

November 21, 2024

Mr. Geoffrey Spain,
Land Quality Bureau
Iowa Department of Natural Resources
6200 Park Avenue, Suite 200 Street
Des Moines, Iowa 50321



**RE: July 10, 2014 Unnumbered Permit Amendment
TSS and Field Turbidity
Cass County Sanitary Landfill
15-SDP-01-75C**

Dear Mr. Spain:

This information is submitted in order to address the July 10, 2014 Unnumbered Permit Amendment (Doc # 80703) related to turbidity and request to use field turbidity measurements in lieu of collecting field TSS samples for laboratory analysis. The use of turbidity in lieu of TSS is also allowed by Special Provision 5.b of the Permit dated October 31, 2024 (Doc # 111241)

Well Construction – Site monitoring wells were constructed in accordance with applicable IDNR regulations at the time of installation and were deemed appropriate to monitor site hydrogeologic conditions. Screen slot size for wells in the HMSP represents the smallest slot commercially available at the time of construction. Filter pack was optimized to the screen slot size.

Low flow sampling techniques have been employed at the site since the Spring, 2015 sampling event in order to meet the IDNR requirement to employ low flow or no flow sampling techniques. For the purposes of this study, only data from the April 2022, September 2023, May 2024, and October 2024 sampling events are reviewed. No purge sampling techniques were used during the October 2024 sampling event.

Turbidity Measurement – Field turbidity measurements have been collected during sampling events since the Spring 2018 sampling event at various HMSP wells at the landfill facility. Field turbidity was measured with a portable Formazin light source meter. Field turbidity was measured for various samples submitted for metals analyses. Field turbidity data was not measured prior to the Spring 2018 sampling event. Field turbidity readings for the April 2022, September 2023, May 2024, and October 2024 are included in Appendix A.

Total Suspended Solids - During sampling in Spring 2018, samples were collected from HMSP wells and analyzed for Total Suspended Solids (TSS) by method 1376585. For the purposes of this study, only data from the April 2022, September 2023, May 2024, and October 2024. Field turbidity measurements for the corresponding samples were

also collected. A side-by-side summary of the laboratory measured TSS and the corresponding field turbidity is presented in Appendix B.

Appendix C contains a side by side comparison/analysis of the TSS and field turbidity data. A ratio is developed for each measurement pair presented by dividing the TSS value by the field measured turbidity.

The median ratio over all measured monitoring points is reported as 0.63 (average value 1.16). The ratio data in Appendix C is also reviewed and reported based on specific arbitrary data ranges for the field measured turbidity. The ratios were evaluated considering only the data that falls within certain arbitrarily specified field turbidity ranges. The arbitrary NTU ranges along with the median and average ratios are defined and reported as follows:

Range	Median Ratio	Average Ratio
0-25 NTU	0.96	2.37
0-100 NTU	1.11	2.37
100-300 NTU	1.65	1.65
Greater than 300 NTU	1.29	1.29

Review indicates that the average ratio and median ratio appear to decrease slightly relative to the site-wide average in the 0-100 NTU range (NTU goal stated in the July 10, 2014 Unnumbered Permit Amendment is 5.0).

The same TSS data and the corresponding field turbidity data are plotted against each other (Appendix D). The best fit trend line indicates a slope of 1.28 and is another estimation of the ratio of TSS to turbidity data across the entire data set. The R² value for the data indicates a relatively linear distribution of data, and supports the best fit line for the plotted data.

Based on the available data, utilizing a ratio of 2.4 is considered to be a conservative means of estimating TSS values from the field measured turbidity in wells where turbidity is relatively low (less than 100 NTU). In other words, a sample with a field measured turbidity of 5.0 NTU is estimated to have a TSS value of 12.0 mg/L.

Based upon the fact that historic field turbidity data already exist for sampling events in 2022-2024 and the fact that a conservative correlation is made for use in estimated TSS values, it is requested that field turbidity be utilized during on-going monitoring to gauge whether representative samples are collected in the field. Field measured turbidity is collected in real time and the delays that are realized waiting for laboratory TSS data will not hinder field work.

