

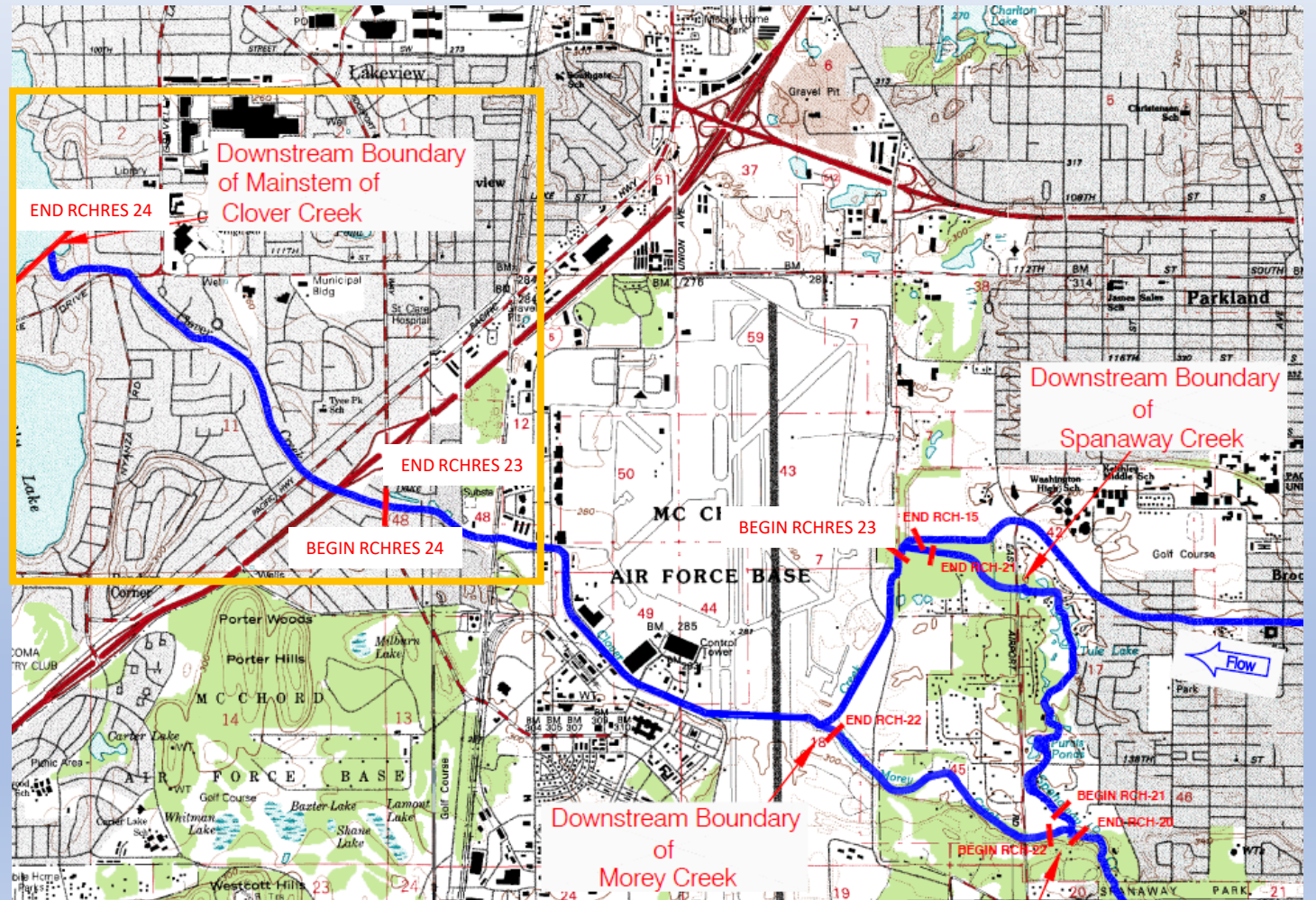
Clover Creek Floodplain Mapping Analysis Update

