EPA Region 5 Records Ctr.
268931

31 October 02

Mr. Joe Fredle
On-Scene Coordinator
Emergency Response Branch
U.S. Environmental Protection Agency Region 5
25089 Center Ridge Road
Westlake, OH 44145

Subject: **Final Letter Report**
Cleveland Hopkins International Airport Site
Cleveland, Cuyahoga County, Ohio
Technical Direction Document No. S05-0107-007
Tetra Tech Contract No. 68-W-00-129

Dear Mr. Fredle:

The Tetra Tech EM Inc. Superfund Technical Assessment and Response Team (START) has prepared this letter report in accordance with the requirements of Technical Direction Document (TDD) No. S05-0107-007, which the U.S. Environmental Protection Agency (U.S. EPA) assigned to START. The scope of this TDD includes photographic documentation of site activities, collection of water samples from airport outfalls, laboratory analyses of samples, validation of water sample analytical data, and preparation of a letter report. Enclosure 1 of this letter report provides site figures, Enclosure 2 provides a photographic log, Enclosure 3 provides the validated analytical results, and Enclosure 4 is a technical summary of the visible and olfactory effects on water quality at the airport outfalls affected by runway construction.

The Cleveland Hopkins International Airport site is located in Cleveland, Ohio (see Figure 1 in Enclosure 1). The site is in a primarily industrial and commercial area and is bounded by State Route 237 and railroad tracks to the east, the NASA John H. Glenn Research Center and Aerospace Parkway to the west, Brook Park Road to the north, and Aerospace Parkway and the IX Center to the south. The airport is owned by the City of Cleveland and is currently expanding through the construction of a new runway. The runway construction involved the placement of approximately 100,000 cubic yards of slag as a sub-base. The slag is a by-product of the steel-making process and was obtained from a local steel manufacturing facility.

Shallow groundwater at the site may have contacted the slag and possibly leached into the two nearby surface water bodies: Abrams Creek and the Rocky River. City of Cleveland officials therefore ordered the slag to be removed and replaced with limestone. The slag-effected outfalls from the airport were monitored for water quality over the course of several monitoring events from July 01 through October 01. Photographs of the sampling events are contained in Enclosure 2. Temperature, pH,

conductivity, turbidity, dissolved oxygen (DO), ammonia, hydrogen sulfide, salinity, and sulfite were all measured in the field during these sampling events. Hach kit analyses were also performed for ammonia, sulfide, and sulfate. Samples were the taken and analyzed for chemical oxygen demand (COD), ethylene glycol, propylene glycol, ammonia, sulfate, sulfide, sulfite, and total dissolved solids (TDS). Resource Conservation and Recovery Act (RCRA) total metals analyses were conducted on samples collected on 03 Oct 01 and 12 Oct 01. Table 1 in Enclosure 3 summarizes all field and laboratory results. The distinguishing color and odor associated with the slag-effected runoff from the airport is explained in Enclosure 4. The unique visual and olfactory attributes of the runoff is commonly associated with slag leachate.

Tetra Tech does not anticipate any further activities under this TDD. If you have any questions or comments about the report or need additional copies, please contact me at (440) 234-0886.

Sincerely,

William P. Kosco

Bill Kosco
Project Manager

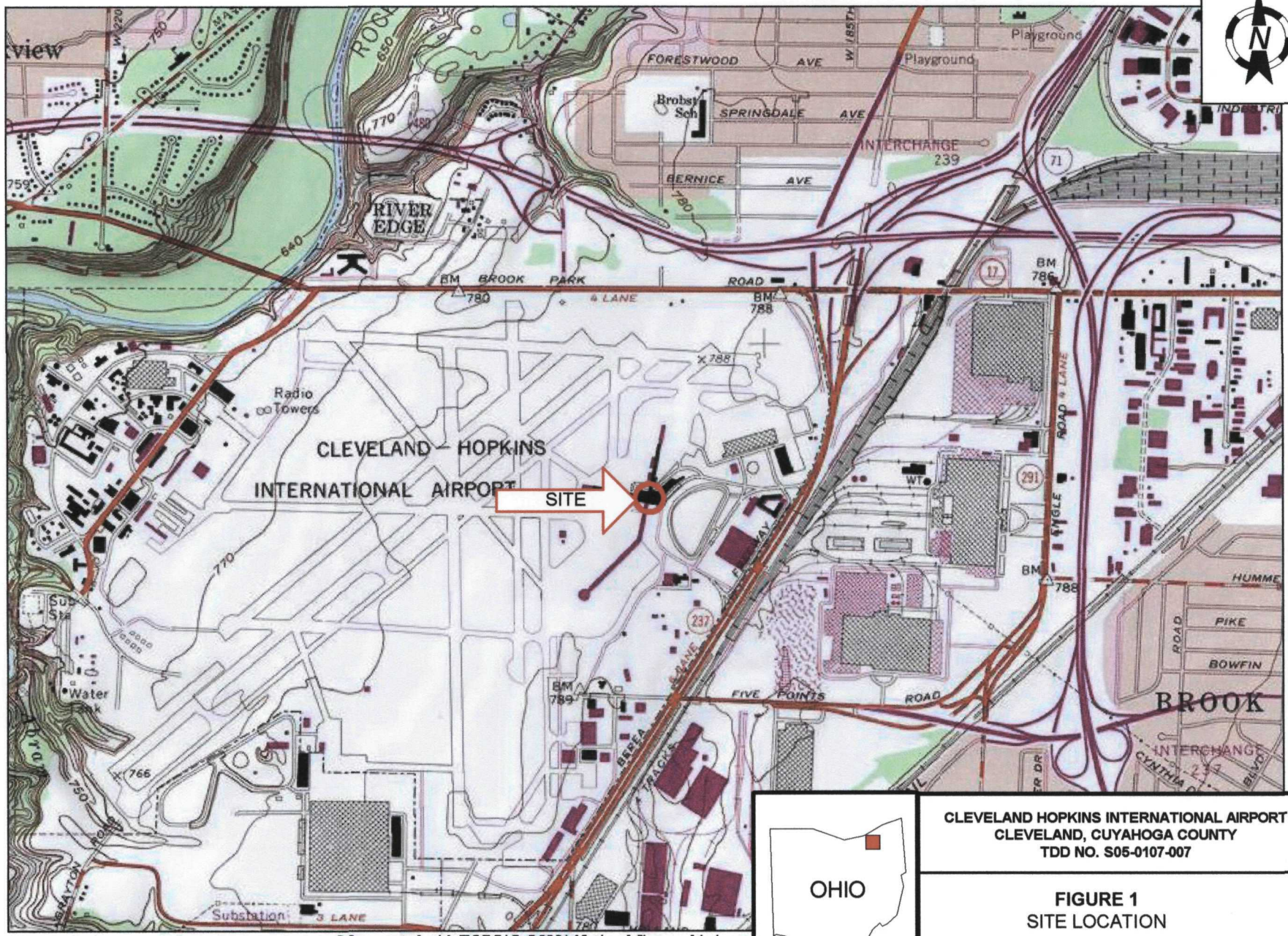
Enclosures (5)

cc: Lorraine Kosik, START Program Officer (letter only)
Thomas Kouris, START Program Manager (letter only)

ENCLOSURE 1

SITE FIGURES

(Two Pages)

