Item #5b

Preliminary USGS Suspended Sediment Load Calculations

Guadalupe River Above HWY 101 at San Jose

November 2002 Through May 2003

Channel cross-section

Channel downstream

Channel upstream

USGS Data Collection

- Continuous streamgaging streamflow calculations.
- Observer collects depth and velocity integrated samples from single vertical fixed installation:
  - High Frequency during storms.
  - 3 to 5 times weekly for non-storm periods.
- USGS technician collects depth, velocity and width integrated cross-section samples:
  - Sampled on routine visits.
  - Supplemented by sample collection during storm events.

Sampling protocol

- Observer:
  - All samples represent concentrations only in the single vertical.
  - 2 sets collected per sample.
  - Samples hourly during storms when safe.
  - Reduces to 2 x daily on recessions.
  - Reduces to 3-5 times weekly during stable flows.
- USGS Technician:
  - All samples collected represent total flow concentrations.
  - 2 sets collected per sample.
  - Technician collects samples using the observer equipment and methods before and after each cross-section sample.

2003 Water Year Sample Summary

- Number of USGS technician cross-section samples = 12
- Number of USGS technician single vertical samples = 26
- Number of single vertical Observer samples = 200
- TOTAL number of samples = 238

Calculation Methods

- USGS software: Graphical Constituent Load Analysis System (GCLAS).
- Interpolates concentration values between samples at 15 minute intervals.
- Corrects single vertical values to cross-sectional values.
- Estimated concentration points are added manually when sample coverage is insufficient to define storm.
- Calculates daily mean concentration and suspended sediment loads for any selected time period.

Comparison of Monthly Load Totals in Tons

- USGS (GCLAS)
  - Oct. 2002 (no record)
  - Nov. = 1,627
  - Dec. = 7,489
  - Jan. 2003 = 187.5
  - Feb. = 264.0
  - Mar. = 228.9
  - Apr. = 672.8
  - May = 223.7
  - Total = 10,693
- USFS (NTU Predicted)
  - Oct. 2002 = 21.3
  - Nov. = 2,298
  - Dec. = 7,746
  - Jan. 2003 = 182.2
  - Feb. = 202.6
  - Mar. = 295.9
  - Apr. = 536.3
  - May = 102.0
  - Total = 11,384

List of Nine Storm Events (USFS criteria)

- **Storm 1** Nov. 7 @ 0130 to Nov. 9 @ 0700
- **Storm 2** Dec. 13 @ 1430 to Dec. 14 @ 0500
- **Storm 3** Dec. 14 @ 1500 to Dec. 15 @ 0700
- **Storm 4** Dec. 16 @ 0200 to Dec. 17 @ 0500
- **Storm 5** Dec. 19 @ 1200 to Dec. 20 @ 0400
- **Storm 6** Dec. 28 @ 1400 to Dec. 29 @ 0400
- **Storm 7** Dec. 31 @ 0200 to Dec. 31 @ 1900
- **Storm 8** Mar. 14 @ 1900 to Mar. 15 @ 1300
- **Storm 9** Apr. 12 @ 1300 to Apr. 13 @ 1400

Comparison of the Nine Storm Event Totals in Tons.

- USGS totals.
  - Storm 1 = 1,600
  - Storm 2 = 142
  - Storm 3 = 2,290
  - Storm 4 = 2,630
  - Storm 5 = 1,140
  - Storm 6 = 331
  - Storm 7 = 144
  - Storm 8 = 143
  - Storm 9 = 419
- 9 STORM TOTAL = 8,839
- Nov. – May TOTAL = 10,693

- USFS Totals
  - Storm 1 = 2,265
  - Storm 2 = 140
  - Storm 3 = 1,397
  - Storm 4 = 3,183
  - Storm 5 = 1, 441
  - Storm 6 = 358
  - Storm 7 = 173
  - Storm 8 = 224
  - Storm 9 = 349
- 9 STORM TOTAL = 9,530
- Nov. – May TOTAL = 11,362.8

Possible reasons for differences.

- USGS adjusts the single vertical values to cross-section values.
- USFS used regression analysis to compute 15 minute values of conc. and load which doesn't directly use sample values.
- USGS used linear interpolation supplemented by estimated points (subjective).

