




Lake Macquarie coal-ash impacts




September 2022

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CURRENT
POWER STATIONS



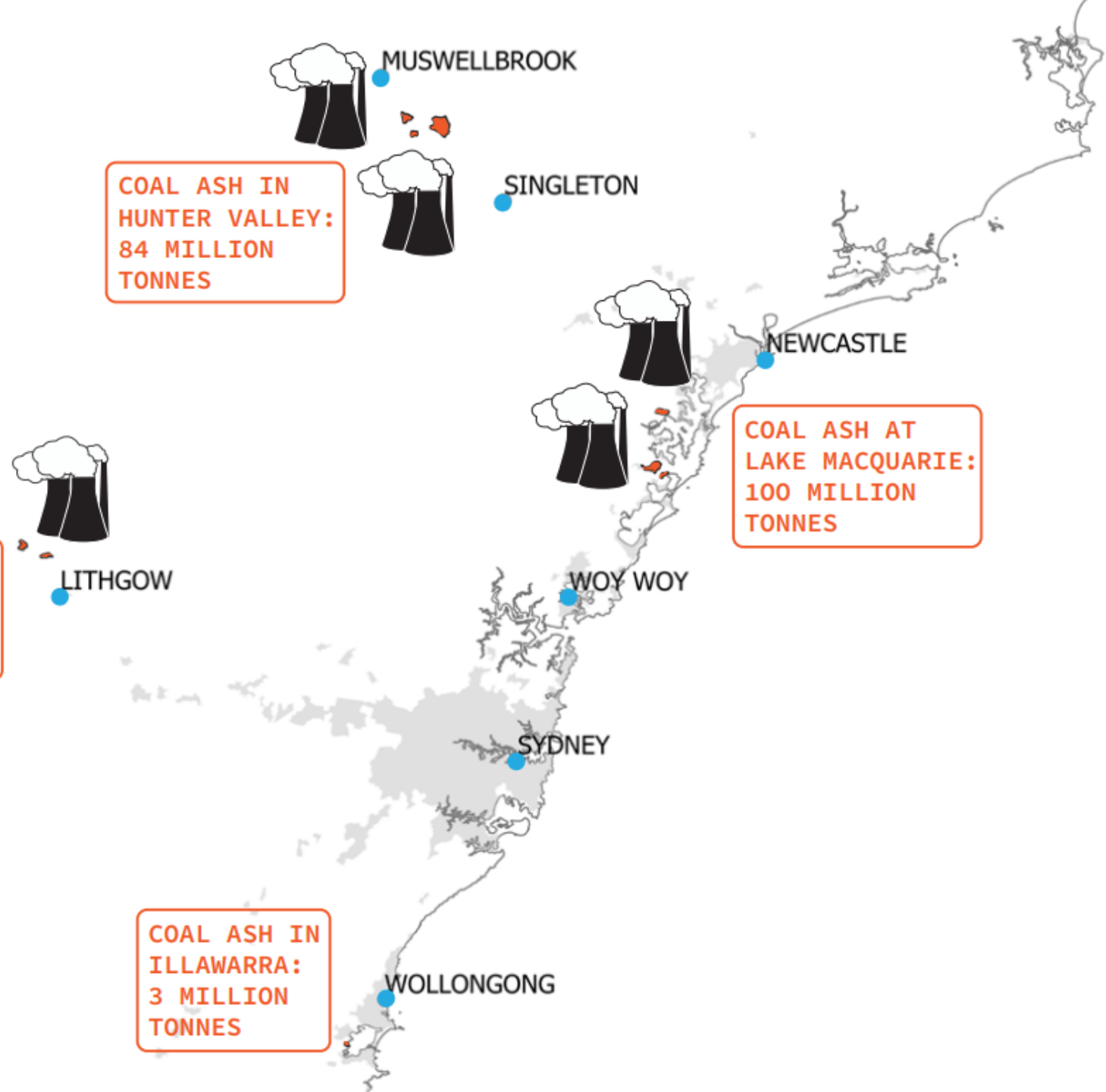
COAL ASH DAMS

COAL ASH
AT LITHGOW:
28 MILLION
TONNES

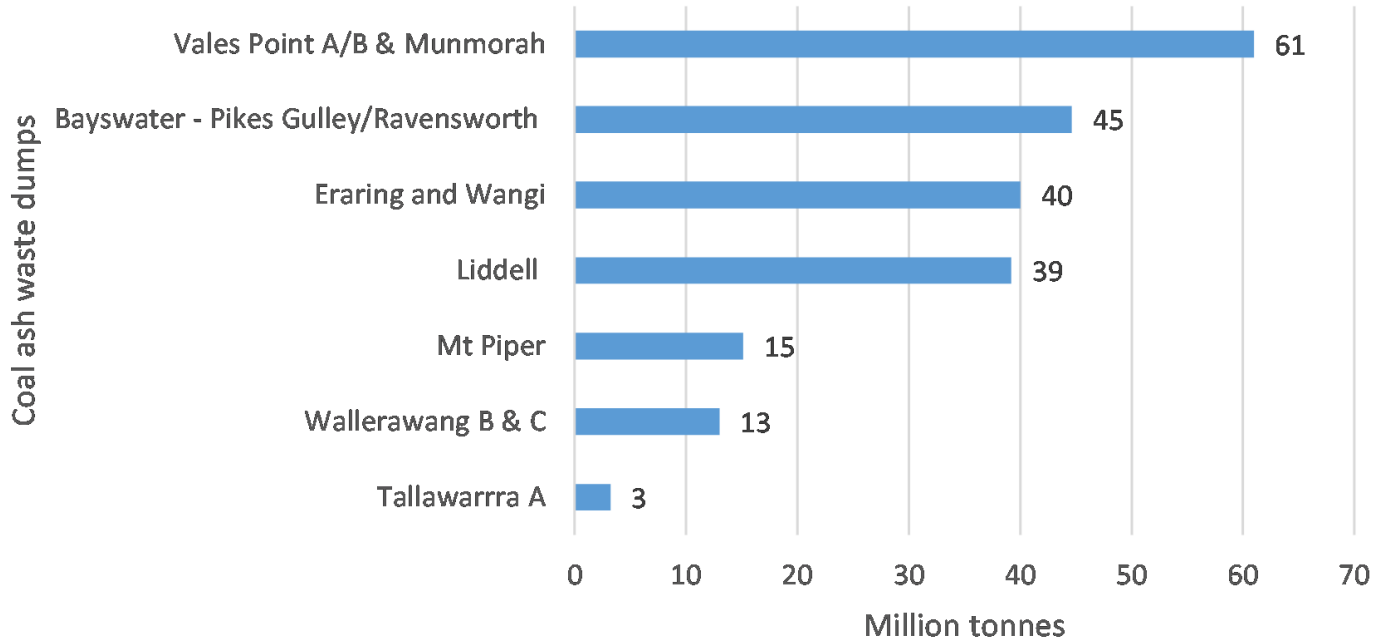
COAL ASH IN
HUNTER VALLEY:
84 MILLION
TONNES

COAL ASH IN
ILLAWARRA:
3 MILLION
TONNES

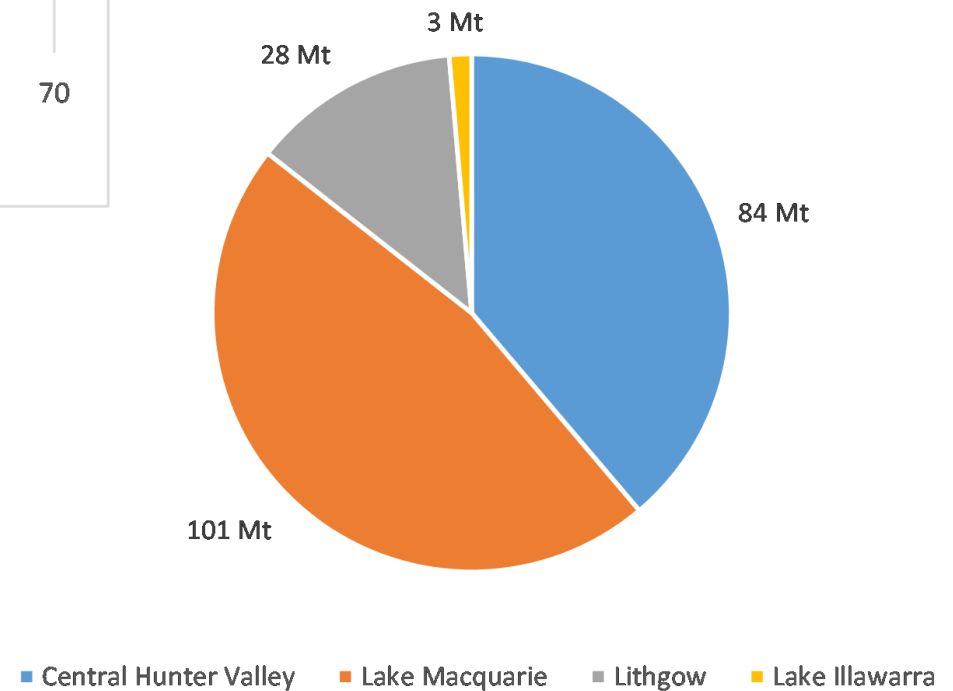
COAL ASH AT
LAKE MACQUARIE:
100 MILLION
TONNES



Accumulated coal ash waste



Regional accumulated coal ash waste



Vales Point Environmental Site Assessment

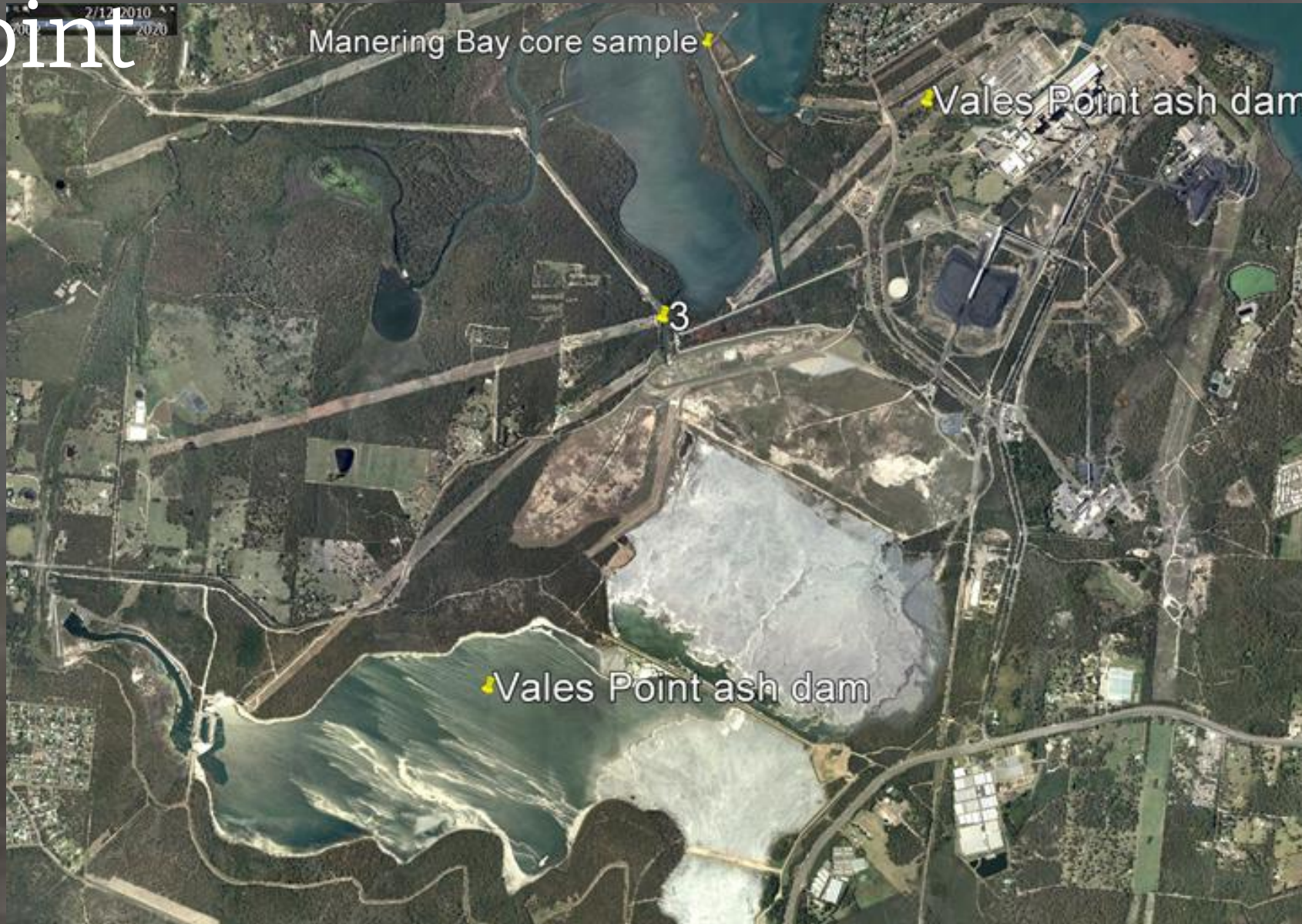
- Acid Sulfate Soil conditions.
- Long term ash disposal, a known sources of metal contaminants, within the Ash Dam, may have contributed to metal impacts in the underlying groundwater.
