



National Park Service
U.S. Department of the Interior
Zion National Park
Springdale, Utah

Irrigation System Upgrade Environmental Assessment

November 15, 2011



Irrigation System Upgrade

Environmental Assessment

SUMMARY

Zion National Park (Zion or park) proposes to upgrade the irrigation system and the diversion structure (Project) that delivers water to areas south of the Canyon Junction. This irrigation water is essential for park operations which irrigate vegetation in staff residential areas and visitor use areas. Zion would replace the open ditch irrigation system with a pressurized system. Operation of the existing irrigation system has been troublesome and has presented a substantial workload because of the maintenance requirements of open ditches. Putting the irrigation water in a pipe and pressurizing the system would improve irrigation efficiency, allow the park to irrigate more areas and areas currently irrigated with culinary water, and decrease the amount of time spent on maintaining the open ditch system.

Three alternatives, including the No Action Alternative, were identified based on program goals and objectives, internal and external scoping, guidance from existing park plans, and policy guidance from the National Park Service (NPS). An external scoping letter dated August 12, 2011 was mailed to over 90 addresses and was also posted on the NPS Planning, Environment, and Public Comment (PEPC) website at <http://parkplanning.nps.gov/>. The public was given 30 days to comment on the Project ending September 12, 2011.

Additionally, the scoping letter was mailed to various federal and state agencies, affiliated Native American tribes, local governments, and local news organizations. No new information came forward from public scoping or consultation with other agencies to necessitate the development of any alternatives other than those described and evaluated in this document.

Alternative A (No Action): Under Alternative A, the existing irrigation system would not be upgraded or modified. The existing open ditch system would continue to irrigate park staff residential areas and visitor use areas. Open ditches within the campground areas would continue to require ongoing maintenance and water use would remain inefficient.

Alternative B (Flanigan Diversion/Preferred Alternative): The Preferred Alternative (Alternative B) was designed to avoid impacts to Zion's historic irrigation structures within the park. Under the Preferred Alternative, the irrigation system would consist of taking water from the Flanigan Diversion and piping it to a new sluice structure, new pump and filter station location, and holding tank. The Flanigan Diversion structure is located on the east side of the North Fork of the Virgin River. The diversion and a portion of the pipeline are currently shared with the Town of Springdale and the Springdale Consolidated Irrigation Company. A new water intake would be constructed in the existing concrete wall of the Flanigan Diversion (next to the existing intake) that would pipe water to a new sluice structure, pump and filter station, and holding tank. Zion would divert up to the full water right amount of 1.38 cubic foot per second (cfs) into a pressurized pipeline to irrigate the campgrounds, Visitor Center, and park staff residential areas. Zion has the capacity to irrigate about 142 acres. The proposed Project would initially irrigate 82 acres and have room for modification to the system to irrigate additional acreage in the future. Any unused water rights would be protected by converting them to non-use status.

Alternative C (Oak Creek Diversion): Under Alternative C, the irrigation system layout would consist of diverting water from the historic Oak Creek Diversion and piping it to a proposed sluice structure and settling tank. The Oak Creek Diversion structure is located on the west side of the North Fork of the Virgin River and currently diverts water to a historic open channel ditch. This structure would be designed to divert 1.21 cfs but initially operate at a reduced flow of about 1.00 cfs. Any water rights in excess of current needs would be protected in non-use status.

New gates would be installed on the Oak Creek Diversion to control flows and to sluice sediment away from the intake. A new pipeline from the sluice structure to the settling tank would be installed either directly beneath or adjacent to the existing Oak Creek Irrigation Ditch. The historic Oak Creek Irrigation Ditch would be restored to original contours following construction of the pipeline. Water would then be piped to the sluice structure, pump and filter station, and holding tank as described under the Preferred Alternative.

Environmental Effects of Proposed Project

This document analyzes the impacts the proposed Project would have to park resources. Specifically, soils, vegetation, water resources, Wild and Scenic rivers, historic structures, park operations, and visitor use and experience. Under the action alternatives, there would be no major impacts to any of the resources analyzed.

As a result of construction, staging, and laydown for the proposed Project, soils, vegetation, water resources, Wild and Scenic rivers, and historic structures would be affected under both the action alternatives described above. These effects would result from excavation, ground-disturbing activities, erosion, revegetation, and increases in water turbidity. Park operations and visitor use and experience would be impacted during construction as well, from increases in employee workloads and potential campground and trail closures, respectively.

During operation of the irrigation system proposed under either action alternative, water resources and Wild and Scenic rivers would be impacted from sediment transport, increases in retained stream flow, decreased water diversions, and the introduction of new above ground facilities in the park. In addition, during operation of the proposed Project, park operations and visitor use and experience would be impacted from reduced maintenance demands and the limitation of some play activities in the campgrounds (as a result of the irrigation system being converted to a pressurized irrigation system).

Through Project design, protective measures, and mitigation measures, all impacts from the proposed Project would be moderate or less to the park resources analyzed in this document.

NOTE TO REVIEWERS AND RESPONDENTS

If you wish to comment on this Environmental Assessment, you may post comments online at <http://parkplanning.nps.gov/> or mail comments to: Superintendent, Zion National Park, Upgrade Irrigation System, Springdale, UT 84767.

This Environmental Assessment will be available for public review for 30 days. Prior to including any personal identifying information in a comment, persons should be aware that entire comments, including personal identifying information, may be made publicly available at any time. Persons can ask the NPS to withhold personal identifying information from public review; however, the park cannot guarantee this.

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Acronyms

°F	degree Fahrenheit
ACHP	Advisory Council on Historic Preservation
APE	Area of Potential Effects
BLM	Bureau of Land Management
BMP	best management practice
BSC	biological soil crust
CAA	Clean Air Act of 1963
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
CRMP	Comprehensive River Management Plan
CWA	Clean Water Act of 1977
cy	cubic yard
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act of 1973
<i>GMP</i>	<i>General Management Plan</i>
HDPE	high density polyethylene
MBTA	Migratory Bird Treaty Act of 1918
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act of 1966
NPS	National Park Service
NRHP	National Register of Historic Places
ORV	outstanding remarkable values
park	Zion National Park
PEPC	Planning, Environment, and Public Comment
PVC	polyvinyl chloride
SHPO	State Historic Preservation Officer
U.S.	United States

USFWS U.S. Fish and Wildlife Service
VFD variable frequency drive
Zion Zion National Park

PURPOSE AND NEED

Introduction

Zion National Park (Zion or park), located in southwest Utah in Washington, Iron, and Kane counties, encompasses some of the most scenic canyon country in the United States (U.S.). Zion was established as Mukuntuweap National Monument on July 31, 1909 by Presidential Proclamation under the authority of the Antiquities Act. The proclamation stated that the area was set apart as "...an extraordinary example of canyon erosion and is of greatest scientific interest, and it appears that the public interest would be promoted by reserving it as a National Monument, with such other land as may be necessary for its protection." In 1918, Presidential Proclamation 1435 (40 Stat.1760) recognized other geologic, archeologic, and geographic resources for protection within the monument and changed the name to Zion National Monument. Zion was established by Congress in 1919. Since that time, Congress has added lands to the park several times. The park now encompasses 148,733 acres. The park is characterized by high plateaus, a maze of narrow, deep, sandstone canyons and striking rock towers and mesas. This varied topography ranges from sub-alpine meadows and coniferous forests at the highest elevations, to juniper and pine forests at mid-elevation, and desert shrublands at the lowest elevations of the park.

Zion displays important and diverse geologic, biological, cultural, and wilderness resources that are enjoyed by approximately 2.7 million visitors annually. Water is also an important resource within the park. Irrigation water is essential for park operations which irrigate turf, trees, and shrubs that are located within park staff residential areas and visitor use areas. The purpose of this Environmental Assessment (EA) is to examine the environmental impacts associated with the proposed Project to upgrade the irrigation system at the park. The proposed Project would replace the open ditch irrigation system with a pressurized system. This EA was prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), regulations of the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] Section 1508.9), and National Park Service (NPS) Director's Order-12, *Conservation Planning, Environmental Impact Analysis, and Decision-Making*.

Background

NPS owns water rights for diverting irrigation water from the North Fork of the Virgin River by virtue of acquiring irrigated farm lands in Zion Canyon along with their associated water rights. Zion currently has an 8-month irrigation season for both surface and pressurized irrigation and obtains irrigation water from the North Fork of the Virgin River using two diversion structures.

The upstream Oak Creek Diversion delivers water to Oak Creek Irrigation Ditch which carries this water along the west side of the river to South Campground. The Flanigan Diversion delivers water through a desander to a pressurized pipeline that is east of the river and is used to irrigate Watchman Campground and the Visitor Center. The Flanigan Diversion, and a portion of the pipeline, is shared with the Town of Springdale and the Springdale Consolidated Irrigation Company. Zion currently has water rights of 1.21 cubic feet per second (cfs) (Water Right #81-1128) and 1.38 cfs (Water Right #81-3608) which can be diverted from the Oak Creek and Flanigan Diversion structures, respectively.

The Oak Creek Irrigation Ditch was built in 1935 by Civilian Conservation Corps (CCC) labor to irrigate vegetation in the park's South Campground. The ditch is concrete lined for part of its length. Oak Creek Irrigation Ditch was determined eligible for listing in the National Register of Historic Places (NRHP) under Criterion A, for its association with significant events related to the CCC, and was listed in the NRHP on July 7, 1987 (NPS 2011a).

The Flanigan Ditch was constructed about 1880 by the Flanigan family, Mormon pioneers in the Zion valley. The Flanigan's began using water from the Virgin River for irrigation in 1880 to water the family's lands along the river. Over time, the farmlands on the lower portion of the ditch were abandoned below the present outlet at Watchman Campground in the park. A portion of Flanigan Ditch continues to carry water for irrigation of Watchman Campground. A portion of the ditch alignment, which is currently buried, is regarded as a potential archeological feature relating to the period of pioneer settlement. Flanigan Ditch was listed in the NRHP on January 12, 1998.

Zion's irrigation system is currently comprised of a combination of potable and irrigated water which services visitor use areas and NPS staff residential areas. Where water is conveyed by open ditch, there are labyrinths of open distribution ditches within the park's campgrounds used for irrigation. Leaves, vegetation, and silt often build up in these ditches, and campers traditionally like to play in, dam up, and reroute fingers of these ditches. Park staff has to continually clear and maintain these ditches to keep them in operation. Operation of the existing irrigation system has presented a substantial workload to park staff because of the maintenance requirements. In addition, the open ditches experience evaporative loss and seepage and are not efficient in irrigating targeted landscaped areas, as the irrigation system does not provide flexibility as to how and where the park irrigates. The system does not currently provide the flexibility to use river water for irrigation in areas where potable water is currently used.

Zion continues to actively maintain Oak Creek Irrigation Ditch in order to preserve its original historic integrity and also optimize its function as an irrigation feature. The park also ensures that the buried portion of Flanigan Ditch, which is no longer visible to park visitors, is preserved and protected from ground-disturbing activities.

The Omnibus Public Land Management Act of 2009 designated approximately 166 miles of the Virgin River and its tributaries across federal land within Zion and adjacent Bureau of Land Management (BLM) Wilderness as part of the National Wild and Scenic River System. The North Fork of the Virgin River has outstanding remarkable values (ORVs) for cultural, geologic, recreational, scenic, wildlife, and fish resources. Its tributary segment, Oak Creek, has ORVs for scenic and wildlife resources.

Purpose and Need

The purpose of the proposed Project is to upgrade the park's irrigation system which would decrease the maintenance requirements for the open irrigation ditches and increase the efficiency of the irrigation system in compliance with the goals and objectives of Zion's current plans and policies. The proposed Project is needed to accomplish the following objectives:

1. Decrease the maintenance demands of the open irrigation ditches.
2. Increase the efficiency of water use within the park.

3. Provide flexibility to use river water for irrigation of landscapes in areas where potable water is currently used.
4. Preserve the integrity of historic structures and the vegetation associated with historic ditches within the park.

Figure 1 is a map of the park area.

Relationship to Other Plans and Policies

Current plans and policy that pertain to the proposed Project include the *Zion National Park General Management Plan (GMP)* (NPS 2001a), the NPS' *Management Policies* (2006), the *Zion National Park Fire Management Plan* (NPS 2004), and the *Zion National Park Soundscape Management Plan* (NPS 2010). The proposed Project meets the goals and objectives of these plans and NPS policies as follows:

- The proposed Project is consistent with the park's 2001 *GMP*, which addresses upgrades to existing utilities. The *GMP* identifies Zion policies and practices that minimize impacts on the park's natural, cultural, and visual resources.
- The proposed Project is consistent with the goals and objectives of the NPS' *Management Policies* (2006) that state that, "...In-park utilities will be as unobtrusive as possible and have the least possible resource impact." In addition, "...The National Park Service will use water efficiently and sustainably. Water systems will be designed to maximally conserve water and the energy used in its treatment and distribution."
- The proposed Project is consistent with the goals and objectives of the *Zion National Park Fire Management Plan* (2004) which state, "...firefighter and public safety is the first priority in every fire management activity." Implementation of the proposed Project construction and operation would in no way interfere with firefighter or public safety.
- The proposed Project is consistent with the goals and objectives of the *Zion National Park Soundscape Management Plan* (2010) which state, "...noise levels that affect wildlife behavior, distribution and numbers should be uncommon and should be limited to locations near roads and heavily developed areas." In addition, "...sound levels that exceed thresholds for sleep interruption [should] rarely occur." The pump systems associated with the irrigation upgrade would be located in developed areas of the park and would not generate noise that would affect wildlife behavior; in addition, construction activities would be conducted during daylight and routine working hours.

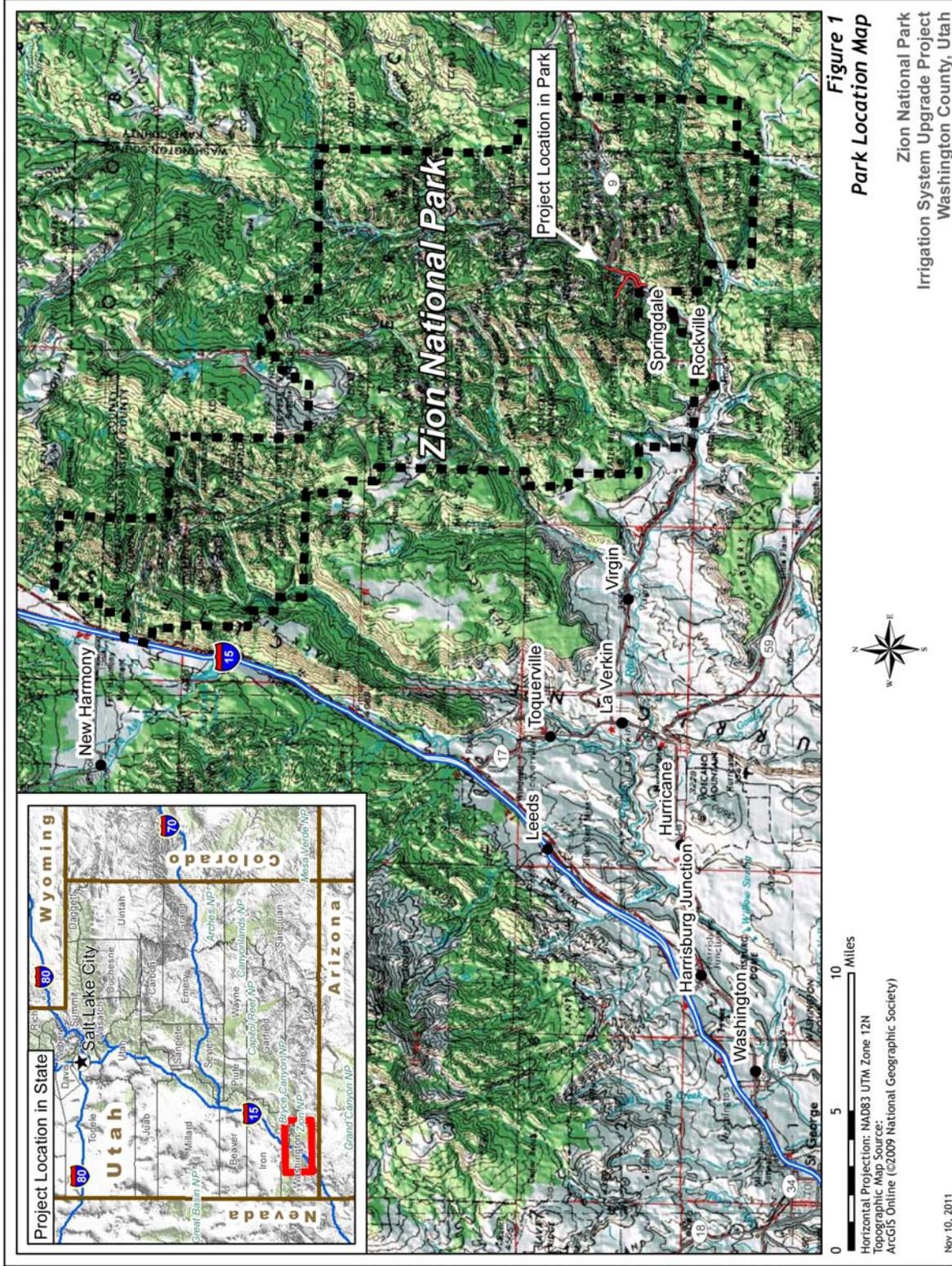


Figure 1
Park Location Map
 Zion National Park
 Irrigation System Upgrade Project
 Washington County, Utah

Impact Topics Retained for Further Analysis

The impact topics retained for further analysis in this EA were identified based on knowledge the NPS has of the resources at Zion, federal laws, the NPS' 2006 *Management Policies*, and the NPS' 2001 *GMP* for Zion. Impact topics carried forward for further analysis in this EA include:

- Soils
- Vegetation
- Water Resources
- Wild and Scenic Rivers
- Historic Structures
- Park Operations
- Visitor Use and Experience

Impact Topics Dismissed from Further Analysis

In this section, NPS takes a “hard look” at all potential impacts by considering the direct, indirect, and cumulative effects of the proposed Project on the environment, along with connected and cumulative actions. Impacts are described in terms of context and duration. The context or extent of the impact is described as localized or widespread. The duration of impacts is described as short-term, ranging from days to 3 years in duration, or long-term, extending to 20 years or longer. The intensity and type of impact is described as negligible, minor, moderate, or major, and as beneficial or adverse. The NPS equates “major” effects as “significant” effects. The identification of “major” effects would trigger the need for an Environmental Impact Statement (EIS). Where the intensity of an impact could be described quantitatively, the numerical data is presented; however, most impact analyses are qualitative and use best professional judgment in making the assessment.

The NPS defines “measurable” impacts as moderate or greater effects. It equates “no measurable effects” as minor or less effects. “No measurable effect” is used by NPS in determining if a Categorical Exclusion applies or if impact topics may be dismissed from further evaluation in an EA or EIS. The use of “no measurable effects” in this EA pertains to whether NPS dismisses an impact topic from further detailed evaluation in the EA. The reason NPS uses “no measurable effects” to determine whether impact topics are dismissed from further evaluation is to concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail, in accordance with CEQ regulations at 1500.1(b).

In this section of the EA, NPS provides a limited evaluation and explanation as to why some impact topics are not evaluated in more detail. Impact topics are dismissed from further evaluation in this EA if:

- they do not exist in the analysis area; or
- they would not be affected by the proposed Project, or the likelihood of impacts are not reasonably expected; or
- through the application of mitigation measures, there would be minor or less effects (i.e., no measurable effects) from the proposed Project, and there is little controversy on the subject or reasons to otherwise include the topic.

Due to there being no effect or no measurable effects, there would either be no contribution towards cumulative effects or the contribution would be low. For each issue or topic presented below, if the resource is found in the analysis area or the issue is applicable to the proposed Project, then a limited analysis of direct, indirect, and cumulative effects is presented.

Topography and Geology

The NPS' *Management Policies* (2006) states that the NPS will protect and preserve geologic resources and features from human activities that cause adverse effects, while allowing natural processes to continue unimpeded. "Geologic processes are the natural physical and chemical forces that act within natural systems and on human developments across a broad spectrum of space and time" (NPS 2006).

Zion sits on the edge of a region called the Colorado Plateau. Bare rock is exposed from a combination of rapid erosion and the dry climate. Sparse vegetation exists, showcasing the park's geology. The Virgin River is still excavating throughout the canyon (NPS 2011b). The construction of the proposed Project would be in an area of Zion that has largely been previously disturbed by the past construction of diversion dams, desanders, pipelines, sluice structures, turnouts, roads, and agricultural fields (though many of these lands have been revegetated so disturbances would appear new). Excavated areas for the proposed Project would be backfilled and surface areas would be returned to original contours and revegetated.

Given that the proposed Project would be constructed in previously disturbed areas that would be returned to original contours and revegetated, the Project would result in minor or less effects to topography and geology. Because these effects would be minor or less, topography and geology are dismissed from further analysis in this EA.

Prime and Unique Farmlands

The Farmland Protection Policy Act of 1981, as amended, requires federal agencies to look at adverse effects to prime and unique farmlands that could result in these being converted to non-agricultural uses. The U.S. Department of Agriculture's Natural Resources Conservation Service defines prime and unique farmlands as "land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. The land is also used as cropland, pastureland, rangeland, forest land, or other land, but cannot be used as urban built-up land or water" (U.S. Legal 2011).

The Project area does not contain prime and unique farmlands. Because there are no prime and unique farmlands in the Project area, this topic is dismissed from further analysis in this EA.

Wildlife

According to NPS' *Management Policies* (2006), NPS strives to maintain all components and processes of naturally-evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of animals (NPS 2006). Elevations in Zion range from approximately 3,800 to 8,800 feet and result in varying microclimates and habitats. As a result, Zion is home to over "78 species of mammals, 291 species of birds, 44 species of reptiles and amphibians, and eight species of fish" (NPS 2011c). Common mammals in the park include the desert cottontail (*Sylvilagus audubonii*), ringtail (*Bassariscus astusus*), mule deer (*Odocoileus hemionus*), and rock squirrel (*Spermophilus variegatus*).

Due to the abundant aquatic resources in the park, Zion supports healthy populations of native fish, including the Virgin spinedace (*Lepidomeda mollispinis*), speckled dace (*Rhinichthys osculus*), flannelmouth sucker (*Catostomus latipinnis*), and desert sucker



(*Catostomus clarki*). The fish of the Virgin River drainage have evolved adaptations to the unique local conditions, including heavy silt loads, frequent floods, and wide fluctuations in water temperature and discharge. The North Fork of the Virgin River contains abundant numbers of native species of fish, “likely due to a combination of a reduction in the primary productivity of the stream because it receives so little sunlight

and the great amount of bed scour and high water velocities that occur during floods” (Sharrow 2007). Other fish have been inadvertently introduced to Zion but are present in low numbers. These populations include rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki*), brown trout (*Salmo trutta*), channel catfish (*Ictalurus punctatus*), and brook trout (*Salvelinus fontinalis*). High sediment loads and frequent floods typically exclude exotic fish or keep their populations very low at Zion (Sharrow 2010).

River flows would not be interrupted during construction of the proposed Project, though some of the work on the intakes may require temporary isolation from the river by sand bags. In addition, best management practices (BMPs) would be implemented to minimize erosion leading to sedimentation in drainage areas. Therefore, impacts to fish would be temporary and negligible in extent.

The majority of the Project area is in areas heavily used by visitors, and wildlife in the area has generally habituated to human presence. The noise from heavy equipment and construction personnel may result in the temporary movement of wildlife away from construction areas and potential mortality of individual wildlife from wildlife and vehicle collisions. Wildlife populations generally could use other areas of local habitats without experiencing much of an adverse effect. Excavation and pipeline trenching would adversely affect wildlife foraging habitat due to the temporary loss of vegetation. Ample vegetation and foraging habitat exist within the surrounding area that would be available during construction. Adverse effects to wildlife foraging would be temporary and negligible as these areas would be revegetated following construction. There would be tree removal within the pipeline alignment. Limited tree and shrub removal may result in minor wildlife habitat loss. Bird populations in the park vary by season. If construction activities are scheduled within the nesting season for birds protected under the Migratory Bird Treaty Act of 1918 (MBTA), generally April 1 through July 15, pre-construction surveys would be conducted for nests. No construction activities would be conducted in identified nesting areas until the young had fledged.

Based on the relatively small areas that would be affected by the proposed Project and the short-term nature of the effects, construction activities associated with the irrigation system upgrade would have short-term and negligible to minor effects on wildlife and their habitats. Because these effects would be minor or less, wildlife has been dismissed from further analysis in this EA.

Special Status Species

The Endangered Species Act of 1973 (ESA) requires the impacts on all federally-listed threatened, endangered, and candidate species to be examined. Consultation with the U.S. Fish and Wildlife Service (USFWS) is required under Section 7 of the ESA to ensure that actions authorized, funded, or carried out by an agency do not jeopardize the continued existence of critical habitats or listed species. The NPS' 2006 *Management Policies* and Director's Order-77, *Natural Resources Management Guidelines*, require NPS to look at impacts on federal candidate species, as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive species (NPS 2006).

