National Park Service
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Natural Resource Stewardship and Science

Saint-Gaudens National Historical Park

Geologic and Soil Resources Inventory Summary



On this page: The Aspet patio and formal gardens during summer bloom, Saint-Gaudens National Historical Park. The Saint-Gaudens estate is a terraced riverine landscape underlain by unconsolidated Pleistocene lake and delta sediments deposited during the last Ice Age. The scenic Mount Ascutney rises in the background to the southeast and formed during the Cretaceous Period as molten rock penetrated upward through overlying strata. NPS photograph / Don Freeman.

Saint-Gaudens National Historical Park

Geologic and Soil Resources Inventory Summary

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Abstract

This document summarizes the status of National Park Service (NPS) Geologic Resources Inventory (GRI) and Soil Resources Inventory (SRI) deliverables for Saint-Gaudens National Historical Park. It also provides information on current geology and soil resources management concerns, with a focus on identified inventory needs related to geologic heritage, geohazards, and related soil features and processes. This document is intended to assist park staff with prioritizing technical assistance or new inventory and assessment funding requests in the near term (roughly 1–5 years).

The GRI hosted a baseline scoping meeting for Saint-Gaudens National Historical Park in 2002. Baseline bedrock and surficial geologic maps were delivered to the parks in 2015 and updated in 2020. SRI delivered a legacy soil database and map to the park in 2006. The most up-to-date soil data for the historical park is available through Web Soil Survey.

Saint-Gaudens National Historical Park's geologic heritage is engrained in its Indigenous connections, the scenic influence of Mount Ascutney and the surrounding Connecticut River Valley, as well as its connections to the Cornish Colony. Geologic hazards identified in the park include climate change, disturbed lands, flooding, mass wasting (e.g., landslides, slumping, or creep), radon, seismicity, swelling clays, and toxicological soils. The geologic and soil resources inventory needs for the park include various data and/or GIS needs related to the inventory and monitoring of cultural resources, erosion, and fossils, in addition to geologic mapping needs.

Additional guidance for park staff regarding proposal processes and timeframes for the new Inventories and Assessment (I&A) program is available on the GSRI and I&A SharePoint sites.

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Background of the GSRI

The Geologic and Soil Resources Inventory (GSRI) facilitates the collection of new data, or derives new information from existing data, regarding the presence, absence, abundance, distribution, and significance of geologic or soil features or processes to inform park management decisions and planning.

In the 1990s, the NPS Geologic Resources Inventory (GRI) and Soil Resource Inventory (SRI) programs were established as two of the original 12 baseline inventories in the Inventory and Monitoring (I&M) program. These baseline inventories compiled existing information, acquired new information, and helped establish a minimum level of data across more than 270 parks, which served as a common starting point for natural resource monitoring. For both the GRI and SRI, the primary deliverable was a digital (GIS) map. Between the 1990s and early 2020s, GRI scoping summaries, geologic map posters, and GRI reports were also produced for most of the 270 parks. As of 2024, the I&M program is transitioning from a baseline inventory strategy to a park-proposed inventory strategy.

The GRI and SRI are now unified as one inventory program, the Geologic and Soil Resources Inventory (GSRI), and will be integrated into the new Inventories & Assessment (I&A) program in which parks will submit geology- and soil-related project requests in PMIS during the Service-wide Comprehensive Call (SCC). This transition will begin in FY25, with new guidance enacted for GSRI. During this transition period, 13 "priority" parks, including Saint-Gaudens National Historical Park ("SAGA," also referred to as the "historical park" herein), were identified as missing a baseline GRI report.

This GSRI summary serves as a substitute for a baseline GRI report and is intended to support the historical park's participation in the new inventories program. As such, it summarizes the status of GRI and SRI deliverables for SAGA and provides information on current geology and soil resources management concerns with a focus on identified inventory needs. Information in this summary was compiled from existing reports, meetings with park staff, and the best professional judgment from GRI and WASO Geologic Resources Division (GRD) geoscientists.

Baseline GSRI Products

Geology

The digital geologic map for the historical park is available on the NPS DataStore accessed through the Integrated Resource Management Applications (IRMA) portal (see https://irma.nps.gov/DataStore/Reference/Profile/2194569) and is adapted from multiple source maps created by the United States Geological Survey (USGS). Additional GSRI documents include the NPS scoping summary (Thornberry-Ehrlich 2008).

GSRI source maps:

- Walsh, G. J. 2016. Bedrock geologic map of the Hartland and North Hartland quadrangles, Windsor County, Vermont, and Sullivan and Grafton counties, New Hampshire: US Geological Survey, Scientific Investigations Map SIM-3361. Scale 1:24,000. https://pubs.er.usgs.gov/publication/sim3361

- Walsh, G. J., P. M. Valley, P. J. Thompson, N. M. Ratcliffe, B. P. Proctor, K. R. Sicard, and J. B. Thompson. 2020. Bedrock geologic map of the Mount Ascutney 7.5- x 15-Minute Quadrangle, Windsor County, Vermont, and Sullivan County, New Hampshire. US Geological Survey, Reston, Virginia. Scientific Investigation Map 3440. Scale 1:24,000. https://pubs.er.usgs.gov/publication/sim3440

GSRI scoping report:

- Thornberry-Ehrlich, T. 2008. Geologic Resource Evaluation Scoping Summary: Marsh-Billings-Rockefeller National Historical Park and Saint-Gaudens National Historic Site. https://irma.nps.gov/DataStore/Reference/Profile/2250337

Soils

Soil maps provide information on soil types, including scores of different characteristics and management considerations, including linear extensibility ("shrink-swell") potential, erosion potential, soil stability, suitability for site development, suitability for recreation development (e.g., trails), and many other topics. Perrone (2023) provides an overview of the use of soil data at the NPS WASO level and lists soil data currently available in the Natural Resources Conservation Service (NRCS) Web Soil Survey website along with NPS-specific uses for the data. The NRCS plans to complete all soil survey areas in the US by 2026 (Thompson et al. 2020).

The most up-to-date soils data for SAGA is available via Web Soil Survey, which is updated and maintained regularly. Management-focused maps for the park or potential project areas can be developed on demand on the website. The Web Soil Survey homepage gives instructions for how to view and download soil data. The Web Soil Survey data are broken down into county-level soil survey areas. Each soil survey area is assigned a code and a name. SAGA includes one soil survey area that is complete (Table 1). To view the soil data on the Web Soil Survey website, use the navigation pane on the left side of the homepage to select the soil survey "Area of Interest ('AOI')" tab. Under the "National Park Service" dropdown menu, select SAGA to view the soil data for the historical park. The AOI icon along the top of the screen allows users to select specific areas of the map and generate detailed soil data (e.g., soil suitability and limitations, soil properties, soil qualities, and ecological sites). Use the "Soil Map" tab at the top to view the soil map and the "Soil Data Explorer" tab to view additional soil data, including linear extensibility and suitability for development. See additional Web Soil Survey guidance and FAQs or contact the NRCS state soil scientist for technical assistance.

Initial soil mapping by the NPS Soil Resources Inventory (SRI) was updated for SAGA in 2006 and is available on IRMA (https://irma.nps.gov/DataStore/Reference/Profile/1048970).

Table 1. Web Soil Survey areas related to the historical park.

Web Soil Survey Area Code	Web Soil Survey Area Name	Status
NH019	Sullivan County, New Hampshire	Complete

Possible Future GSRI Products

As the GSRI becomes integrated into the I&A program, future GSRI products will be determined by the project proposals submitted by the parks. Moving forward, the GSRI program will fund inventory projects that include the following:

- Collect new data or derive new information from existing data regarding the presence, absence, abundance, distribution, and significance of geologic heritage, soil features or processes, or geohazards.
- Include features or processes on an individual feature- or landscape-scale.
- Include groups of features or maps of multiple features in a defined area of management needs.
- Are a snapshot in time and may set a baseline for monitoring or assessment.
- Typically include a geospatial (GIS) component.

GSRI project examples:

- Features and processes eligible for funding through the GSRI program include cave/karst, geothermal, paleontological (fossils), landslides and rockfall, other geohazards (e.g., avalanche, permafrost, volcanoes, earthquakes, tsunami, sinkholes), eolian, erosion, soil suitability and limitations for use, soil properties and qualities, ecological site descriptions, and other geologic or soil features or processes of management interest.
- Features and processes covered by other sources of funding and ***not*** eligible for GSRI funding are abandoned mineral lands (AML), orphaned oil and gas wells, coastal processes, coastal storm response, sea level change projections or mitigation, coastal engineering structures, or shoreline sediment movement.
- The GSRI will accept proposals for new baseline map products such as funding a traditional geologic (bedrock or surficial) or soil mapping effort, especially at new or expanded parks outside the original 270 I&M parks. Parks requesting these products will need to indicate a management need, which the baseline data will support.