- The ash dam appears to be a primary source of arsenic and selenium to groundwater and a secondary source of cobalt, copper, lead, manganese, nickel and zinc.

Vales Point Environmental Site Assessment

Maximum concentrations down-gradient of ash dam;

- Arsenic -184 ppm
- Cobalt -169 ppm
- Copper 596 ppm
- Lead 231 ppm
- Manganese 17,300 ppm
- Nickel 133 ppm
- Selenium 276 ppm
- Zinc 1,200 ppm.

HCEC sediment and water testing: Vales Point



HCEC water testing: Vales Point

Sample location				Vales Point ash dam seepage		ANZECC (2000)				ANZECC (2000) Recreational Use	NHMRC Drinking Water Guidelines
						Marine trigger value					
Sample ID				3wt	3wd	99%	95%	90%	80%		
Field Prep.				TOTAL	DISOLVED						
Type of sample				Water	Water						
Date Sampled				23/5/20	23/5/20						
pH.				4.5		7-8.5					
EC		uS/CM									
Metal/metalloid		Units	PQL								
Aluminium	Al	µg/L	10	81000	75000					200	
Arsenic	As	µg/L	1	43	43					50	10
Boron	Bo	µg/L	20	100	100					1,000	4,000
Barium	Ba	µg/L	1	230	200					1,000	
Cadmium	Cd	µg/L	0.1	0.1	0.2	0.7	0.7	14	36	5	2
Cobalt	Co	µg/L	1	59	60	0.005	1	14	150		
Chromium	Cr	µg/L	1							50	50
Copper	Cu	µg/L	1			0.3	1.3	3	8	1,000	2,000
Iron	Fe	µg/L	10	1700	1700					300	
Lead	Pb	µg/L	1	2	2	2.2	4.4	20	85	50	10
Manganese	Mn	µg/L	5	8600	8600					100	500
Molybdenum	Mo	µg/L	1								
Mercury	Hg	µg/L	0.05			0.1	0.4	0.7	1.4	1	1
Nickel	Ni	µg/L	1	36	36	7	7	200	560	100	20
Selenium	Se	µg/L	1							10	
Thallium	Th	µg/L	1								
Vanadium	V	µg/L	1			50	100	160	280		
Zinc	Zn	µg/L	1	130	130	7	15	23	43	5,000	

HCEC sediment testing: Vales Point

Vales Point A 1962 when metals increase in sediment.