Table 1 lists the threatened, endangered, and candidate species that are either known to occur or that could occur in Zion.

Table 1: Threatened, Endangered, and Candidate Species That Could Occur in Zion

Common Name	Scientific Name	Federal Status
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	Threatened
California Condor	<i>Gymnogyps californianus</i>	Endangered
Western Yellow-billed Cuckoo	<i>Coccyzus americanus occidentalis</i>	Candidate
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	Endangered
Desert Tortoise	<i>Gopherus agassizii</i>	Threatened
Virgin River Chub	<i>Gila seminuda</i>	Endangered
Shivwits Milk-vetch	<i>Astragalus ampullariodes</i>	Endangered
Woundfin	<i>Plagopterus argentissimus</i>	Endangered

Source: USFWS, 2004.

The Mexican spotted owl is federally-listed as a threatened species. It occurs in Zion, which is within the Colorado Plateau Recovery Unit for this species. All of Zion is designated critical habitat for the Mexican spotted owl (USFWS 2004). Zion has 33 historic/known Mexican spotted owl territories that are widely distributed throughout the park (USFWS 2004). There are no historic/known Mexican spotted owl territories within or adjacent to the Project area.

All of Zion was designated as critical habitat for the Mexican spotted owl in August 2004 (USFWS 2004). The identification of critical habitat is based on data available at the time of designation. The focus for critical habitat is on the physical and biological features essential to the conservation of the species, referred to as the primary constituent elements, that are within areas occupied by the species at the time of listing, and that may require special management considerations and protection. The primary constituent elements necessary to ensure the conservation of the Mexican spotted owl include: the presence of water; abundance of canyon walls with crevices, caves, and ledges; clumps or stringers of mixed conifer, pine-oak, pinyon-juniper, or riparian vegetation; and a high percentage of ground litter and woody debris. The proposed Project would not affect the primary constituent elements necessary for the survival of this species.

The federally-endangered California condor must be treated as a listed threatened species under the 10(j) (a nonessential, experimental population under the ESA) designation of Zion. In 2004 and 2006, California condors were observed in the park

and are believed to be expanding their range to the north. Although the California condor may visit Zion more often in the future, the species is not known to use the park as a breeding area nor use the park year round (USFWS 1996).

The western yellow-billed cuckoo is a candidate species for listing on the endangered species list. The primary breeding habitat for this species is cottonwood canopy (Wauer 1997). The park has conducted surveys to determine if this species exists in the park. Surveys in 2008, 2009, and 2010 found no evidence of this bird.

The southwestern willow flycatcher is a federally endangered species that was once sighted on the East Fork of the Virgin River in 1994. Several individuals of this species have been sighted downstream of the park along the Virgin River. The park conducted surveys from 2008 through 2010 to determine if this species exists in the park. No indication of this species has been found.

The desert tortoise, a threatened species, occurs in a small area of the park (USFWS 1994); however, this area is not included within the proposed Project area.

The Virgin River chub and woundfin, both endangered species, occur downstream of Zion in the Virgin River below the Town of LaVerkin (USFWS 1995); however, neither of these species are known to occur within several miles of Zion.

In addition to the federal species discussed above, there are several wildlife species that occur or have the potential to occur in Zion that are under conservation agreements or that are listed as Utah sensitive species.

In lieu of being listed as a threatened or endangered species, the Virgin spinedace and flannelmouth sucker are managed under conservation agreements in Utah (USFWS 1995). These fish have been sighted in the North Fork and East Fork of the Virgin River and several tributaries within Zion. As described in the *Wildlife* section, river flows would not be interrupted during construction of the proposed Project, though some of the work on the intakes may require temporary isolation from the river by sand bags. In addition, BMPs would be implemented to minimize erosion leading to sedimentation in drainage areas. Impacts to fish would be temporary and negligible in extent.

The Northern goshawk (*Accipiter gentilis*) is a state-listed Tier I and Conservation Agreement species in the state of Utah, and is known to nest in the park and hunt over open grasslands. The northern goshawk inhabits high elevations in the park and several of their breeding nests have been found in the park (NPS 2011d). These birds typically return to the same wintering location year after year and use the same nest for many years (Peregrine 2011).

The peregrine falcon (*Falco peregrinus anatum*) was removed from the federal list of endangered and threatened species in 1999 due to its successful recovery. Zion hosts a high concentration of breeding peregrines that nest on steep cliffs throughout the park. Zion is known to have 20 historic falcon breeding territories. A subset of those territories, with technical climbing routes, are monitored each year (NPS 2011d). Each year, cliffs with known nest sites are closed to technical climbing at the beginning of the nesting season. If a nest site is not used, the area is opened to climbing. In areas where the nest sites are used, the areas are closed to climbing until the young falcons have fledged. There are no peregrine falcon territories within the Project area.

One federally listed endangered plant species, the Shivwits milk-vetch (*Astragalus ampullariodes*), occurs in Zion. This species was listed in 2001 by the USFWS because of its extremely limited range on the Chinle Formation and its rapidly vanishing habitat

due to development outside the park (USFWS 2001). The Recovery Plan for Shivwits milk-vetch was finalized in September 2006. On December 27, 2006 the USFWS designated 2,421 acres of critical habitat for Shivwits milk-vetch, with almost half of those acres, 1,201 acres, within the park (USFWS 2011).

The identification of critical habitat is based on data available at the time of designation. The focus for critical habitat is on the physical and biological features essential to the conservation of the species, which are referred to as the primary constituent elements, that are within areas occupied by the species at the time of listing, and that may require special management considerations and protection. The primary constituent elements for Shivwits milk-vetch are: outcroppings of soft clay soil within the Chinle, and less commonly, the Moenave Formations, at elevations from 3,018 to 4,367 feet; topographic features/relief, including alluvial fans and fan terraces, and gently rolling to steep swales with little to moderate slope that are often markedly dissected by water flow pathways from seasonal precipitation; and the presence of insect visitors or pollinators. The proposed Project area is not within the critical habitat for this species and there is no potential habitat for Shivwits milk-vetch within the Project area.

For construction activities scheduled within the nesting season for birds protected under the MBTA, generally April 1 through July 15, pre-construction surveys would be conducted for nests. No construction activities would be conducted in identified nesting areas until the young had fledged. Because these mitigation measures would be implemented to lessen effects to migratory birds, and no sensitive species are known to nest and breed within the proposed construction areas, effects to migratory birds during construction activities would be localized, short-term, and negligible.

Given that there would be no effects to federally threatened, endangered, proposed, and candidate species, and that mitigation measures would lessen the effects to protected fish and migratory birds, the resulting impacts would be short-term and negligible. Because these effects to special status species would be minor or less in degree, this topic is dismissed from further analysis in this document.

Wetlands

The Clean Water Act of 1977 (CWA) defines wetlands as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.” Section 404 of the CWA authorizes the U.S. Army Corps of Engineers (Corps) to regulate or prohibit, through permitting, discharged, dredged, filled, or excavated materials within waters of the U.S. Executive Order (EO) 11990, *Protection of Wetlands*, requires federal agencies to avoid adversely impacting wetlands, where possible. According to the NPS’ 2006 *Management Policies*, the NPS will manage wetlands to prevent their destruction, loss, or degradation, and preserve and enhance their natural and beneficial values. The NPS will also avoid direct and indirect impacts to wetlands with new construction, unless there are no practicable alternatives. The portions of the proposed Project with potential to affect riparian wetlands, at both diversion structures, are consistent with the excepted actions for maintenance, repair, or renovation (but not full reconstruction or expansion) of currently serviceable facilities or structures (NPS Procedural Manual #77-1, Section 4.2.A.1 [NPS 2011e]) and are therefore, exempt from further compliance steps under EO 11990, including a Wetlands Statement of Findings.

No wetlands are located within the proposed Project area. Because there are no wetlands within the proposed Project area, this resource topic is dismissed from further analysis in this EA.

Floodplains

EO 11988, *Floodplain Management*, requires federal agencies to avoid construction within the 100-year floodplain unless no practicable alternative exists. The NPS' 2006 *Management Policies* states that the NPS will manage lands to preserve floodplain values and minimize hazardous conditions associated with floodplains. Director's Order 77-2, *Floodplain Management*, requires preparation of a Statement of Finding for Floodplains for certain construction within a 100-year floodplain.

There are three common types of floods that take place in Zion: spring runoff, summer monsoon, and winter rain-on-snow events. Flows of over 4,000 cfs occur on the North Fork of the Virgin River on average, once every 8 years. The last large flood took place on December 21, 2010 with a peak discharge of 5,910 cfs, at which time the concrete wall at the Flanigan Diversion was overtopped and water washed over the existing sluice structure. No other portions of the Project area were inundated during that flood event (Sharrow 2010).

Some components of the Project that are in the immediate vicinity of a diversion dam, by their very nature, would have to occur in a floodplain. Although filling and modification of the ground surface would be required for the proposed Project, it would not be such that people or inhabited structures would be exposed to flooding, and the Project would not adversely affect the functioning of the floodplains or increase flood risk to others. Construction associated with the proposed Project could result in small-scale temporary disturbances to the stream bank at the Oak Creek Diversion and Flanigan Diversion structures. The stream banks would be restored following construction. A 3- to 4-foot high grouted rock face berm would be constructed above the existing concrete wall of the Flanigan Diversion to protect the sluice structure from overwash during large flood events. The berm would redirect stream flow locally during flood events with return periods of 30 years or greater. In addition, construction equipment and materials may be staged or stored in a potential floodplain area. However, there would be no permanent effects to floodplains from construction staging or laydown, and the effects from the temporary occupancy of staging equipment and material laydown would be negligible.

The proposed Project would not threaten public health and safety nor would there be potential for property damage due to its implementation. The proposed Project would not adversely affect the functions of a floodplain or increase flood risk. The activities associated with upgrading the park's irrigation system would not violate National Flood Insurance Program requirements or result in changes that would increase an existing floodway or the flood elevation level associated with the 100-year flood event.

The proposed Project is exempt from compliance with EO 11988 and from preparing a Statement of Findings for Floodplains because the Project, by its nature, must occur in the floodplain. The proposed Project would not alter the floodplain's function compared to the existing structure, and the presence of a diversion dam is consistent with the Statement of Findings for the *GMP* (NPS 2001a). Because potential effects would be minor or less in degree, this topic is dismissed from further analysis in this EA.

Paleontological Resources

According to the NPS' 2006 *Management Policies*, parks will protect, preserve, and manage mineralized and organic remains in body or trace form, for public education, interpretation, and scientific research.

The Utah Geological Survey completed a survey of the paleontological resources of Zion National Park in 2005 (De Blieux *et al.* 2005). Among the paleontological resources found in the park were bones, plant materials, imprints, tracks, burrows, and other trace fossils, wood, invertebrates, fish, and Quaternary tracks.

No paleontological resources have been identified or documented within the Project area. Should paleontological resources be uncovered during construction, appropriate steps would be taken to protect them, including stopping work in the area until the resources could be evaluated, and if appropriate, stabilized or avoided. Because there would be no impacts to known paleontological resources in the park, this topic is dismissed from further analysis in this EA.

Archeological Resources

The National Historic Preservation Act of 1966 (NHPA) was established to preserve and protect national historical and archeological sites in the U.S. The NPS is one of the principal stewards of America's heritage. Director's Order-28A, *Archeology*, states the NPS is responsible for preserving traditional cultural values of archeological resources for the benefit and enjoyment of present and future generations. The NPS does this through stewardship within the national parks, and by providing assistance to federal, state, tribal, local, and other entities.

Approximately 13 percent of the park, encompassing the whole main canyon area inclusive of the entire Project area, has been surveyed for archeological resources. Over 400 sites, both prehistoric and historic, have been documented. Many of these sites are artifact scatters, containing prehistoric flaked stone tools and ceramics or historic period tin cans and bottles (Conner and Vetter 1986).

There is one known archeological feature within, and two known archeological features near, the Project Area of Potential Effects (APE) that meet eligibility criteria for listing in the NRHP (Conner and Vetter 1986). The site within the APE spans an existing road corridor that has been extensively previously disturbed. The proposed pipeline alignment and associated construction activities would be located within the boundaries of the previously disturbed road corridor.

Because it is a NPS goal to avoid impacts to archeological resources, ground-disturbing activities in archeologically-sensitive areas would be monitored by an archeologist and would meet the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation*. Within known archeological site areas, surface disturbances and construction access corridors would be limited to previously disturbed areas and kept to a minimum. Therefore, the proposed Project would not impact these archeological deposits; however, appropriate steps would be taken to protect any archeological resources that are inadvertently discovered during construction.

Because the proposed Project would not disturb any known archeological sites outside areas that have been extensively previously disturbed, and because the identified archeological site within the Project corridor would be monitored during all ground-disturbing activities, there would be no effects on archeological resources. Because

there would be no effects to archeological resources, this topic is dismissed from further analysis in this document.

Ethnographic Resources

NPS Director's Order-28, *Cultural Resource Management Guideline*, defines ethnographic resources as any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. According to Director's Order-28 and EO 13007, *Indian Sacred Sites*, on sacred sites, the NPS should work to preserve and protect ethnographic resources.

Eleven affiliated American Indian tribes are traditionally associated with Zion. The tribal contacts were sent an informational letter on June 13, 2011 describing the proposed Project and the NPS' desire to hear their comments. No scoping comments were received from American Indian tribes as of the date of this EA. The American Indian tribes will be notified of the availability of this EA for review and comment. If subsequent issues or concerns are identified, appropriate consultation would be undertaken.

According to NPS professional staff and the *GMP* (NPS 2001a), to date, no ethnographic resources within the park have been determined eligible for listing in the NRHP.

Zion and the Virgin River are within the homeland of the Southern Paiute. The Virgin River and canyon retain cultural significance to the Paiute people as a place of special meaning. Although the Project includes work along the Virgin River and Oak Creek, the Project would not affect the abundance or quality of the water (i.e., Zion's currently allotted 2.59 cfs water rights would not be exceeded).

Because it is unlikely that ethnographic resources would be affected by the proposed Project, and because appropriate steps would be taken to protect any ethnographic resources that are inadvertently discovered, this topic is dismissed as an impact topic in this EA.

Cultural Landscapes

A cultural landscape is "a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person, or exhibiting other cultural or aesthetic values" (NPS 1994). A cultural landscape inventory has not been conducted for the Project area. The actions described in this EA would have no long-term effects on the way land is organized and divided, patterns of settlement, or systems of circulation. During construction, areas of open land would be utilized for temporary staging or laydown areas. Adverse effects to cultural landscapes from construction activities would be local, short-term, and negligible. Following construction, new facilities would either be visually screened or not readily visible to park visitors. Historic structures would be preserved or restored to original contours if disturbed. Long-term effects on cultural landscapes would be adverse, local, and negligible. Because there would only be negligible effects on cultural landscapes, this topic is dismissed from further analysis in this document.

Museum Collections

According to Director's Order-24, *NPS Museum Collections Management*, the NPS is the custodian of objects, specimens, and archival and manuscript materials that are irreplaceable and priceless. These represent cultural and natural resources of the U.S. that are part of the natural and cultural heritage of the country. The NPS collects,

preserves, and interprets museum collections for public benefit. The Project area does not contain any museum collections. Because there are not any museum collections in the Project area, this topic is dismissed from further analysis in this EA.

Indian Trust Resources

Secretarial Order 3175 requires Indian trust resources that will be impacted by a proposed Project by U.S. Department of Interior agencies to be explicitly addressed in environmental documents. This is a legally enforceable fiduciary obligation of the U.S. to protect tribal lands, assets, resources, and treaty rights. The federal Indian trust responsibility represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes.

There are no known Indian trust resources in the Project area. Zion park land is not held in trust by the Secretary of the Interior for the benefit of Indians due to their status as Native Americans. Because there are no known Indian trust resources in the Project area, this topic is dismissed from further analysis in this EA.

Air Quality

The Clean Air Act of 1963 (CAA) was developed to protect and enhance the nation's air quality by promoting public health and welfare. Park units are required to meet all federal, state, and local air pollution standards under Section 118 of the CAA. In addition, under the CAA, the Federal Land Manager has the responsibility to protect air quality related values from adverse pollution impacts, including visibility, plants, animals, soils, water quality, cultural resources, and visitor health. Zion is designated a Class I area under the CAA. "This designation allows air quality characteristics, including visibility, to be degraded the least, compared to other CAA designations" (NPS 2001b).

During construction of the proposed Project, hauling materials and operating heavy equipment could impact air quality on a temporary and localized basis. Vehicle and machinery exhaust, emissions, and fugitive dust would be experienced but would likely dissipate quickly with the free-flowing air through the park. The emission of fugitive dust would be reduced by applying water to dry soils as needed. The proposed Project could result in negligible degradation of local air quality, but such degradation would be short-term and only last as long as construction. The Class I air quality designation for Zion would not be affected by the proposed Project. Because there would only be negligible effects on air quality, this topic is dismissed from further analysis in this EA.

Wilderness

On March 30, 2009, President Barack Obama signed into law the Omnibus Public Land Management Act of 2009, which resulted in the designation of Wilderness areas in Zion. Ninety percent of Zion is managed as Wilderness, including 124,462 acres of designated Wilderness and 9,047 acres of recommended Wilderness (NPS 2010). The Wilderness Act and NPS policy (Director's Order-41, *Wilderness Preservation and Management*) require that the "characteristics and values associated with wilderness be protected and preserved."

The proposed Project area is in an area not suitable for Wilderness; however, designated Wilderness or recommended Wilderness is on lands north, east, and west of the park at varying distances. All proposed irrigation upgrade activities would occur outside of wilderness boundaries and, therefore, would not be subject to Wilderness Act requirements. Construction-related noise and disturbance would result in local, short-term, negligible, and adverse effects on the natural quiet typically found in

Wilderness areas, but would have no long-term effect. Because of only the short-term, negligible, and adverse effects to Wilderness during construction, and the absence of direct, adverse effects on Wilderness resources and values from the proposed Project, this topic is dismissed from further evaluation in this EA.

Soundscape

The NPS' 2006 *Management Policies* states that the NPS "will restore to the natural condition wherever possible those park soundscapes that have become degraded by unnatural sounds (noise), and will protect natural soundscapes" (NPS 2006). In Zion, natural sounds predominate and visitors can experience these in most areas of the park unimpaired. The sound environment at Zion plays an important role in supporting diverse and healthy ecosystems. "Properly functioning soundscapes are important for animal communication, territory establishment, predator and prey relationships, mating behaviors, nurturing young, and effective use of habitat" (NPS 2010). Appropriate sounds and sound levels help ensure authentic visitor experiences at the park.

The proposed Project would increase sound levels in the Project area during construction; however, these increases would be temporary and short-term, lasting only as long as construction. Additionally, construction activities that particularly raise sound levels in the park would be timed so as not to conflict with natural wildlife interactions and activities, and to limit the impact on park visitors.

Because the soundscape would experience minor or less effects from the proposed Project, this resource is dismissed from further analysis in this EA.

Lightscape Management

In accordance with NPS' 2006 *Management Policies*, NPS strives to preserve the natural lightscapes of parks to the greatest extent possible. Lightscapes are "natural resources and values that exist in the absence of human-caused light" (NPS 2006). Zion limits the use of artificial lighting to that which is necessary for park operations, security, safety, and cultural resource requirements to retain the park's natural ambient setting.

Construction activities would be conducted only during daylight and routine working hours. The proposed Project could introduce minimal outdoor lighting in the Project area during construction in the unlikely event that construction had to continue in to the evening hours. However, construction-related lighting would be short-term, and no permanent lighting would be introduced to Zion as part of the proposed Project. Any construction-related lighting would be temporary and negligible, lasting only as long as construction. Because these effects would be negligible, this topic is dismissed from further analysis in this EA.

Socioeconomics

The proposed Project would not appreciably affect local businesses or other agencies and would not change local and regional land use. Implementation of the proposed Project may provide a negligible, short-term, beneficial impact to the economies of Springdale, Hurricane, and LaVerkin, Utah due to the flux in employment opportunities for the construction workforce. Local business and government revenues could also experience a slight beneficial impact from the additional construction activities and workers. Should the park experience any temporary campground or other closures, a negligible, short-term, adverse impact to park revenues would be experienced. Any increases in workforces and revenues and any decreases in park revenues would be temporary, short-term, and negligible, lasting only as long as construction. Because the impacts to the economic environment would be minor or less, this topic is dismissed from further analysis in this EA.

Environmental Justice

EO 12898, *General Actions to Address Environmental Justice in Minority Populations and Low-income Populations*, requires all federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities.

The proposed Project would not hire construction workforces based on their race or income, and all populations, regardless of race or income, would have the opportunity to experience the benefits of the improved irrigation system at Zion. Because the proposed Project would not have disproportionately high and adverse human health and environmental impacts, this topic is dismissed from further analysis in this EA.

Climate Change and Sustainability

Weather and temperatures at Zion vary. Warm, sunny weather is typical in the spring. In the summer, monsoons are typical from mid-July in to September, with temperatures often exceeding 100 degrees Fahrenheit (°F). Fall weather is typically cooler and drier, with winters being cold and often wet (with temperatures of 50°F to 60°F during the day and below freezing at night) (NPS 2011f). Precipitation varies with elevation in the park, from about 12 to 25 inches per year (Sharro 2010). The canyon in Zion experiences some regular down-canyon winds. Cool air drains downslope, like water, off of the North Fork watershed and produces regular down-canyon winds when there are no disrupting regional winds (Sharro 2010).

The long-term results of global warming are yet to be known; however, it's clear that the earth is warming. Due to the number of variables that impact the climate, it would be speculative to predict future changes. The analysis in this EA is based on past and present weather patterns at Zion that the proposed Project is not expected to impact and that the authors of this EA cannot predict with any reasonable level of certainty. Because of this, climate change and sustainability are dismissed from further analysis in this EA.

ALTERNATIVES

During August of 2011, an interdisciplinary team of NPS employees met with the purpose of developing Project alternatives. This meeting resulted in the definition of Project objectives as described in the *Purpose and Need* and a list of alternatives that could potentially meet these objectives. A total of five action alternatives and the No Action Alternative were originally identified for this Project. Of these, three of the action alternatives were dismissed from further consideration for various reasons, as described later in this chapter. Two action alternatives and the No Action Alternative were carried forward for further evaluation in this EA. Following are basic descriptions of the four main Project components included in the *Alternatives Carried Forward*. Typical figures for some of these components are provided in Appendix A. A summary table, Table 4, comparing alternative elements is presented at the end of this chapter.

Project Component Descriptions

Diversion Dams

The diversion dams are low-head dams that extend across the river, 6 to 8 feet high, which raise the elevation of the water so that a portion can spill over into intake pipelines. Both the Flanigan Diversion and Oak Creek Diversion dams are constructed of rock rubble covered with a concrete face, with intakes protected by a concrete wall along the river bank (see Appendix A for a typical figure of a diversion dam).

Sluice (Desanding Structure)

The sluice structures are intended to remove rocks, sand, and floating debris from the water to protect the pipelines that carry the water. For the proposed Project, these would be elongated water tanks that are trapezoidal in shape (see Appendix A for a typical sluice figure). Water from the river would flow into the narrow end of the tank and move through it, gradually slowing and decreasing in velocity. This would permit rocks, gravel, and sand from the river to settle to the bottom, where a discharge pipe could carry the sediment back to the river. Similarly, floating debris would be spilled over a lip of the tank and join the sediment discharge back to the river. The desanded water would then enter a pipe which would carry the water to the settling tank. The sluice structure would be located near the intake at the diversion dam. In order for water to flow to it, it would have to be slightly lower in elevation than the water intake at the diversion dam.

Settling Tank

The settling tank for the proposed Project would perform a similar function to the sluice, except that it would be larger and designed to remove fine sand and silt-sized particles before the water reached the filters and pumps. For this to happen, water velocities through the tank would be much slower. As such, the tank would be much larger than the sluice. The settling tank proposed under Alternatives A and B would be circular in shape with water entering at the center of the tank and slowing as it expanded toward the exterior (see Appendix A for a typical figure of a settling tank). As with the sluice, the sediment-laden water at the bottom of the tank would be discharged back to the river. The settling tank would not need to be located near the diversion dam, so its location would be flexible and could be adjusted for ease of construction and maintenance, avoiding sensitive resources. The settling tank could even be constructed below ground level.

Filter and Pump

Before water would enter the distribution and storage system for the proposed Project, it would pass through filters to remove the last of the sediment load. From there, water would be pumped to the storage tank or directly to a pressurized distribution system. Filters and pumps would be housed together in a small structure, typically near the settling tank, with the specific location selected based on ease of construction and maintenance and resource protection.

Alternatives Carried Forward

Alternative A – No Action

Under Alternative A, the existing irrigation system would be retained and not upgraded or modified. The existing open ditch system would continue to irrigate South Campground and portions of Watchman Campground. Open ditches within the campground areas would continue to require ongoing maintenance, and water use would remain inefficient. Should Alternative A be selected, NPS would respond to future needs and conditions of the irrigation system without major actions or changes in the present course of action. See Figure 2 for an exhibit of the existing irrigation system.

