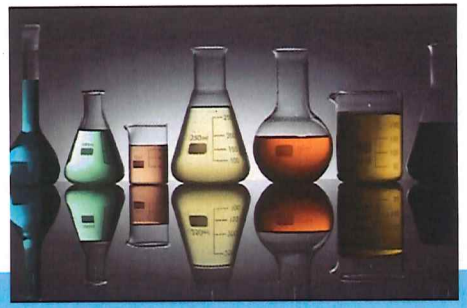
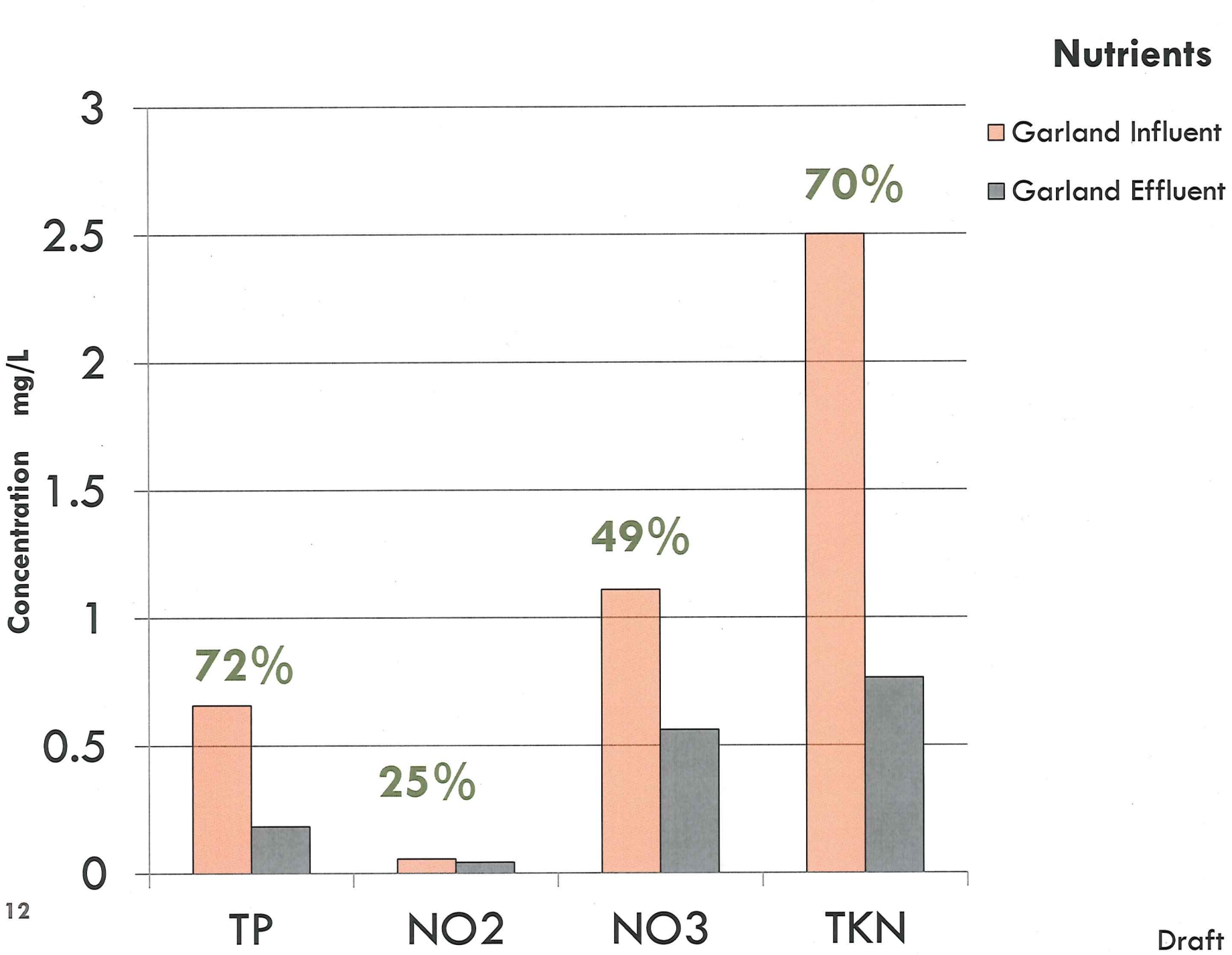
Analytical Results

