May 3, 2024

Mr. Geoffrey Spain
Environmental Engineer
IDNR – Land Quality Bureau
Wallace State Office Building
502 E. 9th Street
Des Moines, Iowa 50319

HLW Engineering Group
Engineering Management

RE: Response to IDNR Letter dated April 9, 2024 (Doc #109785)
Boone County Sanitary Landfill - IDNR Permit No. 08-SDP-01-75P

Dear Mr. Spain:

This response related to GU-3 is prepared as requested in the April 9, 2024 IDNR Letter (Doc #109785).

Description
GU-3 is an underdrain outlet sampled as part of the HMSP. A Statistically Significant Increase (SSI) for Volatile Organic Compounds (VOC) at GU-3 was reported in the 2021 Annual Water Quality Report for the Boone County SLF dated January 24, 2022 (Doc #102107).

In response to the SSI, a Passive Engineered Conveyance Structure (PECS) was installed in 2022 to volatilize organic compounds in water discharged from GU-3 (following discharge and prior to entering a water of the State). The Construction Certification for the PECS (designated PECS-3) is included in Attachment A.

Performance of Treatment System (the PECS)
The water quality at GU-3 is impacted by VOC and this is not anticipated to cease in the future. In 2022, the PECS was constructed in lieu of connecting GU-3 to the leachate collection system as allowed by IDNR in the August 10, 2012 Memorandum of Understanding issued by the IDNR (Attachment A).

Water quality results at GU-3 for 2021 and 2022 are summarized in Attachment B and confirm the on-going presence of VOC at GU-3.

Water quality testing from the outfall of the treatment system (the PECS monitored at PEC-3) is limited. There is only one (1) testing event completed after completion of the PECS (sample results for 4/18/2022). Water quality results for PECS-3 are included in Attachment C.

The single sampling event illustrated that the PECS does effectively treat the GU-3 discharge. However, we recognize the stated IDNR concern related to the unknown status of the performance of the PECS in the treatment of the GU-3 discharge water.

Both GU-3 and the PECS-3 sampling points were consistently submerged below standing water trapped in the sedimentation basin below both GU-3 and PECS-3 during 2023 and the Spring of 2024. Neither GU-3 or PECS-3 could be sampled during this period of time.

Proposed Response
It is recognized that the ability to collect samples from both GU-3 and PECS-3 is paramount in documenting that the discharge from GU-3 is fully treated within the PECS prior to release from the treatment system at PECS-3.

It is proposed that the current condition of the sedimentation basin be improved by excavating the stored sediment to restore flow conditions in the standpipe. This in turn will allow the sedimentation basin to perform as designed and eliminate the long-term storage of water in the basin.

When there is no longer pooled water in the sedimentation basin, then the GU-3 sampling point (end-of-pipe) and the PECS-3 sampling point (discharge from the PECS) will be exposed and free-flowing.

The outflow elevation of GU-3 is 957.9, while the PECS-3 outfall is located at elevation 956.2. The as-constructed elevation of the base of the sedimentation basin is 954.0. This demonstrates that when the sediment basin is maintained at an operational elevation near the base (below elevation 956.2), the PECS will perform as designed.

Boone County Sanitary Landfill is in the process of renting a long-reach excavator to remove the sediment currently filling the sedimentation basin, to expose GU-3, and to reestablish the flowline of the PECS.

Proposed Schedule
It is proposed that the sedimentation basin clean-out and the re-establishment of sampling points GU-3 and PECS-3 be completed prior to July 30, 2024.

It is further proposed that immediately upon completion of the work, water quality samples from GU-3 and PECS-3 will be collected and analyzed to confirm the performance of the PECS thus far in 2024. Additionally, it is proposed that the sedimentation basin be maintained and cleaned on a routine, more frequent, basis to preserve the integrity of sampling points GU-3 and PECS-3 moving forward. It is recognized that continued operation of the PECS is granted dependent upon the consistent demonstration that the PECS is effectively treating the GU-3 discharge.

Please let me know whether the proposed response is acceptable.