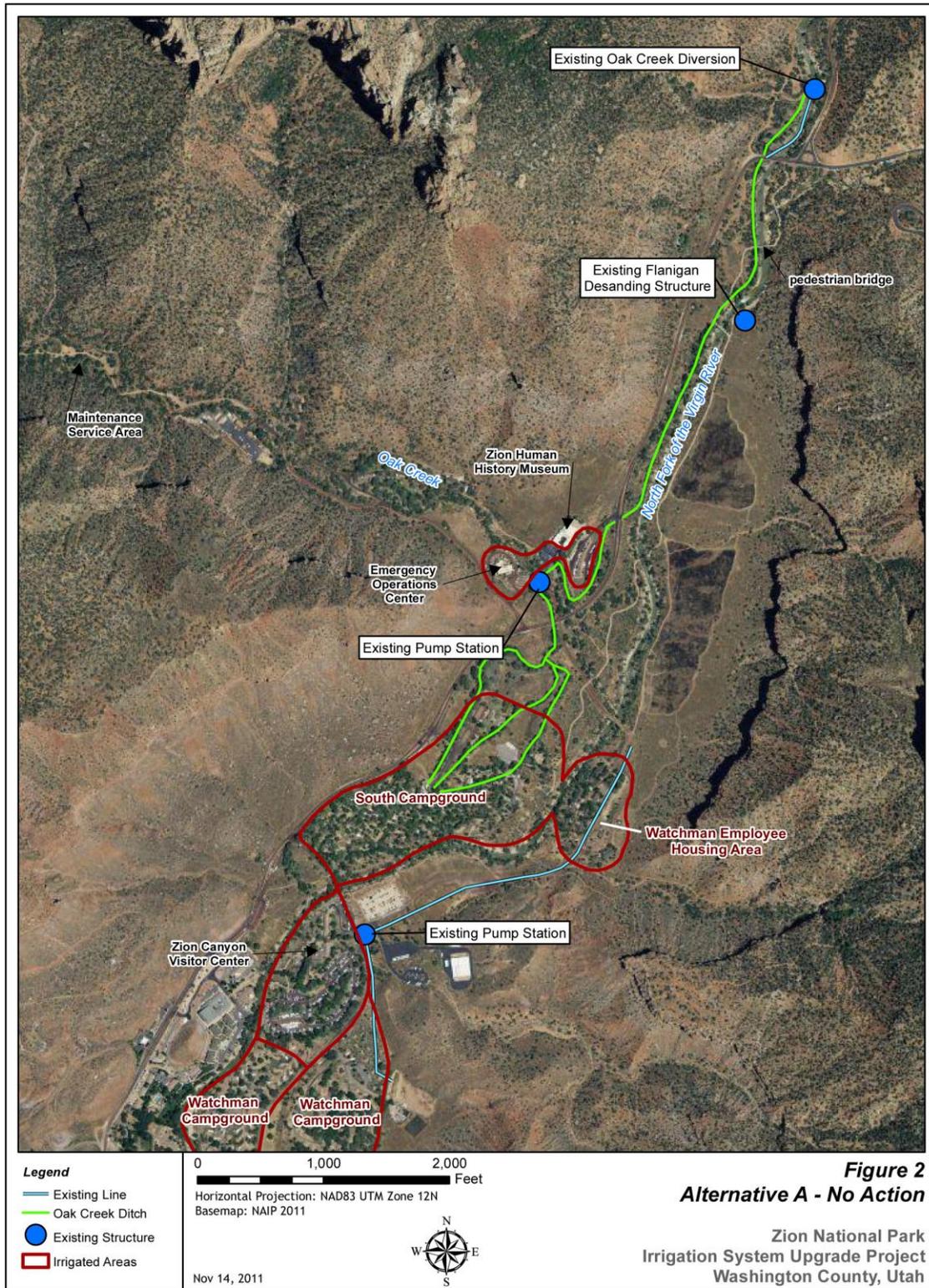
Alternative B – Flanigan Diversion

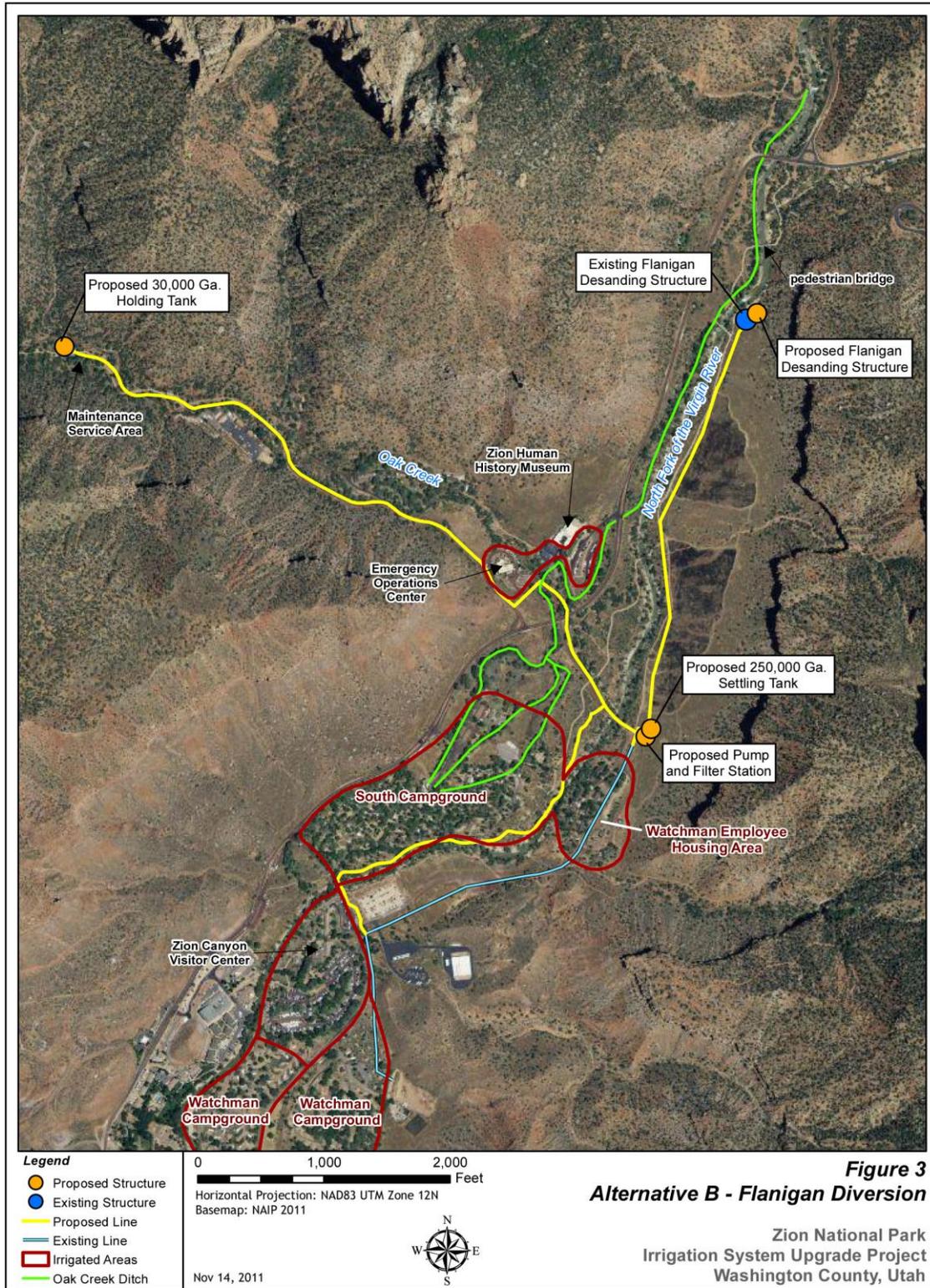
Under Alternative B, pressurized filtered river water would be provided for irrigation by taking water at the Flanigan Diversion. A new water intake would be constructed in the existing concrete wall of the Flanigan Diversion (next to the existing intake) that would pipe water to a new sluice structure, pump and filter station, and holding tank. Small sandbag cofferdams would be constructed within the North Fork of the Virgin River to temporarily divert water away from the construction area. The existing wall at the Flanigan Diversion structure would be core drilled and an 18-inch pipe would be installed to the proposed new sluice structure. A metal slide gate would be installed on the new opening to control flows in and out of the system. River flows would not be interrupted during construction of the proposed Project, though some of the work on the intakes may require temporary isolation from the river by sand bags. A 3- to 4-foot high grouted rock face berm would be constructed above the existing concrete wall of the Flanigan Diversion to protect the sluice structure from overwash during large (i.e., 30-year) flood events.

Zion would divert up to 1.38 cfs of its total water right into a pressurized pipeline to irrigate the campgrounds, Visitor Center, and park staff residential areas. See Figure 3 for an exhibit of the irrigation system proposed under Alternative B.

Zion has the capacity to irrigate about 142 acres. The proposed Project would initially irrigate 82 acres and have room for modification to the system to irrigate additional acreage in the future. Any unused water rights would be protected by converting them to non-use status.

Under Alternative B, there would be no disturbance to the Oak Creek Diversion and Oak Creek Irrigation Ditch.





Sluice Structure, Settling Tank, and Pump and Filter Station

The proposed sluice structure (desanding structure) and settling tank under Alternative B would remove large-particle river sediment from the irrigation system. The structure would be located approximately 60 feet downstream of the Flanigan Diversion and east of the existing Springdale sluice. The sluice structure and settling tank would be accessible from the pedestrian path in this area and an existing dirt access road. The sluice structure would be approximately 30 feet long by 8 feet deep and vary in width from 14 feet to 18 feet, allowing the heavier sediment to settle before exiting the sluice. An outlet to the river would flush the larger silt out from the desanding structure, and a 250,000-gallon concrete settling tank (located in an open area approximately 3,400 feet from the proposed new sluice structure) would remove the finer silts from the system. The tank would be approximately 50 feet long by 45 feet wide by 15 feet deep, and would be buried and located near the proposed pump station, as shown on Figure 3.

Approximately 140 cubic yards (cy) of soil would be excavated for the construction of the new sluice structure and approximately 1,200 cy of material would be excavated for the construction of the new settling tank. Some of the excavated material would be used for visual screening of the new structures. Some excavation would require cuts in the boulders near the Flanigan Diversion. These boulders could be salvaged and used for visual screening of Project components. Excavated rock and soil would be used to create a protective berm between the diversion and the sluice to reduce the risk of overwash during moderate and large flood events.

The water diverted from the sluice structure would be conveyed via a 12-inch pipe to a settling tank and pump and filter station that would be initially designed to pump 1.00 cfs, but expandable to the full water right of 1.38 cfs. The remaining 1.21 cfs would be retained at the Oak Creek Diversion and discharged through the existing open ditch system to irrigate ditch-side vegetation or would be protected in non-use status. The 12-inch pipeline from the sluice structure to the proposed settling tank and pump station would be a gravity-fed system. The settling tank would be located east of the bridge to the Watchman Housing Area. It would receive water from the sluice, remove fine sediment, and then water would be piped a short distance to a filter and pump unit. The pump system would be housed in a small building (approximately 25 feet long by 25 feet wide by 9 feet high). From there, the unit would pump water up Oak Creek Canyon to a holding tank that would provide some storage and a constant pressure for the distribution system. All above ground facilities would be visually screened and designed to blend with the natural setting in the Project area.

Pressure Line and Holding Tank

New pipe (consisting of high density polyethylene [HDPE] pipe or polyvinyl chloride [PVC]) would be laid from the new pump and filter station either within or immediately adjacent to the employee road north to the existing irrigation pipeline interconnect near the Emergency Operations Center and employee parking lot. From there, the water would be transported up Oak Creek Canyon to a holding tank via an 8-inch pressurized pipeline (Oak Creek pipeline). The Oak Creek pipeline would follow the path of the service road upstream of the maintenance service buildings and would be aligned within the previously disturbed areas of the road boundary. The holding tank would be constructed up Oak Creek Canyon near the maintenance service area of the park that is not readily accessible to park visitors. The 30,000-gallon holding tank would be approximately 22.5 feet long by 12 feet wide by 15 feet high. Two-thirds of the tank

(10 feet) would be below ground and one-third (5 feet) would be above ground. The tank would not be visible from Oak Creek.

Note: There is a modification being considered by the park to use an on-demand variable frequency drive (VFD) pump to pressurize the system in place of the holding tank. This EA analyzes impacts associated with the proposed holding tank and associated pipelines. If the reliability of the VFD pump system can be demonstrated, then the 30,000-gallon holding tank and the pipelines to and from it could be eliminated from the proposed Project, along with those associated impacts.

Irrigation Delivery

The delivery from the holding tank to bring water back down to use in park areas would be done via the same pipeline that supplied water to the holding tank. Initial demand for irrigation water would be supplied from the holding tank. Once the tank was drained to a pre-determined level, the pump would turn on and commence to fill the tank and to supply pressurized water to the irrigation lines. A lateral pipeline would branch from the mainline and run through South Campground, connecting to an existing pressurized irrigation system that serves the Visitor Center area and parts of Watchman Campground. A gravity-fed line would also be maintained to tie back in to the low-pressure line by the native plant nursery near Watchman Campground. Alignment of the irrigation line and tank location is shown on Figure 3. An approximate 25-foot wide construction corridor is anticipated for most pipeline construction activities. The pipeline would be bedded and buried to a minimum depth of 4 feet. Trenching, pipeline installation, and backfilling activities would be done in 100-foot segments to minimize the amount of open trench at any one time.

The proposed irrigation line would provide the major trunk line for irrigation water in the park. It would be designed to provide flexibility for further modifications and expansion to currently non-irrigated areas, and to replace potable water irrigated areas with river water irrigated areas. Table 2 summarizes the output of the hydraulic analysis under Alternative B.

System Operation

The portions of the proposed irrigation system under Alternative B that begin at the Flanigan Diversion structure and extend through the sluice and the settling tank would function well only when operated at a consistent flow rate. This is because their function would be dependent on water flow velocities that permit the settling of specific-sized sediment particles in the sluice and settling tank, and not in the pipeline. For this reason, the portion of the irrigation system that begins at the Flanigan Diversion structure and extends through the settling tank would generally be operated continuously at design capacity through the entire irrigation season, except when shut down during flood events, and water in excess of the immediate need would be discharged back to the river. The filter system, pump, and distribution system could be turned on and off or operated at a variable capacity, as needed.

Water from the 30,000-gallon tank would supply gravity-pressurized flow until the supply was drained to a point where the pump would turn on. Once the pump turned on, it would pressurize the line and begin to fill the tank, as well as supply water to irrigated areas. When the tank was filled, the pump would shut off and the line would return to being pressurized by gravity.

The Oak Creek Diversion and Oak Creek Irrigation Ditch would be operated periodically during the irrigation season to maintain ditch-side vegetation that has become part of the historic landscape.

Table 2: Alternative B – Flanigan Diversion System Summary

Description	Elevation Difference (feet)	Pipe Length (feet)	Pipe Headloss (feet)
From Flanigan Diversion (elevation 3,991 feet) to sluice structure (elevation 3,990 feet)	1	60	0.03
From sluice structure (elevation 3,990 feet) to inlet of settling tank (elevation 3,970 feet) adjacent to proposed pump station location	20	3,410	14.31

Source: AEC, 2011.

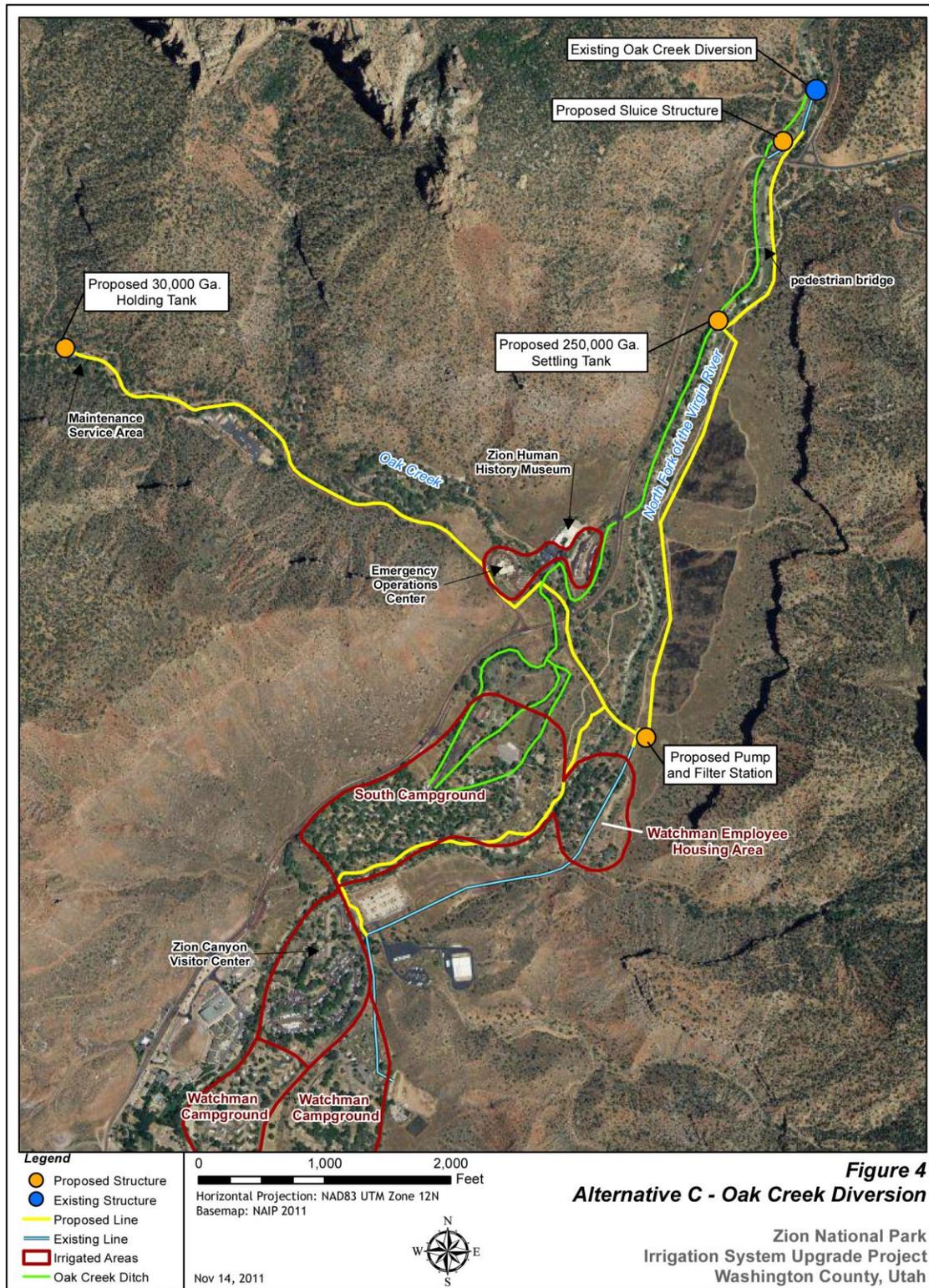
Staging Areas

All staging and laydown for the proposed Project would take place in previously disturbed areas. Exact locations would be determined prior to construction in coordination with Zion staff and construction contractors. A 200-foot by 200-foot staging area is proposed adjacent to the proposed pump and filter station. This area has been previously disturbed and is also a central location within the Project area. In addition, any excess fill material would be stockpiled in this area. At the completion of the Project, the stockpiled material would be distributed within the staging areas, as needed. Following construction, staging areas would be re-vegetated and restored to existing or better than existing conditions.

Alternative C – Oak Creek Diversion

Under Alternative C, the irrigation system layout would have similar components as Alternative B, but would originate at the existing Oak Creek Diversion to the west of the North Fork of the Virgin River and a short distance upstream of the Flanigan Diversion. The system would consist of diverting water from the Oak Creek Diversion and piping it to a proposed sluice structure and settling tank. Water would then be piped to the new pump and filter station location and holding tank as described under Alternative B.

The Oak Creek Diversion structure is located on the west side of the North Fork of the Virgin River and currently diverts water to an open channel earthen ditch. This structure would be designed to divert 1.21 cfs, but initially operate at a reduced flow of about 1.00 cfs. Any water rights in excess of current needs would be protected in non-use status. New gates would be installed on the Oak Creek Diversion to control flows and to sluice sediment away from the intake. Care would be taken to preserve the existing historic Oak Creek Diversion structure. River flows would not be interrupted during construction of the proposed Project, though some of the work on the intakes may require temporary isolation from the river by sandbags. The location of the diversion structure under Alternative C is shown on Figure 4.



Sluice Structure, Settling Tank, and Pump and Filter Station

Under Alternative C, the sluice structure, as described under Alternative B would be located approximately 460 feet downstream of the Oak Creek Diversion in an open, flat area that is accessible from an existing dirt access road. The settling tank described under Alternative B would be buried and located 2,100 feet downstream of the Oak Creek Diversion in an open area adjacent to an existing pedestrian bridge on the Pa'rus Trail, as shown on Figure 4. This site is across the river and a short distance downstream from the Flanigan Diversion. Similar to Alternative B, all above ground facilities would be visually screened and designed to blend with the natural setting in the area.

Under Alternative C, operation of the existing Oak Creek Ditch would be maintained. The new pipeline from the sluice structure to the settling tank would be installed either directly beneath or adjacent to the existing ditch. Oak Creek Ditch would be restored to original contours following construction of the pipeline. Some areas along the ditch are very narrow and within close proximity to the river. Shoring of the slope along the ditch and smaller trenching equipment would be required in these areas. It has also been proposed to slip line the existing 18-inch and 24-inch pipes leading from the diversion dam as depicted on Figure 4.

Diverted water from the settling tank would be conveyed via a gravity-fed 12-inch pipeline under the pedestrian bridge to a pump and filter station located approximately 3,500 feet south of the Flanigan Diversion. The pump system would be housed in a small building (same as that described under Alternative B and in the same location). From there, the unit would pump water up Oak Creek Canyon to a holding tank, as described under Alternative B.

Pressure Line and Holding Tank

The pressure line from the pump and filter station to the 30,000-gallon holding tank under Alternative C would be the same as that described under Alternative B.

Irrigation Delivery

Irrigation delivery under Alternative C would be the same as that described under Alternative B.

System Operation

System Operation under Alternative C would be the same as that described under Alternative B.

Table 3 summarizes the output of the hydraulic analysis under Alternative C.

Table 3: Alternative C – Oak Creek Diversion System Summary

Description	Elevation Difference (feet)	Pipe Length (feet)	Pipe Headloss (feet)
From Oak Creek Diversion (elevation 4,017 feet) to sluice structure (elevation 4,014 feet)	3.82	460	0.23
From sluice structure (elevation 4,013 feet) to inlet of the settling tank (elevation 4,007 feet)	6.87	1,636	6.87
From settling tank outlet (elevation 3,997 feet) to proposed pump location (elevation 3,975 feet)	22.52	3,497	14.68

Source: AEC, 2011.

Staging Areas

All staging and laydown would take place in previously disturbed areas. Exact locations would be determined prior to construction in coordination with Zion staff and construction contractors. As under Alternative B, a 200-foot by 200-foot staging area is proposed adjacent to the proposed pump and filter station. This area has been previously disturbed and is also a central location within the Project area. In addition, any excess fill material would be stockpiled in this area. At the completion of the Project, the stockpiled material would be distributed within the staging areas, as needed. Following construction, staging areas would be re-vegetated and restored to existing or better than existing conditions.

Mitigation Measures

The following mitigation measures were developed to minimize the degree and/or severity of adverse effects from the proposed Project and would be implemented during construction of the Preferred Alternative, as needed.

- To minimize the amount of ground disturbance, staging and stockpiling areas would be located in previously disturbed areas of the park, away from visitor use areas to the extent possible. Staging and stockpiling areas would be returned to pre-construction conditions following construction.
- Newly excavated soil would be shaped and blended with surrounding topography, and planted and seeded with native vegetation.
- Construction zones would be identified and fenced with construction tape, or some similar material prior to any construction activity. The fencing would define the construction zone and confine activity to the minimum area required for construction. Protection measures would be clearly stated in the construction specifications and workers would be instructed to avoid conducting activities beyond construction as defined by construction zone fencing.
- If construction activities are scheduled within the nesting season for birds protected under the MBTA, generally April 1 through July 15, pre-construction surveys would be conducted for nests. No construction activities would be conducted in identified nesting areas until the young had fledged.
- Revegetation and recontouring of disturbed areas would take place following construction and would be designed to minimize the visual intrusion of structures. Revegetation efforts would strive to reconstruct the natural spacing, abundance, and diversity of native plant species using native plants and seeds. Contractors would coordinate with Zion natural resources staff at least 4 weeks prior to construction to determine if plants within the construction area may be salvaged and used for restoration. Zion has its own native plant nursery where plants are grown and used to replenish park areas where native species have been damaged or destroyed. All disturbed areas would be restored as nearly as possible to pre-construction conditions shortly after construction activities are completed.
- Weed control methods would be implemented and monitored to minimize the introduction of noxious weeds, including spraying off construction equipment that enters the park.
- Disturbed portions of park roads would be rehabilitated, especially in staging and laydown areas. The park would restore the roads to better than existing conditions.

