Selenium Research for NDEP 319 Grant

Lake Mead Water Quality Forum
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NDEP Research Grant

- Selenium research part of larger grant
- Gather data to determine existing Se removal of existing wastewater treatment plants
- Conduct bench scale Se spiking studies

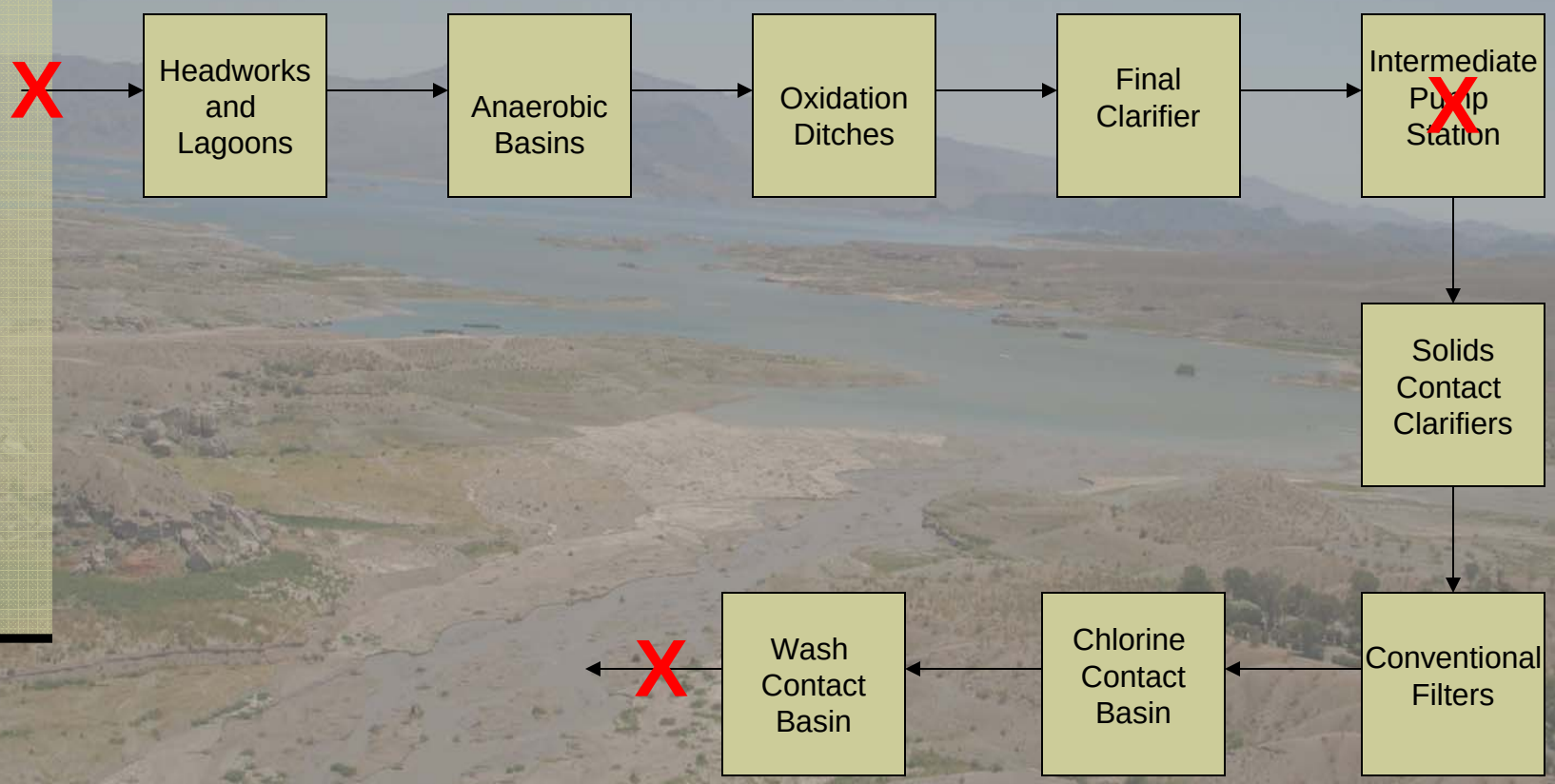
NDEP Research Grant

- Gather data to determine existing Se removal of existing wastewater treatment plants
  - Weekly influent/effluent for one year (added dissolved)
  - Influent/effluent of major processes
  - Hourly samples for 24 hour sampling period

