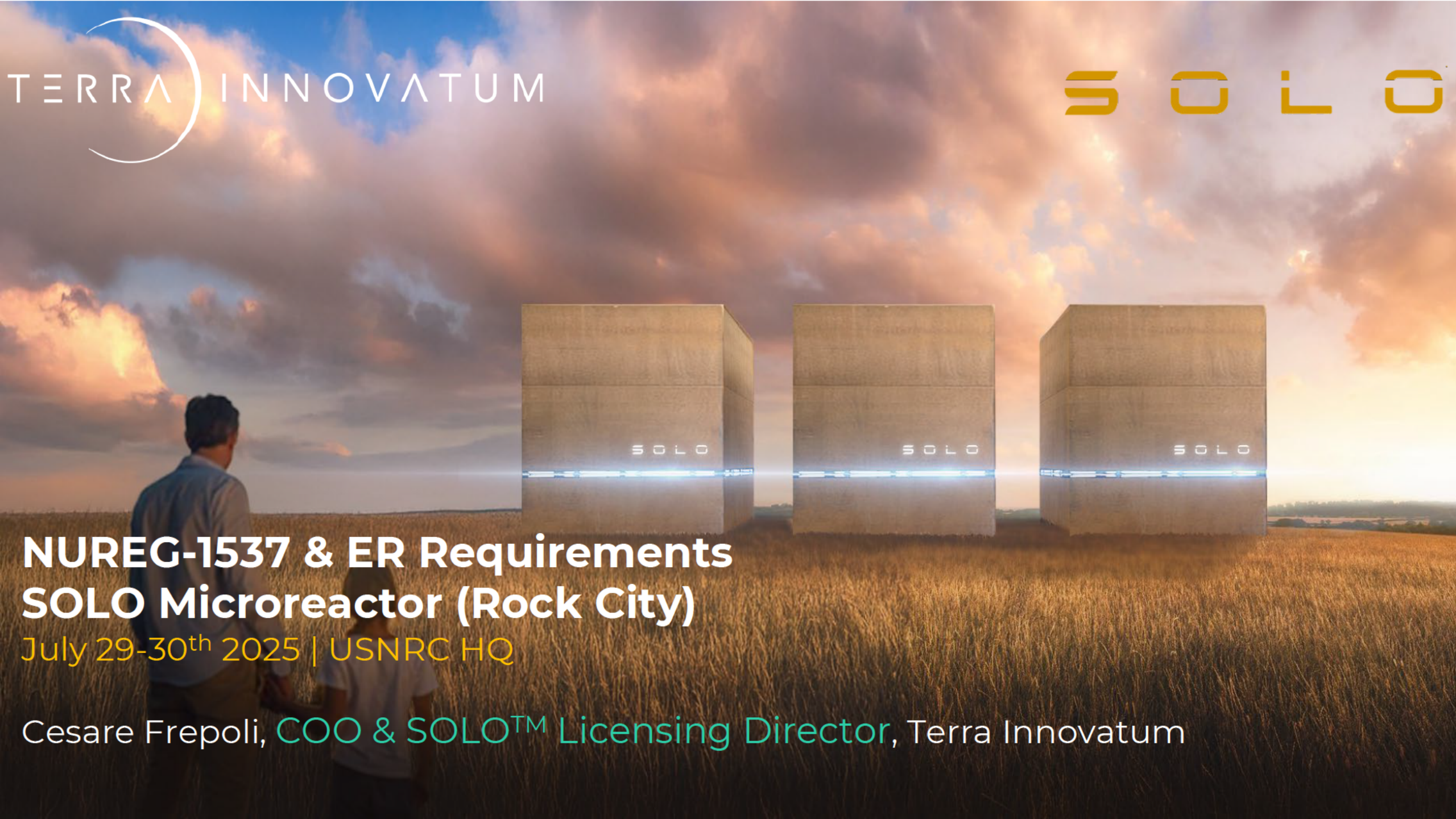

NUREG-1537 & ER Requirements SOLO Microreactor (Rock City)

July 29-30th 2025 | USNRC HQ

Cesare Frepoli, COO & SOLO™ Licensing Director, Terra Innovatum

Outline

- Purpose and Review Request
- Overview SOLO Proposed Action
- Description Of The Affected Environment
- Impacts Of Proposed Construction, Operations, And Decommissioning
- Alternatives
- Conclusions

Purpose and Need for the Proposed Action

- **Federal Action**
  - NRC decision on whether to issue a Construction Permit under 10 CFR Part 50 for the SOLO Microreactor.
- **Purpose of NRC's Action**
  - To support compliance with NEPA (10 CFR Part 51) by preparing an Environmental Impact Statement (EIS).
- **Need for Terra Innovatum's Action**
  - Construct and operate the SOLO Microreactor at Rock City to:
    - Demonstrate feasibility, safety, and performance of the technology in a test environment.
    - Provide operational data to support future microreactor applications in energy, defense, and remote/off-grid use.
- **Decision Context**
  - NRC will weigh environmental impacts and reasonable alternatives before determining whether to issue the permit.

Regulatory Framework

- **Regulatory Basis**
  - Submitted in accordance with 10 CFR Part 50 (Domestic Licensing of Production and Utilization Facilities).
  - ER provided with Construction Permit application per 10 CFR 51.50(a).
  - Supports NRC preparation of an Environmental Impact Statement (EIS) under 10 CFR Part 51, Subpart A (NEPA).
- **Purpose of the ER**
  - Evaluate environmental effects of construction, operation, and decommissioning of the SOLO Microreactor at Rock City
  - Organized consistent with NUREG-1537, Part 1, Chapter 19 and NRC Interim Staff Guidance.
  - Builds on methodologies from recent NRC-reviewed microreactor ERs (e.g., Hermes/Hermes-2).
- **NRC Engagement Objectives**
  - TINN requests NRC review and feedback on the applicability of prior non-power reactor ER frameworks to SOLO's licensing.
  - Obtain NRC input regarding the acceptability of the proposed approach to structuring environmental analyses, including:
    - Use of existing NRC precedent for bounding impact determinations.
    - Proposed methods for assessing alternatives, cumulative impacts, and residual effects consistent with Part 51 guidance.

