PART 2. TREATMENT AND USE

Ultimate Treatment and Use

The ultimate treatment and use of this structure, as defined in the National Park Service "Project Agreement" dated December, 2002, calls for stabilization and rehabilitation of the National Historic Landmark, Quarry Visitor Center at Dinosaur National Monument.

Historically, President Woodrow Wilson proclaimed Dinosaur a National Monument in 1915. Earl Douglas discovered the deposit of dinosaur bones in 1909, and later envisioned a visitor center concept prefacing the structure as it exists today.

The National Park Service Mission 66 program inception and funding resulted in a park service effort to find a suitable contract architect, Anshen and Allen, Architects, for a visitor center commission resulting in Quarry Visitor Center, Dinosaur National Monument.

The ultimate treatment and use of this structure, as defined in the National Park Service "Project Management Information System (PMIS 21511), is found in the document title "Stabilize and Rehabilitate Historic Quarry Visitor Center".

The PMIS further states that the building will "provide for long term protection of fossils from the elements" and "maintain a work environment that informs the public of all park resources, including a visitor contact station and cooperating association sales outlet".

"Park goals, guiding documents and the building's listing on the National Historic Landmark mandate the protection and accessibility of the Quarry Visitor Center to park visitors."

"Quarry building would continue as the focal point of visitors coming to the monument."

The ultimate historic and current use of this structure, as defined in the "National Historic Landmark Nomination", is "Government Recreation and Culture (Government Museum and Office)".

The National Monument Superintendent
wishes to preserve the historic building and use it in the future, primarily, as a visitor center. However, because of functional changes in monument and visitor center goals and operations since the building was constructed, the proposed visitor center's new overall function or use will be one of adaptive use.

Requirements for Treatment

Civil Requirements for Treatment

Civil Requirements for Treatment

General

See Civil Site Plan C-1 for locations of the existing water, sewer, and drainage systems in the immediate vicinity of the building.

Water Supply System

The building does not have its own water meter, but if the staff suspects there is a leak somewhere on a pipeline, they attach a portable water meter to a pipe to check for flow during periods of no water use. These pipes should be checked for leaks on a regular basis since there has been a history of water lines breaking due to ground movement at this site.

It is assumed the pipe leak in the pressure reducing vault will be repaired by the park maintenance staff in the short term. But if it is still found to be leaking in the future, it will have to be repaired.

The water line is far enough from the building that it probably will not have to be replaced if a new foundation system is provided for the south parts of the building.

Sewage Collection System

Due to a history of ground movement at this site causing pipe breakages, the sewer pipes between manholes should be inspected periodically. These inspections could consist of visually looking for straight pipe between manholes, or better, running a video camera through the pipe.

The manholes have had some damage caused by ground movement and require repair. The lids and/or upper sections have been pushed to the side causing misalignment. Photograph #170 in the appendix shows one of the manholes.

The sewer lines and manholes are close enough to the building that they probably will have to be replaced if a new foundation system is provided for the south parts of the building.

Drainage System

An accurate survey of the area around the building will have to be done to determine the need for and configuration of an improved drainage system.

The existing situation where the roof drains are piped into the sanitary sewage system is should probably be changed. It is considered poor design to direct stormwater into a sanitary sewer.

A new system to direct stormwater away from the building could be either underground or on the surface.

An underground system would consist of drop inlets at the roof drain outlets and at any topographic low points and large diameter buried pipes to direct the water away from the building. The disadvantages with this type of system are that the pipes may plug up with debris and that the pipes will break and leak eventually due to ground movement caused by the swelling soil. Since the system is underground and out of sight it could be failing for some time before the damage is discovered.

A surface drainage system would probably consist of concrete swales (perhaps 4-feet wide by 15-feet long) to direct stormwater from the roof drain outlets away from the building a short distance. The rest of the drainage could be accomplished by maintaining consistent surface grading away from the building. As long as no ponding occurs, relatively little water will percolate into the soil due to the low permeability of the bentonite clay. The soils will still tend to move some so the site will have to be regraded periodically. The moving soils would also tend to damage concrete swales, but it may be possible to minimize this by overexcavating 4 or 5 feet where the swales will go and backfilling with a non-expansive clay soil.

Another option for surface drainage would be to replace the expansive soil all along the south side of the building with nonexpansive clay soil. This would probably be from the surface 4 or 5 feet deep and out from the building 15 feet. The soils would then have little tendency to move and damage utility lines and would require little regarding. Concrete swales may still be provided.

It is recommended that the type of drainage system to be implemented be selected using the Value Analysis process.

Pavement

See the Landscape section of this report for an assessment of the pavement condition.

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Site Requirements for Treatment

Architectural Requirements for Treatment

Legal and regulatory requirements include meeting the provisions of the USDI Rehabilitation Standards and Guidelines for Rehabilitating Historic Buildings, NPS Cultural Resources Management Guideline (NPS-28), as well as building code, life safety, accessibility, fire protection, energy conservation and hazardous materials standards and regulations.

Life Safety

"The National Park Service hereby adopts, and will enforce as minimum standards, the most current version of the National Fire Protection Association (NFPA)'s Fire Prevention Code (NFPA 1), Life Safety Code (NFPA 101), and all other associated codes and standards…"

Recently the NFPA has published a building code, NFPA 5000, "Building Construction and Safety Code". NFPA 5000 along with all of the other NFPA Codes and Standards are NPS requirements. All NPS projects shall demonstrate compliance with the applicable NFPA Codes and standards. Deviations from these NFPA Codes and Standards have to be approved by the Authority Having Jurisdiction (AHJ). Each region has an AHJ, which is the Regional Structural Fire Program Manager.

In some localities, there also may be local code requirements, which may be required in addition to the NFPA Codes and Standards.

The Quarry Visitor Center most pressing requirements are for emergency egress. Distances and arrangement of exits, occupancy load, and lack of automatic fire suppression in the visitor portions of the building need study.

Accessibility

The National Park Service is legally mandated by the Architectural Barriers Act and Section 504 of the Rehabilitation Act to provide access for disabled persons to National Park Service facilities and programs. The Architectural Barriers Acts say we must provide access to facilities and Section 504 of the Rehabilitation Act says we must also provide access to programs.

The "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)" provides the guidelines to be followed in National Park Service projects.

Handicapped accessibility for the visitor and employee in the Quarry Visitor Center is a problem. The second floor offers functions which the handicapped can not reach from the first floor. Handicapped accessibility problems need to be addressed.

Solutions for the problem could include:

- Discontinued public use of the second floor entailing the construction of outside public restrooms and discontinued use of the ramp.
- Offer equal functions on the first floor that now only exist on the second floor.

- Provide elevator access to the second floor for the handicapped.

Fire Protection

A partial automatic fire sprinkler system has been installed in the building. It protects the Laboratory, Mechanical Room, Employee Toilet, Lunch Room, and Concessioner's Storage room. A partial Halon gas system protects the Library and Paleontologist's Office/Library. Fire extinguishers and a hose cabinet in the laboratory protect the rest of the building.

A fire and an intrusion alarm system have been installed in the building. However, the fire system is not in compliance with NFPA as it does not include audio/visual devices (strobes).

The Quarry Visitor Center has a piece meal fire protection system.

Hazardous Materials

Hazardous materials which may cause concern for construction and maintenance activities would be a halon gas fire protection system, lead-containing paint, asbestos pipe insulation, radon gas emitted from stone and soil, and hantavirus from mouse droppings. All construction and maintenance activities must be conducted in accordance with federal and state regulations for the handling and disposal of such materials.

Visitor Center Functional Requirements

PARKING & TRAM DROPOFF/HOLDING AREA

- Safe, convenient, and adequate mass transportation will continue to provide an enjoyable visitor experience.
- The 25 car including 2 handicapped car east parking area during off hour and off season use is inadequate at the visitor center. Expansion is needed.
- Employees use the visitor east parking lot and a west service drive parking area.
- Year round visitation is 300,000 people per year.

RAMP

- Formal entry to the visitor center second floor is by the ramp.
- The ramp is structurally damaged and has moved relative to the building.
- The ramp's steep incline is not handicapped accessible.
- The ramp's position does not allow second story lobby access doors to fully open.
- The ramp is a Historic Landmark character defining feature of the building.

VISITOR CIRCULATION THROUGH THE BUILDING

- The original Quarry Visitor Center provided the following pedestrian visitor circulation. From the parking lot, visitors walked up the concrete ramp as it wrapped around the cylindrical structure and entered the building through double glazed doors to the second floor lobby. The lobby was adjacent to the second floor visitor gallery and exhibit area which was entered through another double set of glazed doors. The first and second floor visitor galleries in the exhibit shelter were connected by a narrow stairway in the rotunda of the cylindrical structure and by a stairway at the far west end of the gallery. Visitors were expected to use the ramp entrance, discover the restrooms to the left of the small lobby, talk to a ranger at the lobby information desk, enter and walk along the upper visitor gallery in the exhibit shelter and then take the stairs down to the lower visitor gallery and viewing area. The lower gallery included windows into the paleontologists' preparation and storage room which was part of the South Wing. The visitor could observe paleontologists working on the quarry wall. Visitors concluded their tour of the lower gallery by entering another lobby space, now a crowded bookstore. The building exit back to the parking lot was located in the bookstore lobby. This route provided efficient circulation through the building and back to the parking area.

- Visitation has increased dramatically over the years. Crowding is apparent at certain times of the year. Building functions have been somewhat altered. Present visitor circulation through the visitor center is much the same.
- Because there are two lobbies and because double door entry/exits to the visitor center are in close vertical proximity to each other, visitor circulation paths, information, and orientation can be awkward if some visitors choose to enter the first floor double doors instead of using the second floor ramp.
- The ramp, the first and second story sets of exterior double doors, and the second story of the visitor center including the restrooms are not handicapped accessible.
- Visitor restrooms are located on the second floor. They are not handicapped accessible.
- Safe fire exit for the visitor is questionable because both entry/exits are in close proximity to each other and both are located at one end of the 180 foot long first and second story building visitor galleries.
- The circulation route is tight and crowded in the first floor visitor gallery because exhibits are placed close together throughout the gallery.
- Visitor circulation problems need to be addressed.

SECOND FLOOR LOBBY

- A double door formal entry is provided for the visitor center at the second floor.
- The visitor can make choices in the upper lobby. Restrooms, drinking fountain, seating, limited exhibits, access to the quarry wall visitor gallery/viewing balcony through double doors, and access to the first floor concessionaire sales area by way of a stair are available.
- The NPS Chief of Interpretation office is located off the lobby.
- No National Park Service or Dinosaur National Park information or orientation is provided in this space.
- Visitor direction of movement from the lobby to the second floor visitor gallery is suggested by the quarry wall view through the metal window wall and glazed double doors.
- The second floor is not handicapped accessible.

