

Rhode Island Airport Corporation

First Quarter 2022

Outfall and In-Stream Sampling

Rhode Island T.F. Green International Airport

Prepared by:
Rhode Island Airport Corporation

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Background

The RIPDES permit identifies major and minor outfalls at Rhode Island TF Green International Airport (PVD). Outfalls 001A, 002A, 003A, 004A and 013A discharge to tributaries of Warwick Pond. Outfalls, 006A, 007A, 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.

Part I.B.4.h describes water quality monitoring requirements for receiving water bodies. Stream monitoring is conducted at four locations: the inlet to Warwick Pond at Lake Shore Drive; the outlet to Warwick Pond at the south end of Lake Shore Drive; Buckeye Brook at West Shore Road; and Old Mill Creek at Tidewater Drive. These sample locations are identified as BB-02, BB-03, BB-04 and BB-07 (respectively) to maintain consistency with previous sampling studies in the Buckeye Brook watershed. 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 liquid or solid pavement deicer was applied to runways and taxiways during this sampling event.

Summary of Storm

First Quarter (January 1 through March 31) sampling includes the major outfalls (002A, 003A, 008A and 010A) hourly for twelve hours and in-stream sampling locations (BB-02, BB-03, BB-04 and BB-07) every four hours for forty eight hours. The sampling began upon a precipitation event of sufficient magnitude and subsequent to aircraft deicing as specified in the RIPDES permit.

Light rain began falling around 7:00 PM on March 31, 2022. Sampling commenced at 8:00 PM subsequent to measurable accumulation. Outfall sampling continued until approximately 7:00 AM on April 1, 2022. In-stream sampling continued until approximately 7:30 PM on April 2, 2022.

A total of 0.57 inches of precipitation (as water equivalent) was measured at PVD between March 31 and April 2, 2022. Precipitation data is summarized in Table 2.

Summary of Flow

Flow meters are installed at three of the major outfalls: 002A, 003A, and 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 at 15 minute increments. No flow meters are installed at minor outfalls or at outfall 010A, as it is off airport property.

Maximum daily and average monthly flows for outfalls 002A, 003A, and 008A were calculated using measured data. Estimated runoff volumes calculated using drainage area and depth of precipitation for all outfalls are presented in Table 3.

Sample Collection

For the First Quarter the major outfalls (002A, 003A, 008A, and 010A) were sampled hourly for twelve hours, beginning at 8:00 PM on March 31, 2022. Outfall sampling continued until approximately 7:00 AM on April 1, 2022.

