MEETING SUMMARY

Marine Corps Base (MCB) Camp Lejeune Restoration Advisory Board (RAB) Meeting Minutes

MEETING DATE:	November 20, 2024	
LOCATION:	Coastal Carolina Community College, Business Technology Building, Jacksonville, North Carolina	
ATTENDEES:	Thomas Richard/MCB Camp Lejeune Laura Spung/MCB Camp Lejeune Jennifer Tufts/EPA Laura Bader/RAB Co-Chair Rob Johnson/RAB member Carol Habel/Guest Riley Lewis/Prospective RAB member Thomas Mattison/RAB member	Ben Francisco/NAVFAC Laarni Cooper/NAVFAC Matt Louth/CH2M Monica Fulkerson/CH2M Josh Hanks/NCDEQ Steven Thompson/RAB member
FROM:	Monica Fulkerson/CH2M	
DATE:	December 11, 2024	

I. Welcome and Introductions

Mr. Richard began the meeting, introduced the team, and explained the purpose of the RAB. Mr. Richard mentioned a Department of Defense webinar that was held last night and encouraged RAB members to view the recording. Mr. Richard also mentioned that Success Stories are available on the Marine Corps Base Camp Lejeune Facebook page.

II. Optimizing Long-term Monitoring for Green and Sustainable Remediation

Objective: The purpose of this agenda item is to review the Camp Lejeune long-term monitoring (LTM) program and present green and sustainable remediation (GSR) best management practices (BMPs) that have been implemented, along with their benefits.

Overview: A presentation was reviewed by Ms. Fulkerson.

The objective of the LTM program is to monitor changes in constituent of concern (COC) concentrations over time to evaluate progress towards meeting cleanup goals and to monitor performance at active treatment sites to evaluate the effectiveness of the selected remedies. LTM at Marine Corps Base (MCB) Camp Lejeune includes 19 Installation Restoration (IR) sites and the annual collection of 430 groundwater samples, 8 surface water samples, and 8 sediment samples. Every five years, an additional 96 groundwater samples and 4 surface water samples are collected. LTM requires approximately 1,310 working-hours annually for sampling efforts, and an additional 290 working-hours every 5 years (most recently in 2023) for sampling efforts. Over five years, this sampling effort includes an estimated 20,500 miles driven, 8 tons of greenhouse gas emitted, and $350,000 in labor costs. The LTM program generates waste, which requires management. Typical groundwater sampling via low-flow/well volume techniques generates 3 to 5 gallons of aqueous waste per well. A potential of 1,720 gallon of aqueous waste is generated annually, equivalent to approximately 40 drums of non-hazardous waste, plus an

additional 380 gallons or 9 drums generated every fifth year. The cost for transport and disposal of waste is up to $10,000 annually.

The LTM program can be optimized in two ways: 1) reducing the duration of LTM by accelerating the time to site closure and 2) employing GSR BMPs. Accelerating the time to site closure has been conducted at multiple sites via pilot studies, including air sparging at Sites 35 (2020-present) and 82 (2021-present), enhanced reductive dechlorination and biobarrier treatability studies at Site 88 (2019-present), and the subgrade biogeochemical reactors at Site 93 (2015-present). These pilot studies were detailed during last quarter's RAB presentation.

GSR expands upon the Department of Defense's current environmental practices and employs strategies for cleanups that use natural resources and energy efficiently, reduce negative impacts on the environment, minimize or eliminate pollution at its source, protect and benefit the community at large, and reduce waste to the greatest extent possible. GSR uses strategies that consider all environmental effects of remedy implementation and operation and incorporates options to maximize the overall environmental benefits of cleanup actions. The target phase for applying GSR is during the Remedial Investigation, Remedial Action Construction, and Long-term Monitoring.