Applicable Regulations and Regulatory Guidance

The following are Applicable:

- Regulations
  - **10 CFR Part 51** – Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions
  - **10 CFR 51.50(a)** – Environmental Report—Construction Permit Stage
  - **10 CFR Part 50** – Domestic Licensing of Production and Utilization Facilities (federal action requiring NEPA review)
- NRC Environmental Guidance
  - **NUREG-1537, Part 1 & 2** – Guidelines for Preparing and Reviewing Non-Power Reactor Licensing Applications (Ch.19 = ER content)
  - Interim Staff Guidance (ISG) to **NUREG-1537**, **Part 1, Ch. 19** – supplements ER format and expectations
  - **RG 4.2** – Preparation of Environmental Reports for Nuclear Power Stations (impact analysis methods applicable to microreactors)
  - **RG 1.23** – Meteorological Monitoring Programs for Nuclear Power Plants (data needed for air dispersion and atmospheric analysis)

Site Characteristics and Suitability Guidance

The following regulatory and international guidance documents inform site characterization and hazard evaluation methods used in this ER:

- **Geoscience / Natural Hazards**
  - **RG 1.91** – Explosions at Nearby Facilities and Transportation Routes
  - **RG 1.132** – Site Investigations for Foundations of Nuclear Power Plants
  - **RG 1.208** – Performance-Based Approach to Define Site-Specific Earthquake Ground Motion
  - **RG 4.26** – Volcanic Hazards Assessment for Proposed Nuclear Power Reactor Sites
  - **DG-1290 (Rev. 3 to RG 1.59, Draft)** – Design Basis Flood Hazards, Appendix K methods
- **International Best Practices**
  - **IAEA SSG-35** – Site Survey and Site Selection for Nuclear Installations

Proposed Action (Overview)

- **Action Requested**
  - NRC issuance of a Construction Permit under 10 CFR Part 50 for the SOLO Microreactor at Rock City (Valmeyer, IL).
- **Scope of the Proposed Action**
  - Construction of the SOLO facility, supporting structures, and site infrastructure.
  - Operation of a non-power test reactor to demonstrate microreactor technology.
  - Decommissioning at the end of licensed life, with removal or stabilization of structures and site restoration.
- **Facility Role**
  - Provide operational experience with advanced microreactor systems.
  - Support technology maturation for potential future application.
- **NRC Environmental Review**
  - ER evaluates environmental effects of all project phases: construction, operation, and decommissioning.
  - Supports preparation of an Environmental Impact Statement (EIS) under 10 CFR Part 51.

Facility Description & Key Parameters (SOLO Microreactor)

- **Reactor Type**: Non-power test microreactor (Terra Innovatum SOLO design)
- **Thermal Power**: 5MW
- **Core & Coolant**: Standard LWR fuel pellet stack made of Uranium dioxide (UO_2) enriched up to 4.95%, graphite-moderated and helium-cooled
- **Support Systems:**
  - Passive Decay heat removal systems
  - Instrumentation & control systems
  - Auxiliary systems for startup/shutdown
- **Site Footprint:100 m^2**
  - Reactor building and limited support structures within Rock City industrial zone
  - Controlled area contained within existing developed footprint
- **Resource Needs:**
  - Minimal water use (primarily for domestic/support functions)
  - Grid and backup power connections for operations and safety systems
- **Waste Management:**
  - Low-level radioactive waste (LLRW) managed under existing licensed disposal pathways
  - Conventional solid waste and sanitary waste managed via local infrastructure

Construction & Operations Summary

- **Construction Phase**
  - Duration: ~few weeks
  - Workforce: ~TBD staff
  - Activities: site grading, reactor building construction
  - Disturbance: ~[[ ]]
- **Operations Phase**
  - Workforce: ~TBD staff
  - Reactor Use: non-power test reactor
  - Resource Use: ~Minimal TBD
  - Waste Management:
    - Low-level radioactive waste (Class A/B) shipped to licensed disposal
    - Sanitary & solid waste handled via local municipal services
- **Decommissioning**
  - Conceptual plan only at CP stage
  - Expected to follow NRC decommissioning regulations (10 CFR 50.82)
  - Site suitable for industrial reuse
- **Proposed Schedule**
  - Construction start: ~2027 (projected in ER)
  - Operations: ~2028–2048 (20-year license)
  - Decommissioning: post-license termination

Site History - Site History (Rock City, Valmeyer, IL)

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Source: https://www.rockcitydevelopment.com/

Site History - Site Description & Location

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Source: https://www.rockcitydevelopment.com/

Rock City – Historic & Cultural Resources

- **Cultural Resources Review**
  - Review of National Register of Historic Places (NRHP) listings within a 5-mile radius of the Rock City site.
  - No historic properties, districts, or archaeological sites identified on or adjacent to the site.
- **Consultation Process**
  - NRC will initiate consultation under Section 106 of the National Historic Preservation Act (NHPA) with the Illinois State Historic Preservation Office (SHPO).
  - Tribal and local stakeholders will also be notified as part of the NEPA process.
- **Expected Outcome**
  - Prior industrial development and quarrying of the site make discovery of intact historic or archaeological resources unlikely.
  - Any unanticipated finds during construction would be addressed under a cultural resources management plan consistent with NRC and SHPO requirements.

Rock City – Site Location

Rock City - Site characteristics

- The proposed SOLO Microreactor site is near Rock City, an unincorporated community in Monroe County, Illinois, along the Mississippi River bluffs in the southwest of the state.
- **Topography:** Elevated limestone formations overlooking the floodplain provide stable bedrock and natural elevation above flood hazards.
- **Surrounding land use:** Predominantly agricultural with some woodland.
- **Nearby population centers:** Small rural communities and Valmeyer to the northeast.