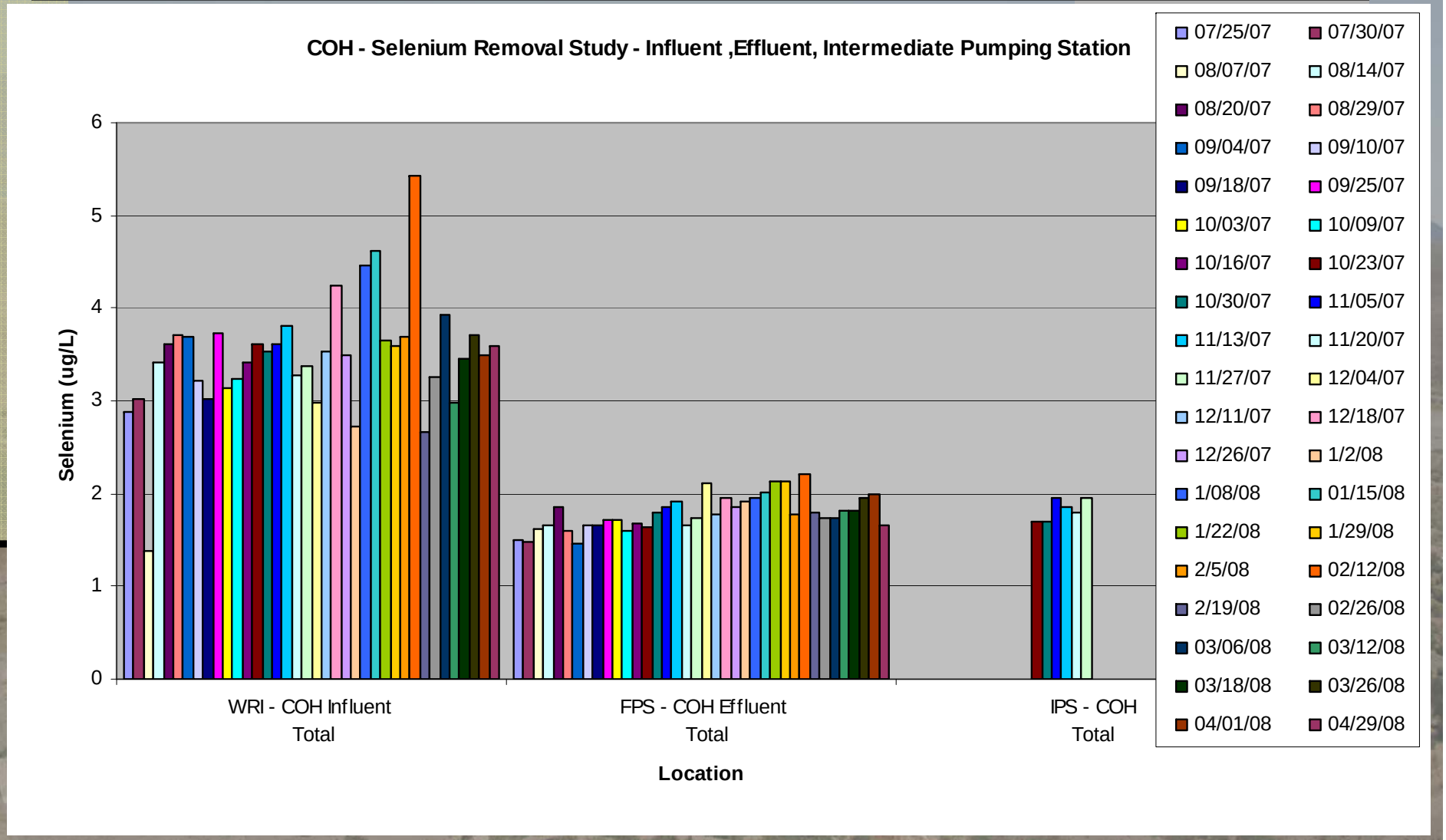
NDEP Research Grant

- Conduct bench scale Se spiking studies
  - Simulate primary clarifier process
  - Simulate alum chemical flocculation
  - Simulate biological uptake of Se in activated sludge to characterize removal in the aerated zone, anaerobic zone
- Perform Se speciation on all samples

