ASSESSMENT OF HEAVY METALS IN SURFACE WATER DISCHARGING FROM UPPER HUNTER COAL MINES AND POWER STATIONS

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The International Centre for Balanced Land Use
The University of Newcastle

Acknowledgements

- UHMD Steering Committee
- EPA Newcastle,
- Environmental Managers at HVO (Rio Tinto), Glencore, AGL, Bengalla,

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

Aim and Objectives

AIM

Assess heavy metals entering the Hunter River via the Hunter Salinity Trading Scheme.

KEY OBJECTIVES

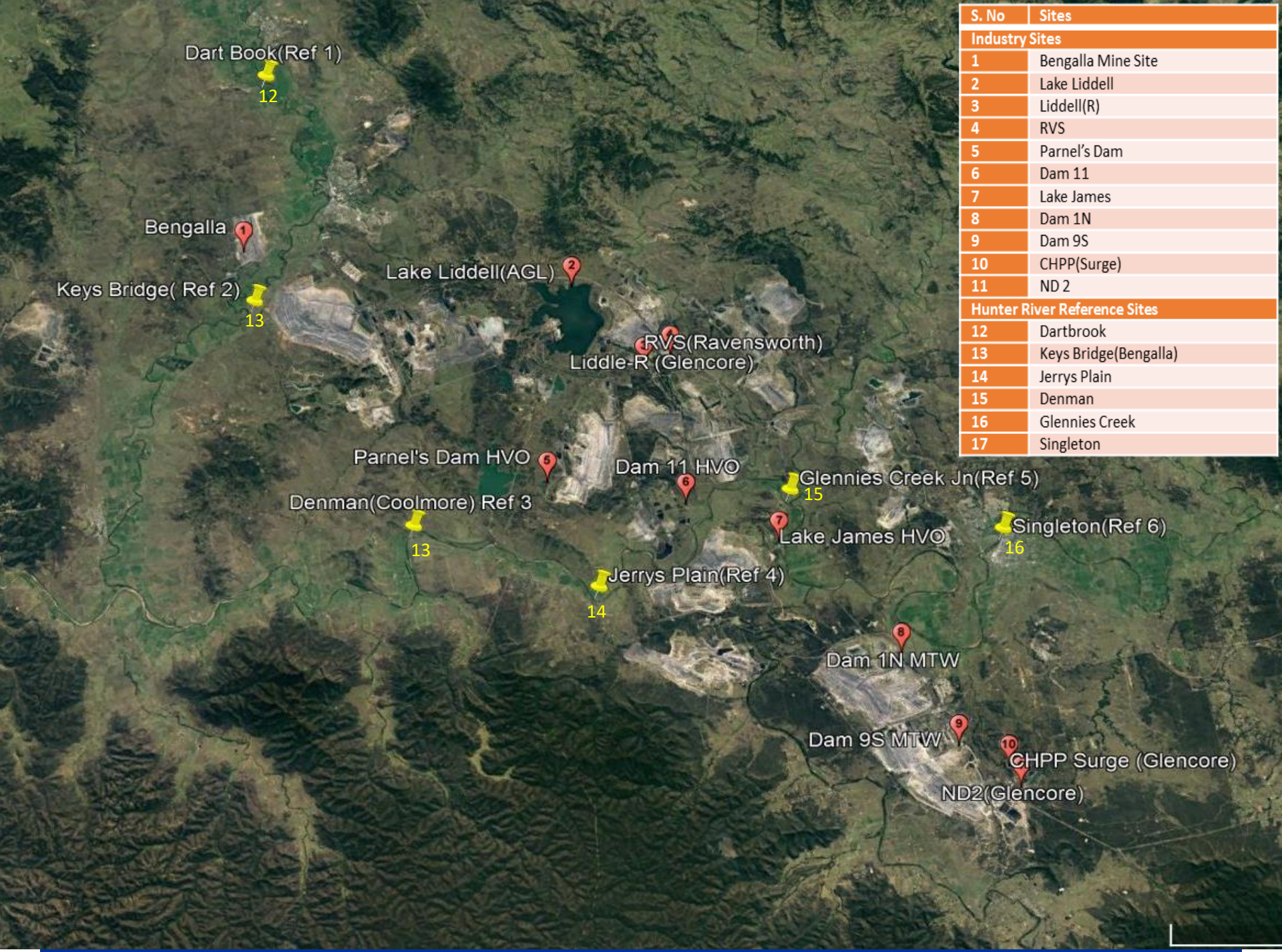
1) Identify heavy metals in surface waters and sediments.
2) Assess the impact of metal contamination.

Approach

Task 1 – Determine the concentration of heavy metal in water and sediments across the HSTS

Task 2 – Assess metal contents against environmental guidelines

If *elevated metal contents are identified, assess dispersal using hydrological models*.



S. No	Sites
Industry Sites	
1	Bengalla Mine Site
2	Lake Liddell
3	Liddell(R)
4	RVS
5	Parnel's Dam
6	Dam 11
7	Lake James
8	Dam 1N
9	Dam 9S
10	CHPP(Surge)
11	ND 2
Hunter River Reference Sites	
12	Dartbrook
13	Keys Bridge(Bengalla)
14	Jerrys Plain
15	Denman
16	Glennies Creek
17	Singleton

Site Visits to identify the sampling points

Hunter River reference sites

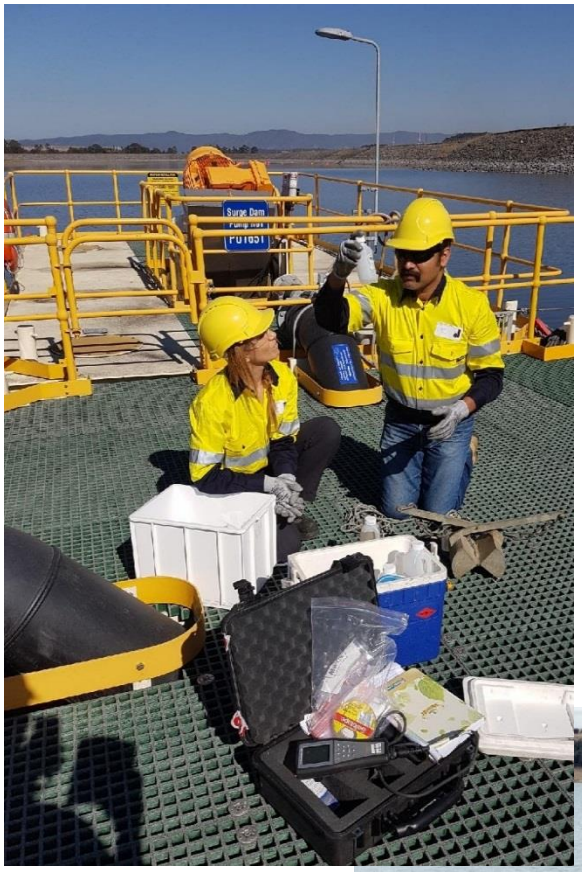
Glennies Creek

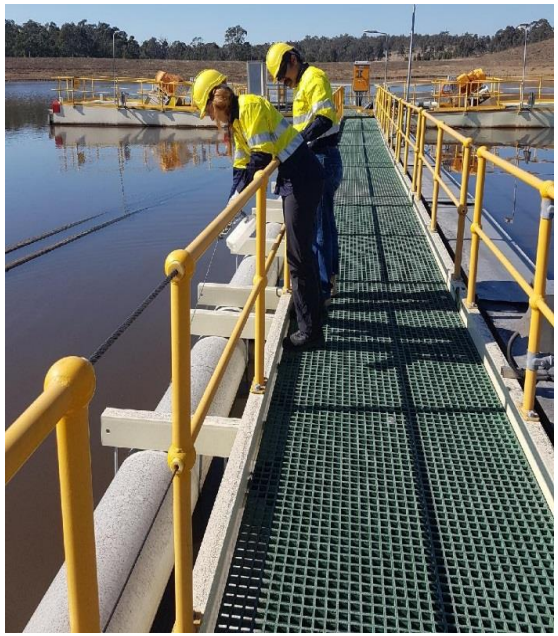
Dartbrook

Denman

Jerrys Plain

Sampling at HRSTS dams





Water Analysis

Parameters	Target compounds
General water quality parameters	pH, Conductivity Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD), Total Nitrogen (TN), Total Phosphorus (TP). Alkalinity(Bicarbonate) Carbon-Dissolved Organic(DOC)
Heavy metals	Copper, Lead, Cadmium, Zinc, Arsenic, Selenium, Iron, Manganese, Silver, Chromium, Nickel, Aluminium, Mercury, Sodium, Potassium, Calcium, Magnesium, Chloride, Sulfur, Phosphorus, Boron, Barium, Cobalt, Molybdenum, Vanadium, Bromide and Silicon
Heavy metal speciation	Total Arsenic, Arsenic(V) & (III)
Nutrients	Nitrate, Nitrite, Phosphate, Ammonium

