ENVIRONMENTAL IMPACTS

Direct, indirect, and cumulative effects are analyzed for each impact topic carried forward. Potential impacts are described in terms of type, context, duration, and intensity. General definitions are defined below, while more specific impact thresholds are given for each resource at the beginning of each section.

Potential impacts are described in terms of type (are the effects beneficial or adverse?), context (are the effects site-specific, local, or even regional?), duration (are the effects short-term, lasting less than one year, or long-term, lasting more than one year?), timing (is the project seasonally timed to avoid adverse effects), and intensity (are the effects negligible, minor, moderate, or major). Because definitions of intensity (negligible, minor, moderate, or major) vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this environmental assessment/assessment of effect.

- **Type** describes the classification of the impact as either beneficial or adverse, direct or indirect:
  - *Beneficial*: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
  - *Adverse*: A change that moves the resource away from a desired condition or detracts from its appearance or condition.
  - *Direct*: An effect that is caused by an action and occurs in the same time and place.
  - *Indirect*: An effect that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.
- **Context** describes the area or location in which the impact will occur. The effects may be site-specific, local, regional, or even broader.
- **Duration** describes the length of time an effect will occur, either short-term or long-term:
  - *Short-term* impacts generally last only during construction, and the resources resume their pre-construction conditions following construction.
  - *Long-term* impacts last beyond the construction period, and the resources may not resume their pre-construction conditions for a longer period of time following construction.
- **Intensity** describes the degree, level, or strength of an impact. For this analysis, intensity has been categorized into negligible, minor, moderate, and major. Because definitions of intensity vary by resource topic, intensity definitions are provided separately for each impact topic analyzed in this environmental assessment.

CUMULATIVE IMPACT SCENARIO

The CEQ regulations implementing NEPA require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or

non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for each alternative, including the No-Action Alternative, Alternative A.

Cumulative impacts were determined by combining the impacts of the preferred alternative with other past, present, and reasonably foreseeable future actions within a defined area and timeframe. Therefore, it was necessary to identify other ongoing or likely future projects at Carlsbad Caverns National Park. Because the scope of this project is relatively small, the geographic and temporal scope of the cumulative analysis is also small. The geographic scope for this cumulative analysis includes the infrastructure located within the developed area of the park, i.e. visitor center, park management offices, staff residences, the utility lines located off the escarpment, and the pumphouse and sewage lagoons below. The temporal scope extends back to 1935 and forward to 2023. Projects considered for the cumulative impacts analysis include:

*The Up Escarpment **Buried** Waterline, 1935*: This waterline begins at the pump house at the bottom of the escarpment and extends up the escarpment where it connects to the park's distribution lines. It is no longer functional.

*The Up Escarpment **Surface** Waterline, 1998*: In 1998 the park replaced the entire 1935 Buried Waterline with a new above-ground waterline. The pipeline from the water tank at the base of the escarpment was an above-ground waterline that followed the course of the 1935 Buried Pipeline. This surface waterline failed in 2011 because of below freezing temperatures and wildfire. This pipeline was replaced in 2013 by a buried pipeline.

*The Up Escarpment **Buried** Waterline, 2013*: This waterline begins at the pump house at the bottom of the escarpment and extends up the escarpment. It replaces the 1935 line and follows along the same route where the 1935 trench is located.

The Above-ground Mesa Top Waterline, early1960's: Originally, this above-ground waterline began at the bottom of the escarpment and extended to the visitor center. This portion was completed in the 1960s. It started at a junction box (connected by a short buried pipeline to the park water distribution point) and led to the Million Gallon Water Storage Tank on the escarpment top located west of the Visitor Center. From the junction box the pipeline was laid on the escarpment surface. It failed due to freezing temperatures and wildfire damage in 2011. The portion of waterline to be repaired or replaced extends 6,930 feet west from the visitor center to the storage tank location. This portion of waterline is still functional but is at risk from freezing, future wildfires, and because of fire-damaged wooden pipe supports. The proposed project would remain in same location and footprint.

Telephone Communication Line Trench, 2013: Two-hundred sixty (260) feet of telephone line will be strung through conduit and placed in a shallow trench along curbing at Visitor Center. It will be connected to the existing communications line at end of the Up the Escarpment Buried Waterline trench.

No reasonably foreseeable future utilities development is anticipated in the next 10 years for Carlsbad Caverns National Park but the park does anticipate demolishing the remaining "Mission 66" buildings in the future.

ANALYSIS OF IMPACTS

Issues and concerns affecting the proposed action were identified by specialists in the National Park Service, as well as by the office of the New Mexico State Historic Preservation Officer (NMSHPO). Impact topics are the natural or cultural resources of concern that could be affected by the range of alternatives. The following impact topics were identified on the basis of federal laws, regulations, orders, and National Park Service Management Policies, 2006, and from input by the NMSHPO.

Visitor Use and Experience

According to Management Policies 2006 (NPS, 2006), the enjoyment of park resources and values by people is part of the fundamental purpose of all park units. The National Park Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and would maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of society. Further, the NPS would provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks. Management Policies 2006 also states that scenic views and visual resources are considered highly valued associated characteristics that the NPS should strive to protect (NPS, 2006).

Intensity Level Definitions

Negligible: Visitors would not be affected, or changes in visitor use and/or experience would be below or at the level of detection. Any effects would be short-term. The visitor would not likely be aware of the effects associated with the alternative.

Minor: Changes in visitor use and/or experience would be detectable, although the changes would be slight and likely short-term. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.

Moderate: Changes in visitor use and/or experience would be readily apparent and likely long-term. The visitor would be aware of the effects associated with the alternative, and would be likely to express an opinion about the changes.

Major: Changes in visitor use and/or experience would be readily apparent and have substantial long-term consequences. The visitor would be aware of the effects associated with the alternative, and would likely express a strong opinion about them.

Impacts of Alternative A--No Action *(Visitor Use and Experience)*

For the short-term, the No-Action Alternative would have beneficial effects on visitor use and experience because the waterline is functional at the present time. Water would be made available to the visitor through minimal maintenance.

Over the long-term, the No Action Alternative could lead to moderate adverse effects. This is because there is a chance of below freezing temperatures or wildfires which could cause additional damage to the existing waterline and could cause a major disruption to the visitor

center drinking water and sewer system operations. Health and safety concerns could become significant issues; this could lead to a reduction in visitor use and diminished experiences.

Cumulative Effects: Under Alternative A (No Action), visitor use functions would remain unchanged, as long as water is available and the pipeline is minimally maintained. Eventually, natural events such as fire or freezing temperatures, could affect the water availability to park visitors. The cumulative effects would be minor and adverse.

Impacts of Alternative B--Repairs In-kind to Existing Waterline *(Visitor Use and Experience)*

For the short-term, Alternative B would have a moderate, beneficial effect on visitor use and experience. The waterline would provide adequate water for drinking and sewer system operations. Minor repairs would be made to the waterline to keep it operational. As long as natural events do not affect the waterline, water would be available to the visitors.

Over the long-term, visitor use functions would remain unchanged, as long as water is available and the pipeline is repaired. Alternative B could result in moderate adverse effects to the visitor use. This is because there is a chance freezing temperatures or wildfires could cause similar damage as evidenced by the existing waterline. This could cause a moderate disruption to visitor center drinking water and sewer system operations. Health and safety concerns could become significant issues; this could lead to diminished visitor experiences.

Cumulative Effects: Visitor use functions would remain unchanged, as long as water is available and the pipeline is repaired and maintained. Eventually, natural events such as fire or freezing temperatures, could affect the water availability to park visitors. The cumulative effects would be minor and adverse.