Rock City - Site characteristics

- **Population density:** Low, with most of the workforce in agriculture, light manufacturing, and regional logistics, limiting potential public exposure under normal operation.
- **Proximity to St. Louis:** Within commuting distance of the St. Louis metropolitan area, allowing access to skilled labor and essential services.
- **Safety and planning advantage:** The site retains geographic separation from dense urban infrastructure, supporting safety, security, and emergency planning.

Rock City – Transportation and Access

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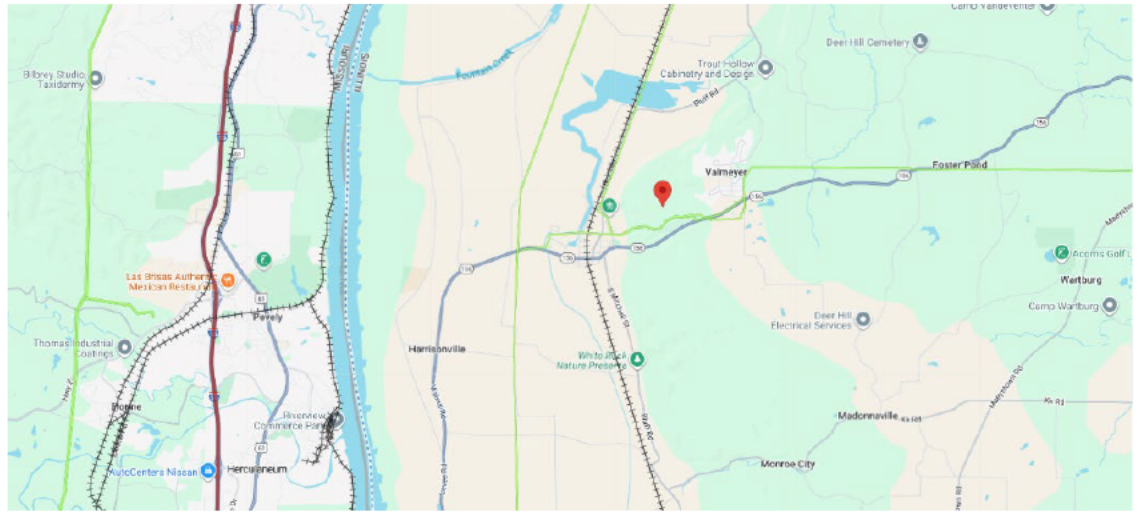

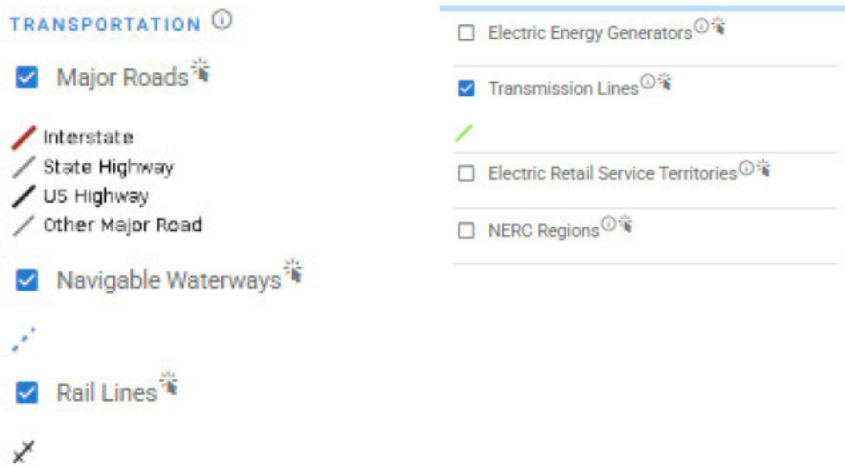

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Source: Stand (https://fptz.org/)

Rock City - USGS seismic hazard data

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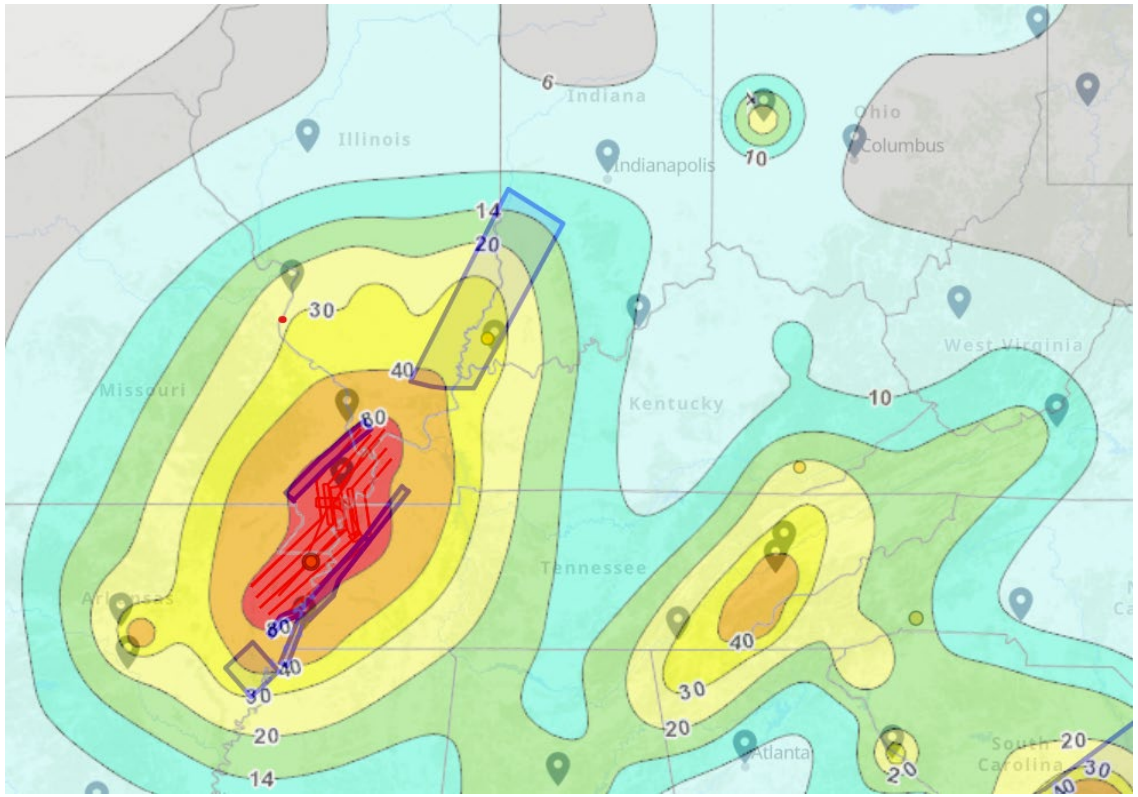