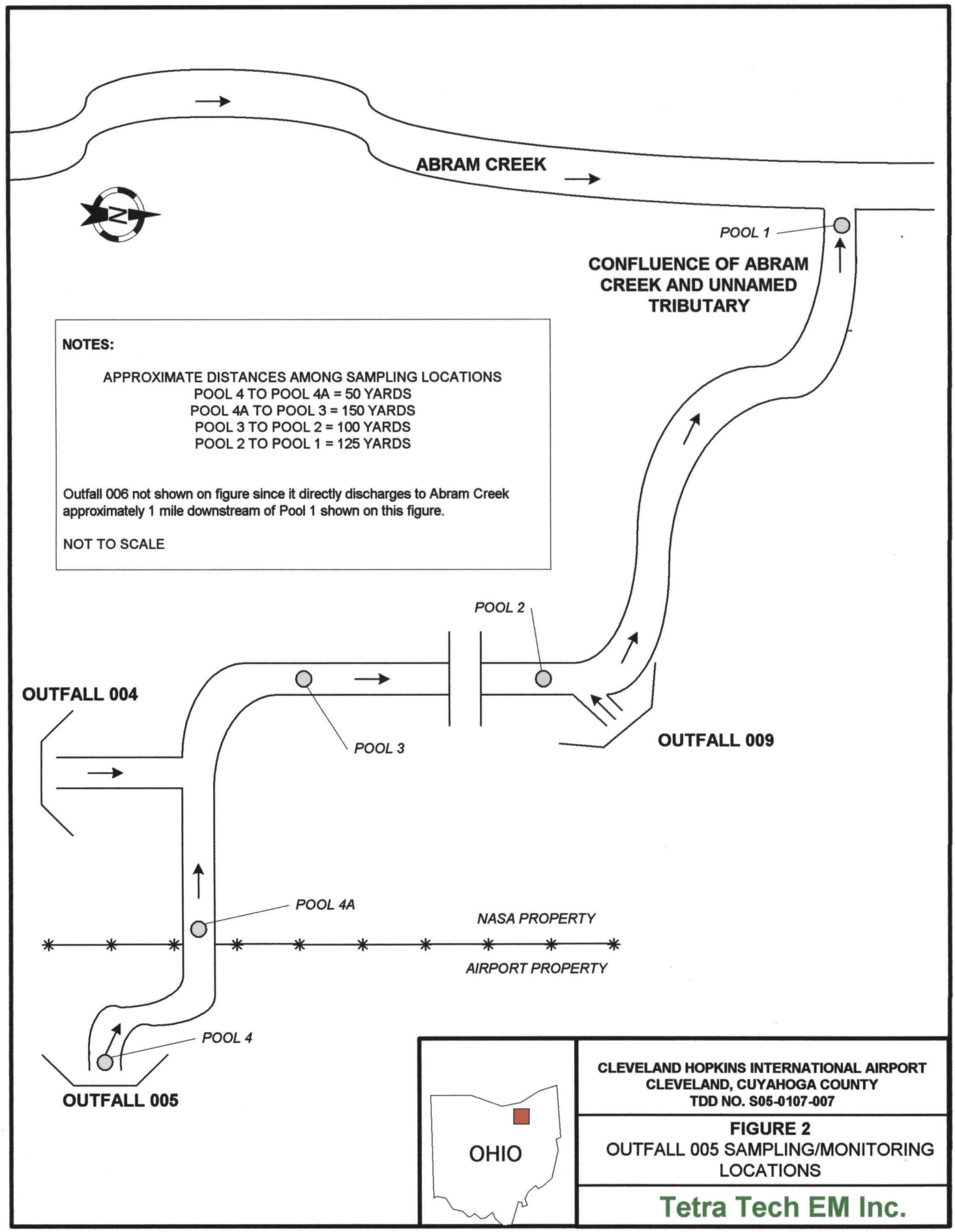


Map created with TOPO!® ©2001 National Geographic (www

CLEVELAND HOPKINS INTERNATIONAL AIRPORT
CLEVELAND, CUYAHOGA COUNTY
TDD NO. S05-0107-007

FIGURE 1
SITE LOCATION

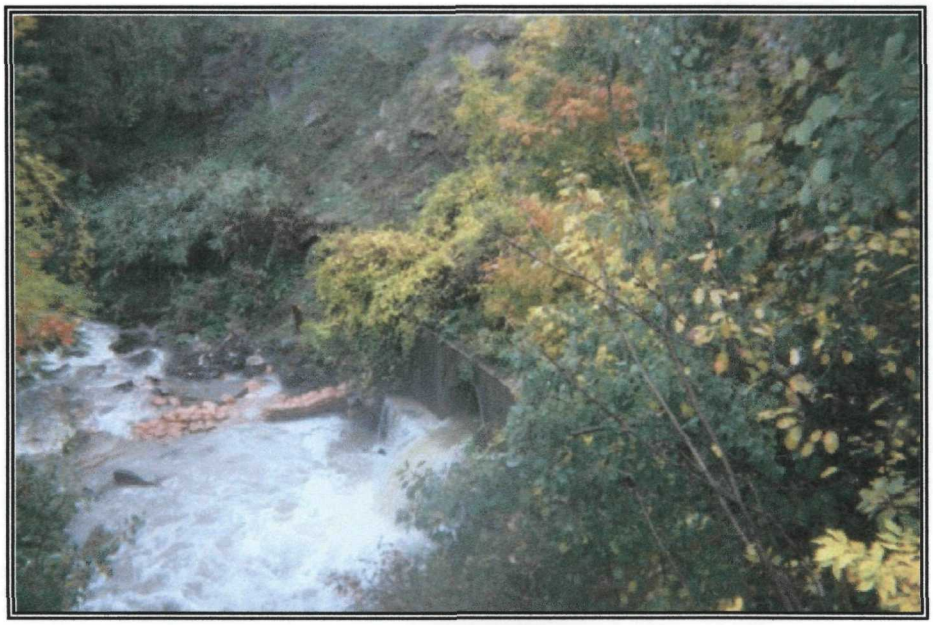
Tetra Tech EM Inc.


ABRAM CREEK
POOL 1
CONFLUENCE OF ABRAM CREEK AND UNNAMED TRIBUTARY
NOTES:
APPROXIMATE DISTANCES AMONG SAMPLING LOCATIONS
POOL 4 TO POOL 4A = 50 YARDS
POOL 4A TO POOL 3 = 150 YARDS
POOL 3 TO POOL 2 = 100 YARDS
POOL 2 TO POOL 1 = 125 YARDS
Outfall 006 not shown on figure since it directly discharges to Abram Creek approximately 1 mile downstream of Pool 1 shown on this figure.
NOT TO SCALE
POOL 2
OUTFALL 004
POOL 3
OUTFALL 009
POOL 4A
NASA PROPERTY
AIRPORT PROPERTY
POOL 4
OUTFALL 005
OHIO
CLEVELAND HOPKINS INTERNATIONAL AIRPORT
CLEVELAND, CUYAHOGA COUNTY
TDD NO. S05-0107-007
FIGURE 2
OUTFALL 005 SAMPLING/MONITORING LOCATIONS
Tetra Tech EM Inc.

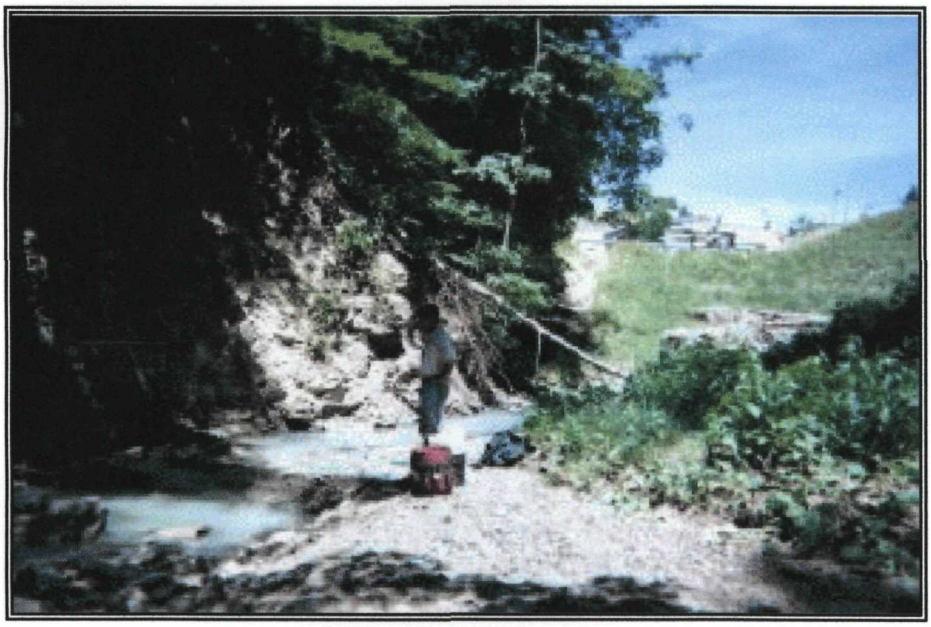
ENCLOSURE 2

PHOTOGRAPHIC LOG

(Four Pages)



Photograph No.: 1 **Orientation:** North
TDD No.: S05-0107-007 **Date:** 12 Oct 01
Location: Cleveland Hopkins International Airport (Hopkins Airport)
Subject: Outfall 005



Photograph No.: 2 **Orientation:** Northwest
TDD No.: S05-0107-007 **Date:** 27 Jul 01
Location: Hopkins Airport
Subject: Impacted stream downstream of Outfall 005 (sampling\monitoring location 3)

Photograph No.: 3 **Orientation:** Southeast
TDD No.: S05-0107-007 **Date:** 01 Aug 01
Location: Hopkins Airport
Subject: Outfall 004 entering Outfall 005 stream. Note milky white color.

Photograph No.: 4 **Orientation:** East
TDD No.: S05-0107-007 **Date:** 18 Jul 01
Location: Hopkins Airport
Subject: Outfall 005 discharge into Abram Creek

Photograph No.: 5 **Orientation:** West
TDD No.: S05-0107-007 **Date:** 18 Jul 01
Location: Hopkins Airport
Subject: Outfall 005 discharge into Abram Creek

Photograph No.: 6 **Orientation:** Southeast
TDD No.: S05-0107-007 **Date:** 8 Aug 01
Location: Hopkins Airport
Subject: Discharge from Outfall 006. View facing outfall pipe.

Photograph No.: 7 **Orientation:** Southeast
TDD No.: S05-0107-007 **Date:** 09 Aug 01
Location: Hopkins Airport
Subject: Outfall 006 discharge staining cliff wall and entering Abram Creek.

