Final

Raptor Survey Report in Support of the Proposed Fallon Range Training Complex Expansion, Nevada

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[Cover - clockwise: Red-tailed Hawk, Prairie Falcon, and Golden Eagle; all photos by M. Ball]

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Acronyms and Abbreviations

BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
DoN	U.S. Department of the Navy
DVTA	Dixie Valley Training Area
EIS	Environmental Impact Statement
FRTC	Fallon Range Training Complex
ft	foot/feet
GBBO	Great Basin Bird Observatory
GIS	geographic information system
km	kilometer(s)
m	meter(s)
NAS	Naval Air Station
NDOW	Nevada Department of Wildlife
NNHP	Nevada Natural Heritage Program
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
WAP	Wildlife Action Plan

1. INTRODUCTION AND OVERVIEW

Naval Air Station (NAS) Fallon manages the Fallon Range Training Complex (FRTC), which currently encompasses a combination of withdrawn and acquired lands totaling approximately over 223,600 acres (90,490 hectares) of military training land located southeast of Fallon, Nevada (Figure 1-1). The FRTC is the United States (U.S.) Department of the Navy's (hereafter Navy or DoN) premier integrated strike warfare training complex, supporting air units and special operations forces in a variety of mission areas. Since World War II, the Navy has extensively used the ranges and airspace of the FRTC to conduct military air warfare and ground training, including live-fire training activities. However, the current training areas are insufficient for implementation of realistic training scenarios and to provide required buffers for public safety. In order to effectively meet these needs, the Navy proposes to modernize the land and airspace configurations of the FRTC. The Navy is currently proposing to expand the land administered by NAS Fallon by approximately 680,000 ac (275,200 ha). The proposed expansion areas are broken into four discontinuous areas associated with four of the current training ranges (ranges B-16, B-17, B-20, and Dixie Valley Training Area [DVTA]) (Figure 1-1):

- The area west of B-16 is the proposed B-16 Expansion Area.
- The area surrounding B-20 is the proposed B-20 Expansion Area.
- The areas west and east of B-17 and south of Highway 50, and areas north of Highway 50 surrounding the DVTA are the proposed DVTA expansion areas.
- The area south of B-17 and Highway 50 and east of B-17 is the proposed B-17 Expansion Area.

Currently, the Navy is preparing an Environmental Impact Statement (EIS) to assess the potential environmental effects of the proposed FRTC expansion (hereafter referred to as the FRTC EIS). In support of the EIS, Naval Facilities Engineering Command, Southwest contracted ManTech International Corporation to perform a variety of ecological surveys to inventory the flora and fauna within the proposed FRTC expansion areas. This report details the results of raptor surveys conducted in 2018 under contract N62742-14-D-1863, Task Order N6247317F4650 and in 2019 under Task Order N6247317F4650, Modification #P00001 (Figure 1-1). Helicopter surveys were conducted to document the occurrence of breeding and wintering diurnal raptor species and associated habitat within the proposed FRTC expansion areas. In addition, incidental sightings of nocturnal raptors (i.e., owls) and mammals were also recorded while conducting diurnal raptor surveys and are presented in this report (see Chapter 5).

1.1 SURVEY AREA AND STUDY AREA

For the purposes of this report, all of the proposed expansion areas define the *survey area*, and the entire area depicted on Figure 1-1 is defined as the *study area*. The survey area includes the proposed FRTC expansion areas plus an approximate 0.6-1.2 mile (1-2 kilometer [km]) area around the boundary of the proposed expansion areas.

The study area lies within the geographic feature known as the Great Basin. The Great Basin Desert is the largest desert in the U.S., roughly bounded by the Sierra Nevada – Cascade mountain range to the west and the Rocky Mountains to the east. Between these large mountain ranges are a series of basins interspersed by smaller, north-south running mountain ranges. This desert covers roughly 158,000 square miles (409,218 square km) of southern Idaho, southeastern Oregon, western Utah, eastern California, and nearly all of Nevada (MacMahon 1985). The Great Basin is a high, cold desert, with most of its elevations over 4,000 feet (ft) (1,200 meters [m]), and most of its precipitation comes in the form of snow, although rain showers can occur throughout the year (Sowell 2001).

