

Biological and Aquatic Life Use Attainment Assessment

Potash Brook

November 15, 2005



photo: Potash Brook Site 1.0

prepared by

Vermont Department of Environmental Conservation
Water Quality Division
Biomonitoring and Aquatic Studies Section
RA La Rosa Environmental Laboratory
103 South Main Street
Waterbury, VT
05671

Biological Assessment Summary Fact Sheet – Potash Brook

1. *Description of impaired water body:* Potash Brook is listed under Vermont's 2004 303(d) List of Waters, Part A – Impaired Surface Waters in Need of TMDL, as non-support of Aquatic Life Uses (ALUs) with poor to fair biological condition from the mouth to river mile 5.2 and likely including its headwaters. Stormwater is identified as the primary pollutant with problems related to stormwater runoff, land development and soil erosion. The Brook drains much of the town of South Burlington, from its mouth in Lake Champlain in Queen City Park, to just south of Burlington International Airport to 1.5 miles south of Interstate 89. Much its drainage is urban with a short natural wetland between Spear and Farrell Streets.
2. *Description of Data used to characterize impairment.* Biological data was collected on Potash Brook by the VTDEC from 1987 to 2004, and at several sites by Pioneer Environmental Associates (PEA) for South Burlington in 2001 and 2004. The biological data collected by South Burlington has been approved by VTDEC pursuant to a QA/QC plan, and verification of data quality through sampling and analytical replication between VTDEC and PEA. Macroinvertebrates were sampled 4 times at RM 0.7; 9 times at RM 1.0; 3 times at RM 1.8; twice at RM 1.9; twice at RM 3.0 and 3 times at RM 4.3. Two tributaries have been sampled: Tributary 3 at RM 0.3 3 times; and Tributary 7 at RM 0.1 twice. Fish were collected by VTDEC from river mile (RM) 0.7 -3 times; from RM 1.0 - 5 times; from RM 1.3-3 times; RM 1.8-4 times; and RM 2.1 once. Tributary 3 was sampled once at RM 0.3.

Macroinvertebrates were assessed in the *poor* range for a majority of the samples. All sampling results from RM 0.7 and RM 1.0 scored *poor*, with the exception of RM 1.0 during 1989 (*fair*). At site RM 1.8, samples taken during 1989, 1994 and 1997 scored *good*, *good-fair* and *fair* respectively. The remaining upstream RM 1.9, 3.0, and 4.3 all scored a *poor* for all sampling events. The tributary samples have also all consistently been assessed using “best professional judgment” (BPJ) as *poor*, with the exception of Trib. 7 RM 0.1 in 1997 which was rated as fair-good.

Fish community evaluations were consistently in the *good* range with the exception of RM 1.3 during 1989 when the site scored in the *very good* range, and the tributary site, which scored *poor*.

3. *Stressor Identification:* Assessment of the characteristics of the biological communities, water quality and physical habitat implicates stormwater, specifically the components related to hydrologic modification, water quality and sediment discharge as being the most significant contributors to the observed impairment. The identification of a single most significant stressor responsible for the impairment has not been possible with the available information, and it is unlikely that a single stressor is responsible for the ALS impairment. It is certain that multiple factors related to stormwater runoff within the watershed are causing erosion and urban runoff resulting in alterations to the biological community. Limited water quality information indicates that enrichment (e.g. nutrients), chemical (e.g. hydrocarbons, metals, chlorides) and physical (e.g. temperature, hydrology and sediment) characteristics of the stream are contributing to the impairment.
4. *Summary statement - overall “weight-of-evidence” summary of findings:* Macroinvertebrate community data provide the most significant basis for the designation of non support of ALUs for Potash Brook. For the last 17 years, impairment (non support of ALUs) has been consistently documented in 21 out of 24 macroinvertebrate samples on Potash Brook main stem. Since 2001, all five main stem sites, (12 samples) from RM 0.7 to RM 4.3 were impaired. All 4 samples collected since 2001 at the base of Trib. 3, and Trib. 7 were impaired. On the main stem the fish community integrity was assessed as moderately degraded for 14 of 15 fish samples, and as impaired in 2004 at RM 1.0. One fish sample on Trib. 3 in 1994 was assessed as impaired.
5. *Recommendations - recommended assessment needs:* macroinvertebrate and fish assemblage sampling will be conducted bi-annually at RM 0.7, RM 1.9, and RM 3.0. This level of biological monitoring should be sufficient to document long-term changes in the biological condition of Potash Brook. This level of biological data collection should supply enough data to allow adjustments to 5-year permits as needed within the watershed.