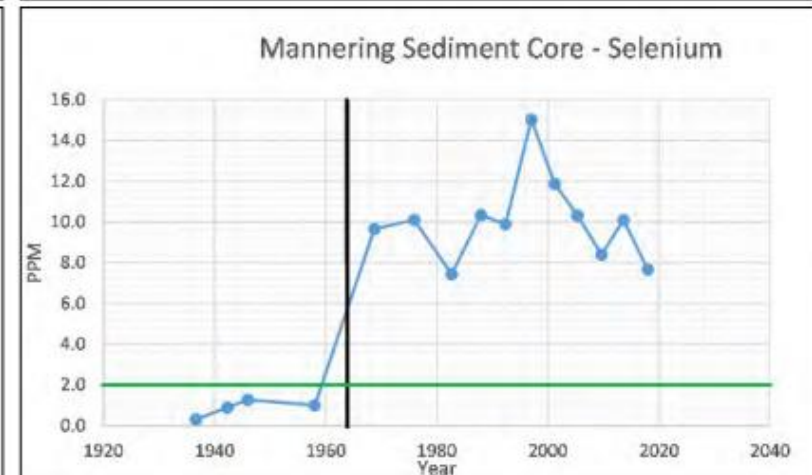
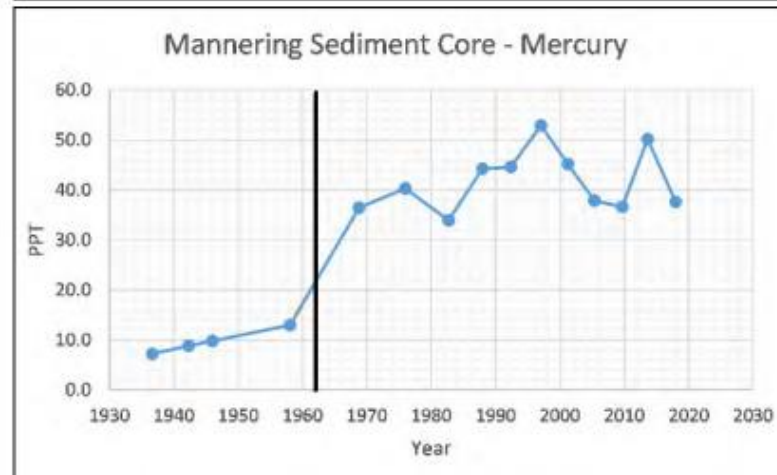
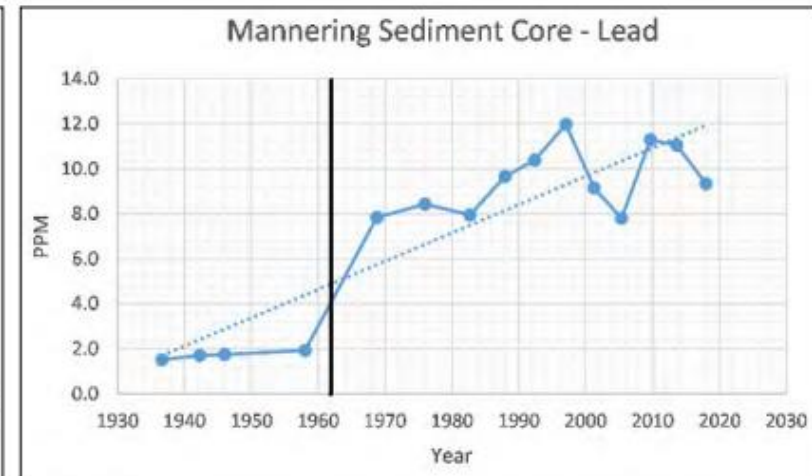
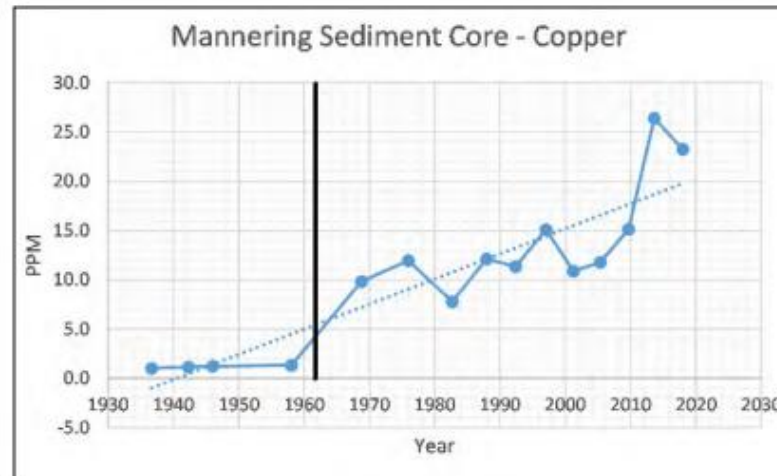
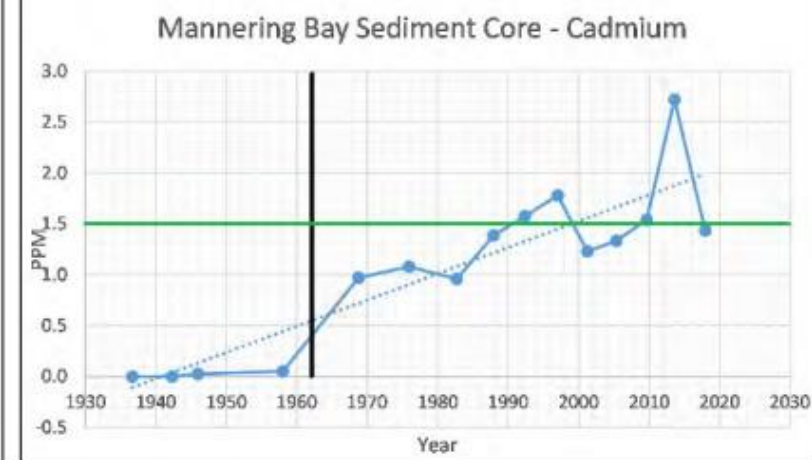
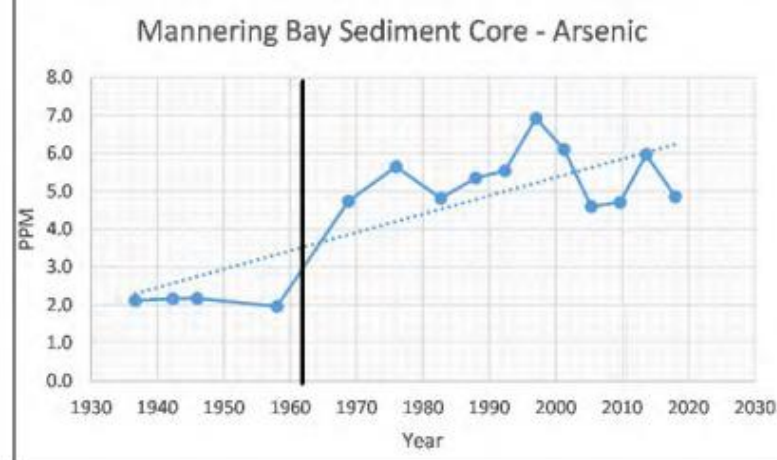
Cadmium x 15