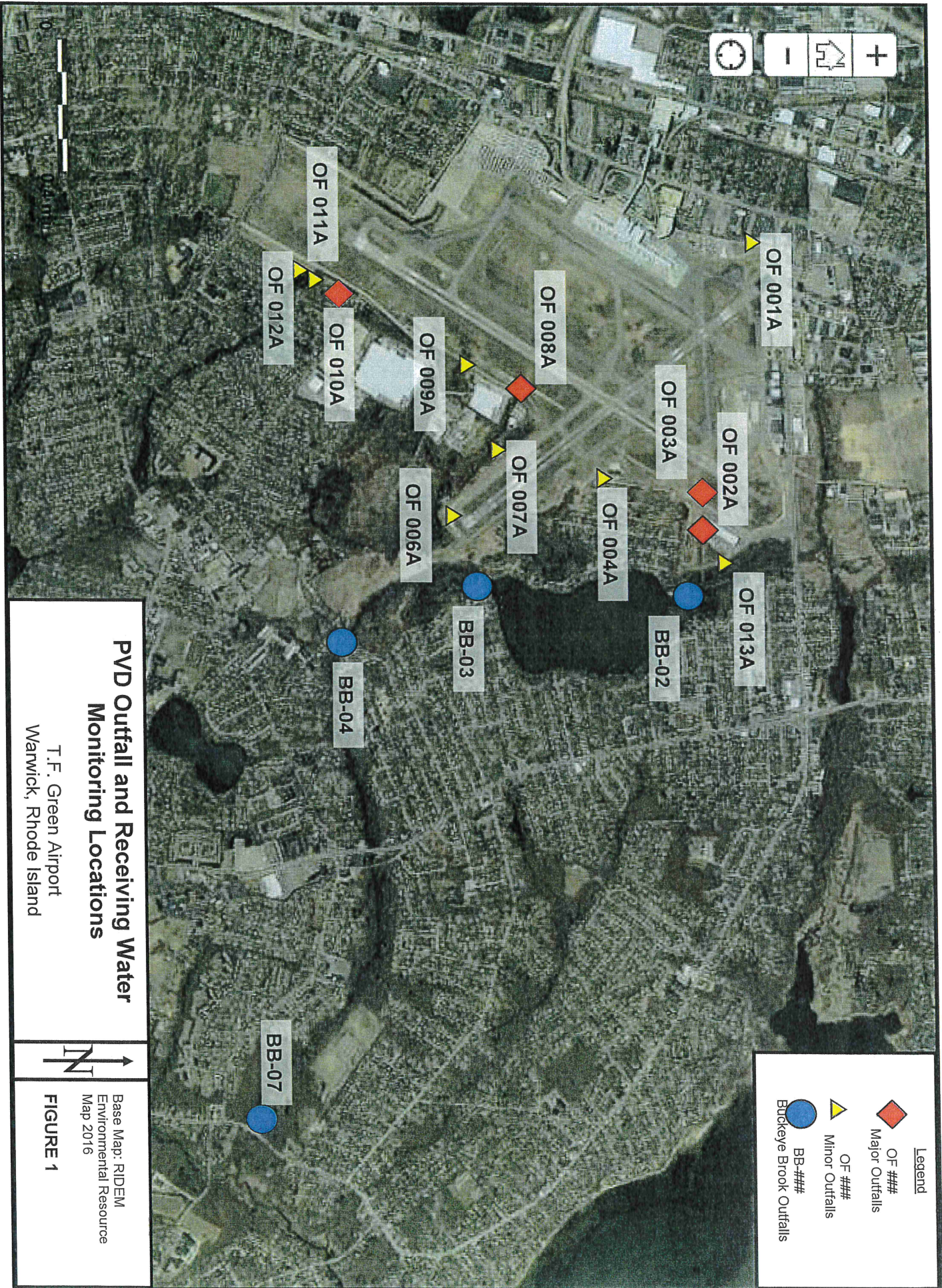
All samples were collected and decanted into sample bottles. The bottles were then placed in ice in a cooler for transport to the laboratory for analysis. Because of the short sample holding time for Fecal Coliform, all samples collected in the first three hours were transported to the laboratory immediately following the third hour of sampling.

Receiving water sampling in Buckeye Brook (BB-02, BB-03, BB-047 and BB-078) commenced concurrent with the outfall sampling. In-stream sampling continued until 7:30 PM on April 2, 2022. Samples were collected every four hours for 48 hours. During downstream sample collection, no discoloration, foaming, or unusual odors were observed by sampling personnel.

At the major outfalls and in-stream sampling measurements for temperature, pH, dissolved oxygen (DO), and specific conductance were taken and recorded in the field. Dissolved oxygen percent saturation was also measured at in-stream locations.

Sampling Results

A summary of sampling results for major outfalls are presented in Tables 4 and 5. In-stream sampling results are presented in Tables 6 and 7.



Legend

- OF ### Major Outfalls
- OF ### Minor Outfalls
- BB-### Buckeye Brook Outfalls

**PVD Outfall and Receiving Water
Monitoring Locations**
T.F. Green Airport
Warwick, Rhode Island

Base Map: RIDEM
Environmental Resource
Map 2016
FIGURE 1

TABLE 1
 LABORATORY ANALYTICAL PARAMETERS
 T.F. GREEN AIRPORT
 WARWICK, RHODE ISLAND
 FIRST QUARTER 2022

Sample Identification	Hours 1-3	Hours 4-12
OF-002A, OF-003A, OF-008A, OF-010A	<ul style="list-style-type: none"> • Fecal coliform • BOD, TSS, Surfactants • COD, TOC • Oil & grease -1664 • Propylene glycol • Dissolved Potassium and Sodium • Total Metals (aluminum, chromium, copper, iron, lead, and zinc) 	<ul style="list-style-type: none"> • BOD, surfactants • COD, TOC • Propylene glycol • Dissolved Potassium and Sodium • Total Metals (aluminum, chromium, copper, iron, lead, and zinc)
Sample Identification	Hours 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, and 48	
BB-02, BB-03, BB-04, BB-07	<ul style="list-style-type: none"> • BOD • COD • Propylene glycol 	