Respectfully Submitted,
HLW Engineering Group

Todd Whipple, CPG.
Project Manager

cc: John Roosa, Administrator, Boone County SLF

Attachment A

2022 Construction Certification Report – PECS

May 5, 2022

Geoffrey Spain
IDNR – Land Quality Bureau
Wallace State Office Building
502 E. 9th Street
Des Moines, Iowa 50319

HLW Engineering Group
Engineering Management

RE: CONSTRUCTION CERTIFICATION
PASSIVE ENGINEERED CONVEYANCE STRUCTURE
BOONE COUNTY SLF – IDNR PERMIT #08-SDP-01-75P
HLW PN 6007-20A.200

Dear Mr. Spain:

This letter shall serve as notice to IDNR that construction of a Passive Engineered Conveyance Structure (PECS) at the Boone County Sanitary Landfill in Boone County, Iowa, has been completed. The following is intended to document the completion of the project.

I. INTRODUCTION

GU-3 is the outlet of the groundwater diversion system under Phases 7-R (installed in 2015) and 8-R (installed in 2021). Note that the groundwater diversion system under Phases 7-R and 8-R is hydraulically separated from the groundwater diversion system under Phases 4-R, 5-R, and 6-R. The groundwater diversion system under Phases 4-R, 5-R, and 6-R does not outlet through GU-3 but is combined with leachate from the Subtitle D compliant landfilling areas and conveyed to the leachate storage lagoon or to underground leachate storage tank #4.

GU-3 is sampled as part of the HMSP. A Statistically Significant Increase for Volatile Organic Compounds (VOC) at GU-3 was reported in the 2021 Annual Water Quality Report for the Boone County SLF dated January 24, 2022 (Doc #102107).

A PECS has been installed to volatilize organic compounds in water discharged from GU-3. The PECS is in accordance with the August 10, 2012 Memorandum of Understanding issued by the IDNR (Attachment A). Details on the PECS are discussed in the text below.

The PECS was constructed by Boone County SLF staff. A Record Drawing for the PECS is included in Attachment B.

II. PASSIVE ENGINEERED CONVEYANCE STRUCTURE

The PECS consists of an excavated open channel to convey the flow leaving GU-3 to the existing sediment basin.

The locations of GU-3, the PECS, and the PECS sampling point (PECS 3) are shown on the Record Drawing in Attachment B.

III. OPERATION OF THE SYSTEM

It is anticipated that the operation of the system will result in the groundwater from GU-3 going through the PECS for volatilization of organic compounds prior to entering the existing sediment basin. Both GU-3 and PECS 3 were sampled during the spring 2022 groundwater sampling event. The following volatile organic compounds were detected at GU-3 during the sampling event: vinyl chloride, benzene, and chlorobenzene. No volatile organic compounds were detected at PECS 3 during the spring 2022 sampling event. Test results for GU-3 and PECS 3 are included in Attachment C. Based on these test results, the flow from GU-3 will continue to be directed to the PECS for the volatilization of organic compounds.

The flow at groundwater diversion system outlet GU-3 as well as the flow at the outlet of the PECS (PECS 3) will be sampled during future groundwater sampling events. If future test results document the verified presence of volatile organic compounds at PECS 3 the flow from the tile will be directed to the leachate collection system until additional sampling shows that the PECS is effective or the PECS is modified as warranted and additional water quality confirmation testing completed. The status of the PECS will be discussed in the Annual Water Quality Report for the Boone County Sanitary Landfill.

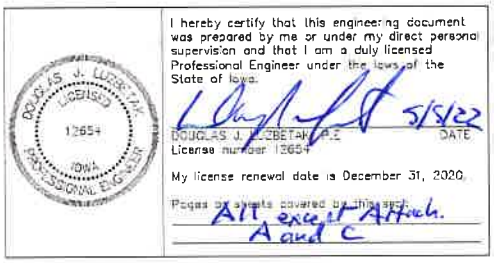
IV. REEVALUATION OF THE HYDROLOGIC MONITORING SYSTEM

One (1) new sampling point should be added to the HMSP as a result of this project:

- PECS 3 - at the outlet of the passive engineered conveyance structure for GU-3.

