# Environmental Assessment

# *Moapa Valley National Wildlife Refuge Palm Removal Plan*

February 2024

Prepared by

Moapa Valley National Wildlife Refuge
Moapa, Nevada

# Environmental Assessment for Palm Removal

**Date: February 9, 2024**

This Draft Environmental Assessment is being prepared to evaluate the effects associated with the proposed action and complies with the National Environmental Policy Act in accordance with Council on Environmental Quality regulations (40 CFR 1500-1509) and Department of the Interior (43 CFR 46; 516 DM 8) and U.S. Fish and Wildlife Service (550 FW 3) regulations and policies. The National Environmental Policy Act (NEPA) requires examination of the effects of proposed actions on the natural and human environment.

## Proposed Action

The U.S. Fish and Wildlife Service (Service) is proposing to control the invasive California fan palm (*Washingtonia filifera*) on the Moapa Valley National Wildlife Refuge (Refuge or NWR). The Service proposes to remove palms to protect existing warm springs, streams, native riparian vegetation, and refuge structures. The proposed action incorporates removal of large and mature palms. A planned project for removal of up to 100 mature palms is proposed on the Plummer Unit and additional palms will continue to be removed from the Refuge.

A proposed action may evolve during the NEPA process as the agency refines its proposal and gathers feedback from the public, tribes, and other agencies. Therefore, the final proposed action may be different from the original. The proposed action will be finalized at the conclusion of the public comment period for the EA.

## Background

National Wildlife Refuges are guided by the mission and goals of the National Wildlife Refuge System (NWRS), the purposes of an individual refuge, Service policy, and laws and international treaties. Relevant guidance includes the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, Refuge Recreation Act of 1962, and selected portions of the Code of Federal Regulations and Fish and Wildlife Service Manual.

The mission of the NWRS, as outlined by the National Wildlife Refuge System Administration Act (NWRSAA), as amended by the National Wildlife Refuge System Improvement Act (16 U.S.C. 668dd et seq.), is:

*"... to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans"*

Additionally, the NWRSAA mandates the Secretary of the Interior in administering the NWRS (16 U.S.C. 668dd(a)(4)) to:

- Provide for the conservation of fish, wildlife, and plants, and their habitats within the NWRS;
- Ensure that the biological integrity, diversity, and environmental health of the NWRS are maintained for the benefit of present and future generations of Americans;
- Ensure that the mission of the NWRS described at 16 U.S.C. 668dd(a)(2) and the purposes of each refuge are carried out;
- Ensure effective coordination, interaction, and cooperation with owners of land adjoining refuges and the fish and wildlife agency of the states in which the units of the NWRS are located;
- Assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the NWRS and the purposes of each refuge;
- Recognize compatible wildlife-dependent recreational uses as the priority general public uses of the NWRS through which the American public can develop an appreciation for fish and wildlife;
- Ensure that opportunities are provided within the NWRS for compatible wildlife-dependent recreational uses; and monitor the status and trends of fish, wildlife, and plants in each refuge.

Therefore, it is a priority of the Service to conserve and manage fish, wildlife, and plants, and their habitats consistent with the purposes for which the refuge was established and the mission of the National Wildlife Refuge System.

The Moapa Valley Refuge was established on September 10, 1979, to secure and protect habitat for the endangered Moapa dace (*Moapa coriacea*; USFWS 1979). The endemic Moapa dace lives out its lifecycle in the Warm Springs thermal spring complex that includes more than 20 springs located within the Refuge. Historic use of the spring pools and the surrounding landscape for agricultural and recreational purposes have altered the habitat of the Moapa dace (USFWS 2009).

The 136-acre Refuge comprises multiple adjacent but visually distinct units. The original Pedersen Unit was acquired in 1979 and is 30 acres in size. An additional 11 acres were purchased in 2006. These are referred to as the Pedersen II Unit. The 28-acre Plummer Unit was acquired in 1997. The 48-acre Apcar Unit was acquired in 2000. An additional 20 acres were added to the Plummer Unit in 2019. Each unit has a separate stream system supported by the steady and uninterrupted flow of several springs that surface at various places throughout the Refuge (USFWS 2009).

The entire Refuge lies within the upper Moapa Valley. It is bounded on the north and east by Warm Springs Road and the Warm Springs Natural Area (managed by the Southern Nevada

Water Authority), on the south by Battleship Wash and Bureau of Land Management lands, and on the west by Bureau of Land Management lands. The Moapa Indian Reservation, trust lands by the Moapa Band of Paiutes, is located 5 miles southeast of the Refuge. (USFWS 2015, Figure 1)

The Service's vision for Moapa Valley National Wildlife Refuge, as outlined in the Desert National Wildlife Refuge Comprehensive Conservation Plan (USFWS 2009) is:

- The Moapa Valley National Wildlife Refuge supports and protects a healthy, thriving population of Moapa dace at the headwaters of the Muddy River. Stable flows from the refuge's numerous warm springs fill meandering channels downstream that provide ideal habitat for dace, Virgin River chub and other species of endemic fish and invertebrates.
- The spring bank and riparian plant communities provide habitat for southwestern willow flycatcher as well as a rich diversity of migratory and resident songbirds, colonial nesting species, and other native wildlife.
- Local residents and visitors learn about and enjoy this restored desert oasis. Volunteers take personal satisfaction from contributing to the conservation and protection of refuge wildlife and the unique spring-nourished habitats on which they depend.

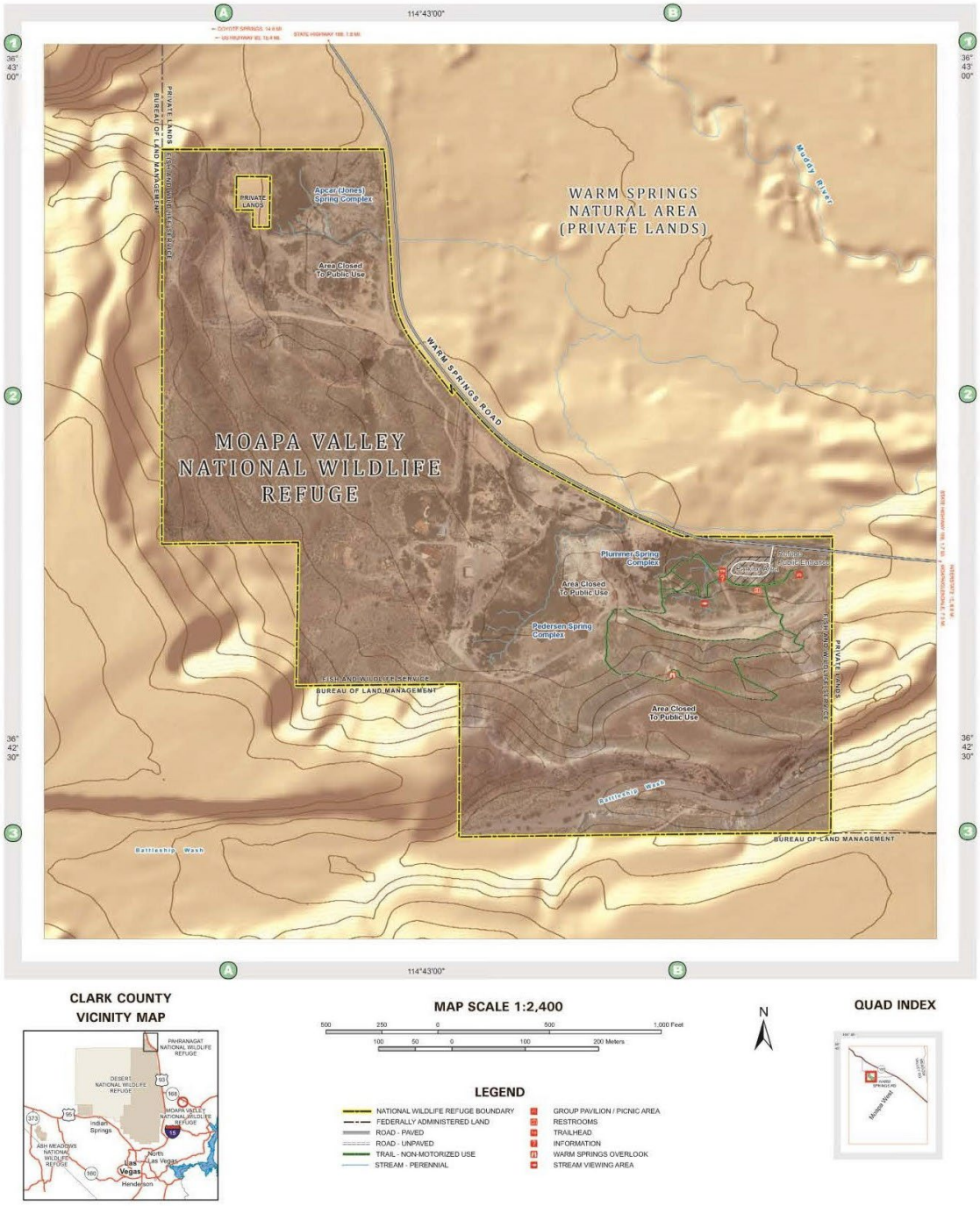


*Figure 1. Moapa Valley National Wildlife Refuge.*

## Purpose and Need for the Action

The purpose of this proposed action is to protect existing warm springs, streams, native riparian vegetation, native species, and refuge structures on Moapa Valley National Wildlife Refuge by eliminating the potential impacts of the invasive California fan palm.

The need of the proposed action is to meet the Service's priorities and mandates as outlined by the National Wildlife Refuge System Administration Act, as amended (16 U.S.C. 668dd(a)(4)) and to support habitat goals as outlined in the Comprehensive Conservation Plan for Desert National Wildlife Complex (USFWS 2009). Additionally, the proposed action will support objectives identified in the Desert National Wildlife Refuge Complex Conservation Summary, particularly those related to the endangered Moapa dace at Moapa Valley National Wildlife Refuge (USFWS 2022).