Copper x 10

Selenium x 8

Lead and mercury x 4

Arsenic x 2.5



Eraring Environmental Site Assessment

- Selenium in offsite sediments down-gradient of the ash dam represent a potential risk to the environment (ecological exposure and ingestion of fish).
- Duty to report exists for exceedances of arsenic, nickel, selenium, benzolalpyrene and vinyl chloride, cadmium, copper, lead, nickel, selenium, and zinc.
- May be effected by Acid Sulfate Soils.

Eraring Environmental Site Assessment

Maximum concentrations down-gradient of ash dam;

- Arsenic 73 ppm
- Cadmium 2.8 ppm
- Copper 100 ppm
- Nickel 254 ppm
- Selenium 205 ppm
- Zinc 1,050 ppm

HCEC water testing: Eraring

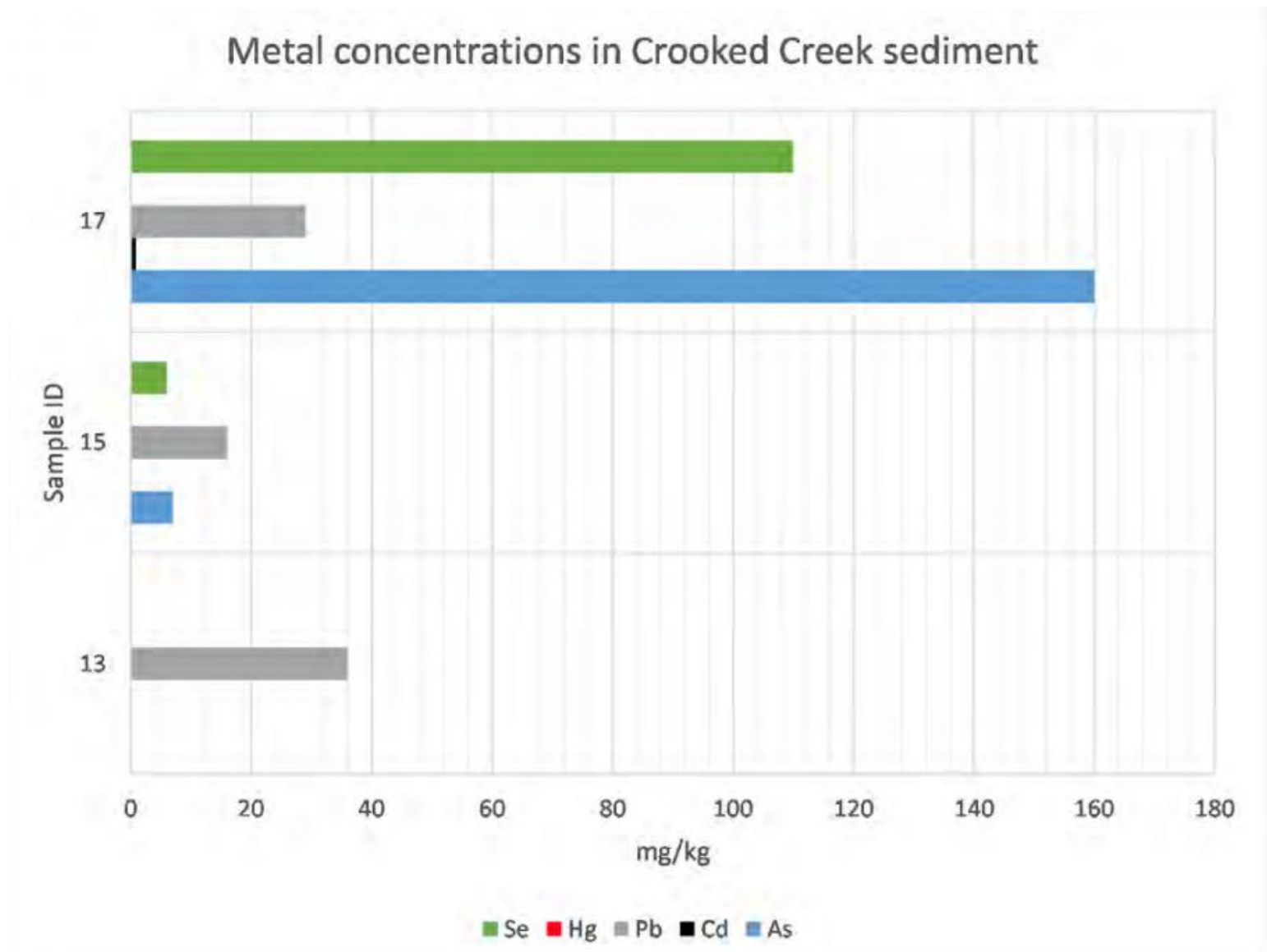


HCEC water testing: Eraring

Sample location				Eraring ash dam overflow Crooked Creek				ANZECC (2000)				ANZECC (2000) Recreational Use	NHMRC Drinking Water Guidelines
								Marine trigger value					
Sample ID				1wt	1wd	2wt	2wd	99%	95%	90%	80%		
Field Prep.				TOTAL	DISOLVED	TOTAL	DISOLVED						
Type of sample				Water	Water	Water	Water						
Date Sampled				23/5/20	23/5/20	23/5/20	23/5/20						
pH.				5.9		4.1		7-8.5					
EC		uS/CM		>3999									
Metal/metalloid		Units	PQL										
Aluminium	Al	µg/L	10	330	290	16000	15000					200	
Arsenic	As	µg/L	1	2	1	8	4					50	10
Boron	Bo	µg/L	20	1900	1900	1800	1800					1,000	4,000
Barium	Ba	µg/L	1	190	250	100	100					1,000	
Cadmium	Cd	µg/L	0.1	0.3	0.3	0.1	0.1	0.7	0.7	14	36	5	2
Cobalt	Co	µg/L	1	4	4	18	19	0.005	1	14	150		
Chromium	Cr	µg/L	1			5						50	50
Copper	Cu	µg/L	1	2		3		0.3	1.3	3	8	1,000	2,000
Iron	Fe	µg/L	10	11000	11000	43000	6400					300	
Lead	Pb	µg/L	1			3		2.2	4.4	20	85	50	10
Manganese	Mn	µg/L	5	1600	1900	5600	5900					100	500
Molybdenum	Mo	µg/L	1	3	2	4							
Mercury	Hg	µg/L	0.05					0.1	0.4	0.7	1.4	1	1
Nickel	Ni	µg/L	1	6	7	21	22	7	7	200	560	100	20
Selenium	Se	µg/L	1			3						10	
Thallium	Th	µg/L	1										
Vanadium	V	µg/L	1			13		50	100	160	280		
Zinc	Zn	µg/L	1	46	53	49	45	7	15	23	43	5,000	

