



Rhode Island

T. F. Green International Airport

Second Quarter 2023

Outfall Sampling

Prepared by:
Rhode Island Airport Corporation

July 2023

Background

The RIPDES permit identifies a total of 16 perimeter outfalls at PVD. Outfalls 001A, 002A, 003A, 004A and 013A discharge to tributaries of Warwick Pond. Outfalls, 006A, 006B, 006C, 006D, 007A, 007B, 008A and 009A discharge to tributaries of Buckeye Brook downstream of Warwick Pond. Outfalls 010A, 011A, and 012A discharge to Tuscatucket Brook. Major outfalls, 002A, 003A, 008A, and 010A, are those outfalls which receive or may receive drainage from areas where aircraft deicing fluid is applied. Sampling for these major outfalls is defined at Part I.A.1 of the permit. Minor outfalls drain taxiways, runways and other paved services. Outfall 005A was combined with Outfall 006A during construction of Runway 34 Safety Area Improvements. Sampling for these minor outfalls is defined at Part I.A.2. of the permit. Additional sampling requirements are defined at Part I.A.5. and Parts I.C. and I.D. Table 1 lists parameters sampled. Figure 1 identifies outfall and in-stream sampling locations.

Industrial activities at PVD with the potential to impact stormwater quality include the use of glycol-based Aircraft Deicing and Anti-icing Fluids (ADFs/AAFs) and pavement deicers. Only propylene glycol (PG)-based ADFs/AAFs are used at PVD. Pavement deicers used at PVD include solid sodium formate, and liquid potassium acetate. No aircraft or pavement deicing material was applied during this event.

Summary of Storm

Second Quarter (April 1 through June 30) sampling includes the major outfalls (002A, 003A, 008A and 010A) hourly for twelve hours, and minor outfalls (001A, 004A, 006A, 007A, 009A, 011A, 012A and 013A) hourly for the first three hours. The sampling began upon a precipitation event of sufficient magnitude as specified in the RIPDES permit.

Light rain began falling around 8:00 PM on June 12, 2023. Sampling commenced at 2:00 AM July 13, 2023 subsequent to measurable accumulation and continued until approximately 1:20 PM July 13, 2023.

A total of 0.19 inches of precipitation (as water equivalent) was measured at PVD between 8:00 PM June 12, 2023 and 5:00 AM June 13, 2023. Precipitation data is summarized in Table 1.

Summary of Flow

Flow meters are installed at three of the major outfalls: OF-002A, OF-003A, and OF-008A. Continuous flow measurements during the 12 hours of sampling were made using these Isco 2150 area velocity meters programmed to measure level and velocity and produce flow rate (GPM) at 15 minute increments. No flow meters are installed at minor outfalls or at outfall 010A, as it is off airport property.

Flow meters were not operational for this event. Maximum daily and average monthly flows were calculated using hourly precipitation during sampling and outfall drainage areas. Flows for the major outfalls are presented in Table 3. Flows for the minor outfalls are presented in Table 5. Estimated runoff volumes calculated using drainage area and total depth of precipitation for the entire event for all outfalls are presented in Table 7.

Sample Collection

The laboratory analytical parameters for each sample for this event are listed in Table 2. For the Second Quarter sampling event the major outfalls (002A, 003A, 008A, and 010A) were sampled hourly for twelve hours. There was no observed flow in the last four hours of sampling at Outfall 010A. The major outfall sampling results can be found in Tables 3 and 4.

The minor outfalls (001A, 004A, 006A, 007A, 009A, 011A, 012A, and 013A) were also sampled for the first three hours of the event. There was no observed flow at Outfalls 006A, 007A, 009A, 011A, and 013A. The minor outfall sampling results can be found in Tables 5 and 6.

Samples were collected and decanted into sample bottles based on the analysis necessary. The bottles were then placed on ice in a cooler for transport to RIAL. Because of the short sample holding time (six hours) for some of the analytical parameters, all samples collected in the first three hours were delivered to the laboratory immediately. Samples collected in hours four through 12 were delivered at the completion of sampling.

RIAC also collected and recorded field measurements at each outfall for temperature, pH, specific conductance (minors only), and dissolved oxygen (DO).

Sampling Results

Tables 3-6 present a summary of field measurements and analytical results expressed as monthly average and maximum daily concentrations for both the major and minor outfalls. Table values presented as zero reflect data that was non-detect. Temperature and Oil and Grease are expressed as maximum daily only. pH is expressed as minimum daily and maximum daily.