Note: Outfall and BB field measurements for pH, Specific Conductance, Temperature, and Dissolved Oxygen. BB includes DO % saturation
 BOD -biological oxygen demand
 COD -chemical oxygen demand
 TOC -total organic carbon
 TSS -total suspended solids

TABLE 2
PRECIPITATION AMOUNTS
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
FIRST QUARTER 2022

Date	Total Precipitation (water equivalent, in inches)	Snowfall (inches)
March 28, 2022	0	0
March 29, 2022	0	0
March 30, 2022	0	0
March 31, 2022	0.36	0
April 1, 2022	0.21	0
April 2, 2022	0	0

Sampling commenced at 20:00 on March 31, 2022
Major outfall sampling ended at 07:00 on April 1, 2022
Buckeye Brook sampling ended at 19:40 on April 2, 2022

**TABLE 3
PVD RUNOFF VOLUME CALCULATION
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
FIRST QUARTER 2022**

3/31-4/2/2022 Precip (inches): **0.57**

Drainage Basin ID	PVD Storm Water Discharge	Receiving Water	Drainage Area (ac)	gal precip
1	Outfall 001A	Warwick Pond	5.9	91,314
2	Outfall 002A	Warwick Pond	93.4	1,445,539
3	Outfall 003A	Warwick Pond	119.8	1,854,129
4	Outfall 004A	Warwick Pond	30.1	465,854
6	Outfall 006A	Buckeye Brook	10.7	165,602
6B	Outfall 006B	Buckeye Brook	1.5	23,215
6C	Outfall 006C	Buckeye Brook	0.8	12,381
6D	Outfall 006D	Buckeye Brook	0.7	10,834
7	Outfall 007A	Buckeye Brook	9.6	148,578
7B	Outfall 007B	Buckeye Brook	1.2	18,572
8	Outfall 008A	Buckeye Brook	240.6	3,723,734
9	Outfall 009A	Buckeye Brook	38.4	594,312
10	Outfall 010A	Tuscatucket Brook	26	402,399
11	Outfall 011A	Tuscatucket Brook	14	216,676
12	Outfall 012A	Tuscatucket Brook	46.4	718,127
13	Outfall 013A	Warwick Pond	28	433,352
			667.1	10,324,619

**TABLE 4
ANALYTICAL RESULTS
MAJOR OUTFALLS
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
FIRST QUARTER 2022**

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
Flow (gpd) ^{1,8}	900,179	3,939,113	1,154,076	5,050,145	2,319,692	10,150,791	734,208	734,208
Oil & Grease (mg/l) ⁵		0.59		2.7		0.58		7.5
TSS (mg/l) ^{4,5}	9.2	11	1.7	3.0	1.3	4.0	1.8	3.3
Fecal Coliform (MPN/100ml) ^{7,5}	1.8	1.8	3.1	9.3	4.9	33	1.8	1.8
BOD ₅ (mg/l) ^{2,6}	1.2	7.9	7.2	24.0	3.9	11.0	ND	ND
Propylene Glycol (mg/l) ^{2,6}	ND	ND	0.83	11.7	ND	ND	ND	ND
COD (mg/l) ^{2,6}	10	35	19.0	41	13.7	34	5.7	31
Dissolved Potassium (mg/l) ^{2,6}	3.41	5.10	3.99	8.00	2.31	7.00	7.56	12.00
Dissolved Sodium (mg/l) ^{2,6}	0.80	4.60	18.07	57.00	18.51	85.00	9.50	18.00
Surfactants (ug/l) ^{2,6}	29.99	260	45.1	220	53.76	220	34.2	160.0
Dissolved Oxygen (mg/l) ^{2,3}	6.34	7.43	6.56	7.78	7.56	8.90	6.08	7.44
TOC (mg/l) ^{2,6}	2.86	6.1	5.28	12.0	3.40	9.8	2.38	3.7
Total Aluminum (ug/l) ^{2,6}	185.6	500	292.8	630	185.0	580	223.3	1400
Total Chromium (ug/l) ^{2,6}	0.32	2.2	0.79	2.9	0.88	3.0	0.53	4.4
Total Copper (ug/l) ^{2,6}	ND	ND	1.47	10	ND	ND	0.92	11.0
Total Iron (mg/l) ^{2,6}	4.47	12.0	1.11	1.6	1.43	4.5	1.15	2.4
Total Lead (ug/l) ^{2,6}	2.51	9.2	1.01	2.3	0.63	4.3	2.20	13.0
Total Zinc (ug/l) ^{2,6}	ND	ND	ND	ND	ND	ND	ND	ND