Discussion of Biological Assessment Results-Potash Brook

Description of Impaired Waterbody:

Potash Brook is listed as non support of Aquatic Life Uses (ALUs) with poor to fair biological condition from the mouth to the most upstream biological assessments at river mile 4.3, and likely include its headwaters. The listed pollutant is stormwater. The Brook drains much of the town of South Burlington, from its mouth in Lake Champlain in Queen City Park, to just south of Burlington International Airport to 1.5 miles south of Interstate 89. Much of its drainage is urban with a short natural wetland between Spear and Farrell Streets.

Methods:

Segments of Potash Brook containing a mix of pools, runs and riffles were targeted for the purposes of biological community assessments. For the purposes of biological community assessments, the sampled segments are designated as Warm Water Moderate Gradient (WWMG) wadeable macroinvertebrate stream types and Mixed Water Index of Biotic Integrity (MWIBI) fish community wadeable stream types. An exception is the RM 2.1, a soft-bottom low gradient site. The assessment for that site was based on best professional judgment since the MWIBI is calibrated for hard bottomed streams.

The Department has used standard protocols for determining biological condition and making assessments of impairment. Macroinvertebrate community data was assessed using threshold criteria developed for WWMG wadeable streams in Vermont. Analyses of data from reference streams throughout Vermont indicate that small streams (>10km²) within the Champlain Valley are appropriately evaluated using this model. The tributary stream site data was assessed using “best professional judgment” (BPJ) due to their small size. The MWIBI requires a minimum of five species of native fish in order to be reliably calculated. Sampling guidelines require that the section of sampled stream exhibit a representative mix of habitat types found in the stream.

Discussion of Data:

Macroinvertebrate community – Since 2001 all five main stem sites, (12 samples) from RM 0.7 to RM 4.3 were found to be impaired. All 4 samples collected since 2001 at the base of Trib. 3, and Trib. 7 were impaired (**Table 2**). The macroinvertebrate community at all locations is most consistently below expectations for taxa richness and EPT (mayflies, stoneflies and caddisflies) richness (**Table 2**). Low richness and EPT values generally indicate poor habitat (sediment, stream channel modification), and or chronic/acute water quality conditions that most intolerant species are unable to tolerate. The two most water quality sensitive orders, Ephemeroptera (mayflies) and Plecoptera (stoneflies), have been either absent or represented by only a single species at the lower main stem sites since 2001 (**Table 3**).

The community composition has also shifted toward dominance by moderately tolerant insect taxa (**Table 3**). The few EPT taxa present are mostly moderately tolerant taxa from the order Trichoptera, family *Hydropsychidae*. Specifically, the taxa *Hydropsyche betteni*, *Cheumatopsyche sp.*, and *Symphitopsyche slossonae*. These three taxa are all considered filter feeding generalists. The second dominant order is generally the Diptera, from the family *Chironomidae*, most often represented by the moderately tolerant genera *Cricotopus spp.* and *Thienemannomyia* grp. The former is a filamentous algae shredder and the latter a predator.