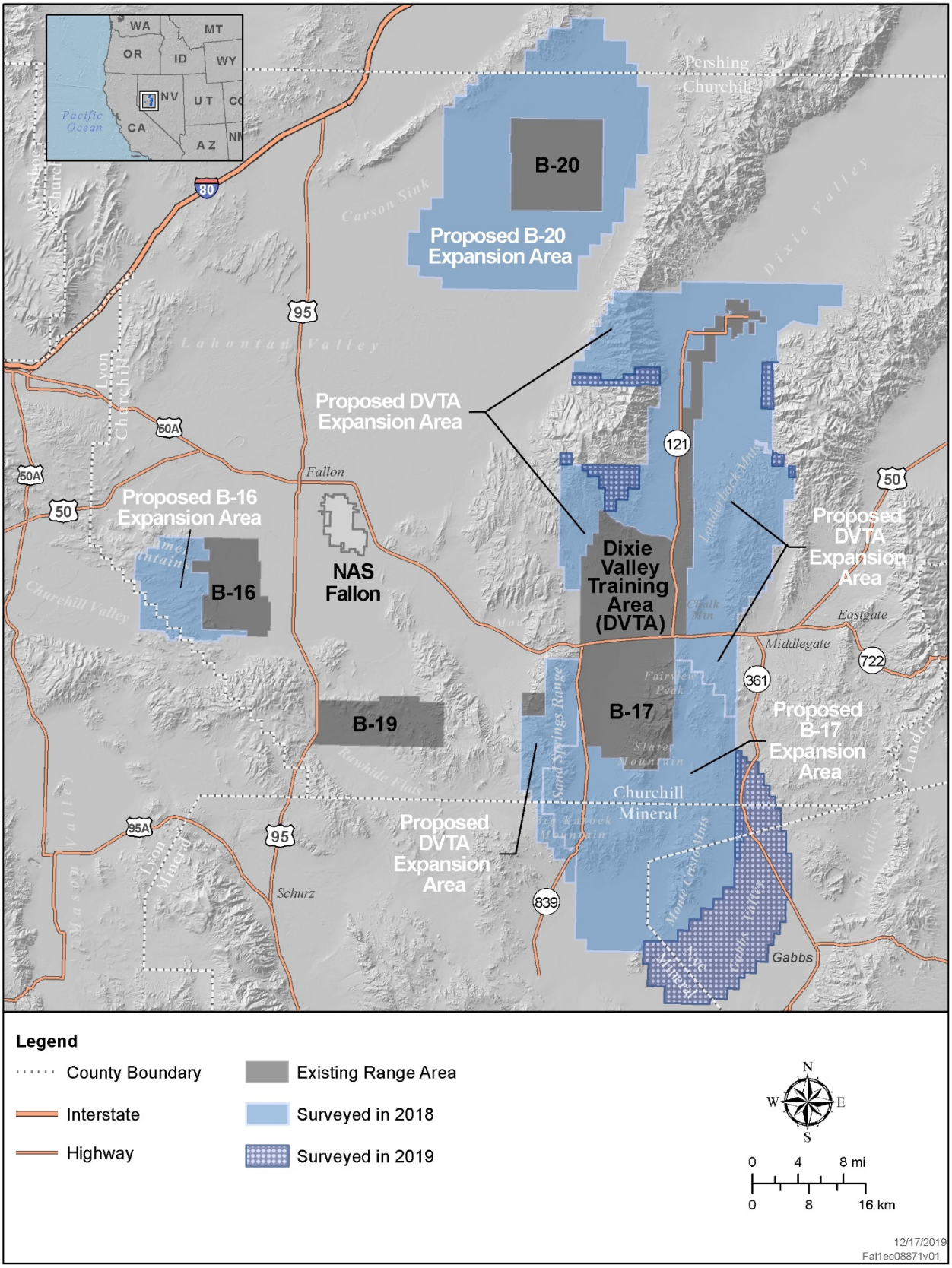

Figure 1-1. Regional Location of the Study Area and Proposed FRTC Expansion Areas

1.1.1 Potential Raptor Habitat within the Proposed Expansion Areas

The most important factors influencing the occurrence of raptors is the presence of suitable foraging and nesting habitat. The following provides an overview of the vegetation communities found within the proposed FRTC expansion areas. In support of the FRTC EIS, mapping and classifying the vegetation within the proposed FRTC expansion areas was conducted as a separate survey effort. The summary below provides the context for potential raptor habitat in relation to the aerial surveys; details can be found in DoN (2019a). The vegetation mapping used the ranks of formation and alliance. Formations can be defined as broad combinations of general dominant growth forms that are adapted to basic temperature (energy budget), moisture, and substrate conditions. Alliances refer to diagnostic species, including some from the dominant growth form or layer (i.e., formation), and moderately similar composition that reflect regional to subregional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes.

Based on the recent vegetation community mapping effort, a total of 25 alliances within 7 formations were recorded within the four proposed FRTC expansion areas (Table 1-1; Figure 1-2 through Figure 1-5). The majority (68%) of the proposed expansion areas consists of shrubland alliances dominated by various species of greasewood (*Sarcobatus* spp.), sagebrush (*Artemisia* spp.), and saltbush (*Atriplex* spp.) (DoN 2019a). These areas support a diverse community of small and medium-sized mammals, birds, and reptiles that are the primary prey of the raptor populations in the survey area (DoN 2019c, d, e).