VISITOR RESTROOMS

- Study of the existing visitor restrooms is needed to ascertain if the fixture number is adequate for expected future visitation.
- The existing restrooms are not handicapped accessible.
- The second floor and future visitor restrooms must be handicapped accessible in the rehabilitated visitor center.

JANITOR'S CLOSET

- Space for visitor restroom and janitorial supplies storage, service sink, and mechanical cleaning equipment is needed.

QUARRY WALL EXHIBIT

- "The visitor center is essentially a massive concrete block, steel frame, and glass shed built over and into one of the most spectacular beds of Jurassic Period fossils ever discovered."
- "The extensive glazed curtain wall construction that forms the walls of the structure emphasizes the continuity between the "in situ" display of the fossils and the surrounding rock outcrops immediately outside the structure."
- The resource enclosure and the accompanying striking interpretive features of the building historically allowed visitors to view scientists excavating the fossils "in situ".
- The interior space must provide visitors with a view of the fossil quarry wall while inside the building.
- While scientists no longer excavate, the historic landmark status bestowed on the building is dependent in part on the quarry wall display and its relationship to the building. The quarry wall will remain a visitor exhibit of a former working quarry.
- Climate control is needed in this space for visitor comfort.

VISITOR GALLERIES

- Secondary exhibits are displayed on the first and second floor visitor galleries which are open on one side to the quarry wall exhibit.
- The visitor galleries serve as the major pedestrian circulation elements for the visitor center as well as viewing space for the quarry wall.
- Presently the first floor gallery serves as the NPS visitor contact, information, and program space.
- The nature of the gallery exhibits will be altered. Park natural and cultural resource interpretation will share importance with fossils.
- Fossil interpretation will become a smaller more cohesive portion of the interpretive program and consolidated in area footprint.
- Use of the second floor gallery is not mandatory from the park staff perspective.
- The interpretive program to be used for the future visitor center is yet to be created.

LABORATORY

- The working laboratory, where scientists separated petrified bone from rock while the visitor watched from the visitor gallery, was a major exhibit feature of the building. Paleontologists no longer work in the laboratory.
- The laboratory will not be replicated.
- The laboratory space will be used for other functions such as storage and offices.
- Fossil excavation and laboratory fossil preparation will be done off site.

PALEONTOLOGY, RESEARCH, AND INTERPRETER'S LIBRARY/CONFERENCE ROOM

- The paleontology portion of the library will move to Vernal, Utah. The Vernal location will provide a more secure location for the books. The paleontology library will be located in conjunction with the off site laboratory and paleontology offices.
- A working library with the shelving capacity of the existing library for the interpreters will remain in the visitor center.
- The library will function as the interpreter's research and work space.
- The park's photo collection will be located in the library.
- The library will also function as a conference room.

PALEONTOLOGY STORAGE

- Existing fossil storage in the laboratory is minimal.
- Future storage will not be in the visitor center.
- Future storage of fossils will be off site.

AUDIO/VISUAL SPACE

- There is no existing separate area with seating for specialized audio/visual presentations in the visitor center.
- There will be no separate audio/visual space in the future rehabilitated visitor center.
- There may be small unenclosed video spaces provided as visitor exhibits.

FIRST FLOOR LOBBY

- The existing space is primarily a cooperative association book and souvenir sales area placed in a major visitor center pedestrian circulation node.
- Two information desks are available to the visitor. The south desk is used for sales transactions and links to an association office behind the desk. The north desk is used for information purposes. Both desks are manned by association employees.
- The space serves as the visitor first floor exit from the visitor center by way of glazed double doors to the exterior of the building.
- The quarry wall and first floor visitor gallery is accessed through a glazed window wall with double doors.
- Both sets of double doors are not handicapped accessible.
- National Park Service Administrative offices and cooperative association offices exit to the lobby.
- A stair to the second floor lobby lies adjacent to the first floor lobby.
- A corridor leading to the paleontologist's working area connects to the lobby.
- Area, outside, walking tours are coordinated from and leave from this lobby.

- The first floor lobby is small and can be crowded given the amount of sales item display, visitor circulation, and employee circulation at certain times of the year.

VISITOR CONTACT AND INFORMATION DESK

- An existing concessionaire visitor contact and information desk is located near the first floor lobby exit doors.
- An existing NPS visitor contact and information desk is located in the exhibit shelter near the quarry wall.
- A past NPS visitor contact and information desk was located in the second floor lobby. It is no longer there.
- A future NPS visitor contact and information desk is needed in the visitor center.
- No fee collection is needed.
- Brochure and miscellaneous storage is needed.

COOPERATIVE ASSOCIATION SALES AREA

- An existing cooperative association sales desk is located in the first floor lobby.
- A future sales desk is needed with display of books and sales items.
- The existing space is appropriate but some expansion in the rehabilitated visitor center would be needed.

COOPERATIVE ASSOCIATION OFFICES

- Area is needed for a Cooperative Association Sales supervisor's private office.
- Office space is needed for two cooperative association employees who work in the building.
- The cooperative association office space can be in the same space or adjacent to the National Park Service interpretive staff offices.

COOPERATIVE ASSOCIATION STORAGE

- Short term storage in the visitor center for the association is adequate.
- Some expansion of storage in the future rehabilitated visitor center would be desired.
- Bulk storage is located in Vernal, Utah, and will remain there.

NATIONAL PARK SERVICE OFFICES

- The existing Chief of Paleontology's office will be deleted.
- Two existing paleontology office cubicles in the laboratory will be deleted.
- A Chief of Interpretation enclosed office will be needed.
- A full time interpreter will share an office/work space with three seasonal interpreters.
- An enclosed and separate space will be needed for two resource personnel.
- Total staff proposed is 4 full time and 3 seasonal employees. The guideline for office space is found in the "NPS Space Management Guideline" which states that office space…'should not exceed and average of 125 square feet per person for the primary office area, plus 22% for office support space".

OFFICE SUPPORT

- Space for Xerox machine, fax machine, office supply, office storage, files etc. is needed within or adjacent to the offices.

LIBRARY

- See Paleontology, Research, and Interpreter's Library/Conference Room.

LUNCH ROOM/KITCHEN/BREAK ROOM

- A lunch room with kitchen/break room is needed for the employees of the NPS and concessionaire.

FIRST AID ROOM

- A small room for first aid for visitors needs will be provided.
- The room must be convenient to both public and staff but private for emergency and first aid needs.

EMPLOYEE TOILETS AND LOCKERS

- Provide one handicapped toilet room for each sex. An employee shower would be nice but not necessary.
- Provide lockers for the employees.

JANITOR'S CLOSET

- Janitor storage for supplies and cleaning equipment matching the existing areas are needed.

MECHANICAL ROOM

- Building mechanical equipment and electrical equipment space will be needed.
- A separate communication network space will be needed.
- Some space is needed to facilitate maintenance activities within the building.

Architectural Requirements

Recommended preparatory and demolition work in order to accomplish project stabilization and rehabilitation of the Quarry Visitor Center.

Retain the Exhibit Shelter portion of the total building:

- Retain the membrane roofing, insulation board, 2" wood deck, and 2" wood nailer.
- Retain the steel structure including the roof beams, visitor gallery second floor beams, floor deck, columns, and window wall frame.
- Disconnect and re-route roof drainage manifold piping from existing drain pipe to ground extension to new temporary drain pipe to ground extension during construction.
- Remove metal window wall glass and plexiglass panes and sealant. Salvage glass panes for possible reuse in limited building elevations.
- Remove east wall swamp cooler, support frame and opaque window panel.
- Remove the east wall wood frame panel at the original driveway doors location. Demolish.

- Remove the warped, binding and dented west wall metal doors at the driveway location. Salvage for reuse.
- Remove reinforced, crushed, and cracked CMU portion of west wall. Demolish. Shore up the interior second floor deck and stair metal framing.
- Disconnect and cap gas and water piping through west concrete stem wall.
- Remove the gantry crane, platform, floor rail, and concrete foundation. Salvage gantry crane, platform, and floor rail for reuse.
- Retain a representative sample of all finishes interior and exterior.
- Remove the quarry driveway NPS interpretive platform. Demolish. Salvage the metal guardrail for reuse.
- Remove and salvage the first floor lobby to visitor gallery aluminum door and steel window wall. Salvage the steel window wall for modification and replacement along building line B.
- Remove and salvage the second floor lobby aluminum doors and aluminum infill frame. Retain in place the steel window wall.
- Remove the lunch/kitchen and concessionaire storage wood frame walls. Demolish.
- Salvage doors and hardware.
- Salvage lighting fixtures.
- Provide a representative sample of all finishes from each room.
- Salvage all historic furnishings. It is highly recommended that all historic furnishings be stored at a suitable facility off-site while the visitor center undergoes rehabilitation. After construction is complete, the furnishings should be returned to the visitor center as they are an integral part of the structures historic integrity.
- Remove first floor visitor gallery concrete floor slab and metal rail. Salvage the metal rail for reuse. Shore up the west end stairs.
- Remove second floor visitor gallery concrete flooring and guardrail from the metal deck. Salvage the metal rail for reuse.
- See mechanical.
- See electrical.

Remove the ramp. Salvage for reuse.

Remove the structurally damaged, South Wing.

- This would include the roof, walls, floor slab, and foundations to column line B.
- Shore up steel framing/contiguous structure from the exhibit shelter and south exhibit shelter/visitor gallery steel framed window wall.
- Cap all utility lines.
- Salvage steel windows.
- Salvage doors and hardware.
- Salvage lighting fixtures.
- Salvage historic heating supply registers and return grilles.
- Salvage toilet and plumbing fixtures.
- Provide a representative sample of all finishes from each room.
- Salvage all historic furnishings. It is highly recommended that all historic furnishings be stored at a suitable facility off-site while the visitor center undergoes rehabilitation. After

construction is complete, the furnishings should be returned to the visitor center as they are an integral part of the structures historic integrity.
- See mechanical.
- See electrical.

Remove the structurally damaged two story Admin Wing.
- This would include the roof, walls, floor slab, and foundations to column line B.
- Shore up steel framing/contiguous structure from the exhibit shelter.
- Cap all utility lines.
- Salvage the circular metal and concrete stair and rail.
- Salvage steel window wall.
- Salvage steel windows.
- Salvage doors and hardware.
- Salvage lighting fixtures.
- Salvage historic heating supply registers and return grilles.
- Salvage toilet and plumbing fixtures.
- Salvage toilet partitions.
- Salvage toilet accessories.
- Salvage second floor ceramic tile.
- Salvage the birch plywood wall veneer, trim, and doors.
- Provide a representative sample of all finishes from each room.
- Salvage all historic furnishings. It is highly recommended that all historic furnishings be stored at a suitable facility off-site while the visitor center undergoes rehabilitation. After construction is complete, the furnishings should be returned to the visitor center as they are an integral part of the structures historic integrity.
- See mechanical.
- See electrical.

