1912
First Floor elevation 184.96



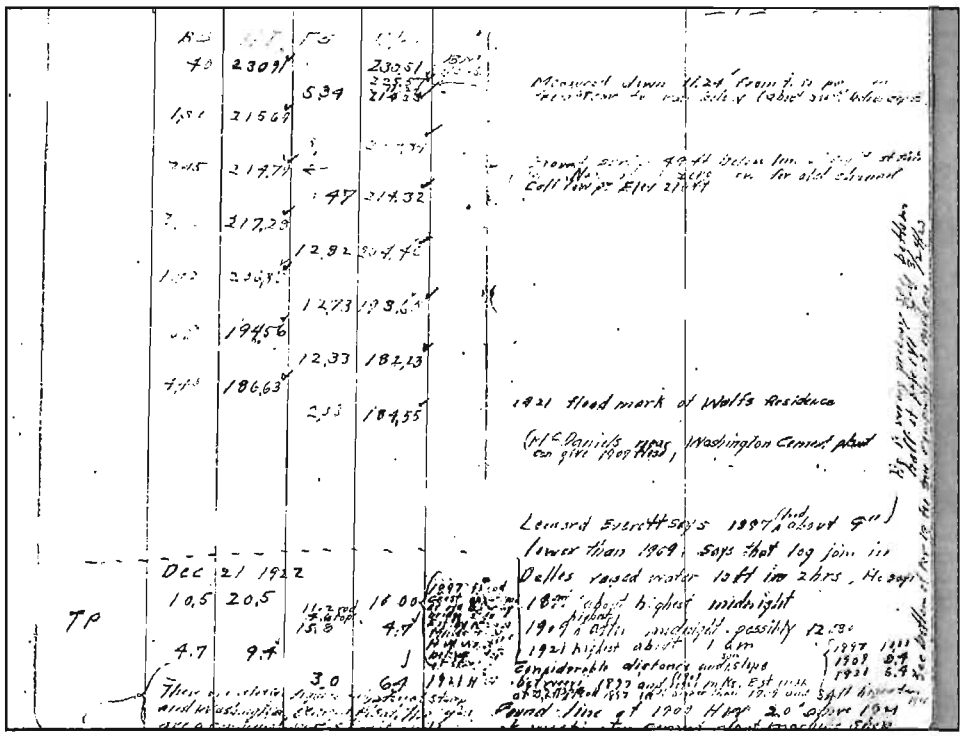

Part II: Hydraulic Model Extension
N
0
0.4mi
Includes material © Space Imaging LLC

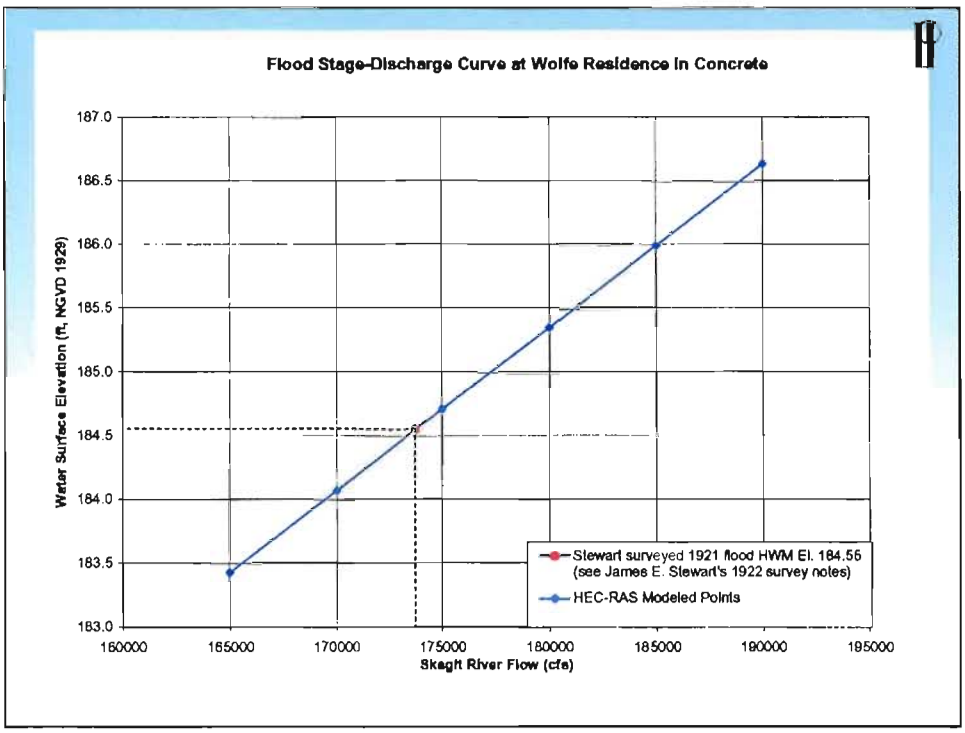

HEC-RAS cross-section location map
(2007 Aerial Photo provided by Skagit County)
October 2003, USGS Skagit River Gage
- 166,000 cubic feet per second
- 172.21 feet NGVD 29
SR20
1 inch equals 1,000 feet