Geologic Setting and History

Park Establishment and Setting

Saint-Gaudens National Historical Park is located along the Connecticut River just north of the city of Cornish in Sullivan County, New Hampshire. Established 30 May 1977, SAGA preserves the home, studios, and gardens of renowned artist Augustus Saint-Gaudens and commemorates his contributions to the cultural development of the United States (National Park Service 2015b, 2016). Augustus Saint-Gaudens was not only America's foremost sculptor during the late 1800s and early 1900s, but he also served as a teacher, mentor, and advocate. Saint-Gaudens' artistic vision has inspired artists around the world and brought international recognition to American art (National Park Service 2015b). Saint-Gaudens helped establish the Cornish Colony, an artist community best known for modernizing and applying classical European artistic and architectural styles in America. The historical park is a living memorial to Saint-Gaudens, featuring more than 120 original sculptures and the largest collection of his work in the world. Encompassing approximately 77 ha (190 ac), the historical park is distributed among four distinct properties that include the Saint-Gaudens estate (Augustus named the property "Aspet" after his father's birthplace in France), Saint-Gaudens Farm, Blow-Me-Down Farm, and Blow-Me-Down Mill. The Aspet estate encompasses the historic core of SAGA and includes Saint-Gaudens' home, studios, and classically inspired formal gardens. Adjacent to Aspet is Saint-Gaudens Farm, a former working farm that served as pasture for sheep, cattle, and horses; today the area is primarily used for park operations (Brown and Beagan 2013b; Tierney and Gibbs 2018). The Blow-Me-Down Farm and Blow-Me-Down Mill are adjacent to the Connecticut River and are associated with Charles Beaman Jr., a prominent New York City lawyer who was instrumental in bringing Augustus Saint-Gaudens to Cornish and establishing the Cornish Colony (National Park Service 2015b). In all, SAGA contains 19 historic buildings, a collection of over 10,000 cataloged objects, and a landscape featuring agricultural lands, forests, meadows, ravines, tributary streams, river terraces, a pond, and wetlands.

Geologic History

The geologic history of SAGA dates back nearly 430 million years ago and can be subdivided into three main chapters: (1) Paleozoic marine sedimentation and deformation; (2) Mesozoic plutonism (the process of magma intrusion and crystallization), which formed Mount Ascutney; and (3) Cenozoic glaciation and fluvial (river) modification. The highly deformed metamorphic rocks beneath the historical park were originally deposited in an ancient marine basin and subsequently deformed, faulted, and transformed during the Acadian orogeny—one of several mountain-building episodes that created the Appalachian Mountains. The surficial geology of SAGA includes unconsolidated sediments and soils that represent fluvially reworked remnants of the previous Ice Age.

Paleozoic Era (541.0 million to 251.9 million years ago): Marine Deposition and Acadian Deformation

The bedrock of the Connecticut River Valley in western New Hampshire and eastern Vermont consists of highly deformed Paleozoic metasedimentary and metaigneous rocks (metamorphosed sedimentary and igneous rocks) of the Bronson Hill arc and the Connecticut Valley trough, two regional features that formed during the assembly of the supercontinent Pangea. The Bronson Hill arc is an extensive, 400 km (250 mi)-long volcanic arc system that collided with ancestral North America during the Ordovician Taconic orogeny (mountain-building episode) roughly 475 million to 440 million years ago (Karabinos et al. 2017; Jacobi and Mitchell 2018; Hildebrand and Williams 2021). The volcanic arc is composed of metamorphosed volcanic

and plutonic rocks, schist, and quartzite (Valley et al. 2020). Following the orogeny, the Connecticut Valley trough developed during the Silurian Period (443.8 million to 419.2 million years ago) due to crustal extension and later transitioned to a foreland basin (an inland depositional trough) during the Devonian Acadian orogeny approximately 425 million to 395 million years ago (Valley et al. 2020; Wilson et al. 2017; Hillenbrand and Williams 2021). Compressional forces associated with the Acadian orogeny folded, faulted, and metamorphosed the rocks throughout the region. Within and surrounding SAGA are several major thrust faults (low-angle reverse faults) and shear zones (narrow zones defined by strongly deformed rock) that include the Monroe thrust fault, Ammonoosuc fault zone, Sumner Falls shear zone, and Northey Hills shear zone (Figure 1; Walsh 2016; Walsh et al. 2020). The Monroe thrust fault represents a major tectonic boundary where older Ordovician strata of the Bronson Hill arc were uplifted on top of younger Silurian and Devonian rocks of the Connecticut Valley trough (Walsh et al. 2012, 2020; Walsh 2016).

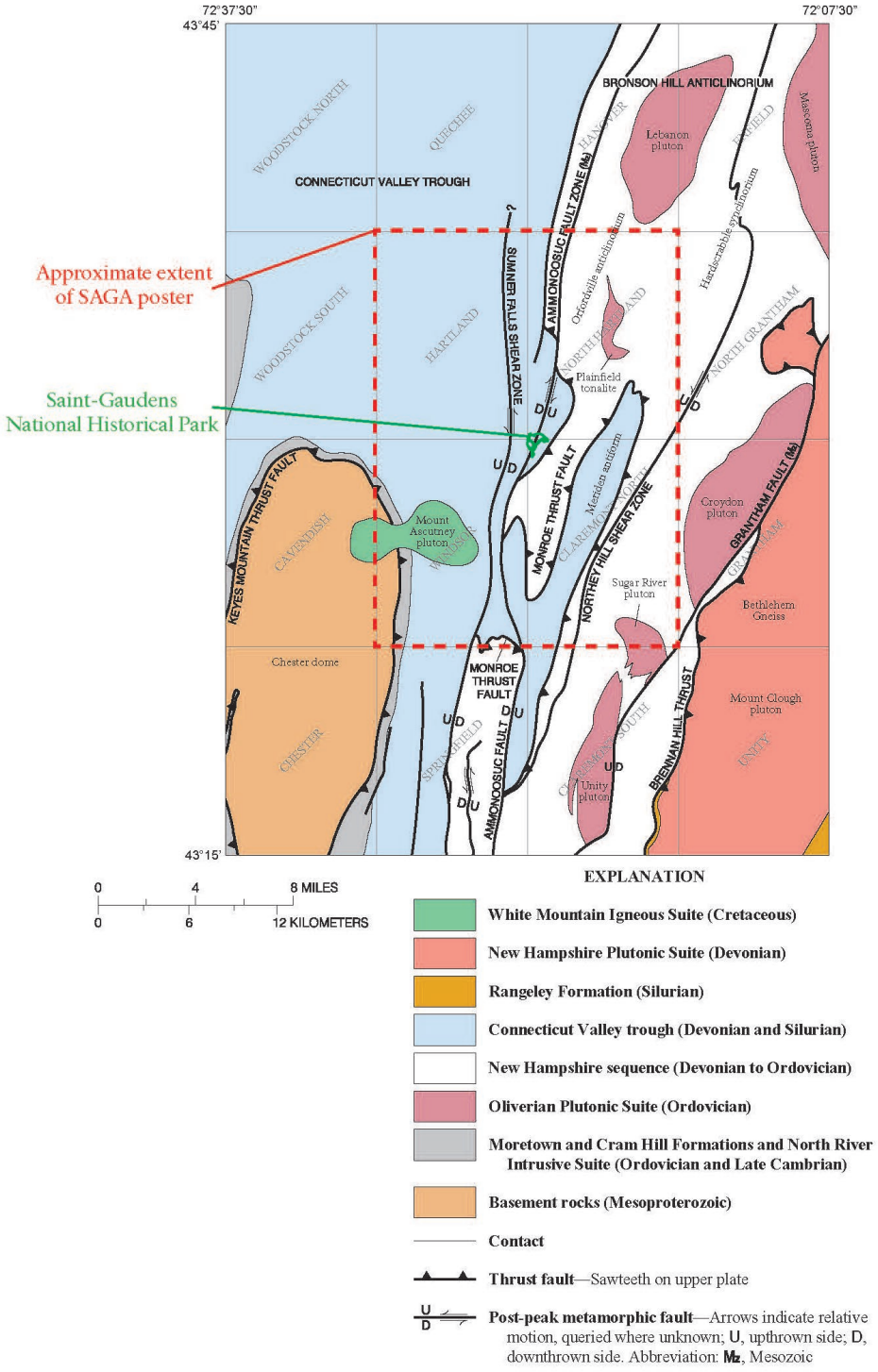


Figure 1. Simplified tectonic map showing major geologic structures and lithologies of eastern Vermont and western New Hampshire. The bedrock underlying the historical park is highly deformed metamorphic rock of the Connecticut Valley trough (Silurian–Devonian Waits River Formation and Devonian Gile Mountain Formation). Several regional faults are mapped within or surrounding SAGA, including the Ammonoosuc fault zone, Monroe thrust fault, Sumner Falls shear zone, and Northey Hills shear zone. Figure 1 from Walsh et al. (2020) modified by Timothy C. Henderson (Colorado State University).