Recommended Treatment of Architectural Items on the existing Exhibit Shelter:
- Modify and adjust the concrete pier, footing, and stem foundation wall structure under the exhibit shelter.
- Rehabilitate and adjust the existing building steel super structure of the exhibit shelter.
- Sandblast the paint off the remaining steel window wall structure and re-weld.
- Construct a new reinforced CMU west first story wall on the exhibit shelter.
- Design and construct a new workable roof leader and drainage system to direct water down and away from the building foundations.
- Replace, modify, and install the heating and cooling mechanical system, sprinkler system, water and waste systems, and electrical, communication, and security systems in the first and second story visitor gallery floors.
- Re-construct the first and second story visitor gallery concrete floors.
- Rehabilitate and reinstall the metal guard rails on the first and second story visitor galleries.
- Clean, rehabilitate, restore to working order the mechanical windows and opening operational hardware.
- Apply metal primer and paint to match the historic window sash color.

- Replace broken glass panes, replace plastic panes, retain and rehabilitate remaining glass. Set with new wire clips and caulk.
- Rehabilitate and reinstall the metal east and west doors to the driveway.
- Rehabilitate and reinstall the gantry crane, platform, and floor rail.
- Clean and rehabilitate all historic furnishings after obtaining the recommendations of a historic furniture conservator.

Recommended Treatment of Architectural Items on the new South Wing:

- Construct a new south, one story wing with appearance and materials of the same kind as used in 1957-58, except as noted.
    - Modify and construct the south wing substructure (new concrete piers, footings, and foundation walls) to improve structural stability.
    - Rehabilitate and re-use the existing salvaged steel windows and hardware.
    - Rehabilitate and re-use the existing roof steel beams.
    - Roofing shall be a membrane equal to that on the exhibit shelter roof.
    - Design and construct a workable roof drainage system to direct water down and away from building foundations.
    - Re-design and construct interior floor plan with wood frame and gypsum board walls to reflect current functional program and space needs.
    - Clean and rehabilitate all historic furnishings after obtaining the recommendations of a historic furniture conservator.

Recommended Treatment of Architectural Items on the new Administration Wing:

- Construct a new administration, two story wing with appearance and materials of the same kind as used in 1957-58, except as noted.
    - Modify and construct the administration wing substructure (new concrete piers, footings, and foundation walls) to improve structural stability.
    - Rehabilitate and re-use the existing salvaged steel windows and hardware.
    - Roofing shall be a membrane equal to that on the exhibit shelter roof.
    - Design and construct a workable roof drainage system to direct water down and away from building foundations.
    - Re-design and construct interior floor plan with wood frame and gypsum board walls to reflect current functional program and space needs.
    - Rehabilitate or modify and re-use the existing salvaged steel window walls.
    - Rehabilitate and reinstall the circular stair and rail.
    - Rehabilitate and reinstall the finish birch plywood walls, trim, and doors.
    - Clean and rehabilitate all historic furnishings after obtaining the recommendations of a historic furniture conservator.

Structural Requirements for Treatment

Structural Recommendations for Treatment

The Quarry Visitor Center cannot be stabilized without extensively modifying, replacing, or stabilizing the building's foundation system. The nature of the site geology and the current building foundation system is such that continued movement of the foundation and the supported structure is certain unless an altered foundation system is built. Future movement in the foundation can be minimized by controlling water at the site, but this strategy has had limited success in the past. Groundwater is known to exist at elevations up to 12 feet above the floor elevation just north of the building. Stormwater and snowmelt can percolate into the permeable strata at the site and affect the expansive materials under the foundations. Individual water and sewer pipe breaks and other events introducing water to the subsoils and rock under the building have resulted in significant damage to the structure. The rate of deterioration will increase as the subsoils decompose.

The recommended approach to stabilizing the structure is to replace the existing shallow bearing foundation systems under the south half of the building with a deep foundation system that bears at depths 40' below the ground surface. This proposed foundation system is shown conceptually on drawings S5 and S6 on pages __ and __ in Appendix F of this report. The concept drawings are intended to indicate the extent of construction that is likely to be required to stabilize the building. The drawings should not be interpreted as design drawings. This foundation reconstruction will result in the following recommended treatments:

A. The south and west walls of the south wing (rooms 103 through 111) must be underpinned in order to isolate these masonry walls and the integral roof/visitor gallery beam support pilasters from the expansive soils below the wall's shallow foundation footings. The underpinning system should include straight shaft foundation piers that extend to 40 feet below existing ground surface. The bearing pressure on the end of these piers should be very high. This will require large grade beams to collect enough load to keep the piers under high pressure. The underpinning of the west wall should run north to interface with the short section of wall under the large double doors underpinned in 1967.

B. The required foundation alterations must address the instability of three of the ten steel butterfly frames (columns along building line (B)). Both the east and west end frames (at building lines (1) and (10)) and the first frame west of the east end frame (at building line (9)) are unstable due to the continuity between their foundation pedestals and adjoining shallow footings under adjacent walls and their susceptibility to uplift caused by water intrusion into the underlying expansive soils. All three affected frame foundations are proximate to potential water utilities that have leaked in the past. While relatively unaffected to date, the conditions of the other seven interior frame foundations are likely to lead to uplift problems unless their shallow foundations are underpinned on elements that bear on rock strata at deeper elevations less affected by moisture changes. Because the risk for future movement of the interior seven frame footings is significant and the cost to underpin them at a later date would be extremely high relative to the cost to underpin them as part of the stabilization of the south wing foundation, all ten butterfly frame footings should be underpinned at the same time.

C. The foundation system under the two-story administrative wing (masonry cylinder at southeast corner of building), including both the exterior wall footings and the interior wall footings, needs to be underpinned to separate the building from the underlying expansive soils. Because the foundations of this wing are integrated with the foundations under the eastern two butterfly frames, movement in the foundations of this wing causes movement in the steel frames and distresses large areas of the building. The concept drawings (S5 and S6) indicate a concrete platform supported on deep piers and separated from the surface soils that can support the exterior and interior bearing walls of this wing.

D. The interior walls of the administrative wing currently are supported on shallow strip footings. The uplift of the shallow foundations has caused extensive damage to the building and if not corrected, will cause structural failures that will make the building unsafe. The interior walls need to be supported on a foundation system that moves the same as the exterior walls of this wing. Otherwise, the roof, second floor, and interior wall framing will disintegrate from the differential movement between the interior foundations and the exterior foundations.

E. The serpentine concrete ramp (original entry ramp on east side of building) must be replaced or extensively rehabilitated and needs a new foundation system. The complete structural failure of one pier and the rupture of the ramp support at the building threshold caused serious distress to the structure. Reinforcing steel has been stressed beyond the yield point at several locations. Reintegrating the pier that has separated from the underside of the ramp will be difficult. The impacts of reconstructing the ramp may be preferred to the impacts of rehabilitating the structure from an aesthetic and philosophical viewpoint.

F. The concrete slabs on grade in the south wing and administrative wing must be replaced if the space is to be functional for employee use. The widespread, irregular, and continuing uplift of soils beneath these concrete floor slabs make the floor surfaces highly irregular and creates safety hazards for occupants. The foundation work required for other elements of the building will require demolition of the floor slab in many areas of the building. Replacing the slab completely in the south wing and administrative wing will be more appropriate than patching the extensive damage in the irregular remains of the floor slab. The replacement floor slabs should be concrete structural slabs. As shown in the conceptual drawings (S5 andS6), these replacement slabs can be supported on framing and can provide a space under the floor system that can be used as a utility chase, an inspection gallery, or storage and habitable space. The ability to access the underfloor space for inspection, utility repair, or foundation adjustment could be highly beneficial to the stability of the building.

G. The interior partitions of the south wing (between rooms 103 and 104, 104 and 107, 107 and 109, 110 and 111, and the south corridor wall) need to be removed and reconstructed to relieve the roof/visitor gallery beams from uplift forces that are causing beam anchorage failures and to allow reconstruction of the concrete floor slab and provide isolation of the walls from the expansive soils. The interior partitions should be reconstructed in a manner that will prevent future movement of the floor from translating to uplift of the roof/visitor gallery beams.

H. The steel columns of the east glazed solarium wall along building line (10) are currently suspended from the east end butterfly frame. In order to reestablish support for these columns, the connections between the foundation pilasters and the bases of the steel columns need to be rehabilitated. Ideally, the butterfly frame should be lowered a nominal distance in order to lower the column bases to elevations near their original elevations. However, this frame movement is not essential and the connections can be rehabilitated without adjustments to the foundation or column elevations.

I. The exterior CMU walls of the west, east, and south walls and the exterior wall of the administrative wing all exhibit cracking caused by the foundation movements. The foundation movement has distorted the original cylindrical shape of the administrative wing to an elliptical shape draped over a high ridge. These CMU walls need to be replaced. Reconstructing the walls will allow access to the foundation system and return the building to the originally designed shape and appearance.

J. The elevation of the top of the south wall will need to be lowered if the visitor gallery is to be raised and leveled to its original height and the historic roof profile rebuilt for the south wing. This can be done by rebuilding the south wall, or cutting the height of the wall, or lowering the entire wall/foundation system. Because of the amount of cracking and distress in the wall, the distortion of fenestrations in the wall, and the ability to replace the CMU with material of the same type as the original construction, the wall should be reconstructed at its original elevation.

K. Structurally adequate connections between the south ends of the roof/gallery beams and the masonry pilasters of the south wall need to be rebuilt. The supplemental steel rod ties anchored to the inside face of the wall in the 1990’s should be removed if the rebuilt anchorages are successful.

L. The tongue-and-groove timber roof decking of the upper roof, lower roof, and administrative wing roof should be inspected for moisture damage when the roof membranes are replaced. Any significant deterioration should be repaired. No areas of extensive damage are anticipated. Removing and replacing the roof decking over the south wing may be necessary to adequately access the new foundation system with the equipment necessary to construct the underpinning.

M. Unless the administrative wing is reconstructed from the foundation up, the framing systems for the roof and second floor in the administrative wing must be thoroughly inspected and rehabilitated. Broken connections and overstressed members are known to exist. Currently, this portion of the building is probably the most likely to experience a dangerous structural failure. Ceiling finishes will need to be removed and repairs made to the framing systems. Reconstructing the administrative wing to its original design is recommended.

N. Sinkholes in the site grading on the north side of the building provide a path for surface moisture to enter the surrounding site. This surface water infiltration may be supplying the perched groundwater table that allows water to seep through the face of the fossil quarry. Site work adjacent to the north wall could provide positive drainage of surface runoff away from the building foundation. The site work should include means of collecting runoff (e.g. impermeable membranes and/or drain pipe in specially designed trenches) and piping it to an existing drainage structure under the access road to the north of the building.

O. The rails for the hoist gantry need to be realigned if the hoist is to operate correctly. The adjustments necessary should be made after foundation work is complete and the building's framing has stabilized. The scaffolding and hoist systems for the gantry need to be rehabilitated before they can be safely operated.