Impacts of Alternative C--Replacement with In-kind Waterline *(Visitor Use and Experience)*

For the short-term, Alternative C would have a minor, adverse on visitors from noise and dust of the construction. Until the waterline is constructed and connected to the system, the visitor's water would be provided through the existing system.

Over the long-term, Alternative C would provide moderate, beneficial effects of providing water to visitors. However, natural events such as freezing temperatures or wildfires could cause similar damage as evidenced by the existing waterline. This could cause a moderate disruption to visitor center drinking water and sewer system operations. Health and safety concerns could become significant issues; this could lead to diminished visitor experiences. These impacts would be moderate and adverse.

Cumulative Effects: Visitor use functions would remain unchanged, as long as water is available and the pipeline is repaired and maintained. Eventually, natural events such as fire or freezing temperatures, could affect the water availability to park visitors. The cumulative effects would be minor and adverse.

Impacts of Alternative D--Replacement with Buried Waterline *(Visitor Use and Experience)*

For the short-term, Alternative D would have a minor, adverse effect on park visitors, from the noise and dust during the construction. Until the waterline is constructed and connected to the system, the visitor's water would be provided through the existing system.

Long-term moderate, beneficial effects would be realized once the project is completed. Burying the pipeline would improve the viewshed and cultural landscape for the visitor. Water

availability would be more secure, and maintenance requirements would be reduced as the pipeline is protected from the natural elements. Natural events such as fire or freezing temperatures, would not cause effects similar to the existing waterline's present condition, i.e. the buckling and twisting of the pipeline's support structure. Future park proposed projects requiring water would be allowed to proceed with this assurance of a dependable water source. Health and safety, including fire protection, would be maintained at the highest level due to the increased dependability of the waterline. The longevity of the pipeline would be increased at least two-fold and probably would last more than 50 years. Visitor use and experience would be maintained at a higher level for a longer period of time, with minimum disruption to the park's water service.

Cumulative Effects: Cumulative effects would be moderate and adverse as additional pipeline and trenching is constructed across the top of the escarpment.

Impacts of Alternative E--Replacement with On-Demand Pump System *(Visitor Use and Experience)*

For the short-term, Alternative E would have a minor adverse effect on visitors, from the noise and dust of the construction. There would be no noticeable effect on visitors' use of water during installation of the pumps as water would temporarily be available to the park from the existing waterline. The viewshed would be temporarily negatively impacted by the presence of construction equipment and materials at the pump house and waterline up the escarpment.

Long-term moderate, beneficial effects would be realized once the project is completed. Removal of the existing pipeline would improve the viewshed and cultural landscape for visitors. Water availability would be restored, and maintenance requirements would be reduced, as the pumps could be inspected on a regular schedule at the pump house. Protection from natural events would be afforded by locating the pumps in the pump house. The pressurized-pump system would require that they be operating continuously which would reduce the longevity of the pumps. This would be an adverse, moderate impact to water availability.

Over the long-term, moderate, adverse effects could also occur to visitors' health and safety, including fire protection, due to the removal of the storage tank, which provides needed back-up supply of water for fire protection, visitor safety and health use.

There would be moderate long-term beneficial impact from burying the waterline up the escarpment because it would no longer be subject to freezing and fires.

Cumulative Effects: Cumulative effects would be moderate and adverse as additional pipeline and trenching is constructed up the escarpment.

Geology and Soils

According to Management Policies 2006 (NPS, 2006), the NPS will "preserve and protect geologic resources as integral components of park natural systems." Management Policies 2006 also states that "Intervention in natural geologic processes will be permitted only when...there is no other feasible way to protect natural resources, park facilities, or historic properties..."

Intensity Level Definitions

Negligible: Geology and soil resources would not be affected, or changes in the condition of geologic resources would be below the level of detection.

Minor: Changes in the condition of geologic and soil resources would be detectable. Effects would be short-term and able to be remediated.

Moderate: Changes in the condition of geologic and soil resources would be detectable. Effects would be likely long-term and able to remediated.

Major: Changes in the condition of geologic and soil resources would be detectable. Effects would be long-term and irreversible.

Impacts of Alternative A--No Action *(Geology and Soils)*

For the short-term, Alternative A would have negligible adverse effects on geologic and soil resources at the present time because the waterline is currently functional.

Over the long-term, the No Action Alternative could lead to minor adverse effects if the existing waterline is compromised due to lack of needed repair or additional deterioration caused by future freezes or wildfires. Failure of the waterline could adversely affect geologic resources through soil erosion caused by water loss/leakage.

Cumulative Effects: There would be no known cumulative impacts from this alternative.

Impacts of Alternative B--Repairs In-kind to Existing Waterline *(Geology and Soils)*

Alternative B would have negligible, short-term adverse effects on geologic and soil resources at the present time due to noise and dust from repairs.

Over the long-term, Alternative B could lead to minor adverse effects if the repairs to waterline is susceptible to the same natural events (e.g. freezes, wildfires) that have caused previous damage to the existing waterline. Failure of the waterline could adversely affect geologic resources through soil erosion cause by water leakage.

Cumulative Effects: There would be no known cumulative impacts from this alternative.

Impacts of Alternative C--Replacement with In-kind Waterline *(Geology and Soils)*

Alternative C would have negligible to minor, short-term adverse effects on geologic and soil resources due to soil disturbance during construction. Soil compaction would likely occur during waterline installation; however, this effect would not be permanent.

Over the long-term, Alternative C could lead to minor adverse effects if the replacement waterline is susceptible to the same natural events (e.g. freezes, wildfires) that have caused damage to the existing waterline. Failure of the replacement waterline could adversely affect geologic resources through soil erosion cause by water leakage.

Cumulative Effects: There would be no known cumulative impacts from this alternative.

Impacts of Alternative D--Replacement with New, Buried Waterline *(Geology and Soils)*

Alternative D would have immediate localized, moderate adverse effects on geologic and soil resources due to the trenching necessary for burying a new waterline. Trenching would cause irreversible soil and bedrock disturbance. Alternative D would have minor adverse effects on geologic resources from the demolition and removal of the existing pipeline. Mitigation measures would reduce the level of impacts.

Over the long-term, Alternative D should provide for negligible to minor adverse effects beyond the initial disruption of geologic and soil resources. Development and replenishment of soils

would occur extremely slowly, and initial removal of bedrock and soil from trenching could potentially lead to erosion of adjacent soil areas as a delayed effect.

Cumulative Effects: Cumulative effects would be moderate and adverse as additional pipeline and trenching is constructed across the top of the escarpment.

Impacts of Alternative E--Replacement with On-Demand Pump System *(Geology and Soils)*

Alternative E would have immediate localized, moderate adverse effects on geologic and soil resources due to the trenching necessary for burying a new waterline. Trenching would cause irreversible soil and bedrock loss. Alternative E would have minor adverse effects on geologic resources from the demolition and removal of the existing pipeline and water tank. Some bedrock may be disturbed, and adjacent soils would suffer from compaction and potential erosion. Development and replenishment of soils would occur extremely slowly, and initial removal of bedrock and soil from trenching could potentially lead to erosion of adjacent soil areas as a delayed effect. Mitigation measures would reduce the level of impacts.

Over the long-term, Alternative E should provide for negligible to minor effects beyond the initial minor disruption of geologic and soil resources. The restoration of a previously disturbed area should provide long-term benefits to soil replenishment in the areas currently occupied by the waterline and tank.

Cumulative Effects: Cumulative effects would be moderate and adverse as additional pipeline and trenching is constructed up the escarpment.

Cave/Karst

According to Management Policies 2006 (NPS 2006), caves will be managed "in accordance with approved cave management plans to perpetuate the natural systems associated with the caves..." Management Policies 2006 also states that "...no developments or uses...will be allowed in, above, or adjacent to caves until it can be demonstrated that they will not unacceptably impact natural cave resources and conditions..."