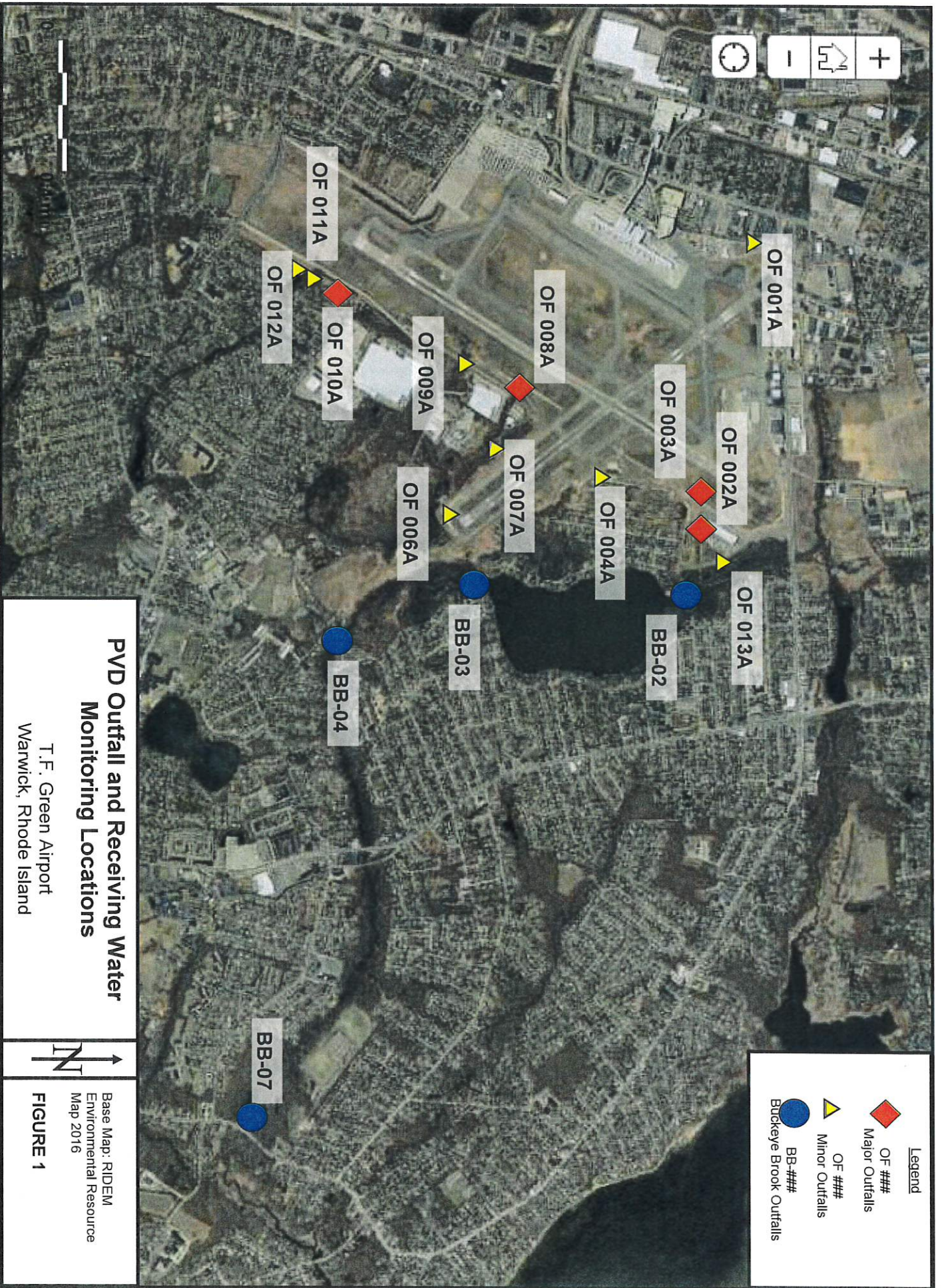


TABLE 1
PRECIPITATION AMOUNTS
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2023
June 10 - 13, 2023

Date	Total Precipitation (water equivalent, in inches)
June 10, 2023	0.02
June 11, 2023	0.00
June 12, 2023	0.17
June 13, 2023	0.02

**TABLE 2
SAMPLING PARAMETERS
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2023**

Sample Identification	Hours 1-3	Hours 4-12
OF-001A, OF-004A, OF-006A, OF-007A, OF-009A, OF-011A, OF-012A, OF-013A	<ul style="list-style-type: none"> • TSS, BOD • Fecal coliform • Dissolved Potassium and Sodium • Oil & grease - 1664 	
OF-002A, OF-003A, OF-008A, OF-010A	<ul style="list-style-type: none"> • pH, Specific Conductance, Temperature • Fecal coliform • TSS, BOD, Surfactants • pH, Temperature, Dissolved Oxygen • COD, TOC • Oil & grease - 1664, TSS • Propylene glycol • Dissolved Potassium and Sodium • Total Metals (aluminum, chromium, copper, iron, lead, and zinc) 	<ul style="list-style-type: none"> • BOD, Surfactants • pH, Temperature, Dissolved Oxygen • COD, TOC • Propylene glycol • Dissolved Potassium and Sodium • Total Metals (aluminum, chromium, copper, iron, lead, and zinc)