Regular sampling at PECS 3 commenced during the Spring, 2022 groundwater sampling event. The location of the sampling point is included on the Record Drawing in Attachment B.

If the IDNR has any questions or if additional information is needed, please contact me at HLW Engineering Group.



cc: John Roosa, Landfill Administrator, Boone County SLF (electronic copy)

ATTACHMENT A

Memorandum of Understanding

To: Solid Waste Section, Wastewater Engineering Section, NPDES Section

From: Alex Moon, Solid Waste Section Supervisor

CC: Brian Tormey, Land Quality Bureau Chief

Shelli Grapp, Water Quality Bureau Chief

Date: 08/7/2012

Re: Passive engineered conveyance structures used at landfills for volatilizing organic compounds from underdrain systems

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Background

Solid waste sanitary landfills utilize groundwater underdrains beneath liner systems to collect and remove groundwater and maintain separation from the solid waste placed in the landfills. Underdrain collection pipes are typically day lighted and discharged to a water of the U.S. Underdrains at landfills must be sampled for the same contaminants that are checked routinely in groundwater monitoring wells surrounding the landfill property. When contamination is discovered[1], underdrains must be routed to the landfill's existing leachate collection system. The landfill must apply for an NPDES permit to continue discharging to a water of the U.S. There have been cases where only volatile organic compounds (VOCs) are discovered in the underdrains. This can be attributed to gas that is migrating below the landfill and into the underdrain system.

A question has arose on whether or not a Wastewater Engineering (WES) construction permit would be required for what would essentially be a passive engineered conveyance structure constructed in accordance with Solid Waste Section permit/authorization that allows for aeration in an attempt to volatilize organic compounds from the groundwater underdrain coming from underneath the landfill liner. The groundwater would be sampled after the conveyance structure outlet and then continue to be discharged to a water of the U.S.; in essence, a passive contaminated groundwater VOC stripper.

Discussion

In terms of the Iowa Code or Administrative Rules this falls into a grey area. A wastewater construction permit could be required if the contaminated groundwater were to be considered an "other waste" under the Iowa Code section 455B.171 definitions for "disposal system" and "treatment works". However, the most that could be done with an application is to attempt to verify volatilization estimates. The only applicable design standard might be 19.4 or deference to the "standard textbooks, current technical literature and applicable safety standards" clause in 64.2(9)"a". The department maintains that a passive engineered conveyance structure constructed in accordance with Solid Waste Section permit/authorization is not a disposal system under Iowa law.

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[1] As determined using the methodology prescribed in IAC 567-113.10(5)"c".

Decision

It has been agreed by program areas that a permit from the wastewater engineering section is not needed for a conveyance structure constructed in accordance with Solid Waste Section permit/authorization used to volatilize organic compounds. Such structures will be amended into the landfill's existing hydrologic monitoring systems plan through the solid waste permitting process. A means to sample before any passive aeration is used to volatilize organic compounds needs to be preserved, but routine detection sampling is needed only after the conveyance structure.

If the conveyance structure is not successful in removing VOCs to non-detect levels, the landfill will need to immediately reroute the underdrain to the leachate collection system. The landfill will need to apply for a NPDES permit to discharge pollutants to a Water of the U.S. (see NPDES Clarification below).

NPDES Clarification

Under the Clean Water Act any point source discharge of a pollutant to a Water of the U.S. is prohibited, except when authorized by an NPDES permit. The landfill may sample the underdrain collection system for pollutants at any point prior to that water entering a Water of the U.S. If a pollutant is discovered, the underdrain cannot be discharged into a Water of the U.S. until an NPDES permit authorizing such discharge is issued. Questions regarding the Water of the U.S. definition should be directed to the NPDES section.