Sediment Analysis

Parameters	Target compounds
General Sediment Quality analysis	pH and EC(1:5) Basic Colour &Texture
Nutrients	Total Carbon (TC), Total Nitrogen (TN), Organic Matter, TC/TN Ratio
Available Nutrients	Calcium, Magnesium, Potassium, Ammonium, Nitrate, Phosphate, Sulfur
Exchangeable Nutrients	Sodium, Potassium, Calcium, Magnesium, Hydrogen, Aluminium, Cation Exchange Capacity
Available Micronutrients	Zinc, Manganese, Iron, Copper, Boron, Silicon
Heavy metals	Silver, Arsenic, Lead, Chromium, Nickel, Cadmium, Mercury
Total elemental analysis	Sodium, Potassium, Calcium, Magnesium,Sulfur, Phosphorus, Silicon, Cobalt, Molybdenum, Selenium, Zinc, Manganese, Iron, Copper, Boron and Aluminium

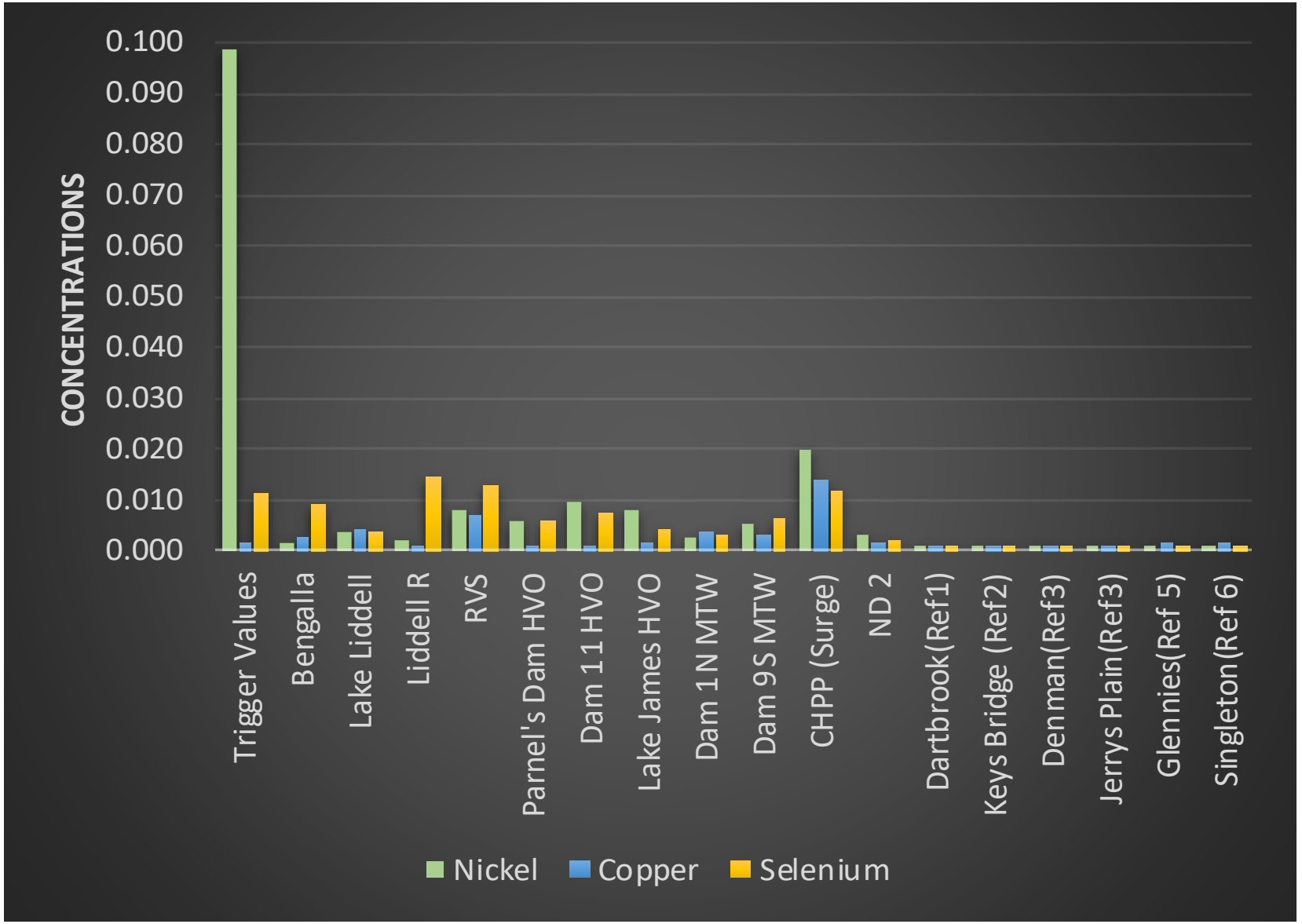
Water Quality in storage dams

Parameters	Bengalla	Lake Liddell	Liddell R	RVS	Parnel's Dam HVO	Dam 11 HVO	Lake James HVO	Dam 1N MTW	Dam 9S MTW	CHPP (Surge)	ND 2
pH	8.51	8.49	8.66	8.76	8.63	8.62	8.94	8.58	8.87	8.89	8.77
Conductivity (EC) (dS/m)	2.150	2.728	6.355	7.972	5.674	6.269	7.318	6.260	9.453	5.230	3.737
Total Dissolved Salts (mg/L)	1,462	1,855	4,321	5,421	3,858	4,263	4,976	4,257	6,428	3,556	2,541

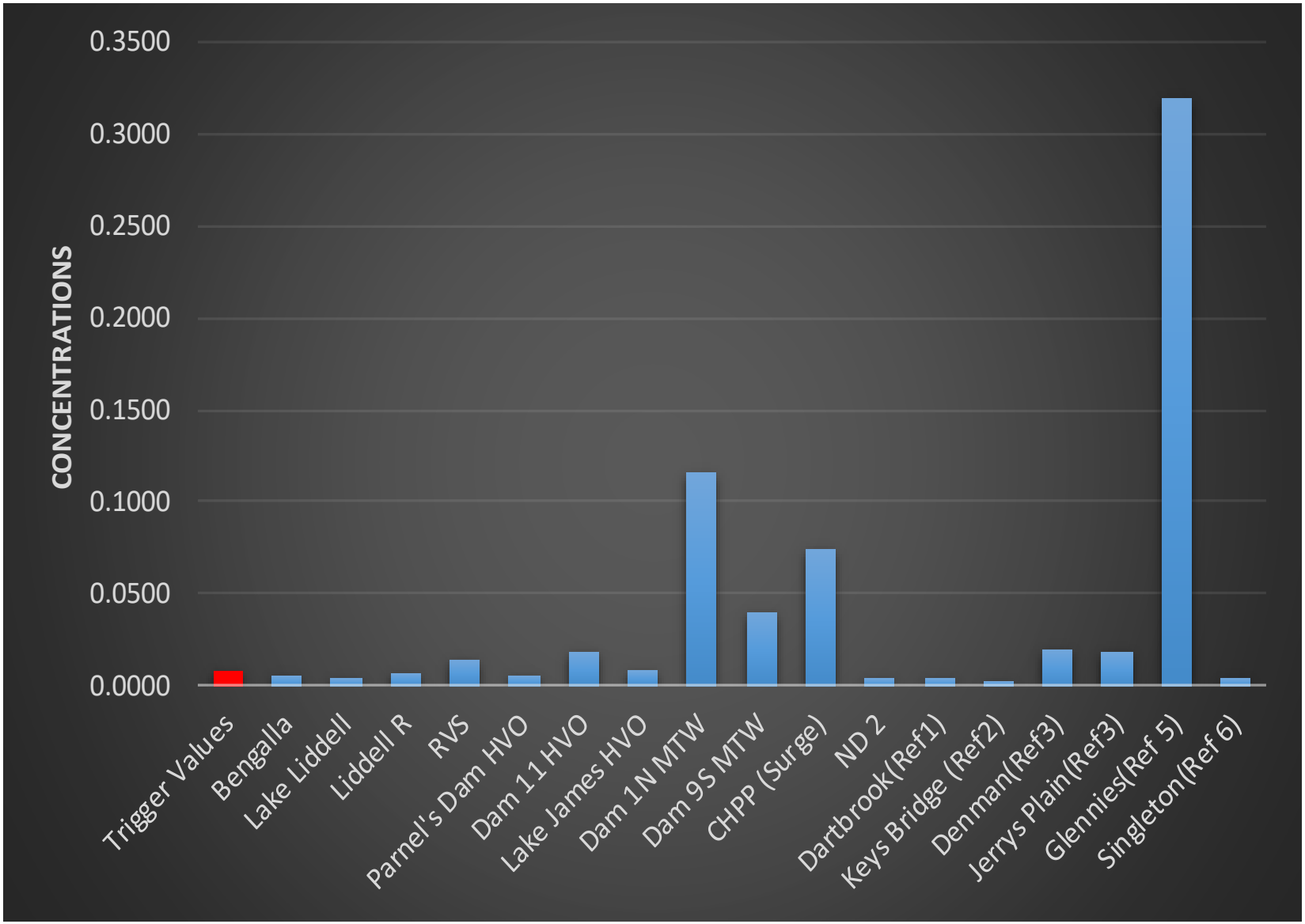
Water Quality in Hunter R reference sites

