Standards and guidance values for PFAS in groundwater and drinking water.

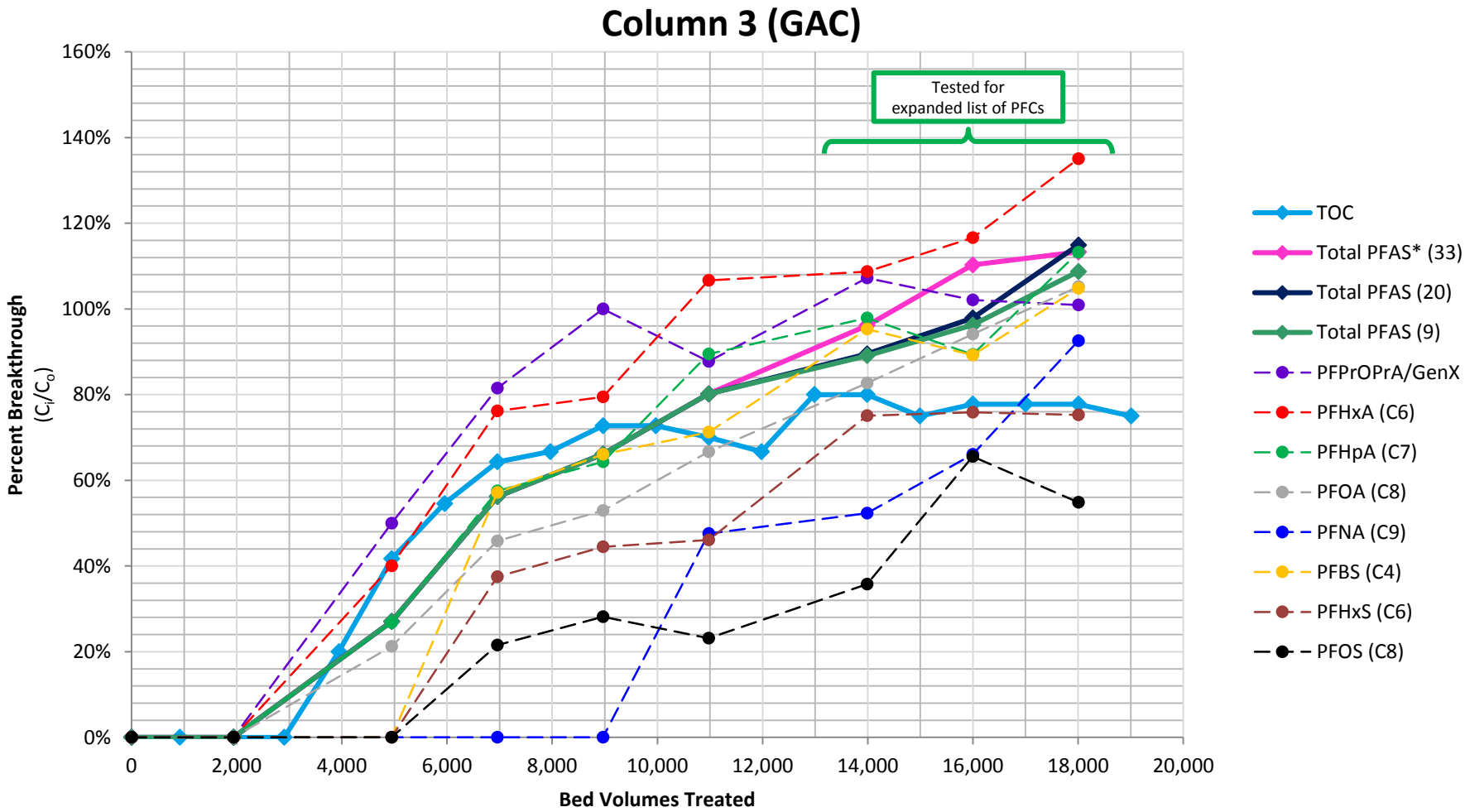
	State/Agency	Agency/Dept.	Year	Standard / Guidance	Type	Promulgated Rule	Notes	PFAS Analyte Concentration (µg/L)												
								PFOA	PFOS	PFNA	PFBA	PFBS	PFHxS	PFHxA	PFPeA	PFHpA	PFOSA	PFDA	6:2 FTS	Gen-X
UNITED STATES	USEPA	Office of Water	2016	HA	DW	No	a	0.07	0.07											
	Connecticut	DPH	2016	AL	GW	No	b	0.07	0.07	0.07				0.07		0.07				
	Colorado (CO)	DPHE	2017	HA	DW	No		0.07	0.07							0.07				
	Minnesota (MN)	MDH	2017	Short-term HBV	GW	No	c	0.035	0.027		7									
			2017	Subchronic HBV	GW	No	c	0.035	0.027		7	9(P)								
			2017	Chronic HBV	GW	No	c	0.035	0.027		7	7(P)								
	New Jersey (NJ)	DEP	2015	ISGWQC	GW	Yes				0.010										
		DEP	2017	GWQS	GW	Pending				0.010										
		DWQI	2017	MCL	DW	Pending				0.013										
		DWQI	2017	MCL	DW	Yes		0.014												
	North Carolina	DENR	2006	IMAC	GW	Yes		2												
		NCDHHS	2017	Health goal	DW	No														0.14
	Vermont (VT)	DEC/DOH	2016	PGWES	GW/DW	Yes	a	0.02	0.02											
INTERNATIONAL	Denmark	EPA	2015	Health-based	DW/GW		d	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
	Netherlands	RIWT	2011	Health-based	DW				0.53											
			2011	Administrative	DW				0.0053											
	Sweden	NFA	2014	Health-based	DW				0.09											
			2014	Administrative	DW		e	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		0.09	0.09	