The bedrock underlying the historical park is part of the Connecticut Valley trough and is comprised of metasedimentary strata of the Silurian–Devonian Waits River Formation and Devonian Gile Mountain Formation (see accompanying geologic poster; https://irma.nps.gov/DataStore/Reference/Profile/2313176). Interbedded schist, phyllite, quartzite, and limestone or marble of the Waits River Formation underlie the western half of the historical park, including Blow-Me-Down Farm, Blow-Me-Down Mill, and a portion of Aspet (Walsh 2016; Walsh et al. 2020). The eastern area of SAGA—including Saint-Gaudens' home, studios, gardens, and farm—is underlain by rocks of the Gile Mountain Formation, which includes quartzite and granofels (metamorphic rocks without distinct foliation or lineation) interbedded with slate, phyllite, or schist (Walsh 2016; Walsh et al. 2020). Outcrops of the Gile Mountain Formation occur along stream beds and ravines associated with Blow-Me-Up and Blow-Me-Down Brooks (Cronan et al. 1981; Wallner 1981). One exposure located along Blow-Me-Up Brook is approximately 60 m (200 ft) downstream of an old 1830s mill site associated with Walter Mercer, a Scotsman and wool merchant who formerly lived on what is now the Aspet property (Cronan et al. 1981; Mealey et al. 2022). The exposure is a narrow bedrock channel formed by stream incision; rocks along the northeast face of the outcrop provide dramatic evidence of Acadian deformation and display folds greater than 2 m (6 ft) in height (Figure 2; Cronan et al. 1981).



Figure 2. Exposed bedrock along Blow-Me-Up Brook. The view is facing downstream to the west. Channel incision has exposed deformed strata of the Devonian Gile Mountain Formation and Devonian–Silurian Waits River Formation. Some exposures along the channel contain folds associated with the Acadian orogeny. NPS photograph.

Mesozoic Era (251.9 million to 66.0 million years ago): The Creation of Mount Ascutney

Often mistakenly referred to as Vermont's most famous volcano, Mount Ascutney is a monadnock (an isolated, steep-sloped mountain) that towers over the surrounding Connecticut River Valley (Walsh et al. 2019, 2020). Rising nearly 915 m (3,000 ft) above the river, the scenic landmark has inspired numerous generations, including Saint-Gaudens and other artists of the Cornish Colony. Rocks that comprise Mount

Ascutney were not formed at the Earth's surface by volcanic eruption; instead, they represent crystallized magma that likely fueled an extinct volcano. The origins of Mount Ascutney date back to the Cretaceous Period, approximately 120 million years ago, as molten rock intruded older, weakened, pre-existing rock and was later exposed by fluvial and glacial erosion (Figure 3). The mountain consists of the Ascutney Mountain Intrusive Complex, a suite of several mafic (minerals or rocks containing high iron or magnesium) to felsic (minerals or rocks containing high silica [SiO_2]) plutons that are also exposed at nearby Little Ascutney Mountain further to the west (Walsh et al. 2019, 2020).

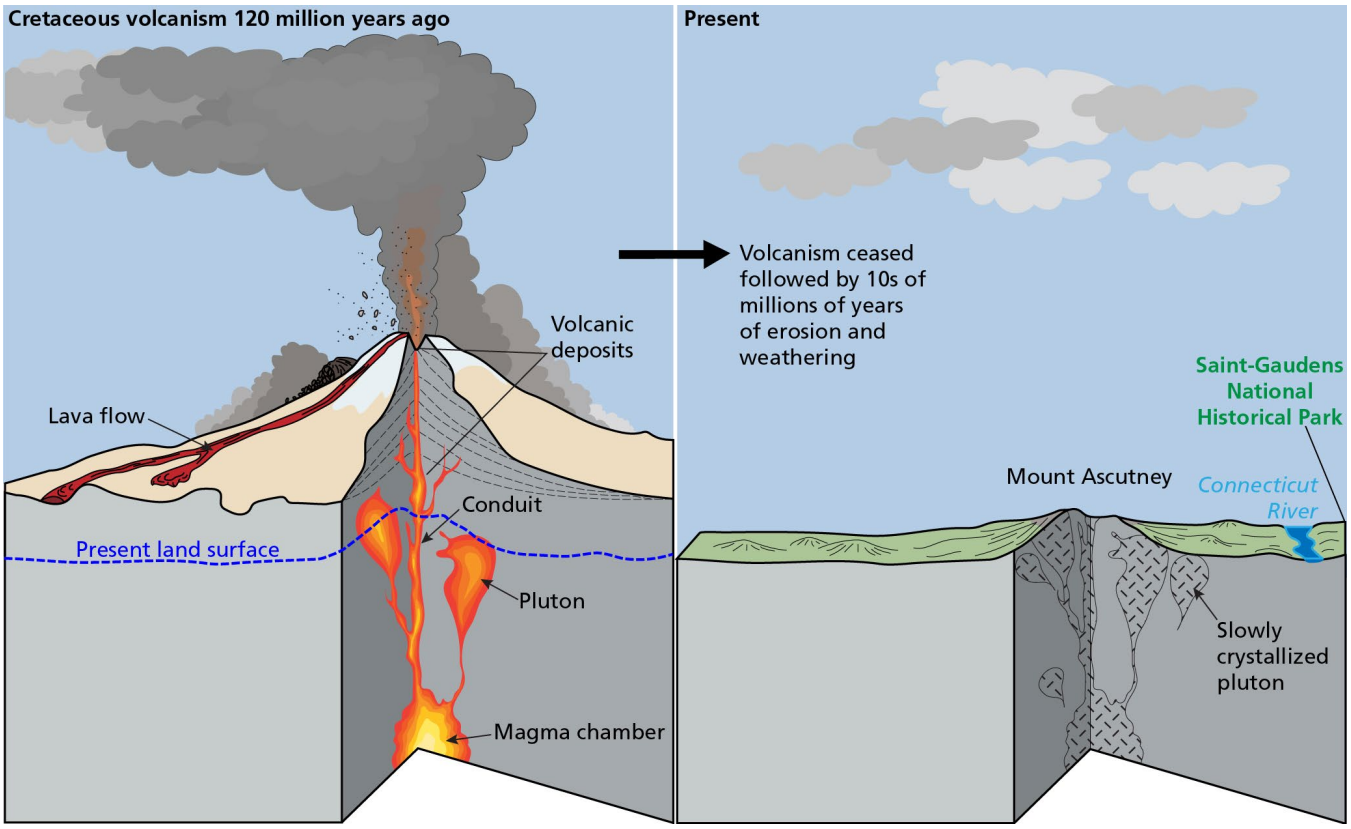


Figure 3. Graphic showing the emplacement and evolution of Mount Ascutney. Rocks that comprise Mount Ascutney formed during the Cretaceous Period, approximately 120 million years ago, as magma intruded pre-existing bedrock. Over millions of years, dynamic glacial and fluvial erosion has revealed the crystallized plutons that form the scenic monadnock. Graphic created by Trista L. Thornberry-Ehrlich (Colorado State University).

Cenozoic Era (66.0 million years ago to present): Glaciers, Lakes, and Rivers

The surficial geology of the historical park consists of unconsolidated Quaternary (2.58 million years ago to present) sediments that were deposited during the Pleistocene Epoch (approximately 2.58 million to 11,000 years ago) and reworked or incised by modern river processes. During the previous Ice Age, vast ice sheets repeatedly advanced and retreated across the northern United States. Akin to frozen sandpaper, these glacial pulses scoured the bedrock of the northern United States and left behind large amounts of unconsolidated rock debris referred to as till. Many of the hills and forested uplands within and surrounding SAGA are underlain by these glacial till deposits (Hildreth 2010a, b; Hildreth 2011a, b). As glaciers began to warm and recede north at the end of the Ice Age, large amounts of meltwater formed several glacial lakes that occupied the Connecticut River Valley. The area of SAGA was once inundated by Glacial Lake Hitchcock, a

waterbody that was impounded when a glacial moraine (a linear accumulation or mound of till) blocked the outflow of the Connecticut River near Middletown, Connecticut (Cronan et al. 1981; Wallner 1981; Hooke and Ridge 2017; Mealey et al. 2022). Glacial Lake Hitchcock formed approximately 18,300 years ago and persisted for several thousand years until it drained about 12,500 years ago (Tweet et al. 2010; Hooke and Ridge 2017).

Within the historical park are lacustrine (lake) sequences of clay, silt, and fine-grained sand that formed within nearshore or lake-bottom settings within Glacial Lake Hitchcock (Hildreth 2010a, b; Hildreth 2011a, b). Additionally, sands and gravels that underlie the upland hills near Aspet and Saint-Gaudens Farm (the 2.6 ha [6.5 ac] parcel east of Aspet) were originally deposited by meltwater tributaries along the margins of the lake as outwash or kame deltas (aprons of unconsolidated sedimentary material; Figure 4; Hildreth 2010b, 2011a). Together, these lacustrine and deltaic sediments underlie a major portion of SAGA and have been dissected by Blow-Me-Up and Blow-Me-Down Brooks. Surficial rock exposures are mapped along the steep ravines of Blow-Me-Up Brook; these outcrops can be easily accessed and observed along the Ravine Trail (Hildreth 2010b; Walsh et al. 2016). Some of the youngest surficial units within SAGA are stream alluvium or stream terrace deposits found adjacent to the Connecticut River, Blow-Me-Down Brook, or Blow-Me-Up Brook (Hildreth 2010a, b; Hildreth 2011a, b). These silts, sands, and gravels represent eroded and reworked deposits of glacial origin.