The LTM program has employed multiple GSR BMPs. One major focus is reducing waste generation. The LTM program uses passive sampling when possible. Compared to low-flow sampling, which involves purging water until parameters stabilize, generating 3 to 5 gallons of aqueous waste and taking 1 to 2 hours to generate high quality investigation data, passive sampling involves pulling a passive diffusion bag (or similar) from a well, generating negligible waste and takes less than 10 minutes to generate data appropriate to evaluate long-term trends (noting that it is not used for site close-out). In 2024, 313 out of 430 LTM samples were collected via passive sampling techniques. This eliminated the generation of approximately 1,565 gallons of aqueous waste, reducing greenhouse gas emissions associated with waste treatment and eliminated the generation of hazardous waste at certain locations. Additionally, passive sampling saved over 400 field hours, leading to an estimated annual savings of 1,200 miles driven, 0.5 tons of greenhouse gas emitted, and $20,000 in labor costs. Where passive sampling is not possible, the LTM program has obtained regulatory concurrence to discharge aqueous waste to the ground surface under special conditions. Small volumes of nonhazardous aqueous waste may be discharged directly to the ground surface if the material stays onsite and remains in the contaminated area, is secured, does not increase the spread of contamination or concentrations in a particular medium, does not cause mobilization of contaminants, does not introduce contamination to uncontaminated soil. This newly adopted BMP will be employed in 2025, during which 115 out of 430 LTM wells have been designated for discharge to ground surface (plus an additional 35 wells every 5 years). As a result, the need for transport and disposal or treatment of approximately 575 gallons of aqueous waste will be eliminated, reducing greenhouse gas emissions by 0.3 tons and saving approximately $1,275 annually. Another way that waste generation is reduced is by re-evaluating monitoring well networks and sampling frequency annually. LTM data are reviewed to evaluate if the program can be optimized for groundwater, surface water, sediment, and pore water sampling (including frequency, network, and site-specific analytes), while achieving the site-specific remedial action objectives. At Site 36, since 2016, sampling of 10 wells has been reduced from annual to every 5 years. At Site 69, since 2021, sampling of 27 wells has been reduced from annual to every 5 years. At Site 86, since 2020 site-wide sampling of 42 wells has been reduced from annual to every 5 years, while retaining the annual monitoring of 8 downgradient monitoring wells to monitor potential migration. These optimization eliminate sampling of 71 wells annually, four out of every five years, eliminating the generation of approximately 355 gallons of waste annually, saving over 400 field hours worked, leading to an estimated annual savings of 1,200 miles driven, 0.5 tons of greenhouse gas emitted, and $20,000 in labor costs.

Another GSR BMP employed by the LTM program is the use of renewable energy. For example, solar power was installed to run the Site 93 SBGRs, which have treated approximately 189,000 gallons of

groundwater over a two-year period, for an estimated savings of 160 kilowatt-hours. At Site 96, a solar power soil vapor extraction treatability study was conducted, which removed contaminants from the vadose zone (the part of the subsurface above the water table), reducing contaminant concentrations in soil by 66% and in soil gas by 99%, which allowed for a passive remedy (monitored natural attenuation) to be selected in the Record of Decision.

The LTM program also uses renewable resources whenever possible. For example, the SBGRs installed and operated at Site 82 consist of non-refined and recycled materials to promote biodegradation, such as mulch, river rock, and natural organic material. The SBGRs at Site 82 have treated more than 4.4 million gallons of impacted water. Similarly, mulch walls were installed as part of the selected remedy at Site 89, which includes mulch and gravel to promote biodegradation to passive treat groundwater as it flows downgradient.

The final GSR BMP being taken into consideration for the LTM program is the consideration of resilience to extreme weather events and climate hazards, including hurricanes and sea level rise. Resilience to extreme weather events is considered throughout the project lifecycle with an emphasis on the remedy selection process and during the Five-Year Review. As a result, new and existing remedies are more resilient to extreme weather events and climate hazards, which will save money and increase protectiveness in the long-term.

Ms. Bader asked what happens to the waste when it is disposed. Ms. Fulkerson explained that waste is transported to certified waste disposal facilities for treatment, or is sent to the groundwater treatment plant.

Mr. Johnson asked if the use of recycled glass had been considered in SBGR applications. Ms. Fulkerson indicated that they have not. Mr. Johnson said that glass has been used in similar applications elsewhere.

IV. RAB Business

A vote was held on Riley Lewis's RAB application. She was approved as a new RAB member. The next RAB meeting is planned for February 19, 2025.