Parameters	Dartbrook	Keys Bridge	Denman	Jerrys Plain	Glennies Creek	Singleton
pH	8.30	8.03	8.33	8.23	8.28	8.68
Conductivity (EC) (dS/m)	0.382	0.520	1.202	1.307	1.322	1.100
Total Dissolved Salts (mg/L)	260	354	817	889	899	748
Total Suspended Solids (mg/L)	2	9	10	19	14	4

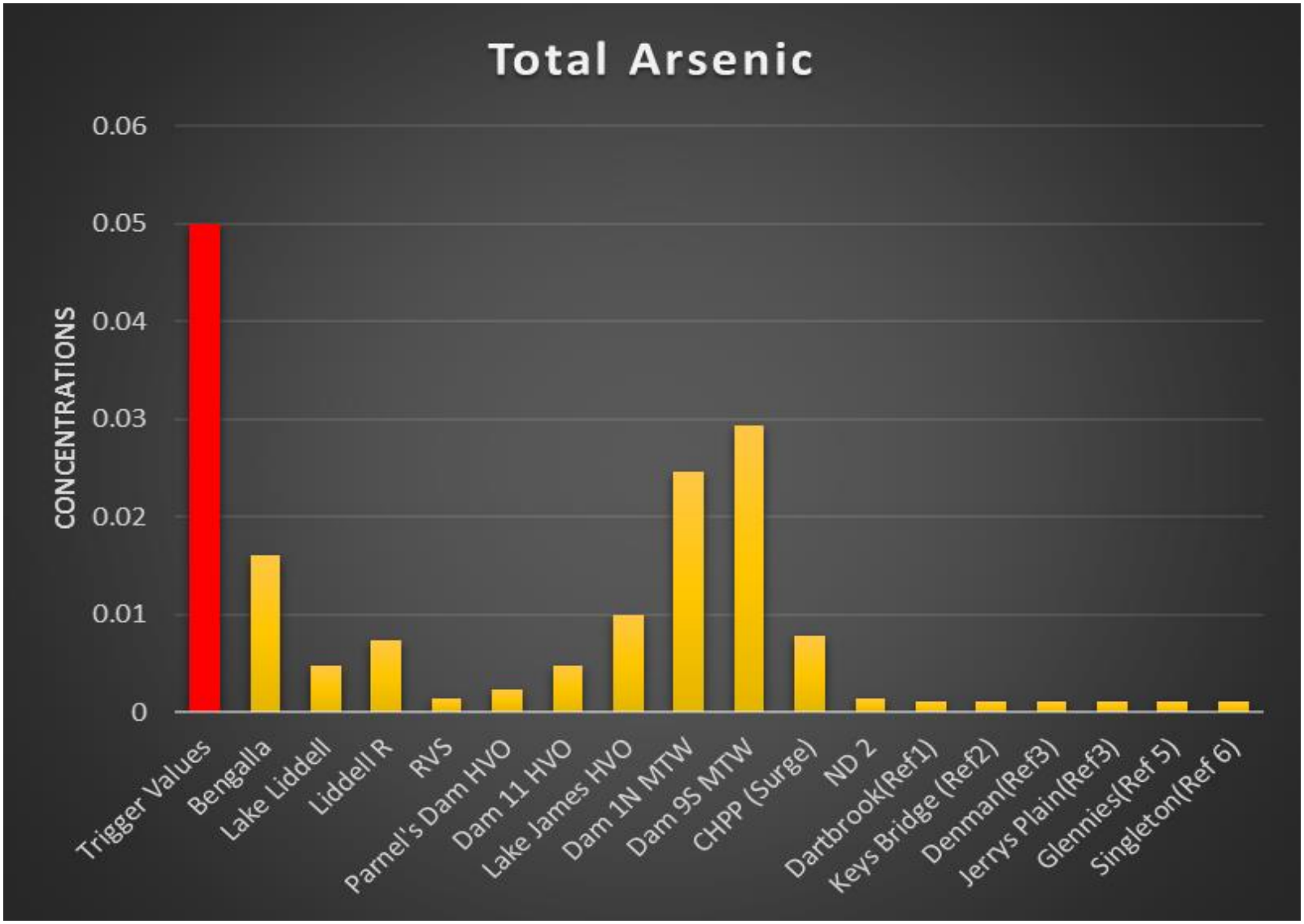
Water Quality – Nickel Copper Selenium



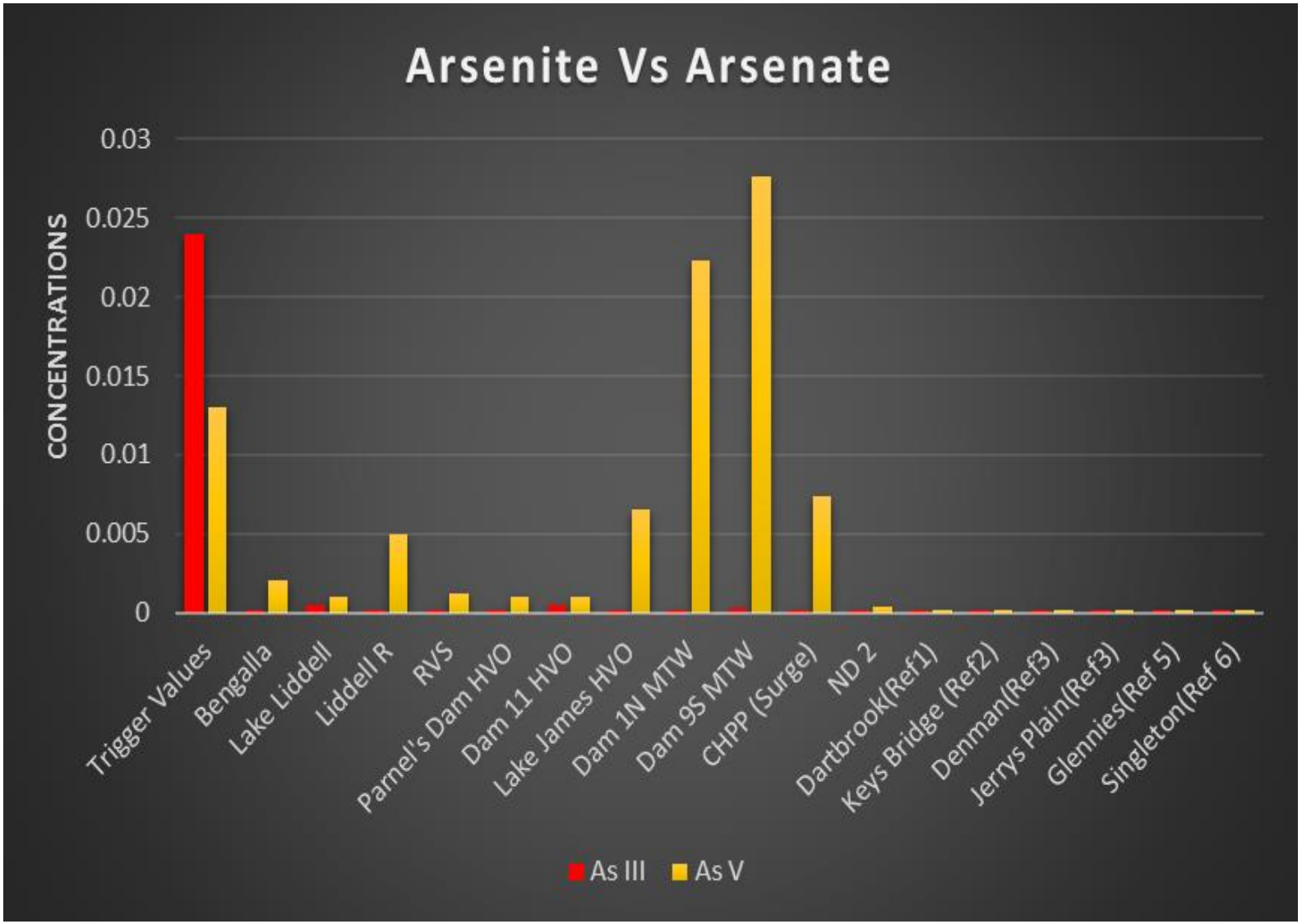
Water Quality – Zinc (mg/L)