Disturbed areas would be returned to grade and any tracks from equipment would be raked out.

- To avoid compaction from heavy equipment to surrounding areas, to the extent practicable, equipment would be kept inside the construction footprint. Equipment would be located outside of the construction footprint, when necessary, only when soil is dry. Compacted soils would be “ripped” or decompacted post-construction to enable revegetation.
- If contaminated soils are found, they would be disposed of according to state regulations. The park would be notified of contaminated soils and would assess next steps.
- Following construction, flows in Oak Creek Irrigation Ditch would be managed to support the continued integrity of the historic structure and the vegetation associated with the historic ditch within the park.
- Because disturbed soils are susceptible to erosion, until revegetation takes place, standard erosion control measures (such as silt fences and/or sandbags) would be utilized to minimize potential soil erosion. BMPs would be implemented to minimize erosion leading to sedimentation in drainage areas. Organic mulches, such as straw bales, would not be used due to the risk of introducing exotic weeds.
- Fugitive dust generated by construction activities and equipment would be controlled by wetting the construction site, if necessary.
- To reduce noise and air emissions, construction equipment would not be permitted to idle for long periods of time.
- To minimize possible petrochemical leaks from construction equipment, contractors would regularly monitor and check construction equipment to identify and repair any leaks.
- Should construction unearth previously undiscovered cultural resources, work would be stopped in the area of any discovery and Zion would consult with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP), as necessary, according to 36 CFR Section 800.13, *Post Review Discoveries*. In the unlikely event that human remains are discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act of 1990 would be followed.
- Ground-disturbing activities in archeologically-sensitive areas would be monitored by an archeologist and would meet the Secretary of the Interior’s *Standards and Guidelines for Archeology and Historic Preservation*. Within known archeological site areas, surface disturbances and construction access corridors would be limited to previously disturbed areas and kept to a minimum.
- A minimum 10-foot buffer between the construction area and the staging and laydown area around the historic Flanigan Ditch would be observed to help ensure that historic resource is avoided during construction activities. Work in this area would be confined using protective fencing, or some similar material, placed parallel to the Flanigan Ditch, to help prevent inadvertent “straying” of construction personnel and equipment during construction.
- The NPS would ensure that all contractors and subcontractors are informed of the penalties for illegally collecting artifacts or intentionally damaging paleontological

materials, archeological sites, or historic properties. Contractors and subcontractors would also be instructed on procedures to follow if previously unknown paleontological or archeological resources are uncovered during construction.

- In the event that the historic Oak Creek Ditch is disturbed, the ditch would be restored to its original contour, elevation, and cross-section. Ditch restoration would be done in consultation with an NPS archeologist. The construction corridors of the proposed Project would avoid the alignment of Flanigan Ditch such that there would be no impacts to this historic ditch.
- In the unlikely event that water to Springdale would require temporary shut off, Zion staff would coordinate details (such as timing) with both the Town of Springdale and the Springdale Consolidated Irrigation Company.
- To minimize potential impacts to park visitors, variations on construction timing may be considered. One option includes conducting the majority of the work in the off-season (winter) or shoulder seasons. Another option includes implementing daily construction activity curfews, such as not operating construction equipment between the hours of 6:00 p.m. to 7:00 a.m. in the summer months (May through September), and 6:00 p.m. to 8:00 a.m. in the winter months (October through April). The NPS would determine the construction schedule in consultation with the contractor.
- Visual screening would be utilized in highly visible areas to blend Project components with the natural setting. Screening could include the planting of trees and native shrub species, and the positioning of boulders to shield views of new above ground structures in the park (e.g., specifically in the area of the new Flanigan sluice structure). Cut slopes would be blended and restored to a more natural color, contour, and roughness. Details of any visual screening applied would be determined by Zion staff in coordination with a landscape architect and Project construction personnel.

Alternatives Considered and Dismissed

The following three alternatives were considered for Project implementation, but were ultimately dismissed from further analysis. Reasons for their dismissal are provided in the following alternative descriptions.

- **Rehabilitate Oak Creek Diversion Dam** – A component of Alternative C was considered to improve the function of the existing dam. The crest of the diversion dam would be raised approximately 1 foot over the eastern portion of the dam to force the current against the west bank during small-to-moderate floods in order to reduce sediment buildup that now occurs at the intake. In addition, to reduce the encroachment of stream bank vegetation and sediment accumulation along the west bank, a concrete wing would be extended upstream along the west bank at the river level. The work within the stream bed to raise the dam would introduce changes in the appearance of the structure and, at some flow levels, local changes in flow patterns within the bed and banks of a designated Wild and Scenic river. This modification would not directly address the purpose and need of the proposed Project to upgrade the irrigation system and reduce maintenance demands associated with open ditch irrigation. Therefore, this alternative to rehabilitate the dam was eliminated because it would not meet the Project's objective to reduce maintenance demands and it could adversely impact a Wild and Scenic river. Any

modification to the dam structure could be considered when the dam required periodic resurfacing of the concrete, which is typically on a 20 to 30 year rotation.

- Pipe Water from Oak Creek Diversion Entirely on the West Side of the River –** This alternative was considered to construct the pipeline from the Oak Creek Diversion entirely on the west side of the river, eliminating the need for the pipeline to cross over the river to reach the storage tank. This would somewhat reduce the length of buried pipe; however, this alternative was dismissed because there would be a large amount of disturbance due to the more challenging topography, the presence of several archeological sites, and the fact that lands on the east side of the river had been previously disturbed by historic agriculture while those on the west side had not. Therefore, this alternative to pipe water entirely on the west side of the river was eliminated from further analysis.
- Abandon Oak Creek Ditch –** Because abandonment of Oak Creek Ditch would further reduce maintenance demands within the park, the option to abandon Oak Creek Ditch was considered as a component of the two action alternatives carried forward. However, if Zion abandoned the ditch, it would change the classification of a historic structure and the vegetation associated with the historic ditch, which would also change the management outcomes and practices of the park. Because this alternative was contradictive to current management and practices of the park, it was dismissed from further analysis.

Alternative Summaries

Table 4 summarizes the major components of Alternatives A, B, and C and compares the ability of these alternatives to meet the Project objectives (the objectives for the proposed Project are identified in the *Purpose and Need* chapter). As shown in the following table, Alternative B meets each of the objectives identified for this Project, while Alternative C and the No Action Alternative do not address all of the objectives.

Table 4: Summary of Alternatives and How Each Alternative Meets the Project Objectives

Alternative Elements	Alternative A – No Action	Alternative B – Flanigan Diversion	Alternative C – Oak Creek Diversion
Diversion	The existing two diversions would continue to serve the irrigation needs of Zion.	A new water intake at the Flanigan Diversion would separate the Zion irrigation system from that of Springdale and the Springdale Consolidated Irrigation Company.	Minor repairs would be made to restore the function of the Oak Creek Diversion.
Sluice Structure	The existing sluice structure shared with Zion and the Town of Springdale and the open ditch from the Oak Creek Diversion would continue to serve the irrigation needs of Zion.	A new sluice structure would be constructed and located approximately 60 feet downstream of the Flanigan Diversion and east of the existing Springdale sluice.	A new sluice structure would be located approximately 460 feet downstream of the Oak Creek Diversion.

Alternative Elements	Alternative A – No Action	Alternative B – Flanigan Diversion	Alternative C – Oak Creek Diversion
Settling Tank	No new settling tanks would be constructed.	A 250,000-gallon concrete settling tank would be installed approximately 3,400 feet from the new sluice structure in an open, flat area.	A 250,000-gallon concrete settling tank would be installed approximately 1,600 feet from the new sluice structure in an open area adjacent to an existing pedestrian bridge on the Pa'rus Trail.
Pump and Filter Station	No new pump and filter station would be constructed.	A new pump and filter station would be housed in a small building (approximately 25 feet long by 25 feet wide by 9 feet high) near the settling tank.	Same as Alternative B. A new pump and filter station would be housed in a small building approximately 3,500 feet downstream of the settling tank.
Pressure Line	No new pressure line would be installed.	Water would be pumped from the pump and filter station, through an existing irrigation pipeline interconnect, to a holding tank located in Oak Creek Canyon upstream of the maintenance service buildings.	Same as Alternative B.
Holding Tank	No new holding tank would be installed.	A 30,000-gallon holding tank would be constructed near the maintenance service buildings.	Same as Alternative B.
Irrigation Delivery	Irrigation delivery would continue via the existing Oak Creek Ditch and Flanigan pipeline.	Water from the holding tank would come back down (via a gravity-fed line) to be distributed to South Campground and the Visitor's Center. The new pipe would then tie back in to the existing system. A gravity line would also be maintained to tie back in to the low-pressure line by the native plant nursery in the park.	Same as Alternative B.

Project Objectives	Meets Project Objectives?	Meets Project Objectives?	Meets Project Objectives?
Decrease the maintenance demands of the open irrigation ditches	No. Maintenance demands would remain at current levels.	Yes. The labyrinth of open irrigation ditches within public use areas would be replaced with a pipeline system, thereby reducing maintenance demands associated with clearing and maintaining those ditches.	Yes. Similar to Alternative B, irrigation ditches would be replaced with a pipeline system, thereby reducing maintenance demands.
Increase efficiency of water use within the park	No. Efficiency of water use within the park would remain at current levels.	Yes. Replacement of open irrigation ditches with pipelines would reduce evaporative loss of water and seepage, and better target landscaped areas.	Yes. Similar to Alternative B, replacement of ditches with pipelines would reduce evaporative loss of water and seepage, and better target landscaped areas.
Provide flexibility to use river water for irrigation of landscapes in areas where potable water is currently used	No. Irrigation in areas currently utilizing potable water would not have the flexibility to be irrigated with river water.	Yes. The system would allow for the use of river water for irrigation in areas currently irrigated with potable water.	Yes. Similar to Alternative B, the system would allow for the use of river water for irrigation in areas currently irrigated with potable water.
Preserve the integrity of historic structures and the vegetation associated with historic ditches within the park	Yes. Zion would continue to maintain, protect, and preserve historic structures and the vegetation associated with historic ditches within the park.	Yes. The Oak Creek Irrigation Ditch would continue to be maintained and would not be disturbed. The Flanigan Ditch would be protected from land disturbing impacts.	No. The Oak Creek Irrigation Ditch would be disturbed with the installation of the irrigation pipeline. The ditch would be restored following construction, but the original integrity of the historic structure would not be retained. Similar to Alternative B, the Flanigan Ditch would be protected from land disturbing impacts.

Table 5 summarizes the environmental impacts for Alternatives A, B, and C. Only those impact topics that have been carried forward for further analysis are included in this table. The *Affected Environment and Environmental Consequences* chapter provides a more detailed explanation of these impacts.

Table 5: Environmental Impact Summary by Alternative

Impact Topic	Alternative A – No Action	Alternative B – Flanigan Diversion	Alternative C – Oak Creek Diversion
Soils	Continuation of the existing conditions would result in adverse, direct, site-specific, short- and long-term, minor impacts as a result of ground-disturbing activities, displacement of surface soil layers, and erosion.	Construction activities would have adverse, direct, site-specific, short-term, and minor effects on soils from ground-disturbing activities and erosion. Because the soils would be stabilized and revegetated, there would be negligible long-term effects on soils as a result of excavation. The short-term effects would be adverse, direct, site-specific, and moderate from excavation.	General effects from construction activities, including ground-disturbance, erosion, and excavation, would be the same as those described under Alternative B.
Vegetation	Continuation of the existing conditions would result in adverse, direct, site-specific, short-term, and negligible impacts to vegetation due to continued off-trail hiking and biking near visitor use areas.	<p>Construction activities would have adverse, direct and indirect, local, short- and long-term, and minor effects on native vegetation from construction activities such as grading, excavating, and recontouring. To protect vegetation, weed control methods would be implemented and monitored to minimize the introduction of non-native plant species.</p> <p>Existing non-native vegetation would be destroyed during construction and disturbed areas would be revegetated with native seed and plant species; this would result in beneficial, direct and indirect, local, long-term, and minor effects on native vegetation.</p> <p>The loss of individual trees and shrubs would result in adverse, direct, site-specific, long-term, and minor impacts.</p> <p>A portion of the Oak Creek Irrigation Ditch would be abandoned resulting in adverse, indirect, localized, long-term, and minor impacts.</p>	Same as Alternative B.

Impact Topic	Alternative A – No Action	Alternative B – Flanigan Diversion	Alternative C – Oak Creek Diversion
Water Resources	No impacts.	<p>Additional stream flow would result in beneficial, indirect, regional, long-term, and negligible impacts.</p> <p>Small sandbag cofferdams would be constructed within the North Fork of the Virgin River to temporarily divert waters away from the construction area.</p> <p>Increases in turbidity near the construction activity would result in adverse, direct, local, short-term, and negligible impacts.</p> <p>Sediment increase as a result of erosion would result in adverse, indirect, local, short-term, and negligible impacts.</p> <p>Sediment taken from irrigation water and returned to the river would not be detectible; impacts would be direct, local, long-term, and negligible.</p>	Same as Alternative B.
Wild and Scenic Rivers	No impacts to cultural, geologic, recreational, scenic, wildlife, and fish ORVs.	<p>Indirect, local, short-term, minor, and adverse impacts to wildlife, scenic, and recreational ORVs would result from construction disturbance.</p> <p>Long-term, there would be no adverse effects to scenic views because above ground facilities would be visually screened and designed to blend with the natural setting of the area, and would be constructed in previously disturbed areas of the park.</p> <p>No impacts to cultural, geologic, and fish ORVs.</p>	<p>Indirect, local, short-term, minor, and adverse impacts to wildlife, scenic, and recreational ORVs would result from construction-related activities.</p> <p>Direct, local, short-term, moderate, and adverse impacts to cultural ORVs would result from demolition and reclamation of Oak Creek Irrigation Ditch.</p> <p>Long-term, there would be no adverse effects to scenic views because above ground facilities would be visually screened and designed to blend with the natural setting of the area, and would be constructed in previously disturbed areas of the park.</p> <p>No impacts to geologic and fish ORVs.</p>

Impact Topic	Alternative A – No Action	Alternative B – Flanigan Diversion	Alternative C – Oak Creek Diversion
Historic Structures	No impacts.	<p>With protective measures in place, construction activities would not disrupt the Flanigan Ditch, and there would be no adverse impacts on it.</p> <p>Construction activities would not affect the historic portions of the Oak Creek Irrigation Ditch.</p> <p>There would be adverse, indirect, local, short-term, and negligible impacts to the Oak Creek Historic District as a result of construction activities associated with the Oak Creek pipeline and holding tank.</p>	<p>Impacts to the Flanigan Ditch and Oak Creek Historic District would be the same as those described under Alternative B.</p> <p>The destruction and re-construction of the Oak Creek Irrigation Ditch would result in adverse, direct, site-specific, short- and long-term, and moderate impacts.</p> <p>New gates installed on the Oak Creek Diversion would result in adverse, direct, site-specific, long-term, and minor impacts.</p>
Park Operations	<p>The existing open ditch irrigation system would not change.</p> <p>The impact of continued maintenance to repair and maintain the existing irrigation system would be adverse, direct and indirect, local, short- and long-term, and moderate on park operations.</p>	<p>A pressurized irrigation system would reduce maintenance demands, and impacts would be beneficial, direct and indirect, local, short- and long-term, and minor.</p> <p>The typical work load for park employees would increase during implementation of the proposed Project resulting in adverse, direct, local, short-term, and minor effects on park operations.</p>	Same as Alternative B.
Visitor Use and Experience	No impacts.	<p>Construction activities would result in direct, local, short-term, and minor impacts.</p> <p>Changes to the Project area would result in adverse, direct, local, and long-term impacts.</p> <p>The conversion to a pressurized irrigation system would limit some play activities (in the ditches) in the campgrounds, resulting in adverse, direct, local, long-term, and minor impacts.</p> <p>Any campground closures would result in adverse, direct, local, short-term, and minor effects.</p>	Same as Alternative B.

Environmentally Preferable Alternative

According to the CEQ regulations implementing NEPA (43 CFR Section 46.30), the Environmentally Preferable Alternative is the alternative “that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The Environmentally Preferable Alternative is identified upon consideration and weighing by the Responsible Official of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one Environmentally Preferable Alternative.”

Alternative B (Flanigan Diversion) is the Environmentally Preferable Alternative for the proposed Project for several reasons: 1) the upgraded irrigation system would conserve water by enabling Zion to use the water in a targeted and on-demand manner, and there would be less evaporative loss of irrigation water; 2) the proposed irrigation system would blend with the natural setting and would not degrade the ORVs associated with either the North Fork of the Virgin River or Oak Creek, both designated as Wild and Scenic rivers; 3) the commitment of non-renewable resources, such as petroleum-based products (e.g., gasoline and diesel) associated with maintenance efforts in visitor use and NPS staff residential areas would decline under Alternative B; and 4) the Oak Creek Diversion, Oak Creek Irrigation Ditch, and the Flanigan Ditch, all historic structures that are listed in the NRHP, would be maintained and preserved under Alternative B. For these reasons, the actions associated with Alternative B cause the least damage to the biological and physical environment and best protect, preserve, and enhance historical, cultural, and natural resources within the park.

Alternative C (Oak Creek Diversion) is not the Environmentally Preferable Alternative because although the upgraded irrigation system would conserve water, blend with the natural setting, and lessen the use of non-renewable resources, the proposed construction under Alternative C would not retain the integrity of the Oak Creek Ditch, a historic structure, in place. The irrigation ditch would have to be extensively disturbed and then restored.

By contrast, Alternative A (No Action) is not the Environmentally Preferable Alternative because, although there would be no construction or ground-disturbing activities that would damage historic structures or previously undisturbed elements of the biological and physical environment, 1) the existing irrigation system does not use water efficiently; 2) the commitment of non-renewable resources, such as petroleum-based products, associated with maintenance efforts in visitor use and NPS staff residential areas would persist; and 3) irrigation of residential and other areas of the park with potable water would continue.

Preferred Alternative

No new information came forward from public scoping or consultation with other agencies to necessitate the development of any new alternatives outside of those described and evaluated in this EA. Alternative B is the Environmentally Preferable Alternative and better meets the Project objectives; therefore, it is also considered the NPS Preferred Alternative. For the remainder of this EA, Alternative B is referred to as the Preferred Alternative.

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AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the affected environment (i.e., the existing setting or baseline conditions). It analyzes the potential environmental consequences that would occur as a result of implementing the proposed Project. Analysis for direct, indirect, and cumulative effects for each resource topic carried forward is presented. Resource discussions are presented in terms of type, context, duration, and intensity. Basic definitions for each of these terms are presented below. Specific intensity level definitions are presented by resource following each resource's *Affected Environment* discussion.

Type describes the classification of the impact as beneficial or adverse and 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 that 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 would occur. Effects may be site-specific, local, regional, or even broader.

Duration describes the length of time an effect would occur, either short-term or long-term.

- *Short-term* impacts generally last only during construction, and the resources return or are returned to their pre-construction condition following construction.
- *Long-term* impacts last beyond the construction period, and the resources may not resume their pre-construction condition.

Intensity describes the degree, level, or strength of an impact and varies by resource. For this analysis, intensity has been categorized as *negligible*, *minor*, *moderate*, and *major*.

Cumulative Impact Scenario

The CEQ regulations which implement 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 both the No Action Alternative and the action alternatives.

Cumulative impacts were determined by combining the impacts of the No Action Alternative with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at Zion, and, if applicable, the surrounding region. Because the scope of this

Project is relatively small, the geographic and temporal scope of the cumulative analysis is similarly small. The geographic scope for this analysis includes actions within the park's boundaries, while the temporal scope includes projects within a range of approximately 5 years. Given this, the projects described below were identified for the purpose of conducting the cumulative effects analysis, and are listed in order from past to future.

Past Actions

- The Flanigan Diversion and Oak Creek Diversion dams have been in operation at or near their current locations since the 1880s. They were originally constructed of rock and brush, and later modified to include concrete and stone masonry.
- Oak Creek Irrigation Ditch was determined eligible for listing in the NRHP under Criterion A, for its association with significant events related to the CCC efforts in the area, and listed in the NRHP on July 7, 1987.
- The Town of Springdale municipal water pipeline was installed at the Flanigan Diversion in 1988, replacing ditch conveyance dating to 1880.
- Flanigan Ditch was determined eligible for listing in the NRHP under Criterion A for its association with significant events related to pioneer Mormon agriculture in the Zion area, and listed in the NRHP on January 12, 1998.
- The Omnibus Public Land Management Act of 2009 designated approximately 166 miles of the Virgin River and its tributaries across federal land within Zion and adjacent BLM Wilderness as part of the National Wild and Scenic River System (NPS n.d.). The Wild and Scenic River Act affords classified rivers protection under free-flowing condition, water quality, and ORVs. The river segments in the Project area, including Oak Creek and the North Fork of the Virgin River, are designated as recreational rivers.
- In 2010, Mount Carmel Highway in Zion was rebuilt and repaved. Resurfacing the road extended the life of the pavement and improved vehicle traction.
- In the fall of 2010, an 85-kilowatt hour solar panel system was installed at the park's headquarters. This system provides energy to the park headquarters, the Zion Human History Museum, and the Emergency Operations Center.
- In the fall of 2010, campsites were rehabilitated and utilities were improved at Watchman Campground. The project consisted of reconstruction and delineation of 69 campsites with new site furnishings, resurfacing the road system, installing new irrigation lines, water and sewer line improvements, and revegetation.

Current and Future Projects

- Ongoing water conservation efforts to conserve water in the park. Zion has reduced water usage by about 50 percent through native plant landscaping, low-flow fixtures, linen reuse, and guest education about water conservation.
- Ongoing exotic vegetation management to reduce the invasion of exotic plants and restore disturbed soils includes hand removal, herbicide treatments, seeding, planting, and controlled burns.
- Ongoing maintenance program for fish health and populations (described in the Virgin River Recovery Program).

- Zion is in the process of developing a Comprehensive River Management Plan (CRMP) to protect the ORVs, free-flowing condition, and water quality of the Virgin River and its tributaries.
- Project planning for the expansion of the parking area in the Visitor's Center is currently underway and the construction is proposed for 2014/2015.
- Project planning is currently underway for the renovation of South Campground and the construction is proposed for 2015/2016.
- Project planning is currently underway for the Kolob Terrace Road rehabilitation west and north of the park and the construction is proposed for the 2016 time-frame.

Soils

Affected Environment

Soils in Zion are generally young, low in fertility, well drained, and easily eroded (USDA, SCS 1977). There are 36 soil complexes that occur in the park; more than 80 percent have low productivity or high erosion potential. Slickrock, where little soil exists, covers large areas of the park, though slickrock outcrops are not found in the Project area. Deep soils are typically confined to river terraces and floodplains, as well as isolated pockets on some of the flatter upland terraces. These are some of the park's most productive soils, particularly where watered by rivers and streams.



Soils in the Project area are of recent origin and have little or no development of soil horizons. They are derived from local bedrock material that is transported a short distance down slope, or have been recently deposited by the river. Due to the similar source materials, all have similar textures; a fine sand, silt loam, or sandy loam. Having evolved in a warm arid environment, all soils are low in organic matter, well-drained, and low in nutrients. These soils are generally deep, 60 inches or greater, because they have accumulated in depositional areas adjacent to the river or at the base of colluvial slopes. Substantial deposition of soil occurs in riparian areas along the Virgin River near the existing Flanigan Diversion structure. Additionally, due to the high volumes of rock carried downstream by the North Fork of the Virgin River and its tributaries, there are often substantial amounts of gravel, cobbles, and boulders in soil units in the Project area (Sharrow 2011a).

Specific soil types identified within the Project area include Naplene silt loam, 2 to 6 percent slopes; Redbank silty clay loam, 0 to 2 percent slopes; and Rock land. Naplene silt loam soils occur throughout most of the Project area. Redbank silty clay loam soils occur within a small area of the southern portion of the Project above the Visitor's Center. Naplene silt loam and Redbank silty clay loam soils are well-drained, highly erodible alluvial soils with a moderate runoff potential (NRCS 2011). Rock land soil is comprised primarily of rocks and stones and occurs within the western portion of the Project area outside of Oak Creek. Figure 5 presents a map of soils types within the construction area for the proposed Project, and Table 6 provides a brief description of each soil type.