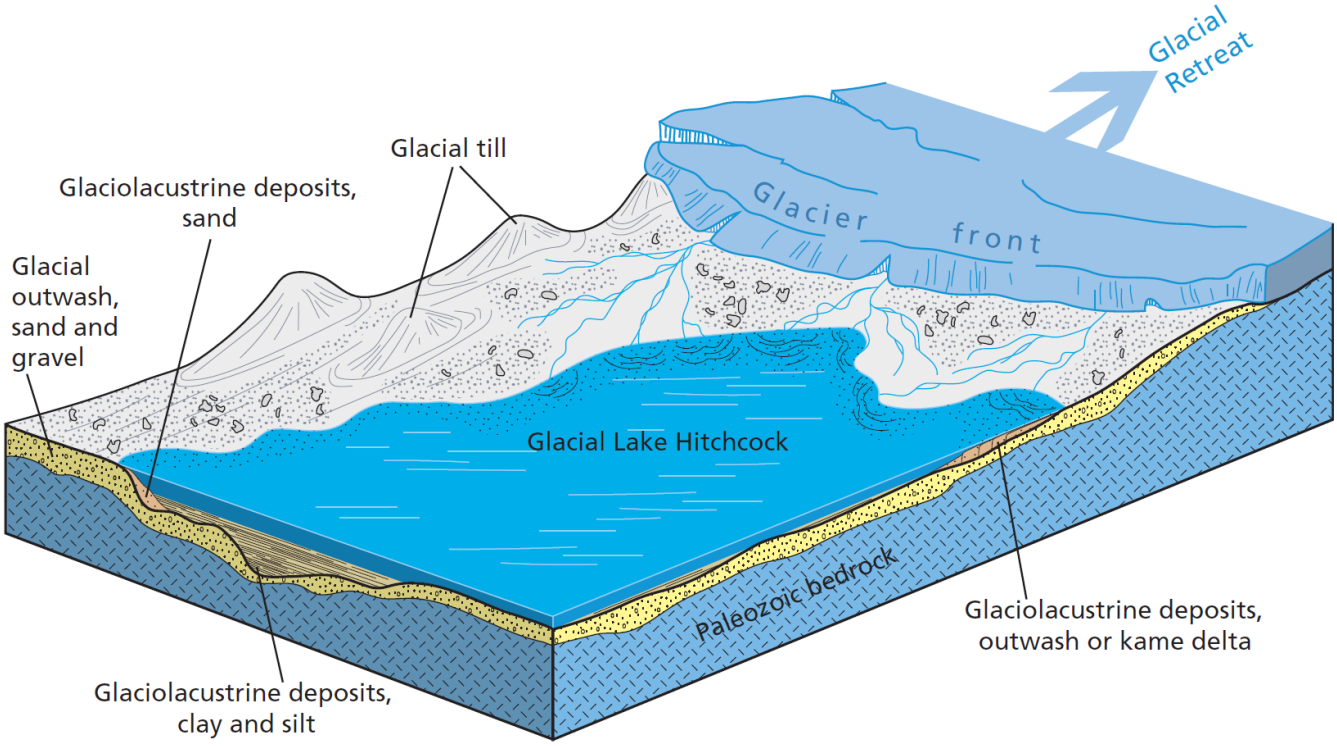


Figure 4. Cross-sectional illustration depicting the late Pleistocene glacial setting of the historical park. As the Laurentide Ice Sheet retreated north at the end of the Ice Age, glaciers released an immense amount of meltwater that formed a series of glacial lakes within the Connecticut River Valley. Fine-grained clays and silts accumulated along the deep lake bottom, while coarser sands and gravels were deposited along shorelines and deltas near the shallow margins of the lake. Graphic created by Trista L. Thornberry-Ehrlich (Colorado State University).

Geologic Heritage

Geologic heritage (also called “geoheritage”) evokes the idea that the geology of a place is an integral part of its history and cultural identity. In 2015, the National Park Service's GRD, in cooperation with the American Geosciences Institute, published a booklet introducing the American experience of geoheritage, geodiversity, and geoconservation: *America's Geologic Heritage: An Invitation to Leadership*. This publication introduces key principles and concepts of America's geoheritage, which are the focus of ongoing collaboration and cooperation on geologic conservation in the United States. The booklet includes the following five big ideas:

- America’s geologic landscape is an integral part of its history and cultural identity, and Americans have a proud tradition of exploring and preserving geologic heritage.
- America’s geologic heritage, as shaped by geologic processes over billions of years, is diverse and extensive.
- America’s geologic heritage holds abundant values—aesthetic, artistic, cultural, ecological, economic, educational, recreational, and scientific—for all Americans.
- America’s geologic heritage benefits from established conservation methods developed around the world and within the United States.
- America’s geologic heritage engages many communities, and involvement by individuals will ensure its conservation for future generations.

Mount Ascutney

Mount Ascutney is a scenic volcanic mountain located immediately southwest of SAGA and is a valuable landscape component that has influenced generations of people over thousands of years. Early Indigenous occupants of the Connecticut River Valley, notably the Western Abenaki, considered Mount Ascutney to be an important natural element of their culture (Mealey et al. 2022). The prominent mountain has often served as an inspirational landmark and was highly regarded by Saint-Gaudens and other members of the Cornish Colony (Walsh et al. 2019). Like Saint-Gaudens, most artists of the Cornish Colony selected or modified the buildings and landscape of their properties to frame views of Mount Ascutney and the adjacent hills (Figure 5; Brown et al. 2013). During the early 20th century, Mount Ascutney was the classic location where Canadian geologist Reginald Daly (1903) discussed evidence for pluton emplacement by magmatic stoping, a process in which pieces or blocks of surrounding bedrock become detached, engulfed, and assimilated into magma rising toward the surface (Thornberry-Ehrlich 2008; Walsh et al. 2019, 2020).



Figure 5. Aerial view of Mount Ascutney. The scenic monadnock rises above the surrounding river valley and represents exposed plutons that intruded the surrounding bedrock during the Cretaceous Period, approximately 120 million years ago. NPS photograph.

Indigenous Connections

The Connecticut River Valley is ancestral territory to several Indigenous groups who have been living in the area for thousands of years. The fertile floodplains and forested uplands of New Hampshire and Vermont have important cultural associations, notably for the Abenaki people, who were organized into several bands, including the Missisquoi, Pigwacket, Pennacook, Sokoki, Cowasuck, Winnipesaukee, Ossipee, and Elnu (Brown and Beagan 2013a, b; Mealey et al. 2022). Geologic features such as Mount Ascutney were also considered important natural elements of Western Abenaki culture; the mountain's name is derived from several Abenaki words meaning "mountain of the rocky summit" (Mealey et al. 2022; see also Vermont State Parks - Mt. Ascutney; accessed December 2024). Although the historical park currently has no reported Indigenous cultural sites or artifacts, there is a high potential for future discovery, especially along river terraces located at Blow-Me-Down Farm (National Park Service 2015b; Lee and Boyce 2017). According to Lee and Boyce (2017), a previous owner and farmer of Blow-Me-Down Farm, Donald MacLeay, reported finding projectile points ("arrowheads") in the agricultural fields throughout the property. The riverbank terrace setting adjacent to the tributary confluence of Blow-Me-Down Brook–Connecticut River is similar to other recorded cultural sites in the region (Lee and Boyce 2017).

The various properties and hydrological features that comprise SAGA feature the name "Blow-Me-Down," which is a subject of legend with multiple origins. One possible source of the name originates from an early encounter between Indigenous people and one of the first European settlers to the area. According to Mealey et al. (2022), Saint-Gaudens' friend Charles Beaman recounted the legend of the name's origin:

> *They tell me that their grandmother or her sisters told them that soon after they came here an Indian came up the [Connecticut] River in a canoe and stopped again. He had his canoe loaded with furs and skins and was going down to the West Post…to trade. He had some branches in the stern of his canoe and when they asked him what they were for, he said "Winds" "Blow Me Down" "Blow Me Down". This was said at the mouth of the brook just as he was starting off [down the Connecticut River] and so the children and Deacon came to call the Brook "Blow-Me-Down.* (Mealey et al. 2022, p. 18)

The only name featured on one of the first early Euro-American maps of Cornish in 1761 was "Blowmedown Brook" (Child 1911). When Saint-Gaudens acquired the Aspet estate in 1891, he named the stream by his home "Blow-Me-Up Brook" since it is the upstream counterpart and tributary to Blow-Me-Down Brook.

Geology and the Cornish Colony

The geology of the Connecticut River Valley—including its fertile floodplains, forested uplands, and the famous Mount Ascutney—provides spectacular views that attracted or inspired Augustus Saint-Gaudens, his family, and other artists of the Cornish Colony (Figure 6). The aesthetic views of the river valley, including Mount Ascutney, combined with their artistic influence, are considered key elements of the historical park's landscape and history (National Park Service 2015b; Tierney and Gibbs 2018). Although Mount Ascutney is protected from development as Mount Ascutney State Park, the viewshed of the mountain from SAGA has been negatively impacted by construction projects and forest succession (Tierney and Gibbs 2018). According to NPS policy (National Park Service 2006), SAGA administrators should consider collaborating with state or local partners to protect the historic viewshed of Mount Ascutney, the surrounding hills, and the Connecticut River.