Lakewood, Washington

July 10, 2019

Hydrology Background

- Effective FIS hydrology developed in HSPF
- 50 years of simulation (through 1999)
- Reaches
 - 23 – Bridgeport Way
 - 24 – Steilacoom Lake



HSPF layout from FEMA 2006

Hydrology – Peak Flows

- WSE extended HSPF simulation through 2009 and updated peak flow frequency analysis
- Resulting peak flows were within a few percent, therefore will not update effective peak flows

Comparison of Instantaneous Peak flows from Effective FEMA Study and Flow Frequency on Extended HSPF Model

Source	10-year Peak Flow (cfs)	50-year Peak Flow (cfs)	100-year Peak Flow (cfs)	500-year Peak Flow (cfs)
<i>Bridgeport Way (RCHRES 23)</i>				
Effective FIS Hydrology	291	434	501	677
WSE Flow Frequency Analysis	294	415	466	584
% Difference	+1%	-4%	-7%	-14%
<i>Steilacoom Lake (RCHRES 24)</i>				
Effective FIS Hydrology	297	439	506	680
WSE Flow Frequency Analysis	299	425	479	606
% Difference	+1%	-3%	-5%	-11%

Hydrology - Volumes

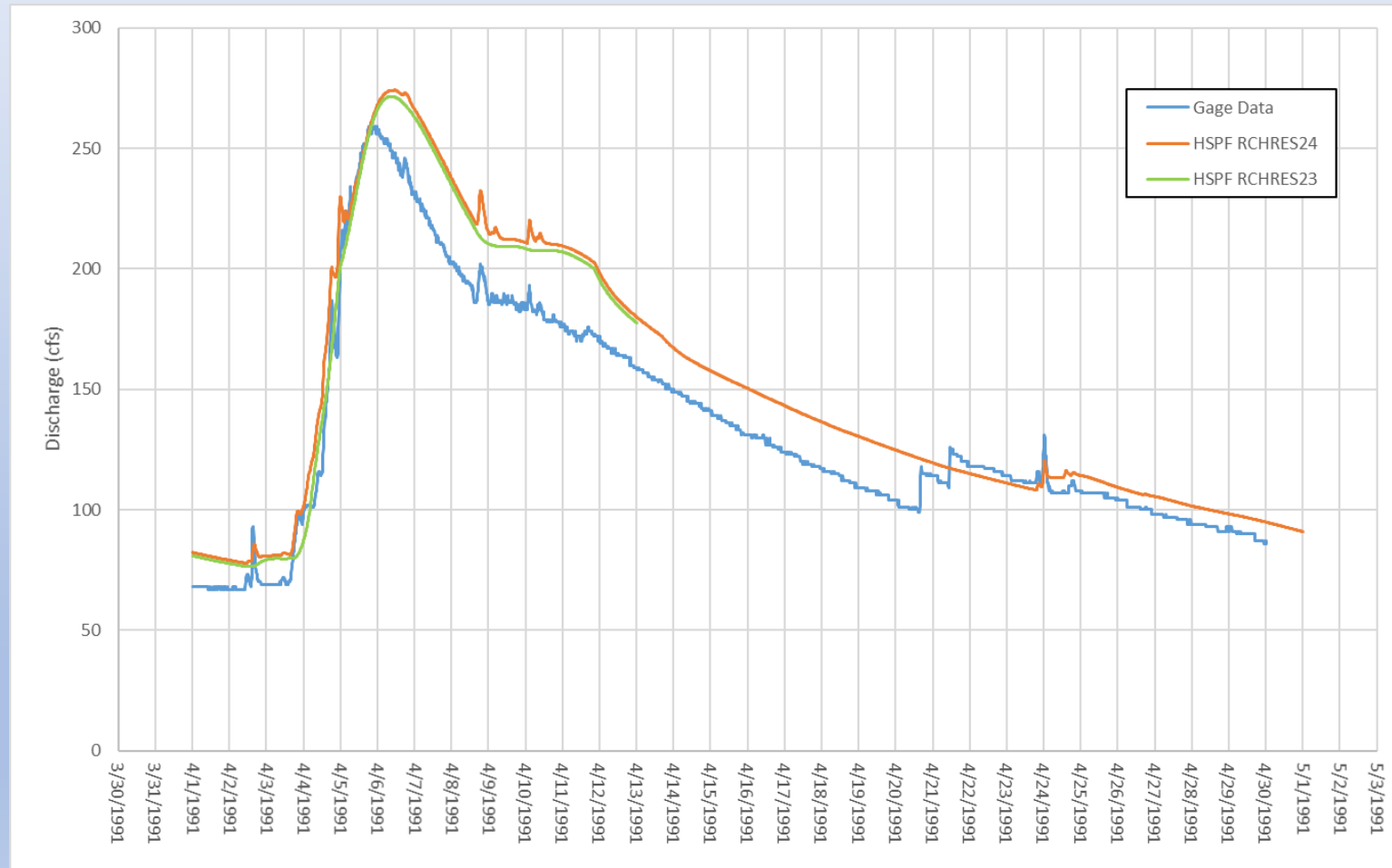
- Calculated 100-year, 24-hour, 3-day, 7-day event volumes based on extended HSPF record