The Moapa Valley is a unique ecosystem consisting of warm springs and their associated warm streams (USFWS 1995). Prior to its acquisition by the Service, the area that is now Moapa Valley National Wildlife Refuge was operated as a resort with snack bars, recreational vehicle hook-ups, and swimming pools created from springs and streams that were chlorinated and concentrated (USFWS 1981, USFWS 2004). Historically, willow (*Salix* spp.) and mesquite (*Prosopis* spp.) trees bordered streams, but human activities throughout the 20$^{th}$ century introduced invasive species, including palms, into riparian areas (USFWS 1995, USFWS 2009).

Since Refuge establishment, the Service has worked to restore Refuge lands to be as near natural conditions as possible and to optimize available stream habitat for recovery of the Moapa dace. The Moapa dace is an endemic and federally endangered species that occupies roughly six miles of habitable streams in the headwaters of the Muddy River (Figure 2, Lausch *in prep*). The Moapa dace and other endemic species of fish and invertebrates that are sensitive to changes in stream layout and flow, as well as to changes in leaf litter composition, inhabit the streams in the Moapa Valley. The California fan palm is an invasive species that is prevalent in the Moapa Valley and threatens these species by changing stream morphology, hydrology, litter composition, and shading out or replacing other native vegetation. Palm tree roots spread and grow into stream channels, impede water flow, and replace the desirable rocky substrate used by the Moapa dace with unsuitable habitat. Additionally, palm "skirts" and fallen debris pose a significant fire hazard. In 1994, a fire perpetuated by palms nearly extirpated the Moapa dace from the entire refuge spring system (USFWS 1995). Refuge structures and buildings located near palms are also at risk of fire damage.

Palms spread through several methods on the Refuge. Each mature palm tree drops up to 350,000 seeds. If these seeds are dropped on moist soil, they can germinate in as little as five days (Cornett 1989). Birds and mammals, including coyote, fox, bluebirds, waxwings, and

phainopepla (Bullock 1980, Cornett 1988) consume seeds on nearby properties and deposit seeds onto the Refuge. Bullock (1980) found that seeds had an 82% better germination rate after being regurgitated by birds than control seeds. The California fan palm has proven its ability to invade new areas with little resistance, while the Moapa dace can only be found along the small streams in this valley, and nowhere else. Thus, management of the palm on the Refuge is paramount in the protection of the Moapa dace (Lausch *in prep*).

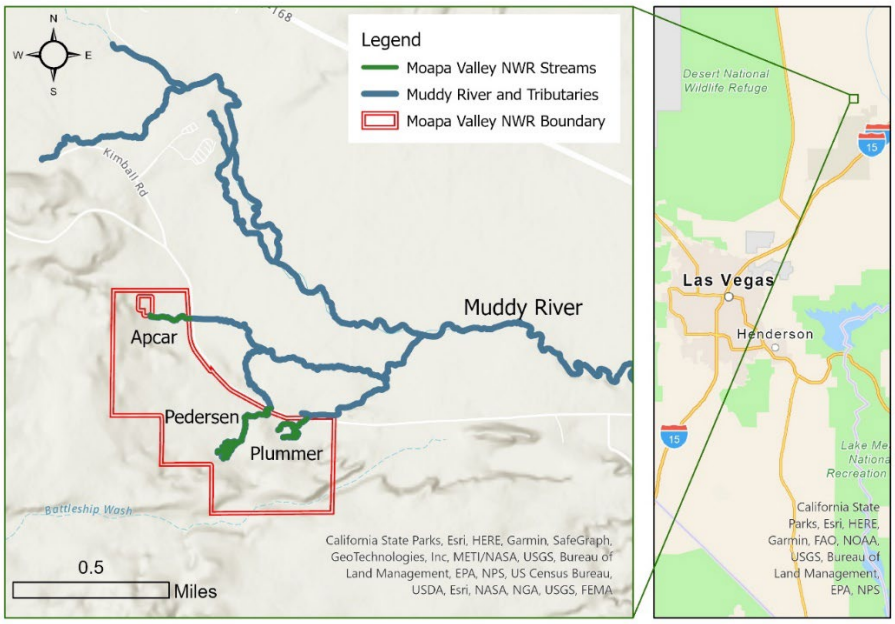


*Figure 2. Moapa Valley National Wildlife Refuge is in Clark County, Nevada. The map on the left displays the boundary of the refuge, the refuge streams, the Muddy River, and tributaries of the Muddy River outside the refuge. The entire range of the Moapa dace is contained within this map. The map on the right indicates the location of the left-hand map in southern Nevada (figure from Lausch in prep).*

The Service has conducted a series of restoration projects, most recently in 2021 when mid-sized palms within 50 meters of streams in the Pedersen and Apcar Units were removed (USFWS 2021a). Between 2004 and 2009, a major component of the restoration projects was the removal and replacement of non-native and invasive plants that had been used as landscaping throughout the resort, including oleanders (*Nerium oleander*), fountain grass (*Pennisetum setaceum*), Ravenna grass (*Sacchraum ravennae*), and fan palms. Dense stands of palm trees and other non-native vegetation were removed from the Pedersen, Plummer, and Apcar units. However, not all palms were removed (USFWS 2004).

Due to the threat that palms pose to the endangered Moapa dace, the ability of palms to displace native vegetation in sensitive habitats, and the risk of fire hazards and damage to structures, the Service has a need to remove California fan palms from the Refuge.

# Alternatives

## Alternative A – No Action Alternative

Under the No Action Alternative, the Service would not implement a planned invasive species control project to remove mature California fan palms from the Plummer Unit of the refuge or continue the removal of additional palms from the refuge. However, the Service would continue to operate and maintain the Moapa Valley Refuge. Invasive species are common at Moapa Valley NWR due to the Refuge's extremely moist habitat and disturbed conditions. The construction of recreational facilities in the past removed much of the native vegetation and destroyed suitable habitat for their reestablishment. As part of refuge management, the Service would continue to manage invasive plant species through an integrated pest management approach (IPM). IPM involves using control methods based on effectiveness, cost, and minimal ecological disruption, which consider minimum potential effects to non-target species and the refuge environment. Pesticides may be used where physical, cultural, and biological methods or combinations thereof, are impractical or incapable of providing adequate control, eradication, or containment. Pesticide use is allowed in accordance with U.S. Fish and Wildlife Service and Department of the Interior Integrated Pest Management Policies (569 FW 1 and 517 DM 1). Consistent with DOI policy (517 DM 1), the Service allows only pesticides registered with the U.S. Environmental Protection Agency (USEPA) in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Pesticides may be used only after approved through the Service's Pesticide Use Proposal (PUP) process. As part of the PUP process, field station personnel identify the pesticide product(s) proposed for use and describe the associated use pattern; target pest(s); alternative management practices that may be integrated into the overall management action; location of use including factors important to the environmental fate of the pesticide post-application; and sensitive non-target resources that may be exposed. The refuge manager or refuge project leader reviews the PUP and may approve some pesticide uses where that authority has been delegated by the regional office. Uses that can be approved at the field-station level typically are pesticides with inherently low risk to wildlife resources. Field-station-level reviewers also must consider all applicable federal, state, and local laws, regulations, policies, and court decisions applicable to pesticide use on the refuge. PUPs that cannot be approved at the field-station level are elevated to the regional level (the regional IPM coordinator) or possibly to the national headquarters office for review and final decision (i.e., approval, approval with modification, or disapproval). Potential effects of pesticide use on the physical environment, biological resources, and potentially humans; and environmental fate of these chemicals are evaluated during the PUP review process.

Service-approved herbicides would continue to be used on the Refuge for controlling invasive plants. Plants historically targeted for treatment include common reed (*Phragmites australis, Phragmites communis*), California fan palm, salt cedar (*Tamarix ramosissima*), Bermuda grass (*Cynodon dactylon*), and Ravenna grass. The active ingredients in herbicides may include

glyphosate (both terrestrial and aquatic formulations) and imazapyr. Glyphosate is one of the most commonly used herbicides in natural areas, because it provides effective control of many species. Natural area weeds that have been controlled with glyphosate include bush honeysuckle (*Lonicera maackii*), cogon grass (*Imperata cylindrical*), common buckthorn (*Rhammus cathartica*), and smooth brome (*Bromus inermis*). In aquatic or wetland systems, glyphosate has successfully controlled common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), reed canarygrass (*Phalaris arundinacea*), and hybrid cattail (*Typha x glauca*). Imazapyr is a non-selective herbicide used for the control of a broad range of weeds including terrestrial annual and perennial grasses and broadleaved herbs, woody species, and riparian and emergent aquatic species.

As part of ongoing invasive species management, the Refuge would continue to remove small California fan palms and seedlings via hand pulling or use of hand tools to prevent additional large and seed-bearing palms from developing on the Refuge. Additionally, trimming of palm skirts will continue on a regular basis to reduce fuel loads and mitigate fire risk. Mid-sized palms (6-18 inches in diameter) within 50 meters of streams in the Apcar and Pedersen units would be cut down and treated with herbicide.

### Mitigation Measures

- Best management practices are used when applying pesticides to control invasive plant species, as outlined in Appendix A. This includes adherence to all warning labels and application requirements, as well as the Service's pesticide use proposal (PUP) process.
- In addition, the Service has prepared chemical profiles of the active ingredients in pesticides to guide their application on Service managed lands. Best management practices listed in the chemical profiles for glyphosate and imazapyr are incorporated in Appendix A. The full chemical profiles of glyphosate and imazapyr are available upon request.