Intensity Level Definitions

Negligible:	Caves and cave resources would not be affected or changes in the condition of cave resources would be below the level of detection.
Minor:	Changes in the condition of cave resources would be detectable. Effects would be short-term and able to be remediated.
Moderate:	Changes in the condition of cave resources would be detectable. Effects would be likely long-term and able to be remediated.
Major:	Changes in the condition of cave resources would be detectable. Effects would be long-term and irreversible.

Impacts of Alternative A-No Action *(Cave/Karst)*

Alternative A would have short-term, negligible adverse effects on cave resources at the present time because the waterline is currently functional.

Over the long-term, the No Action Alternative could lead to minor, adverse effects if the existing waterline is compromised due to lack of needed repair or additional deterioration caused by future freezes or wildfires. Failure of the waterline could adversely affect cave resources through substantial water input into the subsurface environment.

Cumlative Effects: There would be no known cumulative effects from this alternative.

Impacts of Alternative B – Repairs In-kind to Existing Waterline *(Cave/Karst)*

For the short-term, Alternative B would have negligible adverse effects on cave resources at the present time because the existing waterline would continue to be functional.

Over the long-term, Alternative B could lead to water leaks if the in-kind repairs to the waterline fail, or if the currently sound sections of the waterline are damaged by future freezes or wildfires. Failure of the waterline would cause minor to moderate, adverse effects to cave resources through substantial water input into the subsurface environment.

Cumulative Effects: There would be no known cumulative effects from this alternative.

Impacts of Alternative C- Replacement with In-kind Waterline *(Cave/Karst)*

For the short-term, Alternative C would have negligible adverse effects on cave resources because a functional waterline would be installed above ground in the same location and manner of construction as existing waterline.

Over the long-term, Alternative C could lead to water leaks if the replacement waterline is susceptible to the same natural events (e.g., freezes, wildfires) that have caused damage to the existing waterline. Failure of the replacement waterline could lead to minor to moderate adverse effects to cave resources/karst resources through water input into the subsurface environment.

Cumulative Effects: There would be no known cumulative effects from this alternative.

Impacts of Alternative D- Replacement with New, Buried Waterline *(Cave/Karst)*

Alternative D would have short-term, moderate adverse effects on cave/karst resources, depending on whether bedrock excavation intersects a void space that is determined to be a previously unknown cave or cave passage. Mitigation measures such as a ***Ground-Penetrating Radar*** (GPR) surveys can be conducted, void spaces can be detected in advance and water line route can be adjusted to avoid these features. In this case, effects would be minor and adverse.

Negligible effects would occur if no voids are intersected during excavation. Minor effects would occur if an unknown cave or cave passage is intersected, little to no damage to cave resources occurs, and the new entrance can be sealed or secured to protect the cave from future impact. Moderate effects would occur if an unknown cave or cave passage is intersected, significant damage to cave resources occurs, and the new entrance cannot be sealed or secured to protect the cave from additional impact.

Over the long-term, Alternative D would provide for negligible effects, provided that mitigation measures are followed and initial bedrock excavation did not cause immediate minor or moderate effects. The better durability and reliability of a buried pipeline would reduce the chances of damage from freezing and eliminate the possibility of wildfire damage. Degradation from other causes, however, such as corrosion, could lead to moderate adverse effects, especially if failure of the pipeline is not immediately apparent due it being buried, and/or if future repair of the pipeline requires additional excavation that could put cave resources at risk.

Cumulative Effects: Cumulative effects would be moderate and adverse as additional pipeline and trenching is constructed across the top of the escarpment.

Impacts of Alternative E- Replacement with On-Demand Pump System *(Cave/Karst)*

For the short-term, Alternative E would have moderate, adverse effects on cave/karst resources, depending on whether bedrock excavation intersects a void space that is determined to be a previously unknown cave or cave passage. Mitigation measures such as a ***Ground-Penetrating Radar*** (GPR) surveys can be conducted, void spaces can be detected in advance and water line route can be adjusted to avoid these features. In this case, effects should be minor and adverse.

Negligible effects would occur if no voids are intersected during excavation. Minor effects would occur if an unknown cave or cave passage is intersected, little to no damage to cave resources occurs, and the new entrance can be sealed or secured to protect the cave from future impact. Moderate effects would occur if an unknown cave or cave passage is intersected, significant damage to cave resources occurs, and the new entrance cannot be sealed or secured to protect the cave from additional impact.

Over the long-term, Alternative E should provide for negligible to adverse effects, provided that mitigation measures are followed and initial bedrock excavation did not cause immediate minor or moderate effects. The better durability and reliability of a buried pipeline would reduce the chances of damage from freezing and eliminate the possibility of wildfire damage. Degradation from other causes, however, such as corrosion, could lead to moderate adverse effects, especially if failure of the pipeline is not immediately apparent due it being buried, and/or if future repair of the pipeline requires additional excavation that could put cave resources at risk.

Cumulative Effects: Cumulative effects would be moderate and adverse as additional pipeline and trenching is constructed up the escarpment.

Threatened and Endangered Species and Migratory Birds

Management Policies 2006 (NPS, 2006) requires that the Service strive to protect and preserve species of federal and state concern. Regarding species listed under the U.S. Endangered Species Act, Section 4.4.2.3 of Management Policies 2006 states, "The Service will survey for, protect, and strive to recover all species native to national park system units that are listed under the Endangered Species Act. The Service will fully meet its obligations under the NPS Organic Act and the Endangered Species Act to both proactively conserve listed species and prevent detrimental effects on these species." The Migratory Bird Treaty Act (MBTA, 16 U.S.C. 703-712) prohibits, among other actions, the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests.

Intensity Level Definitions

Negligible: The construction would not harm any state- or federally listed threatened or endangered wildlife or plants or migratory birds, avoiding them by following specific mitigation procedures, and physically avoiding identified plants. Any effects would be short-term.

Minor: Construction would startle some listed wildlife or migratory birds, although the effects would be slight and likely short-term. There would be no effect on breeding behavior or offspring through specific mitigations. Listed plants could be somewhat damaged without being trampled or uprooted.

Moderate: Listed wildlife or migratory birds would have breeding disrupted. Individual animals would be harmed. Listed plants would be trampled or covered with dust and unable to photosynthesize.

Major: Major damage or death would occur to individuals, populations, or offspring of a listed wildlife or plant species, or migratory birds.

Impacts of Alternative A-No Action *(Threatened and Endangered Species and Migratory Birds)*
For the short term, as long as the existing waterline remains functional, impacts to Threatened and Endangered Species (T&E) wildlife and plants and migratory birds would be negligible to minor adverse impacts. If/when the existing waterline requires repairs, the following impacts would result.

In the short-term, if repairs were conducted during the winter, and if all listed cacti were surveyed and strictly avoided during repairs, then the potential impacts to threatened and endangered plants and wildlife would be negligible. Impacts to migratory birds would also be negligible.

In the short-term, if repairs were conducted outside the winter season, and if 1) professional biologists using a nest search protocol determine if there are nesting bird species in the area and disturbance near those nests is avoided and 2) all listed cacti were surveyed and strictly avoided during repairs. Then the potential impacts to threatened and endangered plants and wildlife, and migratory birds, would be minor and adverse.

If repairs were conducted outside the winter season without the mitigations of proper nest searches and nest avoidance, cactus surveys and cactus avoidance, then the potential impacts to threatened and endangered plants and wildlife, and migratory birds, would be moderate.

If the repairs were conducted on an emergency basis, without mitigations, the impacts would be moderate and adverse.

In the long-term, it is likely that the existing above-ground waterline will freeze or suffer other serious damage at some future time.