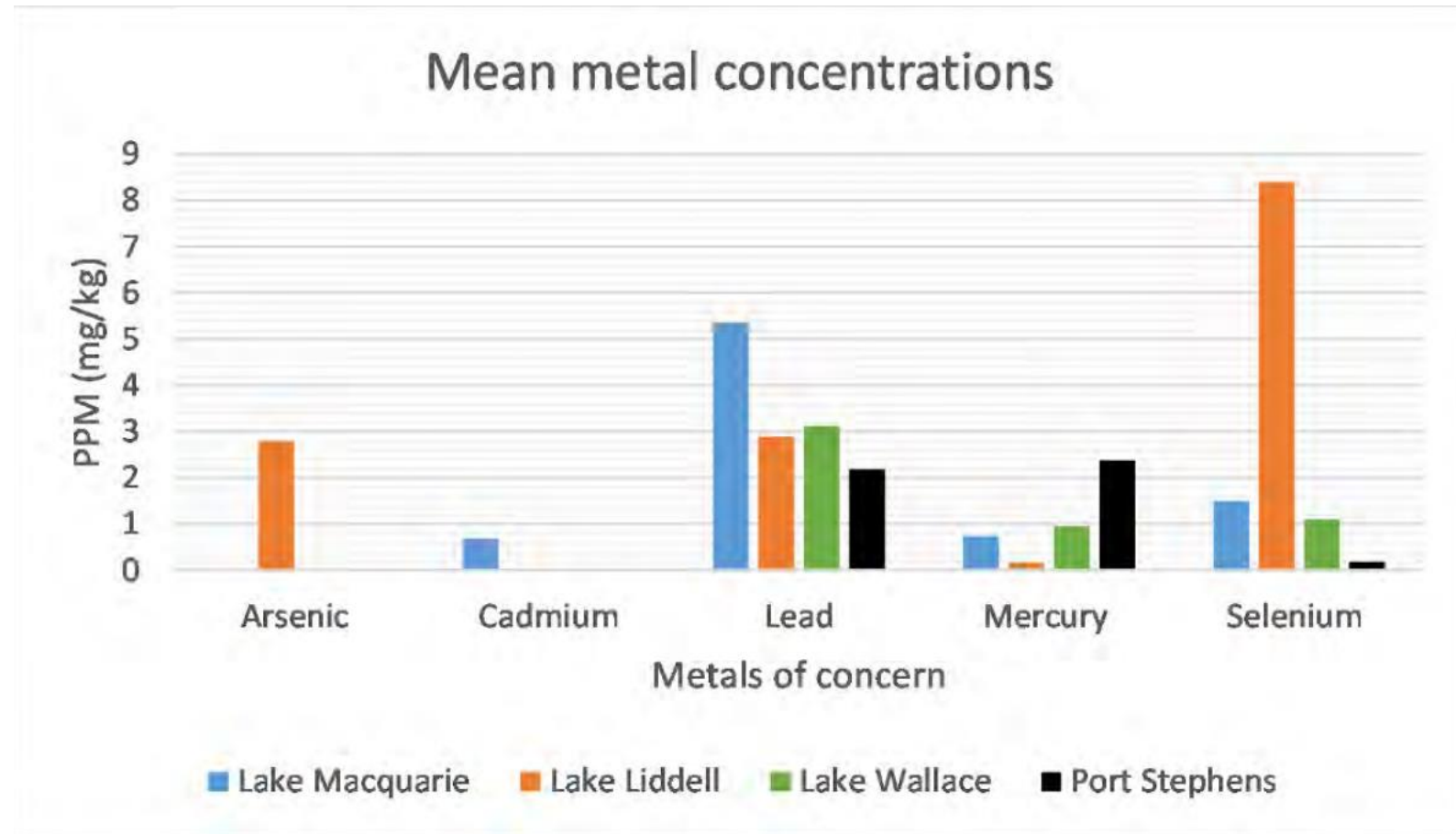
HCEC sediment testing: Eraring

Maximum concentrations:
Selenium - 110 ppm
Arsenic - 160 ppm
Lead - 36 ppm
Cadmium - 0.9 ppm



Toxic Habitat: *water birds near power stations*

Half of all birds from which we sampled feathers were potentially suffering health impacts from heavy metals emitted by coal-fired power stations.



Results: Bird feather study

Lake Macquarie

- Selenium in 6/14
- Lead in all feathers.
- Cadmium only in 4/14 from Lake Macquarie

