

# Remediation of AFFF/ PFAS Impacted Soil by Sequestration and Natural Attenuation

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Battelle - 6<sup>th</sup> International Symposium on  
Bioremediation and Sustainable Environment  
Technologies

May 11, 2023

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**SUPPORTING**

**[DOING]**

**LEADING**



# RockGen Energy Center Facility and Site Description

## Site Description

- 77.81 acres over two parcels located in the Town of Christiana/ Cambridge, WI in SW Dane County

## Site History

- 1910 – Agricultural land including dairy farm on southeast portion of the property
- 1945 – Limestone quarry operated by T&T Stone Co. until 1960s
- 2000 – Construction of generation facility (facility ownership changes multiple times)

## Facility Description

- Natural gas and fuel oil generation with three combustion turbines and generators, three above ground storage tanks, and support structures on 10 acres of the Site



Public: View down (part) of 111 - Project 111 - Rockgen Energy Center in the topography map. 42655348-3065-316-001\_Topo.mxd  
 Date: 9/20/2022 10:11:11 AM



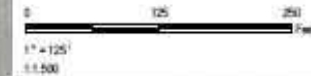
# Site Topography and Layout

## LEGEND

- POTABLE WELL
- DEEP PRODUCTION WELL
- STORM SEWER INLET/OUTLET
- 2' MINOR CONTOUR
- 10' MAJOR CONTOUR
- APPROXIMATE AREA OF AFFF INSPECTION TESTING
- APPROXIMATE EXTENT OF SEPTIC MOUND
- PROPERTY BOUNDARY
- PARCEL BOUNDARY
- SITE EXTENT FOR PURPOSE OF INVESTIGATION
- DRAINAGE CHANNEL\*

## NOTES

1. BASE MAP IMAGERY FROM DANE COUNTY, 2020
2. PARCEL BOUNDARIES ACQUIRED FROM WISCONSIN STATE CARTOGRAPHER'S OFFICE PARCEL DATA.
3. CONTOUR DATA FROM DANE COUNTY LAND INFORMATION OFFICE, 2017.
4. \* = DRAINAGE CHANNEL APPEARS TO BIFURCATE; MAP SHOWS CHANNEL THAT APPEARS TO BE PRIMARY DRAINAGE PATHWAY.



PROJECT		BRRTS #02-13-687341 ROCKGEN ENERGY CENTER 2348 CLEAR VIEW RD, TOWN OF CHRISTIANA DANE COUNTY, WISCONSIN 53623	
TITLE			
SITE TOPOGRAPHY			
DESIGNED BY	G. CORDELL	DRAWN BY	42795-001
CHECKED BY	S. ALBERT	DATE	SEPTEMBER 2022
APPROVED BY	J. PAMET	FIGURE 3	
		TRC (Headquarters), Suite 3300 Madison, WI 53717 Phone: 608.224.5800 www.trcgroup.com	
FILE NO.		42795-001_Topo.mxd	



## Site Geology





## NR 700 Steps Completed/ In Progress

- March 2021 – NR 706 Hazardous Substances Discharge Notification
- April 2021 – NR 716 SIWP w/ Interim Action Options (approved within 1 week)
- Apr. 2021 – Jul. 2021 – NR 716 SI (initial)
- July 2021 – NR 708 Interim Action Workplan (approved within 1 week)
- August 2021 – NR 716 Supplemental SIWP (approved within 1 week)
- September 2021 – NR 716 SIR (approved April 2022)
- Oct. 2021 – Dec. 2021 – NR 716 SI (phase 2)
- Apr. 2022 – Jun. 2022 – NR 708 Interim Action Construction
- October 2022 – NR 708 Remedial Action Documentation Report (approved January 2023)
- December 2022 – NR 716 Technical Assistance Meeting CSM/3D Model (memo. January 2023)
- March 2023 – NR 716 Supplemental SIWP Addendum (review requested within 2 weeks)
- April 2023 – May 2023 – NR 716 SI (phase 3)

# Forensic Signature

## Ansulite 3% AFFF AFC-3A



**LEGEND**

- DRAINAGE CHANNEL\*
- APPROXIMATE AREA OF AFFF INSPECTION TESTING
- APPROXIMATE EXTENT OF SEPTIC MOUND
- PROPERTY BOUNDARY
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**GROUNDWATER RESULTS**  
PIE CHART AREA PROPORTIONAL TO SUM OF DETECTED PFAS (ng/L)