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Source: USGS Earthquake Hazard Toolbox (https://earthquake.usgs.gov)

Rock City - Wetlands & Riparian Assessment

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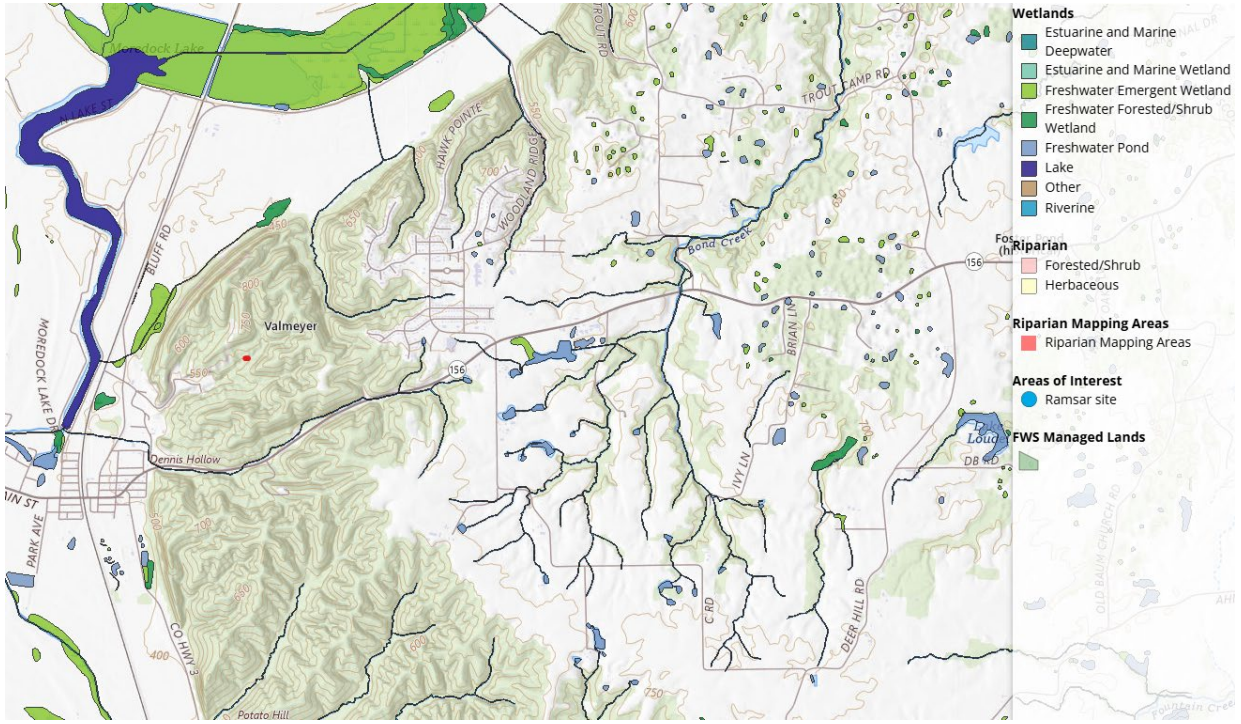

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Source: Wetlands Mapper (https://www.fws.gov/)

Rock City – Flood Hazard Assessment

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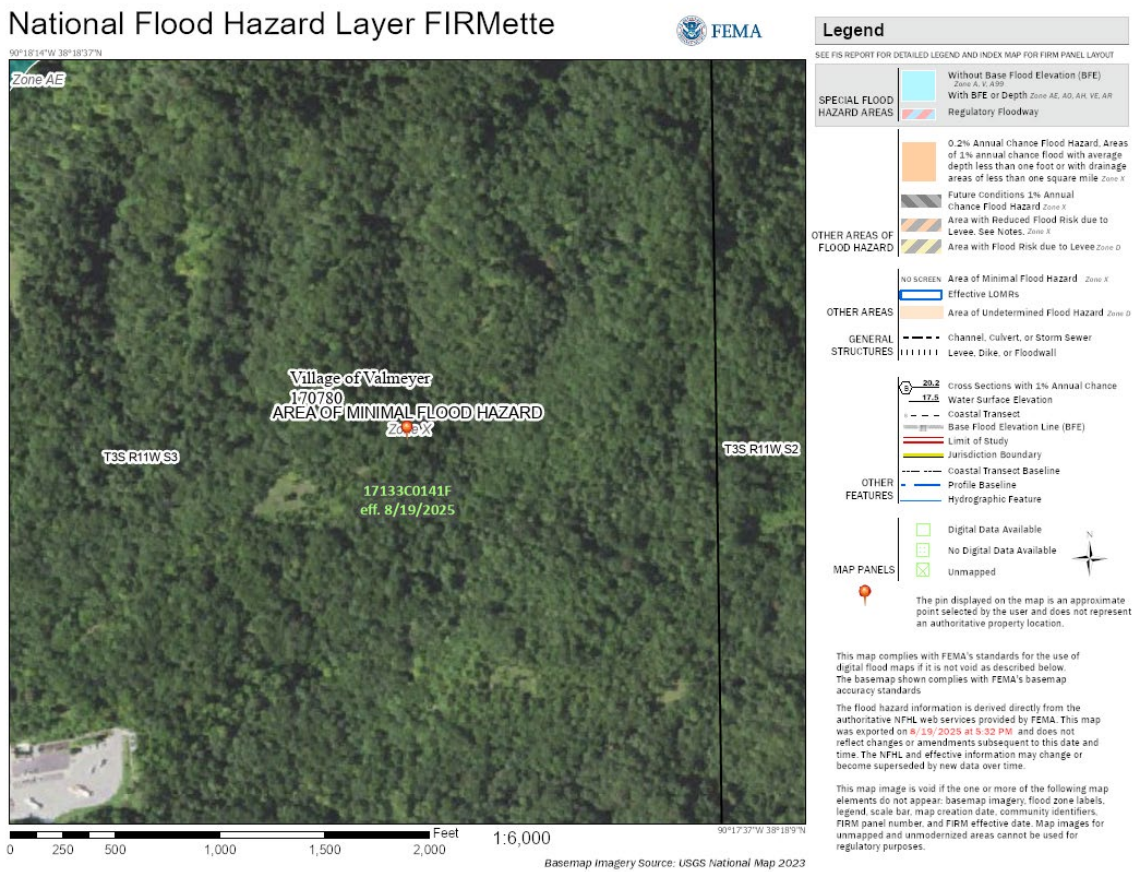