BOD -Biological oxygen demand
 COD -Chemical oxygen demand
 TOC -Total organic carbon
 TSS -Total suspended solids
 Specific Conductance, pH, Temperature, and Dissolved Oxygen measured in the field

TABLE 3
ANALYTICAL RESULTS
MAJOR OUTFALLS
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2023

Parameter	Major Outfalls									
	Outfall 002A		Outfall 003A		Outfall 008A		Outfall 010A			
	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily
Flow (gpd) ^{1, 8}	1,316,336	6,236,242	1,836,154	8,146,698	4,034,719	16,708,482	303,564	1,694,310		
Oil & Grease (mg/l) ⁵		1.8		1.4		2.5		2.1		
TSS (mg/l) ^{4, 5}	9.6	12	2.6	4.0	5.4	8	13.8	21.0		
Fecal Coliform (MPN/100ml) ^{7, 5}	2.9	6.8	72.3	350	256.1	3,500	898.4	5400		
BOD ₅ (mg/l) ^{2, 6}	4.7	11	6.9	16	0.00	0	2.40	20		
Propylene Glycol (mg/l) ^{2, 6}	0	0	0	0	0	0	0	0		
COD (mg/l) ^{2, 6}	20.1	27	18.6	37	2.8	27	16.3	32		
Dissolved Potassium (mg/l) ^{2, 6}	3,650	4,600	4,185	8,200	10,318	13,000	8,664	12,000		
Dissolved Sodium (mg/l) ^{2, 6}	8,906	17,000	10,811	18,000	14,437	46,000	28,256	36,000		
Surfactants (ug/l) ^{2, 6}	66.4	150	71.1	190	52.7	140	151.6	210		
Dissolved Oxygen (mg/l) ^{2, 3}	5.37	6.49	5.62	7.00	6.18	6.90	5.39	5.63		
TOC (mg/l) ^{2, 6}	4.99	6.9	5.87	10.0	2.31	3.5	4.41	7.2		
Total Aluminum (ug/l) ^{2, 6}	21.2	38.4	24.4	51	39.8	250	95.3	600		
Total Chromium (ug/l) ^{2, 6}	0.4	1.2	0.20	1.1	0.30	1.1	0.4	2.2		
Total Copper (ug/l) ^{2, 6}	0	0	0	0	0	0	0	0		
Total Iron (mg/l) ^{2, 6}	4.09	6.4	3.04	4.70	1.50	3.40	1.10	3.10		
Total Lead (ug/l) ^{2, 6}	0.04	1.5	0.10	1.6	0.6	2.9	0.1	3.6		
Total Zinc (ug/l) ^{2, 6}	15.5	34	13.8	35	0.6	16	14.4	26.0		

¹ Results reported as average monthly were determined using the arithmetic average of rainfall amount during the entire storm for the outfall drainage area. Results reported as maximum daily was determined from maximum rainfall measurement for the duration of the storm for each outfall drainage area.

² Results reported as maximum daily were the maximum of the 12 samples collected during the 12 hours of sampling.

³ Results reported as average monthly were determined using the arithmetic average of the 12 samples collected during the 12 hours of sampling.

⁴ Results reported as average monthly were determined using the arithmetic average of the 3 samples collected (when available) during the first 3 hours of sampling.

⁵ Results reported as maximum daily were the maximum of the 3 samples collected (when available) during the first 3 hours of sampling.

⁶ Results reported as average monthly were determined by using a flow-weighted average of the 12 samples collected during the 12 hours of sampling.

⁷ Results reported as average monthly were determined by using a geometric mean of the 3 samples collected (when available) during the 3 hours of sampling.

⁸ Outfall 010A: Results reported as average monthly were determined using the arithmetic average of rainfall amount during the entire storm for the outfall drainage area. Results reported as maximum daily was determined from maximum rainfall measurement for the duration of the storm for each outfall drainage area.