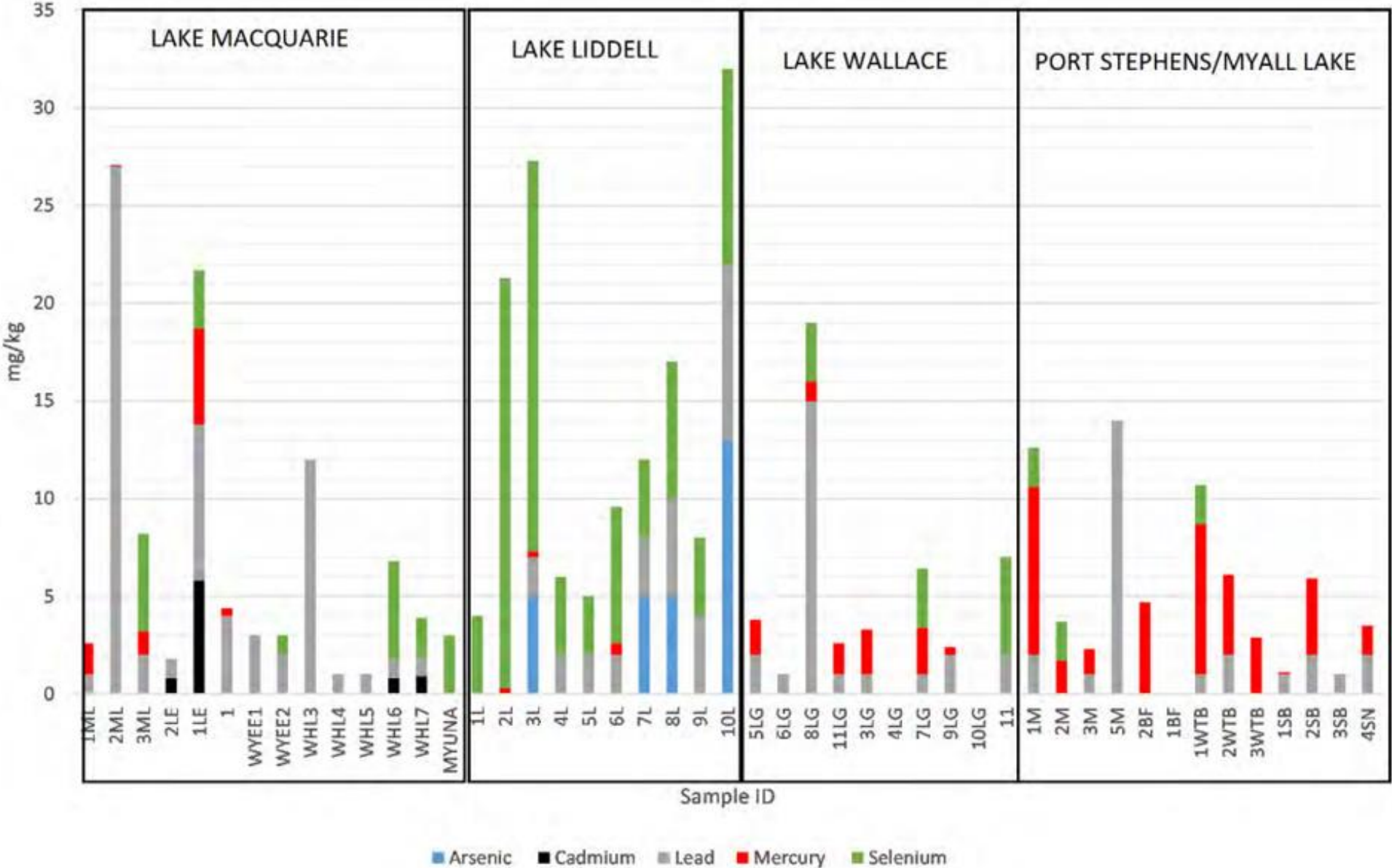
Lake Wallace

- Lead in all 10
- Mercury in 6/10 -
- Selenium in 7/10 - All above adverse health thresholds

Lake Liddell

- Selenium in all feathers. Most exceeding health thresholds.
- Arsenic only in 4/10 from Lake Liddell.
- Highest arsenic, lead, and selenium from an adult Black Swan carcass

Cumulative metals – all sites



Annual metal leaching from NSW ash

Arsenic 1.6t
 Cadmium 193kg
 Chromium 2t
 Copper 3t
 Mercury 40kg
 Nickel 681kg
 Lead 80kg
 Selenium 3t
 Zinc 5t

Metal (mg/k - ppm)		NSW coal-fired power stations					Mean ppm	Estimated annual leachate (kg)
		1	2	3	12	13		
Arsenic	As	12	4	6.6	12	43	16	1,634
Boron	B	25	56	89	75	80	65	44,428
Barium	Ba	393	420	653	393	510	474	29,668
Berillium	Be	22	15	4	9	6	11	1,473
Cadmium	Cd	0.4	0.9	0.25	0.44	0.35	0	193
Cobalt	Co	11	10	6	11	38	15	220
Chromium	Cr	50	40	18	45	72	45	2,017
Copper	Cu	52	50	28	47	151	66	2,940
Gernanium	Ge	40	18	5	10	10	17	2,998
Mercuy	Hg	0.02	0.03	0.15	0.12	0.22	0	39
Lithium	Li	180	28	48	58	106	84	12,540
Manganese	Mn	88	200	899	321	413	384	7,939
Molybdenum	Mo	8	5	5	6	10	7	10,802
Nickel	Ni	41	30	11	24	70	35	681
Lead	Pb	59	60	48	68	48	57	78
Antimony	Sb	2.9	2.3	3.1	3.9	2.9	3	760
Selenium	Se	5.2	4.7	2.5	3.5	3.7	4	3,068
Tin	Sn	10	12	6	10	11	10	13
Vanadium	V	128	120	49	109	172	116	10,896
Tungsten	W	5	7	6	6	3	5	1,805
Zinc	Zn	108	86	67	124	142	105	5,210
Zirconium	Zr	600	440	250	400	450	428	14
TOTALS								139,416