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Source: FEMA's National Flood Hazard Layer (https://msc.fema.gov/portal/home/)

Rock City – Critical Habitat Assessment

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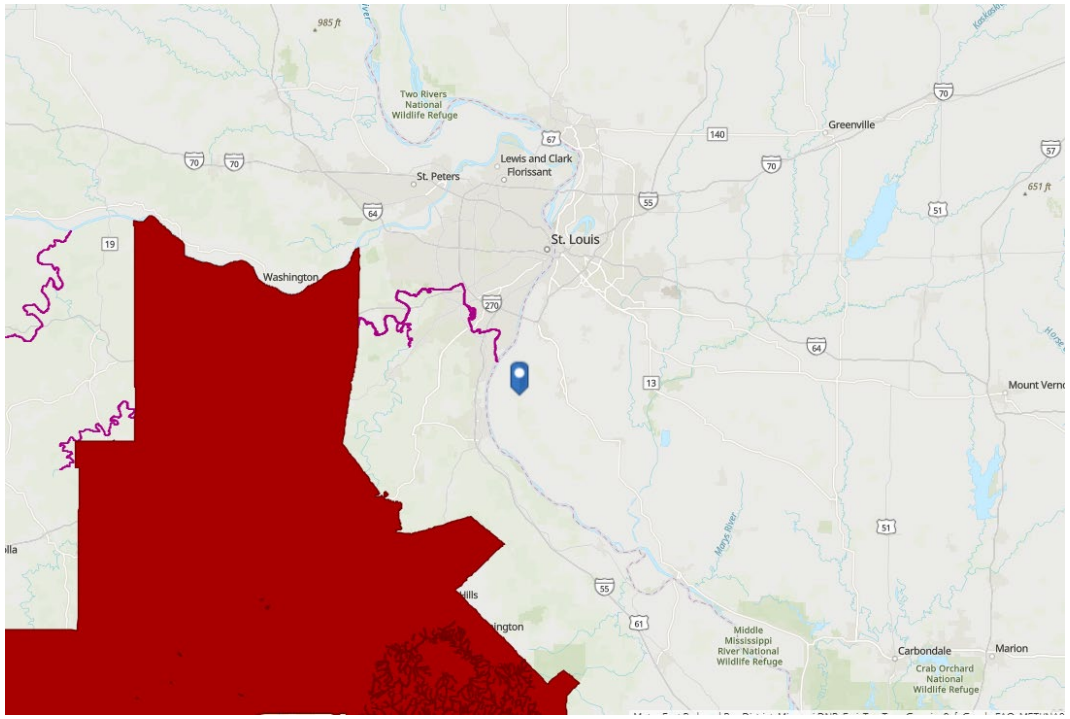

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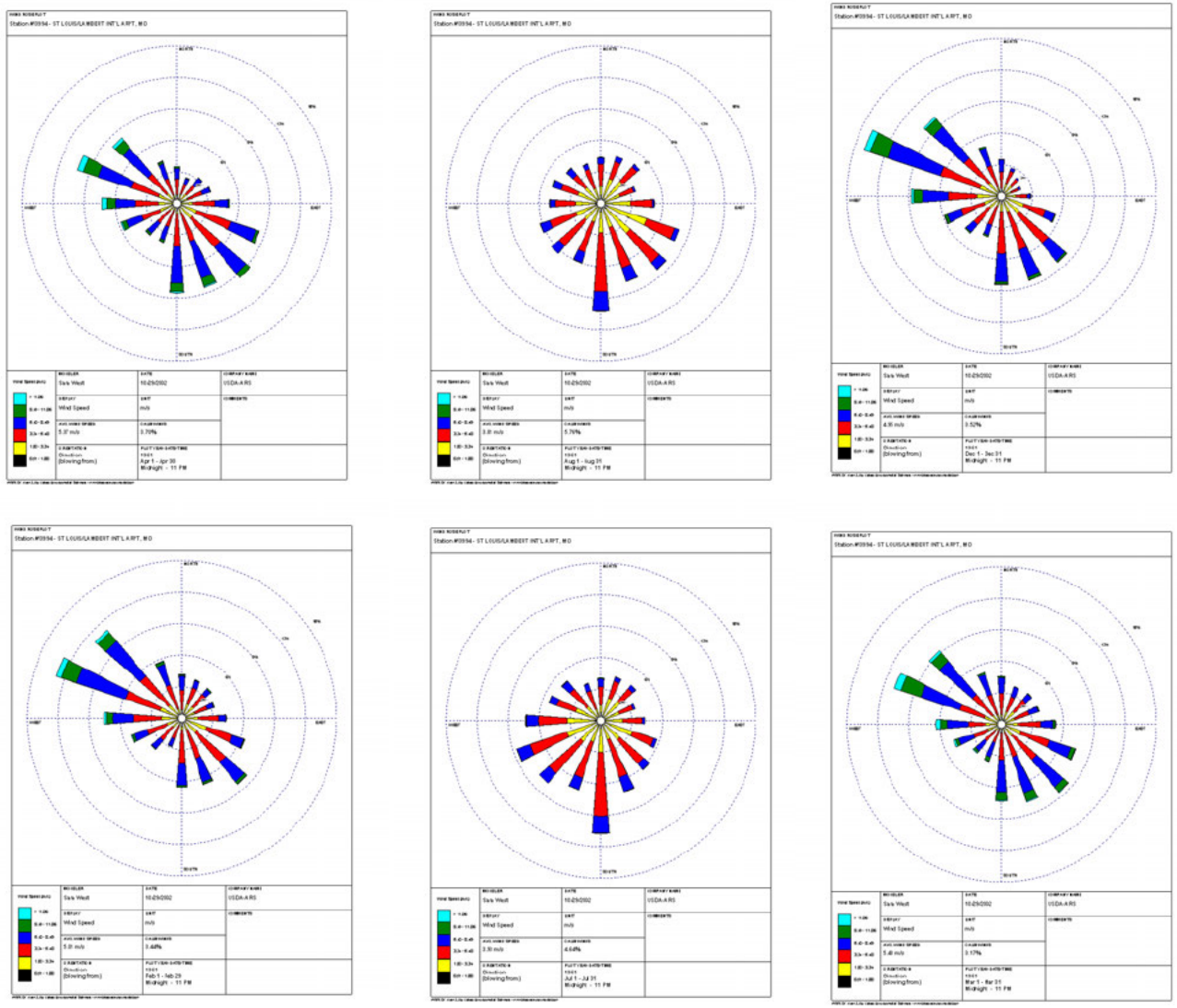
Source: USFWS Critical Habitat Online Mapper (https://www.arcgis.com/)