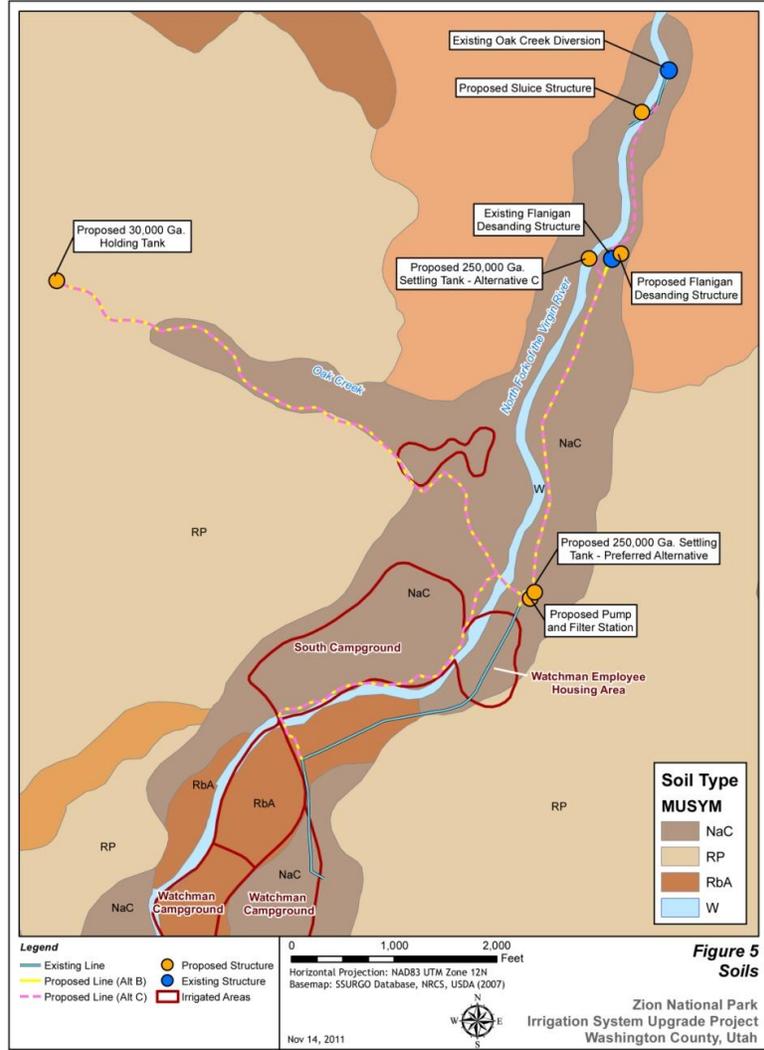


Table 6 Map Key of Soils Within the Project Area

Soil Type	Map Unit Symbol	Description
Naplene silt loam, 2 to 6 percent slopes	NaC	Deep, well-drained, highly erodible, moderately slowly or slowly permeable soils that formed in alluvium from sedimentary and igneous rocks.
Redbank silty clay loam, 0 to 2 percent slopes	RbA	Deep, well-drained, highly erodible soils that formed in coarse textured alluvium derived from redbed sandstone and shale. Redbank soils are on recent flood plains.
Rock land	RP	Comprised primarily of rocks and stones.
Water	W	River water.

There are notable amounts of biological soil crusts (BSC) at Zion where the soil surface is held together by algae, fungi, lichen, and other microorganisms. BSC also provide other ecological functions, such as nitrogen fixing, and water, nutrient, and organic matter storage in forms that are more easily available to plants. BSC are fragile; therefore, human and animal activity can negatively affect them. Footprints, operation of machinery, or other compressional disturbances can easily crush and break BSC apart, especially when the crusts are dry and brittle. Broken crusts are easily washed away by rain, leading to increased soil erosion (USGS 2006). Recovery of BSC is generally more rapid when the disturbance is narrow, such as in a pipeline corridor, rather than rectangular. Since the Project area has been repeatedly disturbed, the BSC are either not present or are very poorly developed. The potential for disturbing BSC is negligible in the Project area.

Intensity Level Definitions

Intensity thresholds of soil impacts are defined as follows:

Negligible: The action would result in a change in soils or a geologic feature, but the change would be at the lowest level of detection or not measurable.

Minor: The action would result in a detectable change, but the change would be slight and local. Soils or geologic resources might be slightly altered in a way that would be noticeable. There could be changes in a soil's profile in a relatively small area, but the change would not appreciably increase the potential for erosion or reduce soil productivity.

Moderate: The action would result in a clearly detectable change in soils or geologic resources. Soils would be obviously altered, or a few features would show changes. There could be a loss or alteration of the topsoil in a small area, or the potential for erosion to remove small quantities of additional soil would increase.

Major: The action would result in the permanent loss of an important soil or geologic resource, or there would be highly noticeable, widespread changes in many soils or features. There would be a permanent loss or alteration of soils or geologic resources in a relatively large area, or there would be a strong likelihood for erosion to remove large quantities of additional soil as a result of the action.

Characteristics of the soils in the Project area were identified and assessed within the extent of the Project area using published soil survey data for Washington County, Utah (NRCS 2011). Soils within the study area are shown on Figure 5.

To assess the impacts of the alternatives on soil resources, digital polygons representing individual soil types and the facility footprints were overlain on aerial photography. Permanent impacts were determined by calculating the overlain footprint of each alternative on each soil type. Indirect impacts include soil loss by wind and water erosion, rutting, and compaction. These impacts cannot be quantified and are discussed generally. Loss of soil from disturbed lands would generally be limited where slopes are less than 5 percent.

Impacts of Alternative A (No Action)

Under the No Action Alternative, no new construction would occur and no impacts to soils would occur outside of those occurring with the present irrigation system. Soil deposition would continue to occasionally occur over the Flanigan desanding structure during large flood events. Disturbances associated with park visitation would continue to contribute to slightly detectible soil compaction and erosion within and around the

irrigation system. These disturbances include venturing off designated trails near the irrigation system and campgrounds, and damming up or rerouting the irrigation ditches within the campgrounds. Trampling by hikers and bikers could increase the rate of erosion by destroying the vegetation that holds soils in place and displacing the surface soil layers that may take a long time to regenerate. Maintenance efforts related to maintaining the open ditch irrigation system, such as dredging and restoring original ditch contours, would mitigate some of these impacts. Continuation of the existing conditions would result in adverse, direct, site-specific, short- and long-term, minor impacts.

Cumulative Effects: Past, present, and reasonably foreseeable future projects with the potential to affect soils include the rehabilitation and utility improvements at Watchman Campground, the proposed renovation of South Campground, the expansion of the Visitor's Center parking area, the Kolob Terrace Road rehabilitation, and the ongoing exotic vegetation management. All of these projects either have involved, or would involve, disturbing soils in the park during the construction process. The impacts to soils from these projects would be readily apparent in the short-term. Following the completion of construction and restoration activities, there would be negligible long-term impacts to soils. The overall cumulative impacts to soils from past, present, and reasonably foreseeable future projects would be adverse, direct, site-specific, short-term, and minor. The No Action Alternative would provide a small incremental impact to the overall cumulative impacts.

Conclusion: Implementation of the No Action Alternative would result in adverse, direct, site-specific, short- and long-term, minor impacts from ground disturbance, displacement of surface soil layers, and erosion. The overall cumulative impact to soils under the No Action Alternative, in combination with other past, present, and reasonably foreseeable future activities, would result in adverse, direct, site-specific, short-term, and minor impacts from ground-disturbing activities.

Impacts of Alternative B (Preferred Alternative)

Construction activities, such as grading, excavating, and recontouring would have adverse, direct, site-specific, short-term, and minor effects on soils under the Preferred Alternative. BMPs would be implemented to minimize erosion leading to sedimentation in drainage areas. Existing roads would be used whenever possible, and in areas where existing roads could not be utilized, vehicle traffic and trips would be limited to the minimum number required to complete the Project. Following construction activities, all areas would be revegetated to minimize soil erosion.

Within the proposed pipeline alignments under the Preferred Alternative, approximately 6.43 acres of Naplene silt loam soils, 0.22 acre of Redbank silty clay loam soils, and 1.06 acres of Rock land soils would be disturbed during construction. This disturbance would be detectible during construction, but would not be visible following successful revegetation. Generally, disturbance from pipeline construction would have adverse, direct, site-specific, short-term, and minor effects on soils under the Preferred Alternative.

Under the Preferred Alternative, approximately 140 cy of Naplene silt loam soils would be excavated for the construction of the sluice structure, 1,200 cy of Naplene silt loam soils would be excavated for the construction of the settling tank, and 100 cy of Rock land soils would be excavated for the construction of the holding tank. Some of the excavated material from the sluice structure would be used for visual screening of the new structures and construction of the earth and rock berm near the Flanigan Diversion.

Excess excavated soils would be moved to stable locations within the park where they would not erode into streams. Newly excavated soil piles would be shaped and blended with surrounding topography and planted and seeded with native vegetation. Because the soils would be stabilized and revegetated, there would be negligible long-term effects on soils as a result of excavation. The short-term effects would be adverse, direct, site-specific, and moderate.

Soil surface disturbance would impact a total of about 7.71 acres under Alternative B.

Cumulative Effects: Past, present, and reasonably foreseeable future projects with the potential to affect soils would be the same as those described under the No Action Alternative; adverse, direct, site-specific, short- and long-term, minor effects. Under the Preferred Alternative, construction-related activities would incrementally add to the cumulative short-term impacts.

Cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the Preferred Alternative, would be adverse, direct, site-specific, short- and long-term, and negligible to minor.

Conclusion: Under the Preferred Alternative, impacts to soils would be adverse, direct, site-specific, short- and long-term. Cumulative impacts from other past, present, and reasonably foreseeable future projects with ground-disturbing activities, in combination with the Preferred Alternative, would be adverse, direct, site-specific, short- and long-term, and negligible to minor.

Impacts of Alternative C (Oak Creek Diversion)

Under Alternative C, general effects from construction activities would be the same as those described under the Preferred Alternative, except for additional pipeline trenching to reach the Oak Creek Diversion approximately 3,500 feet farther upstream. Within the proposed pipeline alignments, approximately 7.45 acres of Naplene silt loam soils, 0.22 acre of Redbank silty clay loam soils, and 1.06 acres of Rock land soils would be disturbed during construction. Similar to the Preferred Alternative, disturbance would be detectible during construction but would not be visible following backfilling, restoring original contours, and successful revegetation. Generally, disturbance from pipeline construction would have adverse, direct, site-specific, short-term, and minor effects on soils.

Under Alternative C, soil types contained in and around the sluice structure, settling tank, and holding tank locations would be the same as the Preferred Alternative. Impacts associated with excavation for these facilities would be the same as those described for the Preferred Alternative; adverse, direct, site-specific, short-term, and moderate.

Soil surface disturbance would impact a total of about 8.73 acres under Alternative C.

Cumulative Effects: Past, present, and reasonably foreseeable future projects with the potential to affect soils would be the same as those described under the No Action Alternative; adverse, direct, site-specific, short-term, and minor. Under Alternative C, construction-related activities would incrementally add to the cumulative short-term impacts.

Cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the actions associated with Alternative C, would be adverse, direct, site-specific, short-term, and minor.

Conclusion: Under Alternative C, impacts to soils would be adverse, direct, site-specific, short-term, and minor from ground disturbance and excavation. Cumulative impacts from other past, present, and reasonably foreseeable future projects with ground-disturbing activities, in combination with the actions associated with Alternative C, would similarly be adverse, direct, site-specific, short-term, and minor.

Vegetation

Affected Environment

The NPS relies on natural processes to maintain native plant species and to influence natural fluctuations in populations of these species (NPS 2006). Zion's elevation ranges from 3,666 to 8,726 feet and includes the Lower Sonoran, Upper Sonoran, Transition, and Canadian life zones. These life zones include low-elevation desert shrubland communities with Mojave Desert elements, and mid-elevation shrublands and pinyon-juniper woodlands typical of the Colorado Plateau and Great Basin, as well as montane forests and oak brush shrublands at the park's highest elevations.



Within the Project area, there are two basic vegetation types: riparian near the river and mid-to-low elevation upland vegetation. The riparian vegetation includes Goodings willow (*Salix goodingii*), Fremont cottonwood (*Populus fremontii*), boxelder (*Acer negundo*), coyote willow (*Salix exigua*), and velvet ash (*Fraxinus velutina*).

The upland vegetation in the Project area includes pinyon pine (*Pinus edulis*), one-seed juniper (*Juniperus osteosperma*), four-wing saltbush (*Atriplex canescens*), rubber rabbitbrush (*Chrysothamnus nauseosus*), broom snakeweed (*Gutierrezia sarothrae*), and sand dropseed (*Sporobolus cryptandrus*). Cheatgrass (*Bromus tectorum*), a non-native invasive species, has taken over much of the park due to previous disturbance.

Intensity Level Definitions

The intensity thresholds of an impact on vegetation communities are defined as follows:

Negligible: The action might result in a change in vegetation, but the change would not be measurable or would be at the lowest level of detection.

Minor: The action might result in a detectable change, but the change would be slight and have a local effect on a population. This could include changes in the abundance or distribution of individuals in a local area, but not changes that would affect the viability of local populations. Changes to local ecological processes would be minimal.

Moderate: The action would result in a clearly detectable change in a population and could have an appreciable effect. This could include changes in the abundance or distribution of local populations but not changes that would affect the viability of regional populations. Changes to local ecological processes would be of limited extent.

Major: The action would be severely adverse or exceptionally beneficial to a population. The effects would be substantial and highly noticeable, and could result in widespread change and be permanent. This could include changes in the abundance or distribution of a local or regional population to the extent that the population would not be likely to recover (adverse), or would return to a sustainable level (beneficial). Important ecological processes would be altered, and “landscape-level” (regional) changes would be expected.

Direct impacts to vegetation were assessed qualitatively. Mature woody vegetation was considered to be of the greatest value and impacts were considered to be permanent. Indirect impacts to vegetation include eventual loss of vegetation due to activities associated with the Project, such as erosion or loss of hydrology. These impacts cannot be quantified and are discussed generally.

Impacts of Alternative A (No Action)

Under the No Action Alternative, there would be no change to existing conditions. Irrigation system upgrades would not take place. Park visitors would continue to venture off designated trails near public use areas and campgrounds. Trampling by hikers and bikers could destroy relatively small areas of vegetation and contribute to the spread of invasive non-native plant species. The effects may be slightly noticeable, but would not be measureable when considered with the whole vegetation populations within the park. Vegetation could grow back following trampling. The spread of invasive plants species could displace native vegetation populations, but would be mitigated by Zion’s on-going vegetation management. Impacts would be adverse, direct, site-specific, short-term, and negligible.

Cumulative Effects: Past, present, and reasonably foreseeable future projects with the potential to affect vegetation include the renovation of South Campground, the expansion of the Visitor’s Center parking area, the Kolob Terrace Road rehabilitation, and ongoing vegetation management, including controlled burns. All of these projects would involve some level of local ground disturbance that would impact vegetation. While the projects would collectively cover a large area, only vegetation areas in and directly adjacent to the construction footprints would be affected, and only a relatively limited portion of the species population would be affected overall. When considering whole populations of vegetative species within the park, these local changes in the vegetation would not be measureable. Over the long-term, the construction projects would be completed and disturbed areas would be revegetated with native species and monitored for control of non-native species. Ongoing exotic vegetation management and controlled burns would temporarily reduce the populations of non-native plant species and beneficially impact native vegetation.

The overall cumulative impacts to vegetation from past, present, and reasonably foreseeable future projects, would be adverse and beneficial, direct and indirect, site-specific, short-term, and negligible. When combined with other past, present, and reasonably foreseeable future actions, the No Action Alternative would provide no incremental addition to overall cumulative impacts on vegetation.

Conclusion: The No Action Alternative would result in adverse, direct, site-specific, short-term, and negligible impacts to vegetation due to continued off-trail hiking and biking near visitor use areas. The overall cumulative impacts to vegetation from past, present, and reasonably foreseeable future projects would be adverse and beneficial, direct and indirect, site-specific, short-term, and negligible.

Impacts of Alternative B (Preferred Alternative)

Under the Preferred Alternative, vegetation within the Project area consists primarily of native trees and shrubs and non-native cheatgrass.

Under the Preferred Alternative, construction activities, such as grading, excavating, and recontouring, would have adverse, direct and indirect, local, short- and long-term, and minor effects on native herbaceous vegetation. Earth moving activities can contribute to the spread of invasive non-native plant species. Once established, invasive non-native plants displace native plants and are difficult to eradicate. To protect vegetation, weed control methods would be implemented and monitored to minimize the introduction of non-native plant species (noxious weeds), including spraying off construction equipment that enters and leaves the Project site.

Established non-native vegetation (such as cheatgrass) would be destroyed during construction and the area would be revegetated with native grass species. This would result in beneficial, direct and indirect, local, long-term, and minor effects on native vegetation.

Construction activities associated with clearing the alignment for the proposed irrigation pipelines would result in the loss of individual mature trees and shrubs located in the riparian areas near the river. The loss of these individual trees and shrubs could be noticed by park visitors, but would not have a measureable effect on the local population of riparian vegetation within the park. Impacts would be adverse, direct, site-specific, long-term, and minor.

Under the Preferred Alternative there would be indirect impacts to individual plant shrub species, but there would be no measurable effect on vegetative populations as a whole. Impacts would be adverse, indirect, site-specific, long-term, and negligible.

Indirect impacts to vegetation would occur by the Nature Center, where a portion of the irrigation ditch would be abandoned and water flow to mature cottonwoods would be eliminated. As such, vegetation dependent on this segment of the irrigation ditch (including cottonwoods that do not root down to the groundwater) would lose their water source and eventually die, resulting in changes in the abundance and distribution of individual species in a site-specific area. Impacts would be adverse, indirect, localized, long-term, and minor. The proposed irrigation system under the Preferred Alternative is designed to accommodate future expansion; this area would have the potential to be re-irrigated with a branch from the main trunk line of the system.

Cumulative Effects: Impacts from past, present, and reasonably foreseeable future projects with the potential to affect vegetation would be the same as those described under the No Action Alternative; adverse and beneficial, direct and indirect, site-specific, short-term, and negligible. Under the Preferred Alternative, construction-related activities would incrementally add to the cumulative short- and long-term impacts.

Cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the Preferred Alternative, would be adverse and beneficial, direct and indirect, site-specific, short- and long-term, and minor.

Conclusion: The Preferred Alternative would contribute adverse and beneficial, direct and indirect, localized, short- and long-term, negligible to minor impacts on vegetation. Generally, these effects would have a slight effect on a local population. Cumulative impacts from other past, present, and reasonably foreseeable future projects, in

combination with the Preferred Alternative, would be adverse and beneficial, direct and indirect, site-specific, short- and long-term, and minor.

Impacts of Alternative C (Oak Creek Diversion)

Under Alternative C, general effects from construction activities would be similar to the effects described under the Preferred Alternative. Direct impacts to vegetation under Alternative C would be slightly greater than under the Preferred Alternative because more mature tree and shrub vegetation would be removed along Oak Creek Ditch upstream from the pedestrian bridge on the Pa'rus Trail, and more undisturbed grass and shrubland would be temporarily utilized for staging and laydown activities for construction of the sluice, and settling tank. The noticeable effects would be adverse, direct, site-specific, short- and long-term, and minor as there would be little change to the abundance or distribution of local populations of riparian, grass, and shrubland communities.

Overall, impacts to vegetation under Alternative C would be similar to the Preferred Alternative; beneficial and adverse, direct and indirect, localized, short- and long-term, and negligible to minor.

Cumulative Effects: Impacts from past, present, and reasonably foreseeable future projects with the potential to affect vegetation would be the same as those described under the No Action Alternative; adverse and beneficial, direct and indirect, site-specific, short-term, and negligible. Under Alternative C, construction-related activities would add to the cumulative short- and long-term impacts to a slightly greater degree than they would under the Preferred Alternative. However, the overall incremental effect under Alternative C would be the same as the Preferred Alternative.

Overall, cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the actions associated with Alternative C, would be adverse and beneficial, direct and indirect, site-specific, short- and long-term, and minor.

Conclusion: The actions associated with Alternative C would contribute adverse and beneficial, direct and indirect, localized, short- and long-term, and negligible to minor impacts to vegetation. Generally, these effects would be similar to the effects described under the Preferred Alternative. Cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the actions associated with Alternative C, would be adverse and beneficial, direct and indirect, site-specific, short- and long-term, and minor.

Water Resources

Affected Environment

Water resources within the Project area include the North Fork of the Virgin River (which flows perennially) and its tributary, Oak Creek (which flows seasonally). The Project area lies within U.S. Geologic Survey Hydrologic Unit Code 15010008, Upper Virgin Watershed (USGS 2011).

The Virgin River and its tributaries in Zion have carved spectacular vertical-walled canyons through the Navajo sandstone and surrounding sedimentary strata, and continue to carve them today. The erosive force is provided by frequent flood events that occur most numerous from sudden summer monsoon storms, but also from spring snowmelt, and rarely from very large winter rain-on-snow flood events. Annual flow is highly variable and large runoff years are more likely during El Niño climate events

(NPS n.d.). Sediment transport from this rapidly eroding landscape is exceptional. Annual sediment loads in the North Fork of the Virgin River are estimated at 800,000 to 1 million tons per year (NPS n.d.). Sediment loading and turbidity during floods would be considered a major deficiency elsewhere, but in the rivers in Zion, it is an attribute of natural conditions rather than a concern, and sediment levels appear to be a major factor preventing the invasion of the river and its tributaries with exotic fish species (NPS n.d.).

Water quality conditions of the North Fork of the Virgin River and its tributaries are generally considered natural and high quality. This is due to the relatively light level of development on the watershed, and due to the fact that most, and for some of the tributary streams, all, of the flow is from groundwater discharge from the Navajo sandstone aquifer. The Navajo sandstone is made up of over 99 percent pure quartz sand and provides a near perfect sandstone filter. Major cations in the water are calcium, magnesium, and sodium, while anions are dominated by bicarbonate, sulfate, and chloride (NPS n.d.). The North Fork of the Virgin River is protected under the CWA as a source of domestic drinking water. It carries a "High Quality Category 1" designation that prohibits new point-source discharges (NPS n.d.).

Stream flow in the large rivers and almost all tributaries are essentially natural and free-flowing in Zion. There are no large reservoirs on the watershed that would reduce flood flows, augment base flows, cause daily hydropower fluctuations, or modify stream temperatures. Therefore, discharge patterns show the full range of natural conditions. Total annual stream discharge in Zion totals about 133,000 acre-feet per year. Consumptive use of water upstream of Zion totals about 4,600 acre-feet per year, or 3.4 percent of the flow and depletions by the park are about 490 acre-feet per year or about 0.4 percent of the total flow. Base flow in the North Fork of the Virgin River varies from about 40 cfs in dry years to 60 cfs in wet years. The diversion by the NPS of a combined rate of 2.59 cfs from the Flanigan Diversion and Oak Creek Diversion structures constitutes 4 to 6 percent of the flow. The combined diversion of 4.72 cfs by Springdale, the Springdale Consolidated Irrigation Company, and the Town of Rockville constitutes 8 to 12 percent of the base flow. It is estimated that 50 percent of this flow is in excess of that consumed by irrigated plants and returns to the river (Sharrow 2011b).

Intensity Level Definitions

Intensity thresholds of water resource impacts are defined as follows:

Negligible: Neither water quality nor hydrology would be affected, or changes would be either non-detectable or, if detected, would have effects that would be considered slight and local.

Minor: Changes in water quality or hydrology would be measurable, although the changes would be small and the effects would be localized. No mitigation measures associated with water quality or hydrology would be necessary.

Moderate: Changes in water quality or hydrology would be measurable, but would be relatively local. Mitigation measures associated with water quality or hydrology would be necessary and the measures would likely succeed.

Major: Changes in water quality or hydrology would be readily measurable, would have substantial consequences, and would be noticed on a regional scale. Mitigation measures would be necessary and their success would not be guaranteed.

Impacts of Alternative A (No Action)

Under the No Action Alternative, there would be no change to existing conditions. Irrigation system upgrades in the park would not take place, and there would be no ground disturbance or construction activities with associated effects on water resources. Open ditches in an arid climate would continue to experience evaporative loss of water and seepage, and would not be efficient in irrigating targeted landscaped areas, as the irrigation system would not provide flexibility as to how and where the park irrigates. The park would continue to divert 4 to 6 percent of the base flow of the river at current locations and consume about 50 percent of this in irrigated landscapes.

Cumulative Effects: Past, present, and reasonably foreseeable future projects with the potential to affect water resources include the Omnibus Public Land Management Act of 2009 designating the Virgin River and its tributaries within Zion as part of the National Wild and Scenic River System (which affords protection under free-flowing conditions, water quality, and ORVs); ongoing water conservation efforts; an ongoing maintenance program for fish health and native fish populations; a CRMP which is currently under development; the proposed expansion of the parking area in the Visitor's Center; and the proposed renovation of South Campground.

The Omnibus Public Land Management Act of 2009, water conservation efforts, the ongoing fish maintenance program, and the proposed CRMP cumulatively provide for protection (for both water quality and quantity) of the North Fork of the Virgin River and Oak Creek. Impacts to water quality and quantity from these efforts are or would be beneficial, direct and indirect, regional, long-term, and moderate. The proposed expansion of the parking area at the Visitor's Center and the proposed renovation of South Campground would slightly increase impervious surface area within the vicinity of the North Fork of the Virgin River. The impervious surfaces created by buildings and pavement could cause rainwater to flow quickly over the landscape, rather than soaking naturally into the soil or being absorbed by plants. This could potentially change stream flows, increase flooding, and erode stream banks and channels. Runoff can also carry pollutants such as oil, heavy metals, bacteria, sediment, and pesticides into streams or groundwater. BMPs would be implemented during construction and design to mitigate impacts from stormwater runoff. Given the small scale of the proposed increased impermeable surface areas and the required mitigation to protect water resources, these effects would be adverse, indirect, local, short- and long-term, and negligible.