Long-term impacts from repairs could cause negligible to moderate adverse impacts.

Cumulative Effects: There are no known cumulative impacts from this alternative.

Impacts of Alternative B – Repairs In-kind to Waterline *(Threatened and Endangered Species and Migratory Birds)*

Since the season and duration of the proposed work have not been specified, this impact analysis is written to cover a variety of options.

In the short-term, if the work were conducted during the winter, and if all listed cacti were surveyed and strictly avoided during construction, then the potential impacts to threatened and endangered plants and wildlife, and migratory birds, would be negligible and adverse.

In the short-term, if the project were conducted outside the winter season, and if 1) professional biologists using a nest search protocol determine if there are nesting bird species in the area and disturbance near those nests is avoided, and 2) all listed cacti were surveyed and strictly avoided during construction, then the potential impacts to threatened and endangered plants and wildlife, and migratory birds, would be negligible and adverse.

In the long-term, there would be negligible, adverse impacts.

Cumulative Effects: There are no known cumulative impacts from this alternative.

Impacts of Alternative C- Replacement With In-kind Waterline*(Threatened and Endangered Species and Migratory Birds)*

Since the season and duration of the proposed work have not been specified, this impact analysis is written to cover a variety of options.

In the short-term, if the work were conducted during the winter, and all listed cacti were surveyed and strictly avoided during construction, then the potential impacts to threatened and endangered plants, as well as T&E wildlife and migratory birds, would be negligible.

In the short-term, if the project were conducted outside the winter season, and if 1) professional biologists using a nest search protocol determine if there are nesting bird species in the area and disturbance near those nests is avoided, 2) all listed cacti were surveyed and strictly avoided during construction, then the potential impacts to threatened and endangered plants and wildlife, and migratory birds, would be negligible and adverse.

In the long-term, there would be negligible impacts.

Cumulative Effects: There are no known cumulative impacts from this alternative.

Impacts of Alternative D- Replacement with New, Buried Waterline *(Threatened and Endangered Species and Migratory Birds)*

Since the season and duration of the proposed work have not been specified, this impact analysis is written to cover a variety of options.

In the short-term, if the work were conducted during the winter, and if all listed cacti were surveyed and strictly avoided during construction, then the potential impacts to threatened and endangered plants, as well as T&E wildlife, and migratory birds, would be negligible and adverse.

In the short-term, if the project were conducted outside the winter season, and if 1) professional biologists using a nest search protocol to determine if there are nesting bird species in the area and disturbance near those nests is avoided, 2) all listed cacti were surveyed and strictly avoided during construction, and 3) a qualified biologist was on site throughout the project to monitor the open trench and remove trapped wildlife, then the potential impacts to threatened and endangered plants and wildlife, and migratory birds, would be negligible to minor, and adverse.

In the long-term, there would be negligible adverse effects by burying the waterline.

Cumulative Effects: There are no known cumulative impacts from this alternative.

Impacts of Alternative E- Replace with On-Demand System*(Threatened and Endangered Species and Migratory Birds)*

Since the season and duration of the proposed work have not been specified, this impact analysis is written to cover a variety of options.

In the short-term, if the work was conducted during the winter, and if all listed cacti were surveyed and strictly avoided during demolition of the old line and tank, then the potential impacts to threatened and endangered plants and wildlife, as well as migratory birds, would be negligible and adverse.

In the short-term, if the work were conducted outside the winter season, and if all listed cacti and migratory bird nests were avoided, the potential impacts would be negligible to minor and adverse. Impacts would be reduced to negligible through mitigation.

In the long-term, there would be negligible, adverse impacts.

Cumulative Effects: There are no known cumulative impacts from this alternative.

Vegetation and Wildlife

Intensity Level Definitions

Negligible: The construction would not harm most vegetation or wildlife in the immediate vicinity of the construction work.

Minor: Construction would impact the vegetation, although the effects would be slight and likely short-term. A few plants would be trampled or covered with dust and unable to photosynthesize.

Moderate: Wildlife would have breeding disrupted. Individual animals would be harmed. Many plants in the vicinity of the construction would be removed or uprooted.

Major: Major damage or death would occur to individuals, populations, or offspring of wildlife or plant species.

Impacts of Alternative A-No Action *(Impacts to Vegetation and Wildlife)*

It is clear that the un-insulated aboveground waterline will freeze or suffer other serious damage at some future time. When that happens, a response will be required, and impacts to wildlife and plants could occur. Without knowing when this will happen and how it will be dealt with, impact analysis is difficult. This impact analysis is written to cover a variety of possibilities.

For the short term, as long as the existing waterline remains functional, impacts to wildlife and plants remain negligible to minor adverse. If and when the existing waterline leaks and requires repairs, the following impacts would result.

If the repairs were conducted during the winter, and if construction activities were conducted solely within the allotted corridor, then the potential impacts to plants and wildlife would be negligible to moderate and adverse.

If the repairs were conducted outside the winter season, and if 1) professional biologists using a nest search protocol to determine if there are nesting bird species in the area, and disturbance near those nests is avoided, 2) driving equipment was strictly kept inside the construction corridor, and 3) a qualified biologist was on site to monitor wildlife, then the potential impacts to plants and wildlife would be negligible to minor and adverse.

If the repairs were conducted on an emergency basis, without mitigations, the impacts would be moderate and adverse.

Long-term impacts to vegetation and wildlife resources would be negligible to minor adverse impacts.

Cumulative Effects: Depending on the exact circumstances of waterline functionality or leaks and of the ensuing repairs, cumulative effects could be negligible to moderate and adverse.

Impacts of Alternative B– Repairs In-kind to Waterline *(Impacts to Vegetation/Wildlife)*

Since the season and duration of the proposed work have not been specified, this impact analysis is written to cover a variety of options.

In the short-term, if the repairs were conducted during the winter, and if construction activities were conducted solely within the allotted corridor, the potential impacts to plants and wildlife would be negligible.

In the short-term, if the repairs were conducted outside the winter season, and if professional biologists using a nest search protocol determine if there are nesting bird species in the area, and disturbance near those nests is avoided, the potential impacts to plants and wildlife would be negligible to minor and adverse.

If the repairs were conducted outside the winter season without the mitigation of proper nest searches and nest avoidance, and staying within the allotted corridor, the potential impacts to plants and wildlife would be minor to moderate and adverse.

Long-term impacts to vegetation and wildlife resources would be negligible and adverse.

Cumulative Effects: Depending on the exact circumstances of construction, there are no known cumulative effects.

Impacts of Alternative C- Replacement With In-kind Waterline *(Impacts to Vegetation/Wildlife)*

Since season and duration of the proposed work have not been specified, this impact analysis is written to cover a variety of options.

In the short-term, if the work was conducted during the winter, and if construction activities were conducted solely within the allotted corridor, then the potential impacts to plants and wildlife would be negligible to minor and adverse.

If the project were conducted outside the winter season, and if 1) professional biologists using a nest search protocol determine if there are nesting bird species in the area, and disturbance near those nests is avoided, 2) driving equipment was strictly kept inside the construction corridor, then the potential impacts to plants and wildlife would be minor and adverse.

Long-term effects to vegetation and wildlife would be negligible and adverse.

Cumulative Effects: Depending on the exact circumstances of construction, there would be no known cumulative effects.

Impacts of Alternative D- Replacement with New, Buried Waterline*(Impacts to Vegetation/Wildlife)*

Since the season and duration of the proposed work have not been specified, this impact analysis is written to cover a variety of options.

In the short-term, if the work were conducted during the winter, and if construction activities were conducted solely within the allotted corridor, then the potential impacts to plants and wildlife would be negligible to minor and adverse.