BOD₅ - Biological oxygen demand 5-day test
 COD - Chemical oxygen demand
 gpd - Gallons per day
 mg/l - Milligrams per liter
 TOC - Total organic carbon
 TSS - Total suspended solids
 ug/l - Micrograms per liter

TABLE 4
 FIELD ANALYTICAL RESULTS
 MAJOR OUTFALLS
 T.F. GREEN AIRPORT
 WARWICK, RHODE ISLAND
 SECOND QUARTER 2023

Parameter	Major Outfalls							
	Outfall 002A		Outfall 003A		Outfall 008A		Outfall 010A	
	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²
pH	6.67	7.00	6.61	7.00	6.39	6.89	6.60	6.76
Temperature (°F)		61.2		61.8		63.8		61.8

Bold text indicates exceedance of permit standards

¹ Results reported as minimum daily were the minimum of the samples collected during the 12 hours of sampling.

² Results reported as maximum daily were the maximum of the samples collected during the 12 hours of sampling.

TABLE 5
ANALYTICAL RESULTS
MINOR OUTFALLS
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2023

Parameter	Outfall 001A		Outfall 004A		Outfall 006A		Outfall 007A		Outfall 009A		Outfall 011A		Outfall 012A		Outfall 013A	
	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily
Flow (gpd) ¹	NO FLOW	NO FLOW	285,378	1,961,489	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	NO FLOW	409,088	3,023,697	NO FLOW
Oil & Grease (mg/l) ³				1.3											1.4	
TSS (mg/l) ^{2,3}			0	0										1.1	3.2	
Fecal Coliform (MPN/100ml) ^{2,3}			1.8	1.8										1.8	1.8	
BOD ₅ (mg/l) ^{2,3}			0	0										0	0	
Disolved Potassium (mg/l) ^{2,3}			9,067	9,700										4,433	4,600	
Disolved Sodium (mg/l) ^{2,3}			3,70	3,90										7,900	8,300	

¹ Results reported as average monthly were determined using the arithmetic average of rainfall amount during the entire storm for the outfall drainage area. Results reported as maximum daily was determined from maximum rainfall measurement for the duration of the storm for each outfall drainage area.
² Results reported as average monthly were determined using the arithmetic average of the 3 samples collected (when available) during the first 3 hours of sampling.
³ Results reported as maximum daily were the maximum of the 3 samples collected (when available) during the first 3 hours of sampling
 gpd - Gallons per day
 mg/l - Milligrams per liter
 TSS - Total suspended solids

TABLE 6
FIELD ANALYTICAL RESULTS
MINOR OUTFALLS
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2023

Parameter	Outfall 001A		Outfall 004A		Outfall 006A		Outfall 007A		Outfall 009A		Outfall 011A		Outfall 012A		Outfall 013A	
	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²	Minimum Daily ¹	Maximum Daily ²
pH	NO FLOW		6.89		NO FLOW		NO FLOW		NO FLOW		NO FLOW		NO FLOW		6.21	
Temperature (°F)				62.2											63.1	

Bold text indicates exceedance of permit standards

¹ Results reported as minimum daily were the minimum of the samples collected during the 3 hours of sampling.

² Results reported as maximum daily were the maximum of the samples collected during the 3 hours of sampling.

**TABLE 7
PVD RUNOFF VOLUME CALCULATION
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
SECOND QUARTER 2023**

June 12 -13, 2022

Precip (inches): 0.19

Drainage Basin ID	PVD Storm Water Discharge	Receiving Water	Drainage Area (ac)	cu ft precip	gal precip
1	Outfall 001A	Warwick Pond	5.9	4,069.2	30,438
2	Outfall 002A	Warwick Pond	93.4	64,418.0	481,846
3	Outfall 003A	Warwick Pond	119.8	82,626.1	618,043
4	Outfall 004A	Warwick Pond	30.1	20,760.0	155,285
4B	Outfall 004B	Buckeye Brook	2	1,379.4	10,318
4C	Outfall 004C	Buckeye Brook	3	2,069.1	15,477
6	Outfall 006A	Buckeye Brook	10.7	7,379.8	55,201
6B	Outfall 006B	Buckeye Brook	1.5	1,034.6	7,738
6C	Outfall 006C	Buckeye Brook	0.8	551.8	4,127
6D	Outfall 006D	Buckeye Brook	0.7	482.8	3,611
7	Outfall 007A	Buckeye Brook	9.6	6,621.1	49,526
7B	Outfall 007B	Buckeye Brook	1.2	827.6	6,191
8	Outfall 008A	Buckeye Brook	240.6	165,941.8	1,241,245
9	Outfall 009A	Buckeye Brook	38.4	26,484.5	198,104
10	Outfall 010A	Iuscatucket Brook	26	17,932.2	134,133
11	Outfall 011A	Iuscatucket Brook	14	9,655.8	72,225
12	Outfall 012A	Iuscatucket Brook	46.4	32,002.1	239,376
13	Outfall 013A	Warwick Pond	28	19,311.6	144,451
TOTAL AREA			672.1	463,547.4	3,467,334