Comparison of Calculated 100-year Peak and Volumes to Scaled Historical Events

Event	Q_{peak} (cfs)	100-year Scalar	Scaled 24-Hour Volume (ac-ft)	Scaled 3-day Volume (ac-ft)	Scaled 7-day Volume (ac-ft)
100-year (Effective FIS @ RCHRES23)	501	-	917	2,529	5,207
April 1991	259	1.95	981	2,715	5,427
February 1996	418	1.21	949	2,568	4,966
January 2006	240	1.92	925	2,721	6,256
January 2007	332	1.52	933	2,678	5,436

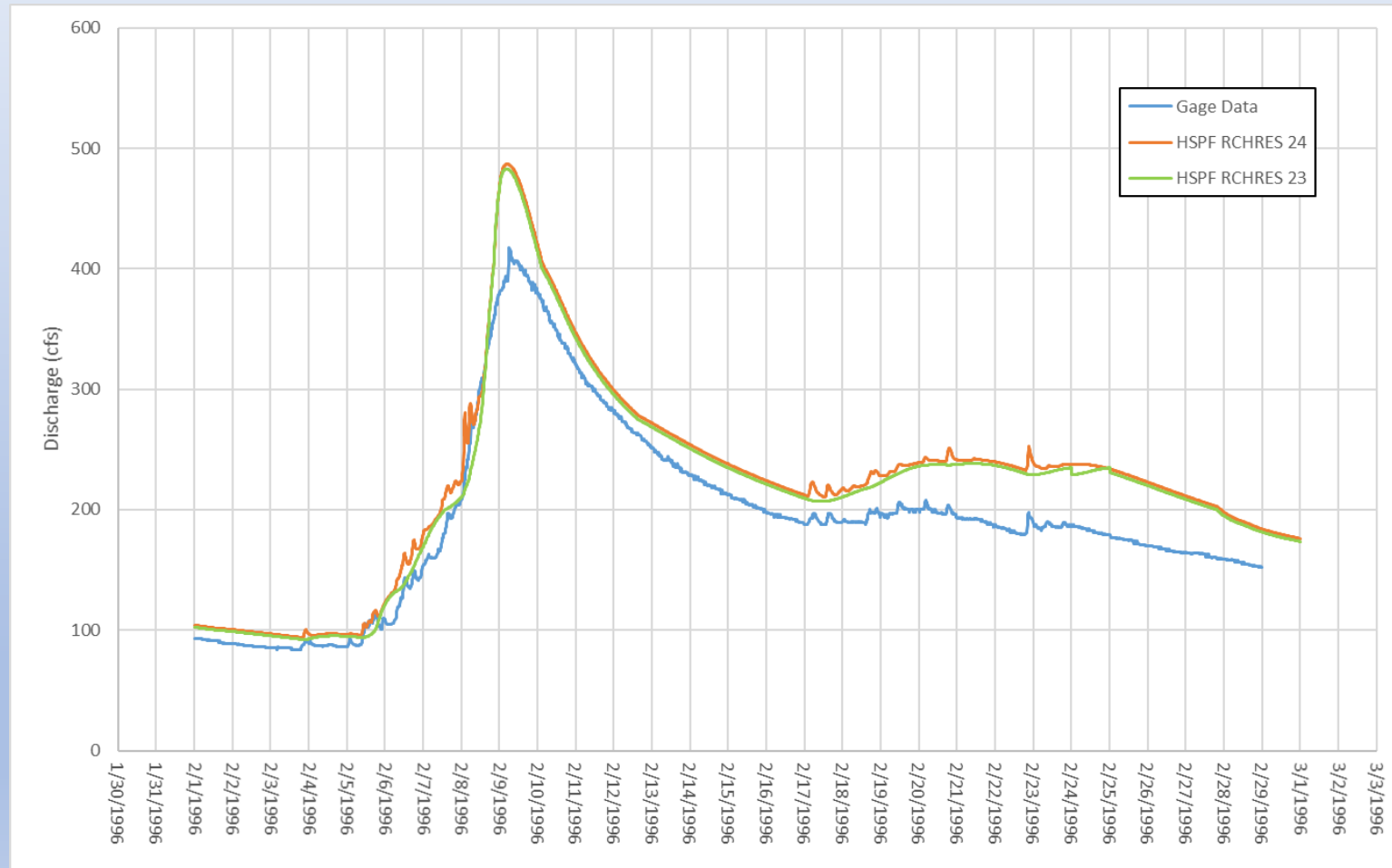
Hydrograph Comparison

- April 1991



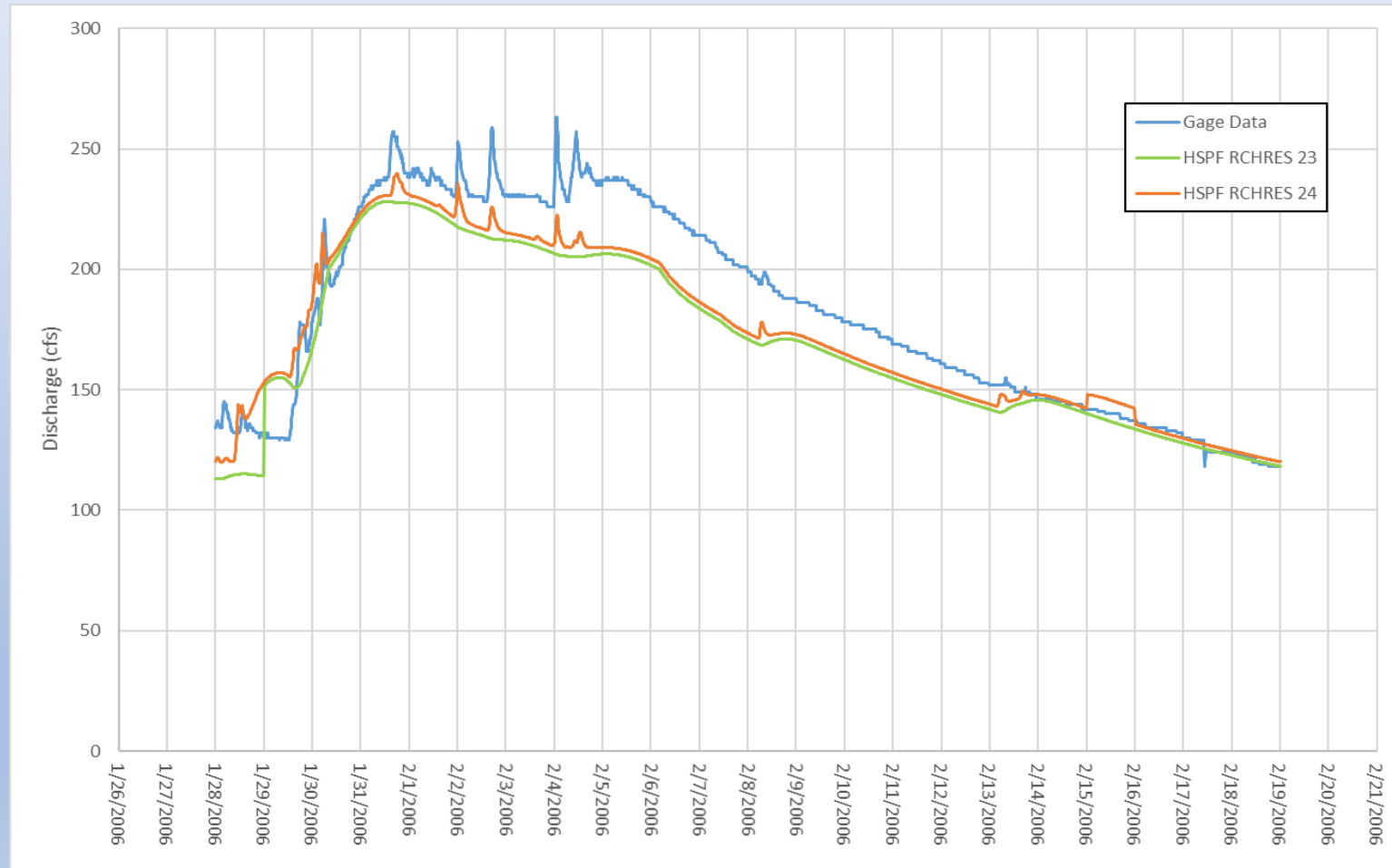
Hydrograph Comparison

- February 1996



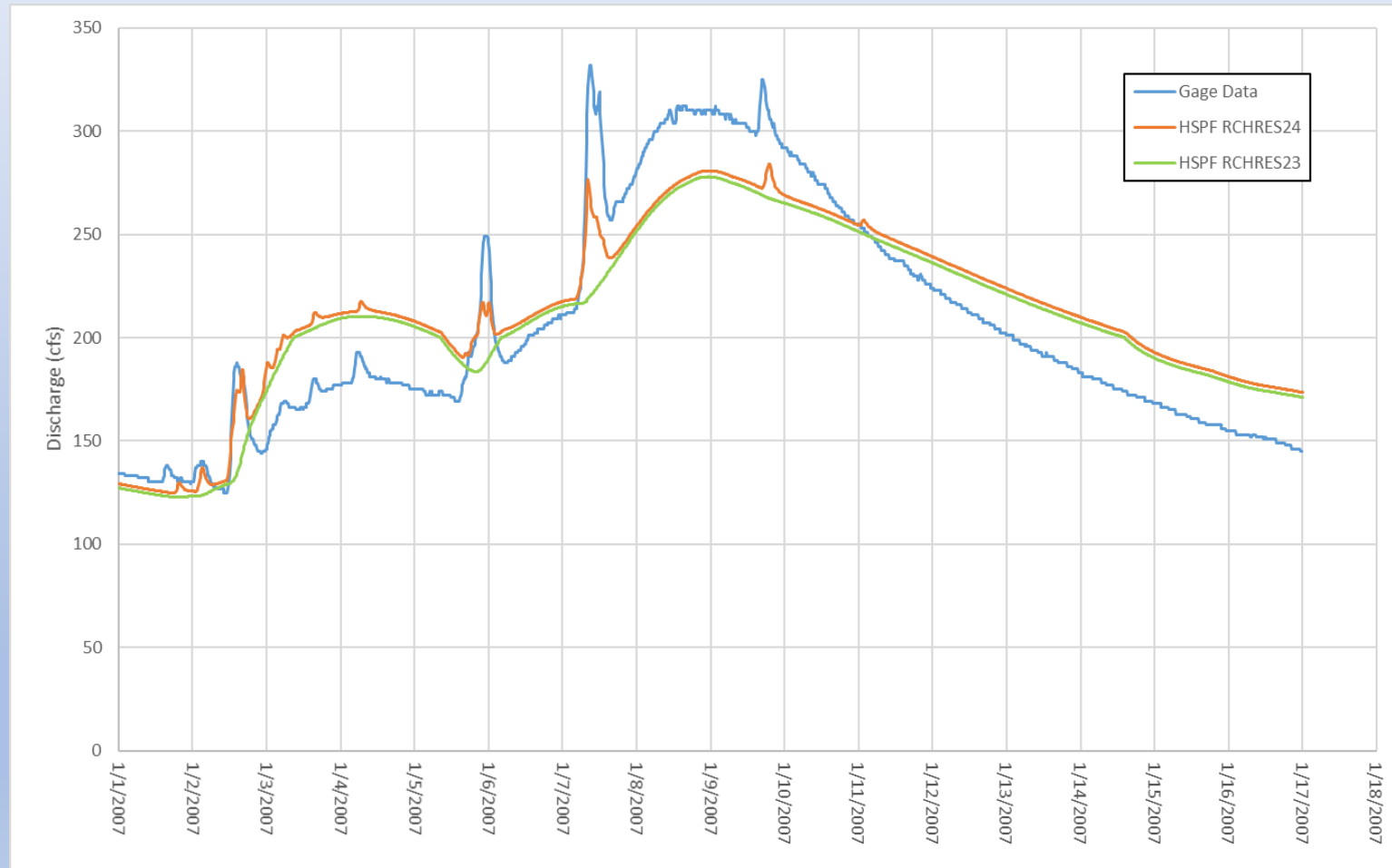
Hydrograph Comparison

- January 2006



Hydrograph Comparison

- January 2007



Hydrograph Comparison Summary

- HSPF does a reasonable job of representing the flood events recorded at Pacific Highway Gage
 - Both event volume and event peak
- The largest events are not flashy and flows remain up for many days.