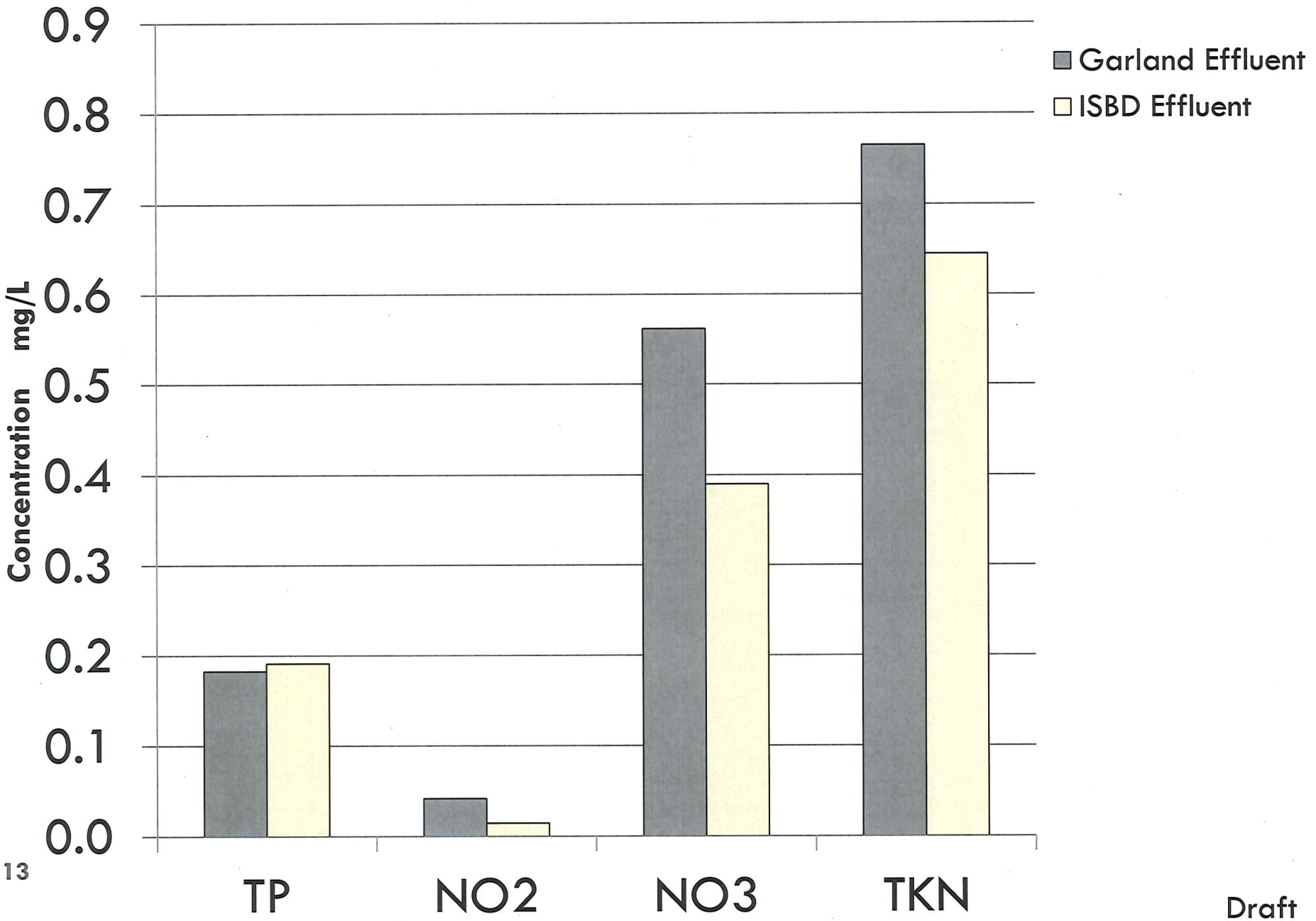


- Handout Garland Stormgarden (Water Year 2015-2017) handout
- 6 sample events
- Constituents analyzed
  - Conventionals
  - Nutrients
  - Total metals
  - Diss. metals
  - Hardness
  - Petroleum
  - PCB


Nutrients
Garland Influent
Garland Effluent
Concentration mg/L
3
2.5
2
1.5
1
0.5
0
72%
25%
49%
70%
TP
NO2
NO3
TKN