ENCLOSURE 3

LABORATORY ANALYTICAL RESULTS

(Ten Pages)

Table 1. Hopkins International Airport Data

			Water Quality Meter Readings						KIT	HACH KIT					Laboratory Data							
Location	Date	Time	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (oC)	Salinity (%)	Ammonia (mgL)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Sulfite (mg/L)	Sulfate (mg/L)	Ammonia (mg/L)	COD (mg/L)	Ethylene Glycol (mg/L)	Propylene Glycol (mg/L)	Ammonia (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Total Sulfide (mg/L)	Sulfite (mg/L)
Pool 1 Confluence 005 and Abram Creek	07/25/01	14:45	7.00	1.77	110	***9.40***	24.4	0.08	5	3.5	NA	NA	NA	NA								
	07/26/01	9:45	6.80	0.95	218	***9.80***	20.6	0.03	5	0.3	NA	NA	NA	NA								
		14:20	6.80	0.84	74	***9.66***	22.3	0.03	10	0.0	0.063	NA	NA	NA								
	07/27/01	10:50	6.30	1.18	104	***10.38***	18.2	0.05	10	0.0	0.025	NA	115	8.70	42	<5	<5	6.1	700	120	<0.1	<2
		16:00	7.76	1.15	106	***10.00***	22.3	0.05	NA	0.0	0.032	NA	105	6.90								
	07/30/01	9:20	7.05	1.89	106	***10.03***	20.1	0.08	10	4.0	0.645	NA	165	6.70								
		17:00	7.50	1.66	112	***8.90***	24.2	0.07	15	4.5	>0.660	NA	75	9.05								
	07/31/01	9:15	7.30	1.18	153	***10.00***	20.4	0.05	5	0.3	0.272	NA	50	5.90	80	<5	<5	5	690	54	0.23	<2
	08/01/01	8:15	7.07	1.07	31	***10.11***	19.9	0.04	8	0.3	0.047	NA	95	6.35								
	08/06/01	10:00	7.35	1.39	98	***9.27***	21.1	0.06	15	0.0	0.054	NA	91	10.01								
	08/07/01	9:00	7.64	1.59	NA	0.02	19.9	0.07	10	0.0	0.031	1.28	105	8.70								
	08/08/01	8:50	7.68	1.49	39	0.10	21.6	0.06	15	0.5	0.044	3.84	125	10.96								
	08/09/01	10:52	7.65	1.74	37	0.06	22.3	0.08	12	0.3	1.620	5.76	120	10.90	40	<5	<5	9	960	130	<0.1	<2
	08/16/01	9:30	7.63	1.61	NA	1.78	18.2	0.07	10	0.0	0.004	1.28	165	7.55								
	08/20/01	10:30	7.87	1.64	34	1.18	18.0	0.07	0	0.0	0.024	3.84	1280	8.20	48	<5	<5	7.4	950	120	<0.1	<2
	08/23/01	12:10	7.81	0.88	13	5.34	19.0	0.03	0	0.1	0.000	0.64	95	3.50								
	08/27/01	17:30	7.71	0.95	22	4.05	21.6	0.04	8	0.0	0.004	0.64	115	1.05								
	08/30/01	17:00	7.72	1.42	17	1.36	21.3	0.06	8	0.1	0.000	1.28	120	5.95								
	09/04/01	16:50	Confluence Water Discharge Not White																			
	09/05/01	13:35	Confluence Water Discharge Not White																			
	09/06/01	14:40	Confluence Water Discharge Not White																			
	09/17/01	14:30	Confluence Water Discharge Not White																			
	09/20/01	13:30	Confluence Water Discharge Not White																			
	09/26/01	15:20	Confluence Water Discharge Not White																			
	10/03/01	12:30	8.19	1.62	18	2.48	16.3	0.07	15	0.0	0.012	0.64	240	10.80								

Note: Dissolved oxygen concentrations in bold type are considered invalid data.

Table 1. Hopkins International Airport Data

			Water Quality Meter Readings						KIT	HACH KIT					Laboratory Data							
Location	Date	Time	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (oC)	Salinity (%)	Ammonia (mgL)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Sulfite (mg/L)	Sulfate (mg/L)	Ammonia (mg/L)	COD (mg/L)	Ethylene Glycol (mg/L)	Propylene Glycol (mg/L)	Ammonia (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Total Sulfide (mg/L)	Sulfite (mg/L)
Pool 2 Upstream of OF 009	07/25/01	15:00	7.10	1.77	91	***9.62***	22.9	0.08	5	5.0	NA	NA	NA	NA								
	07/26/01	10:00	6.80	0.77	58	***9.73***	20.0	0.03	15	0.7	NA	NA	NA	NA								
		14:50	7.10	0.93	132	***9.23***	22.6	0.04	5	3.0	0.064	NA	NA	NA								
	07/27/01	11:30	6.42	1.14	61	***9.84***	17.8	0.05	10	1.0	0.031	NA	90	10.45	50	<5	<5	6.3	690	110	0.2	<2
		16:10	7.85	1.17	107	***9.90***	21.2	0.05	NA	4.0	0.095	NA	105	6.50								
	07/30/01	10:00	7.45	2.04	56	***9.61***	19.9	0.09	15	4.0	>0.660	NA	110	6.96								
		17:10	7.74	1.54	161	***8.92***	23.4	0.07	15	>5.0	1.320	NA	60	15.00								
	07/31/01	9:30	7.79	1.08	83	***10.20***	20.0	0.04	2	>5.0	1.804	NA	45	6.25	140	<5	<5	4.8	730	61	<0.1	<2
	08/01/01	8:45	7.85	1.35	NA	***9.82***	19.5	0.06	8	1.0	0.650	NA	95	6.70								
	08/06/01	10:20	7.65	1.39	102	***9.30***	20.9	0.06	15	5.0	>0.660	NA	105	11.11								
	08/07/01	9:20	7.79	1.52	NA	0.45	19.7	0.07	20	4.5	1.506	0.64	120	9.10								
	08/08/01	9:30	7.90	1.54	34	0.50	20.9	0.07	15	5.0	13.770	10.24	185	12.16								
	08/09/01	11:10	7.87	1.72	22	0.61	22.5	0.08	18	5.0	1.620	5.76	135	11.05	47	<5	<5	9.3	970	150	0.16	<2
	08/16/01	9:45	8.04	1.70	NA	1.34	18.3	0.07	15	0.7	0.012	7.04	170	8.35								
	08/20/01	10:45	7.93	1.61	44	1.49	17.9	0.07	10	0.0	0.030	5.76	130	8.05	60	<5	<5	7.4	940	140	0.26	<2
	08/23/01	12:20	7.84	1.00	17	6.26	18.8	0.04	0	0.7	0.000	0.64	110	4.30								
	08/27/01	17:40	7.86	0.89	18	4.96	20.7	0.03	2	0.0	0.003	0.64	110	0.60								
	08/30/01	17:15	7.73	1.44	27	1.50	20.5	0.06	9	0.7	0.000	1.92	135	5.50								
	10/03/01	12:45	8.20	1.63	15	4.02	17.7	0.07	15	0.3	0.030	0.64	210	8.56								

Note: Dissolved oxygen concentrations in bold type are considered invalid data.

Table 1. Hopkins International Airport Data

			Water Quality Meter Readings						KIT	HACH KIT					Laboratory Data							
Location	Date	Time	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (oC)	Salinity (%)	Ammonia (mgL)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Sulfite (mg/L)	Sulfate (mg/L)	Ammonia (mg/L)	COD (mg/L)	Ethylene Glycol (mg/L)	Propylene Glycol (mg/L)	Ammonia (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Total Sulfide (mg/L)	Sulfite (mg/L)
Pool 3 Downstream of Confluence of OF 004	07/25/01	15:15	7.10	2.07	126	***9.96***	21.3	0.09	10	4.0	NA	NA	NA	NA								
	07/26/01	10:30	7.00	0.95	50	***9.98***	19.1	0.04	10	2.0	NA	NA	NA	NA								
		15:10	7.20	0.90	68	***9.68***	21.0	0.03	10	4.0	0.660	NA	NA	NA								
	07/27/01	13.:05	7.58	1.23	69	***11.32***	19.4	0.05	10	4.0	0.036	NA	105	7.95	95	<5	<5	7	780	140	1	<2
		16:10	7.97	1.37	103	***9.95***	20.0	0.06	NA	4.0	0.063	NA	80	8.60								
	07/30/01	10:20	7.73	2.35	148	***9.82***	19.1	0.11	10	1.5	>.660	NA	115	8.45								
		17:25	7.57	1.57	114	***9.39***	22.3	0.07	15	>5.0	3.060	NA	55	8.75								
	07/31/01	9:55	7.79	1.34	43	***10.26***	16.6	0.06	8	3.0	0.646	NA	115	4.20	170	<5	<5	3.6	910	130	0.7	<2
	08/01/01	9:05	7.80	1.27	NA	***9.78***	19.1	0.05	5	1.5	0.397	NA	115	6.20								
	08/06/01	10:35	8.05	1.54	95	***9.48***	20.8	0.07	15	4.0	0.656	NA	112	13.42								
	08/07/01	9:40	7.89	1.77	NA	0.64	19.2	0.08	20	5.0	0.623	1.28	130	2.56								
	08/08/01	10:00	7.98	1.90	42	0.83	19.7	0.09	20	5.0	1.479	8.96	240	16.24								
	08/09/01	11:30	7.88	1.85	33	0.35	20.8	0.08	15	>5.0	1.392	5.76	145	11.95	91	<5	<5	11	1080	160	<0.1	2.5
	08/16/01	10:00	8.09	1.93	NA	1.03	17.9	0.09	15	2.0	0.040	5.12	165	10.60								
	08/20/01	14:10	8.00	2.04	62	3.81	17.3	0.09	10	2.0	0.036	6.40	165	7.85	210	<5	<5	7.3	1260	180	<0.1	<2
	08/23/01	12:30	7.79	1.02	18	4.40	18.3	0.04	0	0.7	0.000	1.28	115	4.60								
	08/30/01	17:35	7.75	1.52	45	1.93	19.3	0.07	8	1.0	0.007	2.56	195	6.30								
	10/03/01	13:05	8.33	1.50	18	3.25	16.7	0.06	15	0.3	0.016	0.64	200	9.20								

Note: Dissolved oxygen concentrations in bold type are considered invalid data.