Mechanical Requirements for Treatment

It is in the best interest of the Government that long-term operating costs be kept as low as practically possible because the National Park Service will be a long-term owner and occupant of this structure. To keep operating costs at a minimum, it is essential that all potential mechanical systems and building envelope treatments considered for inclusion into future designs be analyzed with respect to these costs. Efforts should be made to reduce construction and operating costs as much as possible, while maintaining historical integrity, aesthetics, comfort, simplicity of operation, ease of maintenance, sustainability, and low environmental impact.

The following mechanical description makes recommendations for the proposed building envelope treatments, HVAC, plumbing, and fire protection for the Quarry Visitor Center. This description is based on the premise that the entire admin wing and the entire south wing will be demolished and replaced with similar structures, each with a crawlspace where mechanical components, ductwork, and piping can be located. All designs should be based on current NPS required codes.

"Ductwork" – includes ducts, fittings, housings, dampers, supports, insulation and accessories comprising a system.

"Piping" – includes pipe, fittings, valves, supports, insulation and accessories comprising a system.

Building Envelope:

The new admin and south wings should be insulated to meet current ASHRAE standards and the exhibit shelter should be insulated as much as is practical because of the substantial energy savings that will result. In addition to substantially reducing energy consumption, adequate building insulation has the added benefits of reducing mechanical system size and increasing interior comfort levels.

The addition of low-E treatments to the Quarry Visitor Center glazing is highly recommended because of the significant long term energy savings that will result. Low-E glass will reduce heat loss in winter, heat gain in summer and ultraviolet light transmittance, without significantly reducing the amount of visible light entering the spaces. Modern low-E treatments are available that are virtually invisible and do not appear mirrored or tinted. These treatments have high visible light transmittance, selectable solar heat gain coefficients, and low ultraviolet light transmittance. The visible light transmittance (VT) is a measurement of the percentage of visible portion of the solar spectrum that crosses a glazing assembly. The solar heat gain coefficient (SHGC) is a measurement of solar radiation admitted through a glazing assembly. The ultraviolet light transmittance (UVT) is a measurement of the percentage of UV light that passes through a glazing assembly. The following table quantifies these characteristics for the low-E treatments recommended above, and for uncoated clear glass for comparison:[67]

Glazing Type	Visible Light Transmittance (VT)	Solar Heat Gain Coefficient (SHGC)	Ultraviolet Light Transmittance (UVT)
Single pane clear glass	90%	0.86	65%
High-solar-gain low-E	75%	0.71	as low as 1%
Moderate-solar-gain low-E	75%	0.53	as low as 1%
Low-solar-gain low-E	70%	0.39	as low as 1%

Glazing experts should be consulted and a whole-building lifecycle analysis be performed that takes into account: lifetime building energy consumption, including lighting, heating, and air conditioning costs; daylighting utilization; and the value of cooling equipment displaced by these more advanced glazing systems.

1. Insulate and install vapor barrier on interior face of all exterior crawlspace foundation walls.
2. Insulate and install radiant/vapor barrier between joists above all crawlspaces.
3. Insulate and install vapor barrier on interior face of all exterior walls in new admin wing and new south wing.
4. Insulate and install foil faced radiant/vapor barrier above ceilings of new admin wing and new south wing.
5. Install radiant barrier on roof of new admin wing and new south wing.
6. Insulate and install radiant barrier on exhibit shelter roof – (required only on portion of roof directly above enclosed exhibit space).
7. Fix operable windows in exhibit shelter so that actuation is smooth and units seal properly.
8. Install tempered thermopane high-solar-gain low-emittance (low-E) windows on south elevation of exhibit shelter to allow for higher solar heat gain in winter.
9. Install tempered thermopane moderate-solar-gain low-E windows on east elevation of exhibit shelter to allow for moderate solar heat gain in winter and summer.
10. Install tempered thermopane low-solar-gain low-E windows on west and north elevations of exhibit shelter to reduce solar heat gain from hot afternoon sun in summer.
11. Install new thermopane low-E windows in new admin wing and new south wing with low-solar-gain on west windows, and moderate-solar-gain on all other windows.

HVAC System:

The upper and lower visitor galleries of the exhibit shelter should not be conditioned to comfort conditions, only enough to moderate the temperature for visitors. Outside air for ventilation in the exhibit shelter will be provided by open windows in the summer when visitation peaks, and by infiltration during fall, winter and spring when visitation is substantially less.

The use of ground source heat pumps (GSHPs) is highly recommended because significant long term energy savings will result. In addition, components outside the building are underground,

[67] Efficient Windows Collaborative, Low E coatings. <http://www.efficientwindows.org/lowe.cfm> (accessed 10/03).

which offers concealment from visitors and protection from the elements. According to the Environmental Protection Agency (EPA), GSHP systems are the most energy-efficient, environmentally clean, and cost-effective space conditioning systems available.[68] The EPA also determined that GSHPs can reduce energy consumption–and corresponding emissions–up to 44% compared to air-source heat pumps, and up to 72% compared to electric resistance heating with standard air-conditioning equipment.[69]

The use of radiant heating and cooling systems is also highly recommended because indoor air quality and occupant comfort will be improved, maintenance costs and mechanical equipment sizes will be reduced, and significant long term energy savings will result. Indoor air quality will be improved because ventilation air is not recirculated and the quantity of wet surface cooling coils is reduced, decreasing the potential for mold and bacterial growth and "sick-building" syndrome. Occupant comfort will be improved because large quantities of air are not passed through the conditioned spaces, reducing drafts and noise. The temperature in each space can also be individually regulated, and heating and cooling can occur simultaneously in different areas of the building. Maintenance costs will be reduced because of the inherent system simplicity and mechanical equipment can be centrally located, simplifying maintenance and operation. Mechanical equipment sizes will be reduced because heating and cooling water delivery temperatures are closer to room temperatures. In addition, no space is required within the conditioned room for mechanical equipment. Energy savings will result because water is used as the heat transfer medium. Water has roughly 3,500 times the energy transport capacity of air.[70] Even accounting for the pressure drop involved in pumping water throughout a building, a hydronic system can transport a given amount of heating or cooling with less than 5 percent of the energy required to deliver hot or cool air with fans.[71] In addition, the ventilation function for required outside air is separate, and the volume of air moved can be roughly five times smaller than a conventional ducted air system where most of the air is recirculated. Peak loads are also reduced as a result of the thermal energy storage in the water and the structure.

The following 20 year life cycle cost comparison shows how radiant heating and cooling stacks up against three typical conventional HVAC systems. This comparison was part of a presentation made by Geoff McDonell, P.E. at the U.S. Green Building Council's 2002 International Conference and Expo, and is based on a commercial 90,000 square feet three story office building with windows 50% of total wall area, concrete construction, and R-20 insulation in the walls and roof.[72]

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68 U.S. Environmental Protection Agency, Space Conditioning: The Next Frontier. Office of Air and Radiation, 430-R-93-004 (4/93).

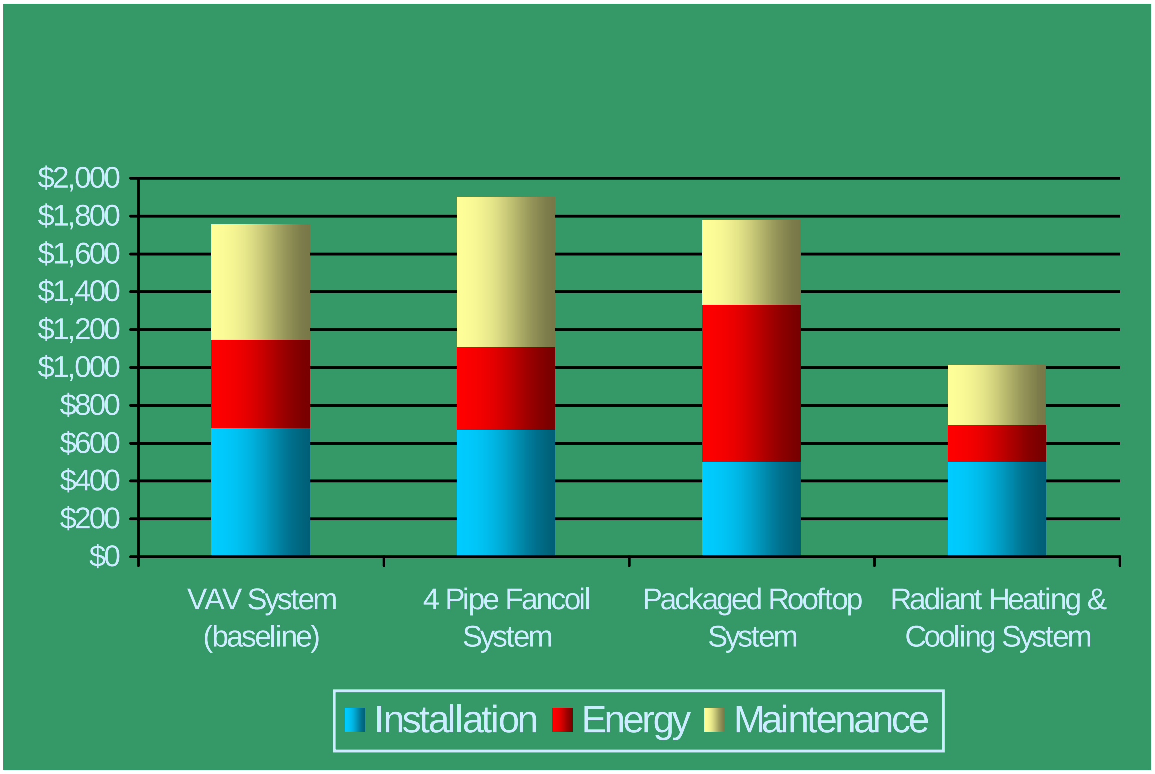
69 U.S. Department of Energy, Energy Efficiency and Renewable Energy, (1998) Geothermal Heat Pumps, DOE/GO-10098-652, <http://www.eere.energy.gov/erec/factsheets/geo_heatpumps.pdf> (accessed 10/03).

70 California Public Utilities Commission, Energy Design Resources, Radiant Cooling Design Brief, <http://www.energydesignresources.com/docs/db-02-radiantcooling.pdf> (accessed 10/03), 2.

71 Ibid, 2.

72 U.S. Green Building Council, (2002) New Approaches to Economical Energy Efficient Buildings, <http://www.usgbc.org/expo2002/schedule/powerpoints/WS206_McDonell_P330.pdf> (accessed 10/03), 38.

Example 20 Year Life Cycle Cost Comparison:



According to Mr. McDonell, the life cycle cost comparison shown above is very conservative, and depicts high efficiency conventional equipment versus a medium efficiency radiant heating and cooling system. A life cycle cost comparison for the Quarry Visitor Center will most likely favor a radiant heating and cooling system even more than that shown in the graphic above.