Optimizing Long-term Monitoring for Green and Sustainable Remediation

MCB Camp Lejeune

Restoration Advisory Board Meeting

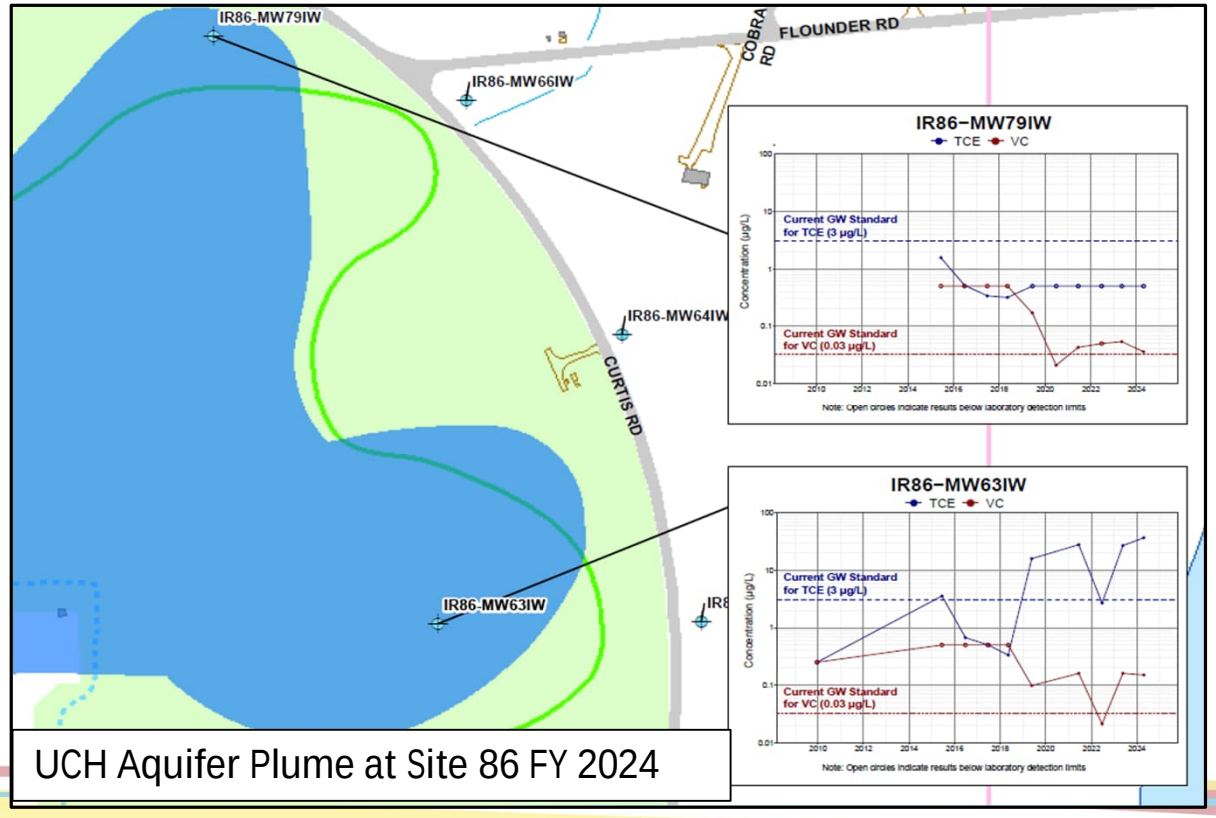
November 20, 2024

Objectives

- Review Camp Lejeune Long-term Monitoring (LTM) Program
- Present Green and Sustainable Remediation (GSR) best management practices (BMPs) that have been implemented and their benefits