Abbreviations:
DW = drinking water
GW = groundwater
AL = private well action level
HA = lifetime health advisory
HBV = health-based value
ISGWQC = interim specific groundwater quality criterion
GWQS = groundwater quality standard
MCL = maximum contaminant level
IMAC = interim maximum allowable standard
PGWES = primary groundwater enforcement standard

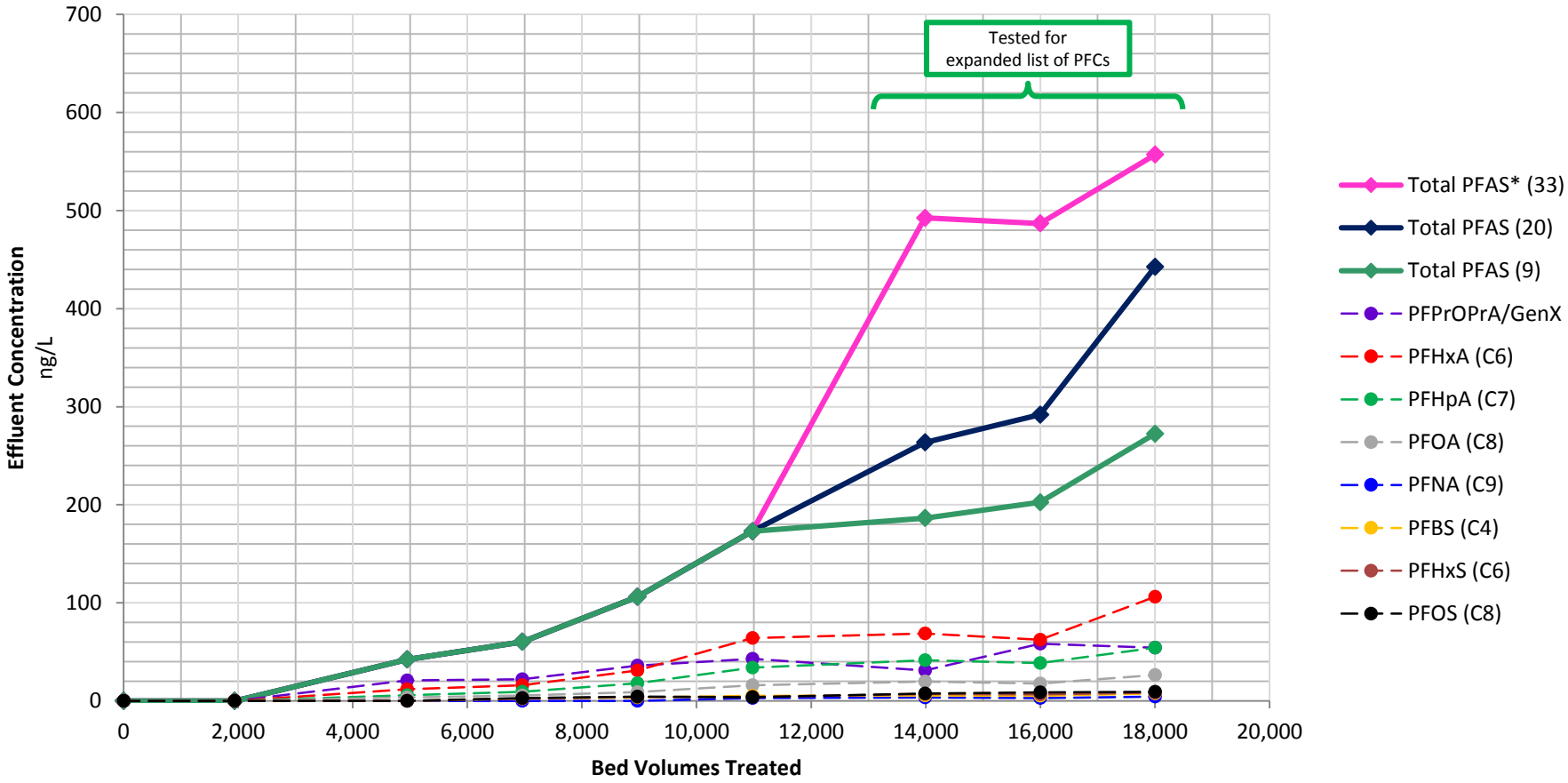
Notes:
a. Applies to the individual results for PFOA and PFOS, as well as the sum of PFOA + PFOS.
b. Applies to the individual results for PFOA, PFOS, PFHpA, PFNA, and PFHxS as well as the sum of concentrations of these 5 PFAS.
c. HBVs just published May 2017 and full promulgation of HRLS anticipated in 2018.
d. Applies to the individual results for PFOA, PFOS, PFNA, PFBA, PFBS, PFHxS, PFHxA, PFPeA, PFHpA, PFOSA, PFDA, AND 6:2 FTS as well as the sum of concentrations of these 12 PFAS.
e. Administrative value is for the sum of eleven PFAS found in drinking water: PFBS, PFHxS, PFOS, 6:2 FTS, PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, and PFDA. PFOS is considered to be the most toxic. Water can still be used at up to 0.09 µg/L.