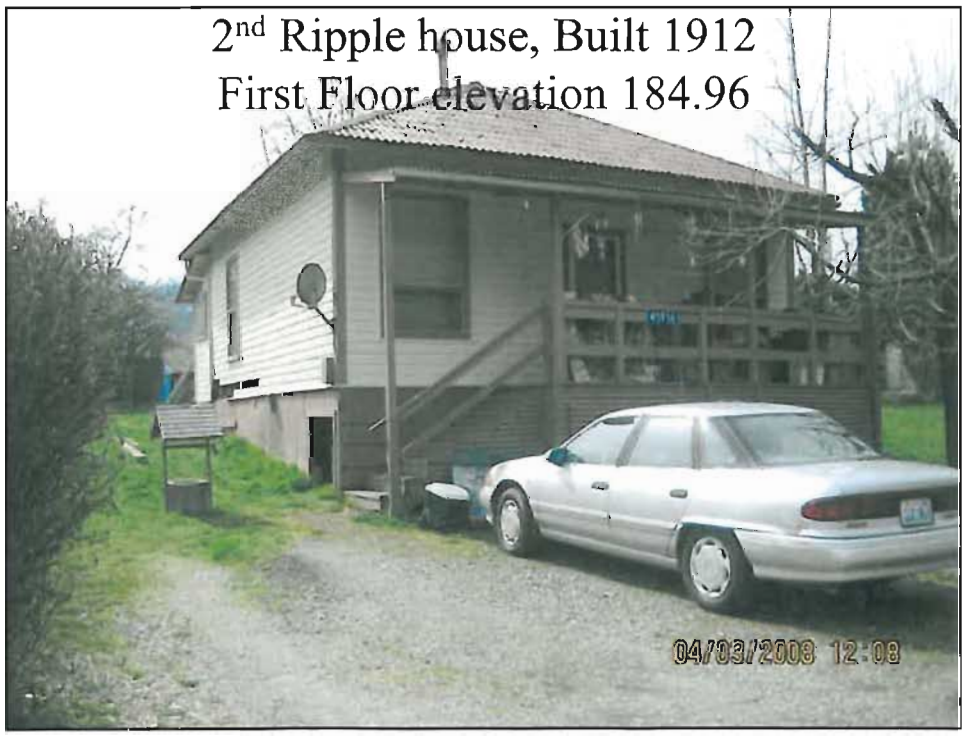
October 2003 Flood

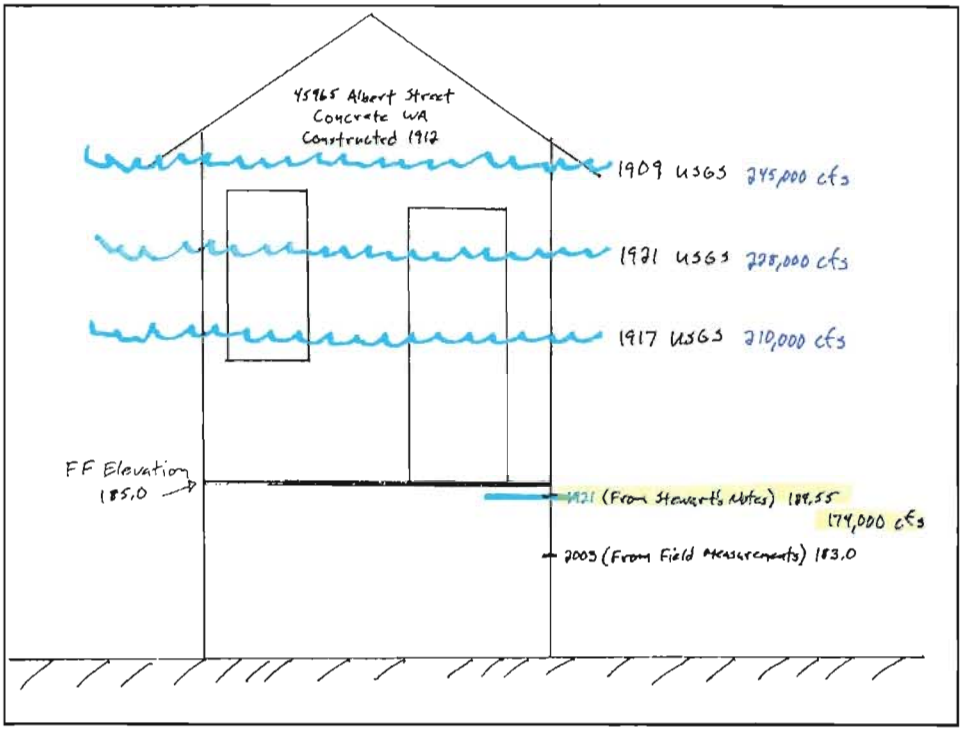
Jenkins House at 7752 South Dillard

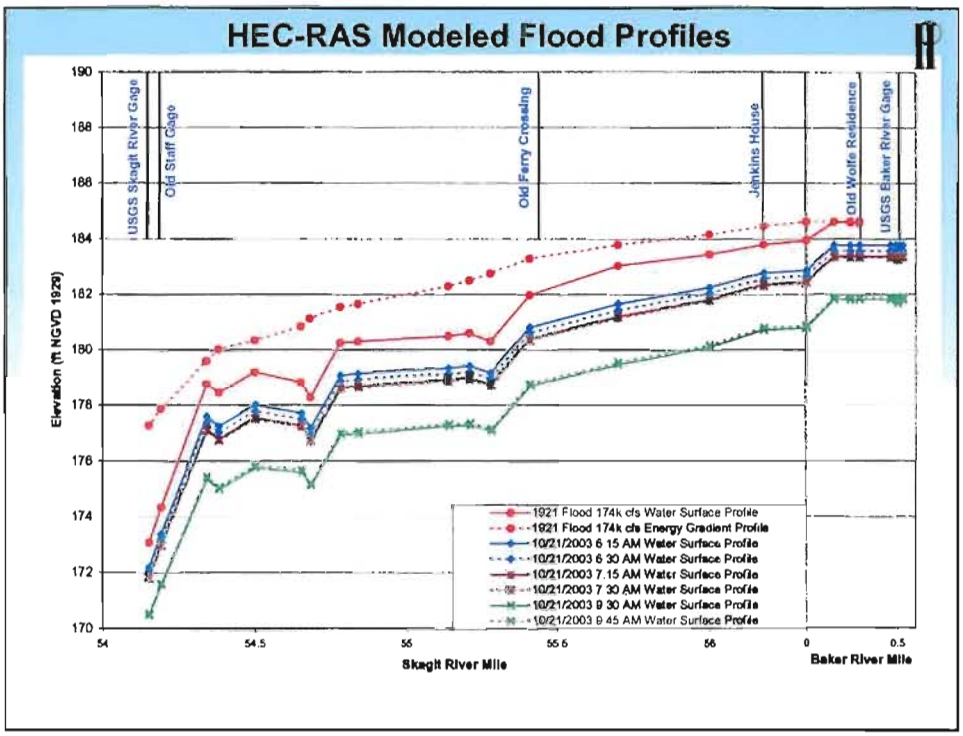
(Photo provided by Allen Jenkins)



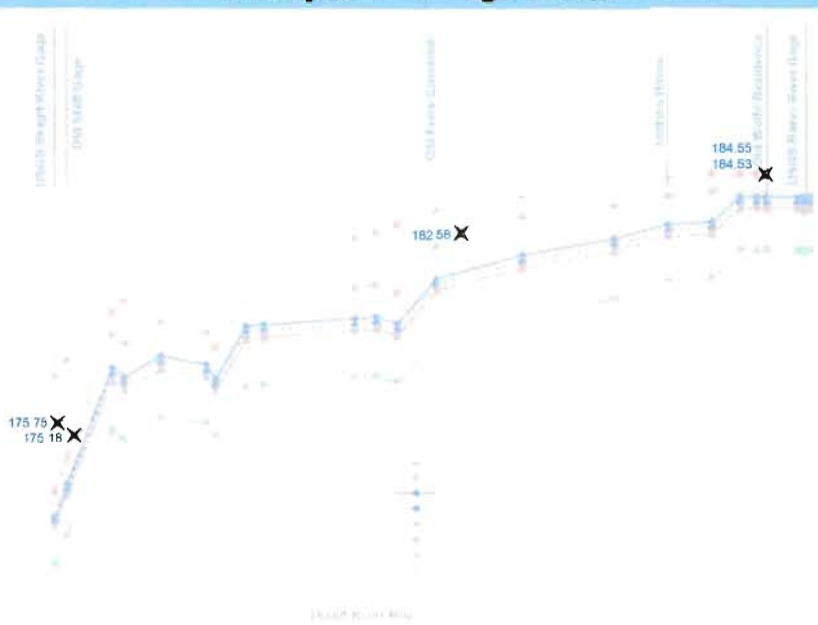

Flood Stage-Discharge Curve at Wolfe Residence in Concrete
Water Surface Elevation (ft, NGVD 1929)
187.0
186.5
186.0
185.5
185.0
184.5
184.0
183.5
183.0
160000
165000
170000
175000
180000
185000
190000
195000
Skagit River Flow (cfs)
Stewart surveyed 1921 flood HWM El. 184.56 (see James E. Stewart's 1922 survey notes)
HEC-RAS Modeled Points