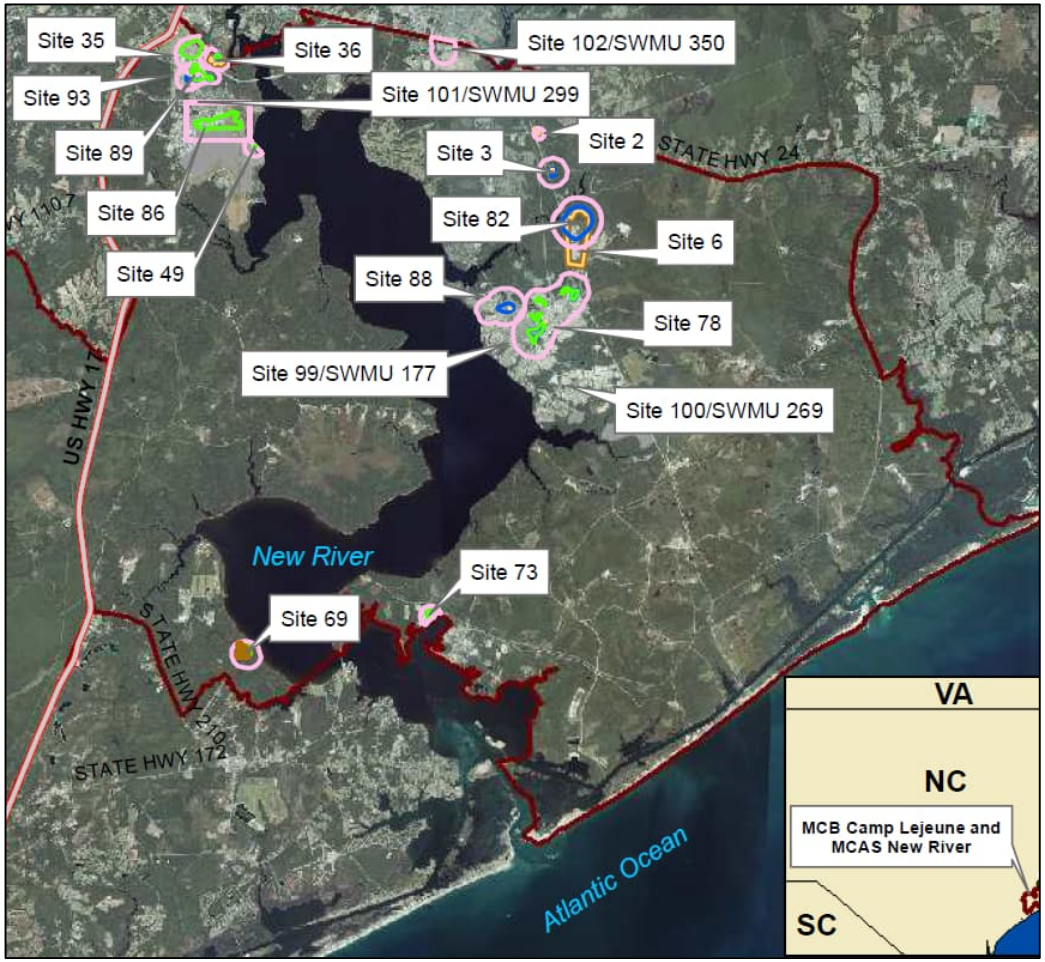
Objective of the LTM Program

- To monitor changes in constituent of concern (COC) concentrations over time:
  - Evaluate progress toward meeting cleanup goals
  - Performance monitoring for active treatment to evaluate the effectiveness of selected remedies



UCH Aquifer Plume at Site 86 FY 2024

LTM at MCB Camp Lejeune



Includes19 Installation Restoration Sites

- Annual collection of:
  - 430 groundwater samples
  - 8 surface water samples
  - 8 sediment samples
- Every 5 years collection of an additional:
  - 96 groundwater samples
  - 4 surface water samples

LTM at MCB Camp Lejeune

- Requires approximately 1,310 working-hours annually for sampling efforts
  - Additional 290 working-hours every 5 years (most recently in 2023) for sampling efforts
- Over five years, this sampling effort includes an estimated
  - 20,500 miles driven
  - 8 tons of greenhouse gas emitted
  - $350,000 in labor costs

LTM at MCB Camp Lejeune

Waste Management

- Typical groundwater sampling via low flow/well volume techniques generates 3 – 5 gallons per well of aqueous waste
- A potential of 1,720 gallons of aqueous waste generated annually from the LTM Program
  - Approximately 40 drums of non-hazardous waste
  - Additional 380 gallons (9 drums) generated every 5 years
- Costs for transport & disposal of waste – up to $10,000 annually

Optimization of LTM

1. Reduce duration of LTM by accelerating time to site closure
2. Employ Green and Sustainable Remediation BMPs

Optimizing LTM at MCB Camp Lejeune

1. Accelerating time to site closure via pilot studies

Current pilot studies:

- Site 35 Air Sparging (2020 – present)
- Site 82 Air Sparging (2021 – present)
- Site 88 ERD and biobarrier treatability studies (2019-present)
- Site 93 SBGRs (2015 – present)

Site 82 Air Sparge Point

Site 93 SBGR Installation

Optimizing LTM at MCB Camp Lejeune

2. Employ Green and Sustainable Remediation BMPs

What is Green and Sustainable Remediation (GSR)?