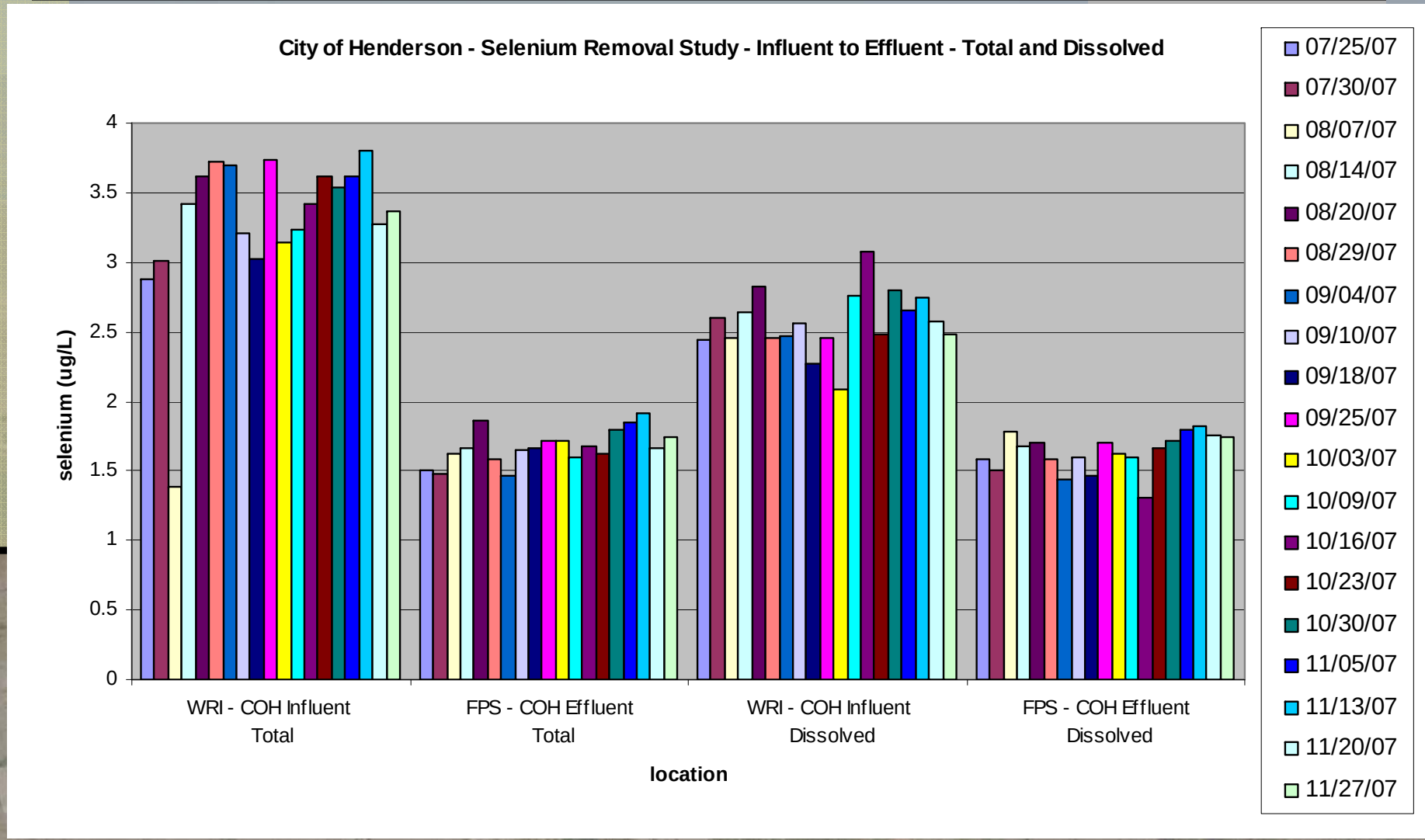
City of Henderson Se Removal



City of Henderson Se Removal



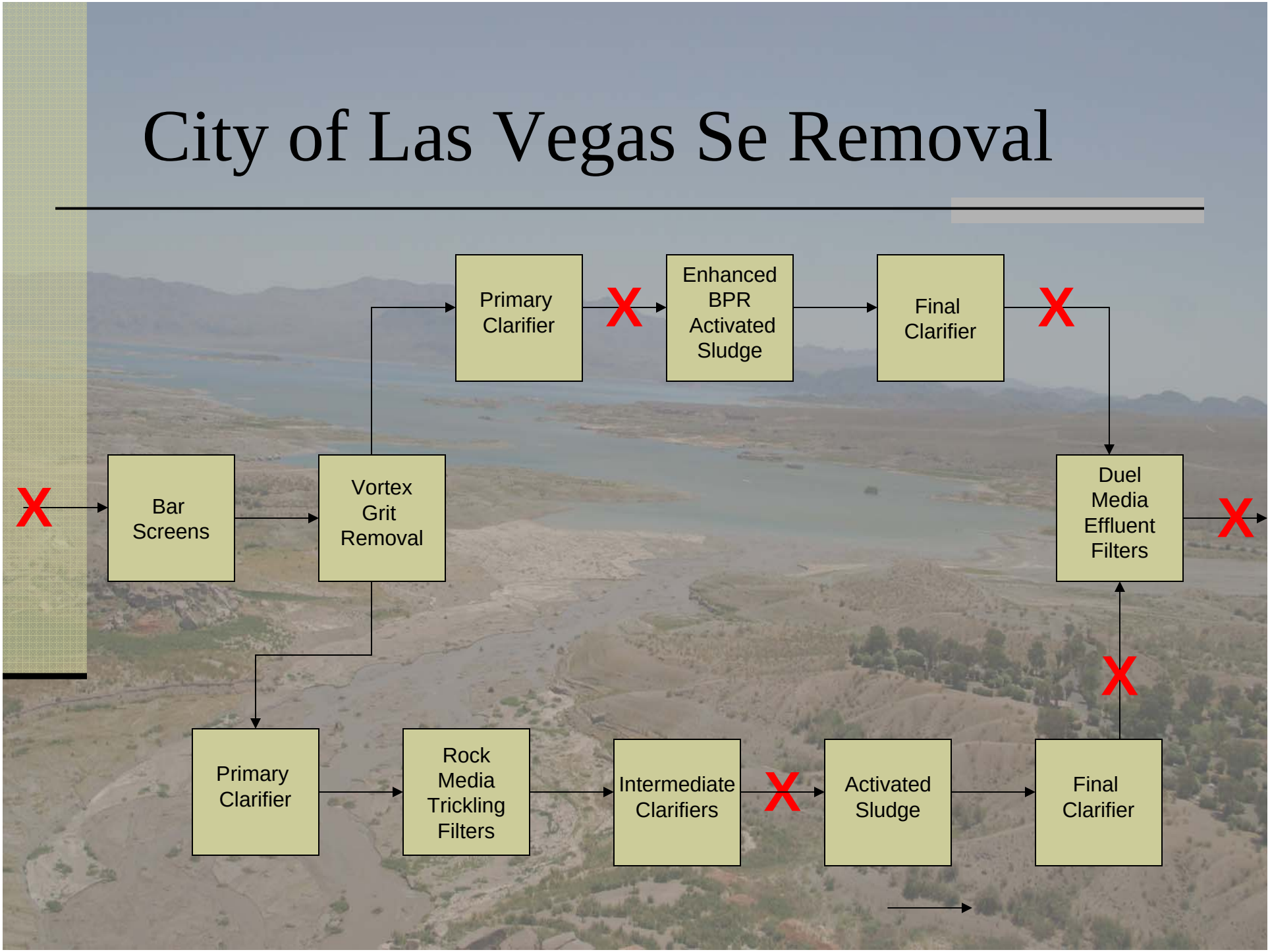
City of Henderson Se Removal



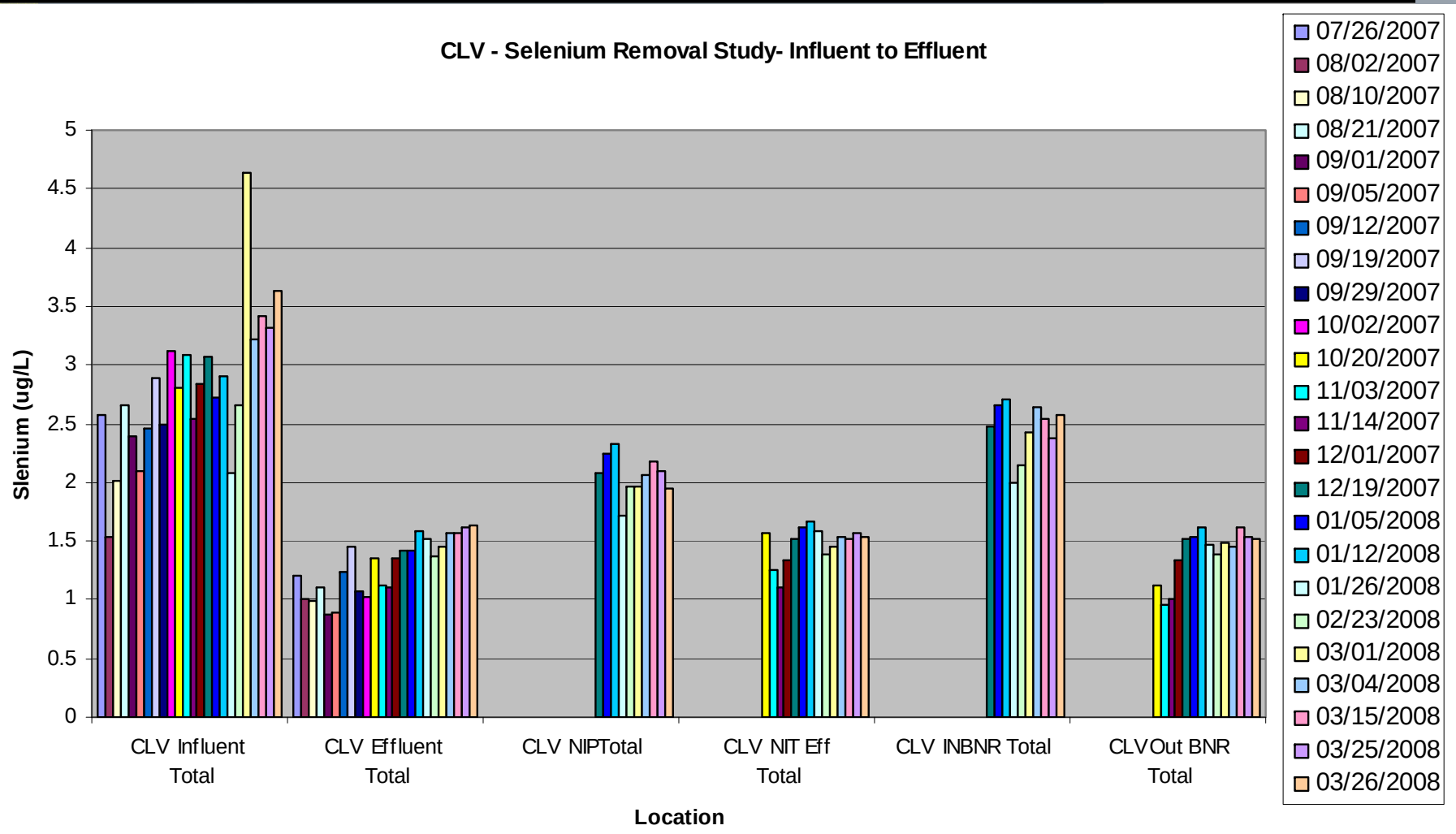
City of Henderson Se Removal

- COH removes 48% of total Se entering treatment plant
- COH removes 39% of the dissolved Se
- COH treatment process consists of biological removal followed by chemical removal. All Se removed in the biological process.
- All Se in the effluent is dissolved