## Alternative B – Palm Removal (Proposed Action Alternative)

Under the Proposed Action Alternative, existing invasive species management would continue on the Refuge, as described in Alternative A. The following actions are also included in Alternative B:

- Remove palms, including large and mature palms, from Moapa Valley National Wildlife Refuge.
- Currently planned, anticipated work includes removal of mature California fan palms from the Plummer Unit of Moapa Valley National Wildlife Refuge (Figure 3). Removal methods for this effort include the use of a bucket lift, crane, climbing methods, and traditional felling methods:

    - For trees removed via special methods (bucket lift, crane, climbing methods), trained individuals would remove large trees in sections, starting at the top of the tree and dropping or lowering pieces to the ground.
    - Large palms considered hazards due to proximity to sensitive habitat or visitor structures would be removed using climbing methods, rather than using heavy equipment, to avoid damage to surrounding vegetation or refuge structures. Tree sections would be carefully lowered to the ground.
    - Root grinding may be implemented to lower cut stumps to 6-12 inches below the surrounding soil height. Stumps may remain if root grinding is not implemented for all cut trees.
    - Pieces of palm and debris would be transferred to a designated disposal site on the refuge or chipped and hauled offsite. Debris will be removed continuously as removal efforts proceed.
    - Post-removal clean-up and grooming of removal sites will be performed to repair any damages that occur during removal.
- Removal of additional palms using similar methods or methods previously approved for restoration (e.g., cutting via chainsaw and herbicide treatment of stumps or removal via heavy equipment such as excavator and track loader) would be implemented to protect existing warm springs, streams, native riparian vegetation, and refuge structures. Special methods, such as climbing, crane, or bucket lift methods described above, may be used when felling trees would be detrimental to surrounding habitat or refuge structures. Removal methods will be discussed between FWS staff and, when applicable, contractors to determine the most appropriate and least damaging removal method.
- Native species would be planted in areas surrounding removal as funding allows. Potential plant species that may be used for revegetation include but are not limited to: Gooding's willow (*Salix goodingii*), Fremont cottonwood (*Populus fremonti*), velvet ash (*Fraxinus velutina*), honey mesquite (*Prosopis glandulosa*), and screwbean mesquite (*Prosopis pubescens*).
- Treatment areas will be monitored for reinvasion and palm seedlings and small individuals will be removed as they emerge.


*Figure 3. Palms planned for removal during the invasive species control project are displayed in this figure. Some palms require special removal methods to protect surrounding habitat and/or refuge structures. Each point is labeled according to how many palms exist at that point. Red triangles indicate palm(s) that require climbing and purple pentagons indicate palms that can most likely be reached by a bucket lift.*

## Mitigation Measures

In addition to the mitigation measures listed under the No Action Alternative, the Service would also implement the following measures to minimize adverse effects to air quality, vegetation, wildlife, and to minimize fire hazard.

- Air Quality
    - Water disturbed soils immediately following work activities, if appropriate.
    - Limit stockpile height to 8 feet.
    - Immediately clean track out from paved surfaces.
    - Cut materials will be transferred to designated areas primarily using main roads (versus internal, gravel roads on Moapa Valley NWR).
- Vegetation
    - Prevent the spread of noxious weeds by cleaning vehicles and equipment used on the project with high-pressure sprayers to dislodge seeds prior to accessing the area.
    - Avoid unnecessary disturbances to vegetation by driving on existing roads when possible and working only in the required area.
    - Special methods, such as removal with bucket lift, crane, or climbing methods, will be used when felling trees would be a hazard to sensitive riparian habitat. All trees will be felled away from streams and existing riparian vegetation when

possible. Removing trees in sections and avoiding using heavy equipment near sensitive habitat will protect surrounding vegetation from damage.
    - During palm removal, palm trunks and other debris will be removed from sites continuously to avoid damaging surrounding vegetation.
- Wildlife
    - Palm trimming will not take place during nesting season (April-September) to avoid disturbance to bird species.
    - As staff availability allows, emergence surveys for bats will be performed before trimming or removing trees with significant palm skirt accumulations to confirm the absence of bat species and to minimize disturbance.
- Fire Hazard
    - During palm removal, palm trunks and other debris will be removed from sites continuously to avoid fire hazards from accumulation of vegetation debris near and under equipment, tools, and vehicles.

## Affected Environment and Environmental Consequences

This section is organized by affected resource categories and, for each affected resource, discusses both (1) the existing environmental and socioeconomic baseline in the action area for each resource and (2) the effects and impacts of the proposed action and any alternatives on each resource. The effects and impacts of the proposed action considered here are changes to the human environment, whether adverse or beneficial, that are direct, indirect, or cumulative. This EA includes the written analyses of the environmental consequences on a resource only when the impacts on that resource could be more than negligible and therefore considered an "affected resource." Any resources that will not be more than negligibly impacted by the action have been dismissed from further analysis.

The Moapa Valley NWR is a desert oasis located on 136 acres and contains stream channels supported by six thermal springs. These springs support about 10 acres of riparian habitat on the Refuge. Several endemic species inhabit the thermally isolated warm springs, including a variety of invertebrates, such as riffle beetles and snails, the Moapa White River springfish (*Crenichtys baileyi moapae*), which is considered a species of concern due to limited habitat availability, and the Federally and State endangered Moapa dace. Because of their isolated environment, the endemic organisms have evolved with the pre-historical conditions present within the valley, and theoretically adapted to the best habitat within the Warm Springs area. The Moapa Valley NWR is located upstream from the town of Moapa (See Figure 1). The Refuge is bordered to the north and east by the Muddy River, to the south by the Dry Lake Valley, and to the west by the foothills of the Arrow Canyon Range.

For more information regarding and the general characteristics of the refuge's environment, see section 4.4 of the Refuge's Comprehensive Conservation Plan, which can be found here: ServCat Reference 7305.

The following resources either (1) do not exist within the project area or (2) would either not be affected or only negligibly affected by the proposed action:

- Socioeconomic Resources: The removal of palms and revegetation of native species would not adversely affect the regional economy.
- Geology: The removal of palms and revegetation of native species would have no effect on the geology of the area.
- Wilderness: There is no wilderness on the Refuge.
- Environmental Justice: The removal of palms and revegetation of native species would not cause any indirect or direct adverse human health or environmental impacts to local communities.
- Floodplains: The removal of palms and revegetation of native species is outside the 100-year floodplain so no adverse effects on the floodplain are anticipated.

## Water Resources

### Affected Environment

Moapa Valley NWR is located on the higher terraces of the Muddy River floodplain at elevations ranging from approximately 1,700 feet above msl near the eastern boundary to approximately 1,800 feet above msl to the western boundary (USGS 1983). The Muddy River drains from the northwest to southeast and receives its flows from the Muddy River springs, which discharge perennially (NRCS 1980).

Surface water on the Moapa Valley NWR is composed of a portion of the Muddy River Springs, a series of springs that arise alongside and feed the Muddy River. More than 20 spring orifices occur within the Refuge, including the Plummer and Apcar stream/spring systems. Flow from the combined springs forms a network of pools and small streams that flows northward beyond the property boundaries (USFWS 2009).

Underground flow through the carbonate-rock aquifer in southern Nevada provides the primary source of water for the Muddy River Springs. The source of the underground flow is unknown, but is thought to come from the Sheep Range, the White River Flow System, the Meadow Valley Flow System, or a combination of these sources (Thomas et al. 1996). Predevelopment spring discharge from the Muddy River Springs was relatively constant at 36,000 acre-feet per year (Eakin and Moore 1964).

Based on available water quality samples collected by U.S. Geological Survey, water discharged from Pedersen Springs and Muddy River is similar in nature to that derived from regional carbonate aquifers, with dissolved solids concentrations ranging between 576 and 741 mg/L

(USGS 2021). At the Moapa Valley NWR, water is generally clear with very low suspended sediment. Turbidity may increase locally in response to high rainfall and subsequent runoff and with distance from the spring source. No other upgradient sources of turbidity exist because lands upstream from the Refuge are not developed, farmed, or otherwise disturbed. Water temperature varies from 67 to 86.9°F within Moapa dace habitat (USFWS 1995), generally decreasing with distance from the source. The Service monitors temperature at Pedersen Spring and monthly averages range from 86.2 to 90.8°F (Provencher and Andress 2004).

Monitoring water levels in the carbonate-rock aquifer in the Muddy River area first began in 1987. Water levels were relatively stable for the first 11 years of the record, but then started declining significantly beginning in 1998. Water levels have continued to decline each year, except for an increase during the period from 2005 and mid-2006, which was probably in response to the extremely wet year in 2005 (USFWS 2009).

The decline in carbonate-rock aquifer water levels correlates with a period of significantly increased pumping from the carbonate-rock aquifer that began in 1998. Some researchers believe that this pumping has caused the declines in water levels (Mayer and Congdon 2008); although others dispute this (see individual chapters in the Hydrologic Review Team Baseline Report, 2007). What has been acknowledged by all is that the water level declines in the carbonate aquifer are unique to the Muddy River/Coyote Spring/California Wash area and that the entire water level record, including the period of stable water levels and the more recent period of declines, cannot be explained solely by climate fluctuations.

The decline in carbonate-rock aquifer water levels coincides with and is likely responsible for the decline in spring discharge measured at the Warm Springs West gage. This decline and the potential future declines in groundwater levels and spring discharge from additional pumping from the carbonate-rock aquifer led to the negotiation of a Memorandum of Agreement (MOA) in 2005. The MOA is between the Service and several parties either currently pumping or intending to pump groundwater in the area and is part of the Service's Biological Opinion for the Coyote Spring Pipeline right-of-way. Under conditions in the MOA, the carbonate-rock aquifer pumping will be limited and ultimately stopped as the flow at the Warm Springs West gage declines to "trigger" levels specified in the agreement. The MOA also includes several conservation and habitat restoration measures to be implemented cooperatively by all the parties. Finally, the MOA also requires the parties to form a Hydraulic Review Team for purposes of assessing monitoring and information needs in the area and developing technical analyses (USFWS 2009).

## Description of Cumulative Impacts, Environmental Trends, and Planned Actions

Climate change in Nevada is projected to result in temperature increases of 2-6°C by 2100 (Saunders et al. 2008, Wagner 2009). Increases in nighttime temperatures are projected to lead to a northward shift in the ranges of desert species (Smith et al. 2009). Reduced precipitation in general is predicted for the Southwest (Seager et al. 2007, Wagner 2009) with possible

increased summer precipitation (Smith et al. 2009). Overall, drier conditions are expected even during periods of increased precipitation due to increased evapotranspiration from the higher temperatures (Chambers et al. 2013). Longer and more intense droughts are expected to occur throughout the West. Drought and reduced runoff will result in increased competition for the limited water resources of southern Nevada. The abundance and distribution of wildlife and fish will change, particularly affecting those species already at risk, including the endangered Moapa dace and other endemic species in the Muddy River system.

Future demands for water supply will increase and increased ground water pumping in the carbonate aquifer upgradient from the Moapa Valley NWR is planned.