2nd Ripple house, Built 1912
First Floor elevation 184.96
04/03/2008 12:08


45965 Albert Street
Concrete WA
Constructed 1912
1909 USGS 245,000 cfs
1921 USGS 225,000 cfs
1917 USGS 210,000 cfs
FF Elevation
185.0
1921 (From Stewart's Notes) 184.55
174,000 cfs
2003 (From Field Measurements) 183.0


HEC-RAS Modeled Flood Profiles
USGS Skagit River Gage
Old Staff Gage
Old Ferry Crossing
Jenkins House
Old Wolfe Residence
USGS Baker River Gage
Elevation (ft NGVD 1929)
190
188
186
184
182
180
178
176
174
172
170
54
54.5
55
55.6
56
0
0.5
Skagit River Mile
Baker River Mile
1921 Flood 174k cfs Water Surface Profile
1921 Flood 174k cfs Energy Gradient Profile
10/21/2003 6 15 AM Water Surface Profile
10/21/2003 6 30 AM Water Surface Profile
10/21/2003 7 15 AM Water Surface Profile
10/21/2003 7 30 AM Water Surface Profile
10/21/2003 9 30 AM Water Surface Profile
10/21/2003 9 45 AM Water Surface Profile

Stewart Surveyed 1921 High Water Marks

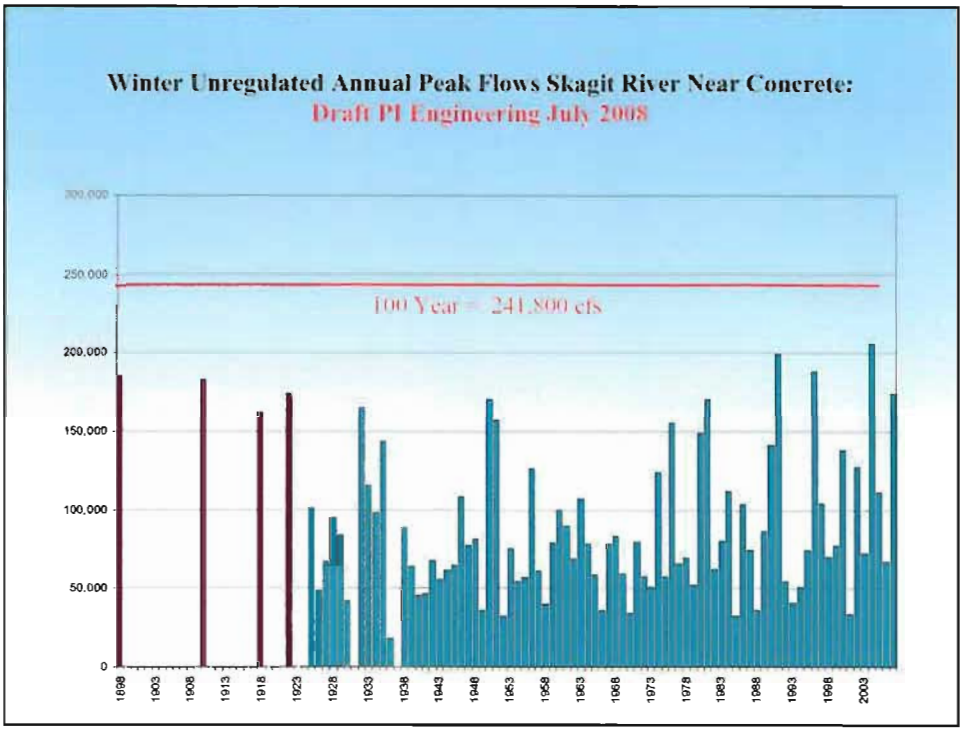


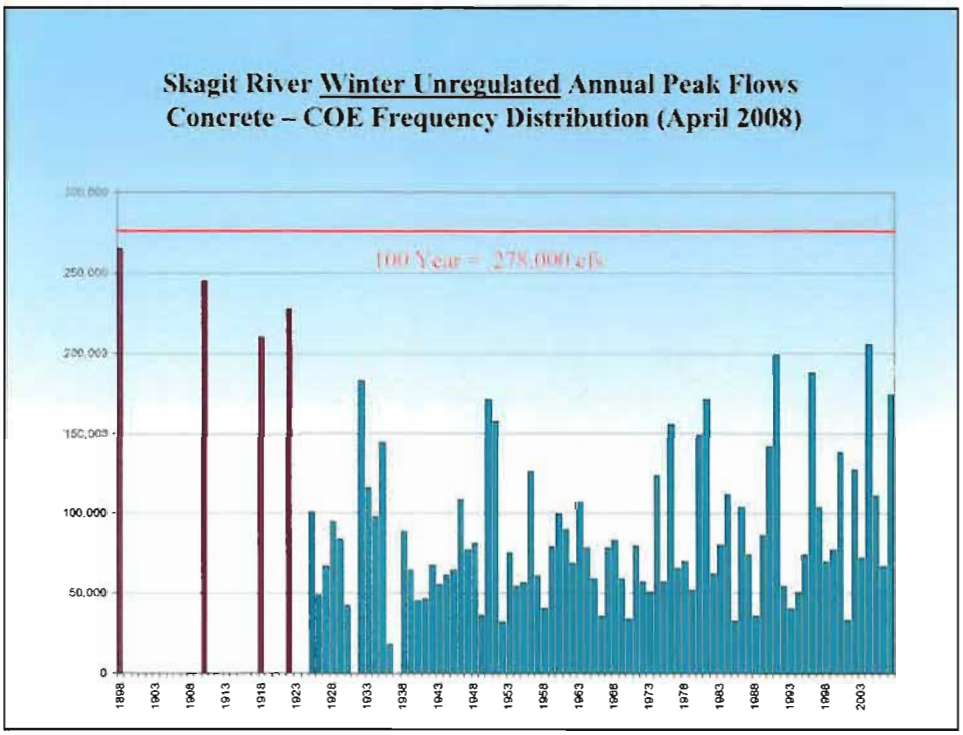
Preliminary Conclusion

- Hydraulic model shows a peak discharge for the 1921 flood of **174,000 cfs**, based on Stewart's survey notes from 1922 –