The macroinvertebrate community overall is dominated by taxa with Bio Index (BI) tolerance values toward organic enrichment of between 5 and 7, on a tolerance range of 0 (intolerant) -10 (tolerant). The highest BI values are consistently found at the lower main stem site RM 0.7 (**Table 2**). High BI values indicate that the overall composition of the community is dominated by taxa tolerant of algae, or are generalist particulate type feeders (**Table 4**).

Fish Community - The fish community has been sampled 17 times at six locations on Potash Brook and Trib. 3 between 1988 – 2004 (**Table 5**). Community condition has been rated as *good* from 16 sampling events. RM 1.3 was rated *very good* in 1989 and Trib. 3 rated *poor* in 1994. MWIBI values (index range 9-45) were observed from 31-37 for all main stem sites. A single tributary site was sampled in 1994 and scored *poor* applying best professional judgment. Generally sites were scored lower on the MWIBI because of a lack of intolerant species and dominance of tolerant generalists feeders. Species composition can be characterized as normal for a stream of this size and in this region. The dominant species are the common species: blacknose and longnose dace, creek chub, and white sucker.

Physical and Chemical data- The physical habitat data collected at the time of biological sampling by the VTDEC provide additional evidence that the biological community is likely stressed by stormwater related sediment and water quality (**Table 6**). The percent sand observed within the riffle habitat ranges up to 20-40 percent in the main stem since 2001. An observational silt rating (0-5) assigned to a site after KN sampling is also often in the 3-5 range, indicating significant plumes of silt cloud the water during this activity.

Periphyton algae observations indicate the substrate (cobble) is often 50-80 percent covered by either filamentous algae or blue green algae. Nutrient sampling in the past two years at base flow by VTDEC and PEA show Dissolved Phosphorus to be slightly elevated at 20-30 ug/l on the main stem sites.

Water quality monitoring data show Potash Brook to be high in conductivity, chloride, and sodium at all main stem sites. Data from Pioneer show Chloride to reach acutely toxic levels in Tributary 3. High Conductivity caused by high Chloride and Sodium generally implicate stormwater from impervious surfaces as having a major influence in the watershed. Other metals including Iron and Manganese are elevated but to a lesser degree. No other priority metals tested for were detected (**Table 8**).

Summary Statement Overall Weight of Evidence:

Macroinvertebrate analyses consistently show impairment, or non compliance with ALUs of Class B WQS. The impairment to the macroinvertebrate community is due to loss of sensitive taxa and compositional shifts in the community toward more tolerant generalist taxa. The end result is a very simplified community structure and an altered functional resiliency. The fish community analyses generally indicate minimal compliance with ALUs (with several exceptions), but indicate that a moderate level of degradation has occurred at all sites, primarily due to the loss of intolerant species.

The physical observations and chemical WQ data strongly implicate stormwater is a significant source for multiple stressors to the biological communities. High levels of sediment, silt, and embeddedness are evident at all main stem sites. A high percent cover of algae in the lower reaches along with some indications of elevated nutrients. Finally elevated conductivity that appears related to elevated levels of Chloride and Sodium are strong indicators that Potash Brook is impaired by stormwater related stressors.

Recommended monitoring:

Macroinvertebrate and fish assemblage sampling will be conducted bi-annually at RM 0.7, RM 1.9, and RM 3.0. This level of biological monitoring should be sufficient to document long-term changes in the biological condition of Potash Brook. This level of biological data collection should supply enough data to allow for evaluations of biological response to TMDL implementation and for adaptive management to occur as appropriate.

An increase in the level of WQ monitoring than presently done may also benefit the evaluation of remediation efforts. This should be done at a minimum of one station in the lower watershed (RM 0.7).

Table 1. - Biomonitoring site locations on Potash Brook. "M"-macroinvertebrates, "F"-Fish.