The overall cumulative effects to water resources from past, present, and reasonably foreseeable future projects would be beneficial, direct and indirect, regional, long-term, and moderate as protection efforts would include mitigation to lessen stormwater runoff impacts from construction, such that water quality would not degrade within the North Fork of the Virgin River or its tributaries. When combined with other past, present, and reasonably foreseeable future actions, the No Action Alternative would provide no incremental addition to overall cumulative impacts on water resources.

Conclusion: The No Action Alternative would result in no impacts to water resources because irrigation system upgrade construction-related activities would not be conducted. The overall cumulative impacts to water resources from past, present, and reasonably foreseeable future projects would be beneficial, direct and indirect, regional, long-term, and moderate. Under the No Action Alternative, no incremental addition to overall cumulative impacts on water resources would result when combined with other past, present, and foreseeable future actions.

Impacts of Alternative B (Preferred Alternative)

Under the Preferred Alternative, Zion allotted water rights of 1.38 cfs (Water Right #81-3608) from the Flanigan Diversion and 1.21 cfs (Water Right #81-1128) from the Oak Creek Diversion (for a total 2.59 cfs allotted water rights) would be retained. Zion has the capacity to irrigate 142 acres. The proposed Project would initially irrigate 82 acres and have room for modification to the system to irrigate additional acreage. Given that the proposed upgrade would be more efficient than the existing system, and that Zion would not initially irrigate up to its full capacity, it is likely that Zion would divert less water than the diversions taking place under the No Action Alternative. As such, there would be an addition to stream flow within the North Fork of the Virgin River. This would consist of about 0.21 cfs and would be beneficial to natural stream flow retained within the North Fork of the Virgin River. When considered with the base flow of the river, the addition of 0.21 cfs (or less than 0.5 percent) would not be detectible. Impacts would be beneficial, indirect, regional, long-term, and negligible.

Under the Preferred Alternative, the only construction activity that could be conducted within the water would be the installation of a new water intake in the existing concrete wall of the Flanigan Diversion. Construction personnel working in the river would disturb the river bed and there would be a slight increase in turbidity near the construction activity. No construction equipment would be staged directly in the water, and there would be no change to stream flow. Potential impacts would be adverse, direct, local, short-term, and negligible. Municipal water for the Town of Springdale would not be affected and would remain unimpaired.

There would be a potential increase in turbidity and suspended sediment from erosion as a result of construction activities under the Preferred Alternative. The proposed sluice, pipeline, and settling tank would be constructed near the North Fork of the Virgin River, and the holding tank and 8-inch pipeline would be constructed near Oak Creek. Because disturbed soils are susceptible to erosion until revegetation takes place, standard erosion control measures (such as silt fences and/or sandbags) would be implemented to minimize potential soil erosion, and BMPs would be utilized to minimize erosion leading to sedimentation in drainage areas. Revegetation and recontouring of disturbed areas would take place following construction to further reduce post-construction erosion.

With proper mitigation, effects from construction-related erosion and sedimentation would be non-detectable, or, if detected, would be slight. Impacts to water resources from sediment increase would be adverse, indirect, local, short-term, and negligible.

Under the Preferred Alternative, sediment from irrigation water would be returned to the North Fork of the Virgin River on an ongoing basis and for the life of the irrigation system. Given the capacity of the river to transport estimated sediment loads of 800,000 to 1 million tons per year, the sediment taken from irrigation water and returned to the river would not be detectible. Impacts would be adverse, direct, local, long-term, and negligible.

Cumulative Effects: Impacts from past, present, and reasonably foreseeable future projects with the potential to affect water quality and quantity would be the same as those described under the No Action Alternative; beneficial, direct and indirect, regional, long-term, and moderate. Under the Preferred Alternative, construction, Project-related activities, and associated increases in stream flow and sediment load would incrementally add to the cumulative short- and long-term impacts, but only to a negligible or less degree.

Cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the actions of the Preferred Alternative, would be beneficial, direct and indirect, regional, long-term, and moderate.

Conclusion: The Preferred Alternative would contribute adverse and beneficial, direct and indirect, local and regional, short- and long-term, negligible impacts to water resources. Generally, these effects would not be detectible. Cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the actions of the Preferred Alternative, would be beneficial, direct and indirect, regional, long-term, and moderate.

Impacts of Alternative C (Oak Creek Diversion)

Under Alternative C, the Oak Creek Diversion would continue to divert 1.00 to 1.21 cfs. The intake gate would be repaired or replaced and the inlet slip-lined with new pipe. As with the Preferred Alternative, the consumptive use of water could decrease when compared to the No Action Alternative as more efficient irrigation practices are implemented. Impacts would be the same as those described under the Preferred Alternative; that is, beneficial, indirect, regional, long-term, and negligible.

Under Alternative C, no new facilities would be constructed directly within the water, and there would be no change to stream flow. River flows would not be interrupted during construction of the proposed Project, though some of the work on the intakes may require temporary isolation from the river by sand bags. Municipal water would not be affected and the water would remain unimpaired as a result of the proposed Project.

Like the Preferred Alternative, there would be a potential temporary sediment increase from construction-related activities under Alternative C. Impacts to water resources from construction-related sediment increase would be adverse, indirect, local, short-term, and negligible. In addition, sediment from irrigation water would be returned to the North Fork of the Virgin River on an ongoing basis and for the life of the irrigation system. Impacts from sediment returned to the river from irrigation water would be adverse, direct, local, long-term, and negligible.

Overall, impacts to water resources under Alternative C would be the same as the Preferred Alternative; adverse and beneficial, direct and indirect, local and regional, short- and long-term, and negligible.

Cumulative Effects: Past, present, and reasonably foreseeable future projects with the potential to affect water quality and quantity would be the same as those described under the No Action Alternative; beneficial, direct and indirect, regional, long-term, and moderate. Overall, cumulative effects under Alternative C would be the same as the Preferred Alternative. Construction and Project-related activities would incrementally add to the cumulative short- and long-term impacts, but only to a negligible or less degree.

Similar to the Preferred Alternative, cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the actions associated with Alternative C, would be beneficial, direct and indirect, regional, long-term, and moderate.

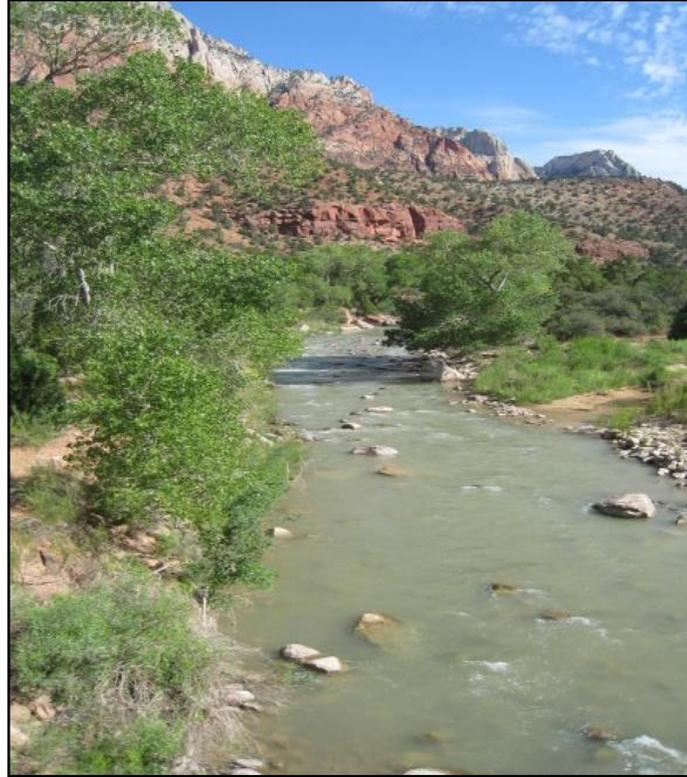
Conclusion: Actions under Alternative C would contribute adverse and beneficial, direct and indirect, local and regional, short- and long-term, negligible impacts to water resources. Generally, these effects would be non-detectible. Cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the

actions of Alternative C, would be beneficial, direct and indirect, regional, long-term, and moderate.

Wild and Scenic Rivers

Affected Environment

The Omnibus Public Land Management Act of 2009 designated approximately 166 miles of the Virgin River and its tributaries across federal land within Zion and adjacent BLM Wilderness as part of the National Wild and Scenic River System (NPS n.d.). “Federal agencies administering Wild and Scenic Rivers are required to prepare a Comprehensive River Management Plan (CRMP) for the protection of the river values, development of lands and facilities, user capacities, and other management practices necessary or desirable to achieve the purposes of the act” (NPS n.d.). Part of that process involves



developing an outstanding remarkable value (ORV) statement. ORVs are “river-related, contribute to the function of the ecosystem and/or owe their location or existence to the river; they are the reason the river rises to the level of national significance and protection” (NPS n.d.). Zion is in the process of developing its CRMP. The Wild and Scenic River Act affords classified rivers protection under free-flowing condition, water quality, and ORVs. ORVs must be river-related or dependent (i.e., in the river or on its immediate shorelands, usually within 0.25 mile of either side of the river), and owe their existence or location to the presence of a river.

Stream flow in Zion is substantially natural, which is extremely rare in the southwest U.S. “Having no large reservoirs on the watershed allows: 1) floods of all sizes, 2) periods of low flow, 3) sediment transport, and 4) the natural range of stream temperatures to occur. All of these natural characteristics support stream channel morphology, and the stream dependent flora and fauna” (Sharrow 2010). Stream flows in Zion are characterized as high with year-to-year variability. In the majority of years (60 percent), flows are less than average due to the dry conditions in the region. However, in wet years, flows increase substantially (Sharrow 2010).

In the Project area, the North Fork of the Virgin River below the Temple of Sinawawa has been designated as a Wild and Scenic river. The North Fork of the Virgin River has ORVs for cultural, geologic, recreational, scenic, wildlife, and fish. Its tributary segment, Oak Creek, has scenic and wildlife ORVs (NPS n.d.). Both the North Fork of the Virgin River and Oak Creek are within the Project area and are classified as “recreational” rivers. Under a recreational designation, rivers can be readily accessible by road, may

have development along the shoreline, and may have undergone some impoundment or diversion in the past.

Zion and the Virgin River are within the homeland of the Southern Paiute. The river and its tributaries provide water, a life element to the Paiute. In addition, the river and canyon retain their cultural significance to the Paiute people as a place of special meaning. As such, a cultural ORV was found for the North Fork of the Virgin River below the Temple of Sinawawa (NPS n.d.).

The unique geologic features at Zion that include Navajo sandstone exposures, river-carved canyons, sandstone cliffs, hanging waterfalls, narrow slot canyons, springs, seeps, and slickrock contribute to Zion's geologic ORV for the Virgin River.

To qualify for a recreational ORV, a river or segment must have river-dependent or river-related recreational activities. The Virgin River and its tributaries in Zion provide visitors with opportunities for canyoneering, hiking, backpacking, photography, scenic viewing, camping, and other activities (NPS n.d.).

The Virgin River and its tributaries in Zion have a scenic ORV due to the unparalleled scenic views they offer, including cross-bedded sandstone cliffs, and geologic tapestry of various colors (i.e., red, white, and pink cliffs). Waterfalls are abundant in the park, and the light reflected from still and flowing water creates dramatic visual contrasts, enhancing visual quality and scenic experiences. The Virgin River is a tributary of the Colorado River and drains parts of southwestern Utah, northwestern Arizona, and southeastern Nevada (Sharrow 2010). The Virgin River branches into several tributaries, "all of which are incised into deep canyons in the western margins of the Colorado Plateau" (Sharrow 2010).

Wildlife is an ORV of the Virgin River and its tributaries because of the habitat they provide. Populations of Mexican spotted owl and the endemic Zion snail (*Physa zionis*) are supported by the Virgin River. The tributaries of the Virgin River afford the Mexican spotted owl with primary nesting habitat – the core of the designated critical habitat identified in the recovery plan for this species (NPS n.d.).

To have an ORV for fish, a river or designated segment must contain native species and species of concern, natural and sustaining populations, and habitat quality and diversity (NPS n.d.). The Virgin River and its tributaries support the Virgin spinedace, flannelmouth sucker, desert sucker, and speckled dace, all native species. The Virgin spinedace is significant and only exists in the Virgin River system (NPS n.d.). The flannelmouth sucker and Virgin spinedace are managed under conservation agreements. All four native species have regionally significant natural and sustainable production levels in the Virgin River and several of its tributaries. In addition, a critical component of the food web, the Zion stonefly (*Isogenoides zionensis*), is found along the Virgin River and its tributaries.

The North Fork of the Virgin River typically has water quality conditions that are natural and high quality. The Navajo sandstone is made up of over 99 percent pure quartz sand and provides a near perfect sandstone filter (NPS n.d.). Water temperatures are well suited for native fish species, though marginal for cold water fish. The Clean Water Act of 1977 (CWA) provides protection against water quality degradation. The North Fork of the Virgin River is protected under the CWA, as administered by the State of Utah, as a source of domestic drinking water, and is designated primary contact recreation and cold water fisheries. It carries a "High Quality Category 1" designation that prohibits new point-source discharges (NPS n.d.).

Discharge patterns for the Virgin River and its tributaries show the full range of natural conditions. Streamflow in the large rivers and almost all tributaries is essentially natural and free-flowing. There are no large reservoirs on the watershed that would reduce flood flows, augment base flows, cause daily hydropower fluctuations, or modify stream temperatures (NPS n.d.). The sediment flow for the Virgin River and its tributaries is exceptional and is estimated at 800,000 to 1 million tons per year (NPS n.d.). The Zion National Park Water Rights Settlement Agreement recognizes the water flow at Zion. This flow is protected by federal reserved and appropriated water rights held by the NPS (NPS n.d.) and administered by the State of Utah.

A Section 7 Analysis Under the Wild and Scenic Rivers Act is included in Appendix B of this EA.

Intensity Level Definitions

Intensity thresholds for Wild and Scenic rivers are defined as follows:

Negligible: The effects of the action would not be detectable to most visitors and would have no discernible effect on the river's ORVs, free-flowing condition, or water quality.

Minor: The effects of the action would be slightly detectable to some visitors, but are not expected to have an overall effect on the river's ORVs, free-flowing condition, or water quality.

Moderate: The effects of the action would be clearly detectable by many visitors and could have an appreciable effect on the river's ORVs, free-flowing condition, or water quality.

Major: The action would have a substantial and noticeable effect on most visitors and the river's ORVs, free-flowing condition, or water quality.

Impacts of Alternative A (No Action)

There would be no construction activities under the No Action Alternative, and therefore, no construction-related impacts to the North Fork of the Virgin River or its tributary segment, Oak Creek. Under the No Action Alternative, the irrigation system in the park would remain as it exists now, with no noticeable change to the geologic, recreational, scenic, cultural, wildlife, and fish ORVs for the North Fork of the Virgin River, and the scenic and wildlife ORVs for Oak Creek.

Without upgrade, the irrigation system in Zion would continue to require high maintenance activities to maintain the ditch distribution system that is irrigation fed. These activities would not have noticeable effects on the ORVs that qualify the North Fork of the Virgin River and Oak Creek for Wild and Scenic river status.

Cumulative Effects: Projects that may result in cumulative impacts to Wild and Scenic river ORVs in the park include the South Campground renovation and other projects. Construction activity in or near rivers or river banks in Zion have the potential to affect resource values of rivers. The planned renovation of South Campground and the planned expansion of the parking area at the Visitor's Center, have the potential to result in indirect, local, short-term, minor, and adverse impacts to recreational, scenic, and wildlife ORVs, primarily due to construction activities. Following construction, the planned renovation of South Campground would result in indirect, local, long-term, minor, and beneficial impacts to recreational values. Projects, such as the CRMP and the Virgin River Recovery Program, may result in beneficial, indirect, local, long-term, and minor impacts to the ORVs of the North Fork of the Virgin River and Oak Creek due

to improved fish habitat and improved recreational values. Although some planned projects could adversely affect Wild and Scenic rivers in the park, others could provide benefit to the ORVs of the North Fork of the Virgin River and Oak Creek. Therefore, cumulative impacts to Wild and Scenic rivers in the park include indirect, local, short-term, minor, and adverse impacts, as well as indirect, local, long-term, minor, and beneficial impacts. Under the No Action Alternative, noticeable additive effects to cumulative impacts would result.

Conclusion: Under the No Action Alternative, there would be no impacts to ORVs for which the North Fork of the Virgin River and Oak Creek are rated for. Cumulatively, past, present, and reasonably foreseeable future projects would have indirect, local, short- and long-term, minor, and adverse and beneficial impacts to the wildlife, recreational, fish, and scenic ORVs of the North Fork of the Virgin River and to the scenic and wildlife ORVs of Oak Creek.

Impacts of Alternative B (Preferred Alternative)

Construction activities under the Preferred Alternative would result in temporary impacts to the ORVs of both the North Fork of the Virgin River and Oak Creek. Construction noise, increased activity, and ground disturbance could alter wildlife use of the area, and affect the scenery and recreational values. Activities would occur in areas visible to park visitors, including trails along the North Fork of the Virgin River, the main park road, and South Campground. The proposed pipeline and holding tank along Oak Creek would not have a strong visual presence, as this area is typically not used by park visitors. The effects of these structures would be considered indirect, local, short-term, minor, and adverse. Permanent, above ground facilities would add new structural elements to the landscape that could detract from the natural scenery; however, these structures would be visually screened and designed to blend with the natural setting. Such structures include the sluice structure, 250,000-gallon settling tank, 30,000-gallon holding tank, and the proposed pump and filter station. The holding and settling tanks would be partially buried, which would reduce the visibility of these structures. Additionally, vegetation and boulders would screen views of several of the above ground structures. Scenic views such as cross-bedded sandstone cliffs and geologic tapestry of various colors would not be affected. In addition, both the North Fork of the Virgin River and Oak Creek are readily accessible by road with existing development along their shorelines. Because above ground facilities would be visually screened and designed to blend with the natural setting of the area, and because these structures would be constructed in previously disturbed areas of the park, there would be no adverse effects to scenic views.

Cumulative Effects: Potential impacts from other past, present, and reasonably foreseeable actions would be the same as those described for the No Action Alternative; indirect, local, short- and long-term, minor, and beneficial and adverse to Wild and Scenic rivers. These would include impacts from construction activities at South Campground and other projects.

The actions associated with the Preferred Alternative would incrementally add to the cumulative impacts with indirect, local, short-term, minor, and adverse impacts to wildlife, scenic, and recreational ORVs associated with construction activities. Overall cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the Preferred Alternative, would be indirect, local, short- and long-term, minor, and beneficial and adverse to wildlife, scenic, and recreational ORVs.

Conclusion: Under the Preferred Alternative, indirect, local, short-term, minor, and adverse impacts to wildlife, scenic, and recreational ORVs would be experienced due to construction disturbance. Long-term, there would be no adverse effects to scenic views. The actions associated with the Preferred Alternative would have no impacts to cultural, geologic, and fish ORVs. Overall cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the actions of the Preferred Alternative, would be indirect, local, short- and long-term, minor, and beneficial and adverse to wildlife, scenic, and recreational ORVs.

Impacts of Alternative C (Oak Creek Diversion)

Under Alternative C, impacts to Wild and Scenic rivers would be similar to those described for the Preferred Alternative. The primary differences between Alternative C, which diverts water at the existing Oak Creek Diversion, and the Preferred Alternative, which diverts water at the Flanigan Diversion, are the facilities between the two diversion points. As shown on Figures 3 and 4, from the Flanigan Diversion south, most of the proposed Project components are the same, including the proposed water pipeline, pump and filter station, and the holding tank.

Construction activities under Alternative C would result in impacts to several of the ORVs of both the North Fork of the Virgin River and Oak Creek. Construction noise, increased activity, and ground disturbance could alter wildlife use of the area, and affect the scenery and recreational ORVs. Cultural resources are one of the designated ORVs of the North Fork of the Virgin River. Under Alternative C, a buried pipeline would be installed either adjacent to or under the Oak Creek Ditch, which is a historic structure. During construction, there would be direct, local, short-term, moderate, and adverse impacts to cultural ORVs along this stretch of the river. The ditch would then be reclaimed to its former contour and appearance, and impacts would be direct, local, long-term, negligible to minor, and adverse. Activities would occur in areas visible to park visitors, including trails along the North Fork of the Virgin River, the main park road, and South Campground. The proposed pipeline and holding tank along Oak Creek would be less visible, as this area is typically not used by park visitors. The effects of these activities and structures would be considered indirect, local, short-term, minor, and adverse. Cultural ORVs for which the river was designated as part of the Wild and Scenic River National System, such as the river and canyon areas which have cultural significance to the Paiute people as a place of special meaning, would experience no adverse effects.

Permanent, above ground facilities would add new structural elements to the landscape that could detract from the natural scenery; however, as described under the Preferred Alternative, these structures would be visually screened and designed to blend with the natural setting. Because above ground facilities would be visually screened and designed to blend with the natural setting of the area, there would be no adverse effects to scenic views.

Cumulative Effects: Potential impacts from other past, present, and reasonably foreseeable actions would be the same as those identified for the No Action Alternative; indirect, local, short- and long-term, minor, and beneficial and adverse to wildlife, scenic, recreational, and cultural ORVs.

The actions associated with Alternative C would incrementally add to the cumulative impacts with indirect, local, short-term, minor, and adverse impacts to scenic, recreational, and wildlife ORVs; and direct, local, short-term, moderate, and adverse impacts to cultural ORVs. Similar to the Preferred Alternative, construction activities

associated with Alternative C would be the primary cause of the indirect, local, short-term, minor to moderate, and adverse impacts.

Overall cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the actions associated with Alternative C, would be indirect, local, short- and long-term, minor, and beneficial and adverse to wildlife, scenic, and recreational ORVs, and direct, local, short- and long-term, moderate, and beneficial and adverse to cultural ORVs.

Conclusion: Under Alternative C, there would be indirect, local, short-term, minor, and adverse impacts to wildlife, scenic, and recreational ORVs from construction-related activities, and direct, local, short-term, moderate, and adverse impacts to cultural ORVs from demolition and reclamation of Oak Creek Ditch. Long-term, there would be no adverse effects to scenic views.

The actions associated with Alternative C would have no impacts to geologic and fish ORVs. Overall cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the actions associated with Alternative C, would be indirect, local, short- and long-term, minor, and beneficial and adverse to wildlife, scenic, and recreational ORVs, and direct, local, short- and long-term, moderate, and beneficial and adverse to cultural ORVs.

Historic Structures

Affected Environment

According to NPS' *Management Policies* (2006), parks utilize preservation, rehabilitation, and restoration as treatments for extant structures. Treatments for historic structures are based on "sound preservation practice to enable the long-term preservation of a structure's historic features, materials, and qualities." Zion's *GMP* states that the park will "manage historic structures as 'cultural resources' and will give full consideration to historical values that may be affected as a result of park planning efforts" (NPS 2001a).

Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on properties listed or eligible for listing in the NRHP. Section 106 also requires agencies to provide the ACHP an opportunity to comment on such undertakings. Historic properties are defined at 36 CFR 800.16(l)(1) as "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the NRHP."

The NPS defines a historic structure as "a constructed work...consciously created to serve some human activity. Historic structures are usually immovable, although some have been relocated and others are mobile by design. They include buildings and monuments, dams, millraces and canals, nautical vessels, bridges, tunnels and roads, railroad locomotives, rolling stock and track, stockades and fences, defensive works, temple mounds and kivas, ruins of all structural types, and outdoor sculpture" (2002). Historic districts are groups of buildings, properties, or sites that have been designated as historically or architecturally significant. The Project area contains two historic structures, the Oak Creek Diversion and Irrigation Ditch and Flanigan Ditch, and one historic district, the Oak Creek Housing District, all listed on the NRHP.

The Oak Creek Diversion and Irrigation Ditch were built in 1935 by enrollees of CCC Camp N.P. #2 as a way to irrigate vegetation in Zion's South Campground (Jurale 1984). Improvements were made to the ditch in 1941 to replace wooden flumes and build new

concrete diversion dams. The Oak Creek Diversion is on the west side of the North Fork of the Virgin River and diverts water from the river to an open channel earthen ditch. The ditch is 2 miles long and diverts water from the North Fork of the Virgin River through a diversion dam, which spans the river. Additional work was performed to the ditch in 1959 and 1961 to irrigate the Visitor Center and Pine Creek residential areas. The ditch rejoins the North Fork of the Virgin River below South Campground. The ditch is concrete lined for most of its length. The Oak Creek Diversion and Irrigation Ditch was determined eligible for listing in the NRHP under Criterion A for its association with significant events related to the CCC activities in Zion, and listed in the NRHP on July 7, 1987 (NPS 2011a).