Combining ground source heat pumps with radiant heating and cooling should provide the most energy efficient, comfortable, low maintenance HVAC system available today. A life cycle cost comparison and value analysis should be performed to compare all viable HVAC alternatives before a preferred alternative is selected.

1. Demolish two boilers and all HVAC equipment in mechanical equipment room (103).
2. Salvage boiler exhaust stack on southwest corner of south wing roof. Re-install exhaust stack on new south wing roof if it is determined that same or similar exhaust stack was present during the 1957-1958 period of significance.
3. Salvage forge fan hanging in lab (104). Rehabilitate historic forge stored in compressor shed west of the exhibit shelter and re-install in new lab along with forge fan.
4. Demolish nine fan coil units on the south wall of the south wing, seven in the lower level of the admin wing, and five in the upper level of the admin wing.
5. Demolish three evaporative coolers on south wing roof, two hanging on east and west sides of admin wing, and one sitting on ground south of admin wing.
6. Demolish LPG make-up air heater on south wing roof.

7. Demolish 12,000 gallon propane tank, fenced enclosure and LPG piping on west side of structure.
8. Ground source heat pumps (GSHP) system, radiant heating and cooling systems and direct digital control (DDC) system shall be designed by an International Ground Source Heat Pump Association (IGSHPA) Certified Designer with extensive experience in radiant heating and cooling systems and DDC systems.
9. Drill GSHP test bore in parking lot and another in level area west of structure to determine drilling conditions and thermal conductivity of site.
10. Install DDC system for entire HVAC system.
11. Install uninterruptible power supply (UPS) with surge suppression for DDC system.
12. Install water-to-water GSHP system in mechanical room (103) for radiant heating and cooling systems, fan coil units, and hot water unit heaters. GSHPs shall be configured in a bank of five or six units including a spare, and shall be staged to activate progressively as called for by the DDC system. Each GSHP shall have a modulating valve, an integral loop field pump, and non-ozone depleting refrigerant. The system shall be capable of supplying both heating and cooling water simultaneously to allow individual temperature control in all zones. The primary GSHP shall have a heat recovery package to supplement hot water to the domestic water heater in the summer months.
13. Install GSHP loop field beneath level area west of structure – (loop field shall be installed by an IGSHPA Accredited Installer).
14. Install primary and backup heating and cooling water circulation pumps in mechanical room, both with variable frequency drives (VFD) for energy savings.
15. Install four pipe hydronic systems with two supply pipes and two return pipes to each radiant zone and each fan coil unit, and one supply pipe and one return pipe to each hot water unit heater.
16. Install cross-linked polyethylene (PEX) tubing for radiant heating and cooling in concrete floors of new admin wing (both levels), new south wing, and both upper and lower visitor galleries in exhibit shelter. The upper visitor gallery (201) concrete floor will have to be shaved 1½ to 2-inches before new concrete and PEX tubing can be installed to maintain historic floor elevation. The lower visitor gallery (102) concrete floor should be removed and replaced with concrete poured on a new structural floor to insure long term leak-free operation. All radiant floor slabs should be divided into 10’x10’ sections, with each section containing separate tubing, concrete reinforcement, and control joints to allow for minor building movement.
17. Install polypropylene capillary tube mats for radiant heating and cooling above gypsum board ceilings in new admin wing (both levels), behind gypsum board south wall of upper visitor gallery (201), and behind gypsum board upper north wall of new south wing – (capillary mats located in ceiling of new south wing are preferred, but historic tongue and groove wood ceiling makes this impractical). Note that all capillary tube mats shall be sandwiched between gypsum board and light gauge sheet metal for rodent protection. Also, all supply and return lines to and from the mats shall be copper for rodent protection.
18. Configure radiant heating and cooling systems and controls to automatically bypass GSHPs and to pump loop field water directly to radiant zones when loop field water temperature is low enough to provide cooling.
19. Control radiant heating and cooling systems with DDC system. Radiant heating and cooling systems shall have a separate zone for each space for a total of at least 15 zones.

20. Install two control valves, one dew point sensor, one room temperature controller, and all associated wiring for each of 15 radiant heating and cooling zones.
21. Install a variable speed fan coil unit in crawlspace beneath admin wing for dedicated outside air system (DOAS).
22. Install DOAS grated concrete areaway with louver and motorized damper in west wall of admin wing crawlspace for outside air (OA) intake.
23. Install DOAS supply ductwork in crawlspace, within furred-out wall between floors, and beneath second floor of admin wing.
24. Install DOAS supply grilles in floors of both lobbies (112 & 202) and all admin wing offices (113, 114, 115, and 204).
25. Install screened transfer grilles in floors of admin wing first floor rooms for partial DOAS exhaust to admin wing crawlspace.
26. Install ductwork above admin wing's first floor ceiling for remaining DOAS exhaust to exhibit shelter through backdraft dampers above ceiling in lobby (112) north wall. (Second floor DOAS exhaust will be extracted by bathroom exhaust fans).
27. Install DOAS exhaust registers in lobby ceiling (112) and office ceilings (113, 114 and 115).
28. Control admin wing DOAS with DDC system. DOAS system shall operate only during occupied hours with variable OA intake and exhaust to mimic seasonal visitation fluctuations (i.e.: 100% in summer, 50% in spring and fall, and 25% in winter). OA shall be filtered, then heated, cooled or left unconditioned by fan coil as dictated by temperature sensor in OA ductwork.
29. Install a fan coil unit in mechanical room (103) for south wing DOAS.
30. Install louver and motorized damper in west wall of mechanical room (103) for south wing DOAS OA intake.
31. Install DOAS supply ductwork in south wing crawlspace with supply grilles in floors of all south wing rooms (101, 103, 104, 110 and 111), except staff restroom (107).
32. Install screened transfer grilles in floors of same rooms noted above for DOAS exhaust to south wing crawlspace.
33. Control south wing DOAS with DDC system. DOAS system shall operate only during occupied hours. OA shall be filtered, then heated, cooled or left unconditioned by fan coil as dictated by temperature sensor in OA ductwork.
34. Install a high-velocity fan coil unit in mechanical room (103) for conditioned air system (CAS) in exhibit shelter.
35. Install louver and motorized damper in north wall of lunch room (101) for CAS return air.
36. Install high-velocity CAS supply ductwork in pipe chase within south wall of upper visitor gallery (201) with adjustable linear diffusers located towards top of 4-feet high wall.
37. Install high-velocity CAS supply ductwork from pipe chase down through space above corridor's (105) ceiling, then exposed below lower visitor gallery (102) ceiling with supply outlets located below north edge of upper visitor gallery (201) deck directed towards lower visitor gallery's northeast extension – (if gallery extension to allow visitor access to the quarry face is to remain).
38. Control exhibit shelter CAS with DDC system. CAS system shall operate only during occupied hours when temperature spikes occur. Return air shall be filtered, then heated or cooled by the high-velocity fan coil unit as dictated by temperature sensor in return air ductwork.

39. Install exhaust fan with exhaust louver in employee restroom (107) exterior wall. Control fan with occupancy sensor.
40. Install two exhaust fans in ceiling above janitor's closet (206) with exhaust louver in masonry above second floor window and ductwork above ceiling to serve restrooms (207) and (208). Control each fan independently with separate occupancy sensors.
41. Install automatic actuators on all operable windows in the exhibit shelter. Actuators shall be low profile and incorporate the historic gearbox to minimize visual impact.
42. Controls for the operable windows shall include a thermostat located on upper visitor gallery (102), an adjustable time clock, and a manual override switch for each building elevation.
43. Test for radon gas in new crawlspaces.
44. Continually ventilate each crawlspace with an exhaust fan for moisture removal and radon gas removal – (semi-conditioned make-up air provided from ground floors through screened transfer grilles mentioned above). Discharge exhaust air from a grated concrete areaway in west wall of each crawlspace.
45. Heat admin wing crawlspace and south wing crawlspace with hot water unit heaters to 45-degrees F to prevent plumbing lines from freezing.

<u>If lab (104) is to be a working lab:</u>

46. Salvage and rehabilitate fume hood in lab (104) and re-install in new lab – (if working lab, otherwise salvage for new lab in Vernal).
47. Salvage air filter, in-line fan, and associated sheet metal hanging in lab (104) and re-install in new lab – (if working lab, otherwise salvage for new lab in Vernal).
48. Salvage dust collection system hanging in lab (104) along with exhaust fan sitting on concrete pad outside lab. Re-install dust collection system in new lab, and exhaust fan on concrete pad outside lab – (if working lab, otherwise salvage for new lab in Vernal).
49. Install bag house style dust collector on concrete pad outside lab to filter dust collection system exhaust – (if working lab).
50. Install a fan coil unit in mechanical room (103) for dust collection make-up air system (DCMAS) in lab – (if working lab).
51. Install louver and motorized damper in west wall of mechanical room (103) for DCMAS OA intake – (if working lab).
52. Install DCMAS supply ductwork in south wing crawlspace with supply grilles in lab floor – (if working lab).
53. Control lab DCMAS with DDC system. DCMAS system shall operate only when dust collector is operating. OA shall be filtered, then heated, cooled or left unconditioned by fan coil as dictated by temperature sensor in OA ductwork – (if working lab).

Plumbing System:

Water supply lines and waste lines will be located in the new admin wing and south wing crawlspaces. Potential changes include a second employee restroom to provide one restroom for each sex, and additional fixtures in both visitor restrooms to accommodate increased visitation.

1. Demolish all plumbing fixtures, components and associated piping (domestic hot, hot return and cold, waste and vent) in south wing and admin wing except for fixtures in men's room (207) and women's room (208).
2. Salvage and rehabilitate two lavatories, two urinals, two water closets, two sensor operated lavatory faucets, and four sensor operated flush valves in men's room (207) and re-install with associated piping (domestic hot, hot return and cold, waste and vent) in new men's room.
3. Salvage and rehabilitate two lavatories, three water closets, two sensor operated lavatory faucets, and four sensor operated flush valves in women's room (208) and re-install with associated piping (domestic hot, hot return and cold, waste and vent) in new women's room. Demolish modern water closet in women's room and replace with salvaged water closet to match existing three.
4. Demolish compressed air piping in lab (104) and re-install new compressed air piping in new lab – (if working lab).
5. Demolish copper tubing hung along exterior of building for evaporative coolers.
6. Demolish storm drain line from trough in exhibit shelter (201) roof to exterior southeast corner of library (111). Re-install two larger diameter lines; one near column B1 for the three western roof drains, the other near column B10 for the three eastern roof drains. Both storm drain lines shall discharge to daylight onto concrete swales sloping away from building. The eastern concrete swale should discharge onto the parking lot to remove water by evaporation. Secondary roof drainage will continue to be spilled off the east and west edges of the exhibit shelter roof.
7. Install heat tape directly beneath roof drains and on all exposed horizontal storm drain lines in exhibit shelter (201).
8. Install roof drains on new admin wing and run storm drain lines concealed in admin wing's exterior wall cavities. Discharge to daylight onto concrete swales sloping away from building.
9. Install gutter on south eave of new south wing and run downspouts exposed on south wing's exterior south wall. Discharge to daylight onto concrete swales sloping away from building.
10. Install single corrosion resistant water supply entry system for domestic water and fire protection. The system shall be flexible and shall be installed beneath the foundation to allow for expansive soils. The system shall have link-seals and flexible containment piping that slopes back to a vault for leak containment and manual leak detection. The system shall be similar to existing water supply entry system shown on the 1991 drawings.[73]
11. Install water meter capable of monitoring low flow conditions for leak detection.
12. Relocate underground sanitary sewer line from beneath ramp to service drive south of ramp for easier future access.
13. Install corrosion resistant, flexible waste line discharge systems beneath foundation to allow for expansive soils. The systems shall have link-seals and flexible containment piping that slopes to a manhole for leak containment and manual leak detection. The quantity of waste line discharges shall be minimized to simplify inspection. Investigate "whole house trap" with cleanouts at both ends if waste line discharges will not drain positively beneath foundations – (whole house traps are required by many municipal plumbing codes on east coast of U.S.).