Table 1. Hopkins International Airport Data

			Water Quality Meter Readings						KIT	HACH KIT					Laboratory Data							
Location	Date	Time	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (oC)	Salinity (%)	Ammonia (mgL)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Sulfite (mg/L)	Sulfate (mg/L)	Ammonia (mg/L)	COD (mg/L)	Ethylene Glycol (mg/L)	Propylene Glycol (mg/L)	Ammonia (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Total Sulfide (mg/L)	Sulfite (mg/L)
Pool 4 005 Discharge Pool	07/25/01	16:00	7.50	2.23	129	***11.66***	17.2	0.10	20	0.0	NA	NA	NA	NA								
	07/26/01	10:50	7.00	0.89	83	***10.80***	17.7	0.04	10	0.0	NA	NA	NA	NA								
		15:30	7.10	1.18	49	***10.64***	18.9	0.05	10	0.0	0.028	NA	NA	NA								
	07/27/01	13:25	8.12	1.48	84	***12.02***	18.8	0.06	20	0.0	0.034	NA	130	10.70	240	<5	<5	11	980	160	<0.1	<2
		16:35	8.25	1.51	58	***11.12***	17.1	0.06	NA	0.1	0.047	NA	100	12.80								
	07/30/01	10:45	7.85	2.25	NA	***10.27***	18.2	0.10	20	0.0	0.131	NA	115	13.75								
		17:45	7.02	1.67	230	***10.71***	19.0	0.07	20	>5.0	1.130	NA	40	11.65								
	07/31/01	10:20	8.02	2.35	102	***11.28***	17.6	0.11	10	0.1	0.045	NA	240	10.40	150	<5	<5	8.9	1290	200	<0.1	<2
	08/01/01	9:45	8.09	2.60	NA	***10.78***	17.0	0.12	20	0.0	0.061	NA	205	11.20								
	08/06/01	11:15	8.49	1.65	126	***9.46***	21.6	0.07	30	0.0	0.081	NA	133	16.72								
	08/07/01	10:20	8.37	1.88	NA	1.97	17.8	0.08	25	0.1	0.022	0.64	175	18.32								
	08/08/01	11:00	8.19	2.09	87	1.81	17.4	0.09	15	0.1	0.037	1.92	185	13.44	190	<5	<5	12	1130	210	<0.1	<2
	08/09/01	11:50	8.14	1.67	115	1.84	17.7	0.07	15	0.0	0.051	4.48	210	18.48								

Note: Dissolved oxygen concentrations in bold type are considered invalid data.

Table 1. Hopkins International Airport Data

			Water Quality Meter Readings						KIT	HACH KIT					Laboratory Data							
Location	Date	Time	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (oC)	Salinity (%)	Ammonia (mgL)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Sulfite (mg/L)	Sulfate (mg/L)	Ammonia (mg/L)	COD (mg/L)	Ethylene Glycol (mg/L)	Propylene Glycol (mg/L)	Ammonia (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Total Sulfide (mg/L)	Sulfite (mg/L)
Pool 4A NASA/Airport Property Line	08/16/01	10:10	8.46	2.14	NA	2.04	17.0	0.10	15	3.0	0.090	5.76	180	12.50								
	08/20/01	14:30	8.07	2.06	51	5.31	17.0	0.09	10	1.0	0.038	3.20	200	8.50	160	<5	<5	7.4	1260	220	<0.1	<2
	08/23/01	12:45	8.13	1.97	34	4.72	17.6	0.04	0	0.7	0.000	1.28	100	5.70								
	08/27/01	18:05	8.10	1.17	31	5.71	18.4	0.05	8	0.5	0.014	0.64	115	2.00								
	08/30/01	17:55	7.84	1.64	47	4.21	17.3	0.07	9	1.9	0.012	1.92	235	6.00								
	10/03/01	14:20	8.79	1.78	26	5.01	17.1	0.08	20	0.5	0.013	0.64	180	12.60								

Table 1. Hopkins International Airport Data

			Water Quality Meter Readings						KIT	HACH KIT					Laboratory Data							
Location	Date	Time	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (oC)	Salinity (%)	Ammonia (mgL)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Sulfite (mg/L)	Sulfate (mg/L)	Ammonia (mg/L)	COD (mg/L)	Ethylene Glycol (mg/L)	Propylene Glycol (mg/L)	Ammonia (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Total Sulfide (mg/L)	Sulfite (mg/L)
OF 005 Discharge Water	07/25/01	16:15	7.30	2.25	131	***11.88***	16.5	0.10	20	0.0	NA	NA	NA	NA								
	07/26/01	11:05	6.90	1.04	52	***10.65***	17.3	0.04	5	0.0	NA	NA	NA	NA								
		15:50	7.30	1.14	117	***11.06***	18.7	0.05	10	0.0	0.055	NA	NA	NA								
	07/27/01	14:00	8.27	1.51	107	***12.70***	16.9	0.06	20	0.0	0.032	NA	120	15.24	230	<5	<5	12	950	150	<0.1	<2
		16:45	8.25	1.55	56	***11.10***	16.5	0.06	NA	0.1	0.038	NA	115	13.02								
	07/30/01	10:55	7.85	2.09	NA	***10.56***	17.1	0.09	20	0.0	0.118	NA	115	15.06								
		17:55	7.02	1.67	230	***10.71***	19.0	0.07	20	>5.0	1.130	NA	90	19.68								
	07/31/01	10:30	8.27	2.25	63	***11.50***	17.0	0.10	8	0.0	0.038	NA	200	12.45	260	<5	<5	10	1540	190	<0.1	<2
	08/01/01	10:00	8.12	2.45	NA	***10.99***	16.4	0.11	20	0.0	0.070	NA	200	11.30								
	10/12/01	10:30	Discharge Water Not White																			
Abram Creek Upstream of Confluence	07/26/01	16:15	7.00	1.00	95	***8.80***	23.7	0.04	4	0.1	0.012	NA	NA	NA								

Note: Dissolved oxygen concentrations in bold type are considered invalid data.

Table 1. Hopkins International Airport Data

			Water Quality Meter Readings						KIT	HACH KIT					Laboratory Data							
Location	Date	Time	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (oC)	Salinity (%)	Ammonia (mgL)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Sulfite (mg/L)	Sulfate (mg/L)	Ammonia (mg/L)	COD (mg/L)	Ethylene Glycol (mg/L)	Propylene Glycol (mg/L)	Ammonia (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Total Sulfide (mg/L)	Sulfite (mg/L)
OF 006 at Abrams Confluence	08/09/01	9:45	6.62	2.45	130	5.05	21.9	0.11	0	0.0	0.003	86.40	460	0.30	160	<5	<5	<.05	1940	750	<0.1	72
	08/16/01	9:00	7.00	1.78	NA	4.46	18.7	0.08	0	0.0	0.004	1.92	370	0.38								
	08/20/01	9:20	7.34	1.63	34	5.52	18.9	0.07	0	0.0	0.000	1.28	190	0.20								
	08/23/01	11:50	7.26	1.33	23	6.66	20.3	0.06	0	0.0	0.000	1.92	235	0.30								
	08/27/01	17:00	7.26	1.04	25	5.73	21.6	0.04	0	0.0	0.000	1.92	190	0.00								
	08/30/01	16:25	7.72	0.78	10	6.48	21.5	0.03	0	0.0	0.000	1.48	125	0.00								
	09/04/01	15:30	7.28	0.83	19	6.03	20.8	0.03	0	0.0	0.021	5.12	305	0.11								
	09/05/01	12:20	6.90	2.03	36	6.13	19.3	0.09	0	0.0	0.010	7.04	990	0.11								
	09/06/01	14:40	7.26	1.84	34	5.80	18.3	0.08	0	0.0	0.021	0.64	570	0.74								
	09/17/01	15:15	Water Discharge Clear																			
	09/20/01	13:30	Water Discharge Clear																			
	09/26/01	15:55	7.60	1.95	49	5.85	15.2	0.09	0	0.0	0.045	13.44	675	0.57								
	10/03/01	14:07	7.88	1.76	91	5.59	17.4	0.08	5	0.0	0.024	0.64	450	0.73								
OF 006	10/12/01	13:45	8.22	1.06	115	8.58	16	0.04	0	0.1	0.055	1.28	220	0.47								

Table 1. Hopkins International Airport Data

			Water Quality Meter Readings						KIT	HACH KIT					Laboratory Data							
Location	Date	Time	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (oC)	Salinity (%)	Ammonia (mgL)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Sulfite (mg/L)	Sulfate (mg/L)	Ammonia (mg/L)	COD (mg/L)	Ethylene Glycol (mg/L)	Propylene Glycol (mg/L)	Ammonia (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Total Sulfide (mg/L)	Sulfite (mg/L)
OF 001	10/12/01	11:35	Discharge Water Not White																			
OF 002		11:20	Discharge Water Not White																			
OF 003		11:55	Discharge Water Not White																			
OF 004		10:40	Discharge Water Not White																			
OF 007		15:00	8.87	0.85	58	8.58	16.1	0.03	6	0.1	0.078	12.80	200	4.65								
OF 008		15:20	Discharge Water Not White																			
OF 009		14:10	Discharge Water Not White																			

Table 1. Hopkins International Airport Data

			Water Quality Meter Readings						KIT	HACH KIT					Laboratory Data							
Location	Date	Time	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (oC)	Salinity (%)	Ammonia (mgL)	Hydrogen Sulfide (mg/L)	Sulfide (mg/L)	Sulfite (mg/L)	Sulfate (mg/L)	Ammonia (mg/L)	COD (mg/L)	Ethylene Glycol (mg/L)	Propylene Glycol (mg/L)	Ammonia (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Total Sulfide (mg/L)	Sulfite (mg/L)
Airport Basin	10/03/01	10:45	10.34	3.39	83	0.19	18.4	0.17	5	>5.0	0.316	>94.5			700	<5	<5	1.2	3310	NA	1.6	370
White Color											0.316		660	2.34								
Green Color											0.095		390	9.68								
RB Effluent	10/12/01	9:45	6.52	3.49	69	1.94	15.0	0.17	0	0.1	0.048	>16.0	1280	2.7	490	<5	<5	0.8	2910	380	<0.1	300

10/03/01 airport retention basin field measurements taken at the interface between green and white water color.