Location	Site RM	Town	Community sampled	Description	Drainage Area km ²	Elevation ft	Latitude	Longitude
Potash Brk	0.7	S Burlington	MF	Located 100 feet below discharge from Champlain Water District treatment pond.	19.0	135	442637	731301
	1	S Burlington	MF	Located below Queen City Park Rd about 50m, below bedrock slide.	18.7	170	442642	731250
	1.3	S Burlington	F	Located adjacent to Southern Connector I-189.	18.0	179	442646	731248
	1.8	S Burlington	MF	Located above Farrel Street bridge 50m .	17.5	198	442649	731216
	1.9	Burlington	MF	Located above Farrel Street Bridge about 100m, above drainage from shopping center.	17.4	198	442648	731212
	2.1	Burlington	MF	Located just east of powerline at edge of UVM's east woods natural area.	17.1	210	442648	731142
	3	Burlington	M	Located above Spear Street about 250m, above a small drainage from the north.	15.1	240	442703	731110
	3.6	S Burlington	F	Located below Dorset Street Crossing, 75m south of Kennedy Drive.	10.5	255	442703	731046
	4.3	S Burlington	MF	Located below Hinesburg Road, and sewage pump station.Fish sampled above road.	9.8	304	442722	731010
	0.1	S Burlington	M	Located below Dorset St. crossing, 100m south of Main stem.	3.6	255	442701	731046
	0.3	S Burlington	MF	Located behind Meadow Brook Condo's Pool (50m below), at the end of Joy Drive.	3.5	260	442708	731141
	0.5	S Burlington	F	Located behind Twin Oaks Townhouses.	2.8	295	442659	731015
	0.7	S Burlington	F	Located at NE end of Village at Dorset Commons below SW ponds outfall.	2.6	310	442655	731005

Table 2. Macroinvertebrate community assessments, metric data from Potash Brook and tributaries, Vt.. A single * indicates data collected by Pioneer, approved by VTDEC. Two ** indicates “best professional judgment” (BPJ) used to make biological assessment determination due to small drainage area. Bolded site RM are recommended as long-term monitoring sites. Grey sample events represent replicate assessments. Bolded metrics are below biocriteria threshold guidance values for the metric.

Location	Sites RM	Date	Assessment	Density /kn	Richness	Ept	PMA-O	BI (0-10)	Oligochaeta %	Ept/Ept&C	PPCS-F
Potash Brk	0.7	9/30/1993	Poor	1986	27.5	7.5	52.5	5.57	0.0	0.89	0.55
		10/10/2001	Poor	2042	15.5	5.0	51.1	6.01	0.0	0.89	0.50
		10/9/2003	Poor	3046	23.5	5.5	47.3	6.25	0.0	0.91	0.39
		9/22/2004	Poor	3872	27.0	6.0	54.2	5.56	0.0	0.72	0.38
	1	10/26/1987	Poor	144	25.0	6.5	47.1	5.49	18.9	0.39	0.48
		10/19/1988	Poor	109	20.0	9.0	57.0	5.70	0.5	0.67	0.40
		10/18/1989	Fair	290	34.5	11.5	66.7	5.04	3.4	0.84	0.56
		7/31/1990	Poor	1670	35.0	9.5	62.7	5.61	0.5	0.67	0.51
		9/30/1991	Poor	663	34.0	12.0	59.0	4.80	0.5	0.82	0.61
		10/15/1992	Poor	622	37.0	11.0	52.9	5.72	0.6	0.89	0.51
		9/30/1993	Poor	2020	28.0	10.0	51.0	5.20	0.0	0.87	0.48
		10/5/2001	Poor	1268	26.0	7.0	56.1	4.93	1.6	0.72	0.60
		10/5/2001*	Poor	1298	17.0	6.0	48.0	5.67	0.0	0.89	0.32
		9/24/2004*	Poor	417	26.0	5.5	51.7	5.19	0.1	0.78	0.47
	1.8	10/18/1989	Good	1580	35.0	15.5	85.7	4.16	1.1	0.95	0.71
		10/13/1994	G-Fair	1900	35.0	15.0	75.7	4.39	0.7	0.94	0.56
		9/22/1997	Fair	1232	29.0	13.0	61.2	4.39	0.0	0.77	0.53
	1.9	10/5/2001*	Poor	756	16.0	5.5	45.8	4.35	0.0	0.96	0.33
		9/24/2004*	Poor	858	27.5	6.5	51.2	4.90	0.1	0.60	0.46
	2.1	9/21/2004	NA-Low gradient	279	46.0	3.0		5.94	0.0	0.19	
3	10/5/2001*	Poor**	693	17.0	4.5	45.5	3.11	0.0	0.93	0.34	
	9/24/2004*	F-Poor**	413	25.0	8.0	62.7	4.22	0.0	0.91	0.54	
4.3	10/26/1987	Poor**	1212	26.0	5.0	50.8	6.10	1.3	0.61	0.49	
	10/5/2001*	Poor**	958	18.0	3.5	52.3	5.74	0.0	0.50	0.48	
	9/24/2004*	Poor**	780	20.0	4.0	52.7	4.74	0.5	0.89	0.35	
Potash Brk-t 3	0.3	10/13/1994	Poor**	1736	23.0	3.5	46.3	5.97	2.0	0.55	0.47
		10/5/2001*	Poor**	345	15.5	4.0	45.8	3.74	0.9	0.85	0.39
		9/24/2004*	Poor**	587	21.5	2.0	44.4	5.39	2.0	0.36	0.47
Potash Brk-t 7	0.1	10/13/1994	F-Good**	1917	43.0	12.0	53.7	5.21	11.5	0.68	0.65
		10/5/2001*	Poor**	444	19.0	2.0	31.4	4.60	0.0	0.14	0.57
		9/24/2004*	Poor**	882	20.0	6.0	62.4	5.02	0.5	0.82	0.49