In the short-term, if the project were conducted outside the winter season, and if 1) professional biologists using a nest search protocol determine if there are nesting bird species in the area, and disturbance near those nests is avoided, 2) driving equipment was strictly kept inside the construction corridor, and 3) a qualified biologist was on site throughout the project to monitor the open trench and remove trapped wildlife, then the potential impacts to plants and wildlife would be minor to moderate and adverse.

Because the above-ground pipeline is relatively low to the ground and yet raised above the ground, wildlife can crawl under it or jump over it with relative ease.

Long-term impacts to vegetation and wildlife resources would be negligible and adverse.

Cumulative Effects: Depending on the exact circumstances of construction, cumulative effects would be minor to moderate and adverse due to additional trenching and pipeline construction.

Impacts of Alternative E- Replace with On-Demand System *(Impacts to Vegetation/Wildlife)*

Since the season and duration of the proposed work have not been specified, this impact analysis is written to cover a variety of options.

In the short-term, if the work were conducted during the winter, the potential impacts to plants and wildlife would be negligible and adverse.

In the short-term, if the project were conducted outside the winter season, and if professional biologists using a nest search protocol determine if there are nesting bird species in the area and disturbance near those nests is avoided, the potential impacts to plants and wildlife would be minor and adverse.

Because the above-ground pipeline is relatively low to the ground and yet raised above the ground, wildlife can crawl under it or jump over it with relative ease.

Long-term impacts to vegetation and wildlife resources would be negligible and adverse.

Cumulative Effects: Depending on the exact circumstances of construction, cumulative effects would be minor to moderate and adverse due to additional trenching and pipeline construction.

Visual Resources

Intensity Level Definitions

Negligible: Visual resources would not be affected or changes to cultural resources would be below or at the level of detection. Any effects would be short-term. The visitor would not likely be aware of the effects associated with the alternative.

Minor: Visual resources would be negatively impacted but in limited extant and duration. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.

Moderate: Visual resources would be negatively impacted. The impacts will be readily apparent and long-term. The visitor would be aware of the effects associated with the alternative.

Major: Visual resources would be negatively impacted. The impacts will be readily apparent and have substantial long-term consequences. The visitor would be aware of the effects associated with the alternative, and would likely express a strong opinion about them.

Impacts of Alternative A-No Action *(Visual Resources)*

In the short-term, there would be no change in impacts to the visual resources. Currently the Mesa Top Waterline can be seen from the Desert Scenic Loop Road at approximately the first 1.75 miles. The waterline can be seen from the Carlsbad Cavern Highway mile marker 6 to the visitor center parking lot. The waterline can be seen from the Old Guano Road Trail at an elevation of 4,222 feet above sea level or higher. The waterline can be seen from the north part of Rattlesnake Canyon Trail. The waterline can be seen from portions of the Guadalupe Ridge Trail.

In the long-term, if repairs are needed, there would be negligible and adverse impacts to visual resources during repair work.

Cumulative Effects: There would be no known cumulative impacts from Alternative A.

Impacts of Alternative B– Repairs In-kind to Waterline *(Visual Resources)*

During the repairs to the waterline, the construction equipment and materials would cause short-term minor to moderate adverse impacts to the visual resources while construction activities are underway.

In the short-term, repairs to the existing waterline would cause minor to moderate adverse impacts due to the reduction of vegetation in the proximity of the project site. Mitigation measures, including natural revegetation, would reduce these impacts over time.

The short-term impact would be minor to moderate depending on the type of repairs that are needed, where the materials staging area is located, and types of materials used.

The reflectivity of the construction materials would also impact the visual resources. If repairs require a metallic shell, then it would be more visible and the impact would be moderately adverse. If the waterline is painted a mosaic of browns and greens, then it would be less visible and thus a minor adverse impact. Mitigation measures would be used to reduce this impact.

Mitigation measures would be taken to help reduce the impacts to visual resources during construction.

The long-term impacts on visual resources would be minor and adverse if the waterline is painted a mosaic of browns and greens and the vegetation regrows along the waterline to conceal it.

Cumulative Effects: There would be no known cumulative impacts from Alternative B.

Impacts of Alternative C- Replacement with In-kind Waterline *(Visual Resources)*

In the short-term, the impacts to visual resources would be minor to moderate adverse due to the the construction equipment, materials, and dust that would impact the visual resources while construction is going on. Location of the materials staging area would impact the visual resources. Mitigation measures would be taken to reduce the impacts to visual resources during construction.

In the long term, impacts on visual resources would be minor and adverse, if the waterline is painted a mosaic of browns and greens and the vegetation regrows along the waterline . Mitigation measures including painting the waterline and revegetation would reduce the impacts to visual resources.

Cumulative Effects: There would be no known cumulative impacts from Alternative C.

Impacts of Alternative D- Replacement with New, Buried Waterline *(Visual Resources)*

The short-term impacts to visual resources would be moderate, adverse effects due to the reduction of vegetation, the change in the color and texture of the landscape because of the mechanical cutting of the rock, dust from the cutting of the rock, construction equipment on site, staging area of materials, and dust on the Desert Scenic Loop Road from equipment being driven along the road. Mitigation measures would be taken to reduce these impacts.

The long-term impacts would be moderate and beneficial, as the existing above-ground waterline is removed from the viewshed, vegetation is restored to the site, and impacts to the viewshed are reduced. There would be minor adverse long-term impacts due to vegetation loss which can be reduced through revegetation.

Cumulative Effects: The cumulative impacts would be moderate and beneficial by decreasing the overall cumulative impacts to visual resources from removal of the existing above-ground waterline.

Impacts of Alternative E - Replace with On-Demand System *(Visual Resources)*

The short-term impacts to visual resources would be minor to moderate, adverse effects due to dust from the cutting of the rock, construction equipment on site, and staging area of materials. Mitigation measures would be taken to reduce these impacts.

The long-term impacts would be moderate and beneficial as the existing above-ground Mesa Top waterline and water tank are removed from the viewshed. There would be reduced visual intrusions along the Loop Road and the view from the Visitor Center.

Cumulative Effects: The cumulative impacts would be moderate and beneficial by decreasing the overall cumulative impacts to visual resources from removal of the existing above-ground waterline and water tank.

Cultural Resources and Landscapes

According to Management Policies 2006 (NPS 2006), the enjoyment of park resources and values by people is part of the fundamental purpose of all park units. The National Park Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and would maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of society. Further, the NPS would provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks. Management Policies 2006 Section *5.3.5* states that "each proposed action will ensure consistency or compatibility in the overall treatment of park resources. Management Policies 2006 also states that scenic views and visual resources are considered highly valued associated characteristics that NPS should strive to protect (NPS 2006).

Archeological Inventories: Intensive inventories (Greer 1960, 1965; Bousman 1974; Swanson 1986; Dillingham 1996; Wilcox and Batten 1998 [NMCRIS 62625]; Kayser and Denny 1999 [NMCRIS 65075]; Kayser 1998, 2000 [NMCRIS 70038]; Haecker 2002; Buehler 2004; Anonymous 2004, 2008a, 2008b; Carlson et.al. 2005a [NMCRIS 90851] 2005b [NMCRIS 91061]; Ireland, 2007 [NMCRIS 109823]; Neppl 2008; Hemingway, Harmon, and Shaw 2009; Selden, Cominiello, Lennen 2011; Denman 2012; and Carpenter, Herzog and Ordemann 2012) include the project area. One low frequency (ca. 1 lithic or less per square meter) non-diagnostic lithic surface scatter on bedrock was identified in 1998 as being near the project area. In 2012 (Carpenter, et. al.) identified the lithic material from this local as being mostly 10 meters ca. 30 feet) from the pipeline and outside of the APE of the project. Only three isolated occurrences of non-diagnostic lithic flakes within 5 meters of the existing pipeline were found. These probably were carried by water from the more concentrated lithic area outside the project area (Carpenter et. al. 2012). All significant data on these were recorded and the items photographed. Other recent inventories have not identified denser concentrations, diagnostic artifacts, or features. The locale is not considered eligible under the criteria of 36 CFR 60.4 (a-d) to the National Register. Four other archeological sites are near but not within 300 feet (100 meters) of the project APE (Area of Potential Effect) and will not be affected by the project.