The Flanigan family (prominent Mormon pioneers) constructed the Flanigan Ditch (an open earthen ditch) in 1880 to water the family's land along the Virgin River after they sought water rights for a portion of the river flow. Over time, the farmlands on the lower portion of the ditch were abandoned below the present outlet at Watchman Campground. Part of the Flanigan Ditch, the buried portion, is a potential archeological feature that relates to the period of pioneer Mormon agriculture in the Zion area (Kardas and Larrabee 1997). The NPS acquired the lands surrounding the ditch from the Flanigans in 1960. The former Flanigan field is now Watchman Campground. Of the original 15,000 feet of ditch, approximately 12,000 feet are within the park, with the upper third largely intact but unwatered for part of its length (Kardas and Larrabee 1997). A portion continues to carry water for irrigation of Watchman Campground.



Flanigan Ditch shares its headworks with the Springdale Consolidated Irrigation Company pipeline. The Springdale pipeline supplies municipal water to the Town of Springdale via a pipeline that was installed in 1988. Flanigan Ditch was determined eligible for listing in the NRHP under Criterion A for its association with significant events related to pioneer Mormon



agriculture in Zion, and it was listed in the NRHP on January 12, 1998. The Flanigan Diversion, as it exists now, diverts water from the river into a desanding structure currently shared between Zion, the Town of Springdale, and the Springdale Consolidated Irrigation Company.

Active portions of the open irrigation ditches in the park have high maintenance efforts associated with them related to ditch overgrowth, visitor's damming up the fingers of the distribution systems in the campgrounds, and gophers boring in to the walls of the ditch banks and causing blowouts.

The buildings of the Oak Creek Historic District were built during the 1930s and early 1940s in what had by then become the standard NPS rustic style adapted for use at Zion. The Oak Creek compound provided housing for NPS employees and included service and utility facilities. Most buildings were constructed by enrollees of the CCC. Oak Creek Historic District is eligible under NRHP Criterion C for the architectural development of the NPS rustic style at Zion. The period of significance is 1936-1941. The Oak Creek Historic District was included in the Zion National Park Multiple Resource Area Thematic Group nomination approved July 7, 1987 (NPS 2011a).

Intensity Level Definitions

Intensity thresholds for historic structures are defined as follows:

Negligible: The impact to historic structures is at the lowest level of detection; barely measurable with hardly any perceptible consequences, either adverse or beneficial. For the purposes of Section 106 under the NHPA, the determination of effect would be "no effect."

Minor: The impact to historic structures is detectable and measurable. Impacts would not diminish the overall integrity or significance of the resource and the NRHP eligibility of the resource would be unaffected. Stabilization/preservation of structures in accordance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (NPS 2001b) could have a beneficial effect on the structures. For the purposes of Section 106 under the NHPA, the determination of effect would be "no adverse effect."

Moderate: The impact to historic structures is readily apparent and considerably measurable. Impacts would diminish the overall integrity or significance of the resource and/or the impact would change one or more of the character-defining features of the resource. For the purposes of Section 106 under the NHPA, the determination of effect would be "adverse effect." A Memorandum of Agreement (MOA) would be executed among the NPS, SHPO, and if necessary, the ACHP, in accordance with 36 CFR 800.6(b). Measures identified in the MOA to minimize or mitigate adverse effects would reduce the intensity of impact under NEPA.

Major: The impact to historic structures is highly noticeable and substantial. Alteration of a structure would diminish the overall integrity or significance of the resource and/or would change one or more of the character-defining features of the resource, to the extent that it would no longer be eligible for listing in the NRHP. For the purposes of Section 106 under the NHPA, the determination of effect would be "adverse effect." Restoration of a structure in accordance with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (NPS 2001b) would have a beneficial impact and result in a determination under Section 106 of the NHPA of "no adverse effect."

Impacts of Alternative A (No Action)

Under the No Action Alternative, there would be no irrigation system upgrades. Current ongoing maintenance efforts would continue and the existing network of historic irrigation ditches and low-pressure pipelines would continue to service Zion visitor use and staff residential areas. Historic structures and districts would continue to be preserved and protected, Oak Creek Ditch would continue to be maintained as a functioning irrigation structure, and there would be no land disturbance near Flanigan Ditch.

Cumulative Effects: Past, present, and reasonably foreseeable future projects with the potential to affect historic structures include the 1988 installment of the Springdale pipeline, and the NHRP eligibility listing for the Oak Creek Irrigation Ditch (1987) and Flanigan Ditch (1998). The 1988 installment of the Springdale pipeline directly disturbed and buried portions of the Flanigan Ditch; these effects were adverse, direct, site-specific, long-term, and moderate.

Because the NPS, through consultation under Section 106, would strive to avoid impacts that would diminish the overall integrity or significance of a historic resource, the determination of eligibility and 1987 listing in the NRHP for the Oak Creek Irrigation Ditch, and the determination of eligibility and 1998 listing in the NRHP for the Flanigan Ditch, both provide beneficial, indirect, local, long-term, and moderate effects on these historic structures.

Overall cumulative impacts to historic structures in the park would be adverse and beneficial, direct and indirect, local, long-term, and moderate. When combined with other past, present, and reasonably foreseeable future actions, the No Action Alternative would provide no incremental addition to the overall cumulative impacts on historic structures.

Conclusion: The No Action Alternative would result in no impacts to historic structures because irrigation system upgrade construction-related activities would not be conducted. The overall cumulative impacts to historic structures from past, present, and reasonably foreseeable future projects would be adverse and beneficial, direct and indirect, local, long-term, and moderate. When combined with other past, present, and foreseeable future actions, the No Action Alternative would provide no incremental addition to overall cumulative impacts on historic structures.

Impacts of Alternative B (Preferred Alternative)

Under the Preferred Alternative, a new intake would be added to the existing concrete wall of the Flanigan Diversion, and a pipe would be installed that connects to a new sluice structure, which would be located next to the existing desanding structure. In addition (as shown on Figure 3) a 250,000-gallon settling tank and pipeline would be installed east of the North Fork of the Virgin River. The pipeline would run parallel to Flanigan Ditch to Watchman Campground.

Construction of the proposed pipeline would not cross or otherwise disturb the historic Flanigan Ditch. A minimum 10-foot buffer between construction areas and staging and laydown areas around the historic Flanigan Ditch would be observed to help ensure that this historic resource would be avoided during construction activities. In addition, work in this area would be confined using protective fencing placed parallel to the Flanigan Ditch, to help prevent inadvertent “straying” of construction workers and equipment during construction. Prior to Project approval, details of the design of the Project components would be reviewed by NPS historical architects and the Utah SHPO. With

protective measures in place, construction activities associated with the Preferred Alternative would not disrupt the Flanigan Ditch and would not diminish those characteristics for which the property has been listed in the NRHP. In summary, there would be no adverse impacts to Flanigan Ditch.

Under the Preferred Alternative, construction activities would not affect the historic portions of Oak Creek Irrigation Ditch. The diversion and ditch would remain intact and continue to operate in their existing condition. Under the Preferred Alternative, there would be no impacts to the Oak Creek Irrigation Ditch.

Under the Preferred Alternative, the Oak Creek pipeline would follow the path of the service road upstream of the maintenance service buildings and would be located within the previously disturbed areas of the existing service road boundary. The alignment of the pipeline would travel through the Oak Creek Historic District. Although there would be temporary disruption of the historic scene within the historic district during construction, following construction, the landscapes within the historic district would be restored. Construction activities would not directly affect historic structures. Temporary impacts due to construction-related activities would be adverse, indirect, local, short-term, and negligible. Pipeline placement within the boundaries of an existing service road within the park's historic district would not represent a change to the existing land use or structure types such that the overall integrity of the historic district would be degraded. The eligibility of the historic structures and district at the park for listing in the NRHP would not be jeopardized by the proposed Project.

The holding tank would be constructed up Oak Creek Canyon near the maintenance service buildings in the park, which is an area that is not readily accessible to park visitors. Although the holding tank would not be constructed within the boundary of the Oak Creek Historic District, there would be a temporary disruption of the historic scene during construction due to equipment, vehicular traffic, and construction crews both near and traveling through the Oak Creek Historic District. Temporary impacts due to the construction of the holding tank would be adverse, indirect, local, short-term, and negligible.

Cumulative Effects: Impacts from past, present, and reasonably foreseeable future projects with the potential to affect historic structures would be the same as those described under the No Action Alternative; adverse and beneficial, direct and indirect, local, long-term, and moderate. Under the Preferred Alternative, with protective measures in place, there would be no impacts to historic structures. When combined with other past, present, and reasonably foreseeable future actions, the actions associated with the Preferred Alternative would provide no incremental addition to overall adverse and beneficial, direct and indirect, local, long-term, and moderate cumulative impacts on historic structures.

Conclusion: Under the Preferred Alternative, with protective measures in place, there would be no impacts and no adverse effects to the historic Flanigan Ditch and Oak Creek Irrigation Ditch. There would be adverse, indirect, local, short-term and negligible impacts to the Oak Creek Historic District as a result of construction activities associated with the Oak Creek pipeline and holding tank. Overall cumulative impacts to historic properties would be adverse and beneficial, direct and indirect, local, long-term, and moderate. When combined with other past, present, and foreseeable future actions, the actions associated with the Preferred Alternative would provide no incremental addition to overall cumulative impacts on historic structures.

Impacts of Alternative C (Oak Creek Diversion)

Under Alternative C, construction of the pipeline on the east side of the North Fork of the Virgin River near Flanigan Ditch and the mitigation measures implemented to protect the Flanigan Ditch would be the same as those described under the Preferred Alternative. There would be no adverse impacts to Flanigan Ditch. Impacts to the Oak Creek Historic District as a result of the Oak Creek pipeline and holding tank construction would be the same as those described under the Preferred Alternative, that is, adverse, indirect, local, short-term, and negligible.

Under Alternative C, the Oak Creek Diversion would be modified to divert the total water right of Zion. New gates would be installed on the Oak Creek Diversion to control flows and to sluice sediment away from the intake, taking care to preserve the existing structure. Because the new gates would not diminish the overall integrity or significance of the diversion structure, impacts to the Oak Creek Diversion would be adverse, direct, site-specific, long-term, and minor.

Water would be diverted from the Oak Creek Diversion and piped in to the proposed sluice structure, new pump and filter station, and holding tank located downstream. The new pipeline from the sluice structure to the settling tank would be installed adjacent to or directly beneath the existing ditch. The historic Oak Creek Irrigation Ditch would either be directly trenched in order to install the new pipeline below the ditch, or the new pipeline would be placed directly within the construction corridor and area of disturbance for the pipeline, being installed adjacent to the irrigation ditch. Following pipeline installation, Oak Creek Ditch would be fully restored to its original contours and irrigation water would continue to be diverted into the ditch. However, Zion may reduce the flow rates within the ditch from original flows. Prior to Project approval, details of the design of the Project components would be reviewed by NPS historical architects and the Utah SHPO. Until restoration was complete, the trenching and construction activities associated with pipeline installation would temporarily alter the character-defining features of the open irrigation ditch. Overall, the demolition and reconstruction of the historic Oak Creek Irrigation Ditch would diminish the original integrity of the resource, but the historic features would be replaced in kind. Ultimately, the destruction and re-construction of the Oak Creek Irrigation Ditch would not diminish those characteristics for which the property was listed in the NRHP. Impacts would be adverse, direct, site-specific, short- and long-term, and moderate.

Cumulative Effects: Impacts from past, present, and reasonably foreseeable future projects with the potential to affect historic structures would be the same as those described under the No Action Alternative; adverse and beneficial, direct and indirect, local, long-term, and moderate. Under Alternative C, there would be no effect to Flanigan Ditch. The Oak Creek Irrigation Ditch would be directly impacted by trenching and construction activities to install the irrigation pipeline either directly under or adjacent to the ditch.

Overall cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with actions associated with Alternative C, would be adverse and beneficial, direct and indirect, local, long-term, and moderate.

Conclusion: Under Alternative C, impacts would be adverse, direct, site-specific, short- and long-term, and minor to moderate to the Oak Creek Diversion and Oak Creek Irrigation Ditch as a result of modifications to the diversion and potential destruction and subsequent re-construction of Oak Creek Ditch. Impacts to the Oak Creek Historic District would be adverse, indirect, local, short-term, and negligible as a result of

construction activities associated with the Oak Creek pipeline and holding tank. Overall cumulative impacts from other past, present, and reasonably foreseeable future projects, in combination with the actions associated with Alternative C, would be adverse and beneficial, direct and indirect, local, long-term, and moderate.

Park Operations

Affected Environment

Zion is open every day of the year, though some of the facilities or services may close or reduce hours during parts of the year. The main visitor facilities in the park include the Zion Canyon Visitor Center, the Zion Human History Museum, Kolob Canyons Visitor Center, and the Nature Center. The administrative functions for Zion are in a wing of the Zion Human History Museum and associated buildings. The park operates a shuttle bus service in the park with the hours of operation varying by season. Zion has three campgrounds, Watchman Campground, South Campground, and Lava Point Campground, with some group campsites available. The sites are available on a first-come, first-served basis, with the exceptions of Watchman Campground and the group campsites which require a reservation (NPS 2011f).

Within the park, various visitor communications, interpretation, and other activities take place to ensure visitor safety and to provide visitors with the history of Zion and ongoing park activities. Such activities typically involve rangers and resource specialists of the park.

The current irrigation system in the park is an open ditch irrigation system. The park experiences evaporative water losses and seepage (reducing efficiency) from this type of irrigation system, and is limited in the areas that can be irrigated.

Currently, Zion has high costs associated with the efforts required to maintain the open irrigation ditch distribution system in the park. Zion's maintenance crews perform routine maintenance on the ditch and fingers of the ditch, including clearing the length of Oak Creek Ditch. Such maintenance requires eight to 10 maintenance employees to clear the length of Oak Creek Irrigation Ditch once a year, and one full-time employee for 8 months out of the year to recontour and clear the finger ditches within the campgrounds. These maintenance efforts relate to naturally-occurring events in the park, like ditch overgrowth and damming up from silt buildup, as well as visitor-induced activities, like visitor's damming up the fingers of the distribution system from their play in the ditches. In addition, Zion's maintenance crews routinely fix bank blowout issues along the length of Oak Creek Ditch from gophers boring in to the walls of the ditch banks.

Intensity Level Definitions

Intensity thresholds of park operations are defined as follows:

Negligible: Park operations would not be affected or the effect would be at or below the lower levels of detection, and would not have an appreciable effect on park operations.

Minor: The effect would be detectable, but would be of a magnitude that would not have an appreciable adverse or beneficial effect on park operations. If mitigation were needed to offset adverse effects, it would be relatively simple and successful.

Moderate: The effects would be readily apparent and would result in a substantial adverse or beneficial change in park operations in a manner noticeable to staff and park

visitors. Mitigation measures would likely be necessary to offset adverse effects and would typically be successful.

Major: The effects would be readily apparent and would result in a substantial adverse or beneficial change in park operations in a manner noticeable to staff and park visitors, and would be markedly different from existing operations. Mitigation measures to offset adverse effects would be needed and could be expensive. The success of the mitigation measures could not be guaranteed.

Impacts of Alternative A (No Action)

Under the No Action Alternative, the existing irrigation system, an open ditch irrigation system, which has been troublesome and has presented a substantial workload for park personnel because of the maintenance requirements, would not change or be modified. Park hours and operations would continue as they typically do and routine maintenance would continue to be performed. In Oak Creek Ditch as well as the entire distribution system, maintenance personnel would continue to manage vegetation overgrowth and silt buildup, free up the ditch system from visitor-induced effects, and repair gopher holes in the banks of the ditch. The open irrigation ditches within the campgrounds would continue to experience evaporative water losses and seepage. In addition, the irrigation system would not provide flexibility as to how and where the park irrigates. There would be no flexibility to irrigate areas with river water that are currently irrigated with potable water, and overall the system would not be efficient.

Under the No Action Alternative, park operations would experience an adverse, direct and indirect, local, short- and long-term, moderate effect.

Cumulative Effects: Any project that occurs in Zion has an effect on park operations by affecting staffing and funding; therefore, the projects listed in the *Cumulative Impact Scenario* section of this EA would have some degree of effect on park operations. Projects, such as the CRMP and Virgin River Recovery Program, and planning for improvements to South Campground, the Visitor's Center parking area expansion, and the Kolob Terrace Road rehabilitation, involve or would involve a large part of Zion's staff to contribute their expertise and assistance. Such demands affect staff availability for other projects and staff availability to address day-to-day job duties and responsibilities, often adding to existing workloads and requiring increased work hours by park personnel. Cumulative impacts would result in adverse, direct and indirect, local, short- and long-term, minor effects on park operations associated with the current and future use of the existing irrigation system, as described above.

Under the No Action Alternative, the proposed Project would incrementally add an adverse, direct and indirect, local, short- and long-term, and minor effect on park operations. When combined with other past, present, and reasonably foreseeable future actions, park operations would experience overall adverse, direct and indirect, local, short- and long-term, minor effects.

Conclusion: The impact of continued maintenance to repair and maintain the existing irrigation system at Zion would be adverse, direct and indirect, local, short- and long-term, and moderate on park operations. When considered with other past, present, and reasonably foreseeable future actions, the proposed Project would incrementally add to cumulative impacts on park operations, having an overall adverse, direct and indirect, local, short- and long-term, minor impact.

Impacts of Alternative B (Preferred Alternative)

Under the Preferred Alternative, the installation of a pressurized pipeline would reduce maintenance costs associated with the existing open ditch irrigation system in the campgrounds. However, the Oak Creek Irrigation Ditch upstream from the campgrounds would continue to operate and would continue to require the same level of maintenance as described under the No Action Alternative. By having a pressurized irrigation system, the amount of evaporative water losses and seepage experienced by the park would be reduced (improving efficiency), and the ability of the park to irrigate additional areas in the park would improve. Under the Preferred Alternative, Zion would experience a beneficial, direct and indirect, local, short- and long-term, minor impact on park operations.

The Pa'rus Trail in the park would likely have to be closed during part or all of the construction activities and would likely need to be reconstructed in some places at the end of the Project from the pipeline crossing locations. This trail closing would have an adverse, direct, local, short-term, and minor effect on park operations from visitors being redirected to other trails and from the lack of alternate trails that allow bicycles and pets (i.e., Pa'rus Trail is the only trail in the park that allows bicycles and pets). This potential trail closing could increase park staff workloads during construction for communication, trail re-routing, and coordination efforts, resulting in adverse, direct, local, short-term, and minor effects on park operations.

Park resources and employees would be dedicated to the planning required to implement the Preferred Alternative, and daily planning and coordination of park activities in the Project area would have to be coordinated and overseen during construction. The typical work load for employees would increase during implementation of the proposed Project from the need to finalize Project plans and engineering designs, hire contractors, coordinate park planning efforts, and monitor construction activities. Once the proposed Project was constructed, normal workloads and patterns would resume. These actions under the Preferred Alternative would have an adverse, direct, local, short-term, and minor effect on park operations.

Cumulative Effects: Cumulative effects under the Preferred Alternative would be the same as those described under the No Action Alternative; adverse, direct and indirect, local, short- and long-term, and minor. Park operations associated with the current and future use of the irrigation system would improve due to the decreased maintenance requirements and the improved irrigation function in the park. The effects that would result under the Preferred Alternative would be beneficial, direct and indirect, specific to the park, short- and long-term, and minor. During construction operations, Zion would experience adverse, direct, local, short-term, and minor effects on park operations under the Preferred Alternative from increased employee workloads. The temporary closing of the Pa'rus Trail could increase park staff workloads during construction for communication, trail re-routing, and coordination efforts, resulting in adverse, direct, local, short-term, and minor effects on park operations.

Cumulatively, when combined with other past, present, and reasonably foreseeable future actions, park operations would experience beneficial, direct and indirect, local, short- and long-term, minor impacts.

Conclusion: Under the Preferred Alternative, park operations would experience adverse, direct, local, short-term, and minor effects during planning and construction due to increased employee workloads, and beneficial, direct and indirect, local, short- and long-term, minor impacts following construction due to reduced maintenance costs and

installation of a more efficient irrigation system. Cumulatively, the improvements associated with the Preferred Alternative would add to the cumulative impacts incrementally for an overall beneficial, direct and indirect, local, short- and long-term, minor effect on park operations, when considered with other past, present, and reasonably foreseeable future actions.

Impacts of Alternative C (Oak Creek Diversion)

Under Alternative C, impacts associated with the ditch irrigation system upgrade on park operations would be the same as those described under the Preferred Alternative. That is, adverse, direct, local, short-term, and minor during planning and construction, and beneficial, direct and indirect, local, short- and long-term, and minor overall following construction. Under Alternative C, adverse impacts to park operations may be slightly greater than under the Preferred Alternative due to the slightly larger construction area, but only negligibly.

Cumulative Effects: Cumulative effects on park operations would be similar to those described for the Preferred Alternative, but to a slightly greater degree due to the larger construction footprint. Like the Preferred Alternative, the improvements associated with Alternative C would add to the cumulative impacts incrementally for an overall beneficial, direct and indirect, local, short- and long-term, minor effect on park operations, when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: Under Alternative C, park operations would experience adverse, direct, local, short-term, and minor effects during planning and construction due to increased employee workloads, and beneficial, direct and indirect, local, short- and long-term, minor impacts overall due to reduced maintenance costs and installation of a more efficient irrigation system. Cumulatively, the improvements associated with Alternative C would add to the cumulative impacts for an overall beneficial, direct and indirect, local, short- and long-term, minor effect on park operations, when considered with other past, present, and reasonably foreseeable future actions.

Visitor Use and Experience

Affected Environment

According to the NPS' 2006 *Management Policies*, "enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks. The Service is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks, and the Service will maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of American society."



Scenic views and visual resources are considered highly valued characteristics of parks that the NPS strives to protect. One of the purposes of Zion is to "provide a variety of opportunities and a range of experiences, from solitude to high use, to assist visitors in learning about and enjoying park resources without degrading those resources" (NPS 2001a).

Over 2.5 million people visit Zion annually (NPS 2001a). The primary visitor activity or reason for visiting Zion is sightseeing/scenic driving. The scenery is what the majority of visitors like most about Zion. The majority of summer visitors spend two or more days at the park, and the majority of fall visitors spend three or more



days at the park (Le *et al.* 2007). Visitors most often make it a point to see or do the Zion Canyon Scenic Drive, the Zion Canyon Visitor Center, and trails from/in Zion Canyon (Le *et al.* 2007). A popular hiking/walking and biking trail in the park is Pa'rus Trail. Park campgrounds are typically full and at capacity throughout the year.

In the vicinity of the Project, the North Fork of the Virgin River borders the Pa'rus Trail, South Campground, Watchman Campground, and the Zion Canyon Visitor Center. During the summer months, the campgrounds are full almost every day – 128 sites for South Campground and 182 sites for Watchman Campground. The Pa'rus Trail is the only trail in the park that allows bicycles and pets. The trail is very heavily used from June through October. During those months, over 1,000 people use the trail during any given week. Zion is developing "a river management plan(s) to address important water resource issues in the park, including visitor uses and the restoration of sections of the

North Fork's floodplain" (NPS 2001a). The North Fork of the Virgin River provides high-quality experiences for visitors with use levels and activities that are consistent with park purposes, which include visitor enjoyment without impairing resources (NPS 2001a).

Intensity Level Definitions

Intensity thresholds of visitor use and experience are defined as follows:

Negligible: Park 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. Park visitors would not likely be aware of the effects associated with this threshold.

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

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

Major: Changes in visitor use and/or experience would be readily apparent and have substantial long-term consequences. Park visitors would be aware of the effects associated with this threshold, and would be apt to express a strong opinion about the changes.

Impacts of Alternative A (No Action)

Under the No Action Alternative, there would be no impacts to visitor use and experience. The existing irrigation system would continue to be used in the visitor and staff residential areas. The visual resources of the Project area would remain unchanged because no new irrigation system or diversion structures would be constructed, and construction activities related to the proposed Project would not take place.

Cumulative Effects: All construction activities have the potential to affect visitor use and experience. The renovation of South Campground, including utilities and the conversion from open irrigation to a sprinkler-drip system, and the expansion of the Visitor's Center parking area would have adverse, direct, local, short-term, and minor effects on visitor use and experience due to noise, dust, potential campground closures, increased construction traffic, and visual obtrusions that would be introduced in to the park during construction (i.e., equipment). Potential improvements to South Campground and the expansion of the Visitor's Center parking area would have a beneficial, direct, local, long-term, and minor effect on visitor use and experience, due to the improved layout of the campground, improved ease of access, and additional parking areas available to visitors.

The ongoing and prescribed controlled burns in the park have an adverse, direct, local, short-term, and minor effect on visitor experience as a result of dust, smoke, smells, and temporary trail closings during the burns. Longer term, however, these burns have a beneficial effect on visitor use and experience because of the direct, local, long-term, and minor effects to the human health and safety aspects of Zion, the visual and natural environment, and the functionality of Zion.