Table 3: Percent composition of the major orders of macroinvertebrates from Potash Brook and Tributaries.

Location	Site	Date	Coleoptera%	Diptera%	Ephemeroptera%	Plecoptera%	Trichoptera%	Oligochaeta%	OtherOrders%
Potash Brk	0.7	9/30/1993	5.9	19.4	1.6	0.0	71.8	0.0	1.3
		10/10/2001	6.1	22.5	0.0	0.0	70.8	0.0	0.5
		10/9/2003	3.5	12.1	0.0	0.2	83.0	0.0	1.1
		9/22/2004	9.1	34.4	0.1	0.0	56.3	0.0	0.1
	1	10/26/1987	12.9	43.5	3.0	2.2	15.1	18.9	4.3
		10/19/1988	9.9	36.9	3.3	0.5	48.1	0.5	0.9
		10/18/1989	2.2	18.7	14.3	4.2	54.8	3.4	2.5
		7/31/1990	0.9	37.5	16.1	0.1	44.5	0.5	0.3
		9/30/1991	12.2	27.6	2.3	0.8	52.8	0.5	3.7
		10/15/1992	5.0	16.9	1.9	0.5	69.1	0.6	6.1
		9/30/1993	3.4	22.7	2.6	0.0	70.5	0.0	0.8
		10/5/2001	6.1	17.1	0.1	0.5	74.8	0.0	1.5
		10/5/2001	9.5	44.5	0.3	0.3	41.0	1.6	2.8
		9/24/2004	6.3	32.9	0.1	0.1	58.2	0.1	2.2
	1.8	10/18/1989	13.2	7.3	44.7	6.9	25.8	1.1	1.1
		10/13/1994	9.0	7.6	19.3	20.8	39.8	0.7	3.0
		9/22/1997	12.0	23.1	2.3	1.9	53.2	0.0	7.5
	1.9	10/5/2001	3.6	5.1	0.2	5.0	84.4	0.0	1.8
		9/24/2004	4.1	41.8	0.2	1.7	50.6	0.1	1.4
	2.1	9/21/2004	7.9	52.0	8.6	0.0	2.2	0.0	29.4
	3	10/5/2001	4.9	8.3	0.0	0.2	78.9	0.0	7.7
		9/24/2004	14.0	24.4	5.5	0.6	52.6	0.0	3.0
	4.3	10/26/1987	4.0	41.7	0.8	0.0	51.7	1.3	0.5
10/5/2001		7.1	47.9	0.2	0.0	42.7	0.0	2.1	
9/24/2004		7.2	19.5	0.0	0.0	71.0	0.5	1.8	
Potash Bk-t 3	0.3	10/13/1994	0.1	50.0	0.0	0.2	38.5	2.0	9.2
		10/5/2001	0.0	23.8	0.0	0.0	65.5	0.9	9.8
		9/24/2004	0.0	62.1	0.0	0.0	29.4	2.0	6.5
Potash Bk-t 7	0.1	10/13/1994	33.9	24.0	3.3	1.4	22.0	11.5	3.9
		10/5/2001	22.5	70.3	0.0	1.4	4.1	0.0	1.8
		9/24/2004	22.9	18.6	4.5	0.5	52.8	0.5	0.2