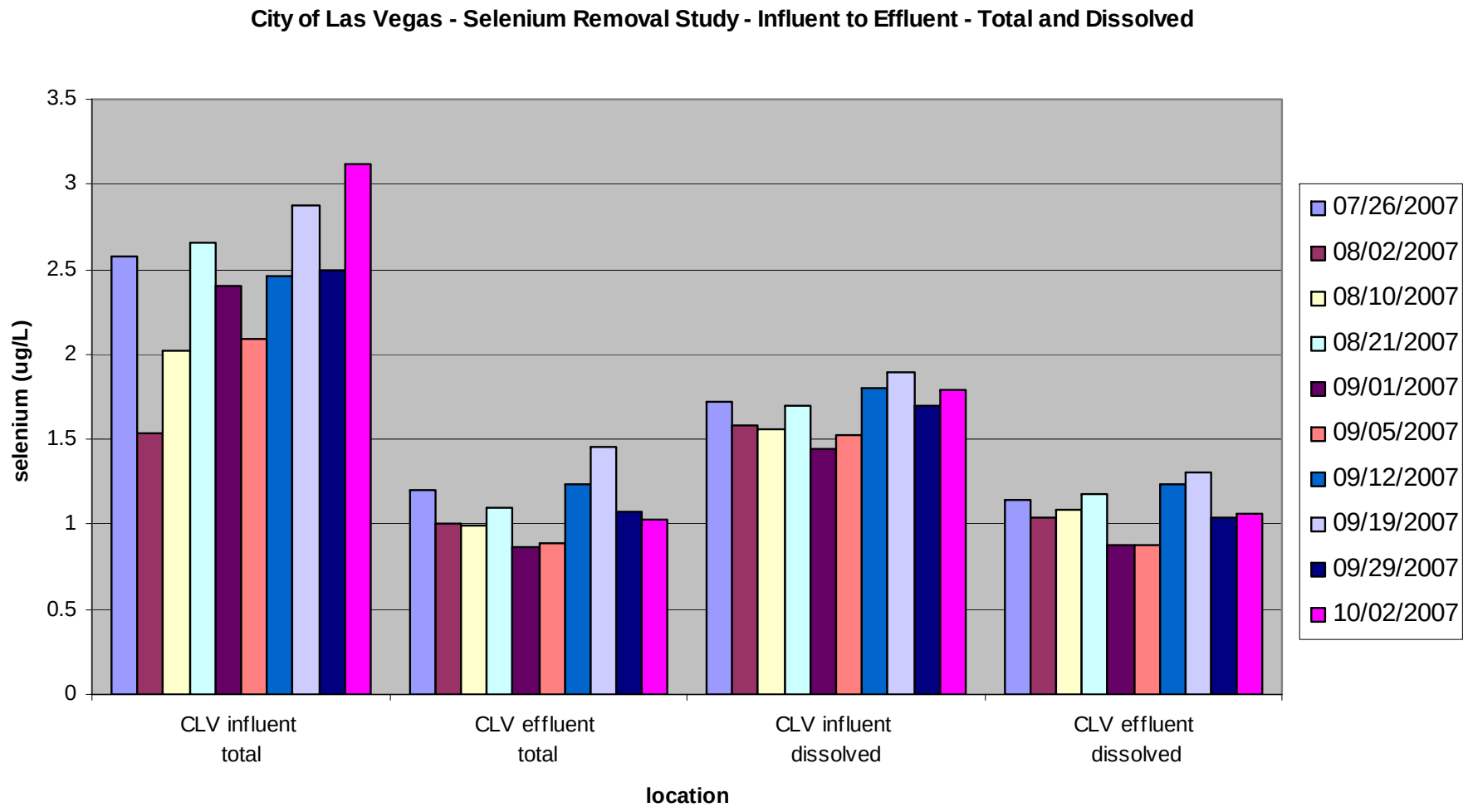
City of Las Vegas Se Removal



City of Las Vegas Se Removal



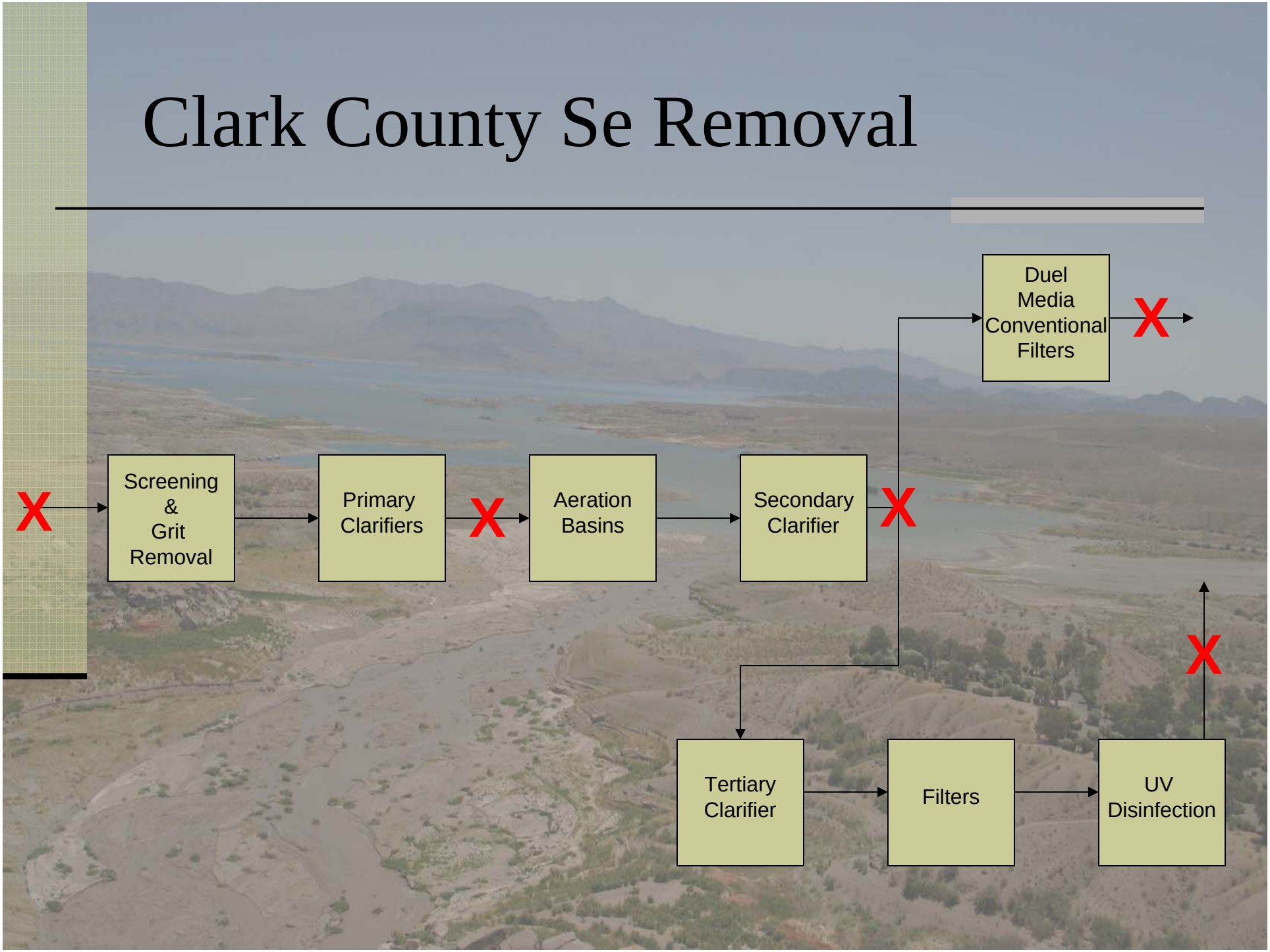
City of Las Vegas Se Removal



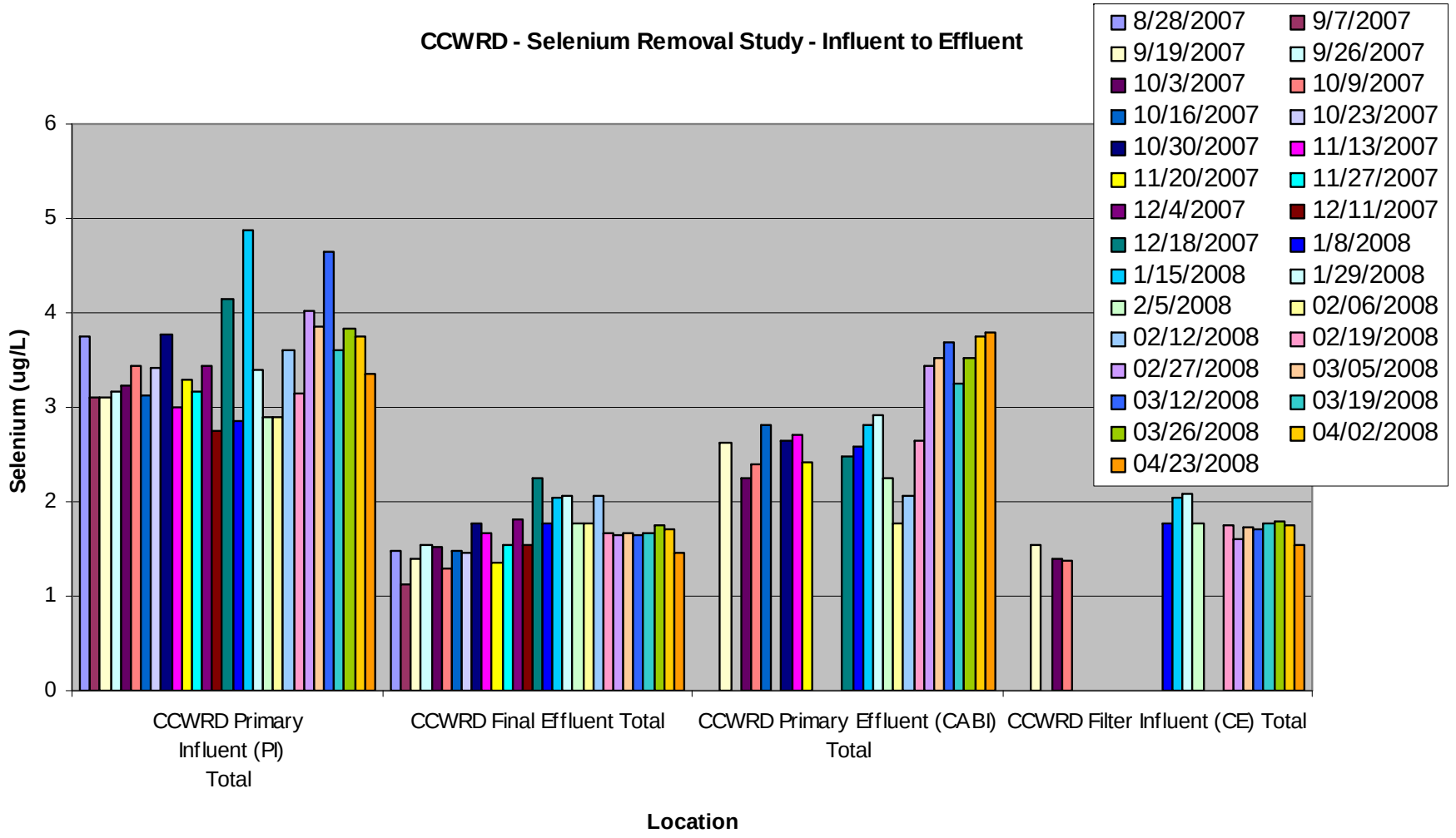
City of Las Vegas Se Removal

- CLV removes 53% of total Se entering treatment plant
- CLV removes 35% of the dissolved Se
- Nitrification removes 29% of the Se
- BNR removes 44% of the Se
- All Se in the effluent is dissolved