"Green and sustainable remediation expands upon the Department [of Defense]'s current environmental practices and employs strategies for cleanups that use natural resources and energy efficiently, reduce negative impacts on the environment, minimize or eliminate pollution at its source, protect and benefit the community at large, and reduce waste to the greatest extent possible.

Green and sustainable remediation uses strategies that consider all environmental effects of remedy implementation and operation and incorporates options to maximize the overall environmental benefit of cleanup actions".

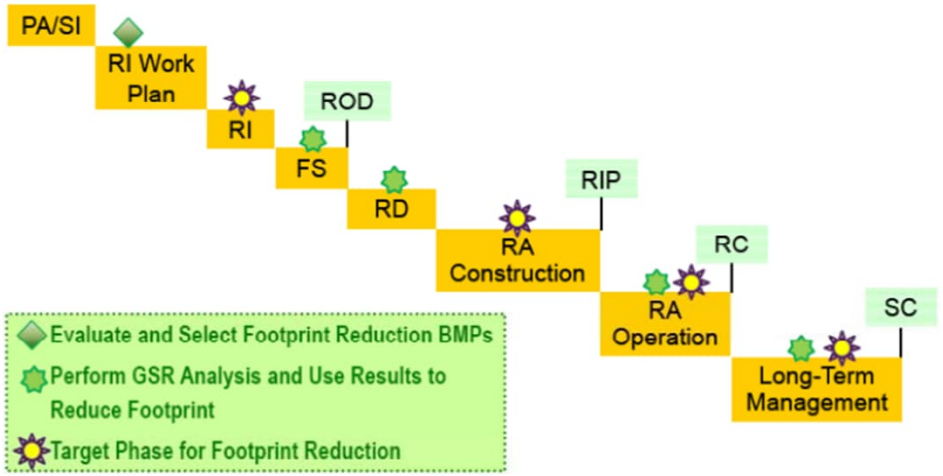


Figure 1-1. Applying GSR throughout the Environmental Restoration Process

GSR BMP: Reduce Waste Generation

- Action taken: Use Passive Sampling when possible

- Low-Flow Sampling:
  - Involves purging water until parameters stabilize
  - Generates 3 to 5 gallons of aqueous waste
  - Takes 1 to 2 hours to purge and sample
  - Generates high quality investigation data

- Passive Sampling
  - Pull passive diffusion bag (or similar) from well
  - Generates negligible waste
  - Takes <10 minutes to collect sample
  - Generates data appropriate to evaluate long term-trends (not used for site close-out)

GSR BMP: Reduce Waste Generation

- Action taken: Use Passive Sampling when possible

> In 2024, 313 out of 430 LTM wells sampled via passive sampling techniques.

- Result:
  - Reduce generation of 1,565 gallons of aqueous waste annually
    - Reduced greenhouse gas emissions associated with waste treatment
    - Eliminated the generation of hazardous waste
  - Save over 400 field hours worked leading to an estimated annual savings of
    - 1,200 miles driven
    - 0.5 tons greenhouse gas emitted
    - $20,000 in labor costs

GSR BMP: Reduce Waste Generation

- Action taken: Discharge to Ground Surface

  Small volumes of nonhazardous aqueous RDW may be discharged on the ground if the material:
  - Stays onsite and remains in the contaminated area
  - Is secured
  - Does not increase the spread of contamination or concentrations in a particular medium
  - Does not cause mobilization of contaminants
  - Does not introduce contamination to uncontaminated soil

GSR BMP: Reduce Waste Generation

- Action taken: Discharge to Ground Surface

For 2025, 115 out of 430 LTM wells have been designated for discharge to ground surface (plus an additional 35 wells every 5 years).