Intensity Level Definitions

Negligible:	Cultural resources would not be affected or changes to cultural resources would be below or at the level of detection. Any effects would be short-term. The visitor would not likely be aware of the effects associated with the alternative.
Minor:	Impacts to cultural resources and/or experience would be detectable, although the changes would be slight and likely short-term. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.

Moderate: Impacts to cultural resources and/or experience would be readily apparent and likely long-term. The visitor would be aware of the effects associated with the alternative, and would be likely to express an opinion about the changes.

Major: Impacts to cultural resources and/or experience would be readily apparent and have substantial long-term consequences. The visitor would be aware of the effects associated with the alternative, and would likely express a strong opinion about them.

Impacts of Alternative A-No Action *(Impacts to Cultural Resources)*

Alternative A would have short-term, moderately adverse effect on cultural resources because the waterline is partially visible from the National Register Carlsbad Caverns Historic District and Cultural Landscape as a visual intrusion.

Over the long-term, the No Action Alternative would have a moderate, adverse effect. This is because the existing, damaged pipeline is visible from the Historic District and would continue to diminish the historic landscape qualities of the site. There would be long-term moderate adverse impacts as long as the existing damaged pipeline is visible.

Cumulative Effects: Under the Alternative A (No Action) cumulative effects would be minor and adverse impacts to the historical landscape qualities.

Impacts of Alternative B – Repairs In-kind to Existing Waterline *(Impacts to Cultural Resources)*

Alternative B would have a short-term, moderate, adverse effect on cultural resources because the waterline is partially visible from the National Register Carlsbad Caverns Historic Distric and Cultural Landscape as a visual intrusion.

Over the long-term, Alternative B would have a moderate, adverse effect. This is because the above-ground pipeline is visible from the Historic District and would continue to diminish the historic landscape qualities of the site. The long-term impacts could be reduced to minor and adverse if mitigation measures are followed.

Cumulative Effects: Under the Alternative B cumulative effects would be minor and adverse impacts to the historical landscape qualities.

Impacts of Alternative C- Replacement with In-kind Waterline *(Impacts to Cultural Resources)*

Alternative C would have a short-term, moderate, adverse effect on cultural resources because the waterline is partially visible from the National Register Carlsbad Caverns Historic District and Cultural Landscape as a visual intrusion.

Over the long-term, Alternative B would have a moderate adverse effect. This is because the above-ground pipeline is visible from the Historic District and would continue to diminish the historic landscape qualities of the site. The impacts could be reduced to minor and adverse by using mitigation measures.

Cumulative Effects: Under the Alternative C cumulative effects would be minor and adverse impacts to the historical landscape qualities.

Impacts of Alternative D- Replacement with New, Buried Waterline *(Impacts to Cultural Resources)*

For the short-term, Alternative D would have a moderate, adverse impact due to visual impacts on historic landscape from the construction activities .

Long-term moderate, beneficial effects would be realized once the project is completed. Burying the pipeline would improve cultural landscape. Although the project is not within a designated or potential cultural landscape, the project site is adjacent and partially visible from the Carlsbad Cavern Historic District and Cultural Landscape. The burial of the pipe would be beneficial to the Carlsbad Cavern Historic District and Cultural Landscape as the pipeline would no longer be a visual intrusion as seen from the National Register Historic District and Cultural Landscape.

Cumulative Effects: Under the Alternative D, there would be a moderate, long-term beneficial impact as the pipeline would be buried and native plants would be planted or would naturally re-vegetate over the pipeline. This would provide an unscarred landscape as seen from the historic district and cultural landscape.

Impacts of Alternative E- Replacement with On-Demand Pump System *(Impacts to Cultural Resources)*

For the short-term, Alternative E would have moderate, adverse impacts due to visual impacts on historic landscape from construction activities.

Over the long-term, Alternative E would have a moderate, beneficial long-term effect on cultural resources once the existing, damaged waterline and storage tank are removed from the site, and the site is restored to a more natural state. Re-contouring and re-vegetation efforts would reduce the remnant imprint left from removal of the old, existing waterline and storage tank.

Cumulative Effects: Under Alternative E, the project would have a moderate, beneficial impact to the overall development of Carlsbad Caverns National Park. This would provide an unscarred landscape as seen from the historic district and cultural landscape. Removal of the existing pipeline would improve the cultural landscape view.

Native American Concerns

The United States has a unique legal and political relationship with Indian tribal governments, established through and confirmed by the Constitution of the United States, treaties, statutes, executive orders, and judicial decisions. In recognition of that special relationship, pursuant to executive Order 13175 of November 6, 2000, executive departments and agencies are charged with engaging in regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications, and are responsible for strengthening the government-to-government relationship between the United States and Indian tribes." (Barack Obama. Executive Order November 9, 2000).

Traditional Associated Tribes and Pueblos of the park have expressed their views as "...being taught not to disturb the natural world in a significant way and that to do so may cause harm...Natural resources can best be protected by managing the land as natural as it was..." Impacts from the project would be of concern to the Native Americans. The project would be located within a natural resource. As impacts from the project could affect the natural resources of the area, Native American concerns will be addressed.

According to *Management Policies 2006* (NPS 2006), the enjoyment of park resources and values by people is part of the fundamental purpose of all park units. The National Park Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and would maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of society. Further, NPS would provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks. *Management Policies 2006 Section 5.3.5* states that "each proposed action will ensure consistency or compatibility in the overall treatment of park resources. *Management Policies 2006* also states that scenic views and visual resources are considered highly valued associated characteristics that NPS should strive to protect (NPS 2006).

Intensity Level Definitions

Negligible: Native American Concerns would not be affected or changes to resources would be below or at the level of detection. Any effects would be short-term. The visitor would not likely be aware of the effects associated with the alternative.

Minor: Impacts to Native American Concerns would be detectable, although the changes would be slight and likely short-term. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.

Moderate: Impacts to Native American Concerns would be readily apparent and likely long-term. The visitor would be aware of the effects associated with the alternative, and would be likely to express an opinion about the changes.

Major: Impacts to Native American Concerns would be readily apparent and have substantial long-term consequences. The visitor would be aware of the effects associated with the alternative, and would likely express a strong opinion about them.

Impacts of Alternative A--No Action (*Impacts to Native American Concerns*)

For the short-term, Alternative A would have moderate, adverse effect on Native American Concerns because the waterline is partially visible from the National Register Carlsbad Caverns Historic District and Cultural Landscape as a visual intrusion.

Over the long-term, the No Action Alternative would continue to have a moderate adverse effect. This is because the existing, damaged pipeline is visible from the historic district and the Desert Loop Road. This alternative would continue to diminish the natural landscape qualities of the site.

Cumulative Effects: There would be moderate adverse impacts as long as the existing damaged pipeline is visible.

Impacts of Alternative B--Repairs In-kind to Existing Waterline *(Impacts to Native American Concerns)*

For the short-term, Alternative B would have moderate, adverse effect on Native American Concerns because the waterline is partially visible from the National Register Carlsbad Caverns Historic District and Cultural Landscape as a visual intrusion.

Over the long-term, the Alternative B could lead to long-term, moderate adverse effects. This is because the existing, damaged pipeline is visible from the historic district and Desert Loop Road. Cumulative Effects: Under the Alternative B, there would be long-term moderate adverse impacts as long as the existing pipeline is visible.