- Muddy River Decree (1920): In 1920, the Nevada State Engineer adjudicated the entire surface flow of the Muddy River and springs. Within the headwater area, the Moapa Valley Water District (MVWD) diverts 3 cfs from Baldwin Spring (approximately 1,200 feet northwest of the Moapa Valley NWR) and 1 cfs from Jones Spring. Downstream of the Moapa Valley NWR, the Nevada Power Company (NPC) diverts about 3,000 acre-ft./year in the winter.
- In the Upper Muddy River Springs Area, the major ground water users are the MVWD and NPC. The NPC pumps from the alluvial aquifer system, primarily during the summer and MVWD pumps from the carbonate aquifer system throughout the year.
- Coyote Spring Valley groundwater development: In 2020, the Nevada State Engineer issued Order 1309, which limited groundwater pumping to a maximum of 8,000 acre-feet per year, for all water rights holders in the area combined. This limit protected current senior water rights holders and was intended to preserve the habitat of the endangered Moapa dace. This ruling restricted groundwater pumping for the Moapa Band of Paiutes, the Moapa Valley, and North Las Vegas (Philip 2020). However, in September 2020, Coyote Springs Investment, the company behind the proposed Coyote Springs master-planned community, sued Nevada's Division of Water Resources for an 'unconstitutional taking' of the water rights it owns and planned to use (Rothberg 2020).
- In 2022, the District Court of Clark County, Nevada concluded that the Nevada State Engineer exceeded his statutory authority, and that Order 1309 is void (*Las Vegas Valley Water District v. Wilson* 2022). The Nevada Division of Water Resources' state engineer's office appealed the 2022 decision of the district court and, as of 2023, the Nevada Supreme Court was weighing arguments in combined civil cases (Saegert 2023).
- In January 2024, the state Supreme Court unanimously ruled that the Nevada State Engineer "has authority to conjunctively manage surface waters and groundwater and to jointly administer multiple basins." Following the Supreme Court ruling, the case was sent back to the Clark County District Court to decide whether proper notice was given by the State Engineer (Ritter 2024).

Other relevant actions include those of the neighboring Warm Springs Natural Area. The Southern Nevada Water Authority (SNWA) owns the Warm Springs Natural Area, which is adjacent to the refuge. The Warm Springs Natural Area is managed to 1) protect the endangered Moapa dace (*Moapa coriacea*) and other native species; 2) restore habitat and preserve ecological integrity; 3) support low-impact public use; 4) promote public education and outreach; and 5) preserve cultural resources (SNWA 2022). The Warm Springs Natural Area contains an important stream that provides spawning habitat for the Moapa dace and feeds the refuge stream. Monitoring and control of the California fan palm also occurs on the Warm Springs Natural Area (SNWA 2011). Given the proximity of the Warm Springs Natural Area to the refuge and the connection to refuge streams, actions taken on the Warm Springs Natural Area may affect refuge environments or lead to cumulative impacts.

The 2022 Habitat Conservation Plan for Warm Springs Natural Area and Hidden Valley Property is based on the SNWA Warm Springs Natural Area Stewardship Plan (SNWA 2011) and supports an application for a 15-year incidental take permit associated with implementing restoration, enhancement, and other conservation actions in the Warm Springs Natural Area and Hidden Valley Property (SNWA 2022). Actions covered by the incidental take permit include the following and are referenced throughout this document:

Restoration for the Moapa Dace:

- Reconnection of channels, streams, and tributaries
- Bank and channel stabilization
- Beaver management
- Fish passage improvements
- Invasive aquatic species management
- Invasive plant management
- Clearing vegetation from streams
- Installation of dace habitat structures
- Spring pool restoration/enhancement

Other Restoration

- Construction and/or enhancement of wetlands
- Restoration and/or enhancement of riparian habitat
- Restoration and/or enhancement of mesquite and upland habitat

General Property Management and Access

- Fire and fuels management
- Pumping water for irrigation, dust control, and fire suppression
- Crossing the Muddy River and North Fork
- Public Access, Education, and Outreach

- General public access
- Property tours, field trips, and school groups
- Neighbor outreach
- Volunteer planting events
- Independent researchers

Detailed information about actions related to water resources, including reconnection of channels, streams, and tributaries, bank and channel stabilization, spring pool restoration/enhancement, and pumping water for irrigation, dust control, and fire suppression can be found in the Habitat Conservation Plan (SNWA 2022).

## Impacts on Affected Resource

### Alternative A

Ongoing invasive species management activities are inadequate to address the threat posed by fan palms so adverse effects on water resources are expected to continue and potentially grow over time under Alternative A. Adverse effects of fan palms on water resources include altered stream morphology, hydrology, and increased consumptive use of water.

The Service uses small amounts of herbicides for refuge management. The Service typically uses between one and six gallons of glyphosate and imazapyr on the Refuge annually to treat invasive plant species. Herbicides are applied in accordance with the label, are commonly used for invasive species control, and are not persistent in the environment. The half-life of glyphosate ranges from several weeks to years but averages two months. In water, glyphosate is rapidly dissipated through adsorption to suspended and bottom sediments and has a half-life of 12 days to ten weeks (Tu et al. 2001). The half-life of imazapyr in soil ranges from one to five months. In aqueous solutions, imazapyr may undergo photodegradation with a half-life of two days (2011a, b). Herbicides would be applied in a variety of habitats such as riparian, desert, and disturbed areas. In some instances, herbicides need to be applied within 25 feet of surface water. Given these characteristics and management controls, the application of herbicides would have only a short term and minor adverse effect on water resources.

### Alternative B

The effects of ongoing invasive plant management under Alternative B would be the same as those described under Alternative A. In addition, the following effects of palm removal on water resources are expected.

Water resources on Moapa NWR are not likely to be disturbed by equipment, vehicle, and pedestrian activities during palm removal. Palm removal and disposal, including removal using special methods identified in this alternative, would not adversely affect water resources because debris will be removed continuously as removal efforts proceed and temporary debris piles would not be in any surface water. Planting native vegetation around the cut stumps of palm trees would not adversely affect water resources. The removal of palms would have a

beneficial effect on water resources by increasing surface water levels as well as the size of seeps.

Future demands for water supply will increase and increased ground water pumping in the carbonate aquifer upgradient from the Moapa Valley NWR is planned. Increased demand coupled with a drier climate future will further stress local water resources. Considering future trends and planned actions, the proposed action could have beneficial effects to water resources in the long term. Replacing palm trees with native vegetation has the potential to reduce consumptive water use, but water savings have not been quantified.

In summary, any adverse impacts of the proposed action to water resources would be minor and short term.

## Vegetation

### Affected Environment

The Moapa Valley, located in northeastern Clark County, Nevada, is one of the few areas of the Mojave Desert with a perennial river. The Muddy River, also known as the Moapa River, originates at the Muddy River Springs. These springs are part of the Warm Springs thermal springs complex in which the Moapa Valley NWR occurs. The Refuge encompasses more than 20 springs from this complex. These springs provide high-quality habitat for numerous wildlife species and support a variety of vegetation within a narrow elevation of 1,700 to 1,800 feet above mean sea level (USFWS 2009).

Situated at the boundary of the Mojave and Great Basin Deserts, native riparian vegetation surrounding the stream should include dense groves of low, shrub-like trees including velvet ash (*Fraxinus velutina*), mesquites, cottonwoods (*Populus* spp.), and willows. Due to habitat modification, riparian habitat is now dominated by invasive palm trees (USFWS 2009). Palm trees are especially harmful to vegetation in the Warm Springs area because they create high levels of dry fuels that increase the risk and intensity of fires to levels that can harm wildlife, including fish (Scoppettone et al. 1998).

Removal of a few thousand palm trees from the Refuge has occurred at various times since 1994, either following fires or as part of stream restoration projects. Full-grown palms remain around the Plummer and Pedersen streams, but all large palms were removed from the Apcar stream area. Palm seedlings persist at all three stream areas. Other invasive species include the Russian thistle, eel grass, salt cedar, oleander, and pampas grass. Many of these species were introduced to the area as ornamentals and became well established on the Refuge, especially in areas where the old resort/recreational facilities have been removed. Tape grass (*Vallisneria americana*), an invasive aquatic weed, affects aquatic habitats on and adjacent to the Refuge (USFWS 2009).

Desert upland habitats are found at higher elevations and are naturally drier than the riparian community. Shrubs and herbaceous vegetation dominate the upland community. Plant species

on the drier, upland areas of the Refuge are dominated by fourwing saltbush (*Atriplex canescens*), big saltbush (*Atriplex lentiformis*), creosote bush (*Larrea tridentate*), and non-native species such as Canada thistle (*Cirsium arvense*) and salt cedar. Non-native herbaceous species in the drier habitats include Mediterranean grass (*Schismus barbatus*) and Spanish brome (*Bromus madritensis*).

## Description of Cumulative Impacts, Environmental Trends, and Planned Actions

See the Water Resources section for relevant environmental trends.

Relevant planned actions include those outlined in the Habitat Conservation Plan for the Warm Springs Natural Area and Hidden Valley Ranch. See the Water Resources section for a full list of planned actions from the Warm Springs Natural Area Habitat Conservation Plan. Among other purposes, the Warm Springs Natural Area is managed to restore habitat and preserve ecological integrity (SNWA 2022). Actions that may affect habitat and vegetation in the area, such as invasive plant management, clearing vegetation from streams, construction and/or enhancement of wetlands, restoration and/or enhancement of riparian habitat, restoration and/or enhancement of mesquite and upland habitat, and fire and fuels management, are described in the Habitat Conservation Plan (SNWA 2022). As birds and mammals can consume palm seeds from nearby properties and deposit seeds onto the refuge, invasive species and palm management on adjacent properties could influence the spread of palms on the Refuge.

## Impacts on Affected Resource

### Alternative A

Use of herbicides as part of refuge management has both short- and long-term positive impacts to native vegetation by controlling invasive and undesirable plant growth that can lead to competitive exclusion of native species. Because invasive species are common near streams on the Refuge, the Service uses both aquatic and terrestrial herbicide formulations. The herbicides that have been approved for use on the Refuge through the PUPS are reviewed to determine the potential effect of each herbicide on native vegetation if unintentional pesticide drift should occur. The product and application method with the least potential for impact to native vegetation, while also providing effective control of the pest species, is selected.