Result:

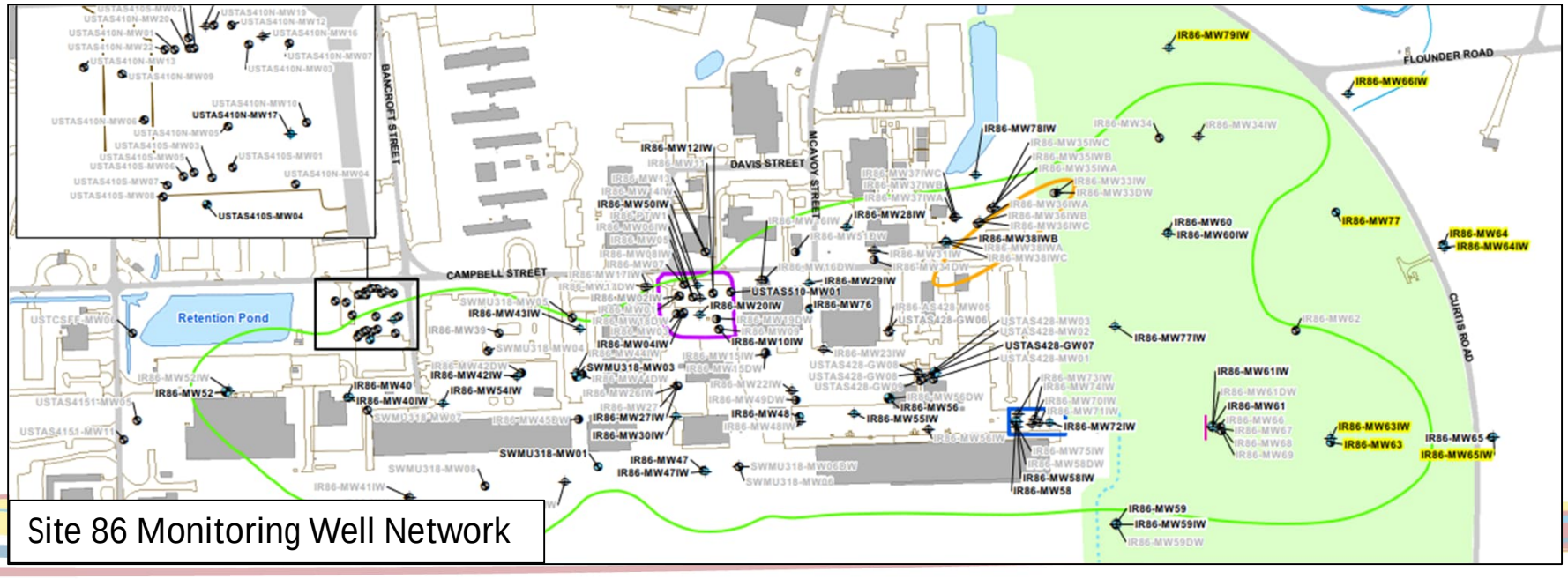
- Will eliminate need for transport and disposal or treatment of 575 gallons of aqueous waste annually
  - Will reduce greenhouse gas emissions associated with waste treatment by 0.3 tons
  - Will save $1,275 in waste transport and disposal costs annually

GSR BMP: Reduce Waste Generation

- Action taken: Evaluate Monitoring Well Network and Sampling Frequency Annually

  LTM data are reviewed to evaluate if the program can be optimized for groundwater, surface water, sediment, and pore water sampling (frequency, network, and site-specific analytes) while achieving the site-specific RAOs

  - Site 36 – since 2016, sampling reduced from annual to every 5 years (10 wells)
  - Site 69 – since 2021, sampling reduced from annual to every 5 years (27 wells)
  - Site 86 – since 2020, site-wide sampling reduced from annual to every 5 years (42 wells); downgradient wells sampled annually (8 wells)



Site 86 Monitoring Well Network

GSR BMP: Reduce Waste Generation

- Action taken: Evaluate Monitoring Well Network and Sampling Frequency Annually

Recent optimization eliminates sampling of 71 LTM wells annually (4 out of every 5 years)

- Result:
  - Reduce generation of 355 gallons of aqueous waste annually (4 out of every 5 years)
    - Will reduce greenhouse gas emissions associated with waste treatment by 0.3 tons
  - Save over 400 field hours worked, leading to an estimated annual savings of
    - 1,200 miles driven
    - 0.5 tons greenhouse gas emitted
    - $20,000 in labor costs

GSR BMP: Use Renewable Energy

- Action Taken: Solar power installed to run Site 93 subgrade biogeochemical reactor (SBGR)
  - Treated ~189,000 gallons of groundwater using exclusively solar power over a 2-year period
  - Estimated savings of 160 kwh