Figure 6. Painting of Mount Ascutney by Augusta “Gussie” Saint-Gaudens. Although the historical park is an homage to world-renowned sculptor Augustus Saint-Gaudens, his wife was also an artist who would often paint from the stairwell landing of Aspet. Several examples of her work are part of SAGA’s collections. NPS photograph.

The geology of the Saint-Gaudens estate is underlain by Quaternary surficial deposits of unconsolidated glacial till, glaciolacustrine sediments, and fluvially reworked alluvium (see “Cenozoic Era: Glaciers, Lakes, and Rivers”). Collectively, these deposits form the manicured landscape of SAGA that was historically modified to create an artificial pond (Blow-Me-Down Pond), a nine-tee, five-hole golf course (“Blow-Me-Up Links”), and a toboggan run (National Park Service 1995; Brown et al. 2013). The glacial and fluvial landscape of SAGA was the backdrop to many social and sporting activities attended by Saint-Gaudens and other members of the Cornish Colony, including swimming, golfing, hiking, skiing, ice skating, and sledding (Figure 7; Pressley and Zaitzevsky 1993a, b; National Park Service 2015b; Brown et al. 2013).

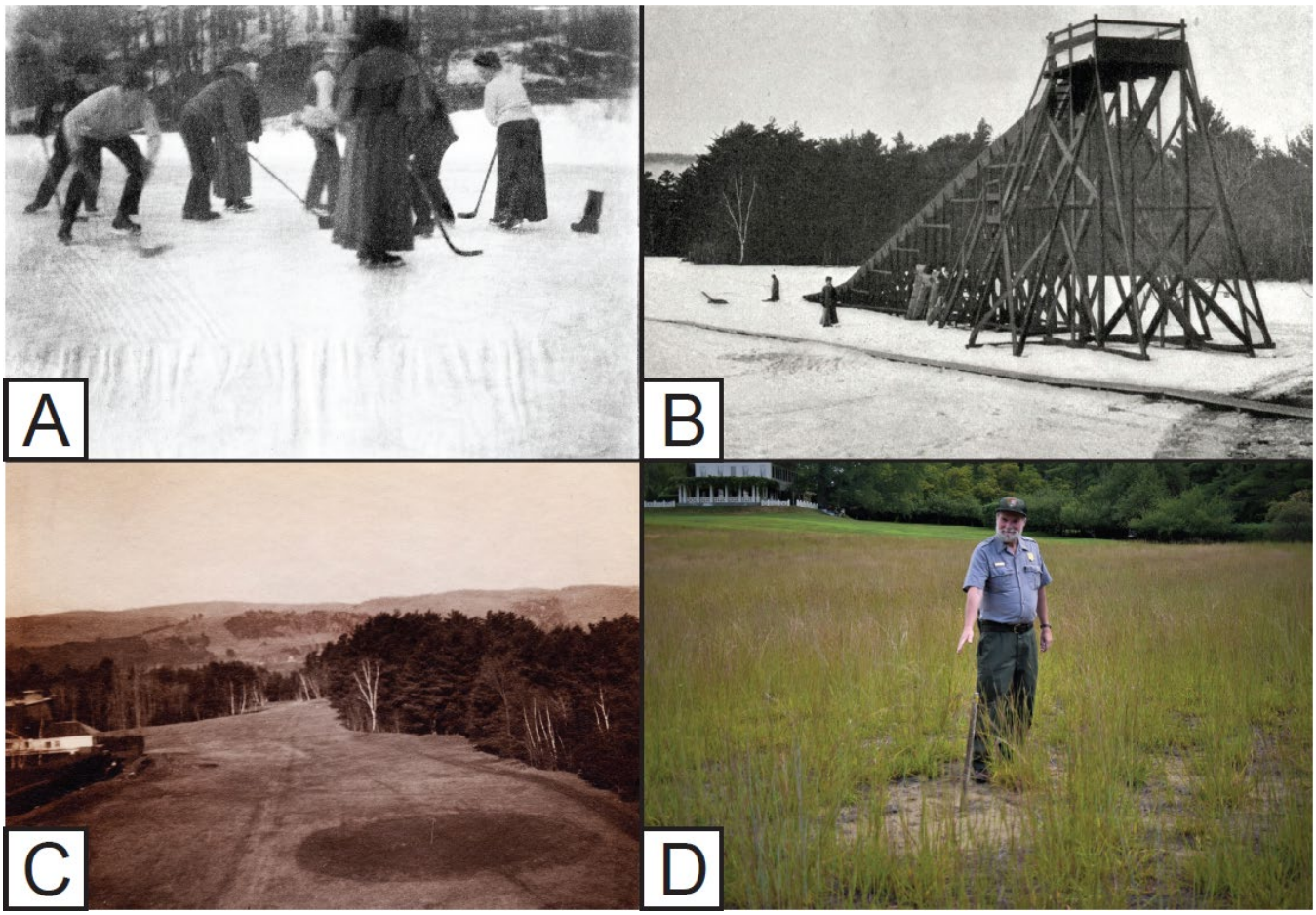


Figure 7. Historic recreational use of the SAGA landscape by Saint-Gaudens and the Cornish Colony. The historical park is predominantly underlain by unconsolidated Pleistocene surficial deposits that were modified or utilized for various social events. A) Members of the Cornish Colony playing ice hockey on Blow-Me-Down Pond circa 1904–1905. B) The 12 m (40 ft) tall toboggan run constructed by Saint-Gaudens' assistants next to the studio. The slide path extended nearly 120 m (400 ft) across the meadow to the west. C) A portion of the nine-tee, five-hole golf course ("Blow-Me-Up Links") constructed by Saint-Gaudens that surrounded the Aspet estate. D) A park ranger (Raymond T. "Ray" Auger) points toward the remnants of a sand trap associated with the historic golf course. The Saint-Gaudens home is in the background. NPS photographs.

Within SAGA are several historical structures made of stone that are considered important to the Saint-Gaudens family or merit additional investigation. On the Aspet property is a 1914 replica of the Temple used in 1905 when members of the Cornish Colony performed the Greek drama, "The Masque of the Golden Bowl," to celebrate the Saint-Gaudens' 20th summer at Aspet (Pressley and Zaitzevsky 1993b). Following Saint-Gaudens' death in 1907, his wife commissioned the American architectural firm McKim, Mead & White to construct the replica out of white Vermont marble (Figure 8). Today, the Temple includes a memorial altar in which the ashes of Saint-Gaudens and members of his family are interred (Pressley and Zaitzevsky 1993b; Brown et al. 2013). According to National Park Service (2010) and Brown and Beagan (2013a), some of the stone buildings or features at the Blow-Me-Down Farm—namely the Blow-Me-Down Mill, Stone Arch Bridge, stone mill wheels, and stone retaining walls—are constructed from local fieldstone materials of unknown origin. Additional small-scale features at the farm, including granite posts and a stone pedestal, may be historic but need additional research (see "Inventory Needs").



Figure 8. Photograph of the Temple from the grounds of Aspet. Constructed out of Vermont marble, the Temple is a replica of the one used to celebrate the Saint-Gaudens' 20th summer at Aspet in 1905. The Temple includes a memorial altar in which the ashes of the Saint-Gaudens family are interred. NPS photograph.

Geologic Resource Management Issues and Inventory Needs

This section briefly summarizes the geologic resource management issues, inventory needs, and geologic hazards that have been identified by discussions with SAGA staff. Geologic resource management issues refer to problems related to geologic resources. Inventory needs are highlighted to summarize what is currently known and what is needed to ensure good management of SAGA. Geologic hazards refer to notable hazards stemming from geologic features or processes that may require active management. Refer to the Guidance for Resource Management SharePoint for more information regarding geologic resource management.

The NPS GRD has developed an article series (https://www.nps.gov/articles/series.htm?id=FA0A8F89-CD67-1CCE-5A6608B444E8A7C0; accessed December 2024) that summarizes the laws, regulations, and policies that specifically apply to geologic and soil resources or processes. These protection measures were established to maintain the integrity of these resources or processes while minimizing the impacts of natural or anthropogenic activity.

Summary of Geologic and Soil Hazards

Park resources are not only visitor attractions but may also be potentially hazardous. The landscape presents a variety of geologic hazards, or "geohazards"—naturally occurring, dynamic geologic processes that have the potential to cause damage, loss of property, and/or injury and loss of life. The Addressing Climate Change and Natural Hazards Handbook (National Park Service 2015a, 2023), grounded in NPS Policy Memorandum 15-01 (Jarvis 2015), provides a process and information to help teams and decision-makers identify, avoid, and mitigate risks associated with environmental change hazards and effects on proposed and planned facility investments. The handbook supports NPS planning guidance, policy directives, and executive orders and does not supersede existing mandated compliance processes and policies. Additional guidance for facility management, e.g., Climate-Smart Planning Principles and Recommended Practices, has been developed to support effective decision-making.