Aug. 10, 2012

Date

Alex Moon

Alex Moon
Solid Waste Section Supervisor

Satya Chennupati

Satya Chennupati
Wastewater Engineering Section Supervisor

Adam Schnieders
NPDES Section Supervisor

ATTACHMENT B

EXISTING CONTROL MH
NEW FL OUT = ~~958.7~~ 958.6

INSTALL R/W VALVE

INSTALL R/W VALVE AND CLEANOUT

UST #4

EXCAVATED CHANNEL
(PASSIVE ENGINEERED
CONVEYANCE STRUCTURE)

LEACHATE
LOADOUT MH
RIM = ~~968.0~~ 968.4
FL IN = 954.9
INVERT = 952.9

8"x12" HDPE PIPE

20' WIDE CROSSING
WITH 12" CPP
TOP CROSSING AT
ELEV 966.0

PECS-3

RIPRAP DIKE
BACKSLOPE

INSTALL R/W
VALVE AND
CLEANOUT

GU-3

EXISTING DRAINAGE WAY

FL = 962.5

FL = 962.5

BALLAST TUBE
(1 OF 8 – TYPICAL)

FENCE

LOWER
SEDIMENT
BASIN

FL = ~~957.0~~
956.6

955.9
FL = ~~956.0~~

GROUNDWATER COLLECTION PIPE

VENT
(1 OF 14 – TYPICAL)

MW88-3GP-6

EROSION CONTROL
MATTING
NOT INSTALLED

MW98-33

MW88-2

MW88-1

SILT FENCE
NOT INSTALLED

DO NOT DIST
MONITORING WE

NOTE: SILT FENCE, EROSION CONTROL MATTING, AND SEEDING WILL BE COMPLETED DURING THE IDOT SPRING 2022 SEEDING PERIOD.

RECORD DRAWING

SCALE
0 25 50

FIGURE: 1

REVISION	NO.	DATE
DRAWN JGH	PROJECT NO. 6007-20A	DATE 5/3/2022

PLAN VIEW PECS-3

BOONE COUNTY SANITARY LANDFILL
BOONE, IA

HLW Engineering Group
204 West Broad Street, P.O. Box 314
Story City, Iowa 50248
Phone: (515) 733-4144
FAX: (515) 733-4146

HLW Engineering Group

ATTACHMENT C

Keystone LABORATORIES, INC.

ANALYTICAL REPORT

April 13, 2022

Work Order: 1FC2817

Report To

Todd Whipple
HLW Engineering
PO Box 314
Story City, IA 50248

Work Order Information

Date Received: 3/29/2022 11:00:00AM
Collector: JGH
Phone: (515) 733-4144
PO Number:

Project: Boone County-UD
Project Number: 6007

Analyte	Result	MRL	Batch	Method	Analyst	Analyzed	Qualifier
1FC2817-01 GU-3				Matrix: Water		Collected: 03/28/22 15:38	
Vinyl Chloride	**3.0 ug/L**	**1.0**	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
1,1-Dichloroethylene	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
trans-1,2-Dichloroethylene	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
Chloroform	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
1,1,1-Trichloroethane	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
Carbon Tetrachloride	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
Benzene	**6.2 ug/L**	**1.0**	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
1,2-Dichloroethane	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
Trichloroethylene	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
1,2-Dichloropropane	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
Bromodichloromethane	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
Toluene	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
Tetrachloroethylene	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
Dibromochloromethane	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
Chlorobenzene	**1.8 ug/L**	**1.0**	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
Ethylbenzene	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
Bromoform	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 11:30	
Surrogate: Dibromofluoromethane	*96.0 %*			*75-136*	AJM	04/03/22 11:30	
Surrogate: 1,2-Dichloroethane-d4	*92.6 %*			*61-142*	AJM	04/03/22 11:30	
Surrogate: Toluene-d8	*98.6 %*			*82-121*	AJM	04/03/22 11:30	
Surrogate: 4-Bromofluorobenzene	*89.5 %*			*80-116*	AJM	04/03/22 11:30	
BOD (5 day)	<14 mg/L	14	1FC1484	SM 5210 B	LAE	03/30/22 10:35	
Nitrogen, Ammonia	**3.63 mg/L**	**0.10**	1FD0253	TIMBERLINE	TJB	04/06/22 13:43	
Nitrogen, Nitrate+Nitrite	**0.12 mg/L**	**0.10**	1FD0298	EPA 353.2	SAA	04/06/22 20:37	
Silica, dissolved	**40.0 mg/L**	**0.20**	1FD0317	SM 4500-SiO2 D-2011	SAA	04/07/22 16:26	
Nitrogen, Kjeldahl, total	**3.67 mg/L**	**0.50**	1FC1595	EPA 351.2	SAA	03/31/22 8:30	
Solids, total suspended	**48 mg/L**	**2**	1FC1515	USGS I-3765-85	MEAH	03/30/22 13:20	
Chloride	**20.8 mg/L**	**10.0**	1FD0544	EPA 9056	MID	04/09/22 1:26	
Fluoride	**0.2 mg/L**	**0.1**	1FD0678	EPA 9056	MID	04/12/22 13:34	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety. Samples were preserved in accordance with 40 CFR for pH adjustment unless otherwise noted. MRL= Method Reporting Limit.