Under the No Action Alternative, there would be no incremental addition to the cumulative scenario. Visitors would not experience impacts from the proposed Project

and visitor functions in the Project area from past, present, and reasonably foreseeable future actions would be beneficial, direct, local, long-term, and minor overall.

Conclusion: Under the No Action Alternative, there would be no impacts to visitor use and experience. The No Action Alternative would not add to the existing beneficial, direct, local, long-term, and minor cumulative impacts when combined with other past, present, and reasonably foreseeable future actions.

Impacts of Alternative B (Preferred Alternative)

Implementation of the Preferred Alternative would result in reduced maintenance of the ditch and the ditch distribution system in the campgrounds by replacing the open ditch system with a pressurized system. The Project area is frequented by visitors. During construction, portions of the Project area could be closed temporarily to visitor use for construction activities. Noise, dust, and traffic from construction activities and equipment would adversely affect visitor use and experience in a direct, local, short-term, and minor way, but all construction-related impacts would be temporary, ceasing at the end of the construction period. During construction, existing parking lots may be used by construction workers, reducing the capacity for visitors. To lessen parking impacts, construction crews could be required to park in designated spaces in the back of parking lots to provide visitors with continued easy and close access to park facilities and resources.

Changes to the Project area would result in adverse, direct, local, long-term, and minor visual effects on visitor experience under the Preferred Alternative. The location, size, and aesthetics of the new structures proposed under the Preferred Alternative would be planned and designed so as not to visually interfere with visitor experience. Permanent, above ground structures would add new structural elements to the landscape that would detract from the natural scenery. The primary visual changes would result from the construction of the new sluice structure and settling tank upstream and to the east of the existing Springdale structure; the construction of the new pump and filter station; excavation for pipeline and utility connections; and the temporary presence of construction equipment, materials, and crews. Observable permanent structures would be constructed with materials that blend with the natural scenery, and natural, boulder, and vegetative screening would be used to mask introductions in to the visual environment at Zion. In addition, the holding and settling tanks would be partially buried, which would reduce the visibility of the structures.

Currently, some park visitors play in the water that flows through the finger ridges in Zion's campgrounds. Families and children are often seen standing and sitting in these finger ridges, splashing and making dams. The conversion of the irrigation system in South Campground from an open ditch system to a pressurized system would remove this activity from visitor use and experience, having an adverse, direct, local, long-term, minor effect on visitor use and experience.

Under the Preferred Alternative, there is the potential for temporary campground closures during construction activities. Such closures would have an adverse, direct, local, short-term, and minor effect on visitor use and experience. Any campground closures would limit the number of camp sites available to visitors, possibly forcing the park to turn away some overnight guests due to lack of accommodations. Any campground closures would be short-term, lasting only as long as construction.

The Pa'rus Trail in the park would likely have to be closed during part or all of the construction activities and would likely need to be reconstructed in some places at the

end of the Project from the pipeline crossing locations under the Preferred Alternative. This trail closing would have an adverse, direct, local, short-term, and minor effect on visitor use and experience from visitors being redirected to other trails and from the lack of alternate trails available to visitors that allow bicycles and pets (i.e., Pa'rus Trail is the only trail in the park that allows bicycles and pets).

Cumulative Effects: Cumulative effects under the Preferred Alternative would be the same as those described under the No Action Alternative. The actions of the Preferred Alternative would incrementally add to the cumulative impact scenario, with adverse, direct, local, short- and long-term, minor effects to visitor use and experience. When combined with other past, present, and reasonably foreseeable future actions, effects to visitor use and experience under the Preferred Alternative would be adverse, direct, local, long-term, and minor.

Conclusion: Under the Preferred Alternative, the upgrade of the irrigation system would have adverse, direct, local, short- and long-term, minor effects on visitor use and experience from temporary construction-related campground and trail closures and the loss of some play activities within the campgrounds. Cumulatively, the actions associated with the Preferred Alternative would incrementally add an adverse, direct, local, short- and long-term, minor effect on visitor use and experience when combined with other past, present, and reasonably foreseeable future actions.

Impacts of Alternative C (Oak Creek Diversion)

Under Alternative C, impacts associated with upgrading the ditch irrigation system on visitor use and experience would be the same as those described under the Preferred Alternative. That is, adverse, direct, local, short- and long-term, and minor. Under Alternative C, adverse impacts to visitor use and experience may be slightly greater than under the Preferred Alternative due to the slightly larger construction area, but would only negligibly increase the areas in the park that could be temporarily closed to park visitors during construction.

Cumulative Effects: Cumulative effects under Alternative C would be the same as those described under the No Action Alternative. The actions under Alternative C would incrementally add to the cumulative impact scenario with adverse, direct, local, short- and long-term, and minor effects on visitor use and experience. When combined with other past, present, and reasonably foreseeable future actions, effects to visitor use and experience under Alternative C would be adverse, direct, local, long-term, and minor.

Conclusion: Like the Preferred Alternative, the actions associated with Alternative C would have adverse, direct, local, short- and long-term, minor effects on visitor use and experience from temporary construction-related campground and trail closures and the loss of some play activities within the campgrounds. Cumulatively, under Alternative C, visitor use and experience would experience an adverse, direct, local, short- and long-term, minor effect when combined with other past, present, and reasonably foreseeable future actions.

CONSULTATION AND COORDINATION

Internal Scoping

The process used to identify the resources that may be impacted by a proposed Project and to look at possible alternative ways of implementing the Project while minimizing adverse impacts is referred to as scoping. An interdisciplinary team of professionals from Zion and the park's subcontractor, URS, met on August 3 and 4, 2011 to discuss the purpose and need for the proposed Project; various alternatives; resource areas to be analyzed; potential environmental impacts; past, present, and reasonably foreseeable projects that could have cumulative effects; and mitigation measures. The interdisciplinary team gathered background information for the Project and discussed public outreach options. Members of the team also conducted a site visit to view, note, and evaluate the proposed Project.

External Scoping

External (public) scoping was conducted to inform the public, agencies, tribes, and other interested parties about the proposed Project to upgrade the park's irrigation system and diversion structures and to solicit feedback. Public scoping was initiated with the distribution of a scoping letter in August 2011 that was mailed to approximately 100 addresses, including landowners adjacent to the park, various federal and state agencies, Native American tribes, and local governments. Information on the proposed Project and EA was also posted on the NPS Planning, Environment, and Public Comment (PEPC) website at <http://parkplanning.nps.gov/>. A press release was also sent to local newspapers. The public was given 30 days to comment on the proposed Project, with the comment period ending September 12, 2011.

During the 30-day comment period, no public comments were received. A representative from the BLM Utah State Office submitted a comment requesting items to consider for clarification: *"1) are all water resources with the Zion National Park boundary? Will there be any affects on resources outside the Park, especially BLM and private lands?; and 2) are water rights secure and any new points of diversion identified and changes submitted to the state?"*

In response to the questions brought up during scoping, Zion currently has allotted water rights of 1.21 cfs (Water Right #81-1128) and 1.38 cfs (Water Right #81-3608) which can be diverted from the Oak Creek and Flanigan Diversion structures, respectively. Under the Preferred Alternative, there would be no change to these existing water rights and there would be no effects on resources outside the park, on either BLM or private lands. In addition, there would no new points of diversion as existing diversion structures would be utilized for the proposed irrigation system upgrade.

Agency Consultation

In accordance with the ESA, NPS will contact USFWS in regards to federally-listed species during the public review period. In accordance with NPS policy, the park will also contact the Utah Division of Wildlife in regards to state-listed species. No adverse impacts are anticipated to either federally-listed or state-listed species.

In accordance with Section 106 of the NHPA, NPS will provide the Utah SHPO with an opportunity to comment on the impacts of the proposed Project during the public review

period and request concurrence of a determination of “no effect” to historic properties under Section 106 of the NHPA.

Native American Consultation

Eleven Native American tribes were contacted during external scoping to solicit feedback on the proposed Project and to see if they wanted to be involved in the environmental review. These tribes included:

- Goshute Indian Tribe
- Hopi Tribe
- Kaibab Band of Paiute Indians
- Las Vegas Paiute Tribe
- Northern Ute Tribe
- Paiute Indian Tribe of Utah
- Pueblo of Zuni
- Shivwits Paiute Band
- Skull Valley Goshute Tribe
- The Navajo Nation
- Moapa Band of Paiute

None of the tribes commented or responded that they would like to be involved in the environmental review of the Project.

Environmental Assessment Review and List of Recipients

This EA is subject to a 30-day public comment period. To inform the public of the availability of this EA, NPS will publish and distribute a letter to the members of the public listed on the mailing list and to various agencies and tribes. The NPS will also place an ad in a local newspaper, notifying the public of the availability of this EA. A copy of the EA will be available on the NPS PEPC website (<http://parkplanning.nps.gov/>). Copies of the EA will be provided to interested parties upon request.

During the 30-day comment period, those wishing to comment on this EA may post comments online at <http://parkplanning.nps.gov/> or mail comments to: Zion National Park, Upgrade Irrigation System, Springdale, UT 84767. Prior to including any personal identifying information in a comment, persons should be aware that entire comments, including personal identifying information, may be made publicly available at any time. Persons can ask NPS to withhold personal identifying information from public review; however, the park cannot guarantee this. Following the close of the public comment period, NPS will review and analyze all public comments prior to release of a decision document. The NPS will respond to substantive comments received during the public comment period and will make appropriate changes to the EA, as needed.

List of Preparers

The persons listed below assisted with the preparation of this EA.

NPS Participants:

- Cheryl Eckhardt, Environmental Compliance Specialist, Intermountain Regional Office, Denver, CO
- Kezia Nielsen, Environmental Protection Specialist, Zion, Springdale, UT
- Jock Whitworth, Superintendent, Zion, Springdale, UT
- Bill Cox, Assistant Superintendent, Zion, Springdale, UT
- Dave Sharrow, Hydrologist, Zion, Springdale, UT
- Cindy Purcell, Chief Park Ranger, Zion, Springdale, UT
- Claire Crow, Wildlife Biologist, Zion, Springdale, UT
- Jim Butterfus, Landscape Architect, Zion, Springdale, UT
- Sarah Horton, Cultural Resources Program Manager, Zion, Springdale, UT



URS Participants:

- Pam McWharter, Project Manager, Denver, CO
- Jody Glennon, Assistant Project Manager, Denver, CO
- David Jones, Wild and Scenic Rivers Specialist, Denver, CO
- Gordon Tucker, PhD, Cultural Resources Specialist, Denver, CO
- Susan Hall, Ecologist/Wildlife Biologist, Denver, CO
- Kim Zielinski, GIS Specialist, Denver, CO

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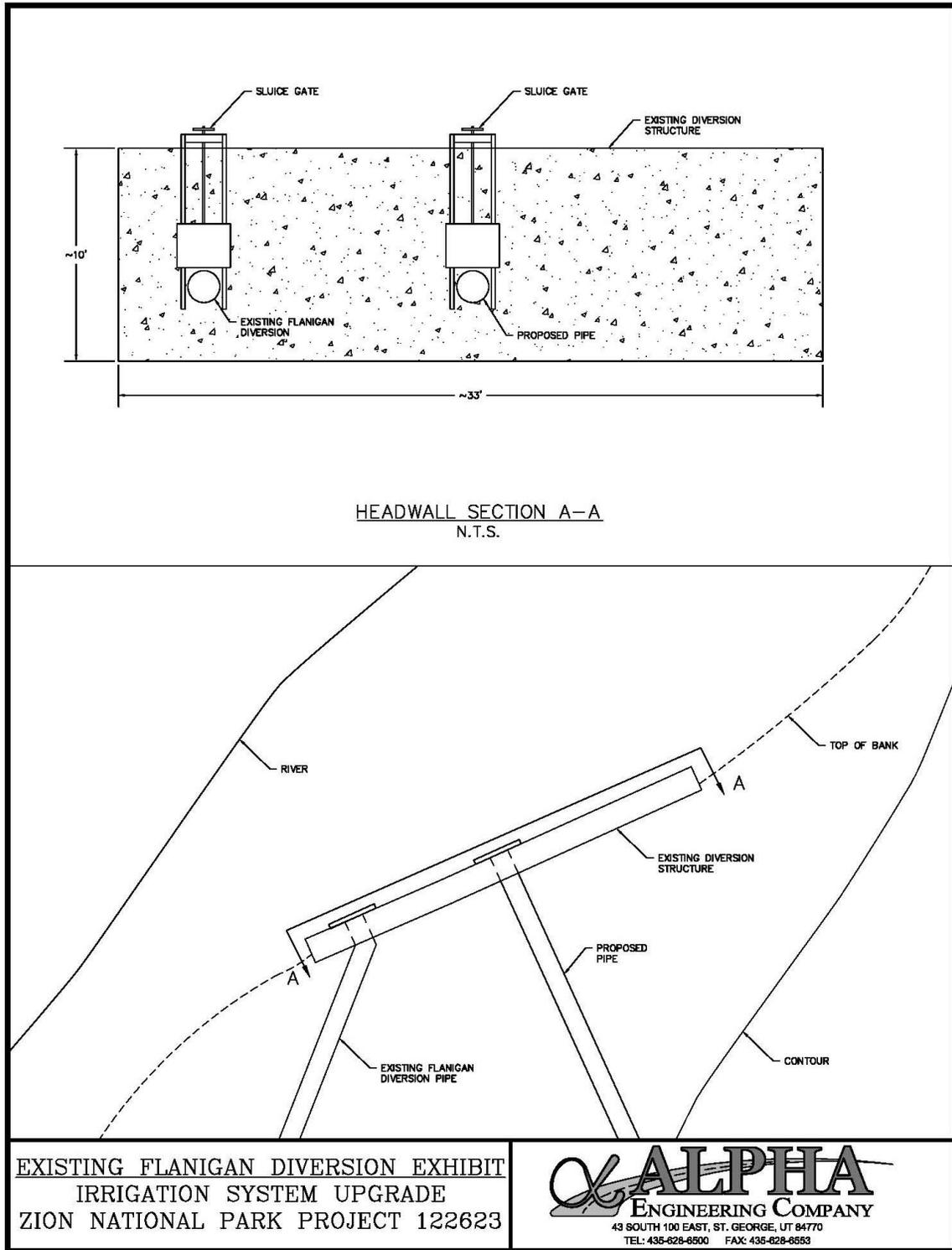
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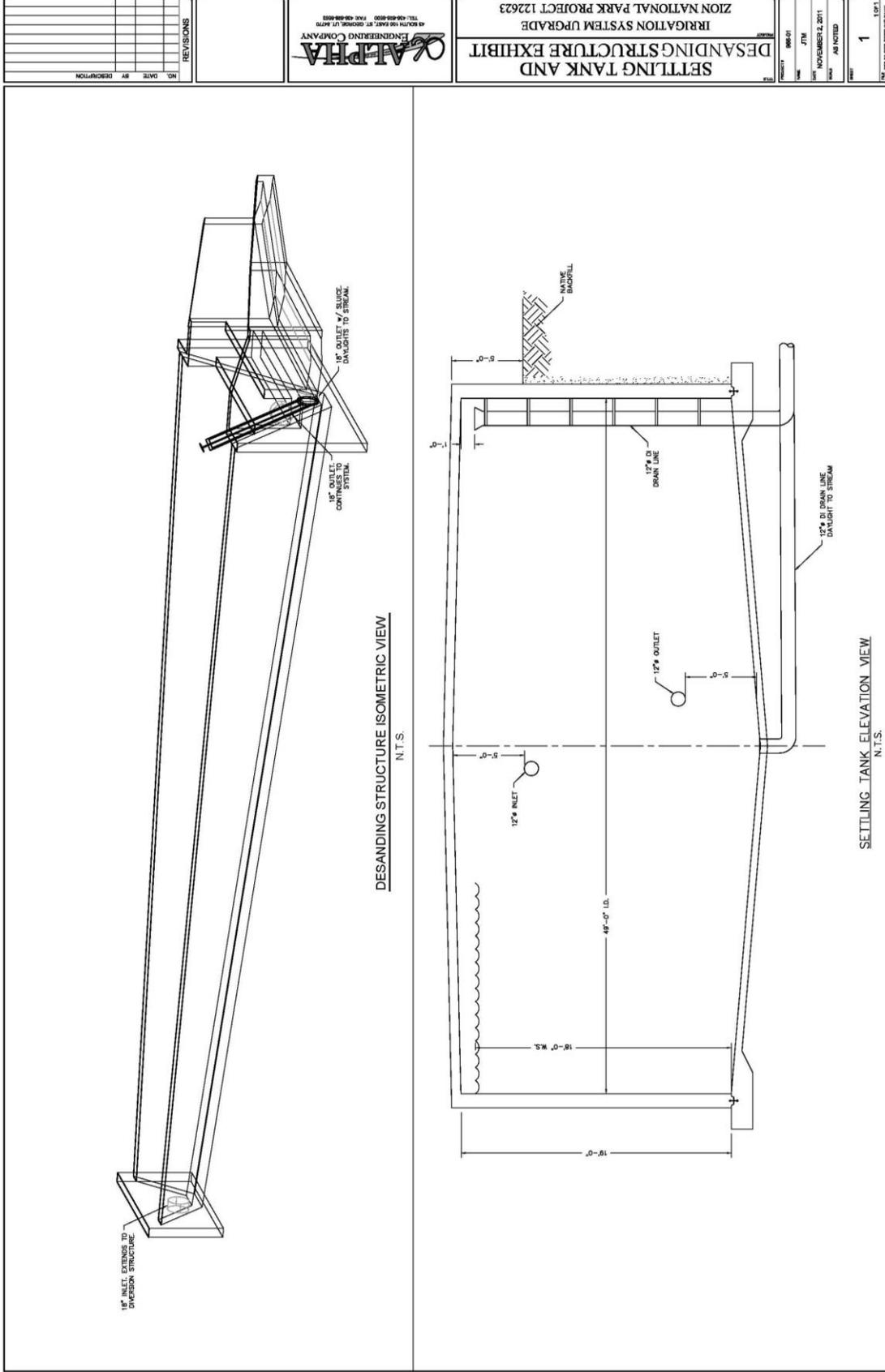
Appendix A

Project Component Typical Figures

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NO.	DATE	BY	DESCRIPTION

REV/ISSUES	

ALPHA
ENGINEERING COMPANY
1817 W. 17th Ave. Suite 100, Fort Collins, CO 80521
TEL: (970) 225-8000 FAX: (970) 225-8003

SETTLING TANK AND DESANDING STRUCTURE EXHIBIT
IRRIGATION SYSTEM UPGRADE
ZION NATIONAL PARK PROJECT 122623

PROJECT	00000001
DATE	JTM
DATE	NOVEMBER 2, 2011
SCALE	AS NOTED

SHEET	1
OF	3 TOTAL

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Appendix B
Section 7 Analysis Under the Wild and Scenic Rivers Act

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Appendix B

Section 7 Analysis Under the Wild and Scenic Rivers Act

1. Describe the Proposed Activity

Refer to the *Alternatives* section of this Environmental Assessment (EA) for a detailed description of the proposed action.

2. Describe How the Proposed Activity Would Directly Alter Within-Channel Conditions

Operation of the proposed Project would not alter water quality parameters, including turbidity, temperature, and nutrient availability of the North Fork of the Virgin River or its tributary, Oak Creek. Existing channel locations, geometry, slopes, and forms would not change as a result of the proposed action, and the existing navigation/course of the North Fork of the Virgin River and Oak Creek would not be altered. Refer to the *Water Resources* section of this EA for a detailed analysis of water resources.

3. Describe How the Proposed Activity Would Directly Alter Riparian and/or Floodplain Attributes

Diversion facilities, sluice structures, and irrigation pipelines would be constructed in riparian vegetation and floodplain areas. There would be no permanent resulting changes in riparian vegetation composition, soil properties (such as compaction or percent bare ground), floodplain width, roughness, bank stability, or susceptibility to erosion. Reference the *Soils* and *Vegetation* sections of this EA for a detailed analysis of these resources. Also, reference the *Floodplain* section (presented under *Impact Topics Dismissed from Further Analysis*).

Riparian vegetation is located near the North Fork of the Virgin River and Oak Creek. The *Vegetation* section of this document presents an analysis of the direct effects to riparian vegetation in the Project area. The loss of individual trees and shrubs could be noticed by park visitors, but would not have a measureable effect on the local population of riparian vegetation within the park. There would be little change to the abundance or distribution of local populations of riparian communities.

Some components of the Project that are in the immediate vicinity of a diversion dam, by their very nature, would have to occur in a floodplain. Although filling and modification of the ground surface would be required for the proposed Project, it would not be such that people or inhabited structures would be exposed to flooding, and the Project would not adversely affect the functioning of the floodplains or increase flood risk to others. There would be no permanent effects to floodplains from construction, staging or laydown, and the operation of the irrigation system. The effects from the temporary occupancy of staging equipment and material laydown in the Project area would be short-term and negligible.

4. Describe How the Proposed Activity Would Directly Alter Upland Conditions

The settling tank, pump and filter station, pipeline, and the holding tank for the proposed Project would be constructed in upland areas. There would be no permanent adverse change in vegetation composition. Areas within the construction area containing non-native plant species would be revegetated with native seeds and plants, resulting in beneficial changes in vegetation composition. There would be no permanent resulting

changes in soil properties (such as compaction or percent bare ground), and no changes in hydrologic properties (such as drainage patterns or the character of surface and subsurface flows). There also would be no change in upland conditions that would influence archeological, cultural, or other identified significant resource values. Reference the *Soils*, *Vegetation*, and *Historic Structures* sections of this EA for a detailed analysis of these resources. Also reference the *Archeological Resources* section (presented under *Impact Topics Dismissed from Further Analysis*).

5. Evaluate and Describe How Changes in On-Site Conditions Could/Would Alter Existing Hydrologic or Biologic Process

Proposed Project components would not be constructed directly within the North Fork of the Virgin River or Oak Creek. The Project would not affect the ability of either river channel to change course, re-occupy former segments, or inundate its floodplain. The Project would not alter the streambank erosion potential, sediment routing and deposition, or debris loading. The Project would also not affect the amount or timing of flow in the channel, existing flow patterns, surface or subsurface flow characteristics, nor would it alter any detention storage, aggradation/degradation of the channel, or biological processes, such as:

- Reproduction, vigor, growth and/or succession of streamside vegetation;
- Nutrient cycling;
- Fish spawning and/or rearing success;
- Riparian dependent avian species needs;
- Amphibian/mollusk needs; and
- Species composition.

The proposed Project includes construction of a 3- to 4-foot high grouted rock face berm constructed above the existing concrete wall of the Flanigan Diversion to protect existing and new sluice structures from overwash during large (i.e., 30-year or larger) flood events. Sediment routing and deposition would be altered in this site specific area only during 30-year or larger flood events. Reference the *Alternatives* section for a description of the proposed action. Reference the *Water Resources*, *Soils*, and *Vegetation* sections of this EA for a detailed analysis of hydrologic and biologic processes, as well as the *Wildlife* section (presented under *Impact Topics Dismissed from Further Analysis*).

6. Estimate the Magnitude and Spatial Extent of Potential Off-Site Changes

Implementation of the proposed Project would not contribute to changes that would influence other parts of the river system in the park, and there would be no circumstances for which construction and operation of the upgraded irrigation system would influence off-site changes to the river system. Reference the *Alternatives* section of this EA for a description of the proposed action. Reference the *Water Resources* section for a detailed analysis of changes, in addition to the *Floodplains* section (presented under *Impact Topics Dismissed from Further Analysis*).

7. Define the Time Scale Over Which Potential Effects are Likely to Occur

Potential adverse effects have not been identified that would directly affect riparian and/or floodplain conditions, upland conditions, biologic processes, streambank erosion potential, amount or timing of flow in the channel, existing flow patterns, surface or subsurface flow characteristics, any detention storage, aggradation/degradation of the channel, or off-site conditions for the proposed Project. There would be a slight localized alteration to sediment routing and deposition approximately once every 30 years during large flood events.

8. Compare Project Analysis to Management Goals

The proposed Project would not affect the achievement or timing of achievement of management goals and objectives of the park relative to free-flow conditions, water quality, riparian area and floodplain conditions, Wild and Scenic outstanding remarkable values (ORVs), and river classification. Reference the *Alternatives* section of this EA for a description of the proposed action, and the *Soils, Vegetation, Water Resources, and Wild and Scenic Rivers* sections of this EA for a detailed analysis of these resources. Also reference the *Wildlife* and *Floodplains* sections (both presented under *Impact Topics Dismissed from Further Analysis*).

9. Section 7 Determination

The proposed Project would not affect the free-flowing conditions of the North Fork of the Virgin River or Oak Creek. Operation of the proposed Project would not affect water quality, and the proposed Project would not contribute to direct and adverse effects on the ORVs for which the river was designated Wild and Scenic. The proposed Project would not result in direct and adverse effects to the ORVs for which the North Fork of the Virgin River and its tributary, Oak Creek, were listed in the Wild and Scenic River National System. In summary, the proposed Project would preserve the free-flowing condition and water quality of the North Fork of the Virgin River and Oak Creek, fulfilling national conservation purposes under the Wild and Scenic Rivers Act.

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