Between 2017 and 2023, the Service applied between one and six gallons of herbicide annually to treat the invasive common reed, California fan palm, salt cedar, Bermuda grass, and Ravenna grass. The active ingredients in the herbicides typically used are glyphosate and imazapyr. Application of broad-spectrum herbicides can result in non-target effects to vegetation from spray drift. For example, glyphosate is a broad-spectrum, non-selective, systemic organophosphate herbicide that is one of the most widely used herbicides in the United States (Benbrook 2016). Modeling and risk assessment studies have shown that indirect exposure (e.g., spray drift) to glyphosate would not be a concern to non-target vegetation beyond a 25 to 100-foot buffer depending on the application rate and weather conditions (USFS 2011a).

Imazapyr is relatively slow acting, does not readily break down in the plant, and is therefore particularly good at killing large woody species. Imazapyr can control salt cedar, privet (*Ligustrum vulgare*), and downy brome (*Bromus tectorum*). Imazapyr herbicide can be mobile within roots and transferred between intertwined root systems of many different plants and/or to several species. Movement of imazapyr via root grafts may therefore adversely affect the surrounding vegetation. All herbicides are applied in accordance with the label, are commonly used for invasive species control, and are not persistent in the environment. Because the Service would follow all pesticide label restrictions and best management practices (see Appendix A) and an appropriate buffer would be used to minimize spray drift, herbicide application would have only a short-term minor direct adverse effect to non-target plant species. Herbicide treatments on invasive plant species would help to minimize weeds in the treatment area as desirable species recolonize and become re-established. This would lead to long-term beneficial effects to native plant species.

Under the No Action alternative, the Service would not remove mature or large palms from the Refuge. As palms can grow in dense stands on the refuge and outcompete desirable, native vegetation, the continued presence of palms under Alternative A will adversely affect native vegetation at the Refuge.

**Alternative B**

The effects of ongoing invasive plant management under Alternative B would be the same as those described under Alternative A. In addition, the following effects of palm removal on vegetation are expected.

The Proposed Action would have both short- and long-term positive impacts to native vegetation by removing invasive palms. Under the Proposed Action alternative, native vegetation on Moapa NWR could be disturbed by equipment, vehicle, and pedestrian activities associated with palm removal. However, when trees are in proximity to sensitive riparian vegetation, climbing methods will be used to remove trees rather than using heavy equipment. Negative impacts of the proposed action to vegetation would be minimal because care will be taken to avoid damaging sensitive habitat and debris would be removed continuously as removal efforts proceed. Potential disturbance of native vegetation from equipment used to remove the California fan palm would be localized and temporary.

Over the long-term, there would be beneficial impacts from the reduction of the invasive California fan palm and restoration of native plant species. The physical removal of palm trees and revegetation of the disturbed site with native species would allow native plant species to become re-established in the areas now inhabited by these invasive species. The additional work under the proposed action would facilitate native plant reestablishment over a greater area than the No Action alternative. This would lead to greater long-term beneficial effects to native plant species.

## Terrestrial Wildlife and Aquatic Species

### Affected Environment

Although the Moapa Valley NWR encompasses only 136 acres, an abundance of wildlife uses the area on a seasonal basis or year-round. See Appendix H in the 2009 CCP/EIS for a list of species present on the refuge (USFWS 2009). The majority of wildlife species that utilize the Moapa Valley NWR occur in riparian and wetland habitats. Birds that are known to occur on the Refuge include the ash-throated flycatcher (*Myiarchus cinerascens*), black-chinned hummingbird (*Archilochus alexandri*), house finch (*Haemorhouse mexicanus*), Lucy's warbler (*Leiothlypis luciae*), common yellowthroat (*Geothlypis trichas*), black-tailed gnatcatcher (*Polioptila melanura*), Crissal thrasher (*Toxostoma crissale*), Abert's towhee (*Melozone aberti*), hooded oriole (*Icterus cucullatus*), southwestern willow flycatcher (*Empidonax traillii extimus*), and others. The house finch and hooded oriole may nest in palm trees.

15 bat species have been documented in the Muddy River drainage (Williams 2001). 11 of these have been captured at Moapa Valley NWR, including the yellow bat (*Lasiurus xanthinus*), pallid bat (*Antrozous pallidus*), and Townsend's big-eared bat (*Corynorhinus townsendii*). These bats use riparian habitat in the Muddy River drainage and on the Refuge, and urban habitats may be used for roosting (Provencher and Andress 2004). The yellow bat has been documented as a year-round resident on the Refuge. The area of the Refuge, which includes neighboring property, is the only known Nevada location for this palm obligate bat species (USFWS 2009, SNWA 2011). Other common mammals on the Refuge include rodents, rabbits, coyotes, and other small carnivores.

The Moapa Valley supports three species of native fish: Moapa dace, Virgin River chub (*Gila seminuda*), and Moapa White River springfish. In addition, 13 non-native species of fish have been documented in the Muddy River system. The Moapa dace is endemic to approximately six miles of stream habitats in five thermal headwater spring systems and on the main stem of the upper Muddy River. Moapa dace are dependent on the link between the upper river and its tributaries (Scoppettone et al. 1992). Cooler water temperatures in the middle and lower Muddy River are likely a natural barrier to downstream movement of Moapa dace (La Rivers 1962). The Virgin River chub is found in the middle Muddy River, and high water temperatures of the upper Muddy River system are believed to preclude adult chubs (USFWS 2004). The Moapa White River springfish is found in the upper Muddy River and spring tributaries. It is adapted to slower water than the Moapa dace and is common throughout suitable habitat.

Palm trees can be detrimental to aquatic wildlife and habitats. Palms tend to grow in dense stands on the Refuge, which outcompete desirable native plants. While palms are used by some species (for example, bats), they do not generally provide high-quality habitat for wildlife (Lund 2001). Palm trees adjacent to streams and springs alter the composition and frequency of leaf litter and create dense fibrous mats that eliminate aquatic substrates used by fish and other aquatic organisms for food, cover, and reproduction. In comparison to native plants, palm trees

use more water, use more nutrients that would otherwise be available for fish, and accumulate salt at their bases (USFWS 2009).

## Description of Cumulative Impacts, Environmental Trends, and Planned Actions

See the Water Resources section for relevant environmental trends.

Relevant planned actions include those outlined in the Habitat Conservation Plan for the Warm Springs Natural Area and Hidden Valley Ranch. See the Water Resources section for a full list of planned actions from the Warm Springs Natural Area Habitat Conservation Plan. Among other purposes, the Warm Springs Natural Area, which is adjacent to the refuge, is managed to protect the endangered Moapa dace and other native species and to restore habitat and preserve ecological integrity (SNWA 2022). Actions that may affect wildlife in the area, such as restoration for the Moapa dace, beaver management, construction and/or enhancement of wetlands, restoration and/or enhancement of riparian habitat, and restoration and/or enhancement of mesquite and upland habitat, are described in the Habitat Conservation Plan (SNWA 2022). The Habitat Conservation Plan supports an application for an incidental take permit, which covers the following species: Moapa dace, Moapa White River springfish (*Crenichthys baileyi moapae*), Virgin River chub, southwestern willow flycatcher, Yuma Ridgway's rail (*Rallus obsoletus yumanensis*), yellow-billed cuckoo (*Coccyzus americanus*), and monarch (*Danaus plexippus,* SNWA 2022).

See the Threatened and Endangered Species, and Other Special Status Species section for additional information related to the Moapa dace, southwestern willow flycatcher, and Yuma Ridgway's rail.

## Impacts on Affected Resource

### Alternative A

Use of herbicides as part of refuge management has both short- and long-term positive impacts to wildlife species by controlling invasive and undesirable plant growth that can lead to competitive exclusion of native plant species. Treatments would focus on the invasive common reed, California fan palm, salt cedar, Bermuda grass, and Ravenna grass. The herbicides that have been approved for use on the refuges through the PUPS are reviewed to determine the potential effect of each herbicide on native vegetation and associated wildlife if unintentional pesticide drift should occur. The product and application method with the least potential for impact to native vegetation, while also providing effective control of the pest species, is selected.

The Service uses between one and six gallons of herbicide on the Refuge annually. The active ingredients in herbicides typically used are glyphosate and imazapyr. Herbicides with these active ingredients are used sparingly, are generally of low toxicity to wildlife, and relatively non-persistent in the aquatic environment (Tu et al. 2001). Glyphosate is a broad-spectrum, non-selective, systemic organophosphate herbicide that is one of the most widely used herbicides in

the United States (Henderson et al. 2010). It has commonly been believed to be relatively low in toxicity to non-target organisms such as birds, fish, and other wildlife (Henderson et al. 2010; Folmar et al. 1979). However, studies by Cauble and Wagner (2005), Lanctôt, Robertson, et al. (2013), Lanctôt, Navarro-Martin, et al. (2014), Relyea 2005, and Williams and Semlitsch (2010) suggest or demonstrate that glyphosate formulations at concentrations found in the environment can be toxic to amphibians (a taxonomic group that has experienced pronounced population declines globally in recent years). Additionally, the World Health Organization International Agency for Research on Cancer recent categorized glyphosate as, "…probably carcinogenic to humans" (Guyton et al. 2015).

These herbicides are applied in accordance with the label, are commonly used for invasive species control, and are not persistent in the environment. Imazapyr is not highly toxic to birds and mammals, has a low toxicity to fish, and algae and submersed vegetation are not affected (Tu et al. 2001). Glyphosate is of relatively low toxicity to birds and mammals (Tu et al. 2001). These herbicides would be applied in both terrestrial and aquatic habitats. The application of pesticides would have a minor, direct, and adverse effect to native wildlife species because the Service would follow all pesticide label restrictions and best management practices, pesticides would not be applied directly to, or within the no-spray buffer of surface waters, and pesticide use is limited to herbicides. These restrictions mean that indirect impacts to aquatic and terrestrial species that use refuge aquatic resources for food, cover, and nesting are not likely to occur.