Draft

Nutrients vs. Database



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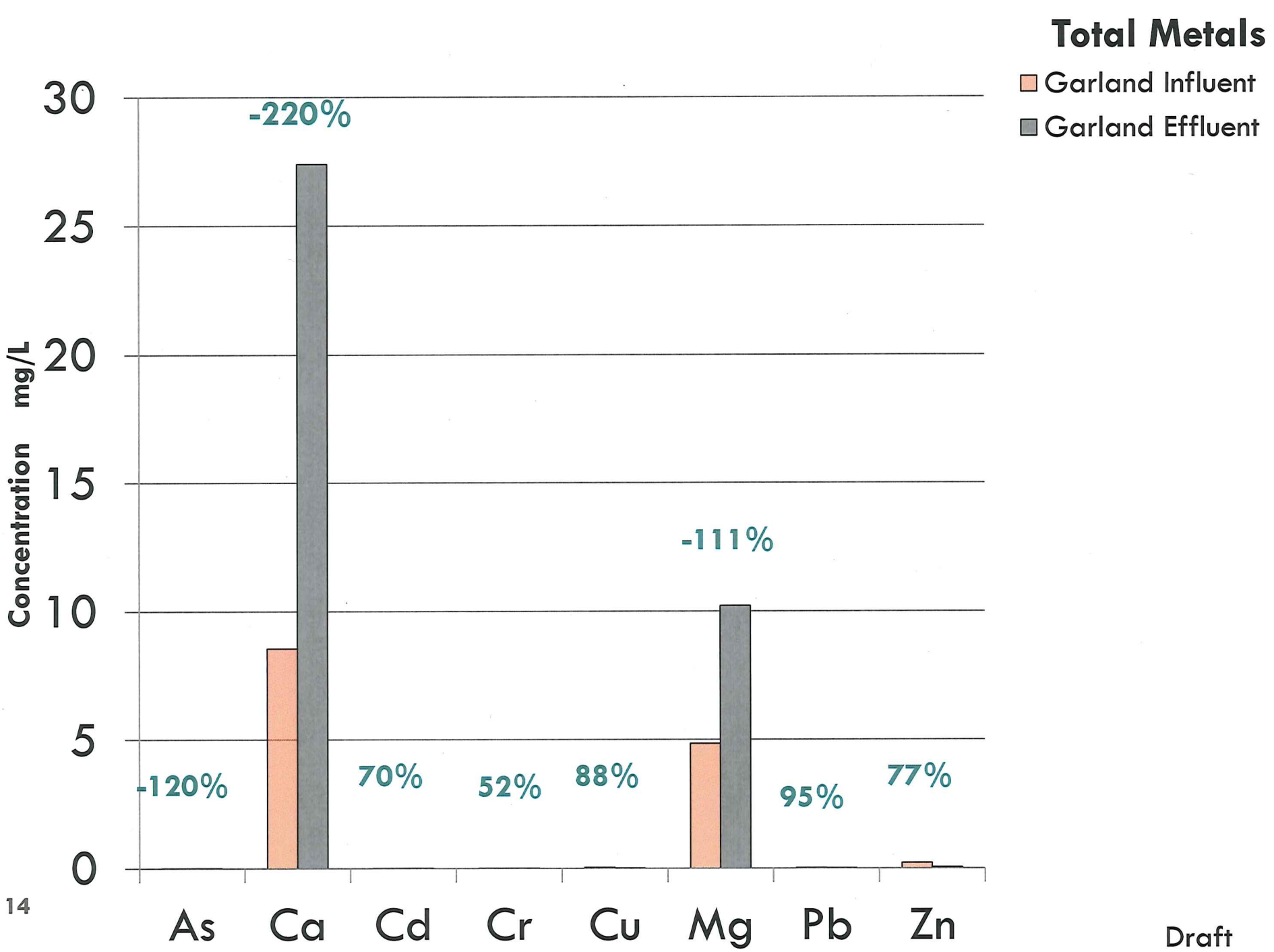