According to PM 15-01, managers should apply the handbook guidance to identify options to manage natural hazard and climate change risks throughout all levels of facility planning and design. Project teams are required to submit the completed Natural Hazards Checklist (Table 2) as part of Regional and Bureau Investment Review Board submissions. This information can also be used as part of the updated (2024) Automated Investment Review Board (AIRB) submittal process at the Investment Concept (IC) stage. This table includes selected geologic and soils hazards listed in Part 1 of National Park Service (2023). The GSRI team has added additional hazards where appropriate for the park. If needed, Part 2 of the handbook could inform the completion of the checklist, such as whether a hazard is applicable. Contact the NPS GRD with any questions.

Table 2. Geologic hazards checklist.

This summary table is a synthesis of existing GSRI-compiled map data and information, as well as published US Geological Survey and other government agency information. It is suitable for use at park-scale discussions and assessments. It is not a substitute for site-specific investigations or NEPA analysis. Ground-disturbing activities should neither be approved nor denied based on the information here. This table is modeled after the Natural Hazard Checklist (see National Park Service 2015a and Jarvis 2015). It is meant to provide general information to identify the full range of natural hazard-based risks for the historical park.

Hazard	Examples of Risk or Secondary Hazard	Best Professional Judgment	Sources of Geohazard Information
Earthquake	Falling objects Collapsing structures Inoperability of major building systems (e.g., power, sewer, water) Trigger to other hazards (e.g., landslides) Human injury or casualty	**Known hazard (very low)**	New England Seismic Network Stover et al. (1980) US Department of Interior (DOI) Strategic Hazard Identification and Risk Assessment (SHIRA) Risk Mapper Report United State Geological Survey (USGS) Earthquake Hazard Probability Map (Petersen et al. 2023) USGS Information by Region: New Hampshire
Slope movements (also called “mass wasting”)	Landslides (e.g., debris flows, rockfalls, slumping or creep) Landslides could mobilize large amounts of woody debris Damage or destruction of park infrastructure Damage to or loss of natural or cultural resource sites or features Human injury or casualty	**Known hazard (susceptible to landslides)**	Cronan et al. (1981) DOI SHIRA Risk Mapper Report Gawler and Bowman (2012) Thornberry-Ehrlich (2008) USGS Landslide Inventory and Susceptibility
Permafrost	Not applicable	Not applicable	Not applicable
Cave/karst	Not applicable	Not applicable	Not applicable
Shrink/swell soils	Damage to infrastructure “Heaving” of ground beneath roads, trails, or structures Increased susceptibility to slope movements	**Potential hazard (mostly low; area of high potential associated with Blow-Me-Down Pond)**	USDA Web Soil Survey
Coastal storm surge/ sea or lake level change/shoreline erosion	Not applicable	Not applicable	Not applicable
Tsunami	Not applicable	Not applicable	Not applicable

Hazard	Examples of Risk or Secondary Hazard	Best Professional Judgment	Sources of Geohazard Information
Riverine Flood	Flooding (driven by storms, prolonged rainfall or snowmelt) capable of generating mass wasting events Enhanced flow regimes capable of carrying large amounts of woody debris Destruction of infrastructure (e.g., roads, trails, buildings, utilities, dam or bridge structures) Stream bank erosion along Blow-Me-Up and Blow-Me-Down Brooks Stream channel migration Sedimentation and infilling of Blow-Me-Down Pond or the historic swimming hole ("The Swimming Hole") by Blow-Me-Up ravine dam Destruction of potential cultural or paleontological sites Human injury or casualty	**Known hazard (extreme; DOI SHIRA)**	Brown et al. (2013) Cronan et al. (1981) DOI SHIRA Risk Mapper Report Federal Emergency Management Agency (FEMA) Map Service Center National Park Service (1995, 2010, 2015) Gawler and Bowman (2012) Tierney and Gibbs (2018)
Flash Flood	Sudden rising water (i.e., tributary valley) capable of generating mass wasting events Enhanced flow regimes capable of carrying large amounts of unconsolidated rock, soil, or woody debris Destruction of infrastructure (e.g., roads, trails, buildings, utilities, dam or bridge structures) Stream bank erosion along Blow-Me-Up and Blow-Me-Down Brooks Stream channel migration Sedimentation and infilling of Blow-Me-Down Pond or The Swimming Hole by Blow-Me-Up ravine dam Destruction of potential cultural or paleontological sites Human injury or casualty	**Known hazard**	Brown et al. (2013)
Volcanic eruption	Not applicable	Not applicable	Not applicable
Hydrothermal activity	Not applicable	Not applicable	Not applicable
Radon	Health hazard	**Potential hazard (moderate – Zone 2)**	US Environmental Protection Agency (EPA) Map of Radon Zones by State

Hazard	Examples of Risk or Secondary Hazard	Best Professional Judgment	Sources of Geohazard Information
Toxicological soil (arsenic[1], *Bacillus anthracis* [causes anthrax][2], cadmium[3], lead[4], and selenium[1])	Health hazard	**[1]Potential hazard (high)** **[2]Potential hazard (low)** **[3]Potential hazard (moderate)** **[4]Potential hazard (very high)**	DOI SHIRA Risk Mapper Report

Climate Change

Although climate change planning is beyond the scope of this GSRI summary, a discussion of climate change is included because of the potential disruption it may cause to the historical park's resources, including geologic resources. The climate at SAGA is already changing; all future climate model projections include temperatures above the recent historical average (1979–2012), and average annual precipitation is anticipated to be highly variable (Tierney and Gibbs 2018; Climate Change Response Program 2024). Forecasted climate scenarios for SAGA include exacerbated extreme weather events, including periods of heightened drought as well as more frequent or intense storms and enhanced flooding. Projected increases of several variables (e.g., air temperatures, evaporation rates, drought, precipitation) may negatively affect wildfire occurrence, aquifer recharge, as well as watershed quality and flow. These modifications to water availability are likely to impact additional geologic processes (e.g., landslides, erosion), in addition to ecological processes (e.g., invasive species, phenology), visitation, and park management procedures (Tierney and Gibbs 2018; Climate Change Response Program 2024). Invasive species of ecological concern to SAGA include the hemlock woolly adelgid (detected in Sullivan County), the emerald ash borer and winter moth (detected in surrounding counties), and the crazy snake worm, *Amynthas agrestis* (detected in SAGA; Tierney and Gibbs 2018). The loss of stabilizing vegetation, such as hemlock or ash trees, could significantly enhance ravine erosion and promote sedimentation along Blow-Me-Down Pond (see "Flooding").

Climate change manifestations that may intensify geologic hazards include the following:

- Increased average temperatures
- Increased frequency and intensity of storms
- Increased frequency and magnitude of fires
- Increased susceptibility to mass wasting events
- Increased extreme weather scenarios, including drought and flooding
- Loss of stabilizing hillslope vegetation, leading to enhanced streambank retreat and sedimentation issues

Disturbed Lands

Disturbed lands are those park lands where natural conditions and processes have been directly impacted by development, including facilities, mining, roads, dams, and campgrounds; agricultural activities such as farming, grazing, timber harvest, and irrigation ditches; and overuse or inappropriate use. Lands disturbed by human activity often cause unwanted and long-lasting problems that affect other resources. Many of these disturbances obliterate soil profiles, exacerbate the invasion of exotic plants, result in contamination of water and soil, and/or cause erosion and sedimentation. These damages, in turn, frequently impair the quality of habitats, disrupt ecosystem functions, and cause problems for parks managing areas as wildlands. Restoration returns a site, watershed, or landscape to some previous condition, commonly some desirable historic baseline. Usually, lands disturbed by natural phenomena such as landslides, earthquakes, floods, and fires are not considered for restoration unless influenced by human activities.

Blow-Me-Down Pond

In the late 19th century, Saint-Gaudens' close family friend Charles Beaman constructed the Blow-Me-Down Brook dam to power a grist mill and create an artificial swimming hole. Although not considered for restoration or removal, the creation of the 2.5 m (8 ft) tall by 9 m (30 ft) wide dam altered the natural drainage pattern of Blow-Me-Down Brook, created the 6-ha (15-ac) Blow-Me-Down Pond and wetland area, and introduced issues related to flooding and sedimentation (see "Flooding"; Nowak and Brown 2009; Brown et al. 2013). During storms or flood events, enhanced runoff along the steep-walled ravines of SAGA can erode, entrain, and deposit large amounts of unconsolidated rock, soil, or woody debris into the impoundment area. Over many years, the accumulation of excess sediment and debris has impacted the morphology and ecological integrity of the pond area (see "Hydrological Resources").

Residential or Park Construction and Maintenance

As local populations and residential development increase, SAGA is concerned about the negative impacts to natural resources and processes as well as the historical viewshed that was prized by Saint-Gaudens and other members of the Cornish Colony (Thornberry-Ehrlich 2008). Construction projects, including NH Route 12A roadwork and telecommunication tower installation, combined with forest succession, have partially obscured or diminished the scenic view of Mount Ascutney and the Connecticut River Valley (Brown et al. 2013; Tierney and Gibbs 2018). According to Brown et al. (2013), selective tree thinning is a recommended maintenance practice that removes the tallest trees and allows smaller trees and undergrowth to reduce soil erosion. However, any activities that remove stabilizing vegetation along hills or steep-walled ravines should be carefully considered, as these actions may result in enhanced runoff, erosion, mass wasting susceptibility, and sedimentation issues (Thornberry-Ehrlich 2008). If selective thinning is performed on steep terrain, it may be best to lay felled trees horizontally across the slope to catch organic debris that may mobilize downhill during heavy rain or storms; this method should help minimize the flow of sediment into streams and the Blow-Me-Down Pond (Brown et al. 2013). In addition to vegetative clearing, the introduction of impermeable surfaces such as parking lots or roadways will likely exacerbate issues related to runoff.