Removal of small palm and palm seedlings via hand pulling and hand tools would have negligible adverse impacts on wildlife at the Refuge. The No Action alternative may have beneficial effects on wildlife. By using herbicides for invasive species control, native plant species can recolonize areas, providing greater habitat value for wildlife species. However, the continued presence of large and mature palms under Alternative A may have adverse effects on wildlife, as palms do not generally provide high-quality habitat for wildlife and can degrade habitats used by aquatic organisms for food, cover, and reproduction (Lund 2001; USFWS 2009). Additionally, the increased fire risk posed by dried fronds of California fan palms creates risk of direct harm to wildlife.

**Alternative B**

The effects of ongoing invasive plant management under Alternative B would be the same as those described under Alternative A. In addition, the following effects of palm removal on terrestrial wildlife and aquatic species are expected.

Although palm trees do not generally provide high quality wildlife habitat, the removal of palm trees would result in a loss of potential habitat for some bat species, including the yellow bat. This effect on the species is likely to be minor because the adjacent Warm Springs Natural Area contains many California fan palms (SNWA 2011) and provides similar habitat where these species could relocate. Other bats and birds are likely to only be temporarily displaced. Once

the native riparian vegetation matures, these species would be able to return to the Refuge. Cottonwood, ash, and willow trees should be much more beneficial to most bats than California fan palm trees (Provencher and Andress 2004). Emergence surveys for bats, as outlined in associated mitigation measures, will ensure that palm removal will not have adverse effects on bat species.

Overall, the Proposed Action would have beneficial effects to wildlife by removing invasive palms, which can form dense monocultures that degrade wildlife habitat. Additionally, dried palm fronds are a highly flammable fuel source (Scoppettone et al. 1998), and the removal of mature palms may reduce the risk of fire that could adversely affect wildlife. To minimize direct, adverse impacts to wildlife, removal of palms in sensitive riparian habitats would be completed using climbing methods.

Impacts of the proposed action on threatened and endangered species, including the endangered Moapa dace, are described in the "Threatened and Endangered Species, and Other Special Status Species" section.

## Threatened and Endangered Species, and Other Special Status Species

### Affected Environment

Several threatened and endangered species occur or have the potential to occur on the Refuge (USFWS 2021b). The Moapa dace, southwestern willow flycatcher, Yuma Ridgway's rail are endangered species that either occur or potentially occur on the Refuge. The threatened desert tortoise (*Gopherus agassizii*) also occurs on the Refuge.

The Moapa Valley NWR was established to protect and secure habitat for the Moapa dace. This species' habitat is restricted to the headwaters of the Muddy River due to its narrow temperature requirements. Habitat modifications and the presence of introduced fish species make the habitat further downstream unsuitable for the dace (USFWS 2009). Refuge management has focused on improving habitat for the Moapa dace. The removal of non-native palm trees from stream channels, in conjunction with planting native vegetation, improving stream velocities, and channel reconfiguration, contributed to an 88 percent increase in the Moapa dace population between February 2012 and February 2013 (USFWS 2013, USFWS 2021c).

The southwestern willow flycatcher is a riparian obligate species, which typically nests in areas with dense tree or shrub cover greater than three meters tall, dense twig structure, green foliage, and often tall canopy vegetation (Sogge et al. 2010). The species will typically nest in stands of vegetation that are 4-7 meters in height (Sogge et al. 2010, NPS 2013). Moapa Valley NWR does not have a large amount of suitable habitat for the southwestern willow flycatcher, but the flycatcher does breed in the adjacent Muddy River drainage. During 2021, there were a few nesting pairs on the nearby property of the Southern Nevada Water Authority. The only detection of the southwestern willow flycatcher on the Refuge was in the Apcar Unit. The bird

captured during mist netting efforts was originally banded at the Warm Springs Natural Area and, as there is no suitable nesting habitat on the Refuge, the detected individual was likely foraging (Lausch pers comm 2024).

The Yuma Ridgway's rail is known to have occurred in the Muddy River area near Moapa Valley NWR in the past, but there is no habitat for this species on the Refuge.

The threatened desert tortoise is typically found in the creosote bush scrub habitat and has been observed on the Moapa Valley NWR.

## Description of Cumulative Impacts, Environmental Trends, and Planned Actions

See the Water Resources section for relevant environmental trends.

Relevant planned actions include those outlined in the Habitat Conservation Plan for the Warm Springs Natural Area and Hidden Valley Ranch. See the Water Resources section for a full list of planned actions from the Warm Springs Natural Area Habitat Conservation Plan. Among other purposes, the Warm Springs Natural Area is managed to protect the endangered Moapa dace and other native species (SNWA 2022). The Warm Springs Natural Area contains an important stream that provides spawning habitat for the Moapa dace and feeds the Refuge stream (SNWA 2011). Management actions at the Warm Springs Natural Area include restoring stream channels and removing invasive fish species that compete with the Moapa Dace (SNWA 2011). Actions that may affect threatened and endangered species in the area, such as restoration for the Moapa dace, are described in the Habitat Conservation Plan (SNWA 2022). Actions described in the SNWA Habitat Conservation Plan may affect federally endangered species covered under the incidental take permit, including the Moapa dace, the southwestern willow flycatcher, the Yuma Ridgway's rail, and the yellow-billed cuckoo. The monarch, which is a candidate species for listing, is also covered under the incidental take permit (SNWA 2022).

## Impacts on Affected Resource

### Alternative A

The Service would continue to use pesticides to manage invasive weeds. The Service uses between one and six gallons of herbicides on the refuge annually. The active ingredients in the herbicides typically used are glyphosate and imazapyr. Herbicides with these active ingredients are used sparingly, are generally of low toxicity to wildlife, and relatively non-persistent in the aquatic environment (Tu et al. 2001). The Service follows all best management practices to minimize any potential effects to sensitive species. The use of herbicides to manage invasive weeds has long-term beneficial effects to sensitive species by preventing habitat degradation by invasive weeds.

Under the No Action Alternative, the Service would not remove mature or large palms from the Refuge. The continued presence of palms prevents and degrades habitat for threatened and endangered species that use or could potentially use the Refuge. Palms directly threaten Moapa dace habitat by growing in or along the stream channel and, in some cases, altering the

channel itself, diverting water around or through its roots, potentially inhibiting fish passage and affecting the natural flow of food sources for the dace through the system (Lausch *in prep*, USFWS 1995).

**Alternative B**

The effects of ongoing invasive plant management under Alternative B would be the same as those described under Alternative A. In addition, the following effects of palm removal on threatened and endangered species and other special status species are expected.

Removal of the invasive palm would improve habitat for the Moapa dace. The removal of palms from stream channels, in conjunction with planting native riparian vegetation, improving stream velocities, and channel reconfiguration, was estimated to have contributed to an 88 percent increase in the Moapa dace population between February 2012 and February 2013 (USFWS 2013). Additionally, the removal of large palms will reduce the risk of fire, which has historically caused serious adverse effects to the Moapa dace population (USFWS 1995). As trees will be felled away from streams, when possible, there is not likely to be any direct, adverse impact to Moapa dace on the Refuge.

The Refuge does not provide suitable nesting habitat for the southwestern willow flycatcher. The southwestern willow flycatcher does not nest in palm trees, and palms do not provide habitat for the species. The only southwestern willow flycatcher individuals detected at the Refuge are in the Apcar Unit, where there are no large palms; therefore, there is no risk of disturbance from the Proposed Action. Removing palms and replacing them with native species could benefit the southwestern willow flycatcher by providing better-quality, native riparian vegetation on the Refuge and in the region. The Proposed Action will not affect the Yuma Ridgway's rail because there is no habitat for this species on the Refuge. Palm trees also do not provide habitat for the desert tortoise.

Overall, removing California fan palms and replacing them with native riparian vegetation will have a positive effect on threatened and endangered species and will directly improve habitat for the Moapa dace.

## Soils

### Affected Environment

The Moapa Valley NWR is located on the floodplain of the Muddy River and is flanked by a series of low alluvial fans, terraces, and benches that grade into higher alluvial fans (NRCS 2021). A total of six soil-mapping units are present on the Refuge, and the soils generally range from gravelly fine sand to silty clay. The gravelly fine sand soil types are derived from or occur near the proximal edges of alluvial fans. The silty clay soil types are derived from or occur near lake deposits or floodplains (USFWS 2009).

## Description of Cumulative Impacts, Environmental Trends, and Planned Actions

There are no known environmental trends or planned actions affecting soils on the Refuge. Information about actions related to soils at the adjacent Warm Springs Natural Area, including bank and channel stabilization and other restoration can be found in the Habitat Conservation Plan (SNWA 2022).

## Impacts on Affected Resource

### Alternative A

The Service would continue to use herbicides for refuge management on the Moapa Valley NWR as needed. The Service uses between one and six gallons of pesticide on the Refuge annually. The active ingredients in the herbicides used most recently are glyphosate and imazapyr. All active ingredients used on the Refuge are degraded primarily by microbial metabolism in soils and are not expected to persist in soils from one year to the next (Tu et al. 2001). For example, glyphosate rapidly and strongly adheres to soil and degrades, especially in areas with high organic content; thus, little is transferred by rain or irrigation water and there would be a minute leaching potential from application (Suave et al. 2005). Glyphosate also dissipates rapidly from natural water bodies through adsorption to the organic substances and inorganic clays, microbial degradation, and dilution.

Imazapyr is a non-selective herbicide that is also degraded primarily by microbial metabolism in soils. Because imazapyr is a weak acid herbicide, environment pH determines its chemical structure, which in turn determines its environmental persistence and mobility. Below pH 5, the adsorption capacity of imazapyr increases and limits its movement in soil. Above pH 5, greater concentrations of imazapyr become negatively charged, fail to bind tightly with soils, and remain available (for plant uptake and/or microbial breakdown). In soils, imazapyr is degraded primarily by microbial metabolism. The half-life of imazapyr in soil ranges from one to five months (Tu et al. 2001). The half-life of imazapyr in soil ranges from one to five months. Under most field conditions, imazapyr does not bind strongly to soils and can be highly available in the environment (Tue et al 2001). These characteristics mean that application has only short-term minor adverse effects on soils.