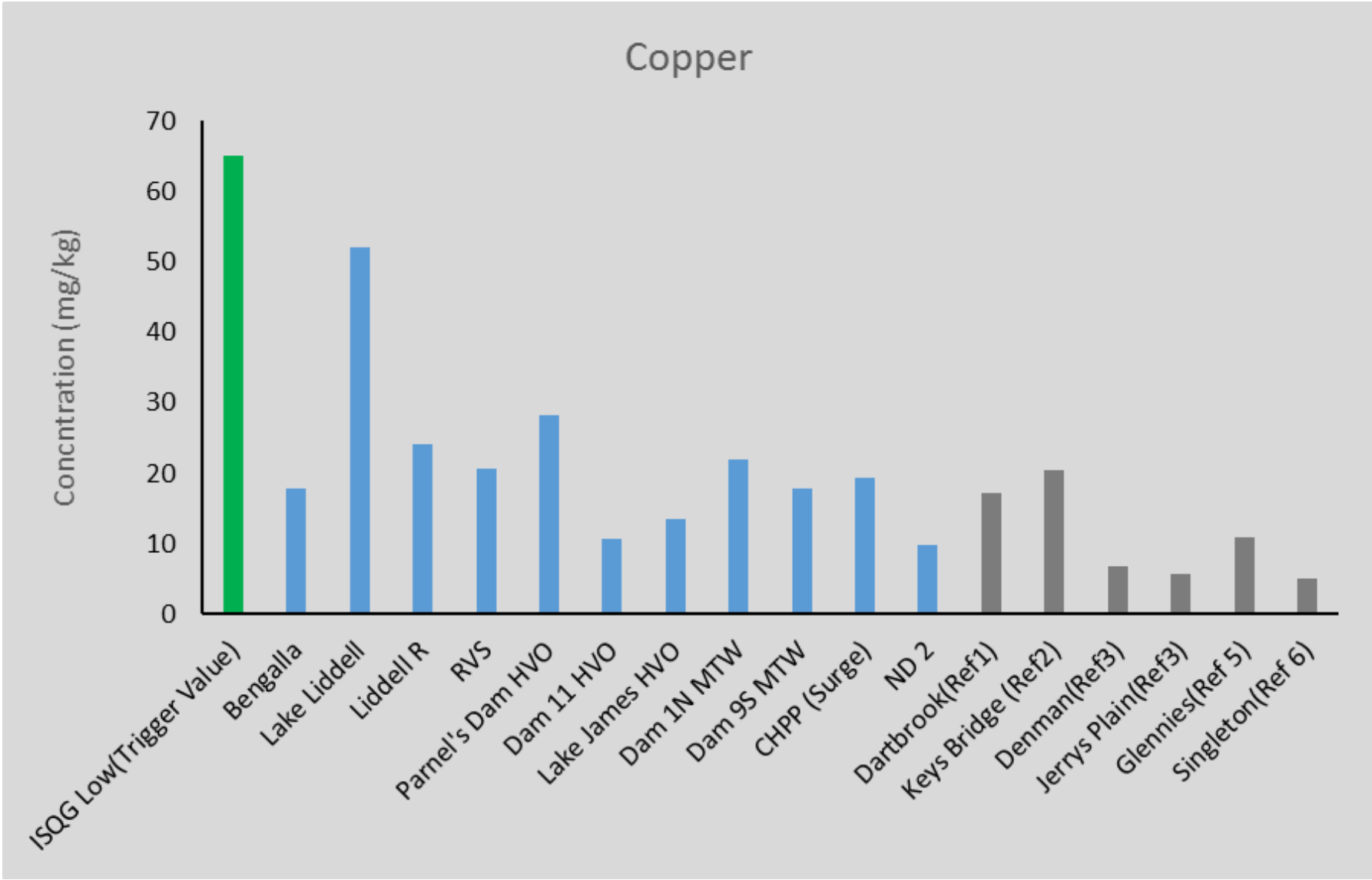
Water Quality - Total Arsenic (mg/L)



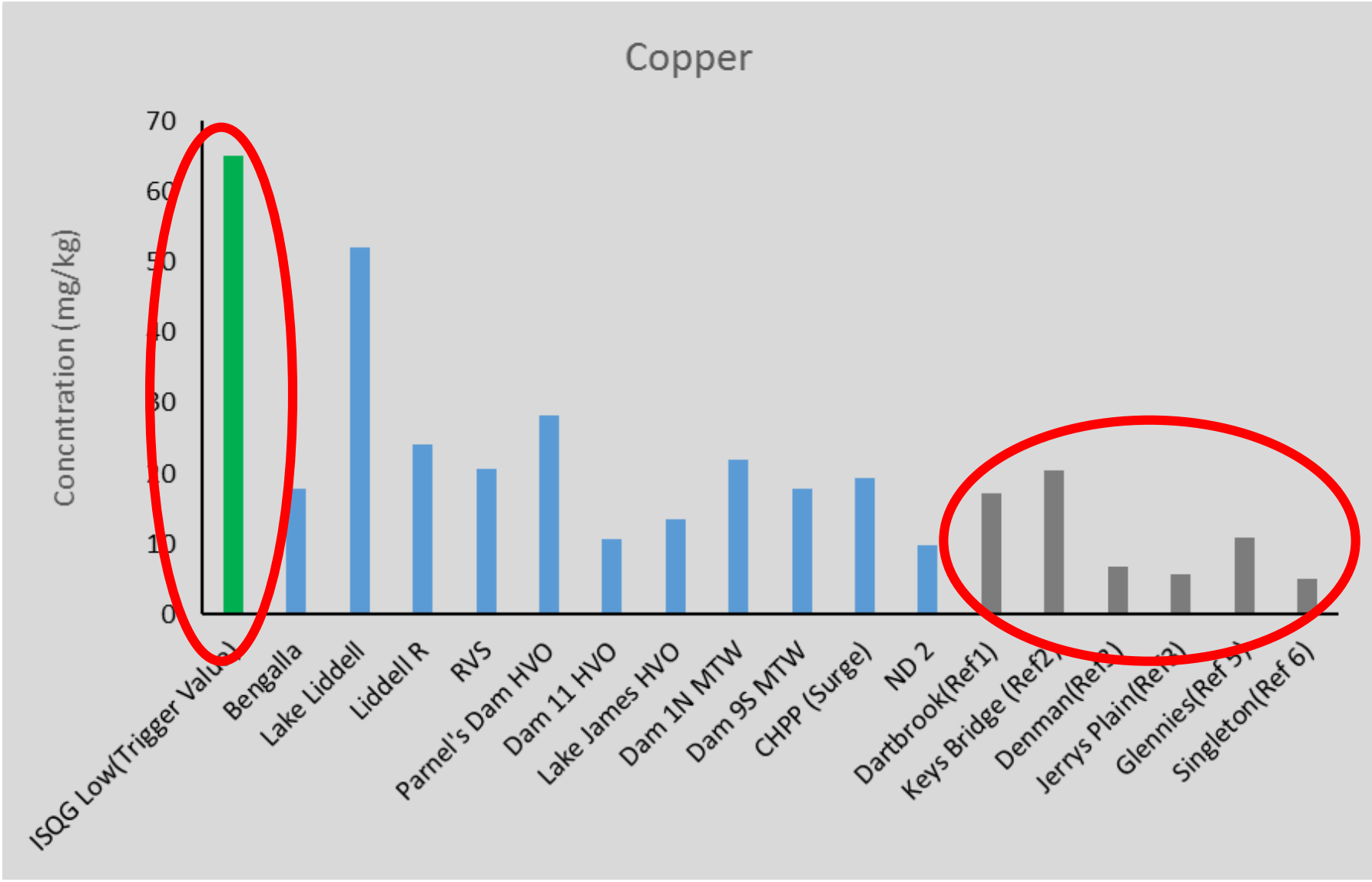
Water Quality -Arsenic species (mg/L)