NOT 228,000 cfs

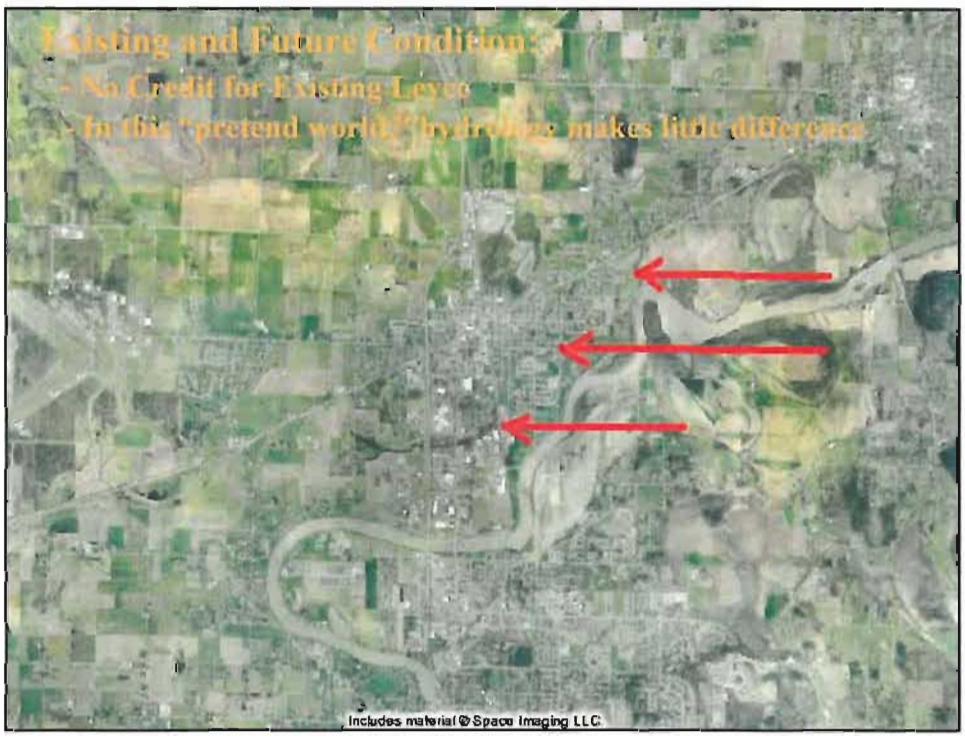
Difference of 54,000 cfs

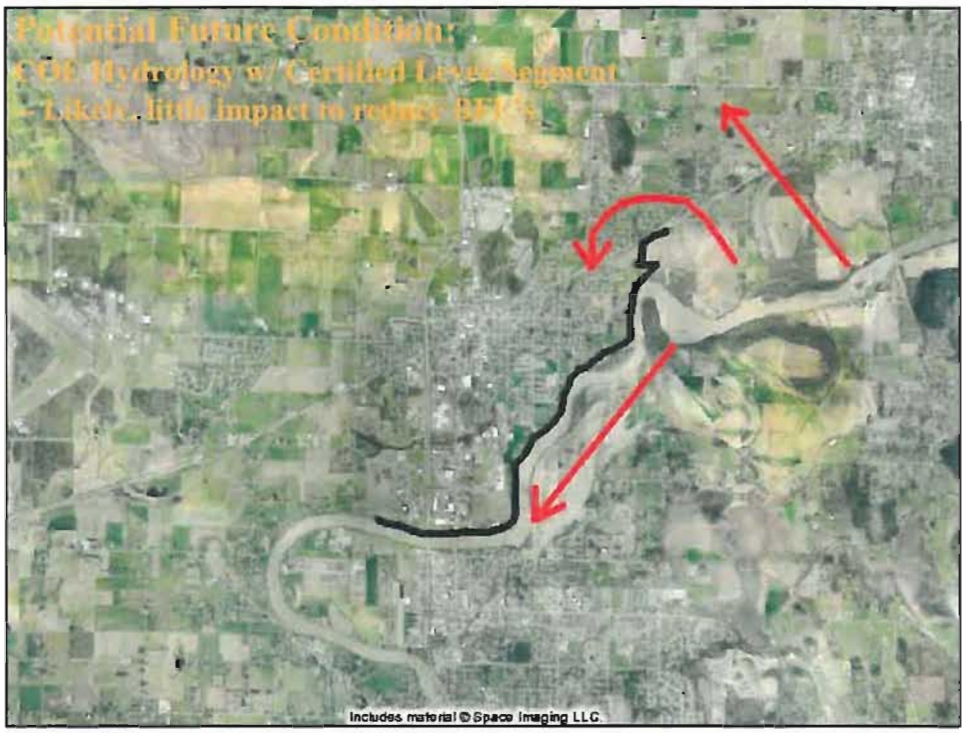

Winter Unregulated Annual Peak Flows Skagit River Near Concrete:
Draft PI Engineering July 2008
100 Year = 241,800 cfs
250,000
200,000
150,000
100,000
50,000
0
1898
1903
1908
1913
1918
1923
1928
1933
1938
1943
1948
1953
1958
1963
1968
1973
1978
1983
1988
1993
1998
2003