HLW Engineering
PO Box 314
Story City, IA 50248

Work Order: 1FC2817

Analyte	Result	MRL	Batch	Method	Analyst	Analyzed	Qualifier
1FC2817-01 GU-3				Matrix: Water		Collected: 03/28/22 15:38	
Sulfate	**144 mg/L**	**10.0**	1FD0544	EPA 9056	MID	04/09/22 1:26	
Aluminum, total	**0.269 mg/L**	**0.050**	1FD0061	EPA 6010B	JAR	04/05/22 0:38	
Arsenic, total	**0.0060 mg/L**	**0.0040**	1FC1569	EPA 6020A	RVV	04/01/22 4:54	
Beryllium, total	<0.0040 mg/L	0.0040	1FC1569	EPA 6020A	RVV	04/01/22 4:54	
Boron, total	**0.285 mg/L**	**0.100**	1FD0061	EPA 6010B	JAR	04/05/22 0:38	
Cadmium, total	<0.0008 mg/L	0.0008	1FC1569	EPA 6020A	RVV	04/01/22 4:54	
Cobalt, total	**0.0014 mg/L**	**0.0004**	1FC1569	EPA 6020A	RVV	04/01/22 4:54	
Copper, total	<0.0040 mg/L	0.0040	1FC1569	EPA 6020A	RVV	04/01/22 4:54	
Iron, total	**17.0 mg/L**	**0.100**	1FD0061	EPA 6010B	JAR	04/05/22 0:38	
Lithium, total	<0.050 mg/L	0.050	1FD0061	EPA 6010B	JAR	04/05/22 0:38	
Manganese, total	**0.637 mg/L**	**0.0040**	1FC1569	EPA 6020A	RVV	04/01/22 4:54	
Molybdenum, total	<0.0040 mg/L	0.0040	1FC1569	EPA 6020A	RVV	04/01/22 4:54	
Nickel, total	**0.0127 mg/L**	**0.0040**	1FC1569	EPA 6020A	RVV	04/01/22 4:54	
Lead, total	<0.0040 mg/L	0.0040	1FC1569	EPA 6020A	RVV	04/01/22 4:54	
Selenium, total	<0.0040 mg/L	0.0040	1FC1569	EPA 6020A	RVV	04/01/22 4:54	
Vanadium, total	<0.0200 mg/L	0.0200	1FC1569	EPA 6020A	RVV	04/01/22 4:54	
Zinc, total	<0.0200 mg/L	0.0200	1FC1569	EPA 6020A	RVV	04/01/22 4:54	
1FC2817-02 GU-4				Matrix: Water		Collected: 03/28/22 15:19	
Vinyl Chloride	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
1,1-Dichloroethylene	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
trans-1,2-Dichloroethylene	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
Chloroform	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
1,1,1-Trichloroethane	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
Carbon Tetrachloride	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
Benzene	**1.4 ug/L**	**1.0**	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
1,2-Dichloroethane	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
Trichloroethylene	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
1,2-Dichloropropane	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
Bromodichloromethane	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
Toluene	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
Tetrachloroethylene	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
Dibromochloromethane	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
Chlorobenzene	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
Ethylbenzene	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
Bromoform	<1.0 ug/L	1.0	1FD0070	EPA 8260B	AJM	04/03/22 12:16	
Surrogate: Dibromofluoromethane	*95.2 %*			*75-136*	AJM	04/03/22 12:16	
Surrogate: 1,2-Dichloroethane-d4	*89.1 %*			*61-142*	AJM	04/03/22 12:16	
Surrogate: Toluene-d8	*103 %*			*82-121*	AJM	04/03/22 12:16	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety. Samples were preserved in accordance with 40 CFR for pH adjustment unless otherwise noted. MRL= Method Reporting Limit.