100-year Hydrograph Determination

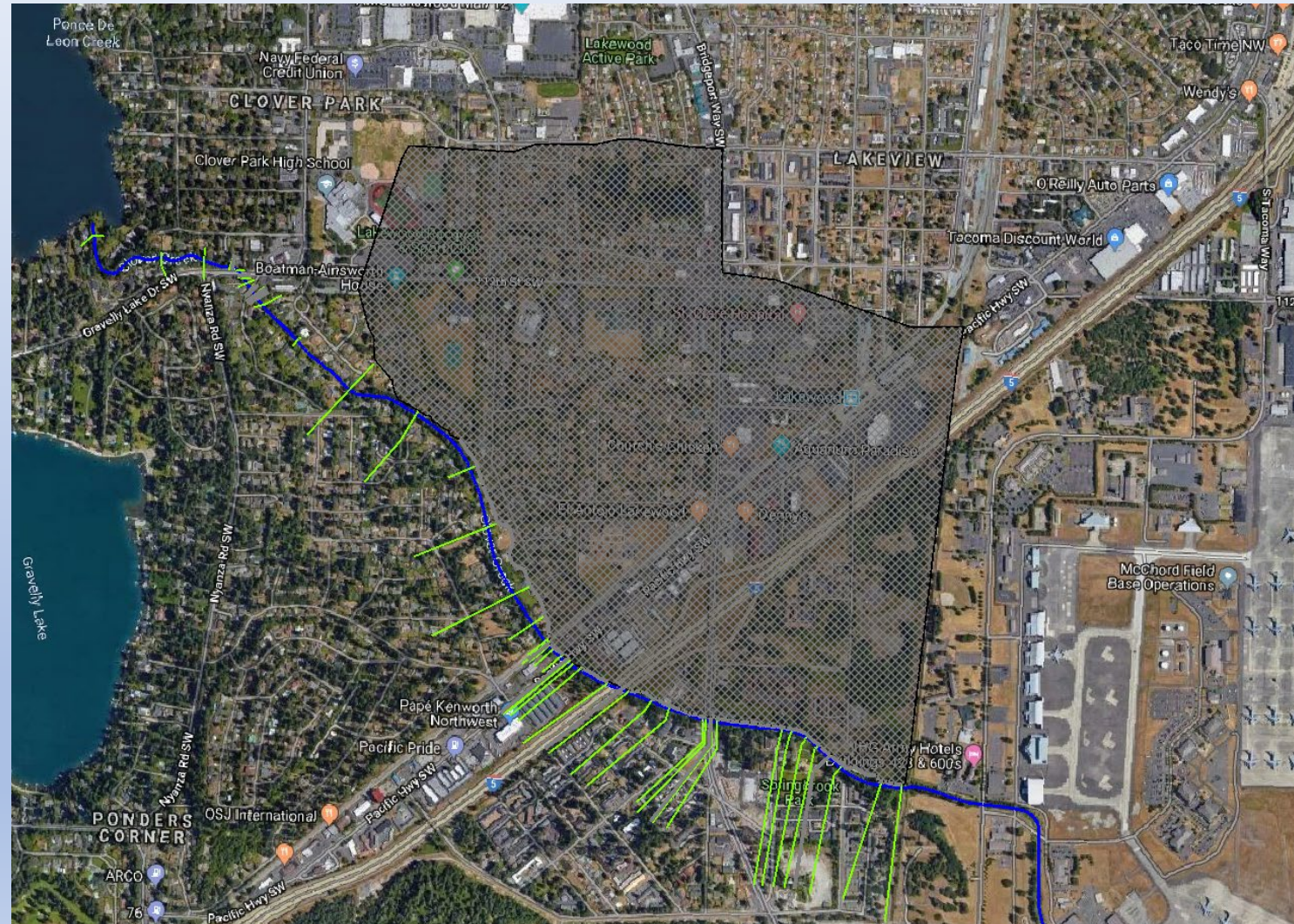
- February 1996 used as pattern event
- Scaled Feb 1996 hydrograph from gage to match 100-year instantaneous peak, 24-hour volume, 3-day volume, & 7-day volume at Bridgeport Way