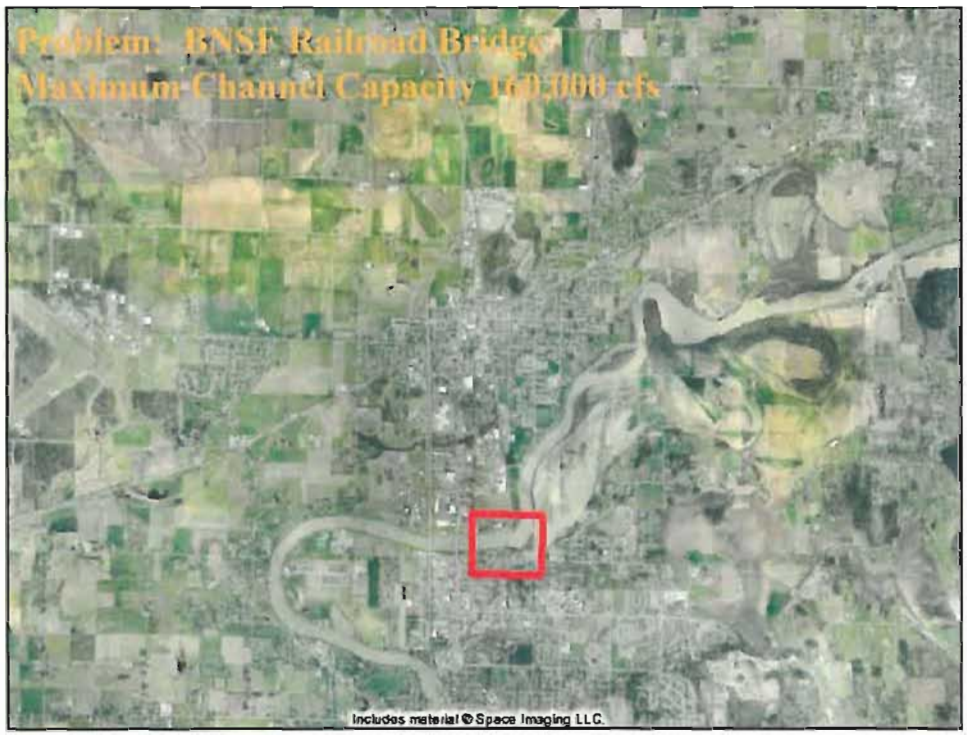

Skagit River Winter Unregulated Annual Peak Flows
Concrete – COE Frequency Distribution (April 2008)
100 Year = 278,000 cfs
250,000
200,000
150,000
100,000
50,000
0
1898
1903
1908
1913
1918
1923
1928
1933
1938
1943
1948
1953
1958
1963
1968
1973
1978
1983
1988
1993
1998
2003

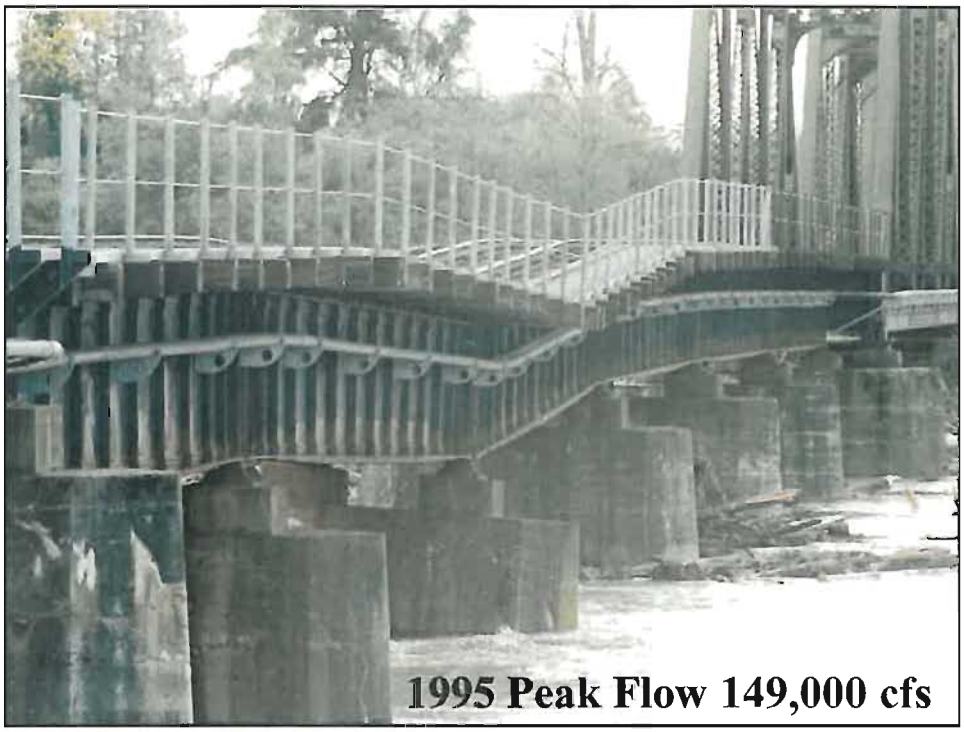
Levee certification concepts for Burlington