Please indicate whether the data presented herein meets your needs with regard to determining an acceptable and conservative correlation between TSS and field turbidity.

To date, field turbidity generally appears to be minimized utilizing low flow or no purge sampling.

Respectfully Submitted,
HLW Engineering Group

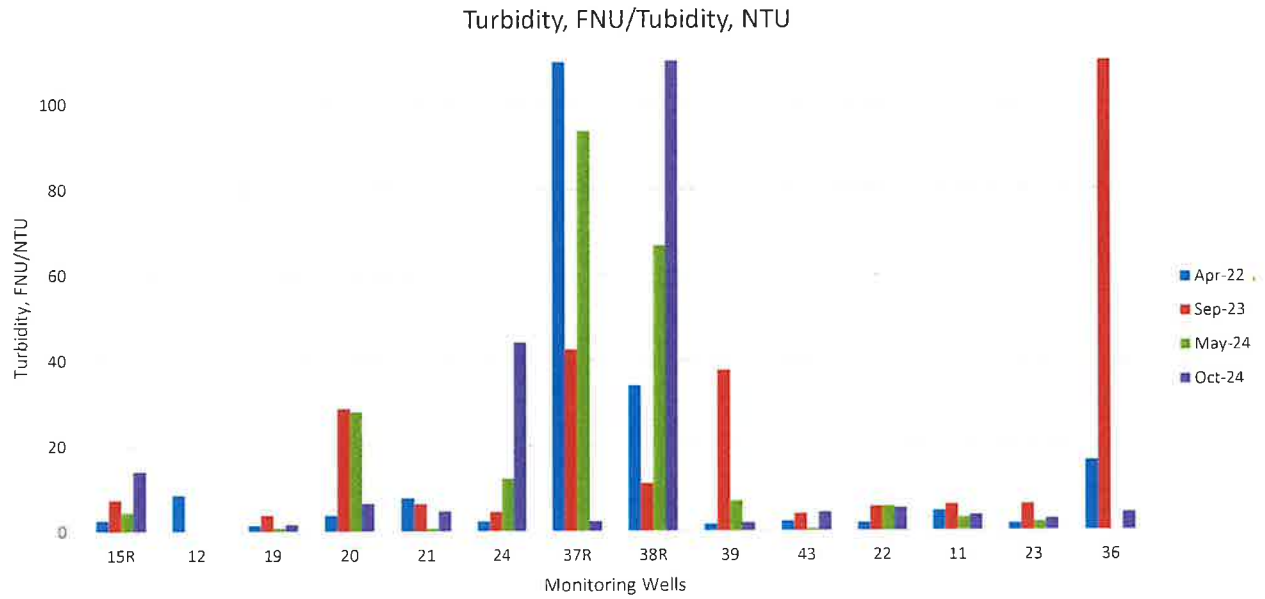


J. Glenn Hunter
Project Manager

cc: Ms. Brandi Mericle, Director

Appendix A
Historic Field Turbidity Measurements

	April 2022	September 2023	May 2024	October 2024
MW	Laboratory TSS Sample Bottle FNU	Laboratory TSS Sample Bottle FNU	Laboratory TSS Sample Bottle FNU	Field Turbidity App I Sample Bottle NTU
15R	2.6	7.4	4.5	14
12	8.5			
19	1.5	3.9	0.8	1.72
20	3.8	28.7	28	6.56
21	7.8	6.5	0.7	4.75
24	2.4	4.6	12.4	44.2
37R	109.8	42.5	93.7	2.37
38R	34	11.2	66.9	398
39	1.6	37.6	7.1	2.04
43	2.3	4.1	0.5	4.37
22	1.9	5.7	5.7	5.35
11	4.7	6.2	3.1	3.7
23	1.7	6.2	2.1	2.86
36	16.4	364.1		4.24