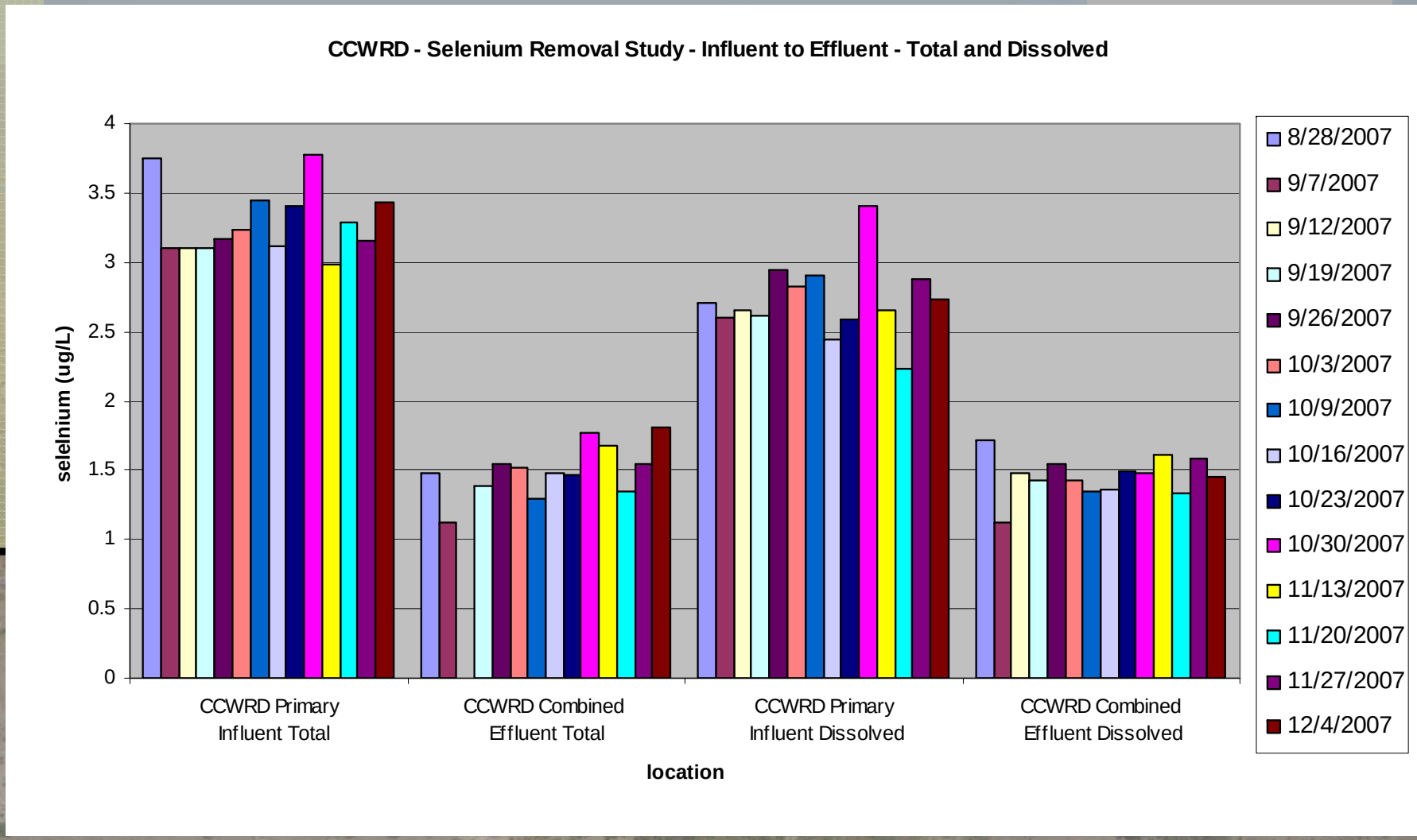
Clark County Se Removal



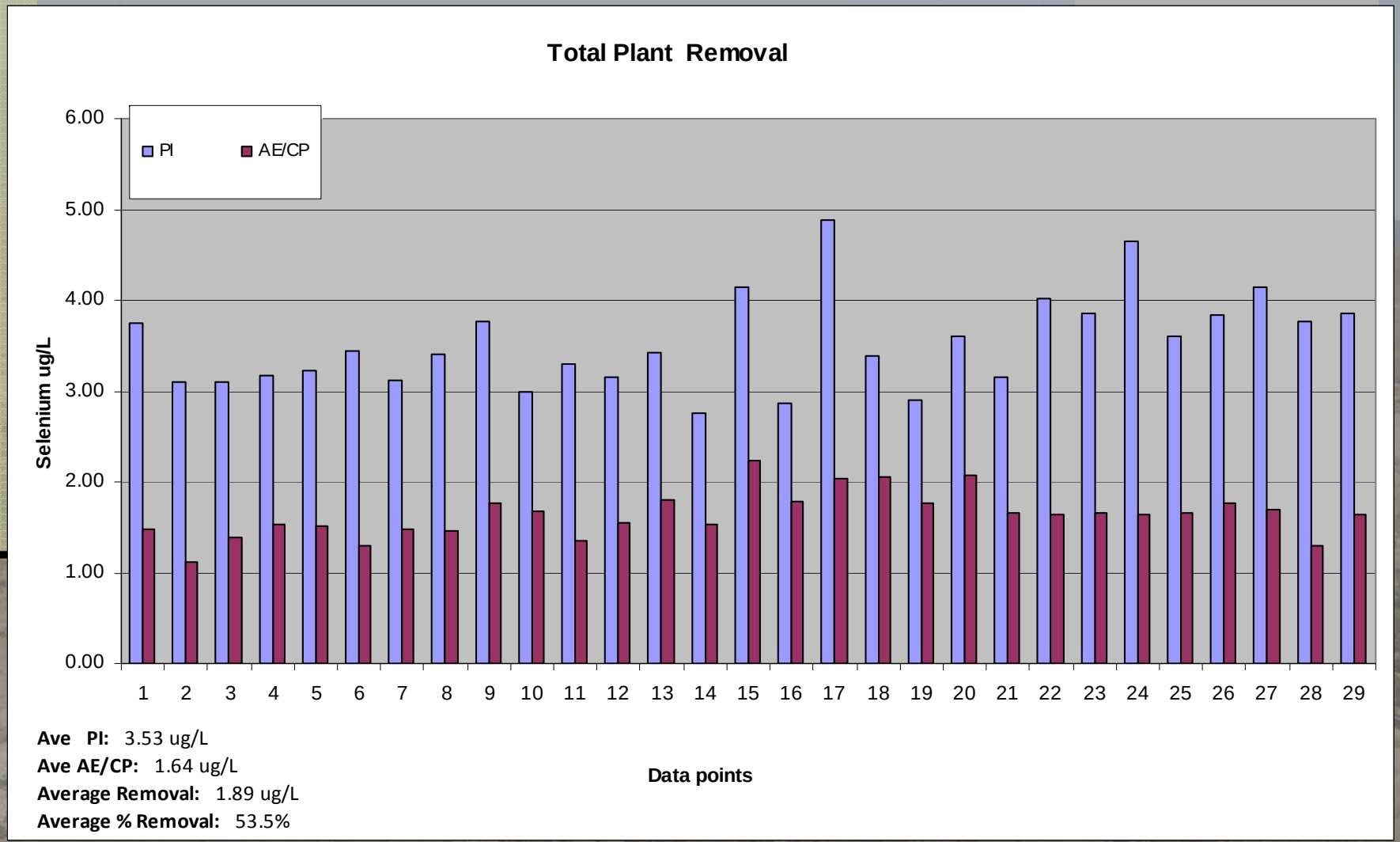
Clark County Se Removal



Clark County Se Removal