Rock City – Wind Rose Data (St. Louis)

- **Dominant Winds:**
  - From the South (S) and South-Southwest (SSW), with notable contributions from Southwest (SW) and West-Southwest (WSW).
- **Secondary Winds:**
  - Some frequency from East-Southeast (ESE) through Southeast (SE).
- **Weaker Winds:**
  - Northerly and easterly directions contribute relatively little.
- **Implication for Siting:**
  - Any release or dispersion analysis should expect prevailing movement northward from the site, consistent with the strong S/SSW flow.



Source: Natural Resources Conservation Service (www.wcc.nrcs.usda.gov)

Rock City - Geographic and Environmental Summary

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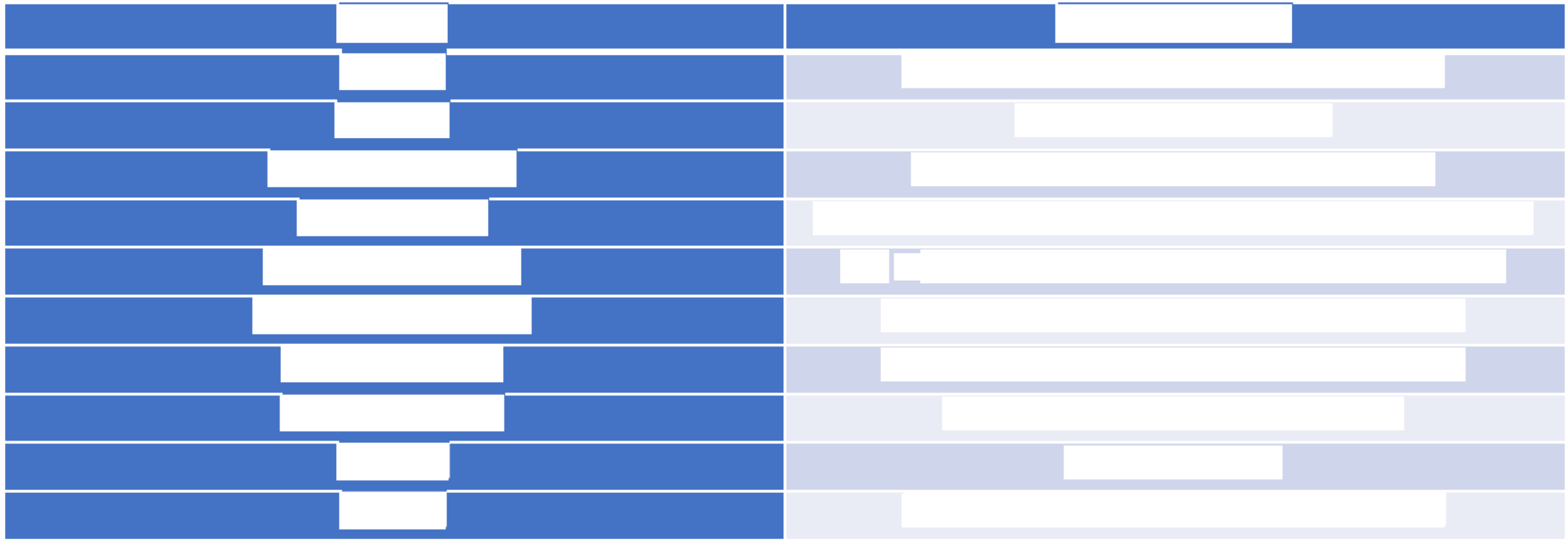

Sources:
Rock City Development
USGS National Map.
FEMA NFHL
NOAA NCEI Climate
U.S. Census Bureau