- PERFLUOROBUTANOIC ACID (FFBA)
- PERFLUOROPENTANOIC ACID (FFPeA)
- PERFLUOROHXANOIC ACID (FFHxA)
- PERFLUOROHEPTANOIC ACID (FFHeA)
- PERFLUOROOCTANOIC ACID (FFOA)
- PERFLUORONONANOIC ACID (FFNA)
- PERFLUORODECANOIC ACID (FFDA)
- PERFLUOROUNDECANOIC ACID (FFUA)
- PERFLUORODODECANOIC ACID (FFDoA)
- PERFLUOROTRIDECANOIC ACID (FFTOA)
- PERFLUOROTETRADECANOIC ACID (FFTA)
- PERFLUOROSUTANE SULFONIC ACID (FFBS)
- PERFLUOROPENTANE SULFONIC ACID (FFPeS)
- PERFLUOROHXANE SULFONIC ACID (FFHxS)
- PERFLUOROOCTANE SULFONIC ACID (FFOS)
- 4:2 FLUOROTELOMER SULFONIC ACID (4:2 FTS)
- 6:2 FLUOROTELOMER SULFONIC ACID (6:2 FTS)
- 8:2 FLUOROTELOMER SULFONIC ACID (8:2 FTS)
- PERFLUOROOCTANE SULFONAMIDE (PFOSA)

**NOTES**

- SAGE MAP IMAGERY FROM DANE COUNTY, 2020.
- PARCEL BOUNDARIES ACQUIRED FROM WISCONSIN STATE CARTOGRAPHER'S OFFICE PARCEL DATA.
- \* = DRAINAGE CHANNEL APPEARS TO BIFURCATE; MAP SHOWS CHANNEL THAT APPEARS TO BE PRIMARY DRAINAGE PATHWAY.
- GROUNDWATER RESULTS FROM SAMPLES COLLECTED JULY 14-21, 2021.

0 200 400 Feet

1" = 200' 1:2,400

PROJECT: BRRS #02-13-587841  
ROCKGEN ENERGY CENTER  
2348 CLEAR VIEW RD, TOWN OF CHRISTIANA  
DANE COUNTY, WISCONSIN 53623

TITLE: GROUNDWATER RESULTS PIE CHARTS  
JULY 2021

DRAWN BY: G. CORPUS	FIELD NO.:	427002
CHECKED BY: L. ALBERT		
APPROVED BY: J. PAMPT	<b>FIGURE 12</b>	
DATE: SEPTEMBER 2021		

TRC  
708 Island Trail, Suite 200  
Madison, WI 53717  
Phone: 608.262.3900  
www.trcinc.com

FILE NO.: 427002-SR-02\_GW\_PIE\_RESULTS\_2021 JULY 2021

Plot Date: 9/20/21, 10:10:10 AM by: GDC/PHILLIP - JARVIS, 17 April 2021 (15:17) - Groundwater System: BRRS #02-13-587841 From: Wisconsin State Cartographer's Office Parcel Data  
 Path: \\trcinc.com\gdc\phillip\proj\427002\SR-02\GWP\_PIE\_RESULTS\_2021 JULY 2021.mxd





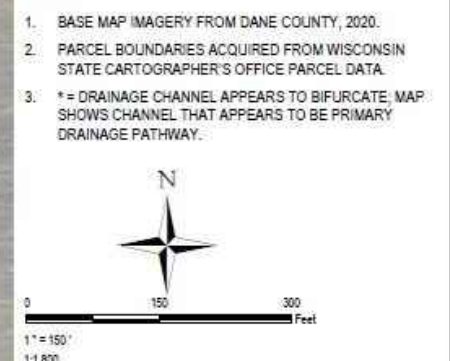
**LEGEND**

- MONITORING WELL
- PIEZOMETER
- GEOPROBE SOIL BORING (APRIL 2021)
- HAND AUGER SOIL BORING (MAY 2021)
- SOIL SAMPLE
- POTABLE WELL
- DEEP PRODUCTION WELL
- STORM SEWER INLET/OUTLET
- DRAINAGE CHANNEL\*
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**BORING SAMPLE ID (SAMPLE DEPTH, FT BGS)  
RESULTS (µg/lgal)**

SOIL RESULTS FOR SELECT PFAS  
(DETECTIONS OF 8.2 FTS, PFOA, AND PFOS)

- NOTES**
- BASE MAP IMAGERY FROM DANE COUNTY, 2020.
  - PARCEL BOUNDARIES ACQUIRED FROM WISCONSIN STATE CARTOGRAPHER'S OFFICE PARCEL DATA.
  - \* = DRAINAGE CHANNEL APPEARS TO BIFURCATE; MAP SHOWS CHANNEL THAT APPEARS TO BE PRIMARY DRAINAGE PATHWAY.



PROJECT		BRTS #02-13-587341 ROCKGEN ENERGY CENTER 2346 CLEAR VIEW RD, TOWN OF CHRISTIANA DANE COUNTY, WISCONSIN 53523	
TITLE		SOIL SAMPLING RESULTS MAP	
DRAWN BY	G. CORWELL	PROJ. NO.	43785
CHECKED BY	L. AUNER		
APPROVED BY	J. RAMEY	FIGURE 8	
DATE	SEPTEMBER 2021		
		706 Heartland Trail, Suite 3000 Madison, WI 53717 Phone: 608.828.3800 www.trcinc.com	
FILE NO.		43785-02-001_SS_Results.mxd	



# Soil Investigation



## Potable Well Abandonment

- Existing well drilled to 200' bsg. impacted
- Abandonment eliminates downward groundwater gradient from pumping
- Two production wells drilled to 1,000' bgs not impacted
- HDD to minimize waste generation (~400')
- Southern industrial well selected for potable