Table 4: Percent composition of the major functional groups of macroinvertebrates from Potash Brook and Tributaries

Location	Site	Date	CollGatherer%	CollFilterer%	Predator%	ShredDetritus%	ShredHerbivore%	Scraper%
Potash Brk	0.7	9/30/1993	10.5	71.2	6.2	0.7	3.7	7.7
		10/10/2001	12.9	70.8	6.3	0.3	3.5	6.1
		10/9/2003	4.5	82.8	6.0	0.2	3.0	3.4
		9/22/2004	16.0	57.4	1.4	0.0	15.9	9.2
	1	10/26/1987	28.8	14.5	17.6	2.6	24.9	11.4
		10/19/1988	1.9	50.8	20.1	0.5	15.0	11.7
		10/18/1989	10.5	55.3	6.5	2.7	9.9	2.3
		7/31/1990	33.7	44.9	6.2	0.3	13.3	1.1
		9/30/1991	15.1	41.5	11.5	0.1	7.1	24.7
		10/15/1992	10.1	67.6	6.4	1.4	5.4	9.2
		9/30/1993	17.8	65.9	2.0	0.2	6.4	7.7
		10/5/2001	8.4	74.8	8.8	0.0	1.7	6.3
		10/5/2001	30.9	38.2	13.2	0.0	4.1	13.6
	9/24/2004	14.6	69.7	3.6	0.1	5.6	6.3	
	1.8	10/18/1989	8.4	22.3	5.9	0.5	3.4	15.7
		10/13/1994	7.5	38.9	5.4	3.8	17.6	10.6
		9/22/1997	21.1	49.4	11.7	0.0	1.0	15.3
	1.9	10/5/2001	2.3	84.6	8.3	0.6	0.6	3.6
		9/24/2004	31.3	57.2	4.7	0.0	2.6	4.1
	2.1	9/21/2004	39.1	4.3	39.4	0.0	5.4	0.7
	3	10/5/2001	2.9	82.8	8.2	0.6	0.4	5.1
9/24/2004		14.4	57.0	10.4	0.3	1.7	16.3	
4.3	10/26/1987	20.8	67.3	7.9	0.8	0.2	3.0	
	10/5/2001	14.8	45.9	29.3	0.8	2.1	7.1	
	9/24/2004	5.9	80.3	4.4	0.0	2.1	7.4	
Potash Bk-t 3	0.3	10/13/1994	46.8	39.2	9.2	3.6	0.6	0.5
		10/5/2001	12.4	65.8	19.2	2.3	0.3	0.0
		9/24/2004	54.8	37.3	4.1	0.5	3.2	0.1
Potash Bk-t 7	0.1	10/13/1994	34.5	21.9	10.4	1.4	2.5	28.8
		10/5/2001	5.0	19.4	48.2	1.8	3.2	22.5
		9/24/5004	5.4	56.9	1.6	0.9	10.0	25.2

Table 5. Fish community data from three sites on Potash Brook and its Tributary 3. The Mixed Water Index of Biological Integrity (MWIBI has a range of values from 9-45 (very poor to excellent).