			Detectable Inorganics										
Location	Date	Time	Total Aluminum (mg/L)	Total Calcium (mg/L)	Total Copper (mg/L)	Total Iron (mg/L)	Total Magnesium (mg/L)	Total Manganese (mg/L)	Total Potassium (mg/L)	Total Sodium (mg/L)	Total Vanadium (mg/L)	Total Zinc (mg/L)	Total Barium (mg/L)
Airport Basin	10/03/01	10:45	6.15	503	0.02	7.81	7.31	0.3	358	127	0.01	0.07	0.18
White Color													
Green Color													
RB Effluent	10/12/01	9:45	ND	459	ND	0.26	6.07	0.364	356	116	<0.01	0.04	0.17

ENCLOSURE 4

TECHNICAL EXPLANATION OF DISCHARGE CHARACTERISTICS

(Two Pages)

COLORATION OF RUNOFF
CLEVELAND HOPKINS INTERNATIONAL AIRPORT

Steel slag was used as an aggregate in the granular base for the construction of a new runway at the Cleveland Hopkins International Airport. Steel slag is a by-product of steel formulation during the separation of steel and impurities while still in the molten condition. The molten liquid consists of oxides and silicates that solidify upon cooling. Table 1 shows the typical composition of steel slag as presented by two different sources. The composition of steel slag is complex and may vary, but the chemical composition of the material may be generally classified within the ranges presented in Table 1.

TABLE 1
TYPICAL STEEL SLAG CHEMICAL COMPOSITION

Constituent	Composition (%)[1]	Composition (%)[2]
CaO	40 – 52	32 – 45
SiO_2	10 – 19	32 – 42
FeO	10 – 40	0.1 – 1.5
	(70 – 90% FeO, 20 – 30% Fe_2O_3)	(Fe_2O_3)
MnO	5 – 8	0.2 – 1
MgO	5 – 10	5 – 15
Al_2O_3	1 – 3	7 – 16
P_2O_5	0.5 – 1	–
S	< 0.1	1 – 2 [3]
Metallic Fe	0.5 – 10	–

Notes:
[1] Turner-Fairbank Highway Research Center 2002
[2] Lankford, Samways, Craven and McGannon 1985
[3] Generally occurring in the form of CaS

The steel slag aggregate base used at the airport expansion impacted the local stream that drains the area of emplacement, and has since been removed and replaced with a limestone base. Before the limestone was emplaced, runoff from the steel slag aggregate typically exhibited a milky-white color. The runoff occasionally exuded a mild sulfur-like odor and showed evidence of a black color. The observed color of the runoff is commonly associated with steel slag leachate, and is indicative of reactions of the slag with water and atmospheric carbon dioxide (Turner-Fairbank Highway Research Center 2002). Equations 1 and 2 show how the calcium carbonate precipitate causing the white color of the runoff forms under ambient conditions. The sulfur odor of the steel slag leachate is produced through the reaction exhibited in Equation 3. Calcium sulfide is also the likely source of the occasional black coloration of the runoff water. Equations 3 and 4 show how colloidal sulfur, black in color, is ultimately formed from the reaction between CaS and H_20.

Equation 1 $2CaO + 2H_20 \rightarrow 2Ca(OH)_2$

Equation 2 $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

Equation 3 $CaS + 2H_2O \rightarrow Ca(OH)_2 + H_2S$

Equation 4 $2H_2S + O_2 \rightarrow 2H_2O + 2S$

REFERENCES

Turner-Fairbank Highway Research Center. 2002. "Steel Slag Material Description." U.S. Department of Transportation, Federal Highway Administration. On-line Address: <http://www.tfhrc.gov/hnr20/recycle/waste/ssa1.htm.> March.

Lankford, William T. Jr., Samways, Norman L., Craven, Robert F., and McGannon, Harold. 1985. *The Making, Shaping and Treating of Steel.* United States Steel. Pittsburgh, PA.

ENCLOSURE 5

DATA VALIDATION REPORT

(19 Pages)

Tetra Tech EM Inc.
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MEMORANDUM

Date: 20 Nov 01

To: William Kosko, Project Manager, Tetra Tech EM Inc. (Tetra Tech)
Superfund Technical Assessment and Response Team (START) for Region 5

From: Harry Ellis, Chemist, Tetra Tech START for Region 5

Subject: Data Validation for
Hopkins Airport Site
Wilmington, Ohio
Analytical Technical Direction Document (TDD) No. S05-0107-012
Project TDD No. S05-0107-007

Laboratory: EIS Analytical Services, Inc. (EIS), South Bend, Indiana
Work Orders No. 010700273, 010800001, 010800114, 010800201, 011000063, 011000182, and 011100014
Ethylene Glycol, Propylene Glycol, Metal, and Indicator Parameter Analysis of 22 Water Samples

1.0 INTRODUCTION

Tetra Tech START for Region 5 evaluated ethylene glycol, propylene glycol, metal, and indicator parameter (ammonia, sulfate, total sulfide, sulfite, chemical oxygen demand [COD], and total dissolved solid [TDS]) analytical data for 22 water samples collected on 27 Jul, 31 Jul, 9 Aug, 20 Aug, 3 Oct, 12 Oct, and 31 Oct 01 during an ongoing evaluation of the Hopkins Airport site in Wilmington, Ohio. The samples were analyzed under the above-referenced work orders by EIS using U.S. Environmental Protection Agency (U.S. EPA) SW-846 Method 8015 for ethylene glycol and propylene glycol analysis; U.S. EPA Methods 200.7, 245.1, and 258.1 for metal analysis; U.S. EPA Method 350.1 for nitrogen as ammonia analysis; Standard Method (SM) 4500-SO4 for sulfate analysis; SM 4500-S.D for total sulfide analysis; SM 4500-SO3 for sulfite analysis; SM 5220.D for COD analysis; and SM 2540.C for TDS

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analysis. EIS submitted summary data packages with no raw data, so a full validation of the data could not be performed.

The organic (ethylene glycol and propylene glycol) data were evaluated in general accordance with U.S. EPA's "Contract Laboratory Program National Functional Guidelines for Organic Data Review" dated Oct 99. Data validation consisted of a review of the following quality control (QC) parameters: holding times, initial and continuing calibrations, blank results, matrix spike and matrix spike duplicate (MS/MSD) results, and laboratory control sample (LCS) results.

The data for metals and indicator parameters were evaluated in general accordance with U.S. EPA's "Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" dated Feb 94. Data validation consisted of a review of the following QC parameters: holding times, initial and continuing calibrations, blank results, and MS/MSD and matrix duplicate (MD) results.

Section 2.0 discusses the results of the organic data validation, Section 3.0 discusses the results of the inorganic data validation, and Section 4.0 presents an overall assessment of the data. The attachment contains EIS's summary of sample analytical results.

2.0 ORGANIC DATA VALIDATION RESULTS

The results of START's data validation for the ethylene glycol and propylene glycol analyses are summarized below in terms of the QC parameters reviewed.

2.1 HOLDING TIMES

All samples were analyzed within the holding time limit of 14 days for volatile organic compound analysis.

2.2 INITIAL AND CONTINUING CALIBRATIONS

The relative standard deviation from the initial calibration results was within the QC limit of less than or equal to 20 percent as required by SW-846 Method 8015. The continuing calibration results were within the QC limit of less than or equal to 15 percent difference between the initial calibration relative response factor and the continuing calibration relative response factor as required by SW-846 Method 8015.

2.3 BLANK RESULTS

A method blank was run with each analytical batch in the proper sequence. No target analytes were detected in the blanks at concentrations exceeding the instrument detection limits.

2.4 MS/MSD RESULTS

An MS and MSD were analyzed with the samples. The percent recoveries for the MS and MSD and the relative percent difference (RPD) between the MS and MSD recoveries were within the QC limits set by the laboratory (60 to 140 percent recovery and 0 to 20 RPD).

2.5 LCS RESULTS

An LCS was analyzed with each analytical batch, and LCS results were within the QC limits of 60 to 140 percent recovery.

3.0 INORGANIC DATA VALIDATION RESULTS

The results of START's data validation for the inorganic analyses are summarized below in terms of the QC parameters reviewed.

3.1 HOLDING TIMES

All samples were analyzed within the various holding time limits.

3.2 INITIAL AND CONTINUING CALIBRATIONS

Initial and continuing calibrations were performed as required by the various analyses. All calibration results were within QC limits.