Cumulative Effects: Cumulative effects would be adverse and moderate as long as the existing damaged pipeline is visible.

Impacts of Alternative C- Replacement with In-kind Waterline *(Impacts to Native American Concerns)*

For the short-term, Alternative C would have moderate, adverse effect on Native American Concerns because the waterline is partially visible from the National Register Carlsbad Caverns Historic District and Cultural Landscape as a visual intrusion.

Over the long-term, Alternative C could lead to long-term, moderate adverse effects. This is because the existing, damaged pipeline is visible from the historic district and Desert Loop Road.

Cumulative Effects: Cumulative effects would be adverse and moderate as long as the existing pipeline is visible.

Impacts of Alternative D- Replace with New, Buried Waterline *(Impacts to Native American Concerns)*

For the short term, Alternative D would have a moderate and adverse effect on Native American Concerns due to construction activity. Re-contouring and re-vegetation efforts would reduce the remnant imprint left from removal of the old, existing pipeline.

Over the long-term, there would be a moderate beneficial impact on Native American concerns. The burial of the pipeline would remove a concern of Native Americans that the pipeline is a man-made unnatural intrusion upon the natural landscape.

Cumulative Effects: The cumulative effects under Alternative D would reduce the impact of the development on the escarpment which would be beneficial to Native American concerns.

Impacts of Alternative E- Replace with On-Demand Pump System *(Impacts to Native American concerns)*

For the short-term, Alternative E would have a moderate , adverse effect on the viewshed due to noise and dust from construction and the presence of construction equipment and materials at the pump house. Re-contouring and re-vegetation efforts would reduce the remnant imprint left from removal of the old, existing waterline and storage tank.

For the long-term, Alternative E would have a moderate, beneficial effect on Native American concerns, once the existing, damaged waterline and water tank are removed from the site, and the site is restored to a more natural state. The visual intrusion from the existing Mesa Top waterline and water tank would be removed and no longer an impact to Native American concerns.

Cumulative Effects: The cumulative effects under Alternative E would reduce the impact of the development on the escarpment which would be beneficial to Native American concerns. Removal of the existing pipeline would improve the natural and cultural landscape, and would improve values important to Native Americans.

Park Operations and Fire Management

According to *Management Policies 2006* (NPS 2006), the enjoyment of park resources and values by people is part of the fundamental purpose of all park units. The National Park Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and would maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of society. Further, NPS would provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks. *Management Policies 2006* also states that scenic views and visual resources are considered highly valued associated characteristics that NPS should strive to protect (NPS 2006).

Intensity Level Definitions

Negligible: Park operations would not be affected or changes would be below or at the level of detection. Any effects would be short-term. The park visitor would not likely be aware of the effects associated with the alternative.

Minor: Changes to park operations would be detectable, although the changes would be slight and likely short-term. The park visitor would be aware of the effects associated with the alternative, but the effects would be slight.

Moderate: Changes to park operations would be readily apparent and likely long-term. The park visitor would be aware of the effects associated with the alternative, and would be likely to express an opinion about the changes.

Major: Changes to park operations would be readily apparent and have substantial long-term consequences. The visitor would be aware of the effects associated with the alternative, and would likely express a strong opinion about them.

Impacts of Alternative A-No Action (Park Operations/Fire Management)

For the short-term, Alternative A would have minor beneficial effects on park operations and fire management because the waterline is functional at the present time.

Over the long-term, Alternative A would have minor , beneficial effects as long as the pipeline is functional. This alternative could also lead to moderate, adverse effects if freezing temperatures or wildfires cause additional damage to the existing waterline. This would cause a moderate to major disruption to visitor center drinking water and sewer system operations. Health and safety concerns could become significant issues; this could lead to a reduction in visitor use and diminished pleasant experiences. Park operations would be compromised without plenty of water for facilities maintenance, fire suppression and other assorted priority tasks.

Cumulative Effects: under Alternative A, park operations and fire management would remain unchanged as long as water is available and the pipeline is minimally maintained. If the waterline fails, future park project developments requiring water would be placed on hold due to lack of dependable water source.

Impacts of Alternative B – Repairs In-kind to Existing Waterline *(Park Operations/Fire Management)*

For the short-term, Alternative B would have a minor, beneficial effect on park operations. The waterline would provide adequate water for drinking and sewer system operations. There would be minimal adverse impacts from repairs to the waterline due to noise and dust from the repairs.

Over the long-term, Alternative B would have moderate beneficial effects on park operations because the waterline would be functional. Also, in the long-term, park operations could experience moderate adverse effects. This is because there is a chance freezing temperatures or wildfires could cause similar damage as evidenced by the existing waterline. This could cause a major disruption to the park's drinking water and sewer system operations. Health and safety concerns could become significant issues; this could lead to impacted park operations, including diminished visitor visits and pleasant experiences.

Cumulative Effects: Cumulative effects would have minor, beneficial impacts of a newly repaired waterline. Cumulative effects would be moderate and adverse nature if waterline is subjected to fire and freezing temperatures.

Impacts of Alternative C- Complete replacement with an In-kind Waterline *(Park Operations/Fire Management)*

For the short-term, Alternative C would have a moderate, adverse effect on park operations as construction activities would cause noise and dust pollution at the project site.

In the long-term, Alternative C would have moderate, beneficial impacts to park operations by extending the life of a functional waterline. Also, it could have moderate adverse impacts to park operations if there are freezing temperatures or wildfires which could cause similar damage as evidenced by the existing waterline.

Cumulative Effects: Cumulative effects would have minor, beneficial impacts of a newly constructed waterline. Cumulative effects would be moderate and adverse nature if waterline is subjected to fire and freezing temperatures.

Impacts of Alternative D- Replacement with New, Buried Waterline *(Park Operations/Fire Management)*

For the short-term, Alternative D would have a moderate and adverse effect on park operations, as construction activities would cause noise and dust pollution at the project site. The trench work would cause temporary road closure.

Over the long-term, burying the pipeline would have long-term beneficial impacts to park operations, because the waterline would no longer be subjected to fires and freezing temperatures. There would be beneficial impacts to fire-suppression efforts because the waterline would no longer be subjected fire and freezing temperatures.

Long-term beneficial effects would be realized once the project is completed. Water availability would be more secure, and maintenance requirements would be reduced as the pipeline is protected from the elements. The longevity of the pipeline would be increased at least two-fold and probably would last more than 30 years. Visitor use and experience would be maintained at a higher level for a longer period of time, with minimum disruption to the park's water service.

Cumulative Effects: Under the Alternative D, future park proposed projects requiring water would be allowed to proceed with this assurance of dependable water source. Health and safety, including fire protection, would be maintained at the highest level due to the increased dependability of the waterline. These would result in moderate and beneficial impacts. There

could be minor adverse cumulative effects due to the increased trenching and construction, and potential for increased development.

Impacts of Alternative E- Replacement with On-Demand Pump System *(Park Operations/Fire Management)*

Short-term impacts to constructing a new trench in a previously-disturbed area would be moderately-adverse due to the presence of construction equipment and materials on the waterline up the escarpment.

For the short-term, Alternative D would have a moderate and adverse effect on park operations, as construction activities would cause noise and dust pollution at the project site. The viewshed would be negatively impacted by the presence of construction equipment and materials at the pump house for a temporary period.

For the long-term , there would be moderate, beneficial impact of burying an additional waterline up the escarpment because it would no longer be subject to fires or freezing temperatures. There would also be moderate, adverse impacts from Alternative E, including having an underground storage tank, more equipment to maintain, and a much higher electricity cost (ie non-green environment). Adverse impacts would be expected in the event of wildfire as the storage tank which provides the backup water supply to conduct fire suppression is no longer available. The pressurized-pump system would require that they be operating 24-7.