GSR BMP: Use Renewable Energy

- Action Taken: Solar power soil vapor extraction treatability study at Site 96
  - Removed contaminants from the vadose zone (above water table)
  - Reduced contaminant concentrations in soil by 66% and in soil gas by 99%
  - Allowed for passive remedy to be selected in Record of Decision (MNA)

GSR BMP: Use Renewable Resources

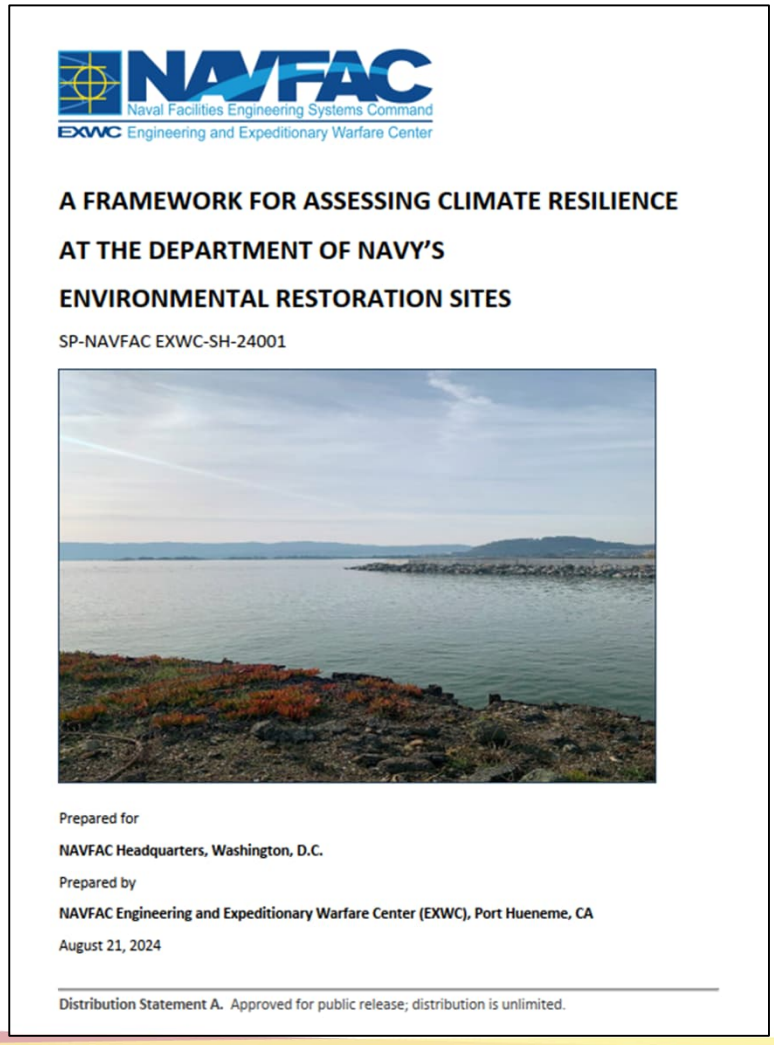
- Action Taken: Installed and operated three SBGRs at Site 82
  - Use of non-refined and recycled materials to promote biodegradation
    - i.e., mulch, river rock, natural organic material
  - Treated more than 4.4 million gallons of impacted water

GSR BMP: Use Renewable Resources

- Action Taken: Installed mulch walls as part of selected remedy at Site 89
  - Use of non-refined materials to promote biodegradation
    - i.e., mulch, gravel
  - Passively treats groundwater as it flows downgradient

GSR BMP: Consider Resilience to Extreme Weather Events and Climate Hazards (including hurricanes and sea level rise)

- Action Taken: Resilience to extreme weather events considered throughout the project lifecycle with an emphasis on the remedy selection process and during the Five-Year Review
- Result: New and existing remedies are more resilient to extreme weather events and climate hazards which will save money and increase protectiveness in the long term



NAVFAC
Naval Facilities Engineering Systems Command
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A FRAMEWORK FOR ASSESSING CLIMATE RESILIENCE AT THE DEPARTMENT OF NAVY'S ENVIRONMENTAL RESTORATION SITES

SP-NAVFAC EXWC-SH-24001

Prepared for

NAVFAC Headquarters, Washington, D.C.

Prepared by

NAVFAC Engineering and Expeditionary Warfare Center (EXWC), Port Hueneme, CA

August 21, 2024

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Questions?