Keystone LABORATORIES, INC.

MEMBER ACIL

ANALYTICAL REPORT

April 27, 2022

Work Order: 1FD2171

Report To

Todd Whipple
HLW Engineering
PO Box 314
Story City, IA 50248

Work Order Information

Date Received: 4/20/2022 10:50:00AM
Collector: JGH
Phone: (515) 733-4144
PO Number:

Project: Boone Landfill-New Regs
Project Number: 6007

Analyte	Result	MRL	Batch	Method	Analyst	Analyzed	Qualifier
1FD2171-01 PEC-3				Matrix: Water		Collected: 04/18/22 13:02	
Chloromethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Vinyl Chloride	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Bromomethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Chloroethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Trichlorofluoromethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
1,1-Dichloroethylene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Acetone	<10.0 ug/L	10.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Methyl Iodide	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Carbon Disulfide	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Methylene Chloride	<5.0 ug/L	5.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Acrylonitrile	<5.0 ug/L	5.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
trans-1,2-Dichloroethylene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
1,1-Dichloroethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Vinyl Acetate	<5.0 ug/L	5.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
cis-1,2-Dichloroethylene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
2-Butanone (MEK)	<10.0 ug/L	10.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Bromochloromethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Chloroform	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
1,1,1-Trichloroethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Carbon Tetrachloride	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Benzene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
1,2-Dichloroethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Trichloroethylene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
1,2-Dichloropropane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Dibromomethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Bromodichloromethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
cis-1,3-Dichloropropene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
4-Methyl-2-pentanone (MIBK)	<5.0 ug/L	5.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	

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HLW Engineering
PO Box 314
Story City, IA 50248

April 27, 2022

Work Order: 1FD2171

Analyte	Result	MRL	Batch	Method	Analyst	Analyzed	Qualifier
1FD2171-01 PEC-3				Matrix: Water		Collected: 04/18/22 13:02	
Toluene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
trans-1,3-Dichloropropene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
1,1,2-Trichloroethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Tetrachloroethylene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
2-Hexanone (MBK)	<5.0 ug/L	5.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Dibromochloromethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
1,2-Dibromoethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Chlorobenzene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
1,1,1,2-Tetrachloroethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Ethylbenzene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Xylenes, total	<2.0 ug/L	2.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Styrene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Bromoform	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
1,2,3-Trichloropropane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
trans-1,4-Dichloro-2-butene	<5.0 ug/L	5.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
1,1,2,2-Tetrachloroethane	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
1,4-Dichlorobenzene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
1,2-Dichlorobenzene	<1.0 ug/L	1.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
1,2-Dibromo-3-chloropropane	<5.0 ug/L	5.0	1FD1193	EPA 8260B	AJM	04/23/22 0:31	
Surrogate: Dibromofluoromethane	*110 %*			*75-136*	AJM	04/23/22 0:31	
Surrogate: 1,2-Dichloroethane-d4	*111 %*			*61-142*	AJM	04/23/22 0:31	
Surrogate: Toluene-d8	*105 %*			*82-121*	AJM	04/23/22 0:31	
Surrogate: 4-Bromofluorobenzene	*102 %*			*80-116*	AJM	04/23/22 0:31	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety. Samples were preserved in accordance with 40 CFR for pH adjustment unless otherwise noted. MRL= Method Reporting Limit.