All herbicides are applied in accordance with the label, are commonly used for invasive species control, and are not persistent in the environment. Under most environmental conditions, the field half-life for these herbicides ranges from 0.2 days to 26 days (USFS 2011a, b). These herbicides would be applied in a variety of habitats such as riparian, desert, and disturbed areas. All label instructions would be followed thereby reducing the potential for soil erosion transport. Given these characteristics and management controls, the application of herbicides would have only a minor adverse effect on soils.

**Alternative B**

The effects of ongoing invasive plant management under Alternative B would be the same as those described under Alternative A. In addition, the following effects of palm removal on soils are expected.

Soils on Moapa NWR could be locally disturbed by equipment, vehicle, and pedestrian activities associated with palm removal, including use of bucket lift and climbing methods, use of tracked equipment, and root grinding to lower stumps below surrounding soil height. Soil to cover cut stumps would be provided onsite by the Service. Appropriate post-removal clean-up and grooming of the site where the trees were removed would be conducted. For example, damages such as divots and tracks left from vehicles or equipment would be repaired and equipment tracks and footprints would be raked. These types of activities would have minimal effects on soils because debris would be removed continuously as removal efforts proceed and these temporary debris piles would not cause soil erosion. The impacts of herbicides would be similar as to what is described under the No Action Alternative and would have only a minor adverse effect on soils.

Overall, the impacts of the proposed action to soils would be minimal. There could be localized soil disturbance from equipment used to remove the California fan palm. However, these impacts would be temporary and would not lead to soil erosion.

## Air Quality

### Affected Environment

Ambient air quality is not currently measured at Moapa Valley NWR. Due to the lack of major sources in the area, ambient concentrations of criteria pollutants near the Refuge are likely to be very low. Occasional elevated levels of ozone or particulate matter may be possible through transport into the area or by local sources of fugitive dust. The nearest sources of emissions are from the NPC generating plant, approximately 7 miles away, the Las Vegas area, approximately 50 miles to the southwest, and the Apex industrial complex, located approximately 30 miles to the southwest. Based on existing wind data, winds generally blow towards the north less than 5 percent of the time (USGS 2003), which suggests that emission from the Las Vegas and Apex regions do not generally affect Refuge air quality.

### Description of Cumulative Impacts, Environmental Trends, and Planned Actions

Due to the proximity to the refuge, relevant planned actions related to air quality include those outlined in the Habitat Conservation Plan for the Warm Springs Natural Area and Hidden Valley Ranch. Actions related to or affecting air quality at the adjacent Warm Springs Natural Area, such as pumping water for irrigation, dust control, and fire suppression are described in the Habitat Conservation Plan (SNWA 2022).

There are no other known environmental trends and planned actions affecting air quality on the Refuge.

## Impacts on Affected Resource

### Alternative A

Pesticides are used for refuge management to control invasive plant species. When sprayed, pesticides travel through the air to their intended target. Although generally formulated and propelled to reach and (with the assistance of a surfactant) attach to their target pest, a percentage of some pesticides may volatilize into the air or small pesticide droplets may remain suspended in the air. These effects would be more pronounced with aerial spraying, and less so with ground level spot spraying, and direct application to stumps. Once airborne, pesticides can move off of the pest control site and drift with the wind or return to surface soils, waters, or plants through precipitation (van Es and Trautmann 1990). High temperatures, low relative humidity, air movement, and small pesticide droplet size all increase volatilization; and pesticides that tightly adsorb onto soil particles are less likely to volatilize (Fishel 2003). The Service uses all appropriate best management practices to reduce the drift of pesticides such as selecting application equipment to provide site-specific delivery to target pests while minimizing/eliminating direct or indirect (e.g., drift) exposure to non-target areas.

### Alternative B

The effects of ongoing invasive plant management under Alternative B would be the same as those described under Alternative A. In addition, the following effects of palm removal on air quality are expected.

Under the Proposed Action, there may be an increase in dust and exhaust from equipment used to remove palms. Whenever possible, vehicles and equipment will use main roads, such as West Warm Springs Road, rather than gravel roads on the refuge to transport debris and palm material, which may minimize dust during palm removal. Since the increase in dust and emissions will be constrained to the removal period, the effects to air quality are not likely to be significant.

Effects to air quality from pesticide application would be the same as described in Alternative A. The Service would follow all best management practices for pesticide application. These practices will minimize any adverse impacts to air quality. Overall, impacts to air quality are minimal and temporary.

# Land and Visitor Use

## Affected Environment

Moapa Valley NWR is bounded on the north and west by private land holdings, including the Warm Springs Natural Area, and to the south and east by BLM-managed lands (Figure 1). The Mormon Mesa ACEC, established for the protection of the desert tortoise, is located to the north of the Refuge. At least one currently occupied private residence is directly adjacent to the Refuge. The Moapa River Indian Reservation lies to the southeast (USFWS 2009).

The Refuge was established September 10, 1979, to secure habitat for the endangered Moapa dace. Prior to acquisition, the Pedersen and Plummer Units had been developed and operated as resorts. The primary management objectives of the Refuge are to restore these units to as near a natural condition as possible and to optimize available stream habitat for recovery and downlisting of Moapa dace (USFWS 2009).

The Plummer Unit of the Refuge contains a parking lot, public restroom, two pavilions, five informational kiosks, an outdoor sculpture, a fish pond viewing chamber, and stream viewing area. The Pedersen Unit of the Refuge contains a parking lot, maintenance shop, mobile home pad, single family home, and detached garage.

Moapa Valley National Wildlife Refuge is open for public use from 8:00 am to 4:00 pm on Fridays, Saturdays, and Sundays. Due to the Refuge's small size, fragile habitat, and ongoing restoration work, the Refuge is closed to the public during the months of June, July, and August. Visitor use opportunities include hiking on the Interpretive Trail or Warm Springs Overlook Trail, using the Refuge pavilion, visiting the stream viewing window, and interacting with informative displays and kiosks.

## Description of Cumulative Impacts, Environmental Trends, and Planned Actions

See the Water Resources section for relevant environmental trends. Relevant planned actions include those at the adjacent Warm Springs Natural Area. The Southern Nevada Water Authority plans to expand their trail system for the public by including a new connection to the Refuge. This would include a new pedestrian bridge over the Refuge stream, a 0.25 mile connecting trail along the Refuge Stream, and a 1.1-mile loop that would follow the Muddy River and north side of the Apcar Stream. Additional, detailed information about actions related to visitor use at the adjacent Warm Springs Natural Area can be found in the Habitat Conservation Plan (SNWA 2022).

## Impacts on Affected Resource

### Alternative A

Under the No Action Alternative, the Service would maintain the current land use practices and would continue use herbicides to manage invasive plant species, which will have minimal adverse impact to other resources, as described in previous sections. Precautions and best practices (see Appendix A) will be implemented to ensure the safety of applicators and visitors to the Refuge. Under Alternative A, the Service would not implement the planned invasive species control project to remove mature California fan palms from the Plummer Unit of the refuge or continue removal of additional mature palms from the refuge.

Under this alternative, continued management of invasive species would contribute to the primary management objectives of the refuge to restore land units. However, adverse impacts to the Moapa dace from the California fan palm would continue, as the roots of mature palms negatively affect Moapa dace habitat. This could inhibit the ability of the refuge to fully meet

primary management objectives. Additionally, the No Action Alternative has the potential to adversely affect refuge infrastructure, including buildings and visitor structures (Scoppettone et al. 1998). Fires that could occur in visitor use areas would be detrimental to visitor use on the Refuge.

**Alternative B**

The effects of ongoing invasive plant management under Alternative B would be the same as those described under Alternative A. In addition, the following effects of palm removal on visitor use and experience are expected.

Under this alternative, large palms would be removed from the Refuge. Removal of mature palms would have positive effects on the Moapa dace and contribute to land use that supports Refuge establishment and objectives by enhancing habitat for the Moapa dace.

Additionally, removal of mature palms from the refuge reduces the risk of fire and subsequent damage to refuge infrastructure, including visitor use structures. Because special removal methods would be used when appropriate (bucket lift, crane and climbing methods), there would be minimal risk to refuge infrastructure. These removal methods are designed to cut palms in sections and, if needed, lower pieces of the trunk slowly to the ground to avoid damage from felling.

Planned removal of mature palms from the Plummer Unit would be conducted in the vicinity of visitor use areas on the Refuge. There will be no adverse, direct impacts to visitor use (such as noise or closure of visitor use areas), as all palm removal will be conducted from Monday through Thursday when the Refuge is not open to visitors. Before the Refuge is opened to the public each Friday, all equipment, tools, vehicles, and major debris will be removed from the visitor area. Additionally, root grinding may be implemented by contractors or refuge staff, as funding and personnel allow, so that cut stumps are lowered 6-12 inches below the surrounding soil height. Cut stumps would be covered by soil and would not be apparent to visitors. However, stumps may remain visible if root grinding is not implemented for all cut trees. Palm removal, especially removal of large, mature palms, will result in a change in aesthetics surrounding visitor use areas and hiking trails. Palm removal has historically caused some controversy in the area and removal of large palms may be a departure from what some visitors are accustomed to seeing on the Refuge.

The Refuge's vision states that local residents and visitors will learn about and enjoy the restored desert oasis. Palm removal and revegetation with native riparian species will allow the Refuge to better demonstrate high-quality habitat for the endemic Moapa dace and other native wildlife. Overall, impacts to land and visitor use from the proposed action will be positive.

## Cultural Resources and Subsistence

### Affected Environment

Because most of the area making up the Moapa Valley NWR was privately held until recently, considerable alteration to the character of the landscape has occurred and any sites that may have been present are likely buried or destroyed as part of the resort development. Approximately 16 percent of the Refuge has been investigated through archaeological reconnaissance surveys. No historic sites have yet been recorded in the Refuge.

While numerous prehistoric sites have been recorded in the surrounding region, only one site has thus far been recorded within the boundaries of the Refuge (Fergusson and DuBarton 2005). A small lithic scatter was recorded in 1979 by a non-professional archaeologist. No surface evidence remains due to land disturbances around the spring. Sites in the immediate vicinity of the Refuge include pit houses and surface structures of Far Western Puebloan design, rock shelters, and large open sites with lithics and both Far Western Puebloan and Numic ceramics. Local tradition suggests other sites exist in the region, but many have never been formally recorded.