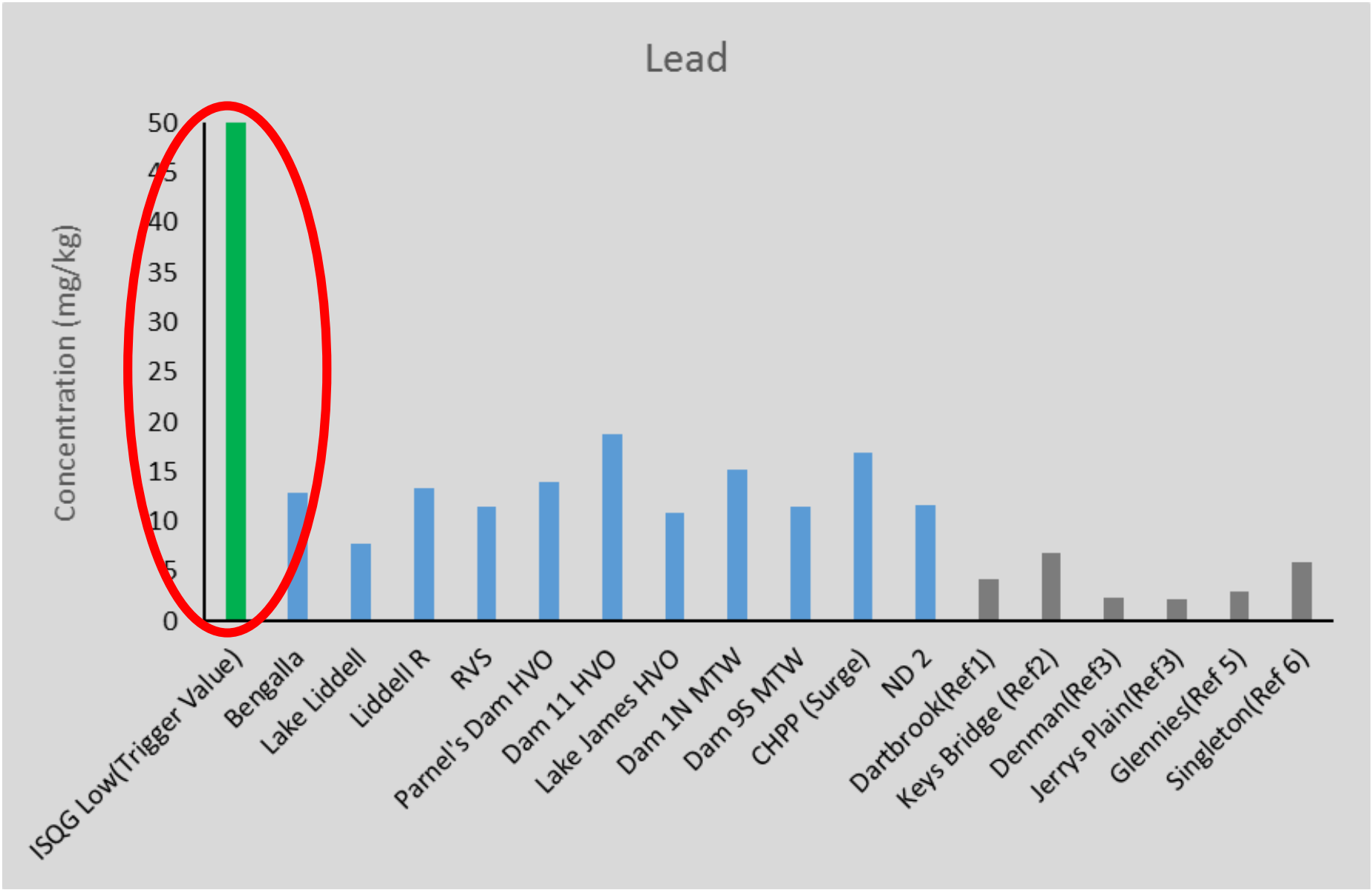
Sediment Quality - Copper



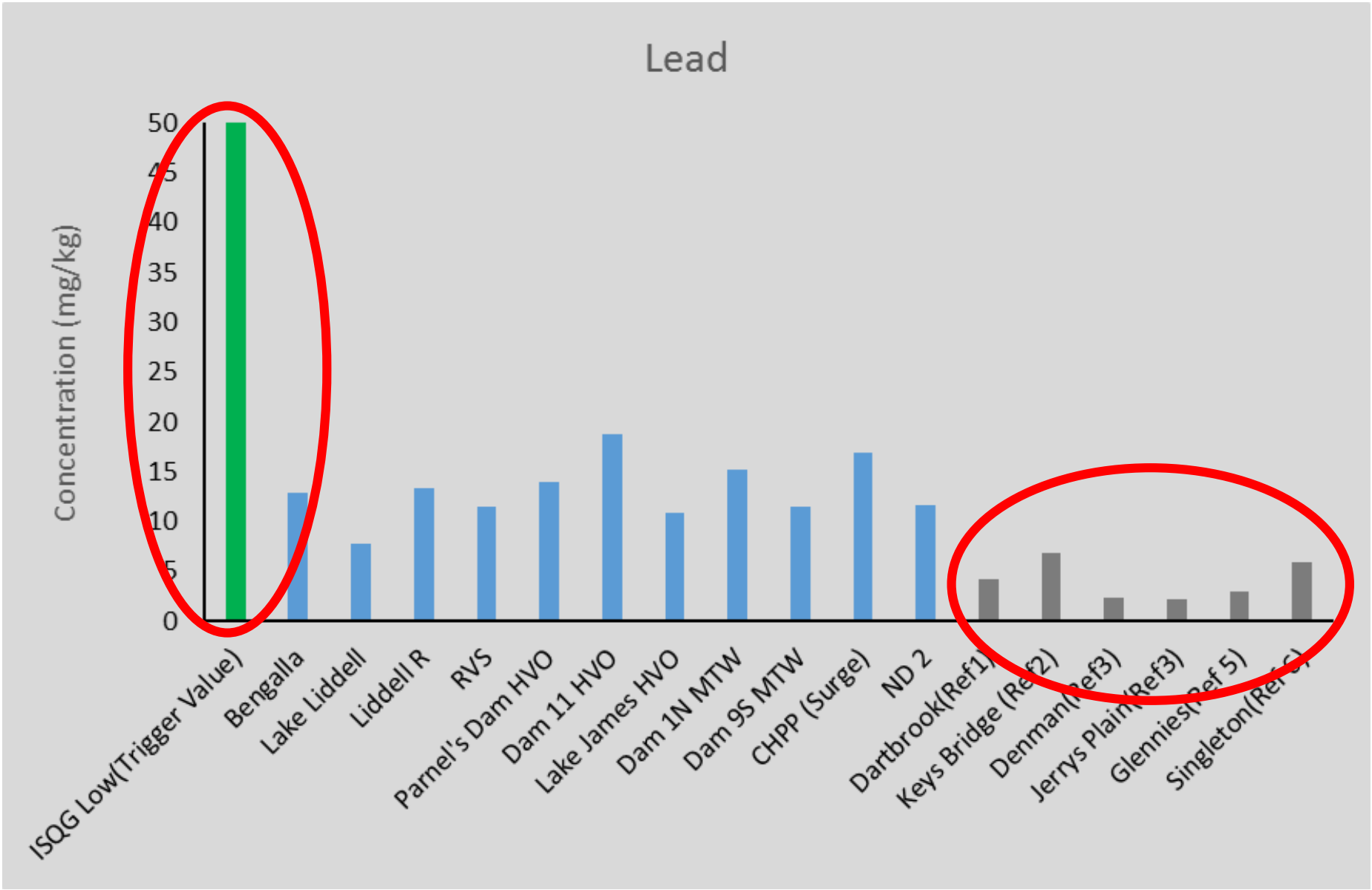
Sediment Quality - Copper



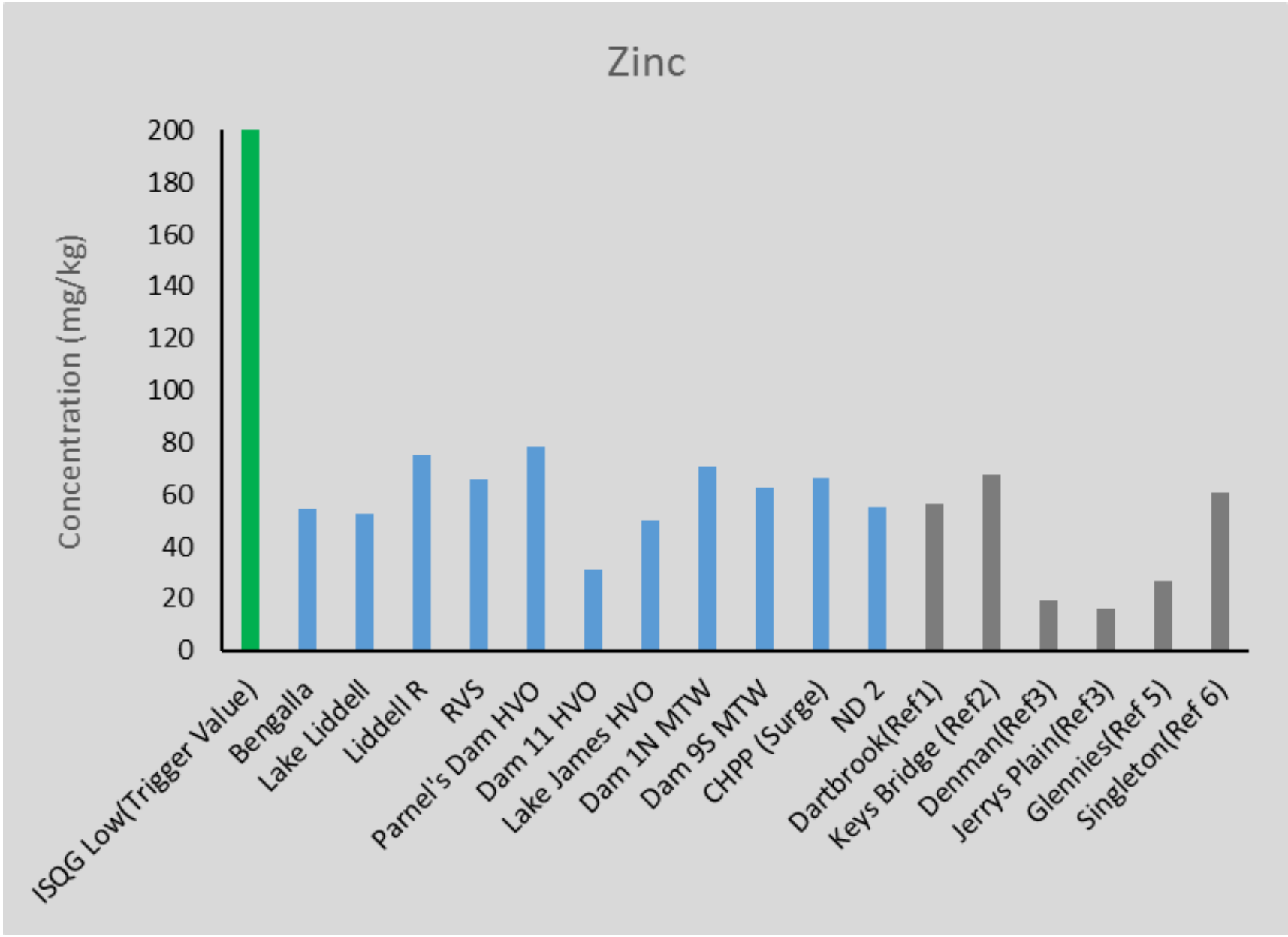
Sediment Quality - Lead



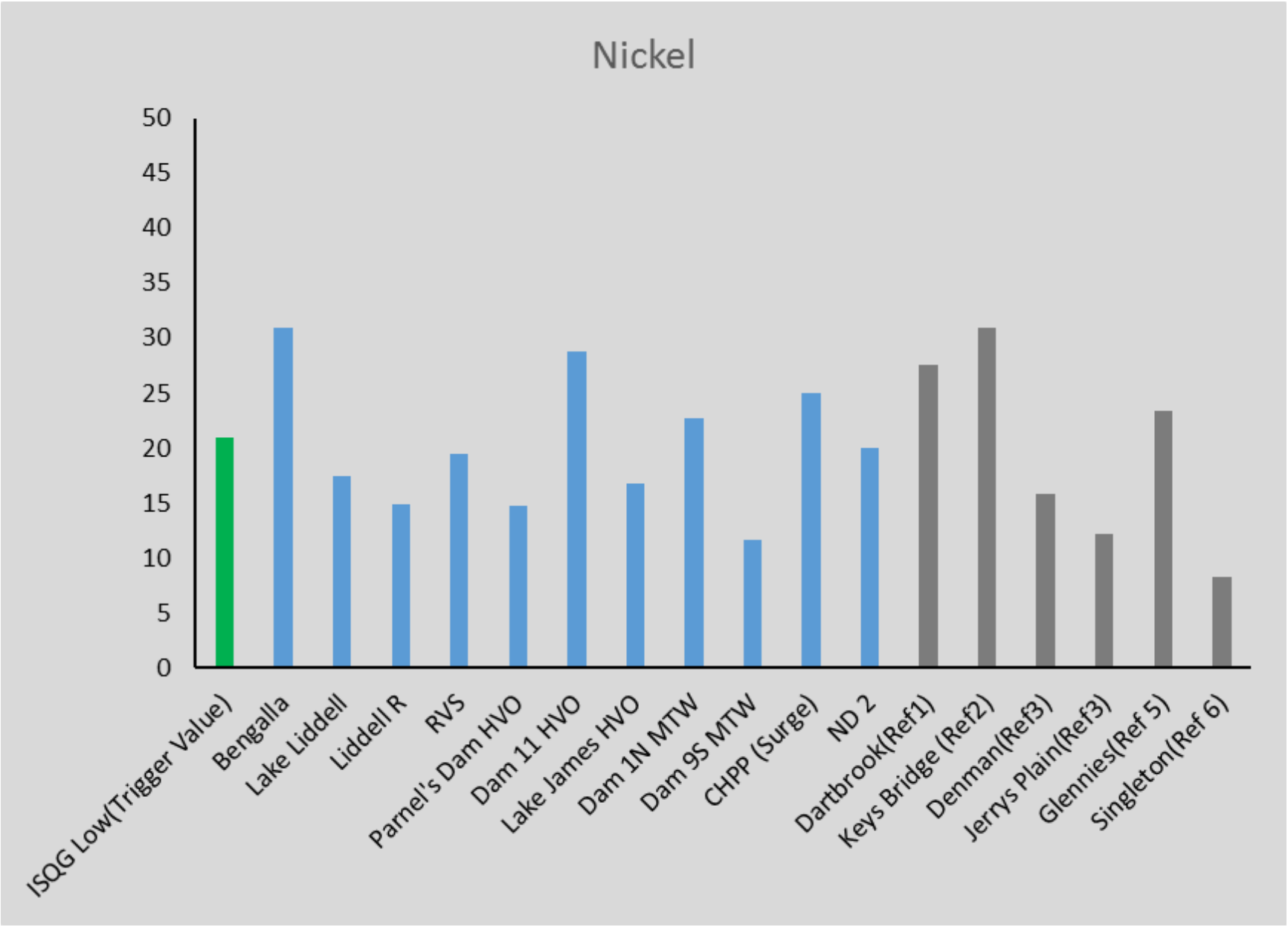