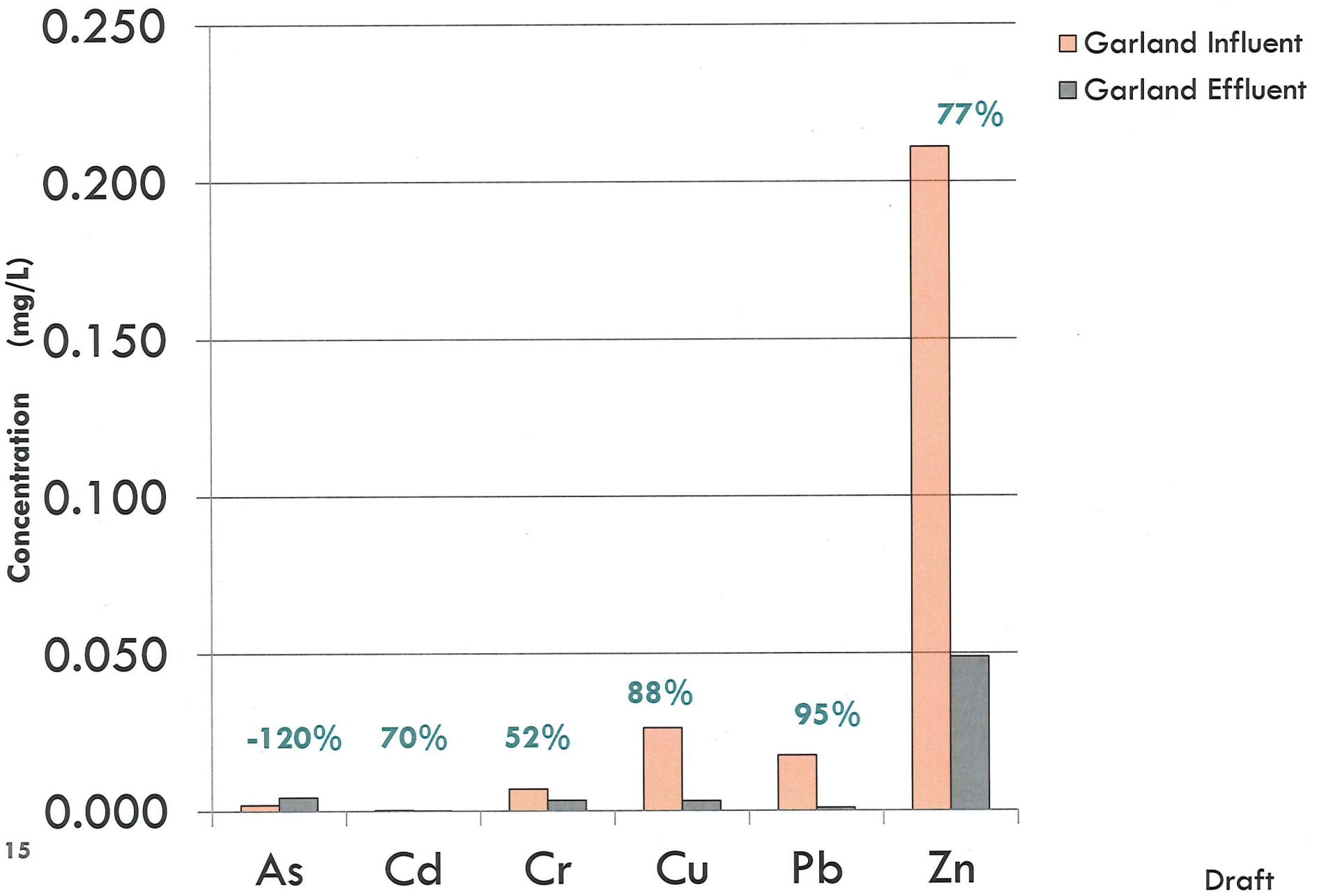
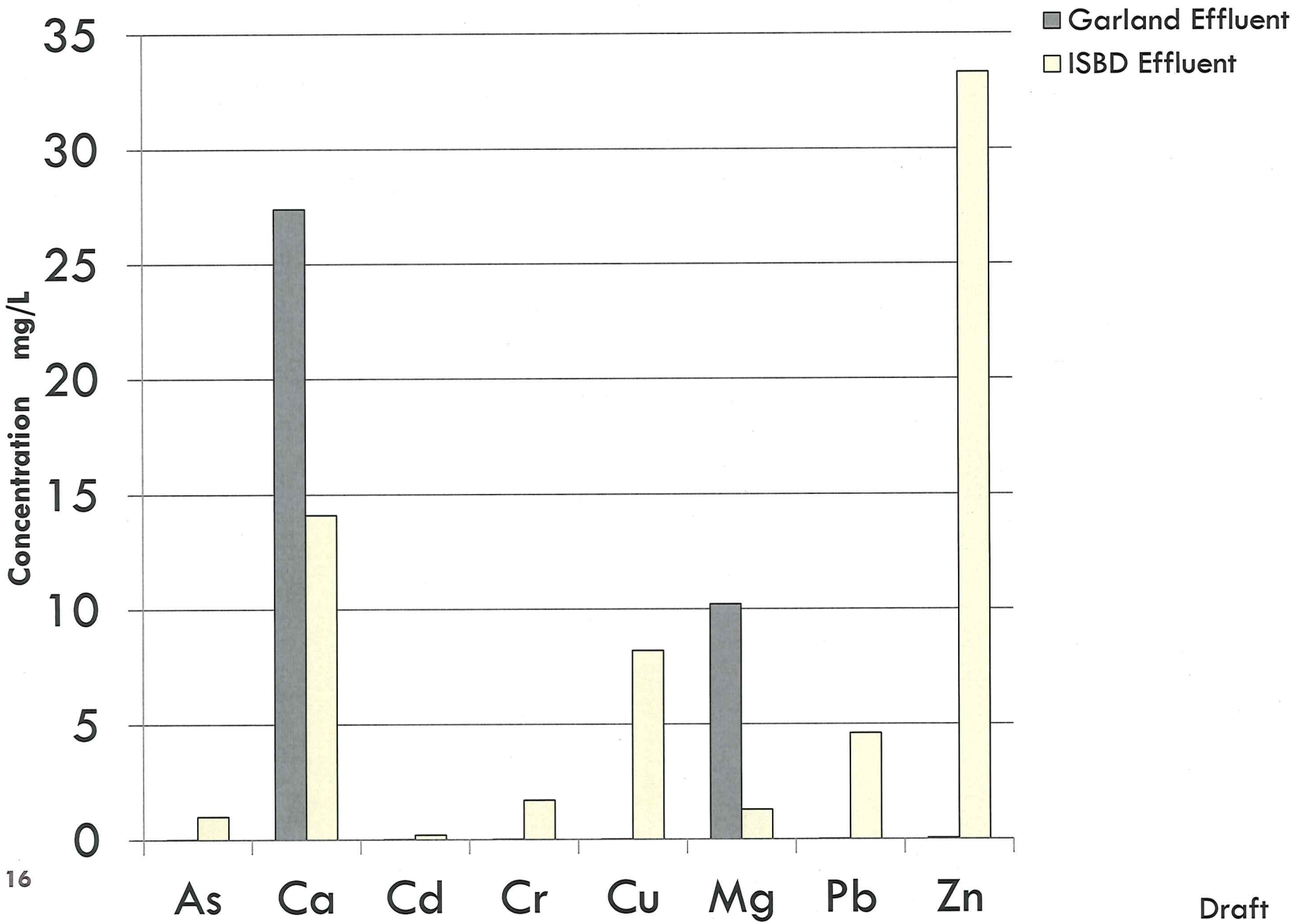
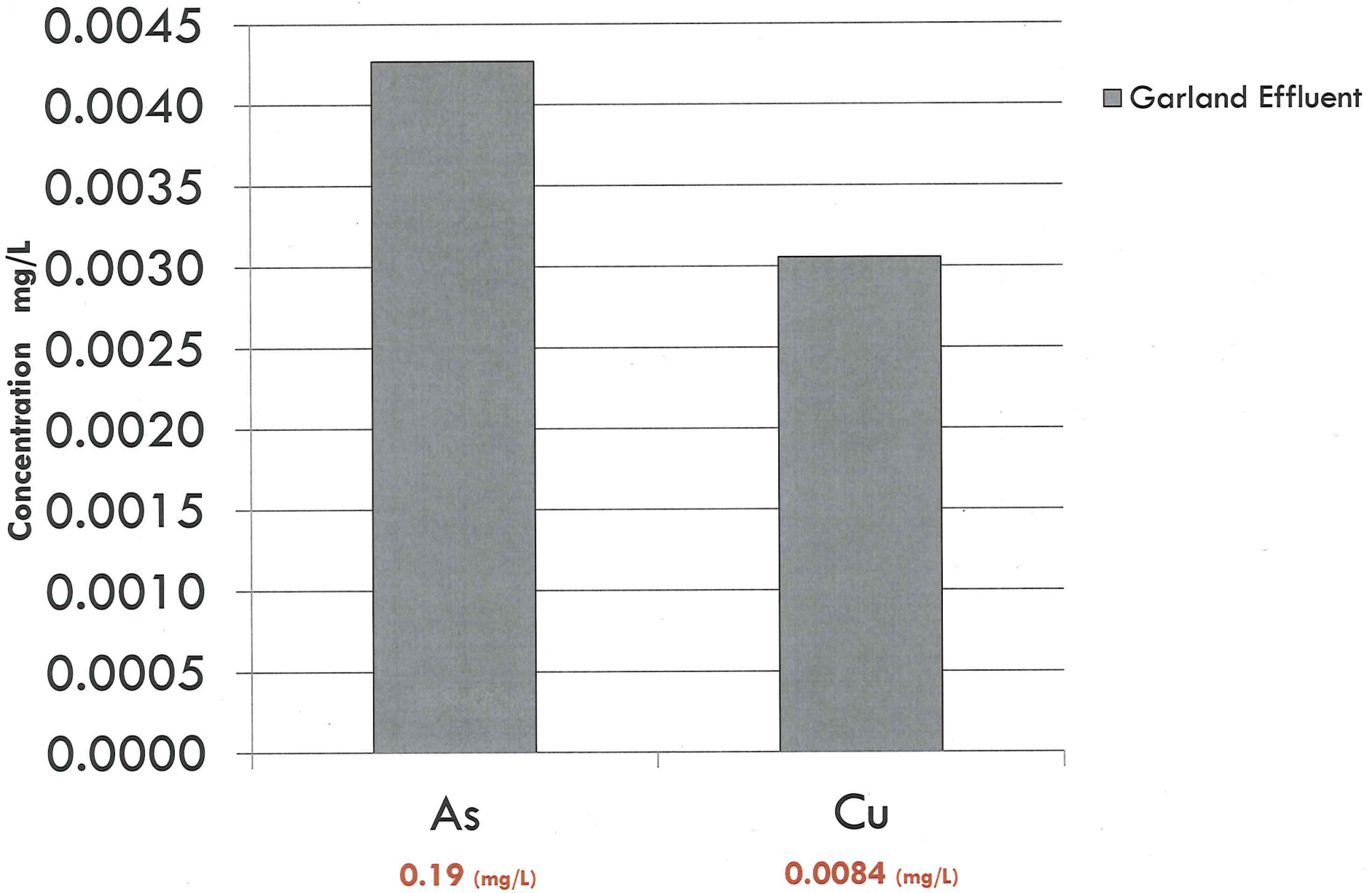