Location	Site (RM)	Date	MWIBI	Assessment	Number of Species	Intolerant Species	Benthic Insectivores	% Creek Chub & White Sucker	% Generalist Feeder	% Insectivore	% Top Carnivore	% Anomaly	Total Run1 /100m2
Potash Bk.	0.7	10/17/2001	33	Good	7	0	2	44	45	55	0	0.7	148
		10/9/2003	35	Good	8	0	2	23	25	75	0	1.3	166
		10/20/2005	37	Good	6	0	1	27	27	73	0	0	245
	1.0	8/9/1988	35	Good	8	0	1	30	32	68	0	0	185
		9/30/1991	37	Good	10	0	2	19	23	77	0	0	125
		8/25/1992	33	Good	11	0	2	47	51	49	0	0	276
		9/24/1993	35	Good	8	0	1	24	26	74	0	0	131
		10/12/2004	31	Good	5	0	1	16	18	82	0	0	80
	1.3	8/9/1988	31	Good	8	0	1	36	48	52	0	1.6	96
		8/2/1989	37	Very Good	6	0	1	13	28	72	0	0	445
		8/26/1994	33	Good	7	0	1	30	39	61	0	1	306
	1.8	8/10/1988	33	Good	6	0	2	19	19	81	0	0	224
		8/2/1989	33	Good	7	0	1	36	39	61	0	0	178
		10/17/2001	33	Good	6	0	2	23	23	77	0	0	77
		10/9/2003	33	Good	7	0	2	12	14	86	0	0.2	79
2.1	9/13/2004	-	Good	7	0	2	53	74	8	0	0	16	
Tributary 3	0.3	8/26/1994	21	Poor	2	0	0	52	52	48	0	12.5	48

Table 6. Temperature and Selected habitat observations often associated with macroinvertebrate/fish sampling events on Potash Brook main stem.

Site (RM)	Date	Temp ° C	% Boulder	% Cobble	% Coarse Gravel	% Gravel	% Sand	Silt Rating 0-5	Embed.	% Canopy	% Film, Algae	% Blue Green Algae	% Moss
0.7	9/30/1993	9.0	0	35	40	10	10	2	2	60	20	45	0
	10/10/2001	11.5	3	25	38	21	13	4	2	60	0	75	0
	10/9/2003	14.0	8	36	29	24	3	5	1	30	0	80	0
	9/22/2004	15.0	3	32	36	20	9	4	2	50	40	50	5
1.0	10/26/1987	8.0	10	5	5	0	75	4	1	50	50	0	0
	10/19/1988	10.0	30	15	15	5	35	1	1	90	75	10	2
	10/18/1989	7.0	25	35	10	10	20		2	90	15	0	0
	7/31/1990	23.0	10	30	20	10	30	3	2	70	100	0	0
	9/30/1991	7.5	20	30	30	10	10	2	2	70	20	60	20
	10/15/1992	9.0	10	25	35	20	12	2	3	70	10	70	0
	9/30/1993	9.0	0	40	40	0	15	2	2	70	15	90	0
	10/5/2001	12.0	30	40	5	5	20		3	60	1	25	1
	10/5/2001	12.0	20	30	35	10	5	4	2	80	60	0	0
10/12/2004	10.0	15	35	15	10	15	3	4	50	0	50	0	
1.8	10/18/1989	7.0	0	30	30	20	20		2	90	10	0	10
	10/13/1994	5.0	25	50	10	5	5	1	4	80	0	0	15
	9/22/1997	12.0	25	40	20	10	5	2	3	90	5	20	0
1.9	10/5/2001		15	35	10	10	30	3	2	60	1	5	1
	9/24/2004		20	25	15	10	30	4	2	50	0	75	0
2.1	9/21/2004	16.7	1	8	9	20	57			40	5	0	0
3.0	10/5/2001		20	50	5	5	20	4	3	60	1	5	1
	9/24/2004		20	30	20	15	15	3	3	40	0	0	20
4.3	10/26/1987	18.5	1	15	10	65	1	4	5	50	80	0	10
	10/5/2001		10	40	5	5	40	4	2	30	1	5	0
	9/24/2004		10	35	15	15	25	0	2	50	0	50	0