Flooding

Flooding can shape the land and improve soil health at SAGA, but it can also introduce several geohazards that threaten or endanger park resources and lives. Flooding at the historical park can wreak havoc on infrastructure (e.g., roads, trails, buildings, dams, bridges, utilities), damage natural resources or ecosystems, exacerbate erosion, increase mass wasting susceptibility, and hinder park operations (Figure 9). The Connecticut River, Blow-Me-Down Brook, Blow-Me-Up Brook, and Blow-Me-Down Pond have dynamic seasonal flooding and drought cycles. Periods of flooding are driven by spring snowmelt and fall storms (including hurricanes) but can also be caused by ice jams along the river (Gawler and Bowman 2012). During the late 19th century, both Blow-Me-Down and Blow-Me-Up Brooks were dammed or modified to power a historic grist mill and for recreational purposes, respectively. The artificial modification of these drainage networks has resulted in flooding issues, particularly along the floodplain adjacent to the river (see "Disturbed Lands"). Some of the more devastating floods to occur along the brooks are documented in the town records for Cornish and Plainfield and include July 1850, March 1866, October 1896, November 1927, March 1936, August 1955, June 1956, July 1973, and April 1976 (Cronan et al. 1981).



Figure 9. Photograph of an August 2011 flood along the Connecticut River. Floodwaters associated with Hurricane Irene encroached upon fishing access points (pictured) and adjacent cornfields before flooding sections of New Hampshire Route 12A that traverse the historical park. The roadway was closed for multiple days which restricted historical park operations. NPS photograph.

According to National Park Service (1995) and Tierney and Gibbs (2018), about 35% of the Blow-Me-Down Farm property (roughly 16 ha [40 ac]) is situated within the 100-year floodplain of the Connecticut River, an area predicted to flood at least once every century (or a 1% chance annually). Additionally, the Blow-Me-Down Mill complex—including the pond and wetland area immediately upstream of the dam—is within the 100-year floodplain of Blow-Me-Down Brook (Figure 10; National Park Service 1995). Today, the pond and wetland are subject to periodic floods and flash floods, but they are also negatively impacted by runoff, sedimentation, and slope instability issues (see "Hydrological Resources"; National Park Service 1995, 2015; Gawler and Bowman 2012; Brown et al. 2013). Particularly large storm events, such as the "Great New England Hurricane" of September 1938, have washed out a pre-existing dam and redistributed large amounts of sediment from the Blow-Me-Down Pond (Cronan et al. 1981). Major flash flooding in 2013 significantly infilled the pond and damaged a portion of the modern dam's fieldstone structure (Brown et al. 2013).

As the climate continues to warm and produce more extreme weather events, SAGA management may want to evaluate the impact heavy storms and flooding have on erosion rates, especially along the ravines of Blow-

Me-Up and Blow-Me-Down brooks. Both streams incise through unconsolidated Quaternary Ice Age deposits that are prone to erosion. Additionally, flood flows concentrated through steep, channelized valleys often result in strong erosive forces (Field et al. 2025). The relative degree of streambank incision or slope failure is complex but is often a function of several variables, including lithology, channel slope morphology, volume and size of entrained flood sediment, hillslope saturation, temperature, and human modification (Field et al. 2025). Regarding the steep ravines of SAGA, both Blow-Me-Up and Blow-Me-Down brooks have steep, channelized stream gradients upstream of their confluence, which makes them more susceptible to erosion. Any approach to slope management should consider the suitability to the stream or riverbank's unique conditions; a comprehensive guide is provided in figure 7 of Field et al. (2025). Stabilization projects intended to mitigate streamflow and bank erosion are likely to have unintended secondary effects, as modifications to water or sediment inputs are likely to cause stream adjustments through bed incision or lateral migration. According to Beeson and Doyle (1995), vegetation clearing or removal along stream channels dramatically increases the rate of bank retreat, as non-vegetated slopes can erode up to five times faster than vegetated slopes and are 30 times more susceptible to major bank erosion. Similarly, lateral river migration rates across deforested floodplains are up to two times faster than forested floodplains (Hickin 1984). Other modifications to the SAGA landscape, such as the modification or removal of the Blow-Me-Down Mill dam, may release large amounts of impounded sediment into the Connecticut River and promote head cutting that propagates upstream, causing localized bed incision and rapid bank retreat (Field et al. 2025).



Figure 10. Photograph of an August 2011 flood at the Blow-Me-Down Mill. Heavy storms associated with Hurricane Irene caused Blow-Me-Down Brook to overwhelm the mill dam and flood the mill. Upon close examination, the peak high-water flood mark can be seen about halfway up the basement door to the left. NPS photograph.

Mass Wasting

The term "mass wasting" is used to describe downhill movements of rock, soil, or ice and includes several types of landslide phenomena, including debris (or snow) avalanches, debris flows, slumping or slope creep, and rockfalls. At the historical park, hillslope instability and mass wasting are prevalent issues often triggered by natural forces such as gravity, frost or root wedging, differential erosion, and flooding, as well as human modifications like road and trail construction, undercutting, and deforestation (Thornberry-Ehrlich 2008). The surficial deposits of SAGA are unconsolidated glacial, glaciolacustrine, and fluvial sediments that are easily eroded, incised, or reworked by tributary streams. Stream channels at the historical park have incised steep-walled ravines of sand and silt that produce numerous groundwater seeps (Gawler and Bowman 2012). The movement of groundwater along the base of these oversteepened slopes may potentially lead to erosion, slope instability, and failure. Along the ravine of Blow-Me-Up Brook, two large slumps occur in clay deposits associated with Glacial Lake Hitchcock (see "Geologic History"). These features display the classic slump morphology, where slope failure has resulted in a downward rotational movement of rock debris and soil (Cronan et al. 1981). In addition to slumping issues, slope creep and mudslides are also

common mass wasting phenomena along the steep ravines of SAGA (Thornberry-Ehrlich 2008; Gawler and Bowman 2012).

Radon

Radon is a naturally occurring gas created by the decay of radioactive elements present in many rocks. Although radon is almost always present in small amounts in soil and rocks, some types of rock (e.g., volcanic rocks, granites, dark shales, phosphate-rich rocks, and metamorphic rocks) have the potential to produce above-average amounts of radon gas that can pose a known health risk (Otton 1992). New Hampshire is well known as the "Granite State," a nickname derived from its abundance of granite bedrock. These granites and similar igneous rocks contain small amounts of uranium that naturally break down to form radon gas that percolates upward through the ground. According to the US Environmental Protection Agency (EPA) map of radon zones, Sullivan County is identified as a zone of moderate potential (zone 2) for elevated indoor radon levels (see https://www.epa.gov/radon/epa-maps-radon-zones-and-supporting-documents-state; accessed December 2024). The EPA has guidance for radon mitigation.

Seismicity

The New England setting of the historical park is a region of relatively low seismological hazard, as the east coast of the US is a passive margin defined by a lack of tectonic subduction, volcanism, or large magnitude seismic events (Petersen et al. 2023). The New England Seismic Network is a collection of 20 stations that help monitor seismic activity across the New England states (New England Seismic Network; accessed December 2024). Two of the closest stations to SAGA include those located at Dartmouth College in Hanover, NH (20 km [12 mi] away), as well as at Franklin Falls Dam, NH (60 km [37 mi] away). Low magnitude earthquakes are a common occurrence in New Hampshire and may be generated by glacial rebound, a process where the Earth's crust slowly adjusts or rises following subsidence caused by glaciation (Felt the ground tremble? Yup, earthquakes in New Hampshire are somewhat common; accessed May 2025). Since 1900, over 170 earthquakes have been recorded, the majority of which register less than magnitude 3.0 (USGS Information by Region: New Hampshire; accessed December 2024). Historically, the two largest earthquakes ever documented in the Granite State were magnitude 5.6 and 5.3 events that occurred near the town of Tamworth (Carroll County) in late December 1940. These two quakes affected a 390,000 km^2 (150,000 mi^2) area, including Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, and parts of New Jersey, New York, and Pennsylvania; additional information can be found in Stover et al. (1980).

Swelling Clays

Swelling clays, or shrink-swell clays, include minerals such as smectites that are physically altered by the presence of water and tend to swell when wet and shrink when dry. As swelling clays expand or contract, the change in volume can undermine the integrity of the substrate, increase the susceptibility of slope failure, and cause infrastructural problems along roadways or trails. According to the USDA NRCS Web Soil Survey, all soils mapped within the historical park are rated "low" in linear extensibility (a determination of shrink-swell potential of soils) except for soils associated with Blow-Me-Down Pond. Ponded sediments or soils (borohemists) mapped immediately upstream of Blow-Me-Down Mill dam are rated "high," meaning they can cause structural issues or damage to buildings, roads, and vegetation.