# Impacted Infrastructure: Clean or Replace?

- Impacted systems may include:
  - Fire suppression systems (concentrate storage tank, piping, nozzles) – Fully replaced
  - Fire trucks and response vehicles – Not applicable
  - Septic tanks – Fully replaced
  - Process equipment – Not applicable





# Excavation

- TRC self-performed excavation of septic system and mound.
- 1,000 tons disposed of in Subtitle C landfill (Wayne Disposal)





## Capping - Asphalt

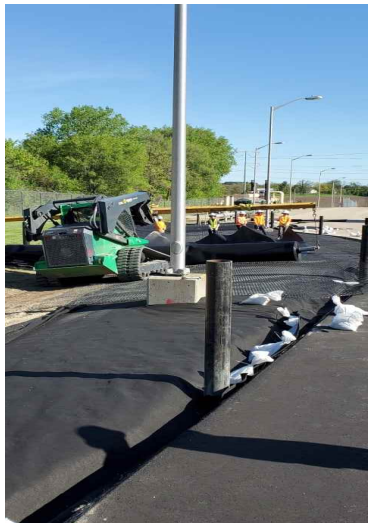
- Site grading and prep – no removal and disposal of soil
- 5” asphalt cap
- Geosynthetic cover beneath piping and facility infrastructure
- Drainage enhanced





## Capping – Geosynthetic Cover System

- Subgrade preparation – no removal and disposal of soil
- Non-woven geotextile cushion
- 40-mil LLDPE
- Engineered synthetic turf
- Hydrobinder infill





## MNA Approach

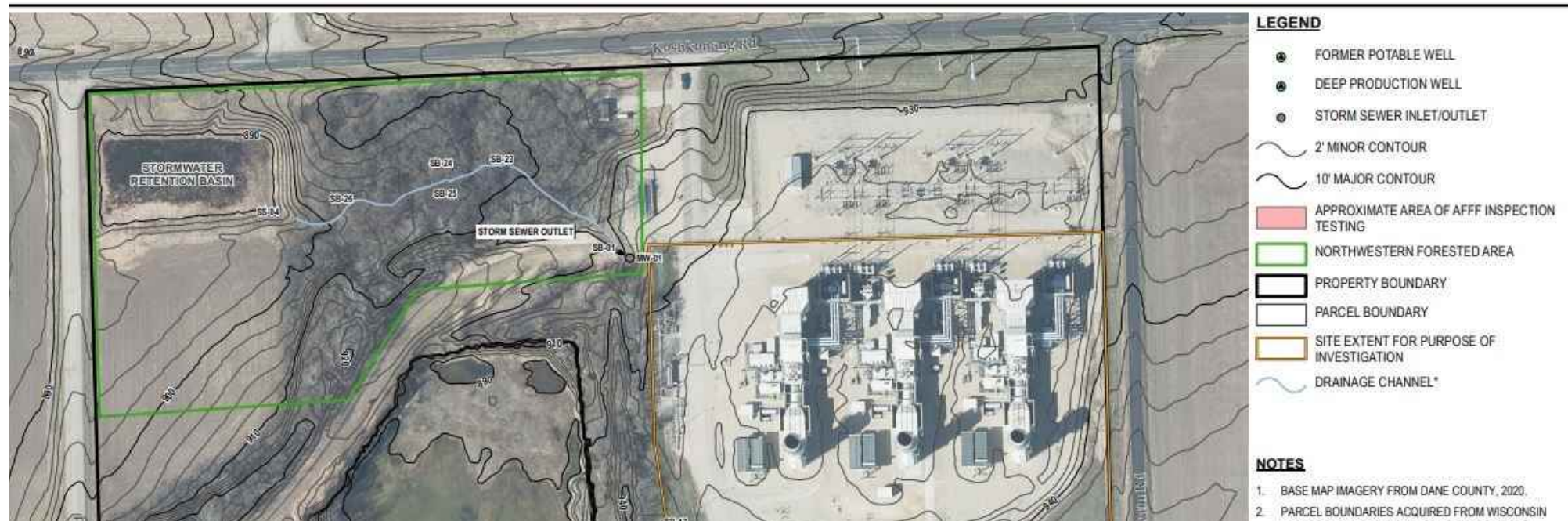
Enhanced attenuation to manage PFAS plumes in groundwater – 2021, Newell, et. al.

1. Injection of particulate sorbents to enhance retention
2. Capping to retain PFAS in the vadose zone
3. Gas sparging in aquifers to concentrate, retain PFAS
4. Retention via PFAS salting out processes
5. Emplacement of particulate sorbents with geotech equipment
6. Intentional LNAPL barrier emplacement to retain PFAS
7. Inject emulsified veg. oil (EVO) to enhance chemical retention
8. Capture PFAS in groundwater discharging to surface water



# Soil Natural Attenuation

- Source sequestration achieved through interim action remedies to allow soil natural attenuation







**Call Us:**

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414.294.9247

# Thanks!



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TRCcompanies.com