[73] 07/02/91 - "Water/Sewer Reconstruction – Quarry Visitor Center", Construction Drawings, 122/80045, RMR.

14. Install single-wall water supply lines and waste lines in the new admin wing and new south wing crawlspaces. Lines shall be above grade and easily accessed for inspection and leak detection.
15. Install sink, faucet and associated piping (domestic hot, hot return and cold, waste and vent) in new lunch room (101).
16. Install service sink, faucet and associated piping (domestic hot, hot return and cold, waste and vent) in mechanical equipment room (103).
17. Install 40 gallon electric water heater and associated piping (domestic hot, hot return and cold) in mechanical equipment room (103) and connect to GSHP heat recovery system.
18. Install domestic hot water circulation pump near water heater and associated piping to serve lunch room (101), lab (104), staff restrooms (107 & ?), janitor's closets (108 & 206), men's restroom (207), and women's restroom (208).
19. Install floor drains and associated piping (waste and vent) in mechanical equipment room (103) near water heater, service sink, and GSHPs.
20. Install sink, faucet with eyewash, and associated piping (domestic hot, hot return and cold, waste and vent) in lab (104).
21. Install lavatory, water closet, shower, floor drain, and associated piping (domestic hot, hot return and cold, waste and vent) in staff restroom (107).
22. Install lavatory, water closet, shower, floor drain, and associated piping (domestic hot, hot return and cold, waste and vent) in new staff restroom – (if added).
23. Install service sink, floor drain and associated piping (domestic hot, hot return and cold, waste and vent) in janitor's closet (108).
24. Install seasonal electric water cooler and associated piping (domestic cold, waste and vent) outside under ramp near main doors.
25. Install electric water cooler and associated piping (domestic cold, waste and vent) in upper lobby (202).
26. Install service sink, floor drain and associated piping (domestic hot, hot return and cold, waste and vent) in janitor's closet (206).

Fire Protection:

The crawlspace beneath the admin wing will require fire protection because it may be used for storage and it will contain mechanical equipment. The crawlspaces beneath the exhibit shelter floor and the south wing floor will not be used for storage nor contain mechanical equipment, and therefore will not require fire protection.

1. Demolish fire riser and double check valve backflow preventer in lunch room (101).
2. Demolish fire sprinkler heads and associated piping in lunch room (101), mechanical equipment room (103), storage (103A), lab (104), and staff restroom (107).
3. Demolish fire hose cabinet in lab (104) and fire line serving cabinet in staff restroom (107).
4. Demolish Halon system in paleontologist office (110) along with associated Halon tank and piping in janitor closet (108).
5. Demolish Halon system including Halon tank and associated piping in library (111).
6. Perform flow and pressure test to determine water supply characteristics before fire protection system design begins.

7. Design fire protection system early to coordinate with architectural, structural, and other mechanical. Preferred sprinkler head locations and pipe routing shall be shown on A/E's drawings to minimize both visual impact and damage to historic fabric.
8. Install water flow alarm switch, fire department connection, and supervised double check valve backflow preventer along mechanical room's (103) west wall.
9. Install wet pipe sprinkler system in lower visitor gallery (102) of exhibit shelter with exposed pipes in south wing and dry sidewall sprinkler heads penetrating divider wall to prevent heads from freezing in exhibit shelter.
10. Install wet pipe sprinkler system in new admin wing with piping concealed above gypsum board ceiling on first and second levels, and exposed in crawlspace.
11. Install wet pipe sprinkler system in new south wing with piping exposed below historic tongue and groove wood ceiling.

<u>If historic documents are to be stored in library (111) and paleontologist office (110):</u>

12. Install water mist sprinkler system in library (111) and paleontologist office (110) with piping exposed below historic tongue and groove wood ceiling. Locate water mist system's gas driven pump unit in janitor's closet (108).

Electrical Requirements for Treatment

ELECTRICAL SYSTEMS

General

Recommended Treatments

Primary Electrical Distribution – It is recommended that the existing Quarry Visitor Center's pad-mounted transformer be replaced to feed the existing and future loads at the Visitor Center.

It is recommended that the meter be returned to the metering section of the main switchboard.

It is also recommended that the existing main switchboard be replaced to feed the existing and future loads at the Visitor Center due to the increase in electrical load required by the proposed HVAC system.

Secondary Electrical Distribution – It is recommended that the existing secondary electrical wiring system for the Visitor Center be replaced. This includes branch wiring. It is recommended that the panelboards be replaced with panelboards with isolated ground bus and 200% rated neutral. Transient voltage surge suppression is recommended for the service entrance and each individual panelboard.

It is recommended that exterior light fixtures be removed, refurbished by a UL listed shop, and reinstalled. However, it is recommended that the interior lighting system in the South and Administration wings be replaced with an appropriate energy efficient lighting system. The existing lighting system shall be salvaged.

Adaptive reuse of the Preparation Lab area for office space will entail installation of additional power and telephone outlets.

New elements related to the electrical system are replacement of the existing fire and security alarm systems and installation of a lightning protection system.

Implementation of a good maintenance program would ensure future reliable operation of the system and is strongly recommended. This would include annual visual inspections, checking tightness of connections, testing circuit breakers, cleaning/replacing lamps, and testing the grounding system.

Emergency Systems – Due to the high initial costs, maintenance factors, and no critical loads, standby power (i.e. emergency generator) is not recommended for the Quarry Visitor Center. However, emergency lighting units with battery backup are recommended for safety.

Lighting

Recommended Treatments. Replace the existing lighting system with a new, energy efficient lighting system. T8 fluorescent lamps with electronic ballast are recommended for office space, hall, kitchen, and mechanical room to replace the less efficient existing T12 lamps. T8 fluorescent lamps with ultraviolet protection are recommended for the Preparation Lab. Track lights are recommended for the Information/Sales area and for the Lobby to preserve the historic integrity of these areas. Historic light fixtures in Exhibit Shelter shall be removed, refurbished by a UL listed shop, reinstalled, and wired to the new panelboards.

Occupancy sensors should continue to be used in bathrooms and kitchen. Light level sensors are recommended for exhibit area and offices close to windows, to maximize natural lighting use and minimize energy costs.

Communications Systems.

Recommended Treatments. It is recommended that the telephone backboard be replaced with a telephone cabinet. It is also recommended that the interior telephone system be rewired in a neat manner and all wires labeled. It is also proposed that the server for the park be brought to the Quarry Visitor Center. A separate room in compliance with ANSI EIA/TIA will be required.

Fire Detection and Alarm System:

Recommended Treatments. Since a significant portion of the building is proposed to be demolished, it is proposed that the existing fire detection and alarm system be entirely removed and replaced. Technology in the area of fire alarm systems advances so fast that it is not worth salvaging the components or the Fire Alarm Control Panel. The new system should provide detection in the entire structure. An alarm system complying with NFPA 72 should be installed.

In addition, there are no audio/visual devices present. An appropriate system should be installed as part of the new alarm system. An appropriate system might include a universal alarm control panel, projected beam smoke detectors to minimize visual distraction, addressable manual pull stations, speaker, and strobe for audio/visual requirements. All installations shall conform with the 2002 National Electrical Code and NFPA standards.

An auto dialer should be included and either hard-wired or radio-signaled to the maintenance facility.

Security Alarm System:

Recommended Treatments. Since a significant portion of the building is proposed to be demolished, it is proposed that the existing security alarm system be entirely removed and replaced. Technology in the area of security alarm systems advances so fast that it is not worth salvaging the components or the Security Alarm Control Panel. The new system should provide protection in the entire structure.

An appropriate system should be installed as part of the new alarm system. An appropriate system might include a universal alarm control panel, motion detectors, speaker, and bell. All installations shall conform with the 2002 National Electrical Code.

An auto dialer should be included and either hard-wired or radio-signaled to the maintenance facility.

Lightning Protection. Protection is recommended because of the severe high risk assessment given to the Quarry Visitor Center., according to the 2000 NFPA 780. The risk assessment consists of determining the type of structure, size of structure, the structure location (topography), and the occupancy and contents of the structure. The risk was determined to be of risk value resulting from an equivalent R Value of 10.33, which is high and well above the recommended value.

Alternatives for Treatment

Civil Alternatives for Treatment

Alternative Treatment for Civil Work	**Advantage**	**Disadvantage**
	Beneficial Effects	*Adverse Effects*
Test/inspect/repair water and sewer systems outside of buildings	Will eliminate any water leaking into the ground and causing soil to swell.	None.
Replace sewer system near building if foundation work destroys it.	Must have sewer system.	None.
Keep putting stormwater into sanitary sewers.	No additional cost. No new stormwater system to maintain.	It is usually not good practice to put stormwater into a sanitary sewer.
Construct new underground stormwater system.	Gets stormwater out of the sewers, keeps stormwater underground and out of the way.	Additional construction and maintenance costs. Pipes may plug or break and leak.
Construct new surface stormwater system.	Gets stormwater out of the sewers, puts it on surface where system performance can easily be observed.	Additional construction and maintenance costs. Site will have to be regraded periodically and concrete swales may break up over time.