3.3 BLANK RESULTS

Blanks were analyzed with each analytical batch. No target analytes were detected in the blanks at concentrations exceeding the instrument detection limits.

3.4 MS/MSD AND MD RESULTS

MS/MSD and MD analyses were performed as required, and all the results were within QC limits.

4.0 OVERALL ASSESSMENT OF DATA

Overall the sample analytical data generated by EIS are acceptable for use without qualification.

SAMPLE RESULTS

Client Name: Tetra Tech EM, Inc.
Client Project: Airport

Report Date: 8/17/01
EIS Order No: 010700273

EIS Lab Number	Client Description	Sample Date	Parameter	Result	Units	RDL	Test Date	Analyst ID	Method
077183	Pool 1	7/27/01	COD	42	mg/L	5	8/6/01	E02	5220 D
		7/27/01	Ethylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/27/01	Nitrogen(Ammonia)	6.1	mg/L	0.12	8/2/01	E03	350.1
		7/27/01	Propylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/27/01	Solids,Total Dissolved	700	mg/L	2	8/2/01	E21	2540 C
		7/27/01	Sulfate	120	mg/L	15	8/3/01	E03	4500-SO4
		7/27/01	Sulfide,Total	<0.1	mg/L	0.1	8/3/01	E03	4500-S D
		7/27/01	Sulfite	<2	mg/L	2	8/15/01	E03	4500-SO3
077184	Pool 2	7/27/01	COD	50	mg/L	5	8/6/01	E02	5220 D
		7/27/01	Ethylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/27/01	Nitrogen(Ammonia)	6.3	mg/L	0.06	8/2/01	E03	350.1
		7/27/01	Propylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/27/01	Solids,Total Dissolved	690	mg/L	2	8/2/01	E21	2540 C
		7/27/01	Sulfate	110	mg/L	25	8/3/01	E03	4500-SO4
		7/27/01	Sulfide,Total	0.20	mg/L	0.1	8/3/01	E03	4500-S D
		7/27/01	Sulfite	<2	mg/L	2	8/15/01	E03	4500-SO3
077185	Pool 3	7/27/01	COD	95	mg/L	5	8/6/01	E02	5220 D
		7/27/01	Ethylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/27/01	Nitrogen(Ammonia)	7.0	mg/L	0.06	8/2/01	E03	350.1
		7/27/01	Propylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/27/01	Solids,Total Dissolved	780	mg/L	2	8/2/01	E21	2540 C
		7/27/01	Sulfate	140	mg/L	25	8/3/01	E03	4500-SO4
		7/27/01	Sulfide,Total	1.0	mg/L	0.1	8/3/01	E03	4500-S D
		7/27/01	Sulfite	<2	mg/L	2	8/15/01	E03	4500-SO3
077186	Pool 4	7/27/01	COD	240	mg/L	10	8/6/01	E02	5220 D
		7/27/01	Ethylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/27/01	Nitrogen(Ammonia)	11	mg/L	0.06	8/2/01	E03	350.1
		7/27/01	Propylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/27/01	Solids,Total Dissolved	980	mg/L	2	8/2/01	E21	2540 C
		7/27/01	Sulfate	160	mg/L	25	8/3/01	E03	4500-SO4
		7/27/01	Sulfide,Total	<0.1	mg/L	0.1	8/3/01	E03	4500-S D
		7/27/01	Sulfite	<2	mg/L	2	8/15/01	E03	4500-SO3
077187	OF 5	7/27/01	COD	230	mg/L	10	8/6/01	E02	5220 D
		7/27/01	Ethylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/27/01	Nitrogen(Ammonia)	12	mg/L	0.06	8/2/01	E03	350.1
		7/27/01	Propylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/27/01	Solids,Total Dissolved	950	mg/L	2	8/2/01	E21	2540 C

SAMPLE RESULTS

Client Name: Tetra Tech EM, Inc.
Client Project: Airport

Report Date: 8/17/01
EIS Order No: 010700273

EIS Lab Number	Client Description	Sample Date	Parameter	Result	Units	RDL	Test Date	Analyst ID	Method
077187	OF 5	7/27/01	Sulfate	150	mg/L	25	8/3/01	E03	4500-SO4
		7/27/01	Sulfide,Total	<0.1	mg/L	0.1	8/3/01	E03	4500-S D
		7/27/01	Sulfite	<2	mg/L	2	8/15/01	E03	4500-SO3

SAMPLE RESULTS

Client Name: Tetra Tech EM, Inc.
Client Project: Airport

Report Date: 8/17/01
EIS Order No: 010800001

EIS Lab Number	Client Description	Sample Date	Parameter	Result	Units	RDL	Test Date	Analyst ID	Method
077198	Pool 1	7/31/01	COD	80	mg/L	5	8/6/01	E02	5220 D
		7/31/01	Ethylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/31/01	Nitrogen(Ammonia)	5.0	mg/L	0.06	8/2/01	E03	350.1
		7/31/01	Propylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/31/01	Solids,Total Dissolved	690	mg/L	2	8/2/01	E21	2540 C
		7/31/01	Sulfate	54	mg/L	15	8/3/01	E03	4500-SO4
		7/31/01	Sulfide,Total	0.23	mg/L	0.1	8/3/01	E03	4500-S D
		7/31/01	Sulfite	<2	mg/L	2	8/15/01	E03	4500-SO3
077199	Pool 2	7/31/01	COD	140	mg/L	5	8/6/01	E02	5220 D
		7/31/01	Ethylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/31/01	Nitrogen(Ammonia)	4.8	mg/L	0.06	8/2/01	E03	350.1
		7/31/01	Propylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/31/01	Solids,Total Dissolved	730	mg/L	2	8/2/01	E21	2540 C
		7/31/01	Sulfate	61	mg/L	10	8/3/01	E03	4500-SO4
		7/31/01	Sulfide,Total	<0.1	mg/L	0.1	8/3/01	E03	4500-S D
		7/31/01	Sulfite	<2	mg/L	2	8/15/01	E03	4500-SO3
077200	Pool 3	7/31/01	COD	170	mg/L	10	8/6/01	E02	5220 D
		7/31/01	Ethylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/31/01	Nitrogen(Ammonia)	3.6	mg/L	0.06	8/2/01	E03	350.1
		7/31/01	Propylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/31/01	Solids,Total Dissolved	910	mg/L	2	8/2/01	E21	2540 C
		7/31/01	Sulfate	130	mg/L	15	8/3/01	E03	4500-SO4
		7/31/01	Sulfide,Total	0.66	mg/L	0.1	8/3/01	E03	4500-S D
		7/31/01	Sulfite	<2	mg/L	2	8/15/01	E03	4500-SO3
077201	Pool 4	7/31/01	COD	150	mg/L	5	8/6/01	E02	5220 D
		7/31/01	Ethylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/31/01	Nitrogen(Ammonia)	8.9	mg/L	0.06	8/2/01	E03	350.1
		7/31/01	Propylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/31/01	Solids,Total Dissolved	1290	mg/L	2	8/2/01	E21	2540 C
		7/31/01	Sulfate	200	mg/L	25	8/3/01	E03	4500-SO4
		7/31/01	Sulfide,Total	<0.1	mg/L	0.1	8/3/01	E03	4500-S D
		7/31/01	Sulfite	<2	mg/L	2	8/15/01	E03	4500-SO3
077202	OF 005	7/31/01	COD	260	mg/L	10	8/6/01	E02	5220 D
		7/31/01	Ethylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/31/01	Nitrogen(Ammonia)	10	mg/L	0.06	8/2/01	E03	350.1
		7/31/01	Propylene Glycol	<5	mg/L	5	8/2/01	E16	8015
		7/31/01	Solids,Total Dissolved	1540	mg/L	2	8/2/01	E21	2540 C

SAMPLE RESULTS

Client Name: Tetra Tech EM, Inc.
Client Project: Airport

Report Date: 8/17/01
EIS Order No: 010800001

EIS Lab Number	Client Description	Sample Date	Parameter	Result	Units	RDL	Test Date	Analyst ID	Method
077202	OF 005	7/31/01	Sulfate	190	mg/L	25	8/3/01	E03	4500-SO4
		7/31/01	Sulfide,Total	<0.1	mg/L	0.1	8/3/01	E03	4500-S D
		7/31/01	Sulfite	<2	mg/L	2	8/15/01	E03	4500-SO3