Sediment Quality - Lead



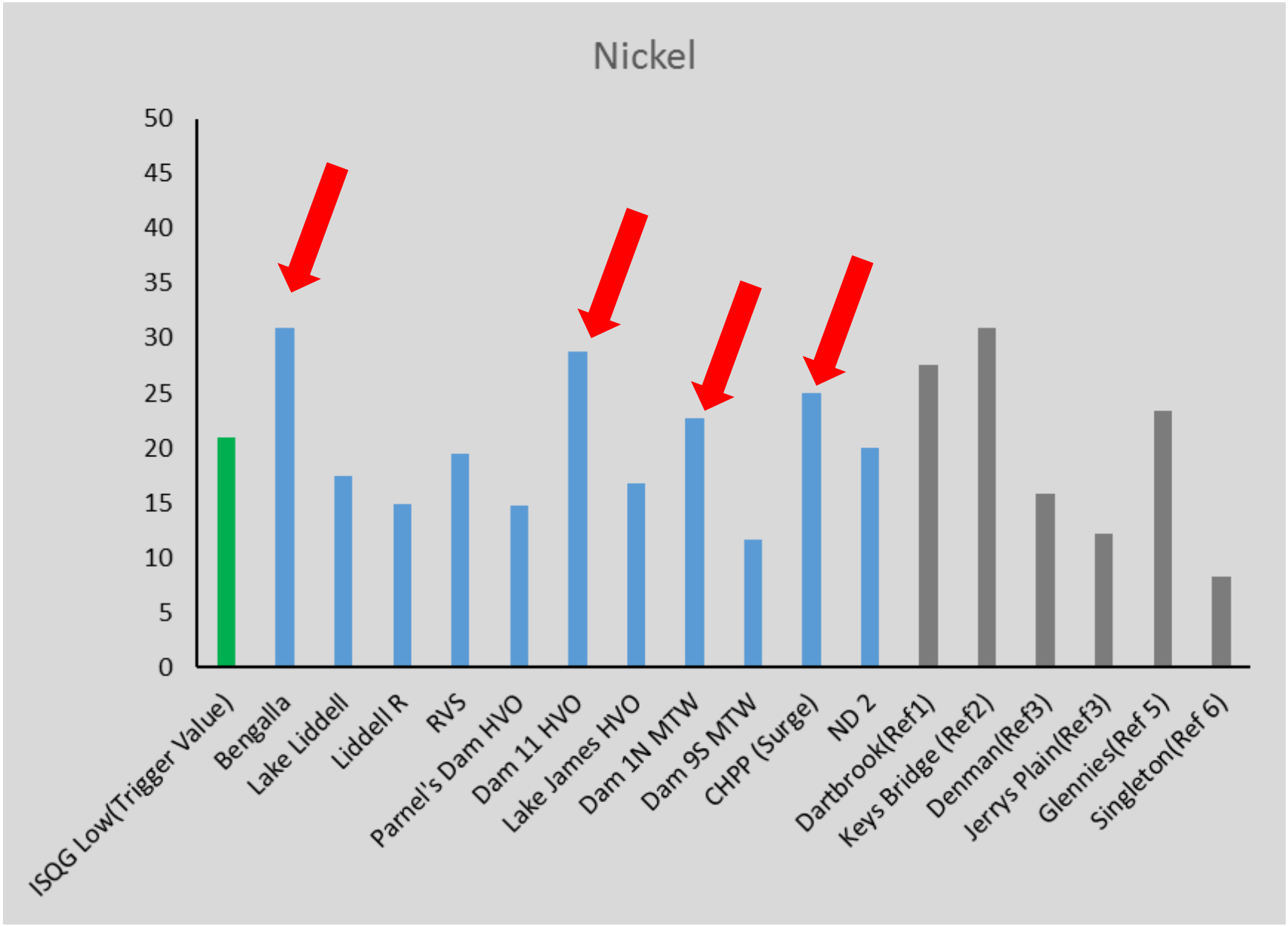
Sediment Quality - Zinc



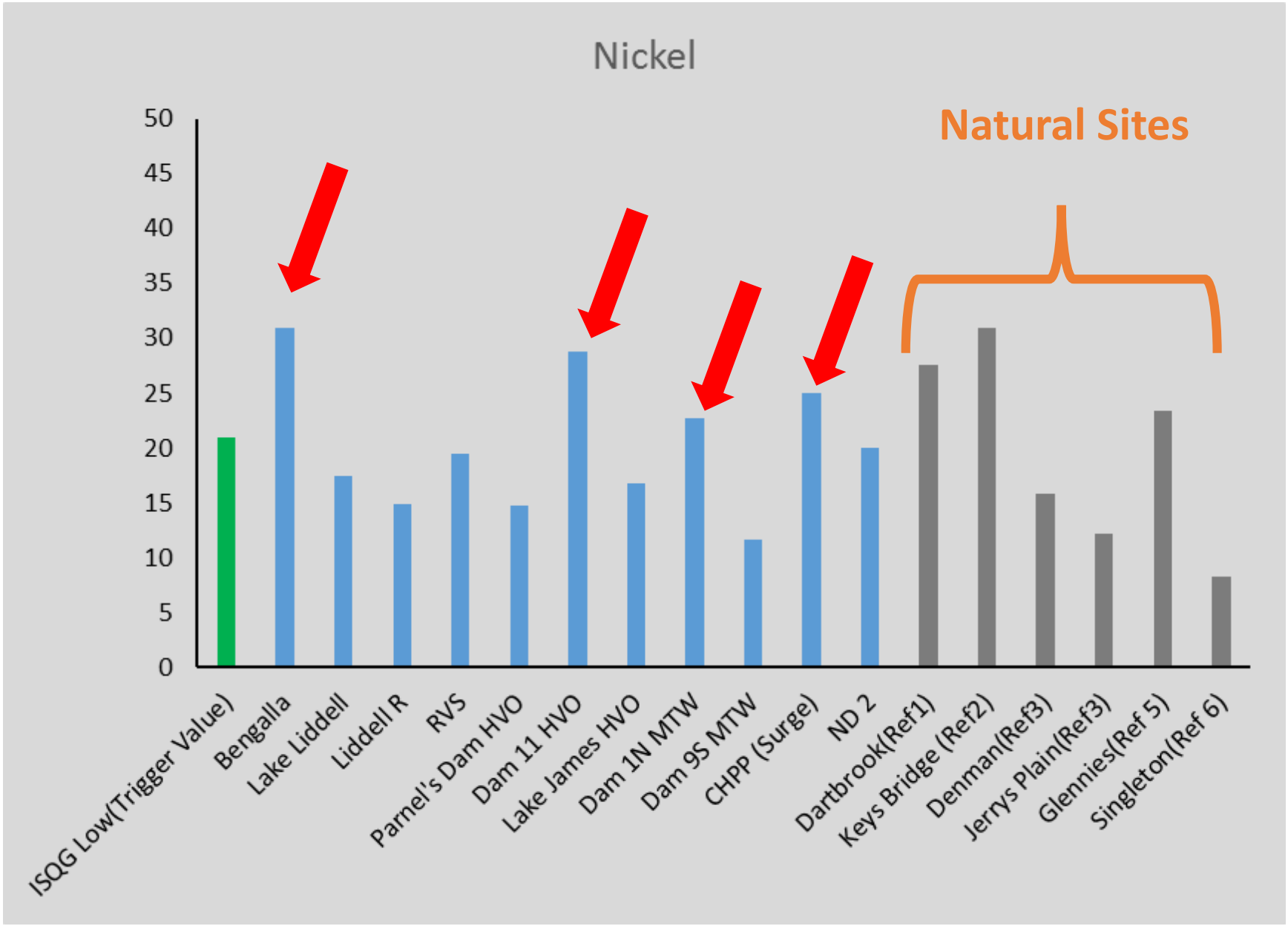
Sediment Quality - Nickel



Sediment Quality - Nickel



Sediment Quality - Nickel