Site Alternatives for Treatment

Alternative Treatment	Advantage	Disadvantage
	Beneficial Effects	*Adverse Effects*
1. Apply waterproof membrane to ground surface north side of gallery	Eliminate rain water penetration to rock strata and building foundation	May block water recharge to nearby wells, stopping of ground water recharge
2. Re-grade site to drain surface water away from structure	Protects foundation from shrink swell of bentonite clays when water is added or removed	Collection requires safe discharge area away from site, structures, to lower elevations to prevent erosion
3. Install new drainage system	Protects foundation from shrink swell of bentonite clays when water is added or removed	Collection requires safe discharge area away from site, structures, to lower elevations to prevent erosion
4. Hard surface all areas surrounding historic structure	Prevents rainfall absorption into the ground.	May block water recharge to nearby wells, stopping of ground water recharge
Exposed aggregate concrete for pea gravel surface Concrete walks Asphalt parking	Collection allows control distribution, and discharge	Collection requires safe discharge area away from site, structures, to lower elevations to prevent erosion
	Removes rain runoff from adjacent foundation with properly sloped pavements	
	Replaces damaged travel surfaces for visitor safety	
5. Construct shade structure/ restrooms/bus stop south end of parking	Provides node where activities of bus stop, information, restrooms and shade remove congestion from the front door.	Construction occurs on talus slope
	Reduces amount of water and related utilities from historic structure.	Visual intrusion to historic structure
		Removes visitor from resource.
6. Construct formal parking sites for employees west of	Removes employee parking from visitor parking	

Alternative Treatment	Advantage	Disadvantage
	Beneficial Effects	*Adverse Effects*
historic structure in service area.		
7. Construct wall along south side of the service drive	Secures employee vehicles	
	Additional visitor parking in visitor parking area	
	Catches rock/debris fall behind wall	

Architecture Alternatives for Treatment

Alternative Treatment	**Advantage**	**Disadvantage**
	Beneficial Effects	*Adverse Effects*
Retain the masonry shell of the Admin Wing	Retains more historic fabric	The appearance will be affected by severe crack repair and racked window and door openings

Structural Alternatives for Treatment

Alternative Treatment	**Advantage**	**Disadvantage**
	Beneficial Effects	*Adverse Effects*
Separate shallow strip footings from butterfly frame foundation pedestals	Reduces foundation bearing area increasing foundation pressures on subsoils under butterfly frames. This helps resist soil swelling pressures and reduces movement of footings.	Separated elements may move independently of each other causing cracks and misalignments at interface of adjoining building elements. Will require flexible joints which might alter appearance.
Underpin only three butterfly frames exhibiting significant movement and do not underpin other seven frames.	Reduces cost of underpinning work and reduces demolition of some floor slab areas.	Leaves internal seven frames in a susceptible condition for future movement. Movement of internal frames with stabilized three external frames will cause the same differential movements ruptures and cracking.
Underpin all ten butterfly frame footings.	Stabilizes the framing in the museum and minimizes the risk of future distress.	Higher cost.
Convert strip footings/stem walls under east and west walls to grade beams and underpin with piers or piles	Foundation bearing is at lower stable strata. Bearing pressures are higher and resist swell pressures of soils.	Higher cost. Results in linking three types of foundation—1967 grade beams, new grade beams, and converted foundation walls.
Convert strip footings/stem walls under south wall of south wing to grade beams and underpin with piers or piles	Foundation bearing is at lower stable strata. Bearing pressures are higher and resist swell pressures of soils.	Higher cost. Leaves structure in distorted state preventing rehabilitation of roof drainage and visitor gallery.
Lower south wall during underpinning process	Lowers top of wall and rotates roof/gallery beams back to original position which will level gallery and slope roof to drain at south edge.	Technically more challenging. Can cause problems at interface with administrative wing due to integrated construction. Additional differential movements may cause new damage to building.
Cut off top of south wall to original elevation.	Lowers top of wall and rotates roof/gallery beams back to original position	Changes original construction. Detailing changes to windows along

Alternative Treatment	Advantage	Disadvantage
	Beneficial Effects	*Adverse Effects*
	which will level gallery and slope roof to drain at south edge.	top of south wall is problematic.
Rebuild south wall	Allows access to south edge of museum with heavy construction equipment thus facilitating underpinning of butterfly frames, reconstruction of floor slab, and construction of new foundation for south wall. Greatly facilitates constructability thus reducing costs. Recreate the original architecture including, roof profile, elevations, gallery elevation, and exterior appearance. Least cost alternative.	Loss of original material.
Replace existing concrete slab-on-grade with new concrete slab-on-grade	Simplest solution	New slab will still be susceptible to movement of supporting subsoils. Buries water utilities beneath hard construction making maintenance and inspection difficult.
Replace existing concrete slab-on-grade with new structurally supported concrete floor system	Provides separation of floor and underlying unstable soils. Provides access to underfloor area for inspection and maintenance of water utilities and foundation drainage. Transfers more dead weight to pier foundations to resist uplift forces. Allows excavation for underpinning butterfly frames to be more extensive without being more expensive. Allows floor to remain stable relative to wall and roof framing reducing possibility	Nominal additional cost

Alternative Treatment	Advantage	Disadvantage
	Beneficial Effects	*Adverse Effects*
	of interior wall distress.	
Underpin the foundations of the administrative wing	Least disturbance to original construction.	Very expensive due to limited access to interior foundations with heavy equipment. Retains cracked CMU and distorted walls causing problems for the rehabilitation of doors and windows and architectural aesthetic concerns. Will still require gutting roof and floor systems to repair damaged framing.
Separate and temporarily move administrative wing away from remainder of building to allow heavy construction equipment to access foundation construction.	Allows easier access to site for new foundation construction and for underpinning butterfly frames' footings. Building wing can be replaced to original shape and elevation. Reducing distortions in interior and roof framing systems.	Technically, extremely difficult. Moving building will require separating integrated construction from other portions of the building. May aggravate some cracking in existing materials. Reintegrating wing to adjacent construction will require special considerations. Distortion of building shape may cause unforeseen complications. Requires gutting interior finishes to repair interior roof and floor framing damage.
Underpin the existing serpentine concrete ramp	Stabilizes the ramp. Less cost. Retains original materials	Ramp encumbers access to other areas of construction increasing cost of foundation work for administrative wing and eastern butterfly frame footings. Ruptured concrete elements will appear "patched" when completed. Difficult to reintegrate the ruptured upper end of the ramp with the original wall construction. Will likely result in supplemental

Alternative Treatment	**Advantage**	**Disadvantage**
	Beneficial Effects	*Adverse Effects*
		exposed framing altering the building appearance at the entrance.
Reconstruct entire serpentine concrete ramp or large portions of the ramp.	Less cost. Allows access by heavy equipment to the east façade of the administrative wing and the museum. Can reintegrate the ramp with the building as per the original architectural concept. Eliminates highly distressed portions of the structure.	Loss of original construction materials.
Lower butterfly frames at east end to lower east wall framing to top of foundation wall.	Reverses some of the movement that caused rupturing of structural materials. Returns wall to an elevation closer to original. Closes openings in joints at base of wall.	Technically more challenging. May cause slight additional damage to wall.
Stabilize east wall in existing location (no change to elevations)	Less cost	Leaves larger voids and ruptures to patch and rehabilitate. Harder to reintegrate the steel framed glazed wall with the concrete foundation walls.
Install membrane and drain system on plateau north of the building to intercept surface water before it enters subsurface geology.	Reduces water in geological strata that are moisture sensitive. Helps keep rock material behind fossil-bearing sandstone outcrop from expanding and pushing out face of quarry.	Higher cost.

Mechanical Alternatives for Treatment

Alternative Treatment	**Advantage**	**Disadvantage**
	Beneficial Effects	*Adverse Effects*
Install new console type fan coil units along walls in admin wing, in pipe chase below bookshelves in south wing, and along south wall in upper and lower visitor galleries.	Lower initial cost than radiant heating and cooling.	Higher operating costs due to reduced energy efficiency and increased maintenance. Reduced comfort. Condensate must be drained from each unit complicating plumbing waste system and introducing additional water beneath structure. Filters in each unit need to be changed periodically. Dedicated outside air system with ducting in crawlspace still required for admin wing and south wing. New console units will take up valuable floor space in admin wing, and will not look historic in admin wing or exhibit shelter.
Install underfloor air distribution system in admin wing and south wing crawlspaces, beneath admin wing's second floor, and beneath new structural floor in lower visitor gallery. Install return air ducting in admin wing ceilings, in south wing crawlspace (due to south wing's historic tongue and groove wood ceiling), and in lunch room wall for lower visitor gallery.	Slightly lower initial cost than radiant heating and cooling. Reduces amount of water pumped through building.	Higher operating costs due to significantly reduced energy efficiency and increased maintenance. Reduced comfort; especially for upper and lower visitor galleries because heat transfer is not direct as it is with radiant – (heating and cooling with air is "lost" in large space, unless entire space is conditioned). More and larger floor grilles in all spaces, changing the historic appearance. Limited space and difficult routing back to HVAC units for return air ducting in admin wing ceilings. Inefficient air mixing in south wing with both supply

Alternative Treatment	Advantage	Disadvantage
	Beneficial Effects	*Adverse Effects*
		and return grilles in floor.
Install GSHP loop field beneath parking lot east of structure.	Not as many utilities as level area west of structure. Larger area that will accommodate more bores.	Further away from mechanical room (103) increasing pumping costs.
Install new propane boilers and indirect (2 stage) evaporative cooling system.	Lower initial cost than ground source heat pump (GSHP) system. Propane tank existing on site.	Higher operating costs due to reduced energy efficiency and increased maintenance. Explosive gas inside structure. Requires chimney/stack and combustion air system.
Install new solar hot water generating system on level area west of structure with new backup propane boilers and indirect (2 stage) evaporative cooling system.	Similar long term energy costs to GSHP system. Propane tank existing on site.	Higher initial cost than GSHP system. Higher long term costs due to substantially increased maintenance. Explosive gas inside structure. Requires chimney/stack and combustion air system. Solar collectors visible to visitors. Solar collectors susceptible to environmental damage. Large water tank required for thermal storage introducing additional water to site.

Assessment of Effect for Recommended Treatment

Civil Assessment of Effect for Recommended Treatment

Treatment	Potential Effects	Mitigating Measures	Beneficial Effects
1. Test buried water lines, repair any leaks found.	Ground already disturbed so digging will not disturb resources.	None required.	Will stop water from leaking into ground and causing swelling.
2. Inspect sewer lines with TV, repair any leaks found.	Ground already disturbed so digging will not disturb resources.	None required.	Will stop water from leaking into ground and causing swelling
3. Repair sewer manholes as needed.	Ground already disturbed so digging will not disturb resources.	None required.	Will stop water from leaking into ground and causing swelling
4. Replace manholes and sewer lines if new building foundation is constructed.	Ground already disturbed so digging will not disturb resources	None required.	Will stop water from leaking into ground and causing swelling
5. Keep stormwater draining into sewer	No new digging so no disturbance. Will continue to increase flows at treatment plant.	None required.	Will continue to remove stormwater from site with only one combined sewer/stormwater pipe to maintain.
6. Construct new underground stormwater drainage system.	Digging may disturb undisturbed soils.	May require clearance of pipe routes.	Will remove stormwater from site without loading sewer system.
7. Construct new surface stormwater drainage system.	Overexcavating for concrete swales will disturb some soils.	Minor surface grading will probably not require clearance.	Will remove stormwater from site without loading sewer system.