SAMPLE RESULTS

Client Name: Tetra Tech EM, Inc.
Client Project: Airport

Report Date: 8/26/01
EIS Order No: 010800114

EIS Lab Number	Client Description	Sample Date	Parameter	Result	Units	RDL	Test Date	Analyst ID	Method
077475	Pool 1	8/9/01	COD	40	mg/L	5	8/14/01	E02	5220 D
		8/9/01	Ethylene Glycol	<5	mg/L	5	8/16/01	E16	8015
		8/9/01	Nitrogen(Ammonia)	9.0	mg/L	0.05	8/14/01	E03	350.1
		8/9/01	Propylene Glycol	<5	mg/L	5	8/16/01	E16	8015
		8/9/01	Solids,Total Dissolved	960	mg/L	2	8/15/01	E21	2540 C
		8/9/01	Sulfate	130	mg/L	15	8/16/01	E03	4500-SO4
		8/9/01	Sulfide,Total	<0.1	mg/L	0.1	8/15/01	E03	4500-S D
		8/9/01	Sulfite	<2	mg/L	2	8/15/01	E03	4500-SO3
077476	Pool 2	8/9/01	COD	47	mg/L	5	8/14/01	E02	5220 D
		8/9/01	Ethylene Glycol	<5	mg/L	5	8/16/01	E16	8015
		8/9/01	Nitrogen(Ammonia)	9.3	mg/L	0.05	8/14/01	E03	350.1
		8/9/01	Propylene Glycol	<5	mg/L	5	8/16/01	E16	8015
		8/9/01	Solids,Total Dissolved	970	mg/L	2	8/15/01	E21	2540 C
		8/9/01	Sulfate	150	mg/L	25	8/16/01	E03	4500-SO4
		8/9/01	Sulfide,Total	0.16	mg/L	0.1	8/15/01	E03	4500-S D
		8/9/01	Sulfite	<2	mg/L	2	8/15/01	E03	4500-SO3
077477	Pool 3	8/9/01	COD	91	mg/L	5	8/14/01	E02	5220 D
		8/9/01	Ethylene Glycol	<5	mg/L	5	8/16/01	E16	8015
		8/9/01	Nitrogen(Ammonia)	11	mg/L	0.05	8/14/01	E03	350.1
		8/9/01	Propylene Glycol	<5	mg/L	5	8/16/01	E16	8015
		8/9/01	Solids,Total Dissolved	1080	mg/L	2	8/15/01	E21	2540 C
		8/9/01	Sulfate	160	mg/L	25	8/16/01	E03	4500-SO4
		8/9/01	Sulfide,Total	<0.1	mg/L	0.1	8/15/01	E03	4500-S D
		8/9/01	Sulfite	2.5	mg/L	2	8/15/01	E03	4500-SO3
077478	Pool 4	8/9/01	COD	190	mg/L	10	8/14/01	E02	5220 D
		8/9/01	Ethylene Glycol	<5	mg/L	5	8/16/01	E16	8015
		8/9/01	Nitrogen(Ammonia)	12	mg/L	0.05	8/14/01	E03	350.1
		8/9/01	Propylene Glycol	<5	mg/L	5	8/16/01	E16	8015
		8/9/01	Solids,Total Dissolved	1130	mg/L	2	8/15/01	E21	2540 C
		8/9/01	Sulfate	210	mg/L	25	8/16/01	E03	4500-SO4
		8/9/01	Sulfide,Total	<0.1	mg/L	0.1	8/15/01	E03	4500-S D
		8/9/01	Sulfite	<2	mg/L	2	8/15/01	E03	4500-SO3
077479	OF 006	8/9/01	COD	160	mg/L	10	8/14/01	E03	5220 D
		8/9/01	Ethylene Glycol	<5	mg/L	5	8/16/01	E16	8015
		8/9/01	Nitrogen(Ammonia)	<0.05	mg/L	0.05	8/14/01	E03	350.1
		8/9/01	Propylene Glycol	<5	mg/L	5	8/16/01	E16	8015
		8/9/01	Solids,Total Dissolved	1940	mg/L	2	8/15/01	E21	2540 C

SAMPLE RESULTS

Client Name: Tetra Tech EM, Inc.
Client Project: Airport

Report Date: 8/26/01
EIS Order No: 010800114

EIS Lab Number	Client Description	Sample Date	Parameter	Result	Units	RDL	Test Date	Analyst ID	Method
077479	OF 006	8/9/01	Sulfate	750	mg/L	250	8/16/01	E03	4500-SO4
		8/9/01	Sulfide,Total	<0.1	mg/L	0.1	8/15/01	E03	4500-S D
		8/9/01	Sulfite	72	mg/L	2	8/15/01	E03	4500-SO3

SAMPLE RESULTS

Client Name: Tetra Tech EM, Inc.
Client Project: Hopkins Airport

Report Date: 9/14/01
EIS Order No: 010800201

EIS Lab Number	Client Description	Sample Date	Parameter	Result	Units	RDL	Test Date	Analyst ID	Method
077688	Pool #1	8/20/01	COD	48	mg/L	5	8/27/01	E02	5220 D
		8/20/01	Ethylene Glycol	<5	mg/L	5	8/27/01	E16	8015
		8/20/01	Nitrogen(Ammonia)	7.4	mg/L	0.05	8/28/01	E03	350.1
		8/20/01	Propylene Glycol	<5	mg/L	5	8/27/01	E16	8015
		8/20/01	Solids,Total Dissolved	950	mg/L	2	8/23/01	E21	2540 C
		8/20/01	Sulfate	120	mg/L	25	8/23/01	E03	4500-SO4
		8/20/01	Sulfide,Total	<0.1	mg/L	0.1	8/23/01	E03	4500-S D
		8/20/01	Sulfite	<2	mg/L	2	8/28/01	E03	4500-SO3
077689	Pool #2	8/20/01	COD	60	mg/L	5	8/27/01	E02	5220 D
		8/20/01	Ethylene Glycol	<5	mg/L	5	8/27/01	E16	8015
		8/20/01	Nitrogen(Ammonia)	7.4	mg/L	0.05	8/28/01	E03	350.1
		8/20/01	Propylene Glycol	<5	mg/L	5	8/27/01	E16	8015
		8/20/01	Solids,Total Dissolved	940	mg/L	2	8/23/01	E21	2540 C
		8/20/01	Sulfate	140	mg/L	25	8/23/01	E03	4500-SO4
		8/20/01	Sulfide,Total	0.26	mg/L	0.1	8/23/01	E03	4500-S D
		8/20/01	Sulfite	<2	mg/L	2	8/28/01	E03	4500-SO3
077690	Pool #3	8/20/01	COD	210	mg/L	10	8/27/01	E02	5220 D
		8/20/01	Ethylene Glycol	<5	mg/L	5	8/27/01	E16	8015
		8/20/01	Nitrogen(Ammonia)	7.3	mg/L	0.05	8/28/01	E03	350.1
		8/20/01	Propylene Glycol	<5	mg/L	5	8/27/01	E16	8015
		8/20/01	Solids,Total Dissolved	1260	mg/L	2	8/23/01	E21	2540 C
		8/20/01	Sulfate	180	mg/L	25	8/23/01	E03	4500-SO4
		8/20/01	Sulfide,Total	<0.1	mg/L	0.1	8/23/01	E03	4500-S D
		8/20/01	Sulfite	<2	mg/L	2	8/28/01	E03	4500-SO3
077691	Pool #4A	8/20/01	COD	160	mg/L	10	8/27/01	E02	5220 D
		8/20/01	Ethylene Glycol	<5	mg/L	5	8/27/01	E16	8015
		8/20/01	Nitrogen(Ammonia)	7.4	mg/L	0.05	8/28/01	E03	350.1
		8/20/01	Propylene Glycol	<5	mg/L	5	8/27/01	E16	8015
		8/20/01	Solids,Total Dissolved	1260	mg/L	2	8/23/01	E21	2540 C
		8/20/01	Sulfate	220	mg/L	25	8/23/01	E03	4500-SO4
		8/20/01	Sulfide,Total	<0.1	mg/L	0.1	8/23/01	E03	4500-S D
		8/20/01	Sulfite	<2	mg/L	2	8/28/01	E03	4500-SO3

SAMPLE RESULTS

CLIENT SAMPLE ID: RB-1
CLIENT PROJECT: Airport
SAMPLE TYPE: Water(Non DW)
Date Collected: 10/3/01

Report Date: 10/26/01
EIS Sample No: 078723
EIS Order No: 011000063
Date Received: 10/4/01

Parameter	Results	Units	RDL	MDL	Test Date	Analyst ID	Method
COD	700	mg/L	10	5	10/9/01	E02	5220 D
Ethylene Glycol	<5	mg/L	5	10	10/9/01	E16	8015
Nitrogen(Ammonia)	1.2	mg/L	0.05	0.05	10/5/01	E03	350.1
Propylene Glycol	<5	mg/L	5	10	10/9/01	E16	8015
Solids,Total Dissolved	3310	mg/L	2	2	10/9/01	E21	2540 C
Sulfate	400	mg/L	50	5	10/25/0	E03	4500-SO4 E
Sulfide,Total	1.6	mg/L	0.1	0.1	10/8/01	E03	4500-S D
Sulfite	370	mg/L	20	2	10/9/01	E03	4500-SO3 B

SAMPLE RESULTS

CLIENT SAMPLE ID: RB-1
CLIENT PROJECT: Airport
SAMPLE TYPE: Water(Non DW)
Date Collected: 10/3/01

Report Date: 10/26/01
EIS Sample No: 078723
EIS Order No: 011000063
Date Received: 10/4/01