Appendix B

Field Turbidity Measurements/ Total suspended Solids

Cass County Sanitary Landfill

MW	April 2022		September 2023		May 2024		October 2024
	Laboratory TSS Sample Bottle FNU	Laboratory TSS Sample Bottle mg/L	Laboratory TSS Sample Bottle FNU	Laboratory TSS Sample Bottle mg/L	Laboratory TSS Sample Bottle FNU	Laboratory TSS Sample Bottle mg/L	Field Turbidity App I Sample Bottle NTU
15R	2.6	0.94	7.4	21.8	4.5	8.6	14
12	8.5	35		427			
19	1.5	0.94	3.9	3.75	0.8	5.5	1.72
20	3.8	123	28.7	151	28	37.5	6.56
21	7.8	13.5	6.5	4.5	0.7	5	4.75
24	2.4	1.5	4.6	45	12.4	4.75	44.2
37R	109.8	181	42.5	100	93.7	144	2.37
38R	34	23.5	11.2	3.75	66.9	22.8	398
39	1.6	1	37.6	1.25	7.1	0.94	2.04
43	2.3	0.575	4.1	25	0.5	0.94	4.37
22	1.9	0.94	5.7	0.94	5.7	3.63	5.35
11	4.7	12.5	6.2	8.25	3.1	8.33	3.7
23	1.7	1	6.2	1.13	2.1	0.94	2.86
36	16.4	1	364.1	468			4.24

Appendix C
TSS & Turbidity Ratio Analysis

Cass County Sanitary Landfill

Sample Date	MW	Laboratory TSS Sample Bottle mg/L	Field Turbidity Same Bottle FTU	Ratio	Field Turbidity Range			
					< 25 FTU	< 100 FTU	100-300 FTU	>300 FTU
Apr, 2022	15R	0.94	2.6	0.36	0.36	0.36		
	12	35	8.5	4.12	4.12	4.12		
	19	1.88	1.5	1.25	1.25	1.25		
	20	123	3.8	32.37*				
	21	13.5	7.8	1.73	1.73	1.73		
	24	1.5	2.4	0.63	0.63	0.63		
	37R	181	109.8	1.65			1.65	
	38R	23.5	34	0.69	0.69	0.69		
	39	1	1.6	0.63	0.63	0.63		
	43	0.575	2.3	0.25	0.25	0.25		
	22	0.94	1.9	0.49	0.49	0.49		
	11	12.5	4.7	2.66	2.66	2.66		
	23	1	1.7	0.59	0.59	0.59		
36	1	16.4	0.06	0.06	0.06			
Sep, 2023	15R	21.8	7.4	2.95	2.95	2.95		
	12							
	19	3.75	3.9	0.96	0.96	0.96		
	20	151	28.7	5.26		5.26		
	21	4.5	6.5	0.69	0.69	0.69		
	24	45	4.6	9.78	9.78	9.78		
	37R	100	42.5	2.35	2.35	2.35		
	38R	3.75	11.2	0.33	0.33	0.33		
	39	1.25	37.6	0.03	0.30	0.30		
	43	25	4.1	6.10	6.10	6.10		
	22	0.94	5.7	0.16	16.00	16.00		
	11	8.25	6.2	1.33	1.33	1.33		
	23	1.13	6.2	0.18	0.18	0.18		
36	468	364.1	1.29	1.29			1.29	
May, 2024	15R	8.6	4.5	1.91	1.91	1.91		
	12							
	19	5.5	0.8	6.88	6.88	6.88		
	20	37.5	28	1.34		1.34		
	21	5	0.7	7.14	7.14	7.14		
	24	4.75	12.4	0.38	0.38	0.38		
	37R	144	93.7	1.54		1.54		
	38R	22.8	66.9	0.34		0.34		
	39	0.94	7.1	0.13	0.13	0.13		
	43	0.94	0.5	1.88	1.88	1.88		
	22	3.63	5.7	0.64	0.64	0.64		
	11	8.33	3.1	2.69	3.10	3.10		
	23	0.94	2.1	0.45	0.45	0.45		
36								
	Max			4.12	16.00	16.00	1.65	1.29
	Min			0.06	0.06	0.06	1.65	1.29
	Median			0.63	0.96	1.11	1.65	1.29
	Average			1.16	2.37	2.37	1.65	1.29

* Outlier - Not used in statistical analysis

Appendix D
TSS vs Turbidity Graph