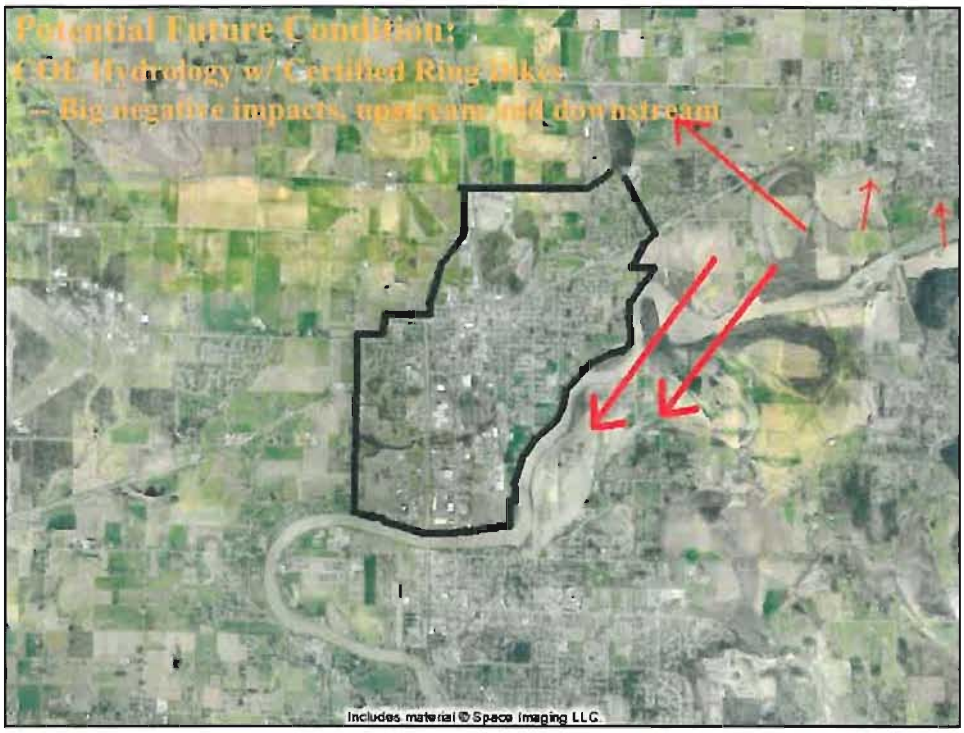
Critical affect of hydrology

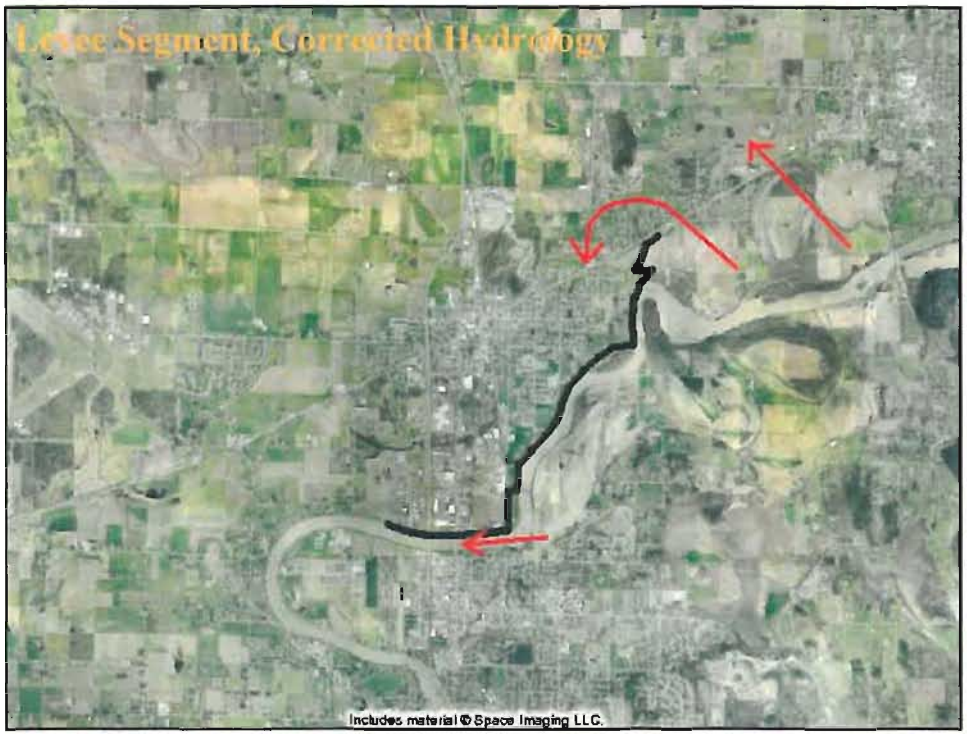



Potential Future Condition:
COE Hydrology w/ Certified Levee Segment
– Likely, little impact to reduce BFE's
Includes material © Space Imaging LLC.


Problem: BNSF Railroad Bridge
Maximum Channel Capacity 160,000 cfs
Includes material © Space Imaging LLC.


1995 Peak Flow 149,000 cfs


Potential Future Condition:
COE Hydrology w/ Certified Ring Dikes
– Big negative impacts, upstream and downstream
Includes material © Space Imaging LLC.


Levee Segment, Corrected Hydrology
Includes material © Space Imaging LLC.

What Path for Burlington?

- Incorrect COE hydrology will force Burlington into a "ring dike" concept that will cause worse flooding upstream and downstream, and leave the City with only 1 option: total removal from flood plain
- Correct hydrology could enable Burlington to avoid a "ring dike", leaving the City in the flood plain but with workable base flood elevations
  - Much friendlier to neighbors (won't raise their flood elevations significantly)
  - Much better environmentally (Burlington will still be in the flood plain and will take water in a large flood event)
  - Communicates flood risk better to Burlington residents and businesses – i.e.. everyone will still be paying for flood insurance

Questions