Total Metals
Garland Influent
Garland Effluent
Concentration mg/L
30
25
20
15
10
5
0
-220%
-111%
-120%
70%
52%
88%
95%
77%
As
Ca
Cd
Cr
Cu
Mg
Pb
Zn


Total Metals
(As, Cd, Cr, Cu, Pb, Zn)
Garland Influent
Garland Effluent
Concentration (mg/L)
0.250
0.200
0.150
0.100
0.050
0.000
-120%
70%
52%
88%
95%
77%
As
Cd
Cr
Cu
Pb
Zn

Total Metals vs. Database



Total Metals vs. State Criteria



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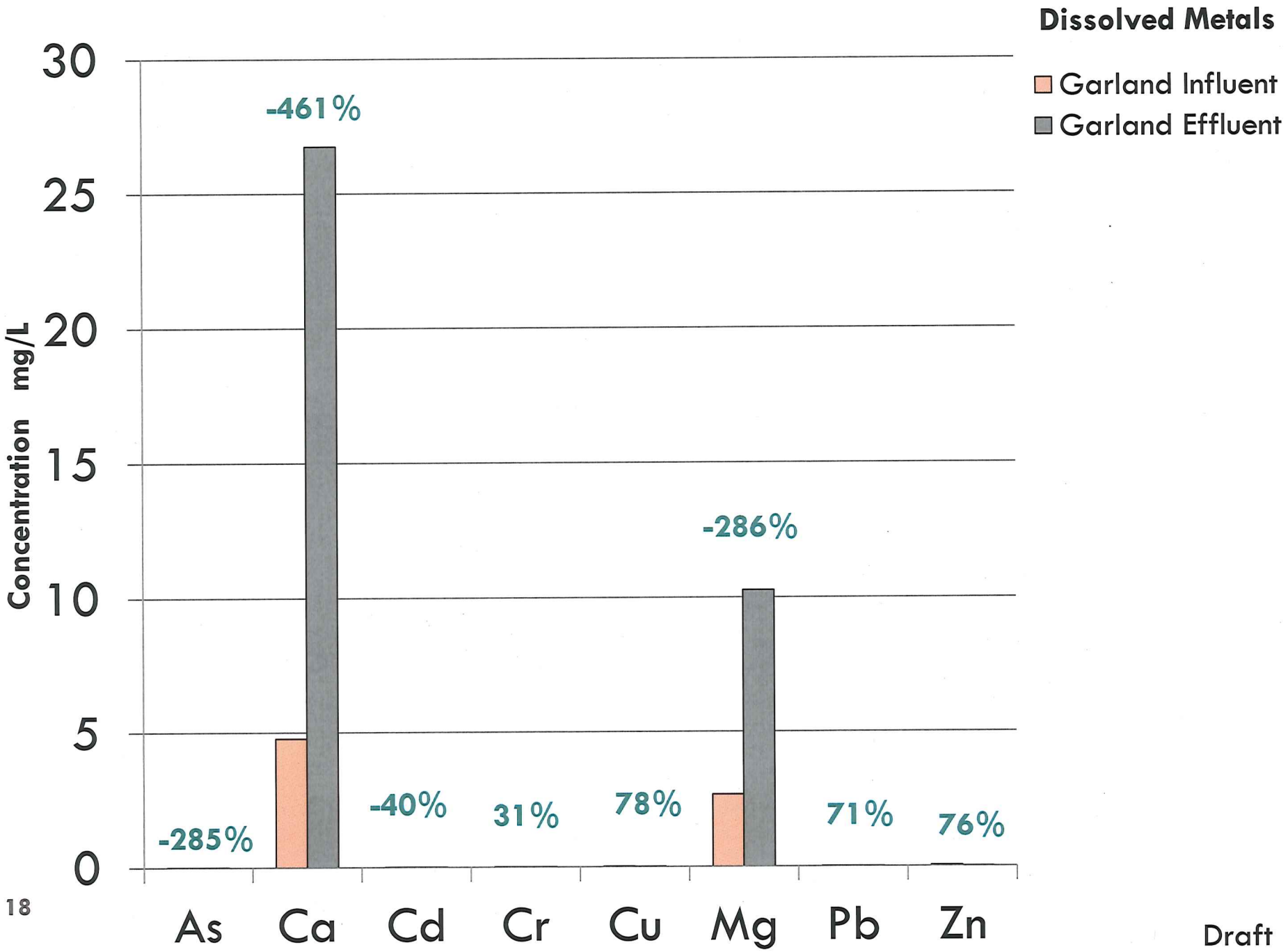
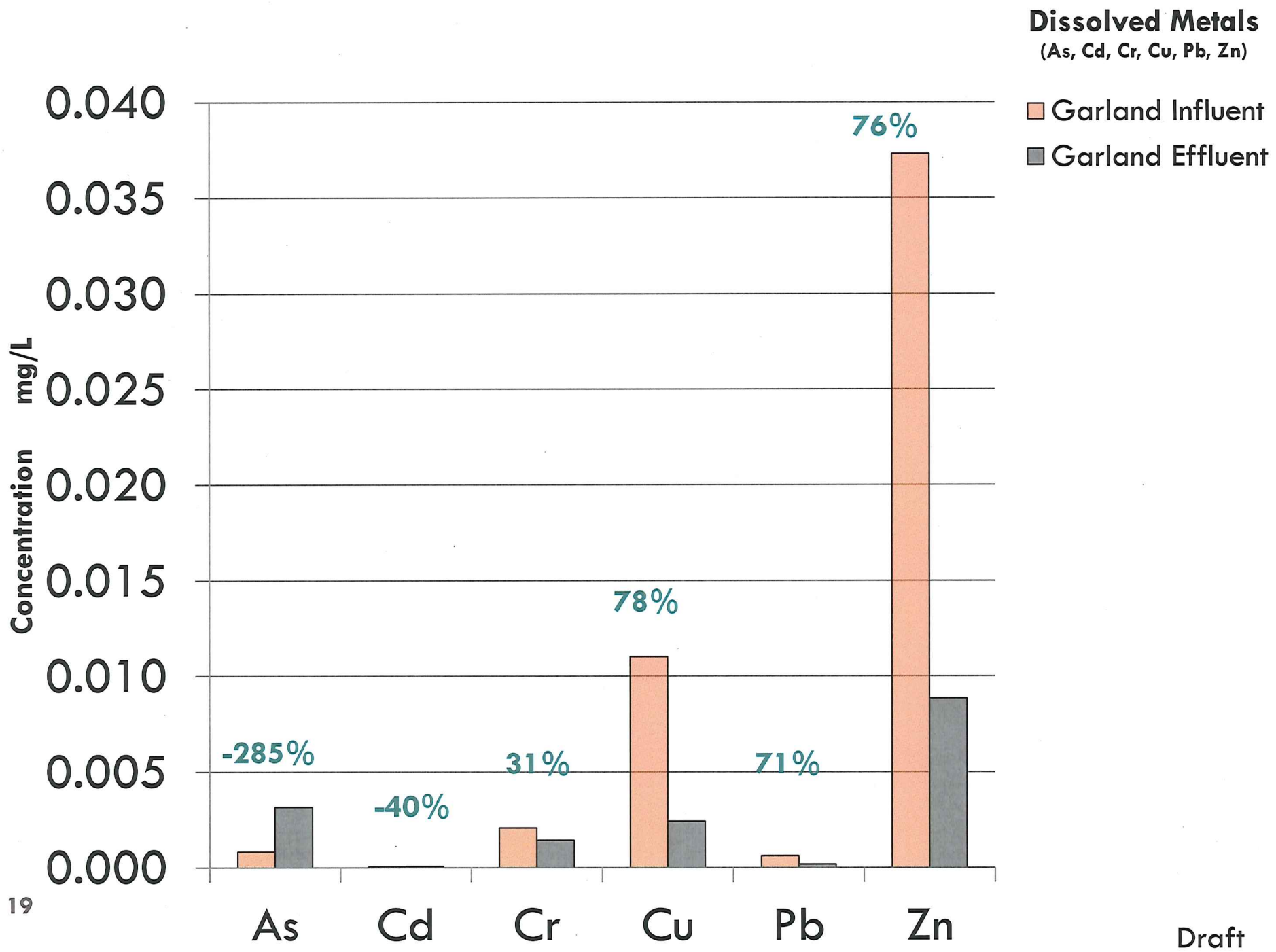
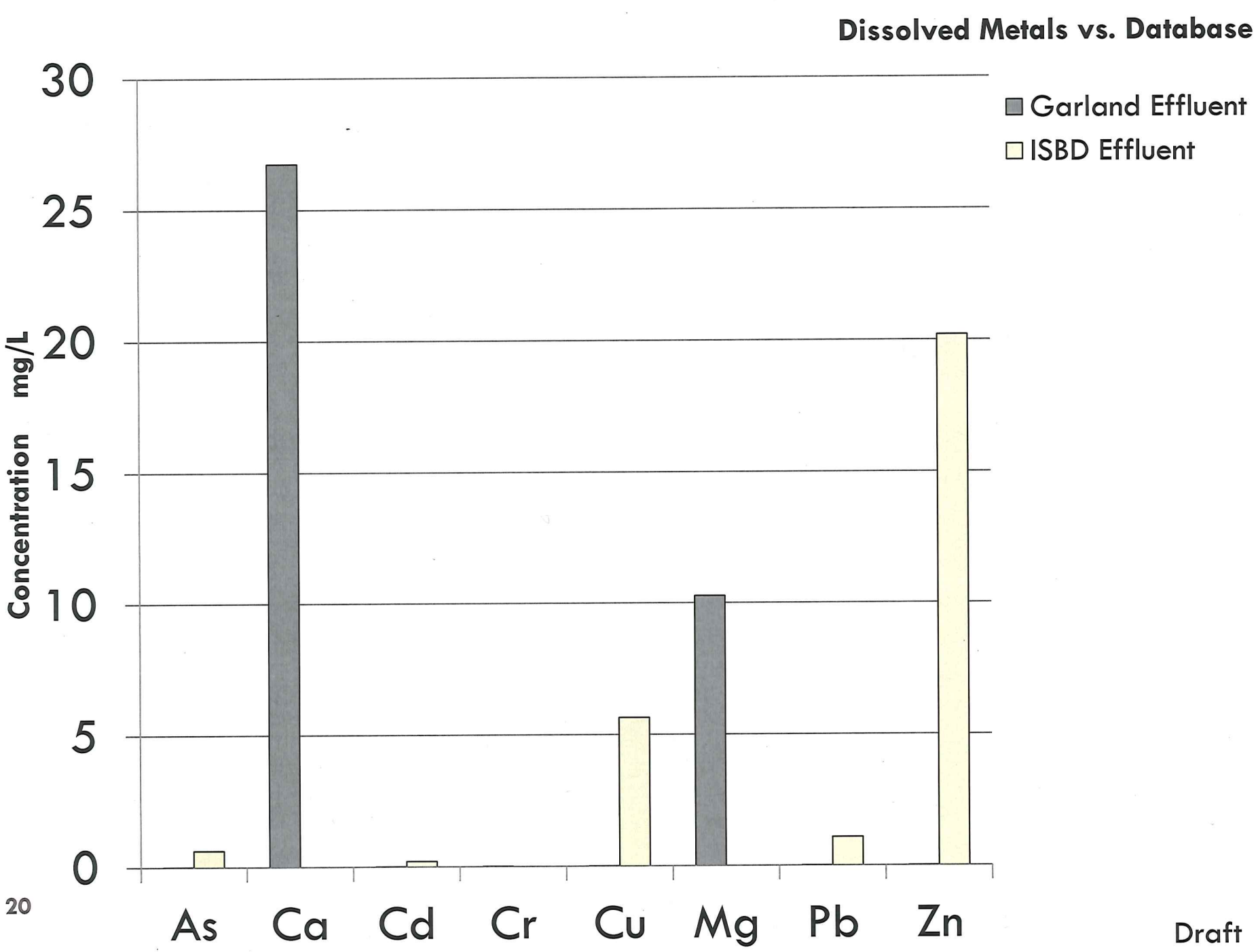
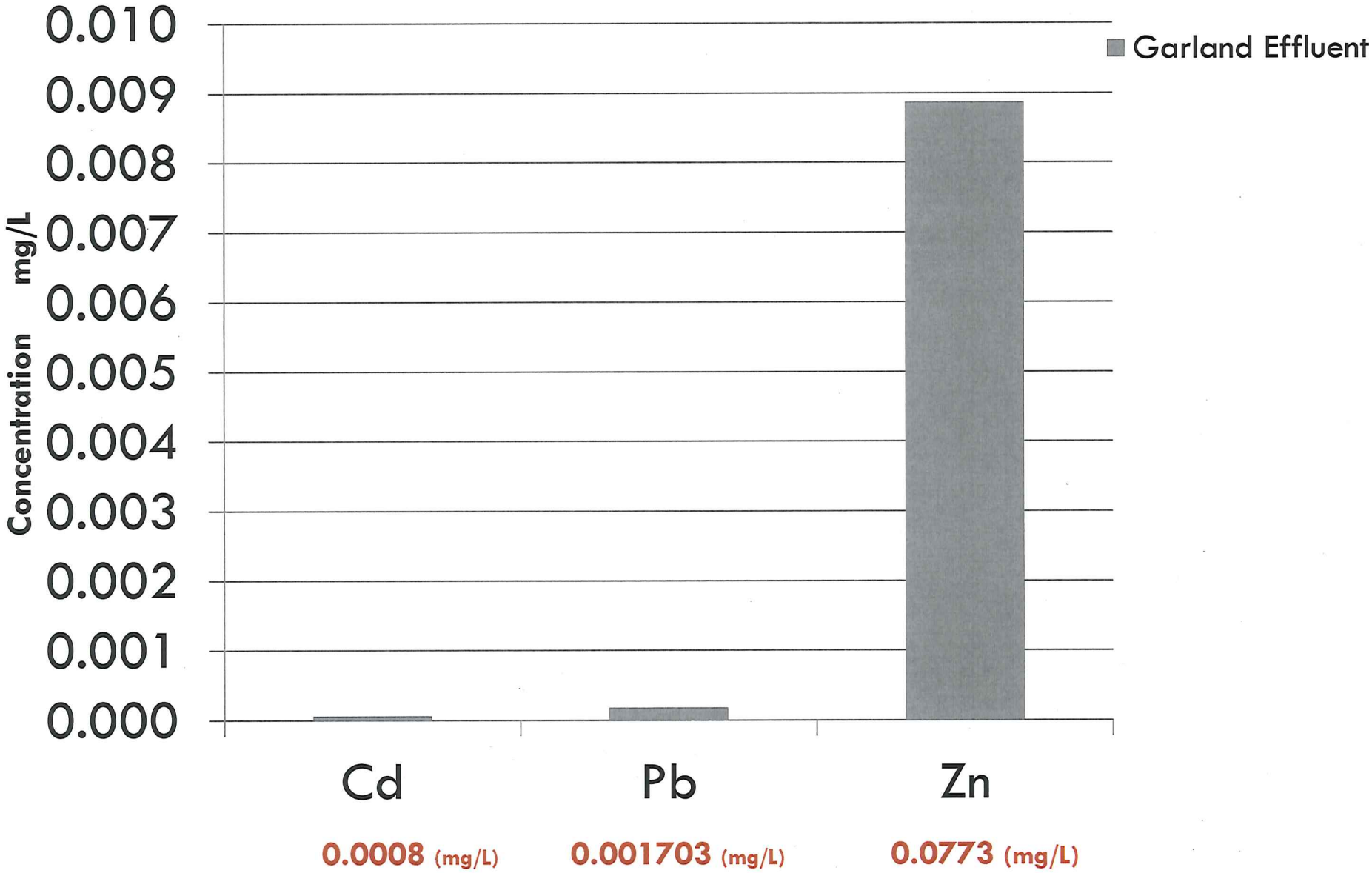