Calculated and Simulated 100-year Event Peak and Volume at Bridgeport Way

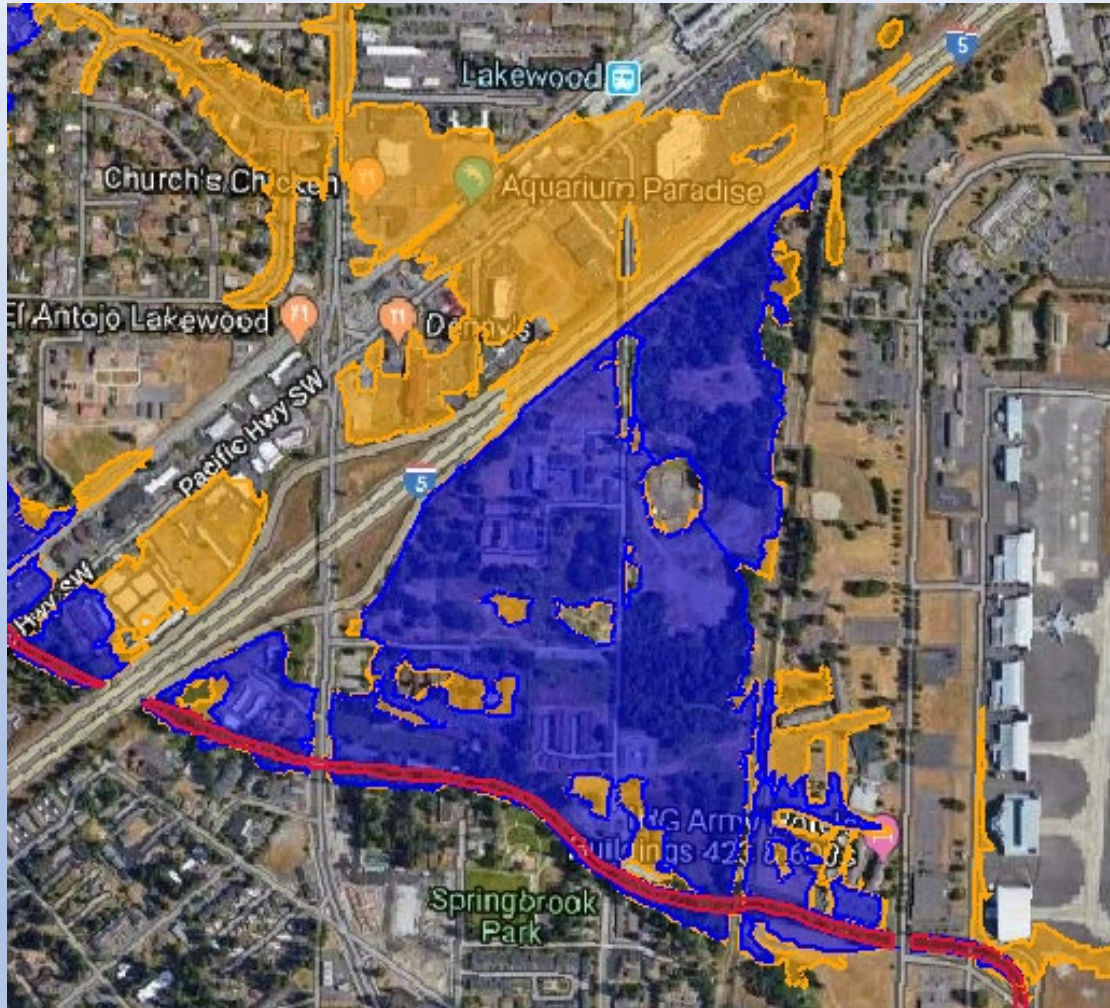
Event	Scalar	Q _{peak} (cfs)	24-Hour Volume (ac-ft)	3-day Volume (ac-ft)	7-day Volume (ac-ft)
Effective 100-year Event @ Bridgeport Way (HSPF Reach 23)	-	501	917	2,529	5,207
Simulated 100-year Event @ Bridgeport Way (HEC-RAS Cross Section 1.5947)	1.35	480	933	2,625	5,246
% Different		-4.2%	+1.7%	+3.8%	+0.8%

HEC-RAS Overview

- Truncated effective model at BNSF Railroad crossing west of McCord Air Force Base
- Converted from Steady State to Unsteady Analysis
- Truncated cross section at high ground on right bank and converted right overbank to 2D area
- Added Springbrook Pedestrian Bridge



Effective Mapping



FEMA Flood Hazard Areas

- Effective Floodway
- Effective 100-year Floodplain
- Effective 500-year Floodplain

**Model inflow based on
Feb 96 hydrograph with
1.35 scalar applied.**

Inundation Results – 100 year Event

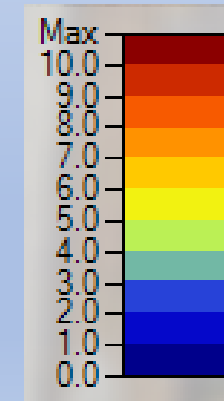


Preliminary results based on HEC-RAS simulation of 100-year event.

Effective FEMA 100-year Floodplain shown in background.

[illegible]

**Model inflow based on
Feb 96 hydrograph with
1.35 scalar applied.**



Floodway Mapping

- Initial modeling results indicate that there would be no change to the effective floodway width
- Floodway water surface elevations increase compared to effective model, but still represent less than 1-ft rise.

Inundation Results – February 1996



Preliminary results based on HEC-RAS simulation of Feb 1996 event.

Model inflow based on Feb 96 hydrograph from Pacific Highway gage applied at model inflow boundary.