Attachment B

Water Quality Testing Summary – GU-3

Table 1

Analytical Data Summary for GU-3

Constituents	Units	9/13/2021	12/3/2021	3/28/2022	9/15/2022
1,1,1,2-tetrachloroethane	ug/L	<1	<1		<1
1,1,1-trichloroethane	ug/L	<1	<1	<1	<1
1,1,2,2-tetrachloroethane	ug/L	<1	<1		<1
1,1,2-trichloroethane	ug/L	<1	<1		<1
1,1-dichloroethane	ug/L	<1	<1		<1
1,1-dichloroethylene	ug/L	<1	<1	<1	<1
1,2,3-trichloropropane	ug/L	<1	<1		<1
1,2-dibromo-3-chloropropane	ug/L	<5	<5		<5
1,2-dibromoethane	ug/L	<1	<1		<1
1,2-dichlorobenzene	ug/L	<1	<1		<1
1,2-dichloroethane	ug/L	<1	<1	<1	<1
1,2-dichloropropane	ug/L	<1	<1	<1	<1
1,4-dichlorobenzene	ug/L	<1	<1		<1
2-butanone (mek)	ug/L	<5	<10		<10
2-hexanone (mbk)	ug/L	<5	<5		<5
4-methyl-2-pentanone (mibk)	ug/L	<5	<5		<5
Acetone	ug/L	<10	<10		<10
Acrylonitrile	ug/L	<5	<5		<5
Aluminum, total	ug/L			269	
Antimony, total	ug/L	<2	<2		<2
Arsenic, total	ug/L	6.1	9.1	6.0	6.3
Barium, total	ug/L	478	415		365
Benzene	ug/L	1.3	6.0	6.2	6.1
Beryllium, total	ug/L	<4	<4	<4	<4
BOD	mg/L			<14	
Boron, total	ug/L			285	
Bromochloromethane	ug/L	<1	<1		<1
Bromodichloromethane	ug/L	<1	<1	<1	<1
Bromoform	ug/L	<1	<1	<1	<1
Bromomethane	ug/L	<1	<1		<1
Cadmium, total	ug/L	<.8	<.8	<.8	<.8
Carbon disulfide	ug/L	<1	<1		<1
Carbon tetrachloride	ug/L	<1	<1	<1	<1
Chloride	mg/L			20.8	
Chlorobenzene	ug/L	<1.0	<1.0	1.8	1.7
Chloroethane	ug/L	1.4	2.0		1.6
Chloroform	ug/L	<1	<1	<1	<1
Chloromethane	ug/L	<1	<1		<1
Chromium, total	ug/L	<8	<8		<8
Cis-1,2-dichloroethylene	ug/L	1.0	10.5		11.9
Cis-1,3-dichloropropene	ug/L	<1	<1		<1
Cobalt, total	ug/L	4.5	2.7	1.4	2.8
Copper, total	ug/L	6.5	<4.0	<4.0	<4.0
Dibromochloromethane	ug/L	<1	<1	<1	<1
Dibromomethane	ug/L	<1	<1		<1
Ethylbenzene	ug/L	<1.0	<1.0	<1.0	1.8
Fluoride	mg/L			.2	
Iron, total	ug/L			17000	
Lead, total	ug/L	5.1	<4.0	<4.0	<4.0
Lithium, total	ug/L			<50	
Manganese, Total	ug/L			637	
Methyl iodide	ug/L	<1	<1		<1
Methylene chloride	ug/L	<5	<5		<5
Molybdenum, total	ug/L			<4	
Nickel, total	ug/L	15.2	12.4	12.7	21.1
Nitrogen, ammonia	mg/L			3.63	
Nitrogen, Kjeldahl, total	mg/L			3.67	
Nitrogen, Nitrate+Nitrite	mg/L			.12	
Selenium, total	ug/L	<4	<4	<4	<4
Silica, dissolved	ug/L			40000	
Silver, total	ug/L	<4	<4		<4
Styrene	ug/L	<1	<1		<1
Sulfate	mg/L			144	
Tetrachloroethylene	ug/L	<1	<1	<1	<1
Thallium, total	ug/L	<2	<2		<2
Toluene	ug/L	<1	<1	<1	<1
Total suspended solids	mg/L			48	
Trans-1,2-dichloroethylene	ug/L	<1	<1	<1	<1
Trans-1,3-dichloropropene	ug/L	<1	<1		<1
Trans-1,4-dichloro-2-butene	ug/L	<5	<5		<5
Trichloroethylene	ug/L	<1	<1	<1	<1
Trichlorofluoromethane	ug/L	<1	<1		<1
Vanadium, total	ug/L	<20	<20	<20	<20
Vinyl acetate	ug/L	<5	<5		<5
Vinyl chloride	ug/L	<1.0	3.6	3.0	1.9
Xylenes, total	ug/L	<2	<2		<2
Zinc, total	ug/L	32.9	<20.0	<20.0	<20.0