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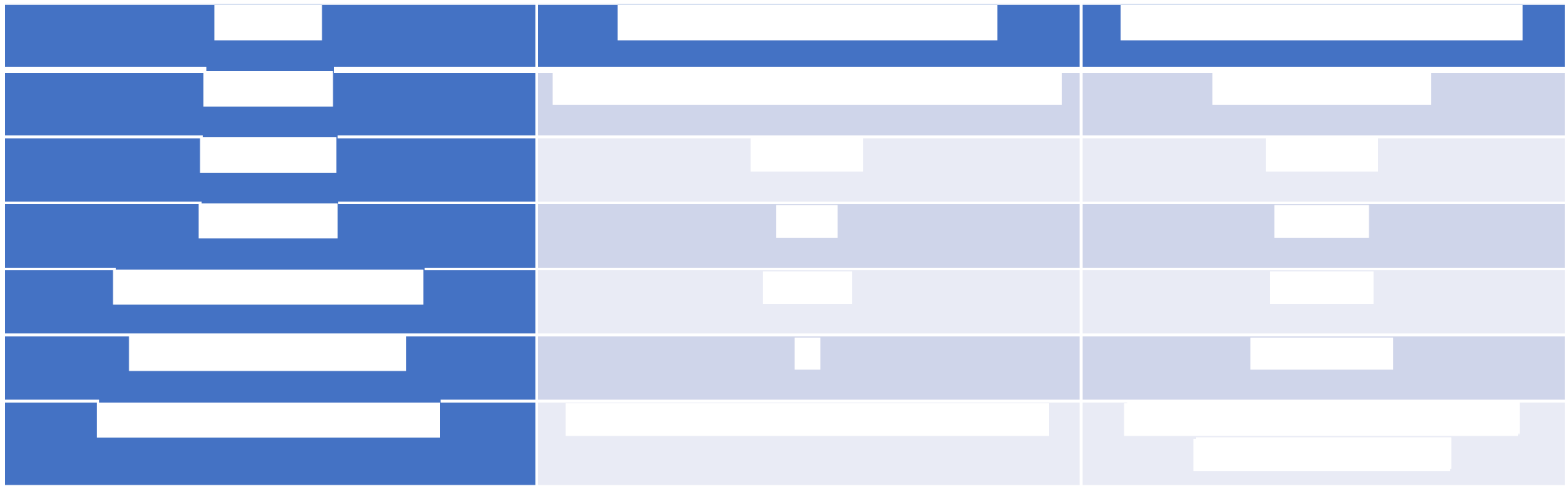
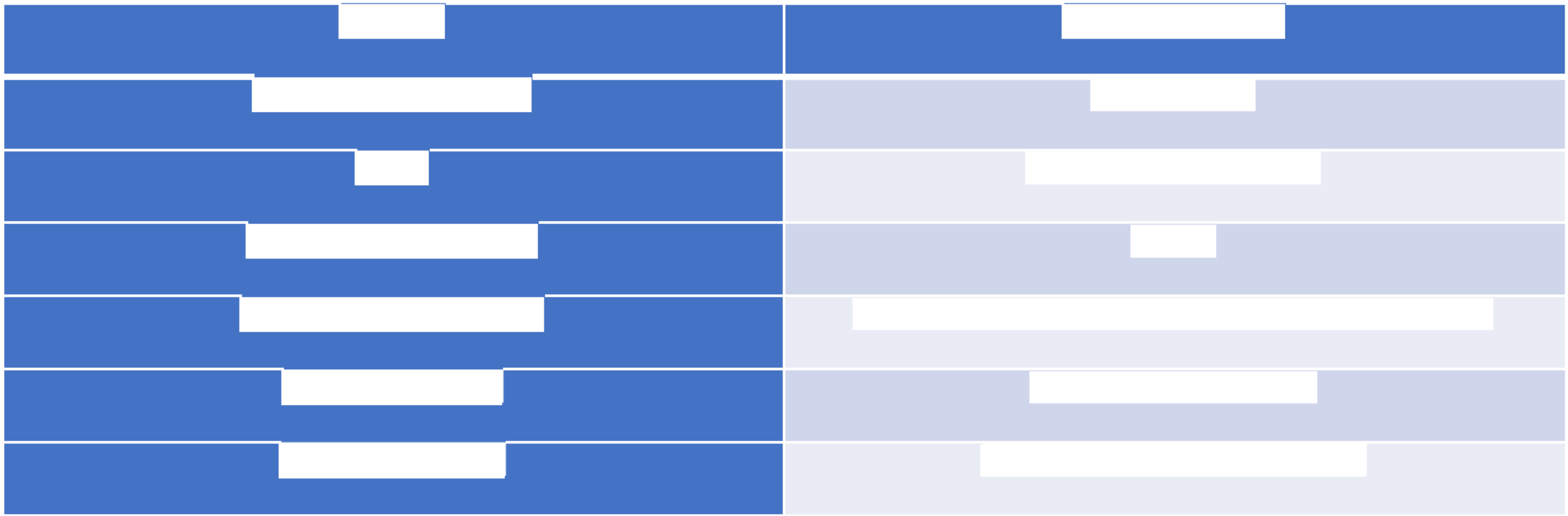
Rock City - Demographic & Workforce Profile