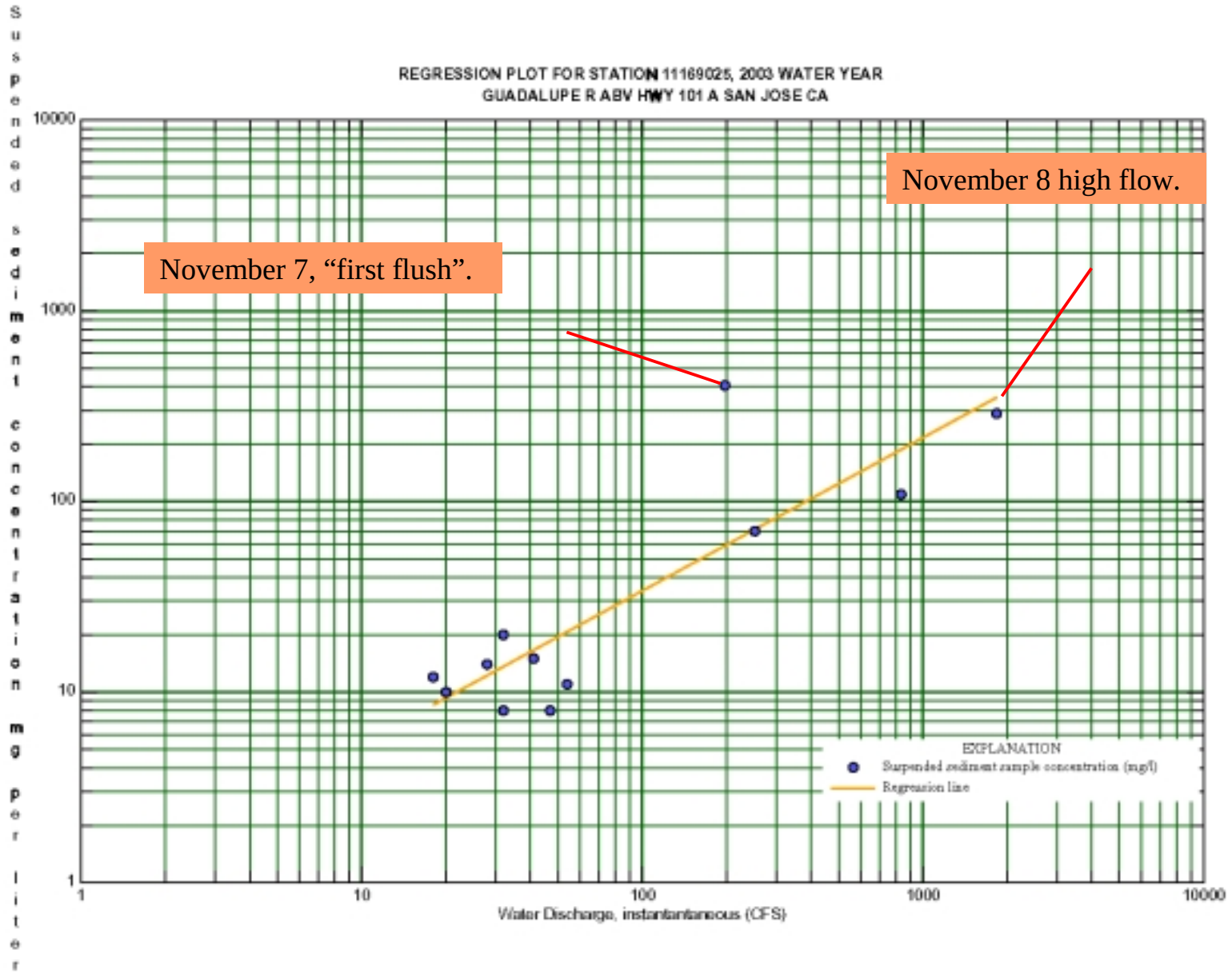
More Reasons

- USFS method accounts for hysteresis defined by 15 minute turbidity record.
- USGS method can only account for hysteresis if enough samples are collected on rising **and** falling limbs of hydrograph.
- USFS method may be effected by electronic drift of turbidity sensor calibration.
- USFS method requires a clean turbidity record.
- Both methods rely on adequate sampling.