Table 7. Water Chemistry parameters for Potash Brook. All measures are dissolved except where designated total ("T"). All values are in mg/l unless otherwise indicated (eg ug/l, stu, umhos).

Site RM	Sample Date	pH st.u.	Alk	Cond umho	TCl	TSO ₄	Ca	Fe ug/l	Mn ug/l	Mg	Na	K	THC	Turb NTU	TSS	TP ug/l	DP ug/l	TN	TN OX
0.7	9/30/1993	8.2	100	506															
	10/10/2001	7.7																	
	10/9/2003		153	1240	311	23.1	64.1	421	53	15.6	176	4.05		3.8	2.4	20	14	1.08	0.55
	9/22/2004	8.1	183	1150	224	17.9	72.4	266	96.8	17.9	156	4.44	254	3.05	1.3	30	11	1.25	
1.0	10/26/1987	8.4	133	770															
	10/19/1988	8.6	150	955															
	10/18/1989	7.9	138	704															
	7/31/1990	8.5	165	856															
	9/30/1991	8.7	198	830															
	10/15/1992	8.2	133																
	9/30/1993	8.2	148	793															
10/12/2004	8.1	192	1265	267	19.5	68.2	145	77.4	18.8	173	5.42	248	3.09	1	22	22	1.64	1.56	
1.8	10/18/1989	8.0	192	685															
	10/13/1994	8.1	135	915															
	9/22/1997	8.2																	
	10/12/2004	7.9	184	1421	301	19.7	68.3	150	5081	17.6	191	6.37	243	1.6		22		1.92	1.81
1.9	10/8/2003		135	1210	309	21.2	58.0	783	<50	13.6	174	4.58		1.8	3.2	36	19	0.81	0.78
2.1	9/21/2004				254	19.0	71.8	426	186	16.9	170	5.10	248	3.52	1.9	37	17	1.77	1.35
3.6	8/26/1994			725															
4.3	10/26/1987	7.6	114	650															
	8/15/1989	7.6	150	560															
	8/26/1994			708															
	10/12/2004	7.5	145	942	189	14.4	57.0	212	141	11.8	116	2.67	191	5.13		23		1.40	1.32

Table 8. Metals sampled in 2003-04 and reported as below detection levels indicated.

Site RM	Sample Date	As ug/l	Cd ug/l	Cr ug/l	Cu ug/l	Zn ug/l	Ni ug/l	Pb ug/l	Al ug/l	Hg ug/l	Be ug/l	Sb ug/l	Se ug/l	Ag ug/l	Tl ug/l
0.7	10/8/2003	<5		<5	<10	<25	<10	<5			<1	<10	<5	<1	<5
	9/22/2004	<1	<1	<5	<10	<10		<5	<10						
1.0	10/12/2004	<1	<1	<5	<10	<10		<5	<10						
1.8	10/12/2004	<1	<1	<5	<5	<10		<5	<10						
1.9	10/8/2003	<5		<5	<10	<25	<10	<5		<0.2	<1	<10	<5	<1	<5
2.1	9/21/2004	<1	<1	<10	<10	<10		<5							
4.3	10/12/2004	<1	<1	<5	<5	<10		<5	<10						