Toxicological Soil

According to the DOI SHIRA Risk Mapper report, soils within the park complex include potentially hazardous elemental abundances of arsenic, cadmium, lead, selenium, and *Bacillus anthracis*—a naturally occurring soil pathogen known to cause anthrax. Soil maps show that potentially hazardous concentrations of arsenic, cadmium, lead, and selenium occur within the top 5 cm (2 in) of soil based on 2010 sampling (DOI SHIRA). For more information on naturally occurring arsenic, cadmium, lead, selenium, and their potential health impacts, visit the US Department of Health and Human Services Agency for Toxic Substances and Disease Registry (see https://www.atsdr.cdc.gov/; accessed September 2024).

Anthrax is a rare, naturally occurring disease caused by the bacteria *Bacillus anthracis* that can cause severe illness in both people and livestock who are exposed to spores. For more information on the public health risks associated with anthrax, visit the US Centers for Disease Control and Prevention's anthrax website (see https://www.cdc.gov/anthrax/about/index.html; accessed September 2024).

Geologic Resource Protection

The core responsibility of the NPS is to preserve and protect park resources, processes, systems, and values unimpaired for present and future generations. According to National Park Service (2006), the NPS will preserve and protect geologic resources, features, and processes as integral components of park natural systems. The goals of the NPS are to assess the impacts of natural processes and human activities on geologic resources; maintain and restore the integrity of existing geologic resources; integrate geologic resources management into NPS operations and planning; and interpret geologic resources for the benefit and enjoyment of park visitors (National Park Service 2006). Various management protection policies applicable to geologic resources, features, and processes are included in National Park Service (2006) and are also organized at the following website: https://home.nps.gov/subjects/geology/geoheritage-nps-management-policies.htm (accessed 26 June 2024).

Paleontological and Cultural Resources

According to the Northeast Temperate Network paleontological resource inventory report by Tweet et al. (2010), there are currently no paleontological resources (fossils) preserved within SAGA. However, Quaternary surficial deposits within the historical park—especially glaciolacustrine sediments of Glacial Lake Hitchcock—represent the most likely potential sources of future fossil discovery (Tweet et al. 2010). The presence of rhythmically layered lake sediments would be ideal locations to look for fossils, including plant and fish body fossils, trace fossils, or microfossils such as pollen. Although surficial mapping by Hildreth (2010a, b; 2010a, b) has identified these deposits within SAGA, additional investigation is needed to determine their scope and extent (see “Inventory Needs”; Tweet et al. 2010). The Devonian Gile Mountain Formation is another possible source of paleontological resources, but it is generally lacking in fossils and has been heavily metamorphosed, which degrades preservation potential. For additional information regarding paleontological resource laws, regulations, and policies, the NPS GRD developed the following summary article: https://www.nps.gov/articles/paleontolosy-legal-instruments.htm (accessed 26 June 2024).

Although the historical park currently has no reported Indigenous cultural sites or artifacts, there is a high potential for future discovery, especially along river terraces located at Blow-Me-Down Farm (National Park Service 2015b; Lee and Boyce 2017). The river terrace setting adjacent to the tributary confluence of Blow-Me-Down Brook and the Connecticut River is similar to other nearby documented cultural sites. For

example, a significant site discovered 10 km (6.5 mi) south of SAGA is located along the confluence of the Sugar River and Connecticut River and preserves the remains of three longhouse dwellings (Lee and Boyce 2017).

Hydrological Resources

The Blow-Me-Down Pond and surrounding wetland area were created in the late 19th century when Blow-Me-Down Brook was dammed to power a historic grist mill. The modification of the brook's natural drainage pattern has subsequently resulted in flooding and sedimentation issues that negatively impact the pond's morphology and ecology (National Park Service 1995, 2010, 2015; Nowak and Brown 2009; Brown et al. 2013). Heavy storms, floods, and mass wasting events often mobilize large amounts of rock, soil, and woody debris that are deposited or trapped behind the dam. Over many years, sedimentation and infilling have reduced the depth and amount of open water within Blow-Me-Down Pond and promoted the growth of vegetation. In 2001, a scenic and interpretive boardwalk was constructed that projected approximately 12 m (40 ft) into the pond and across the wetland (National Park Service 2010). By 2010, the terminus of the boardwalk sat 4.5 m (15 ft) from the water's edge due to the impact of sedimentation (National Park Service 2010).

Early attempts to dredge or clean Blow-Me-Pond began in the 1980s, when the NPS repaired the Blow-Me-Down Mill dam, which required lowering the water level within the impoundment area. Once the pond was drained, a narrow channel was dredged through the pond's center, and it soon became clear that additional work would be needed to remove excess accumulated sediment. Despite efforts to involve the Army Corps of Engineers, no additional assistance was offered, and the project was completed as originally planned (National Park Service 2010). Over the last couple of decades, subsequent attempts to mitigate the pond's sedimentation issues proved to be temporary solutions. In 2000, the Bureau of Reclamation Technical Service Center prepared a condition survey, and a Boy Scout troop removed approximately 46 cm (18 in) of sediment from the pond; within eight years the dam was filled to the top with loose gravel and sediment (Brown et al. 2013). In 2008, a Student Conservation Association crew from the New Hampshire Conservation Corps worked with SAGA staff to dredge along the center of the pond (Brown et al. 2013). However, a major flash flood in 2013 resulted in the complete re-sedimentation and infilling of the pond (Brown et al. 2013). Although the pond is part of the historical landscape of SAGA and is not considered for restorative purposes, issues related to flooding and sedimentation will continue to impact the ecological integrity of the pond and wetland area, especially as climate scenarios predict more extreme precipitation events compared to the historical average (see "Climate Change").

In addition to Blow-Me-Down Pond, an artificial swimming hole ("The Swimming Hole") was created on the Aspet property during the late 19th century when Augustus Saint-Gaudens dammed Blow-Me-Up Brook. Today, the fieldstone dam is located immediately north of the Temple. As a valuable feature of the estate, the pool area was often frequented by Saint-Gaudens and his assistants to cool off during the summer months. Although the Blow-Me-Up Brook ravine dam has resulted in fewer flood concerns compared to the Blow-Me-Down Mill dam, erosion and sedimentation issues have decreased the size and depth of The Swimming Hole (Figure 11; Nowak and Brown 2009).



Figure 11. Photograph of the Blow-Me-Down ravine dam. Constructed during the late 19th century, the dam created The Swimming Hole, where Saint-Gaudens and his assistants would cool off during the hot summer months. Today the ravine pool is impacted by flooding, erosion, and sedimentation issues. NPS photograph.

Inventory Needs

The following table (Table 3) presents several geologic and soil resources inventory needs that were identified during the 2025 follow-up meeting, in NPS planning documents, or through literature review.

Table 3. List of identified geologic and soil resources inventory needs for the historical park.

Subject	Inventory Need(s)	Reference(s)
Cultural resources	Although there are no documented cultural resources at SAGA, an ethnographic/ethnohistoric evaluation would be valuable for determining whether there are any Indigenous groups with ties or affiliations to the historical park.	National Park Service (1995)
Cultural resources	Several small-scale features at Blow-Me-Down Farm—granite posts and a stone pedestal—may be historic but need additional research to learn more about their history. According to SAGA staff, the granite posts may date back to the MacLeay family, some of the earliest settlers in the area who owned the property prior to Charles Beaman.	Brown and Beagan (2013)a
Erosion	Develop a slope management plan. The ravines of Blow-Me-Up and Blow-Me-Down brooks experience enhanced erosion during heavy storms and floods that leads to increased sedimentation along Blow-Me-Down Pond. The management plan should consider the most appropriate slope stabilization method(s) to help mitigate stream flow and bank retreat; a detailed method suitability guide is provided in Field et al. (2025). Studies using cosmogenic nuclides could help quantify the rate or degree of bank erosion for modeling assessments. In areas susceptible to mass wasting, SAGA may use the Federal Highway Commission's Unstable Slope Monitoring Program to determine slope stability and potential hazards to human safety.	2025 follow-up meeting
Mapping	Digitization of the four 1:24,000 scale surficial geologic maps by Hildreth (2010a, b; 2011a, b). The unconsolidated lacustrine and deltaic sediments associated with Glacial Lake Hitchcock are susceptible to erosion along Blow-Me-Down and Blow-Me-Up Brooks. Map digitization may help guide management decision-making regarding sedimentation issues and flooding.	Hildreth (2010a, b; 2011a, b), Thornberry-Ehrlich (2008)
Paleontology	Quaternary-age lacustrine and deltaic deposits associated with Glacial Lake Hitchcock represent some of the most likely sources of future fossil discovery in SAGA. Although these deposits are mapped in the historical park by Hildreth (2010a, b; 2011a, b), their scope and significance merit further investigation. If rhythmically layered varve deposits are present, they would be ideal locations to look for fossils, including plant or fish body fossils and trace fossils.	Thornberry-Ehrlich (2008), Tweet et al. (2010)

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