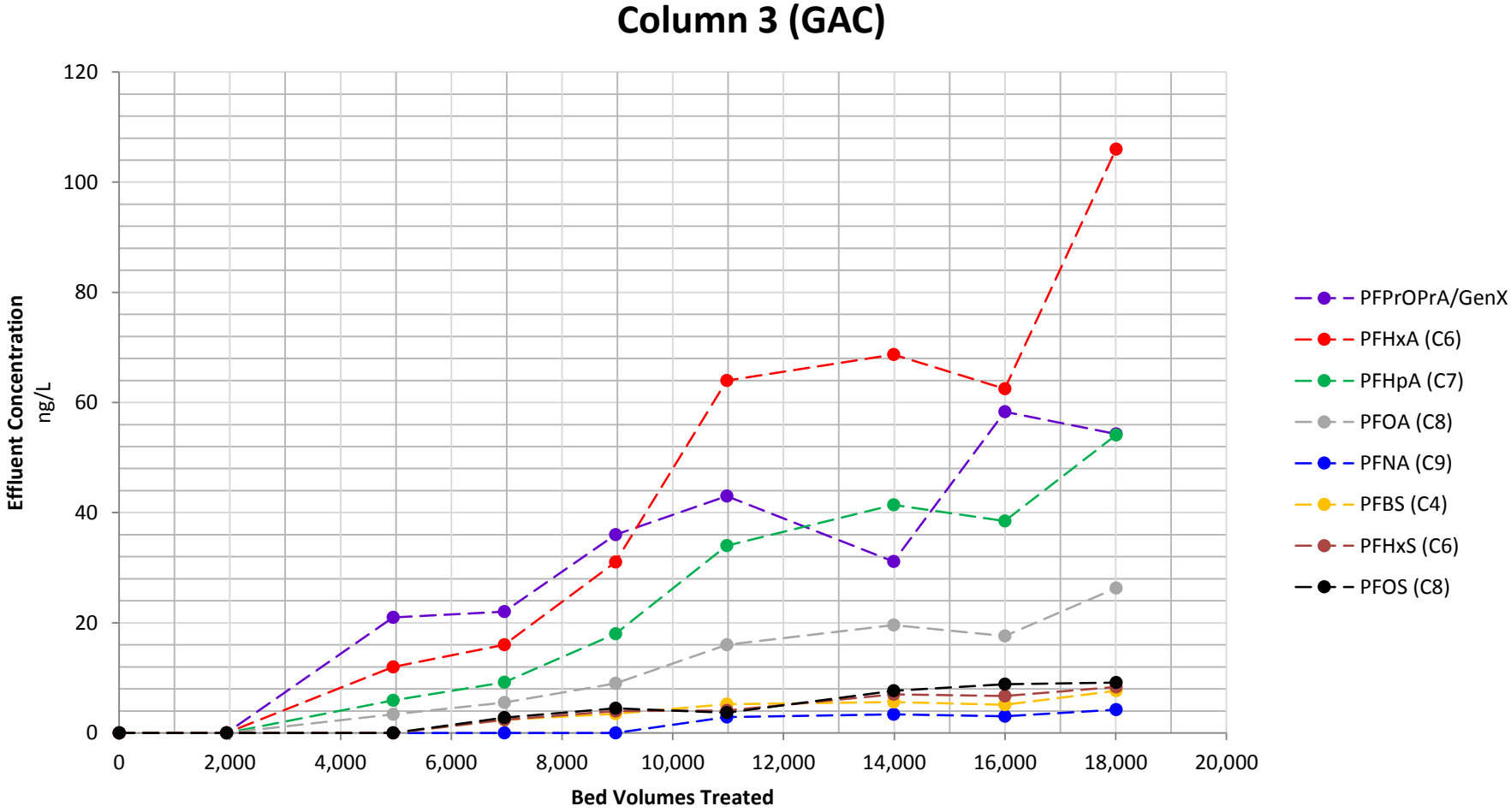
Summary of Planning Level Cost Opinions

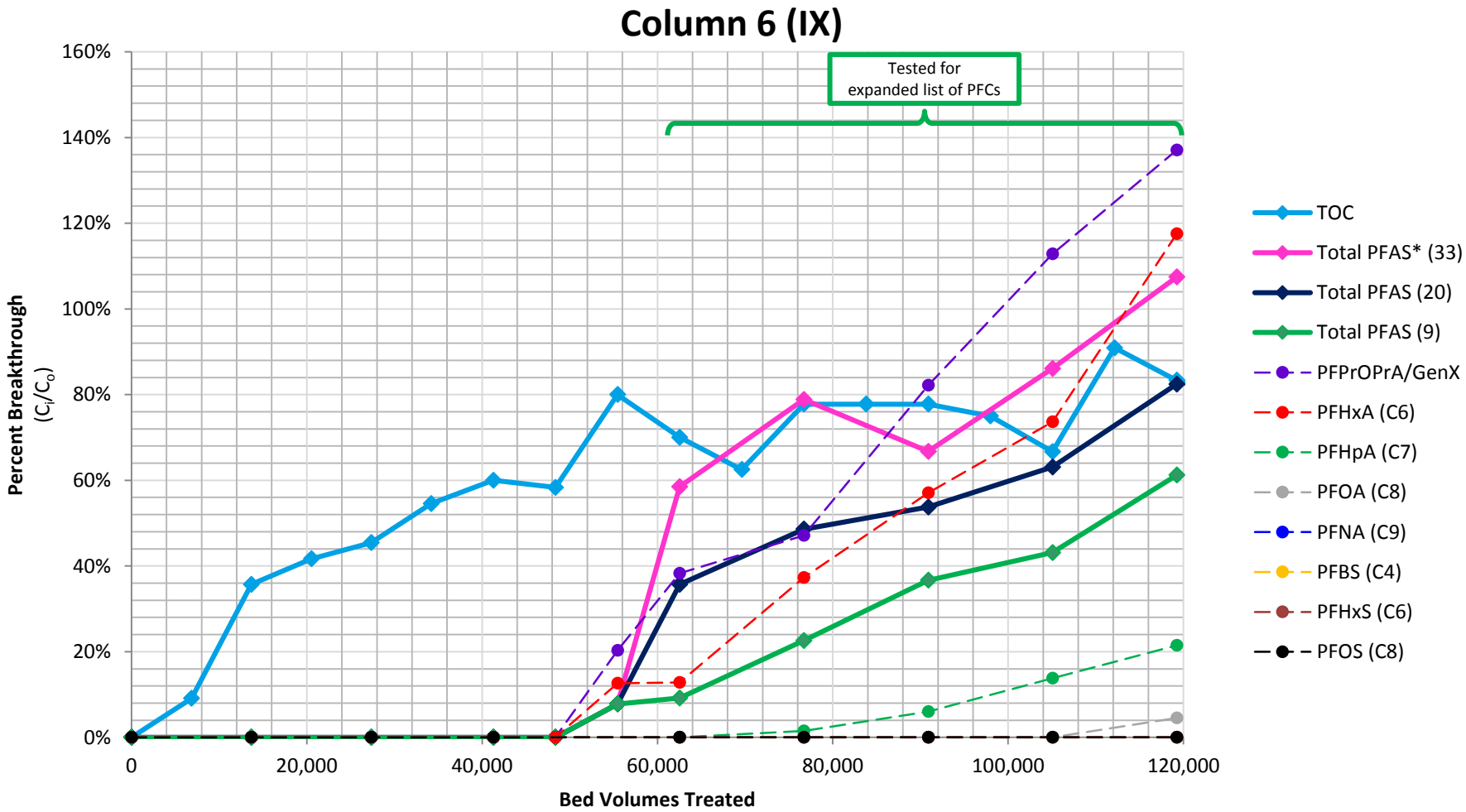
	GAC Contactors Post Filtration	Deep Bed GAC Contactors Post Filtration	Ion Exchange Vessels Post Filtration	RO/NF Post Filtration
Initial Cost	$29M	$36M	$33M	$118M
Annual Operating Cost	$3.3M – $6.3M	$2.9M – $3.1M	$1.4M – $2.3M	$3.3M
Present Worth of Annual Costs	$45M – $86M	$39M – $42M	$19M – $31M	$45M
Total Present Worth	$74M – $115M	$75M – $78M	$52M – $64M	$163M