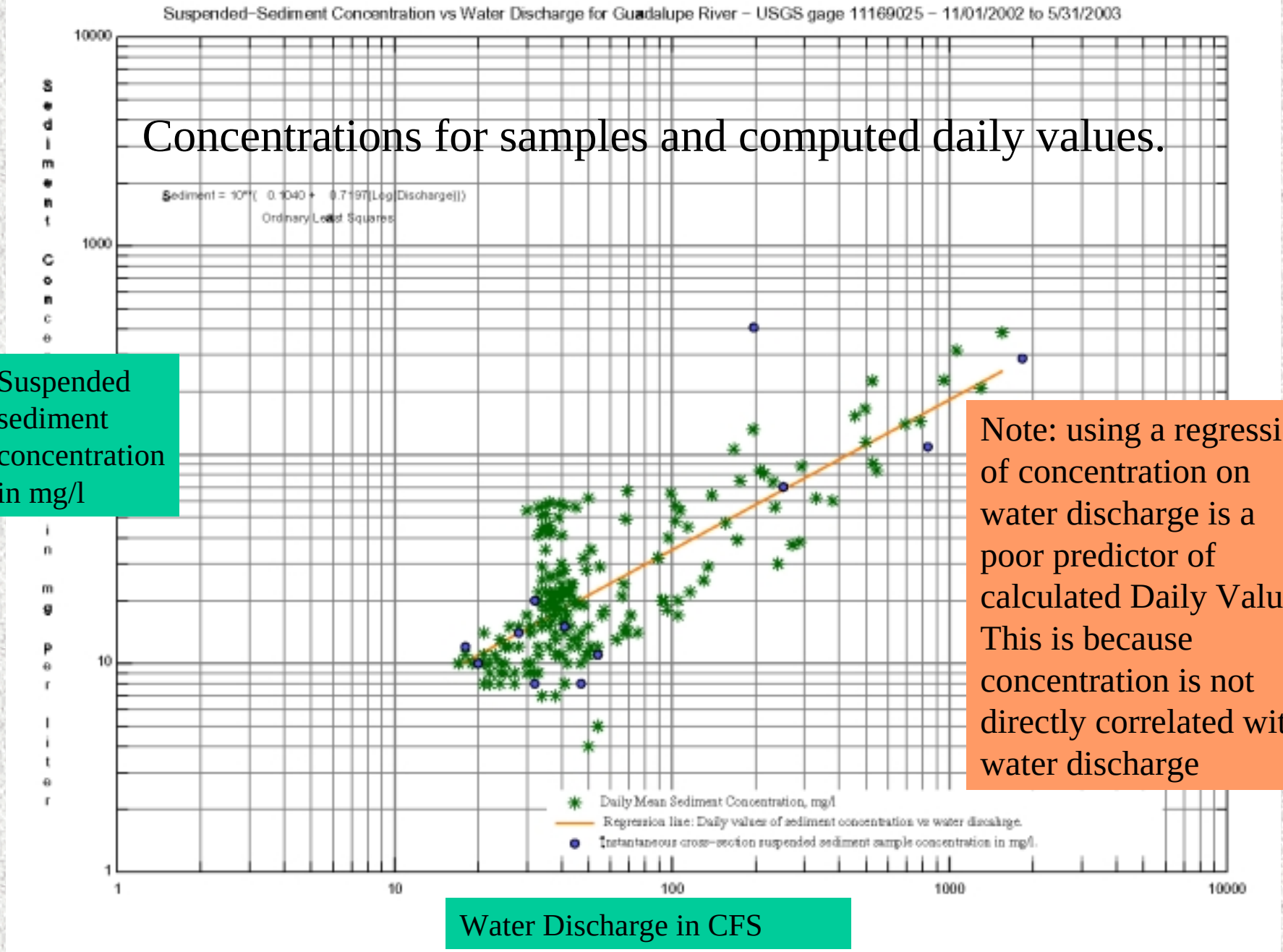
Next Step

- Predicted 15 minute sediment concentrations will be loaded into GCLAS and then fit to actual sample values.
- This will improve computations by:
  - Removal of subjectivity of manual estimates of missing data points.
  - Accounting for hysteresis.
  - Allow for statistical error analysis.