Dissolved Metals
Garland Influent
Garland Effluent
Concentration mg/L
30
25
20
15
10
5
0
-461%
-286%
-285%
-40%
31%
78%
71%
76%
As
Ca
Cd
Cr
Cu
Mg
Pb
Zn


Dissolved Metals
(As, Cd, Cr, Cu, Pb, Zn)
Garland Influent
Garland Effluent
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
Concentration mg/L
-285%
-40%
31%
78%
71%
76%
As
Cd
Cr
Cu
Pb
Zn


Dissolved Metals vs. Database
Garland Effluent
ISBD Effluent
Concentration mg/L
30
25
20
15
10
5
0
As
Ca
Cd
Cr
Cu
Mg
Pb
Zn

Dissolved Metals vs. Metals TMDL



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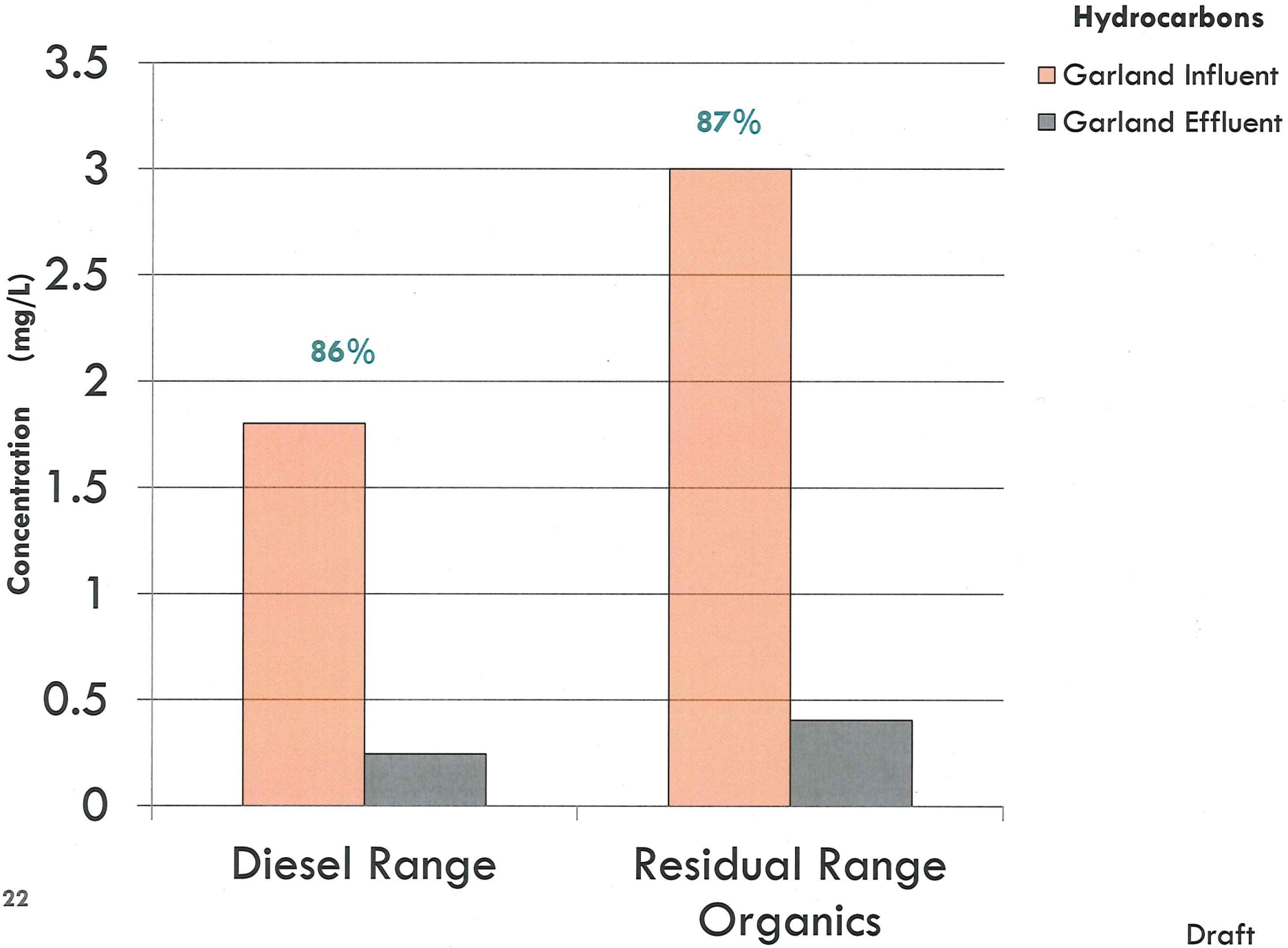
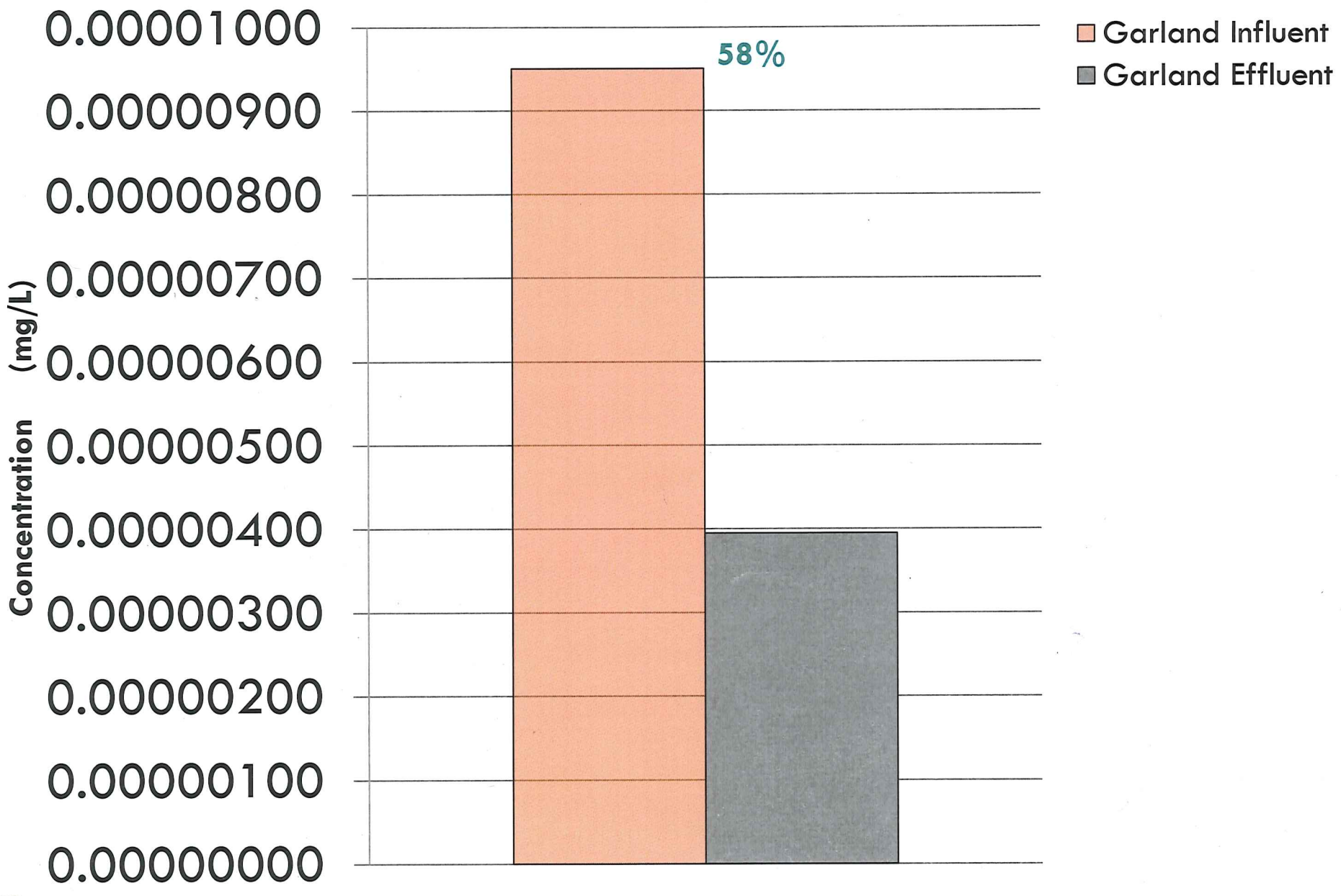

Hydrocarbons
Garland Influent
Garland Effluent
Concentration (mg/L)
3.5
3
2.5
2
1.5
1
0.5
0
86%
87%
Diesel Range
Residual Range Organics


PCB
Garland Influent
Garland Effluent
58%
Concentration (mg/L)
0.00001000
0.00000900
0.00000800
0.00000700
0.00000600
0.00000500
0.00000400
0.00000300
0.00000200
0.00000100
0.00000000

Conclusion

- Monitoring 2015-2017
- 6 events (small sample size)
  - 2015: 3 events
  - 2016: 2 events
  - 2017: 1 event
- Results
  - State criteria
    - As below
    - Cu exceeded state criteria
      - Applicable if directly discharged to surface water
  - Metals TMDL
    - Cd, Pb, Zn below
  - ISBD Effluent Grass Swale
    - TP below
    - Metals and dissolved metals below
      - As, Cd, Cr, Cu, Mg, Pb, Zn
- Ca and Mg could be leaching from biochar
- Continue monitoring
- Next steps

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Thank you!