Critical Minerals in NSW ashes

Alumina	2.2Mt	\$21b
Germanium	3,650t	\$13b
Lithium	18,500t	\$1.2b
Nickel	7,740t	\$285m
Zircon	94,000t	\$235m
Cobalt	3,340t	\$197m
Copper	14t	\$180m

Metal (mg/k - ppm)		NSW coal-fired power stations						Price per USD/Ton	Resources (tonnes) in 220Mt fly ash	Resource value AUD	
		1	2	3	12	13	Mean ppm				
High Purity Alumina								20%	6,500	2,200,000	21b
Arsenic	As	12	4	6.6	12	43	16			-	
Boron	B	25	56	89	75	80	65	750	14,300	16m	
Barium	Ba	393	420	653	393	510	474		104,236	-	
Berillium	Be	22	15	4	9	6	11	3,500	2,464	13m	
Cadmium	Cd	0.4	0.9	0.25	0.44	0.35	0	650	103	98,378	
Cobalt	Co	11	10	6	11	38	15	40,000	3,344	197m	
Chromium	Cr	50	40	18	45	72	45	9,000	9,900	131m	
Copper	Cu	52	50	28	47	151	66	8,500	14,432	180m	
Germanium	Ge	40	18	5	10	10	17	2,370,000	3,652	13b	
Mercuy	Hg	0.02	0.03	0.15	0.12	0.22	0		24	-	
Lithium	Li	180	28	48	58	106	84	45,000	18,480	1.2b	
Manganese	Mn	88	200	899	321	413	384	1,000	84,524	124m	
Molybdenum	Mo	8	5	5	6	10	7	26,000	1,496	57m	
Nickel	Ni	41	30	11	24	70	35	25,000	7,744	286m	
Lead	Pb	59	60	48	68	48	57	2,300	12,452	42m	
Antimony	Sb	2.9	2.3	3.1	3.9	2.9	3	12,000	664	12m	
Selenium	Se	5.2	4.7	2.5	3.5	3.7	4	650	862	824,023	
Tin	Sn	10	12	6	10	11	10	40,000	2,156	127m	
Vanadium	V	128	120	49	109	172	116	650	25,432	24m	
Tungsten	W	5	7	6	6	3	5	6,000	1,188	11m	
Zinc	Zn	108	86	67	124	142	105	3,200	23,188	110m	
Zirconium	Zr	600	440	250	400	450	428	1,700	94,160	235m	
TOTALS								AU\$36b			

Thank you