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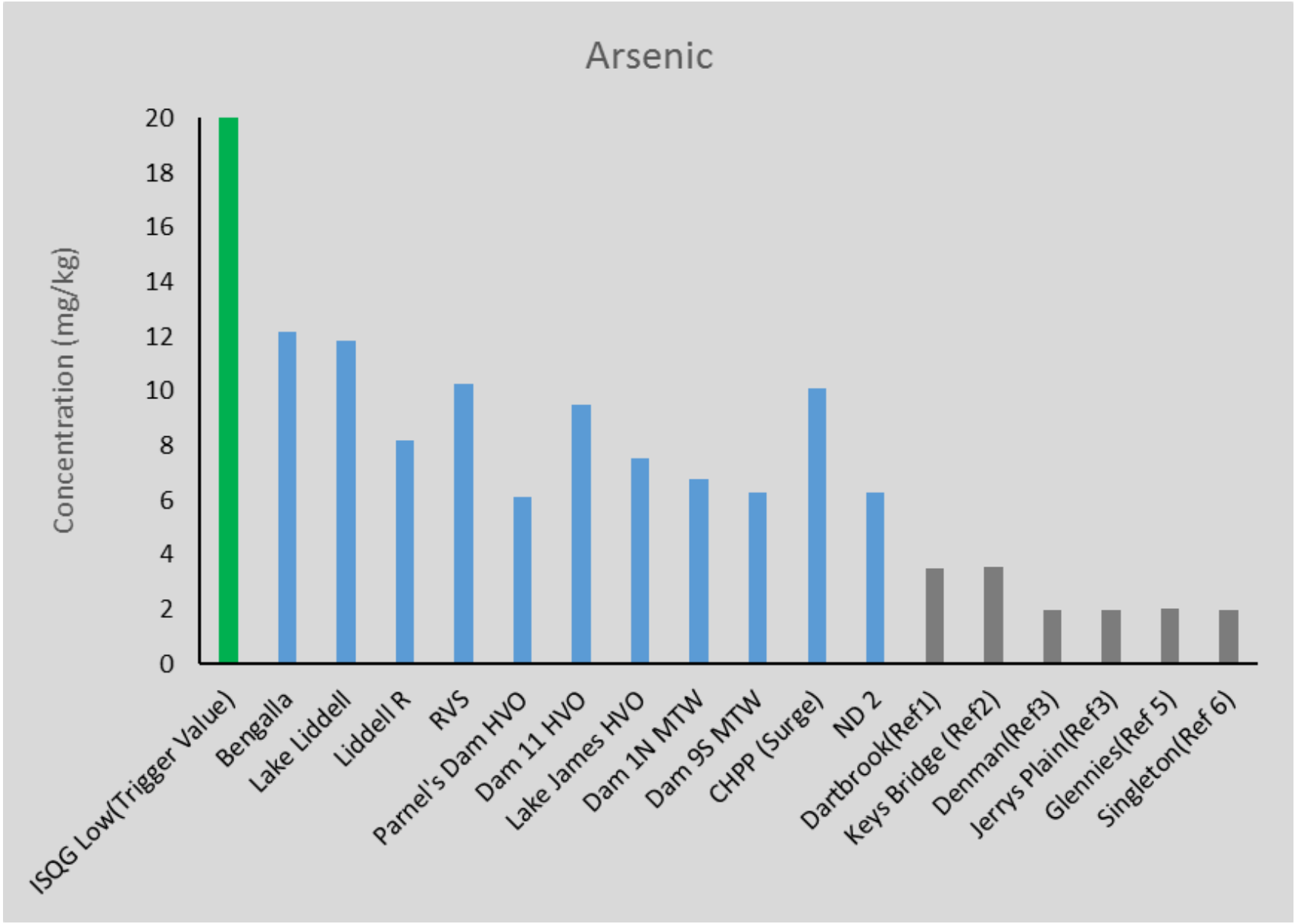
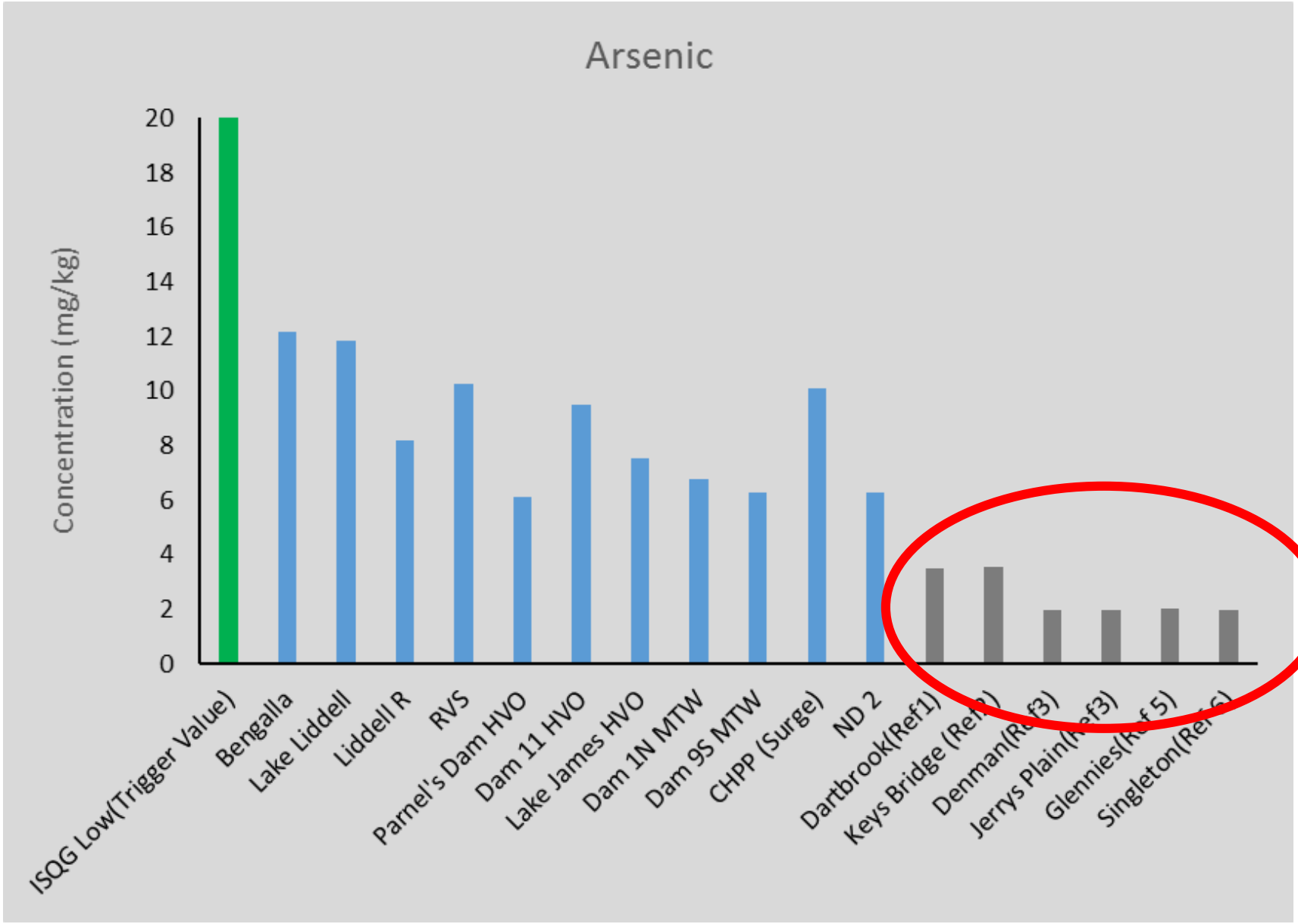
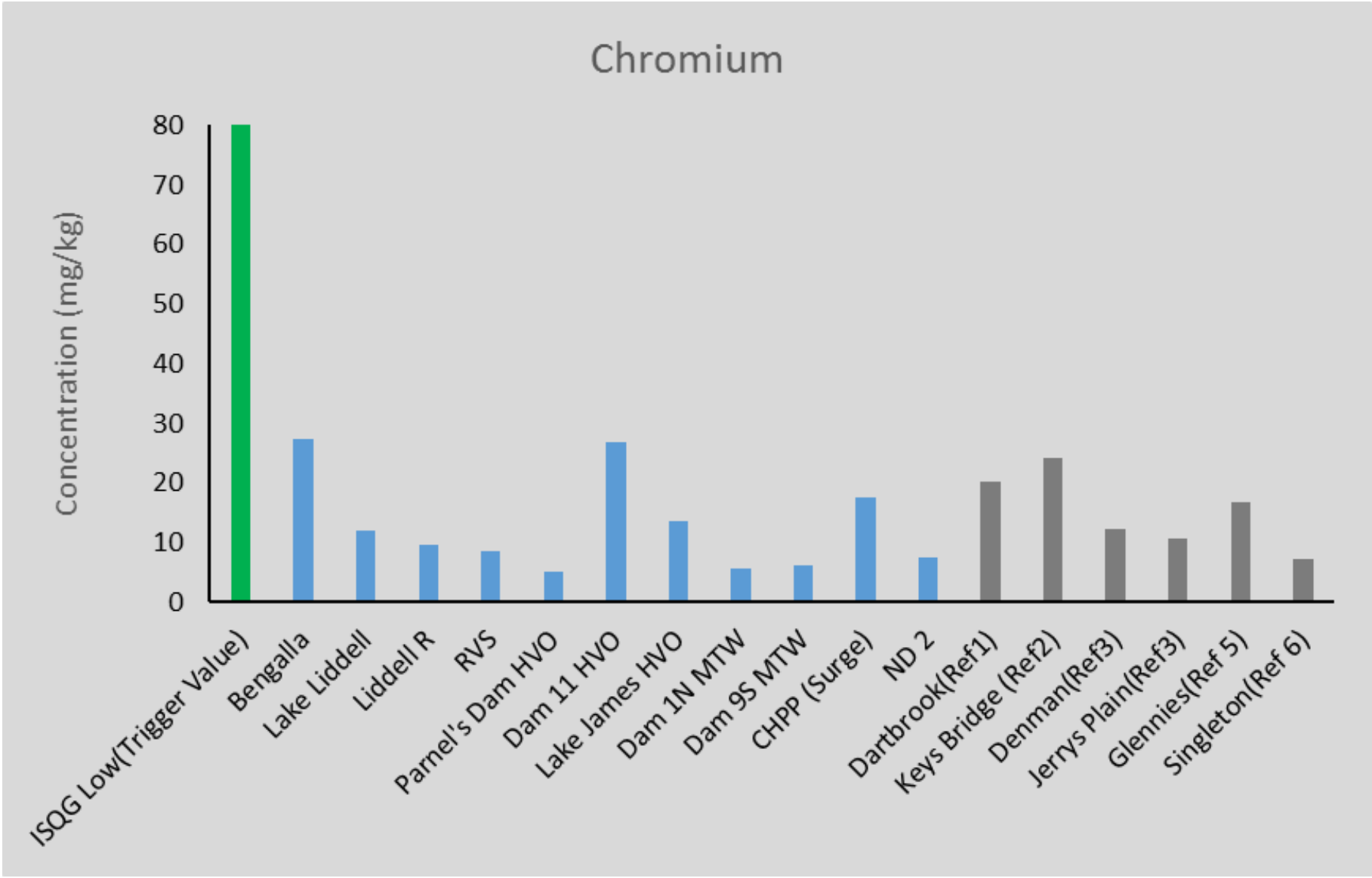


Sediment Quality



Sediment Quality - Chromium



What does it mean for the River?

- Metal concentrations in HSTS dams are very low.
- Some heavy metals exceed trigger values but this occurs in both dams and natural river.
- ANZEC and EPA guidelines require further consideration where slightly elevated heavy metals concentration occurs.