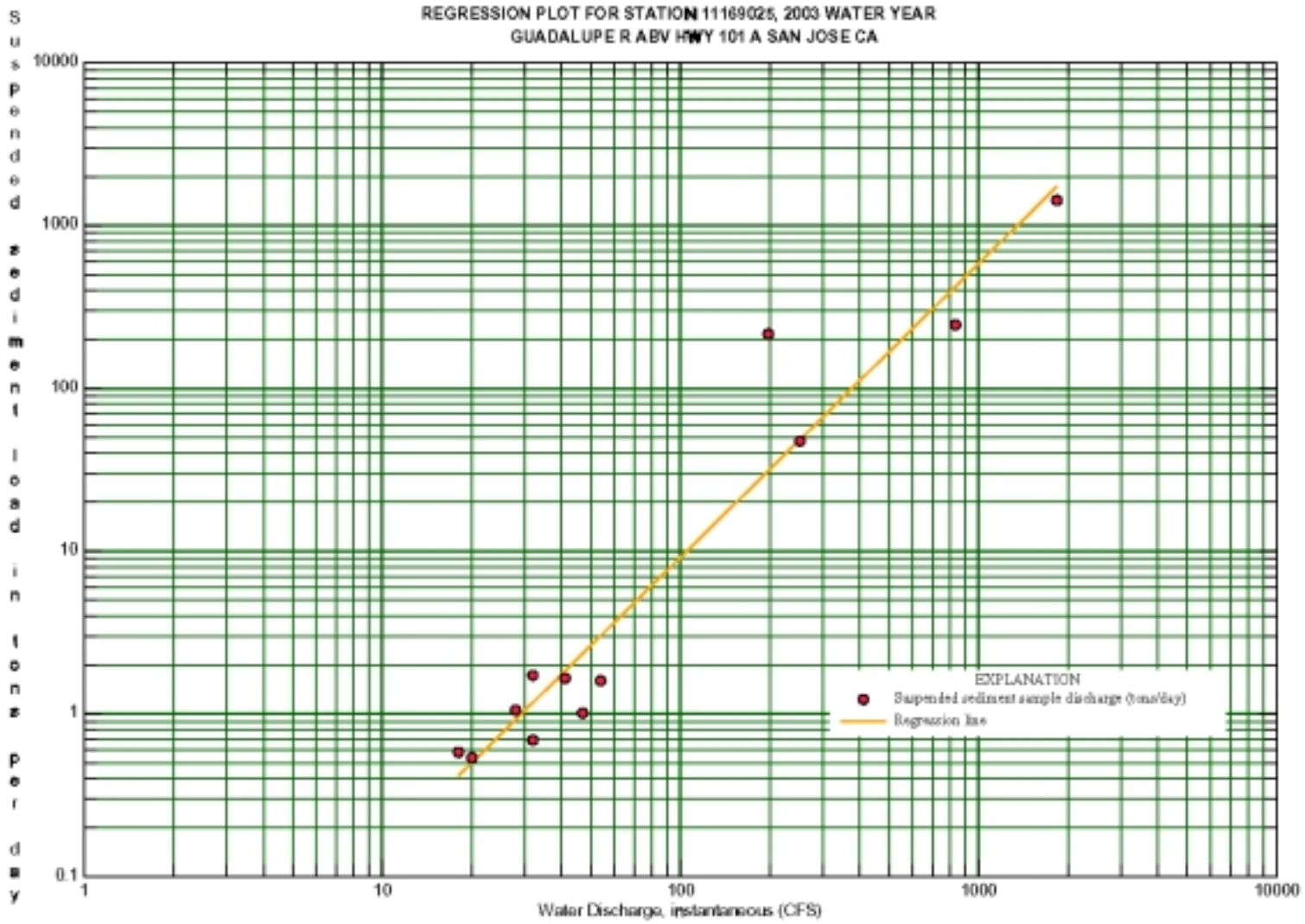
USGS Cross-section samples (mg/l)