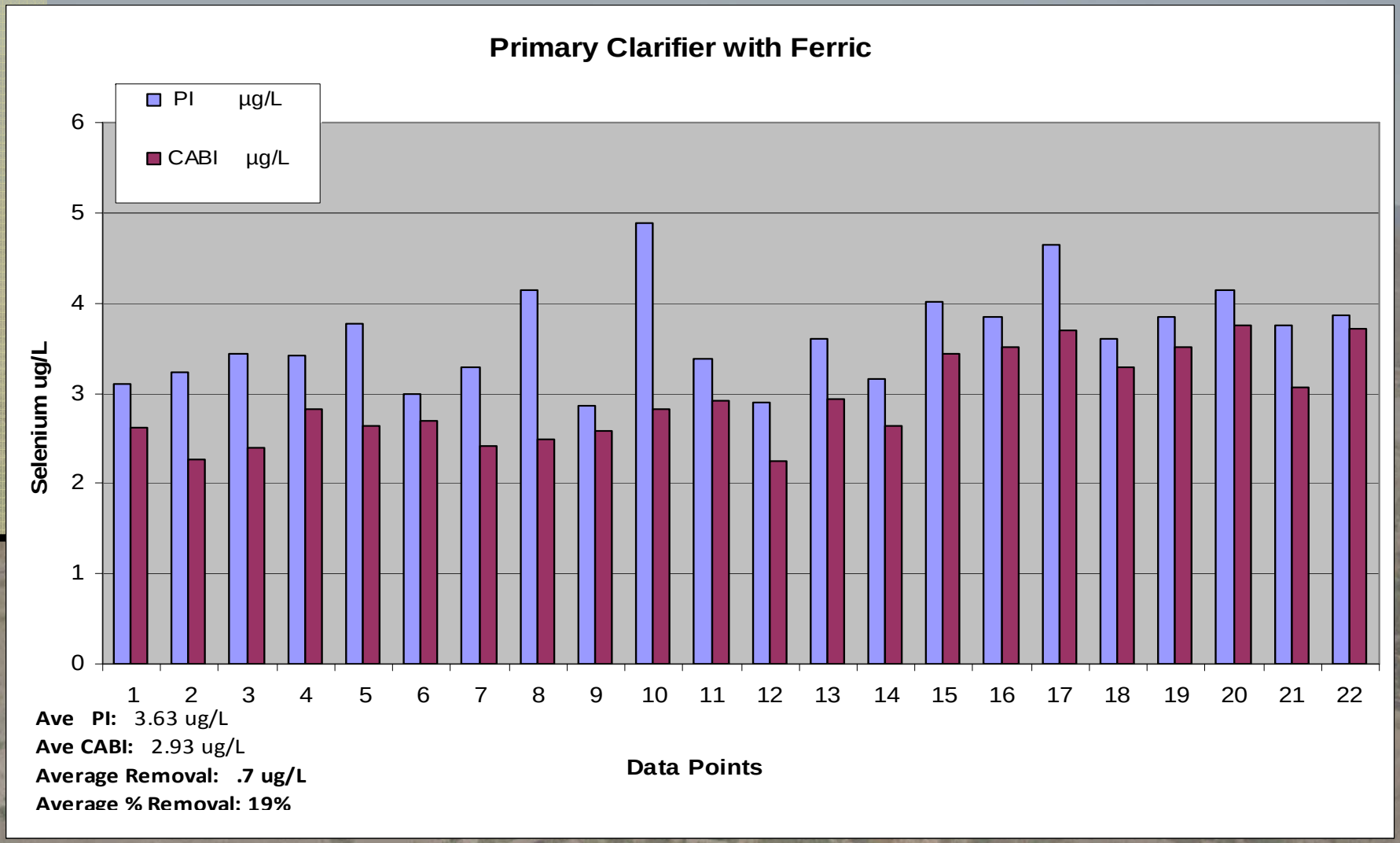


Clark County Se Removal

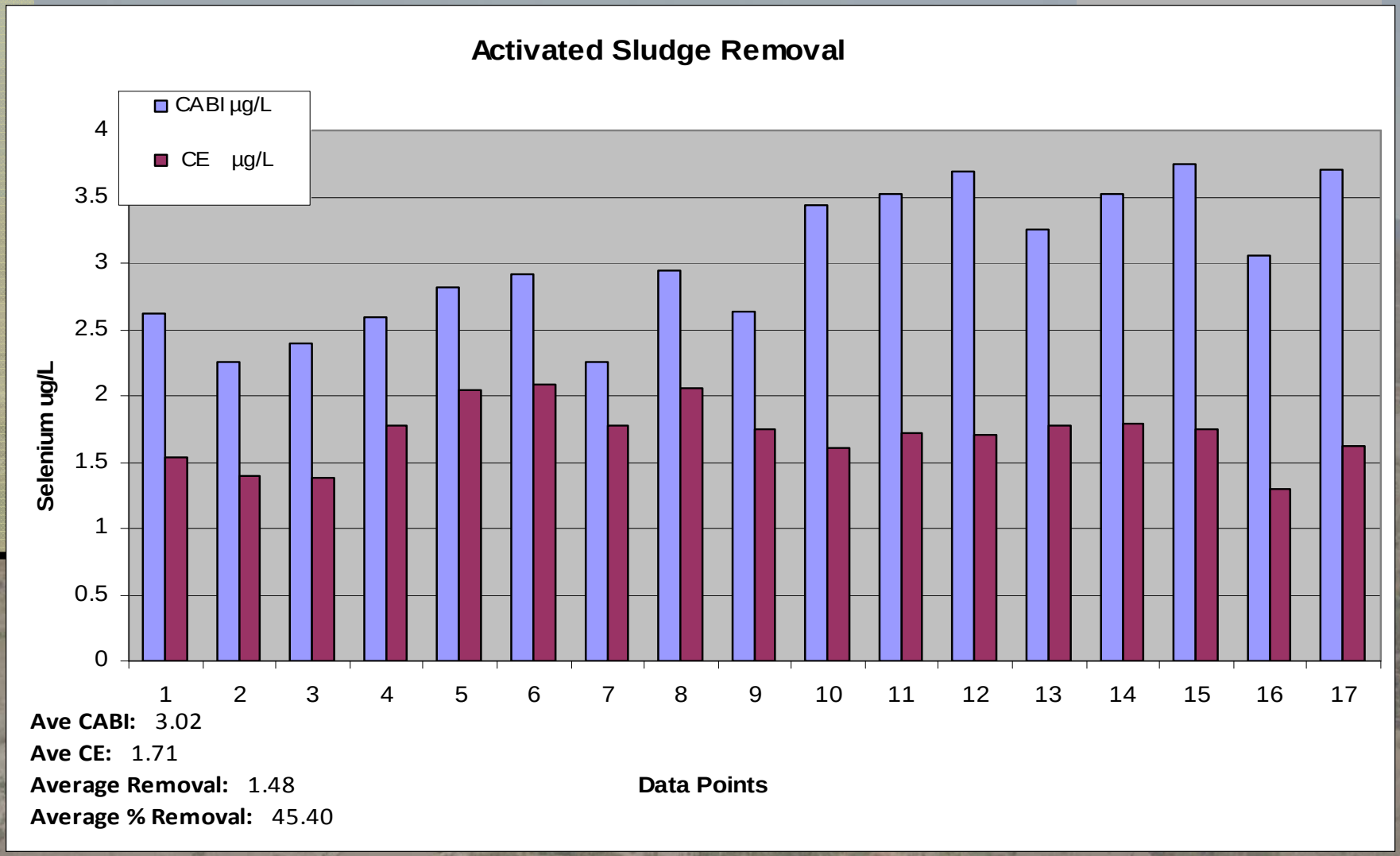


Ave PI: 3.53 ug/L
Ave AE/CP: 1.64 ug/L
Average Removal: 1.89 ug/L
Average % Removal: 53.5%