Parameter	Results	Units	RDL	MDL	Test Date	Analyst ID	Method
METALS							
Aluminum,Total	6.15	mg/L	0.25	0.05	10/9/01	E09	200.7
Antimony,Total	<0.05	mg/L	0.05	0.05	10/17/0	E09	200.7
Beryllium,Total	<0.005	mg/L	0.005	0.005	10/17/0	E09	200.7
Calcium,Total	503	mg/L	1.5	0.02	10/9/01	E09	200.7
Cobalt,Total	<0.01	mg/L	0.01	0.01	10/17/0	E09	200.7
Copper,Total	0.02	mg/L	0.01	0.01	10/11/0	E09	200.7
Iron,Total	7.81	mg/L	0.02	0.02	10/11/0	E09	200.7
Magnesium,Total	7.31	mg/L	0.1	0.02	10/9/01	E09	200.7
Manganese,Total	0.30	mg/L	0.025	0.005	10/9/01	E09	200.7
Nickel,Total	<0.04	mg/L	0.04	0.04	10/11/0	E09	200.7
Potassium,Total	358	mg/L	12.5	0.05	10/16/0	E09	258.1
Sodium,Total	127	mg/L	7.5	0.1	10/11/0	E09	200.7
Thallium,Total	<0.05	mg/L	0.05	0.05	10/17/0	E09	200.7
Vanadium,Total	0.01	mg/L	0.01	0.01	10/17/0	E09	200.7
Zinc,Total	0.07	mg/L	0.01	0.01	10/11/0	E09	200.7

SAMPLE RESULTS

CLIENT SAMPLE ID: RB-1
CLIENT PROJECT: Airport
SAMPLE TYPE: Water(Non DW)
Date Collected: 10/3/01

Report Date: 10/26/01
EIS Sample No: 078723
EIS Order No: 011000063
Date Received: 10/4/01

Parameter	Results	Units	RDL	MDL	Test Date	Analyst ID	Method
METALS							
Arsenic,Total	<0.1	mg/L	0.05	0.05	10/11/0	E09	200.7
Barium,Total	0.18	mg/L	0.01	0.01	10/11/0	E09	200.7
Cadmium,Total	<0.02	mg/L	0.02	0.02	10/11/0	E09	200.7
Chromium,Total	<0.02	mg/L	0.02	0.02	10/11/0	E09	200.7
Lead,Total	<0.05	mg/L	0.05	0.05	10/11/0	E09	200.7
Mercury,Total	<0.0001	mg/L	0.0001	0.0001	10/12/0	E09	245.1
Selenium,Total	<0.1	mg/L	0.05	0.05	10/11/0	E09	200.7
Silver,Total	<0.005	mg/L	0.005	0.005	10/11/0	E09	200.7

SAMPLE RESULTS

CLIENT SAMPLE ID: Retention Basin Effluent
CLIENT PROJECT: Hopkins Airport
SAMPLE TYPE: Water(Non DW)
Date Collected: 10/12/01

Report Date: 10/26/01
EIS Sample No: 078926
EIS Order No: 011000182
Date Received: 10/17/01

Parameter	Results	Units	RDL	MDL	Test Date	Analyst ID	Method
COD	490	mg/L	10	5	10/23/0	E02	5220 D
Ethylene Glycol	<5	mg/L	5	10	10/22/0	E16	8015
Nitrogen(Ammonia)	0.8	mg/L	0.12	0.05	10/24/0	E03	350.1
Propylene Glycol	<5	mg/L	5	10	10/22/0	E16	8015
Solids,Total Dissolved	2910	mg/L	4	2	10/18/0	E21	2540 C
Sulfate	380	mg/L	50	5	10/25/0	E03	4500-SO4 E
Sulfide,Total	<0.1	mg/L	0.1	0.1	10/18/0	E03	4500-S D
Sulfite	300	mg/L	20	2	10/19/0	E03	4500-SO3 B

SAMPLE RESULTS

CLIENT SAMPLE ID: Retention Basin Effluent
CLIENT PROJECT: Hopkins Airport
SAMPLE TYPE: Water(Non DW)
Date Collected: 10/12/01

Report Date: 10/26/01
EIS Sample No: 078926
EIS Order No: 011000182
Date Received: 10/17/01

Parameter	Results	Units	RDL	MDL	Test Date	Analyst ID	Method
METALS							
Aluminum,Total	<0.05	mg/L	0.05	0.05	10/19/0	E09	200.7
Antimony,Total	<0.05	mg/L	0.05	0.05	10/19/0	E09	200.7
Arsenic,Total	<0.05	mg/L	0.05	0.05	10/19/0	E09	200.7
Barium,Total	0.17	mg/L	0.01	0.01	10/19/0	E09	200.7
Beryllium,Total	<0.005	mg/L	0.005	0.005	10/19/0	E09	200.7
Cadmium,Total	<0.02	mg/L	0.02	0.02	10/19/0	E09	200.7
Calcium,Total	459	mg/L	2	0.02	10/19/0	E09	200.7
Chromium,Total	<0.02	mg/L	0.02	0.02	10/19/0	E09	200.7
Cobalt,Total	<0.01	mg/L	0.01	0.01	10/19/0	E09	200.7
Copper,Total	<0.01	mg/L	0.01	0.01	10/19/0	E09	200.7
Iron,Total	0.26	mg/L	0.02	0.02	10/19/0	E09	200.7
Lead,Total	<0.05	mg/L	0.05	0.05	10/19/0	E09	200.7
Magnesium,Total	6.07	mg/L	0.02	0.02	10/19/0	E09	200.7
Manganese,Total	0.364	mg/L	0.005	0.005	10/19/0	E09	200.7
Mercury,Total	<0.0002	mg/L	0.0002	0.0001	10/24/0	E09	245.1
Nickel,Total	<0.04	mg/L	0.04	0.04	10/19/0	E09	200.7
Potassium,Total	356	mg/L	25	0.05	10/24/0	E09	258.1
Selenium,Total	<0.05	mg/L	0.05	0.05	10/19/0	E09	200.7
Silver,Total	<0.005	mg/L	0.005	0.005	10/19/0	E09	200.7
Sodium,Total	116	mg/L	10	0.1	10/19/0	E09	200.7
Thallium,Total	<0.05	mg/L	0.05	0.05	10/19/0	E09	200.7
Vanadium,Total	<0.01	mg/L	0.01	0.01	10/19/0	E09	200.7
Zinc,Total	0.04	mg/L	0.01	0.01	10/19/0	E09	200.7

SAMPLE RESULTS

CLIENT SAMPLE ID: DP-01
CLIENT PROJECT: Airport
SAMPLE TYPE: Water(Non DW)
Date Collected: 10/31/01

Report Date: 11/19/01
EIS Sample No: 079166
EIS Order No: 011100014
Date Received: 11/1/01

Parameter	Results	Units	RDL	MDL	Test Date	Analyst ID	Method
COD	290	mg/L	5	5	11/5/01	E02	5220 D
Ethylene Glycol	<5	mg/L	5	10	11/5/01	E16	8015
Nitrogen(Ammonia)	<0.12	mg/L	0.12	0.05	11/2/01	E03	350.1
Propylene Glycol	<5	mg/L	5	10	11/5/01	E16	8015
Solids,Total Dissolved	3870	mg/L	4	2	11/5/01	E21	2540 C
Sulfate	2220	mg/L	250	5	11/6/01	E03	4500-SO4 E
Sulfide,Total	1.5	mg/L	0.1	0.1	11/5/01	E03	4500-S D
Sulfite	110	mg/L	20	2	11/6/01	E03	4500-SO3 B

SAMPLE RESULTS

CLIENT SAMPLE ID: DP-01
CLIENT PROJECT: Airport
SAMPLE TYPE: Water(Non DW)
Date Collected: 10/31/01

Report Date: 11/19/01
EIS Sample No: 079166
EIS Order No: 011100014
Date Received: 11/1/01

Parameter	Results	Units	RDL	MDL	Test Date	Analyst ID	Method
METALS							
Aluminum,Total	22.4	mg/L	5	0.05	11/5/01	E09	200.7
Antimony,Total	<0.05	mg/L	0.05	0.05	11/5/01	E09	200.7
Arsenic,Total	<0.05	mg/L	0.05	0.05	11/5/01	E09	200.7
Barium,Total	0.29	mg/L	0.01	0.01	11/5/01	E09	200.7
Beryllium,Total	<0.005	mg/L	0.005	0.005	11/5/01	E09	200.7
Cadmium,Total	<0.02	mg/L	0.02	0.02	11/5/01	E09	200.7
Calcium,Total	811	mg/L	2	0.02	11/5/01	E09	200.7
Chromium,Total	<0.02	mg/L	0.02	0.02	11/5/01	E09	200.7
Cobalt,Total	0.02	mg/L	0.01	0.01	11/5/01	E09	200.7
Copper,Total	0.09	mg/L	0.01	0.01	11/5/01	E09	200.7
Iron,Total	55.0	mg/L	2	0.02	11/5/01	E09	200.7
Lead,Total	<0.05	mg/L	0.05	0.05	11/5/01	E09	200.7
Magnesium,Total	67.1	mg/L	2	0.02	11/5/01	E09	200.7
Manganese,Total	1.49	mg/L	0.005	0.005	11/5/01	E09	200.7
Mercury,Total	0.00026	mg/L	0.0002	0.0001	11/5/01	E09	245.1
Nickel,Total	0.05	mg/L	0.04	0.04	11/5/01	E09	200.7
Potassium,Total	370	mg/L	10	0.05	11/6/01	E09	258.1
Selenium,Total	<0.05	mg/L	0.05	0.05	11/5/01	E09	200.7
Silver,Total	<0.005	mg/L	0.005	0.005	11/5/01	E09	200.7
Sodium,Total	128	mg/L	10	0.1	11/5/01	E09	200.7
Thallium,Total	<0.05	mg/L	0.05	0.05	11/5/01	E09	200.7
Vanadium,Total	0.04	mg/L	0.01	0.01	11/5/01	E09	200.7
Zinc,Total	0.32	mg/L	0.01	0.01	11/5/01	E09	200.7