USGS
science for a changing world



USGS Cross-section samples (tons/day)



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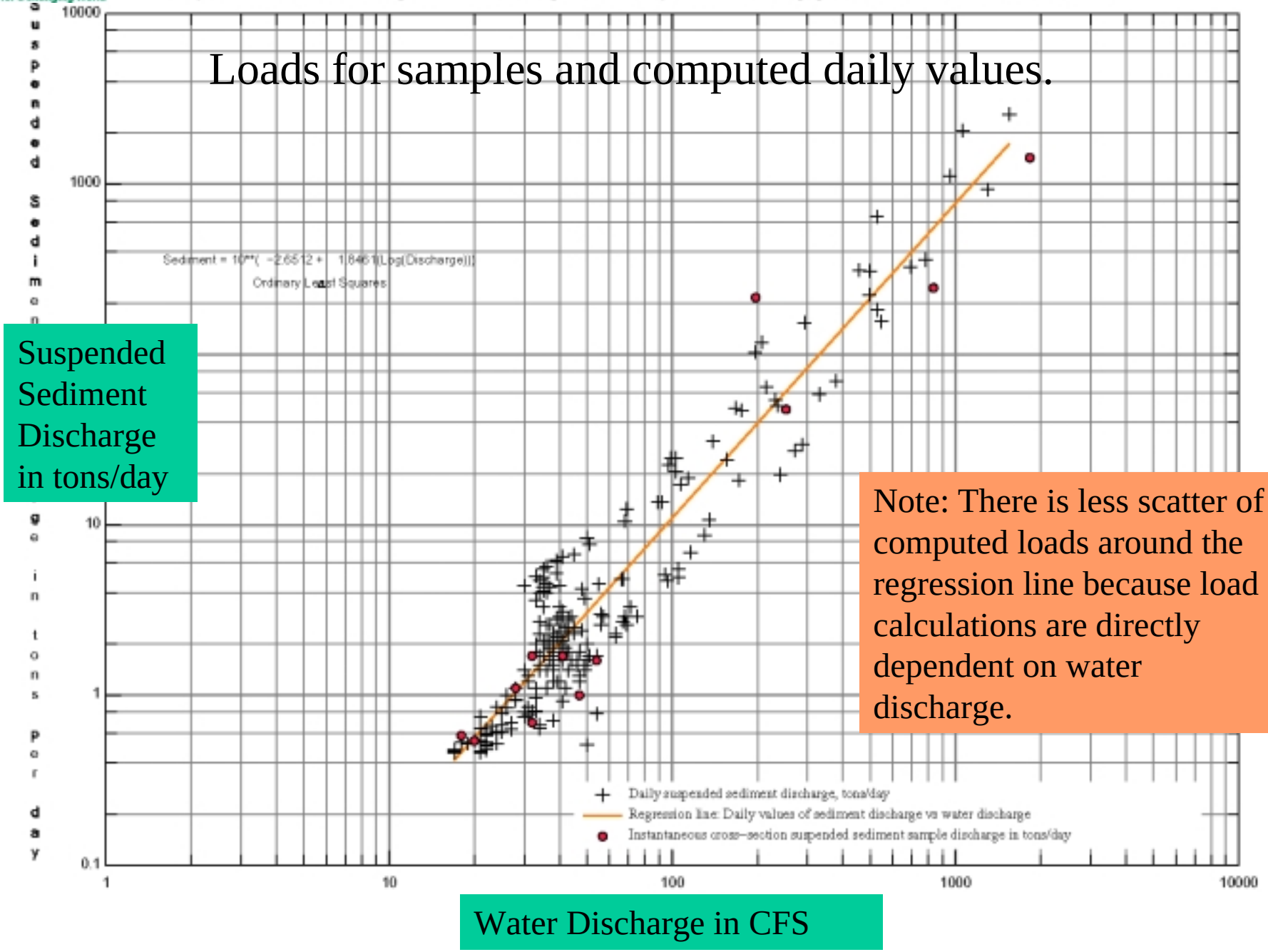
Loads for samples and computed daily values.