Clark County Se Removal

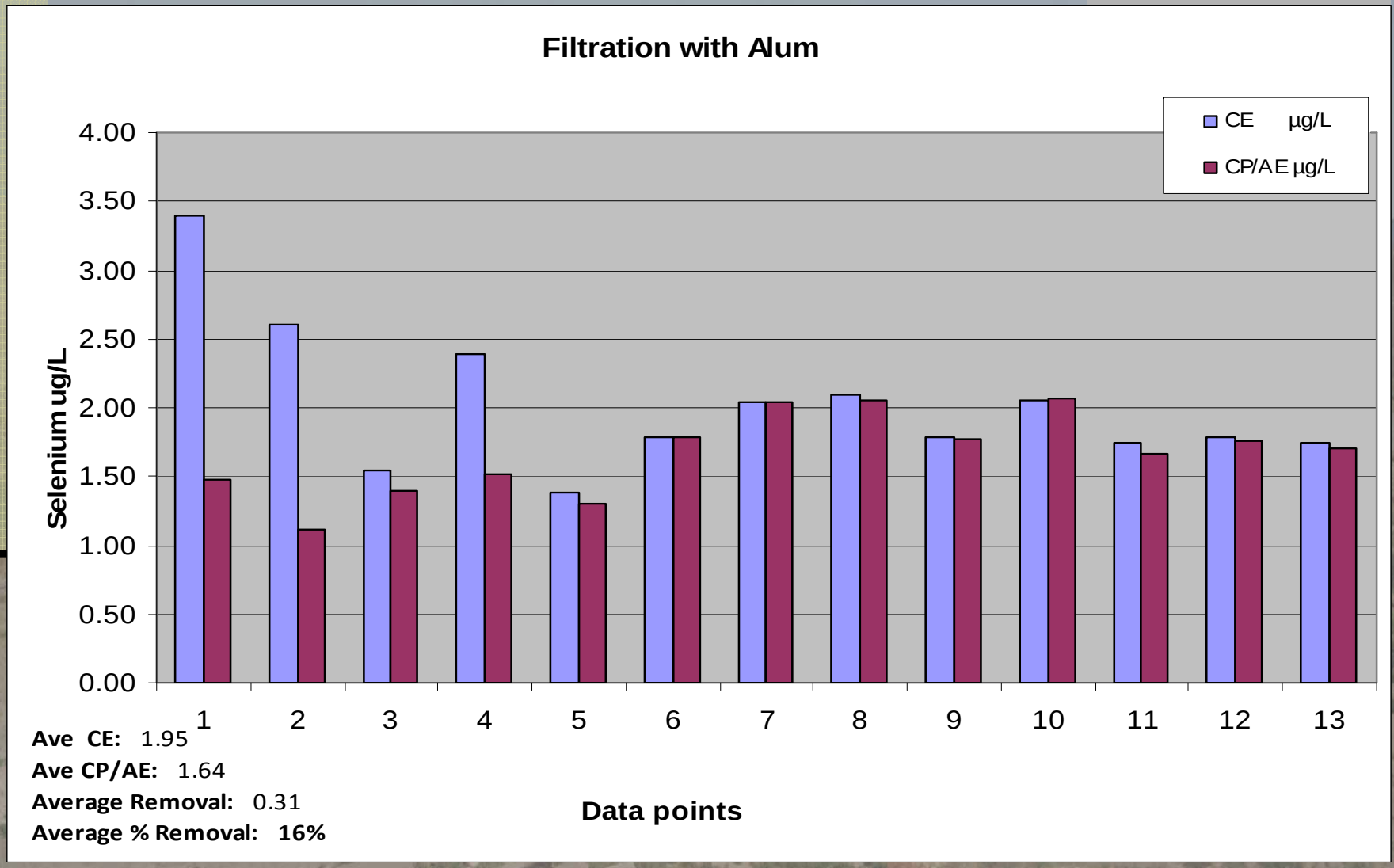


Clark County Se Removal



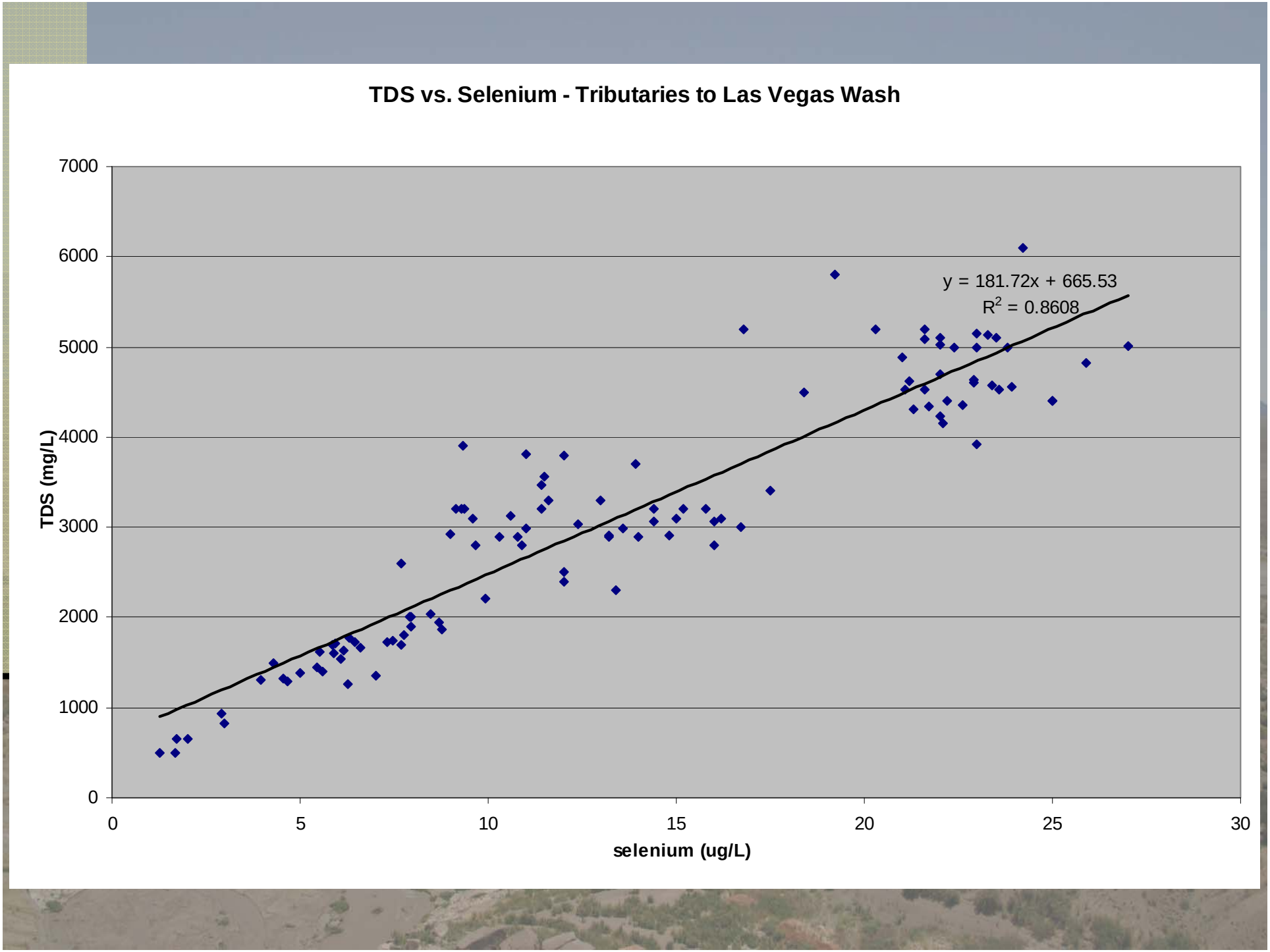
Ave CABI: 3.02
Ave CE: 1.71
Average Removal: 1.48
Average % Removal: 45.40

Clark County Se Removal



Clark County Se Removal

- CCWRD removes 54% of the total Se
- CCWRD removes 44% of the dissolved Se
- Primary Clarification removes 19% of the total Se
- Activated Sludge removes 45.4% of the total Se
- Filtration with alum removes 16% of the total Se
- All Se in the effluent is dissolved


TDS vs. Selenium - Tributaries to Las Vegas Wash
y = 181.72x + 665.53
R2 = 0.8608
TDS (mg/L)
selenium (ug/L)
0
1000
2000
3000
4000
5000
6000
7000
0
5
10
15
20
25
30

NDEP Research Grant

- Outstanding Work to be completed
  - Continue sampling influent and effluent for entire year
  - Hourly samples for 24 hour sampling period

NDEP Research Grant

- Conduct bench scale Se spiking studies
  - Duck Creek
  - Whitney Mesa
  - Primary Clarifier Influent
  - Secondary Clarifier Influent
  - Blend Secondary Clarifier Influent with Return Activated Sludge
  - Secondary Clarifier Effluent

Se Spiking Study

Water Source	Ferric Chloride Dose (mg/L)	Alum Dose (mg/L)
Duck Creek	0, 10, 20, 30, 60, 100	10, 20, 30, 60, 100
Whitney Mesa	0, 10, 20, 30, 60, 100	10, 20, 30, 60, 100
Primary Clarifier Influent	0,7.5, 15, 30, 60, 100	
Secondary Clarifier Influent	0,7.5, 15, 30, 60, 100	
Blend Secondary Clarifier Influent with Return Activated Sludge	0,7.5, 15, 30, 60, 100	
Secondary Clarifier Effluent	0,7.5, 15, 30, 60, 100	5, 10, 20, 30

*Dissolved Se and Se Speciation will be performed on each sample

Additional Sampling

- Biological Removal
  - Anaerobic Zone Influent
  - Anaerobic Zone Effluent
  - Anoxic Zone Effluent
  - Oxic Zone Effluent
  - Recycle
- Infiltration Study
  - East Side of Town – 4 am
  - West Side of Town – 4 am
- Samples collected for total and dissolved Se and speciated