* - The displayed value is the arithmetic mean of multiple database matches.

Attachment C

Water Quality Testing Summary – PECS-3

Table 22

Analytical Data Summary for PEC-3

Constituents	Units	3/28/2022	4/18/2022
1,1,1,2-tetrachloroethane	ug/L	<1	<1
1,1,1-trichloroethane	ug/L	<1	<1
1,1,2,2-tetrachloroethane	ug/L	<1	<1
1,1,2-trichloroethane	ug/L	<1	<1
1,1-dichloroethane	ug/L	<1	<1
1,1-dichloroethylene	ug/L	<1	<1
1,2,3-trichloropropane	ug/L	<1	<1
1,2-dibromo-3-chloropropane	ug/L	<5	<5
1,2-dibromoethane	ug/L	<1	<1
1,2-dichlorobenzene	ug/L	<1	<1
1,2-dichloroethane	ug/L	<1	<1
1,2-dichloropropane	ug/L	<1	<1
1,4-dichlorobenzene	ug/L	<1	<1
2-butanone (mek)	ug/L	<10	<10
2-hexanone (mbk)	ug/L	<5	<5
4-methyl-2-pentanone (mibk)	ug/L	<5	<5
Acetone	ug/L	<10	<10
Acrylonitrile	ug/L	<5	<5
Benzene	ug/L	1.5	<1.0
Bromochloromethane	ug/L	<1	<1
Bromodichloromethane	ug/L	<1	<1
Bromoform	ug/L	<1	<1
Bromomethane	ug/L	<1	<1
Carbon disulfide	ug/L	<1	<1
Carbon tetrachloride	ug/L	<1	<1
Chlorobenzene	ug/L	<1	<1
Chloroethane	ug/L	<1	<1
Chloroform	ug/L	<1	<1
Chloromethane	ug/L	<1	<1
Cis-1,2-dichloroethylene	ug/L	3.2	<1.0
Cis-1,3-dichloropropene	ug/L	<1	<1
Dibromochloromethane	ug/L	<1	<1
Dibromomethane	ug/L	<1	<1
Ethylbenzene	ug/L	<1	<1
Methyl iodide	ug/L	<1	<1
Methylene chloride	ug/L	<5	<5
Styrene	ug/L	<1	<1
Tetrachloroethylene	ug/L	<1	<1
Toluene	ug/L	<1	<1
Trans-1,2-dichloroethylene	ug/L	<1	<1
Trans-1,3-dichloropropene	ug/L	<1	<1
Trans-1,4-dichloro-2-butene	ug/L	<5	<5
Trichloroethylene	ug/L	<1	<1
Trichlorofluoromethane	ug/L	<1	<1
Vinyl acetate	ug/L	<5	<5
Vinyl chloride	ug/L	<1	<1
Xylenes, total	ug/L	<2	<2

* - The displayed value is the arithmetic mean of multiple database matches.