Cumulative Effects: This alternative would result in moderate and beneficial impacts because current need and future proposed projects requiring water would be allowed to proceed with this assurance of dependable water source. Health and safety, including fire protection, would be comprised due to the removal of the mesa top water tank, which provides a needed back up supply of water for fire protection.

Air Quality

Carlsbad Caverns National Park is a mandatory class I clean air area, placing the most stringent constraints on the construction or expansion of stationary sources of air pollution that emit more than 100 tons of pollutants per year in the vicinity of the park." The National Park Service has a responsibility to protect the park's air quality related values including visibility and human health. Dust from the construction can affect both the visibility and human health if inhaled. Emissions from the construction equipment can affect the ozone among other things. Visibility is addressed in the visual resources section. The Clean Air Act, amended 1977, directs the National Park Service to preserve, protect, and enhance air quality in national parks. Additionally, the park is in the Pecos-Permian Basin intrastate air quality control region of New Mexico (Carlsbad Caverns National Park Final GMP/EIS, p.91). The Park needs to maintain "national ambient air quality standards for particulate matter, sulfur dioxide, nitrogen dioxide, ozone, carbon monoxide, and lead."

Intensity Level Definitions

Negligible: The changes to air quality will be below or at the level of detection, and any effects will be short-term. The visitor will not likely be aware of the construction or change in the waterline.

Minor: Air quality will be impacted in limited extant and duration. Localized dust and air quality emissions will be short term. The visitor will see the dust from construction. The effects will be mitigated.

Moderate: There will be readily apparent and short-term to medium-term effects on the air quality. Dust from construction will interfere with the visitors' experience.

Major: There will be readily apparent and long term consequences on air quality. The air quality level will interfere with the visitors' experience.

Impacts of Alternative A-No Action (*Air Quality*)

For the short-term there would be negligible and adverse impacts.

Long term impacts would be negligible and adverse.

Cumulative Effects: There are no known cumulative impacts from Alternative A.

Impacts of Alternative B – Repairs In-kind to Existing Waterline *(Air Quality)*

For the short-term, the effects would be minor and adverse because there will be exhaust emitted from the construction equipment and dust in the construction area.

Long-term effects would be moderate, beneficial nature as the waterline provides water to the park. Air quality will improve after the repairs.

Cumulative Effects: There are no known cumulative impacts from Alternative B.

Impacts of Alternative C- Replacement with In-kind Waterline *(Air Quality)*

For the short-term, the effects will be minor and adverse because there will be exhaust emitted from the construction equipment and dust in the construction area.

Air quality will return to what it was prior to construction.

Cumulative Effects: There are no known cumulative impacts from Alternative C.

Impacts of Alternative D- Replace with New, Buried Waterline *(Air Quality)*

For the short-term, the effects would be minor to moderate adverse impacts because there will be exhaust emitted from the construction equipment. There would be more impact from the dust for this alternative than Alternatives A,B and C, because bedrock will be crushed, ejected through the air, and deposited to the debris spoil pile parallel to the trench. The crushed rock ejected in the air will be blown away from the construction site, impacting the air quality of the park, especially in high winds over 20 mph.

Long-term effects include a minor to moderate adverse impact from the removal of vegetation which would allow soil to blow through the air. Natural revegetation or plantings, would reduce the potential for dust particles to be transported from the construction site. Air quality will return to what it was prior to construction.

Impacts of Alternative E- Replace with On-Demand Pump System *(Air Quality)*

For the short-term, the effects would be minor to moderate adverse impacts because there will be exhaust emitted from the construction equipment and dust in the construction area for a limited time during construction. There would be more impact from the dust for this alternative Alternatives A,B and C, because bedrock will be crushed, ejected through the air, and deposited to the debris spoil pile parallel to the trench. The crushed rock ejected in the air will be blown away from the construction site, impacting the air quality of the park, especially in high winds over 20 mph.

Long-term effects include a minor adverse impact due to a lack of vegetation which would allow soil to blow through the air. Natural revegetation or plantings, would reduce the potential for dust particles to be transported from the construction site. Air quality will return to what it was prior to construction.

Cumulative Effects: There will be moderate, adverse cumulative effects from the increased trenching and construction development.

Soundscape Management

Intensity Level Definitions

Negligible: The changes to the soundscape will be below or at the level of detection, and any effects will be short-term. The visitor would not likely be aware of the construction or change in the waterline.

Minor: Soundscape resources would be impacted but in limited extant and duration. The visitor will hear the sounds of construction. The effects can be mitigated.

Moderate: There would be readily apparent and long-term effects to the soundscape resources. The visitor would hear the sounds of construction and this would affect the visitors' experience. Considerable mitigation effort would need to take place to reduce the effects.

Major: There would be readily apparent and substantial long-term impacts to the soundscape resources. The noise levels of the construction would interfere with the visitors' experience. Extensive mitigation would be required.

Impacts of Alternative A-No Action (*Soundscape Management*)

For the short-term, Alternative A would have negligible to minor, adverse impacts during repairs.

Over the long-term, Alternative A would have negligible to minor adverse impacts during repairs.

Cumulative Effects: There would be no known cumulative effects to Soundscape.

Impacts of Alternative B – Repairs <u>In-kind</u> to Existing Waterline *(Soundscape Management)*

For the short-term, the effects would be of a minor, adverse nature due to the noise from repair work. Mitigation measures would be employed to limit impacts on bats. Work will occur during daylight hours only. Repair work would be allowed only between 1/2 hour after sunrise to 1/2 hour before sunset.

Over the long-term and once the repairs are completed, the sound level would return to previous levels.
Cumulative Effects: There would be no known cumulative effects to Soundscape.

Impacts of Alternative C- Replacement with In-kind Waterline *(Soundscape Management)*

For the short-term, the effects would be of a minor, adverse nature due to the noise from construction. Mitigation measures would be employed to limit impacts on bats. Work will occur during daylight hours only. Construction would be allowed only between 1/2 hour after sunrise to 1/2 hour before sunset.

Over the long-term and once the construction is completed, the sound level would return to pre-construction levels.

Cumulative Effects: There are no known cumulative effects to Soundscape.

Impacts of Alternative D- Replace with New, Buried Waterline *(Soundscape Management)*

For the short-term, there would be moderate, adverse nature due to the construction noise. The soundscape would be impacted because the rock trenching equipment is substantially noisy. The sound level of the rock trenching equipment is estimated to be 85 dBA (Federal Highway Administration Roadway Construction Noise Model User's Guide Final Report) as measured from 50 feet away. Pickup trucks are 55 dBA as measured from 50 feet away. Traffic on the Desert Scenic Loop Road includes pickup trucks. The sound of the construction equipment will be louder than normal traffic on the Desert Scenic Loop Road but only for a limited duration. Mitigation measures would be employed to protect the bats. Work will occur during daylight hours only. Work would be allowed only between 1/2 hour after sunrise to 1/2 hour before sunset, which would reduce impacts to negligible levels.

Over the long-term, once the construction is completed, the sound level would return to pre-construction levels.

Cumulative Effects: There are no known cumulative effects to Soundscape.

Impacts of Alternative E- Replace with On-Demand Pump System *(Soundscape Management)*

For the short-term, there would be moderate, adverse nature due to the construction noise. The soundscape would be impacted because the rock trenching equipment is noisy. The sound level of the rock trenching equipment is estimated to be 85 dBA (Federal Highway Administration Roadway Construction Noise Model User's Guide Final Report) as measured from 50 feet away. Pickup trucks are 55 dBA as measured from 50 feet away. Mitigation measures would be employed to protect the bats. Work will occur during daylight hours only. Work would be