### Description of Cumulative Impacts, Environmental Trends, and Planned Actions

Relevant planned actions include those at the adjacent Warm Springs Natural Area. Among other purposes, the adjacent Warm Springs Natural Area is managed to preserve cultural resources. As part of their incidental take permit, SNWA is requested to submit a Request for Cultural Resources Compliance form to the USFWS. This may require them to conduct cultural resource surveys and potentially mitigate impacts to resources (SNWA 2022).

There are no other known environmental trends or planned actions affecting cultural resources in the area.

### Impacts on Affected Resource

#### Alternative A

As part of Refuge management, the Service would continue to manage invasive plant species through an integrated pest management approach (IPM). IPM involves using control methods based on effectiveness, cost, and minimal ecological disruption, which considered minimum potential effects to non-target species and the refuge environment. Pesticides may be used where physical, cultural, and biological methods or combinations thereof, are impractical or incapable of providing adequate control, eradication, or containment. Use of pesticides will not affect cultural resources. When site-specific projects that include ground-disturbing activity are proposed, surveys and other requirements would be followed to minimize the potential for adverse effects to cultural resource sites that have yet to be discovered in accordance with applicable regulations and guidance.

**Alternative B**

The effects of ongoing invasive plant management under Alternative B would be the same as those described under Alternative A. In addition, the following effects of palm removal on cultural resources and subsistence are expected.

Cultural resource compliance for palm removal on the Pedersen and Apcar Units of the Refuge in 2021 determined that palm tree removal could proceed with no further Section 106 consultation. However, it was determined that revegetation with native shrubs and grasses may require additional review and consideration of cultural resources due to the potential of ground disturbance.

The Service will submit a Request for Cultural Resources Compliance for planned palm removal to ensure that the proposed action will not have adverse effects on cultural resources.

## Monitoring

The Service will monitor each aspect of the Proposed Action as follows:

- A survey to monitor the extent of infestation of palms on the refuge and prioritize areas requiring palm removal is completed at least every two years. The survey follows documentation outlined in an in-progress survey protocol (Lausch *in prep*). Data from the survey, which provide a census of palms on the Refuge, will indicate re-growth in the area where palms were removed. Regular surveying in areas where the proposed action occurs will allow staff to ensure that there are no significant adverse impacts on the environment.
- Pending staff availability, to assess the success of revegetation efforts, planted propagules will be monitored for survival and revegetation sites will be inventoried and assessed to prevent new invasive species from becoming established in those areas.

## Summary of Analysis

### Alternative A – No Action Alternative

As described above, Alternative A includes ongoing invasive plant management by Refuge staff. Minor adverse effects to soil, water resources, vegetation, wildlife, and threatened and endangered species would be temporary and localized. Beneficial effects are expected in the long-term where the reduction of invasive plant infestations will facilitate native habitat restoration.

### Alternative B – Palm Removal (Proposed Action Alternative)

As described above, under the Proposed Action, the Service would remove mature palm trees from the Refuge and revegetate with native species. The Proposed Action would have only minor adverse effects to water resources, vegetation, wildlife, threatened and endangered

species, soils, air quality, and land and visitor use. Adverse effects would be temporary and localized. Appropriate cultural resource compliance will ensure that unknown cultural resources are not disturbed during palm removal, stump grinding, or revegetation. Beneficial effects are expected in the long-term where the reduction of invasive plant infestations will facilitate native habitat restoration. In particular, the Proposed Action could improve habitat for the endangered Moapa dace.

## List of Sources, Agencies and Persons Consulted

Rabecca (Becky) Lausch, Wildlife Refuge Specialist, Moapa Valley National Wildlife Refuge, U.S. Fish and Wildlife Service, Moapa, NV

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## State Coordination

Coordination with the State will take place during the public outreach period.

## Tribal Consultation

The Service will coordinate with the Nuwu Tribes on the proposed action and will provide an opportunity to review and comment on the draft EA.

## Public Outreach

The draft Environmental Assessment will be available to the public and interested agencies for a public review on the Refuge webpages at: Moapa Valley National Wildlife Refuge website.

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## Appendix A

Best management practices are used when applying pesticides to control invasive plant species, as listed below:

- General:
    - All chemical treatments would comply with the applicable federal and state regulations pertaining to pesticide use, safety, storage, disposal, and reporting.
    - Before pesticides can be used to eradicate or control invasive plant species on Service owned land, a PUP would be prepared and approved in accordance with 569 FW1.
    - Application equipment will be selected to provide site-specific delivery to target pests while minimizing/eliminating direct or indirect (e.g., drift) exposure to non-target areas.
    - Target-specific equipment will be used to treat pests.
    - Only qualified personnel may apply pesticides.
    - Chemical treatments will be applied during calm, dry weather and an unsprayed buffer would be maintained near any sensitive areas.
    - Chemical applications must be avoided where seasonal precipitation or excess irrigation water is likely to wash residual chemicals into waterways.
    - All chemicals will be handled in strict accordance to label specifications.
- Pesticide Handling and Mixing:
    - As a precaution against spilling, spray tanks shall not be left unattended during filling.
    - All pesticide containers shall be triple rinsed and the rinsate would be used as water in the sprayer tank and applied to treatment areas.
    - All pesticide spray equipment shall be properly cleaned. Where possible, rinsate should be used as a part of the make-up water in the sprayer tank and applied to treatment areas.
    - Pesticide containers shall be triple rinsed and recycled (where feasible).
    - All unused pesticides shall be properly discarded at a local “safe send” collection site.
    - Pesticides and pesticide containers shall be lawfully stored, handled, and disposed of in accordance with the label and in a manner safeguarding human health, fish, and wildlife, soil, and water.
    - Where specified on the pesticide label, water quality parameters (e.g., pH and hardness) that are important to ensure greatest efficacy shall be considered.
    - All pesticide spills shall be addressed immediately using procedures identified in the refuge spill response plan.
- Applying Pesticides:

- Pesticide treatments shall only be conducted by or under the supervision of Service personnel and non-Service applicator with the appropriate state certification to safely and effectively conduct these activities on refuge lands and waters.
- Comply with all Federal, state, and local pesticide use laws and regulations as well as Departmental, Service, and NWRS pesticide-related policies. For example, as required under FIFRA, the proper application equipment and rates should be used for the specific pest(s) identified on the pesticide label.
- Low-impact herbicide application techniques (e.g., spot treatment, cut stump, oil basal, and Thinvert system applications) rather than broadcast foliar application (e.g., boom sprayer and other larger tank wand applications) shall be used, where practical.
- To maximize herbicide effectiveness and ensure correct and uniform application rates, low-volume rather than high-volume foliar applications shall be used where the low-impact methods above are not feasible or practical.
- Applicators shall use and adjust spray equipment to apply the coarsest droplet size spectrum with optimal coverage of the target species while reducing drift.
- Applicators should use the largest droplet size that results in uniform coverage.
- Applicators shall use drift reduction technologies such as low-drift nozzles, unless otherwise authorized by the refuge manager.
- Where possible, spraying shall occur during low (average <7mph and preferably 3 to 5 mph) and consistent direction wind conditions with moderate temperatures (typically <85$^{o}$F).
- Where possible, applicators shall avoid spraying during inversion conditions (often associated with calm and very low wind conditions) that can cause large-scale herbicide drift to non-target areas.
- Equipment shall be calibrated regularly to ensure that the proper rate of pesticide is applied to the target area or species.
- Spray applications shall be made at the lowest height for uniform coverage of target pests to minimize/eliminate potential drift.
- If windy conditions frequently occur during afternoons, spraying (especially boom treatments) shall typically be conducted during early morning hours.
- Spray applications shall not be conducted on days with >30% forecast for rain within 6 hours, except for pesticides that are rapidly rain fast (e.g., glyphosate in 1 hour) to minimize/eliminate potential runoff.
- Where possible, applicators shall use drift retardant adjuvants during spray applications, especially adjacent to sensitive areas.
- Where possible, applicators shall use a non-toxic dye to aid in identifying target area treated as well as potential overspray or drift. A dye can also aid in

detecting equipment leaks. If a leak is discovered, the application shall be stopped until repairs can be made to the sprayer.
    - For pesticide uses associated with cropland and facilities management, buffers, as required in PUPS, shall be used to protect sensitive habitats, especially wetlands and other aquatic habitats.
    - When drift cannot be sufficiently reduced through altering equipment set up and application techniques, buffer zones shall be identified to protect sensitive areas downwind of applications.
    - Use products labeled for aquatic use if treating invasive plants within 25 feet of surface water.
    - Apply aquatic labeled glyphosate formulations to aquatic habitats to riparian habitats within 25 feet of surface water resources; ensure that surfactants are classified as practically non-toxic or as slight acute toxicity (>10 ppm) to aquatic organisms.
    - Apply only aquatic labeled imazapyr formulations to aquatic and riparian habitats or habitats within 25 feet of surface water resources.
    - Tank mix aquatic imazapyr formulations with surfactants classified as practically non-toxic or slight acute toxicity to aquatic organisms (>10 ppm).
    - Use caution where sensitive non-target plants are present.
    - Applicators shall utilize scouting for early detection of pests to eliminate unnecessary pesticide applications.
    - The timing of applications shall be considered so native plants are protected (e.g., senescence) while effectively treating invasive plants.
    - Rinsate from cleaning spray equipment shall be recaptured and reused or applied to an appropriate pest plant infestation.
    - Application equipment (e.g., sprayer, ATV, tractor) shall be thoroughly cleaned and PPE removed/disposed of on-site by applicators after treatments to eliminate the potential spread of pests to un-infested areas.
- Safety:
    - All applicators should wear the specific personal protective equipment (PPE) identified on the pesticide label. The appropriate PPE should be worn at all times during handling, mixing, and applying. PPE can include the following: disposable (e.g., Tyvek) or laundered coveralls, gloves (latex, rubber, or nitrile), rubber boots, and a NIOSH-approved respirator. Because exposure to concentrated product is usually greatest during mixing, extra care should be taken while preparing pesticide solutions. Persons mixing these solutions can be best protected if they wear long gloves, and apron, footwear, and a face shield.

- Transporting, storing, handling, mixing, and disposing or pesticide containers should be consistent with label requirements, USEPA and OSHA requirements, and Service policy.