Source: U.S Census Bureau

Rock City - Core Physical Attributes



Source: Rock City Development

Rock City - Logistics and Infrastructure Summary

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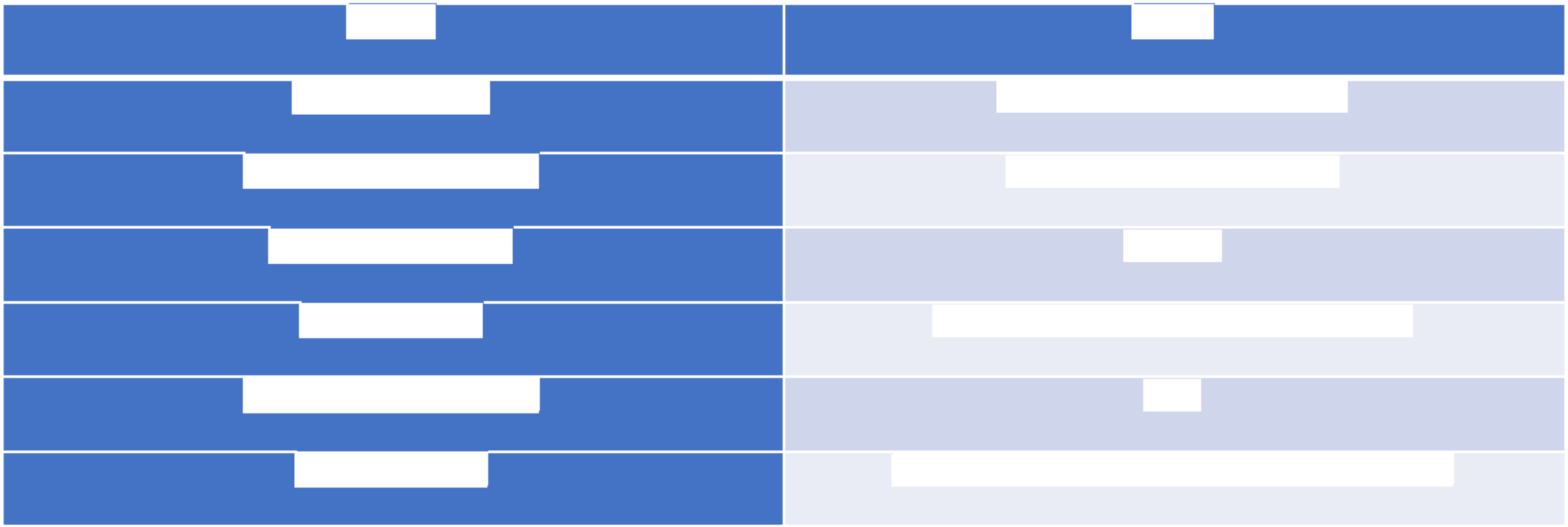

Sources:
Rock City Development
Stand (https://fptz.org/stand/comparison/)

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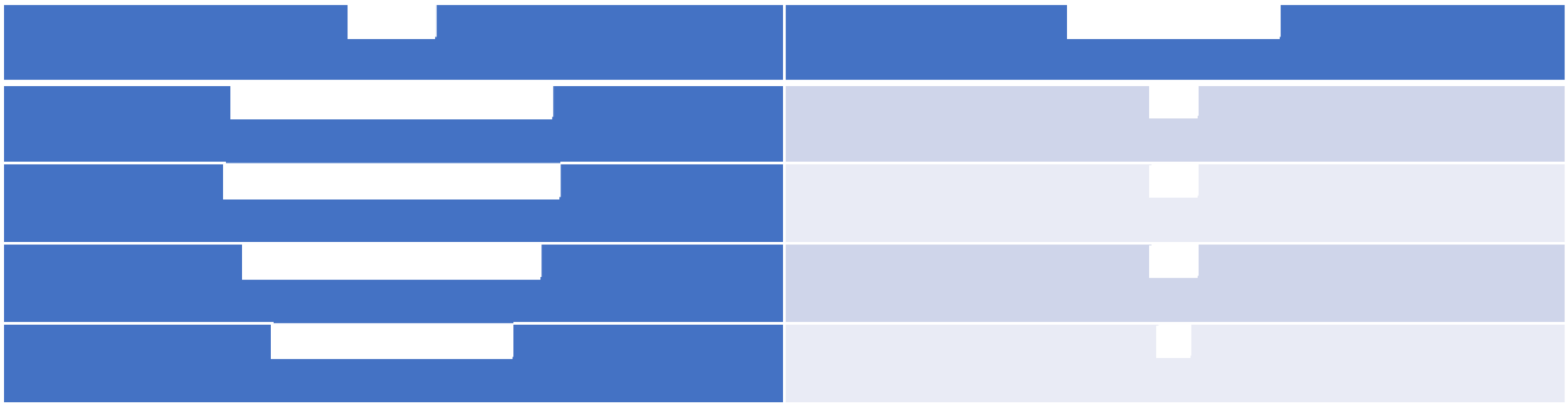
Rock City - Airspace Distance from Rock City Site (Nautical Miles)



Sources:
Rock City Development
Federal Aviation Administration (FAA), Airport Data and Information Portal.
SkyVector (https://skyvector.com/)

Environmental Impact Significance Levels

To provide a consistent framework for evaluating potential environmental effects of the proposed action. NRC assigns impact levels based on the magnitude of the effect on the resource, the potential for mitigation, and whether the resource would be measurably or permanently altered.

- **SMALL**
  - Environmental effects are not detectable, or so minor that they will not destabilize or noticeably alter an important resource.
  - Mitigation is not required.
- **MODERATE**
  - Environmental effects are sufficiently detectable and noticeable, but do not destabilize or permanently alter important resources.
  - Some mitigation may be warranted.
- **LARGE**
  - Environmental effects are clearly noticeable and sufficient to destabilize, alter, or degrade important resources.
  - Mitigation would be required but may not reduce impacts below significance.

Construction Impacts (Preliminary)

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Operations Impacts (Preliminary)

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Decommissioning & Cumulative Impacts (Preliminary)

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Mitigation & Monitoring

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Reasonable Alternatives

Alternative Sites

- Evaluation of other industrial or DOE-affiliated sites considered.
- Rock City preferred due to:
  - Existing industrial zoning and infrastructure.
  - Minimal new land disturbance.
  - Proximity to workforce and transportation corridors.

Alternative Technologies

- SOLO microreactor chosen for its scale, safety features, and demonstration purpose.
- This requires further discussion with USNRC

Alternative Energy Sources

- This requires further discussion with USNRC

Reasonable Alternatives

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Source: Stand (https://fptz.org/stand/comparison/)

Conclusions

Regulatory Compliance

ER prepared in accordance with **10 CFR Parts 50 and 51** and consistent with NRC guidance (NUREG-1537, RG 4.2, RG 1.23).

Environmental Impacts

Construction, operation, and decommissioning impacts assessed as **SMALL** across all resource areas with mitigation measures applied.

Alternatives

No-Action Alternative avoids impacts but does not meet project purpose and need.

Other reasonable alternatives considered

Preferred Action

Construction and operation of the **SOLO Microreactor at Rock City** satisfies the purpose and need while maintaining **minimal environmental impact**

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Questions


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Thank You!
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