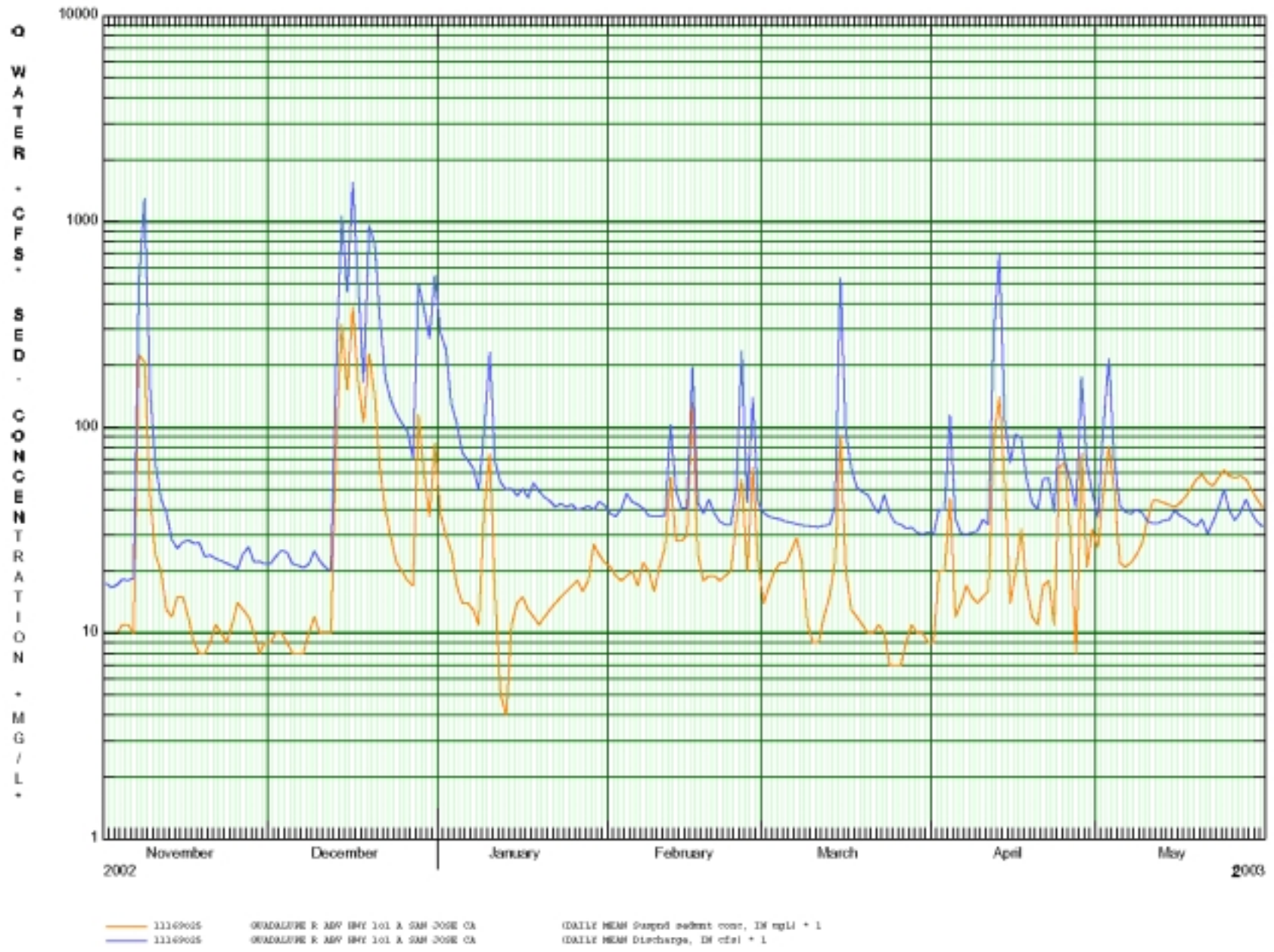


Suspended Sediment Discharge in tons/day

Note: There is less scatter of computed loads around the regression line because load calculations are directly dependent on water discharge.

Water Discharge in CFS

Hydrograph of daily mean sediment concentration.



Hydrograph of Daily Sediment Load