Column 3 (GAC)
Tested for expanded list of PFCs
Percent Breakthrough (C_i/C_o)
160%
140%
120%
100%
80%
60%
40%
20%
0%
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
Bed Volumes Treated
TOC
Total PFAS* (33)
Total PFAS (20)
Total PFAS (9)
PFPrOPrA/GenX
PFHxA (C6)
PFHpA (C7)
PFOA (C8)
PFNA (C9)
PFBS (C4)
PFHxS (C6)
PFOS (C8)

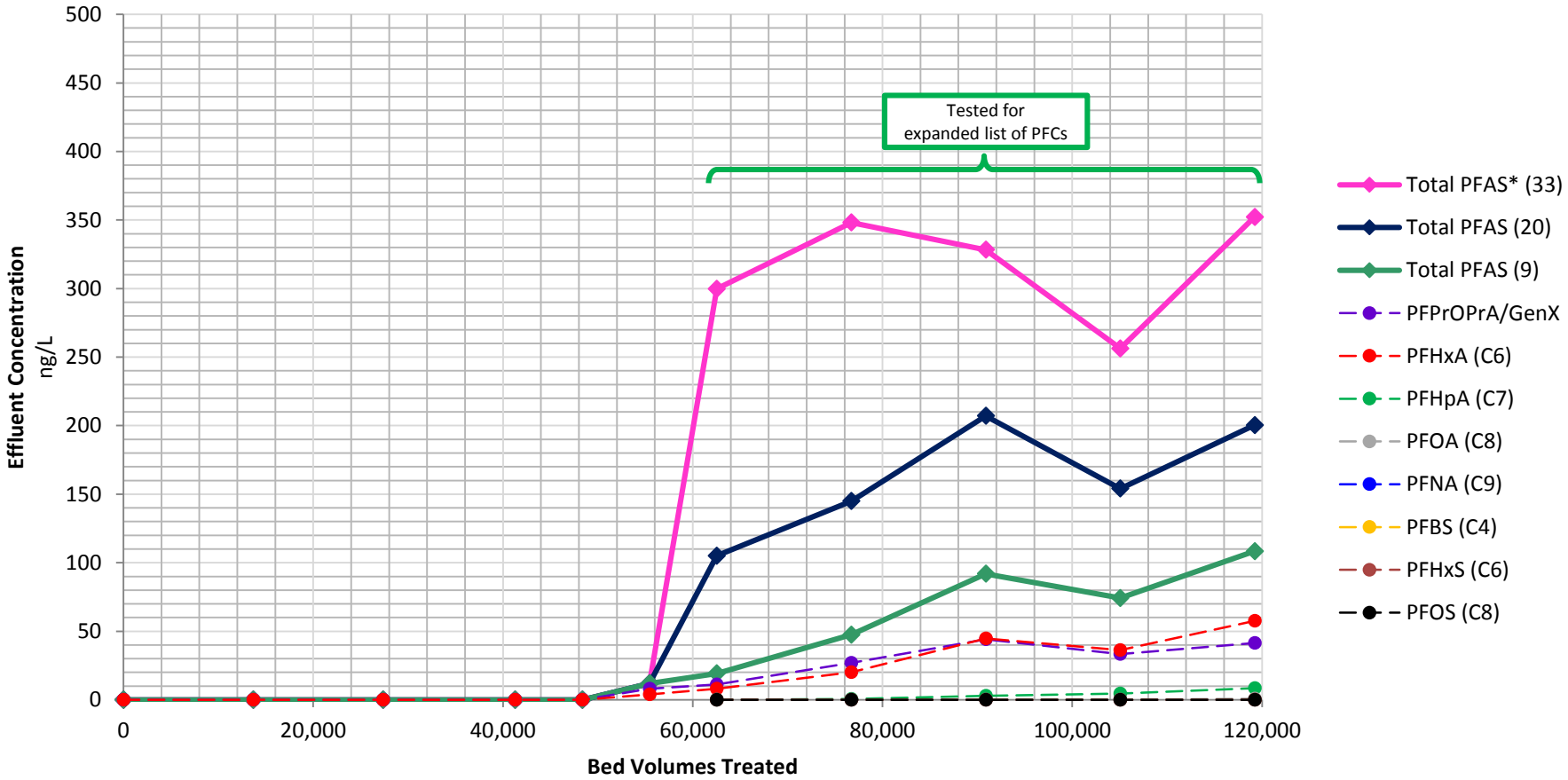
Column 3 (GAC)


Tested for
expanded list of PFCs
Effluent Concentration
ng/L
700
600
500
400
300
200
100
0
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
Bed Volumes Treated
Total PFAS* (33)
Total PFAS (20)
Total PFAS (9)
PFPrOPrA/GenX
PFHxA (C6)
PFHpA (C7)
PFOA (C8)
PFNA (C9)
PFBS (C4)
PFHxS (C6)
PFOS (C8)