¹ Results reported as average monthly were determined using the arithmetic average of measurement made every 15 minutes during the 12 hours of sampling. Results reported as maximum daily was the maximum flow measurements over the 12 hours of sampling. Both reported values were converted from GPM to GPD reflecting a 24 hour day

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 does not have a flow meter installed. Therefore, flow was calculated arithmetically utilizing the Outfall drainage area, storm intensity, and duration.

BOD₅ Biological oxygen demand 5-day test

COD Chemical oxygen demand

TOC Total organic carbon

TSS Total suspended solids

gpd gallons per day

mg/l milligrams per liter

ug/l micrograms per liter

ND - Non-Detect

TABLE 5
FIELD ANALYTICAL RESULTS
MAJOR OUTFALLS
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
FIRST QUARTER 2022

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	6.7		6.5		6.6		6.4	
Temperature (°F)		58.2		58.0		56.4		56.4

Bold text indicates exceedance of permit standards

Reported values are from laboratory analysis. Field pH measurements were taken but not used for this report

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 6
ANALYTICAL RESULTS
BUCKEYE BROOK
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
FIRST QUARTER 2022

Parameter	BB-02		BB-03		BB-04		BB-07	
	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily
Conductivity (umhos/cm) ^{1,2}	335.8	403.3	326.1	358.1	352.5	487.2	313	362
BOD ₅ (mg/l) ^{1,2}	4.0	5.5	4.5	4.8	4.1	5.3	3.7	4.7
COD (mg/l) ^{1,2}	16.8	33	20.2	47	15.6	18	15	23
Dissolved Oxygen (mg/l) ^{1,2}	6.52	7.98	8.53	9.61	6.25	6.85	6.98	8.19
Dissolved Oxygen Saturation (%) ^{1,2}	66.3	101.1	82.5	95.2	61.3	70.0	70.9	83.3
Propylene Glycol (mg/l) ^{1,2}	ND	ND	ND	ND	ND	ND	ND	ND

¹ Results reported as average monthly were determined using the arithmetic average of measurements made every 4 hours during the 48 hours of sampling.

² Results reported as maximum daily were the maximum samples collected every 4 hours during the 48 hours of sampling.

BOD₅ Biological oxygen demand 5-day test

COD Chemical oxygen demand

mg/ milligrams per liter

ND - Non-Detect

TABLE 7
FIELD ANALYTICAL RESULTS
BUCKEYE BROOK
T.F. GREEN AIRPORT
WARWICK, RHODE ISLAND
FIRST QUARTER 2022

Parameter	BB-02		BB-03		BB-04		BB-07	
	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	6.15	7.01	6.26	6.95	6.23	6.96	6.35	6.94
Temperature (°F)		62.1		53.7		54.9		56.8

Bold text indicates exceedance of permit standards

¹ Results reported as average monthly were determined using the arithmetic average of measurement made every 4 hours during the 48 hours of sampling. Results reported as maximum daily was the maximum flow measurements over the 12 hours of sampling.

² Results reported as maximum daily were the maximum of the 12 samples collected during the 48 hours of sampling.