Site Assessment of Effect for Recommended Treatment

Treatment	Potential Effects	Mitigating Measures	Beneficial Effects
8. Apply waterproof membrane to ground surface north side of structure	Eliminate rain water penetration to rock strata and building foundation	Required	Keep expansive soil dry and eliminate soil shrink swell damaging the new foundation of building below
9. Re-grade to create drainage away from the structure	Cause rain runoff to drain away from structure	East, west and south sides of the structure have been previously disturbed by grading operations	Create positive drainage away from structure
10. Install new drainage structures	Removal of rain water penetration to rock strata repairs or replaces the existing system.	Replaces existing system.	Carry away rain runoff from site in a controlled structure
11. Replace parking area	Hard surface parking collects and directs rain runoff away from structure	Replacement of existing parking area	Repair to undulating surface. Smooth surface remove safety tripping hazards. Improves surface drainage.
12. Replace concrete walks	Replaces undulating and cracked asphalt walks	Replacement of concrete walks restores walks to original condition at time of construction and original condition within historic zone	Construction of a hard smooth walking surface reinforced with steel rebar to resist ground movement
13. Replace ground cover aggregate with hard surface.	Promote positive drainage away from structure	Already disturbed site None	Maintenance free, replace pea gravel aggregate with exposed aggregate concrete to promote positive drainage away from structure
14. Replace timber curbing	Remove undulating curbing and safety hazard of tripping	Replacement of timber curbs restores curbs to original condition at time of construction	Replacement with concrete curb and gutter promoting positive collection

Treatment	Potential Effects	Mitigating Measures	Beneficial Effects
		and original conditions within historic zone	and direction of drainage away from site.
15. Repair existing guard rails and interpretative signs	Repair unsightly view of guard rail. Continues interpretation and education for the visitors enjoyment	None	Continues direction of pedestrian traffic. Keeps unwanted travel off soft side slopes of the parking area. Upgrade traffic guard rail to FHWA Standards.
16. Provide bus stop restroom shelter	Intrudes on historic structure Could minimize water usage within historic structure thereby minimum future catastrophic events	Make new construction of structure as distant from photographic view of historic structure as possible. Architecture must be complementary to historic structure	Relocates water related utilities away from the structure. Provides potential shade structure for a bus stop. Provides updated restroom facilities.
17. Construct retaking wall along south service drive	Collects debris behind wall	Minimum maintenance operations and cost	Prevents rock debris from falling into service drive and contacting reconstructed administration wing.
18. Remove employee parking of vehicles from visitor parking area	Visible from gallery	Service area already exists	Additional visitor parking

Architecture Assessment of Effect for Recommended Treatment

Treatment	Potential Effects	Mitigating Measures	Beneficial Effects
19. Demolition of the South Wing.	Loss of historic fabric.	Reconstruction of South Wing reusing original windows, doors assemblies.	New foundation system that will reduce structural displacement caused by expansive soils thus making the structure habitable and restoring the historic scene. New roof will restore the historic roof drainage and historic appearance.
20. Demolition of the Admin Wing.	Loss of historic fabric.	Reconstruction of Admin Wing reusing original windows, doors, steel window wall, birch plywood finishes, steel structural frame, and stair assemblies.	New foundation system that will reduce structural displacement caused by expansive soils thus making the structure habitable and restoring the historic scene.
21. Shore and remove Serpentine Entry Ramp for rehabilitation.	Minor loss of historic fabric because the Entry Ramp support may have to replaced or repaired.	The shored Entry Ramp will be moved back to its historic location after the Admin Wing has been reconstructed.	Retention of a major character-defining feature and enhancement of the historic scene.
22. Rehabilitation of Exhibit Shelter steel frame.	Loss of historic fabric—removal of sacrificial paint coats and brittle glazing.	New paint to match historic color.	Reestablishes the historic scene.
23. Removal of glass from the Exhibit Shelter	Loss of historic fabric and possibly a slight change of appearance	Replacement with safety glass and flexible glazing.	Hazards from falling glass will be reduced. Potential energy savings from well fitting glass panes.
24. Removal of Mezzanine Deck.	Loss of historic fabric.	Replacement with new concrete deck that is level.	Allows opportunity to install new integrated heating system
25. Removal of existing roof membrane from the Exhibit Shelter and repair of roof	Minor loss of historic fabric if any roof sheathing has to be replaced	Installation of a new roof membrane and improved drainage.	The roof will not leak in the future

Treatment	Potential Effects	Mitigating Measures	Beneficial Effects
sheathing, if required			
26. Removal of Visitor Gallery (102) concrete floor slab.	Loss of historic fabric.	Replacement with new concrete deck.	Ease of correction to Exhibit Shelter structure.

Structural Assessment of Effect for Recommended Treatment

Treatment	Potential Effects	Mitigating Measures	Beneficial Effects
27. Underpin footings of butterfly frames	Extensive excavation may encroach on strata of cultural or paleontological significance	Design will minimize excavation consistent with structural needs. Excavations will be monitored for significant findings	Stabilizes existing structure with invisible foundation improvements
28. Underpin the shallow strip footings under the east and west walls of the museum	Excavation may encroach on strata of cultural or paleontological significance	Design will minimize excavation consistent with structural needs. Excavations will be monitored for significant findings	Stabilizes existing structure with invisible foundation improvements
29. Underpin the shallow foundations of the administrative wing	Excavation may encroach on strata of cultural or paleontological significance	Design will minimize excavation consistent with structural needs. Excavations will be monitored for significant findings	Stabilizes existing structure with invisible foundation improvements
30. Construct new grade beam and pier foundation system for the south wing	Excavation may encroach on strata of cultural or paleontological significance	Design will minimize excavation consistent with structural needs. Excavations will be monitored for significant findings	Stabilizes existing structure with invisible foundation improvements
31. Replace concrete floor slab-on-grade with structural concrete floor system in administrative wing and south wing.	Excavation may encroach on strata of cultural or paleontological significance. Changes original architectural design of floor.	Excavations will be monitored for significant findings. Finish on concrete will replicate finish on original concrete floor.	Allows space beneath floor to isolate floor slab from expansive subsoils and provides access for utility and drainage systems' inspection and maintenance
32. Reconstruct south wall of south wing.	Loss of original construction materials	Will replace with construction materials of like kind and finish. Both original and replacement materials are commercially produced in automated processes. Therefore,	Allows restoration of original architectural appearance, elevations, and roof systems. Eliminates disintegrated and ruptured materials.

Treatment	Potential Effects	Mitigating Measures	Beneficial Effects
		no craftsmanship or artistry is sacrificed.	Restores weather-resistance and durability of wall. Allows the anchorages of the roof/gallery beams to be reconstructed eliminating the need for the exposed tension rods and hardware on the interior face of the south wall.
33. Partially reconstruct the serpentine concrete ramp.	Loss of original construction materials	Will replace with construction materials of like kind and finish. Both original and replacement materials are commercially produced in automated processes.	Allows restoration of original architectural appearance, elevations, and integration with the building. Eliminates disintegrated and ruptured materials. Eliminates potential safety hazards at entrance door threshold.
34. Reconstruct interior wood-framed walls in south wing.	Loss of original construction materials. Note that maintenance requirements have already replaced much of the original finish materials including drywall.	Will replace with construction materials of like kind and finish. Both original and replacement materials are commercially produced in automated processes. No significant loss of craftsmanship or artistry.	Allows access to floor slab and foundations for stabilization repairs. Eliminates damage in walls caused by extensive differential movement of supporting soils. Eliminates potential for floor slab movement to compromise the stability of the elevated visitor gallery.
35. Replace CMU walls of the administrative	Loss of original construction materials	Materials as near to the original manufactured materials in all	Reestablish the original architectural

Treatment	Potential Effects	Mitigating Measures	Beneficial Effects
wing		properties will be specified.	appearance and shape of the building. Restore the integrity of the wall to eliminate rodent and vermin intrusion and increase the durability of the wall system.
36. Install a buried membrane and drainage collection system on the plateau north of the building.	Excavation may encroach on strata of cultural or paleontological significance.	Design will minimize excavation consistent with moisture control needs. Excavations will be monitored for significant findings. Membrane will be buried and be invisible.	Membrane will help prevent surface water from seeping into the subsurface geology and deteriorating the foundation soils and quarry face.
37.			

Mechanical Assessment of Effect for Recommended Treatment

Treatment	Potential Effects	Mitigating Measures	Beneficial Effects
38. Replace Exhibit Shelter glass with Low-E, thermopane, safety glass.	Loss of historic fabric and possibly a slight change of appearance.	Replacement with glass that does not appear mirrored or tinted.	Comfort level increased and energy costs decreased by reducing heat loss in winter and heat gain in summer. UV light transmittance almost eliminated protecting all interior items. Hazards from falling glass reduced.
39. Replace Admin Wing and South Wing glass with Low-E thermopane glass.	Loss of historic fabric and possibly a slight change of appearance.	Replacement with glass that does not appear mirrored or tinted.	Comfort level increased and energy costs decreased by reducing heat loss in winter and heat gain in summer. UV light transmittance almost eliminated protecting all interior items.
40. Replace Exhibit Shelter concrete floor slab-on-grade with structural concrete floor system.	Excavation may encroach on strata of cultural or paleontological significance. Changes original architectural design of floor.	Excavations will be monitored for significant findings. Finish on concrete will replicate finish on original concrete floor.	Allows space beneath floor to isolate floor slab from expansive soils and provides opportunity to install new integrated heating system and access for inspection and maintenance.

Electrical Assessment of Effect for Recommended Treatment

Treatment	Potential Effects	Mitigating Measures	Beneficial Effects
41. Replace existing pad mounted transformer.	Transformer will be larger and more visual.	Screen transformer from visitor's sight.	Increase capacity to handle proposed mechanical equipment.
42. Relocate meter in the switchboard.	NONE	NONE	The Power Company will absorb the losses that are now being paid by the Park.
43. Replace main switchboard.	NONE	NONE	Increased capacity to handle proposed mechanical equipment.
44. Replace panelboards.	NONE	NONE	Panelboards will have a 200% neutral to handle non linear loads and an isolated ground bus to handle isolated ground receptacles.
45. Add transient voltage surge suppression to service entrance equipment and panelboards.	NONE	NONE	Surges will be handled before they enter the electrical system.
46. Replacement of light fixtures in the South wing.	NONE	NONE	Provide energy efficient system.
47. Replacement of telephone service and backboard.	NONE	NONE	Larger capacity and improved wire management.
48. Replacement of fire alarm system	NONE	NONE	Addressable system with more options. All devices will be the same brand and compatible with new FACP.
49. Replacement	NONE	NONE	All devices will be

Treatment	Potential Effects	Mitigating Measures	Beneficial Effects
of security alarm system			the same brand and compatible with new SACP.
50. Installing a lightning protection.	Will affect the historic appearance of the building.	Screen the installed system as much as possible.	Provide protection against lightning strikes.