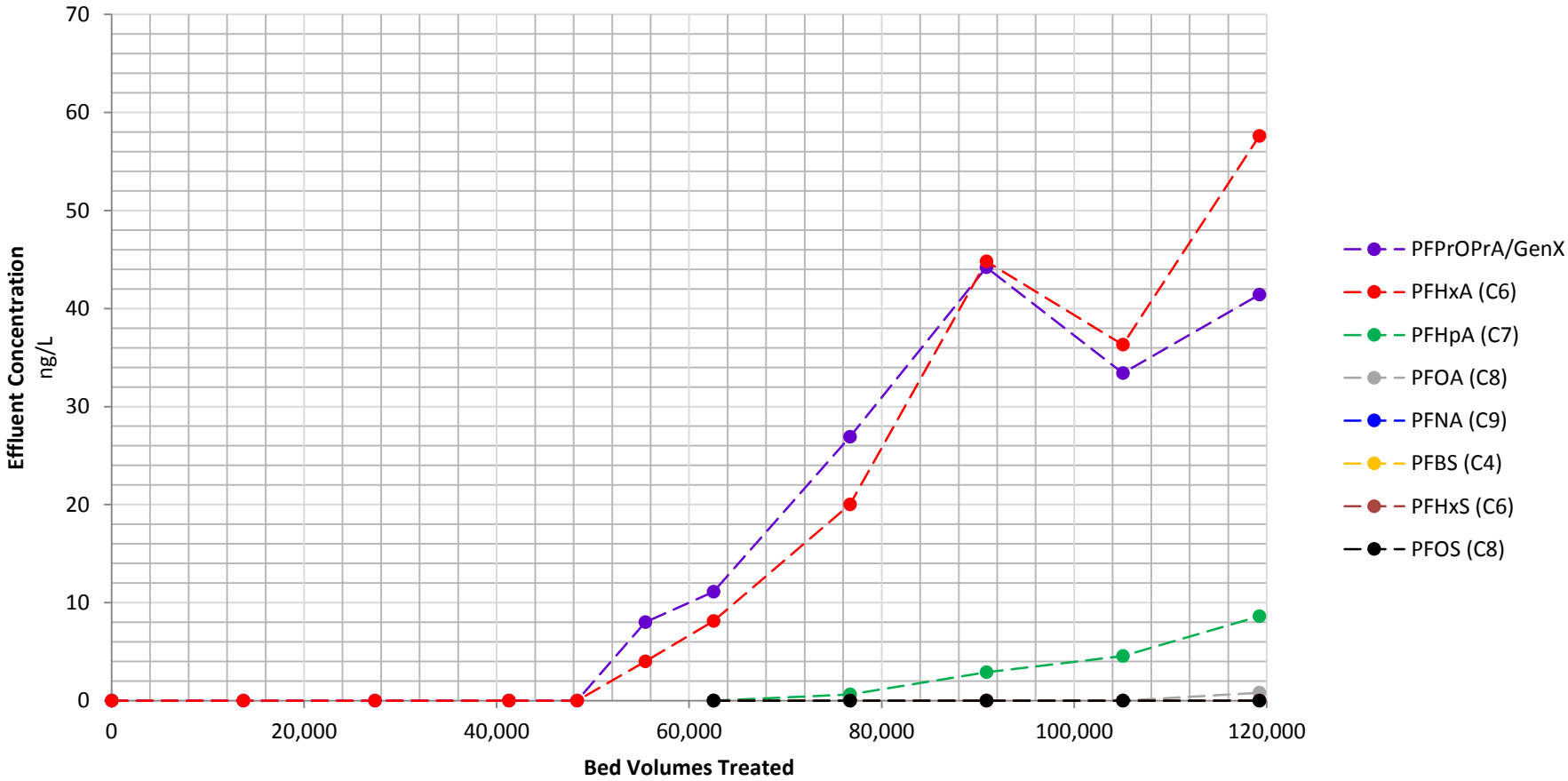

Column 3 (GAC)
Effluent Concentration
ng/L
120
100
80
60
40
20
0
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
Bed Volumes Treated
PFPrOPrA/GenX
PFHxA (C6)
PFHpA (C7)
PFOA (C8)
PFNA (C9)
PFBS (C4)
PFHxS (C6)
PFOS (C8)


Column 6 (IX)
Tested for expanded list of PFCs
Percent Breakthrough (C_i/C_o)
160%
140%
120%
100%
80%
60%
40%
20%
0%
0
20,000
40,000
60,000
80,000
100,000
120,000
Bed Volumes Treated
TOC
Total PFAS* (33)
Total PFAS (20)
Total PFAS (9)
PFPrOPrA/GenX
PFHxA (C6)
PFHpA (C7)
PFOA (C8)
PFNA (C9)
PFBS (C4)
PFHxS (C6)
PFOS (C8)

Column 6 (IX)


Effluent Concentration
ng/L
500
450
400
350
300
250
200
150
100
50
0
0
20,000
40,000
60,000
80,000
100,000
120,000
Bed Volumes Treated
Tested for
expanded list of PFCs
Total PFAS* (33)
Total PFAS (20)
Total PFAS (9)
PFPrOPrA/GenX
PFHxA (C6)
PFHpA (C7)
PFOA (C8)
PFNA (C9)
PFBS (C4)
PFHxS (C6)
PFOS (C8)

Column 6 (IX)


Effluent Concentration
ng/L
70
60
50
40
30
20
10
0
0
20,000
40,000
60,000
80,000
100,000
120,000
Bed Volumes Treated
PFPrOPrA/GenX
PFHxA (C6)
PFHpA (C7)
PFOA (C8)
PFNA (C9)
PFBS (C4)
PFHxS (C6)
PFOS (C8)