Adrianne Pearson, Environmental Analyst
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Garland Stormwater Garden with Biochar Amended Soil (Water Year 2015-2017)

Analytical Statistical Data

		TSS	Nutrients (mg/L)				NWTPH-Dx (mg/L)		PCB (mg/L)
			TP	NO_2	NO_3	TKN	Diesel Range	Residual Range Organics	
Influent	Mean	910.200	1.412	0.060	0.903	3.560	2.280	7.000	0.00000951
	Median	132.000	0.659	0.056	1.110	2.500	1.800	3.000	0.00000951
	Standard Dev.	1782.893	1.888	0.016	0.462	2.746	1.457	9.040	0.00000000
National Stormwater Quality Database (Ver 1.1)	***Residental***								
	Median	49	0.3	0.0006		0.0015	-	-	-
	Coefficient of variation	1.8	1.1	0.0011		0.0011	-	-	-
	Commercial								
	Median	42	0.22	0.0006		0.0015	-	-	-
	Coefficient of variation	2	1.2	0.0011		0.0009	-	-	-
ISBD: Influent Grass Swale	Mean	48.5	0.187	0.0276	0.556	1.21	-	-	-
	Median	28.1	0.111	0.012	0.3	0.704	-	-	-
	Standard Dev.	63.2	0.258	0.0786	0.884	1.58	-	-	-

		Total Metals (mg/L), [Detection Limit]								Hardness
		As	Ca	Cd	Cr	Cu	Mg	Pb	Zn	
Influent	Mean	0.0038	12.8680	0.0006	0.0231	0.0749	7.0340	0.1077	0.5894	61
	Median	0.0019	8.5600	0.0002	0.0069	0.0264	4.8400	0.0176	0.2110	41
	Standard Dev.	0.0050	13.8586	0.0010	0.0239	0.1176	6.0581	0.1699	0.9467	59
National Stormwater Quality Database (Ver 1.1)	***Residental***									
	Median	0.003	-	0.0005	0.0046	0.012	-	0.012	0.073	-
	Coefficient of variation	0.0022	-	0.0034	0.0014	0.0018	-	0.0019	0.0013	-
	Commercial									
	Median	0.0023	-	0.00089	0.006	0.017	-	0.018	0.15	-
	Coefficient of variation	0.003	-	0.0027	0.0009	0.0015	-	0.0016	0.0012	-
ISBD: Influent Grass Swale	Mean	3.43	9.58	0.949	6.3	21	1.08	38.8	114	-
	Median	1.78	8.91	0.53	5.2	13	150	8.9	51	-
	Standard Dev.	3.7	3.22	1.1	6.62	24.6	3.46	154	168	-

		Dissolved Metals (mg/L)								Hardness
		As	Ca	Cd	Cr	Cu	Mg	Pb	Zn	
Influent	Mean	0.0009	5.2360	0.0000	0.0044	0.0127	3.6220	0.0006	0.0597	28
	Median	0.0008	4.7700	0.0000	0.0021	0.0110	2.6600	0.0006	0.0373	23
	Standard Dev.	0.0004	2.0080	0.0000	0.0061	0.0053	2.2900	0.0001	0.0494	14
National Stormwater Quality Database (Ver 1.1)	***Residental***									
	Median	-	-	-	-	0.007	-	0.003	0.0315	-
	Coefficient of variation	-	-	-	-	0.002	-	0.0019	0.0008	-
	Commercial									
	Median	-	-	0.0003	0.002	0.00757	-	0.005	0.059	-
	Coefficient of variation	-	-	0.00134	0.0006	0.0008	-	0.0016	0.0014	-
ISBD: Influent Grass Swale	Mean	2.08	-	0.949	-	12	-	11.5	75.7	-
	Median	0.68	-	0.53	-	6.99	-	1.4	34.4	-
	Standard Dev.	3.01	-	1.1	-	15.1	-	43.3	120	-

		TSS	Nutrients (mg/L)				NWTPH-Dx (mg/L)		PCB (mg/L)
			TP	NO_2	NO_3	TKN	Diseal Range	Residual Range Organics	
Effluent	Mean	61.167	0.205	0.037	0.844	1.255	0.390	0.850	0.00000395
	Median	6.500	0.183	0.042	0.562	0.765	0.245	0.405	0.00000395
	Standard Dev.	109.713	0.109	0.020	0.835	0.979	0.233	0.704	0.00000000
ISBD: Effluent Grass swale	Mean	31.100	0.255	0.027	0.657	0.919	-	-	-
	Median	15.000	0.191	0.015	0.390	0.645	-	-	-
	Standard Dev.	53.300	0.271	0.053	1.260	0.907	-	-	-

		Total Metals (mg/L)								Hardness
		As	Ca	Cd	Cr	Cu	Mg	Pb	Zn	
Effluent	Mean	0.0050	25.4767	0.0001	0.0040	0.0057	10.3150	0.0032	0.0532	106
	Median	0.0043	27.4000	0.0001	0.0033	0.0031	10.2100	0.0009	0.0489	110
	Standard Dev.	0.0032	15.6399	0.0000	0.0035	0.0048	5.2990	0.0041	0.0349	60
ISBD: Effluent Grass swale	Mean	1.47	20.1	0.26	2.43	10.8	2.61	9.39	45.8	-
	Median	1	14.1	0.2	1.7	8.2	1.28	4.6	33.3	-
	Standard Dev.	1.36	16.8	0.193	2.11	9.03	3.46	16.8	43.6	-

		Dissolved Metals (mg/L)								Hardness
		As	Ca	Cd	Cr	Cu	Mg	Pb	Zn	
Effluent	Mean	0.0043	24.9583	0.0055	0.0018	0.0031	10.1783	0.0002	0.0140	104
	Median	0.0032	26.7500	0.0001	0.0014	0.0024	10.2750	0.0002	0.0089	109
	Standard Dev.	0.0036	16.1800	0.0135	0.0015	0.0018	5.5948	0.0002	0.0158	62
ISBD: Effluent Grass swale	Mean	1.17	-	0.26	-	7.55	-	4.28	26.9	-
	Median	0.61	-	0.2	-	5.64	-	1.07	20.2	-
	Standard Dev.	1.37	-	0.193	-	6.1	-	7.49	29.1	-