Although the proposed B-16 Expansion Area is by far the smallest of the expansion areas, it is relatively diverse, with a good representation of upland alliances (Table 1-1 and Figure 1-2). The proposed B-20 Expansion Area is the least diverse, as most of it is a large, unvegetated playa (Table 1-1 and Figure 1-3). However, the margins of the proposed B-20 Expansion Area, particularly at the north end, are more diverse where soils and topography become more complex. The proposed DVTA and B-17 expansion areas have by far the most diverse assemblage of vegetation alliances, consistent with their large size and topographic complexity (Table 1-1; Figure 1-4 and Figure 1-5). The lowest elevations of Dixie Valley are highly complex due to the presence of small seeps and springs as well as development and grazing. The proposed DVTA Expansion Area is the only area that contains mapped riparian alliances.

1.1.2 Topography within the Proposed Expansion Areas

Another important factor influencing the distribution and occurrence of raptors, particularly cliff-nesting species, is the contoured topography and associated slope and structure found within the area. Figure 1-6 through Figure 1-9 depict the topography and slopes between 36 and 78 degrees within and in the vicinity of the proposed FRTC expansion areas. In addition to these areas potentially providing nest and roost sites for raptors, the topography also influences the local movement of air columns, particularly thermals and wind-blown updrafts, which are used by raptors for soaring and hunting. These areas of high slope with associated vegetation areas supporting raptor prey populations would potentially support cliff-nesting raptors within the proposed FRTC expansion areas and were especially targeted during the raptor survey efforts.

Table 1-1. Acreage and Elevation Range of Vegetation Alliances Mapped within the Proposed FRTC Expansion Areas (DoN 2019a)

Formation / Alliance	Elevation (feet)	Area (acres)	Percent of Total	Proposed Expansion Area			
				B-16	B-17	B-20	DVTA
Cool Semi-Desert Scrub & Grassland							
Bailey's Greasewood Shrubland	3,460–7,120	334,009	44.0	X	X	X	X
Black Sagebrush Steppe & Shrubland	3,960–7,440	57,595	7.6		X	X	X
Wyoming Big Sagebrush Dry Steppe & Shrubland	4,320–6,880	47,778	6.3	X	X		X
Basin Big Sagebrush - Foothill Big Sagebrush Dry Steppe & Shrubland	3,400–7,200	16,683	2.2		X	X	X
Big Sagebrush - Mixed Shrub Dry Steppe & Shrubland	3,600–6,920	11,567	1.5	X	X	X	X
Shadscale Saltbush Scrub	3,960–6,000	5,445	0.7	X	X	X	X
Rubber Rabbitbrush - Sand Buckwheat - Four-part Horsebrush Sparse Scrub	3,390–6,600	5,253	0.7	X	X	X	X
Cheatgrass Ruderal Grassland	3,960–6,820	2,929	0.4		X	X	
Nevada Joint-fir Scrub	4,440–7,120	1,045	0.1		X		
Yellow Star-thistle-Dyer's Woad-Prickly Russian Thistle Ruderal Annual Forb	3,960–4,880	1,912	0.3	X	X	X	X
Winterfat Steppe & Dwarf Shrubland	4,080–5,740	276	<0.1		X	X	
Fourwing Saltbush – Rubber Rabbitbrush Desert Wash	3,390–3,450	164	<0.1				X
Bud Sagebrush Shrubland	5,460	29	<0.1		X		
Salt Marsh							
Microphytic Playa	3,390–4,120	136,314	17.9		X	X	X
Intermountain Greasewood Wet Shrubland	3,390–6,600	69,802	9.2	X	X	X	X
Mojave Seablite - Red Swampfire Alkaline Wet Scrub	3,400–4,080	6,740	0.9		X	X	X
Western Wildrye Alkaline Wet Meadow	3,390–4,900	599	<0.1			X	X
Saltgrass Alkaline Wet Meadow	3,390–4,140	439	<0.1		X		X
Cool Temperate Forest & Woodland							
Great Basin Singleleaf Pinyon - Utah Juniper/Shrub Woodland	4,040–7,480	30,038	4.0				X
Utah Juniper/Shrub Woodland	5,000–8,280	9,353	1.2		X		X
Warm Desert & Semi-Desert Scrub & Grassland							
Mojave-Sonoran Burrobrush - Sweetbush Desert Wash Scrub	3,480–6,960	19,380	2.6		X	X	X
Fremont's Smokebush - Nevada Smokebush Desert Wash Scrub	4,200–5,800	1,715	0.2	X	X		
Temperate Flooded & Swamp Forest							
Ruderal Tamarisk Riparian Scrub*	3,410–6,880	183	<0.1				X
Great Basin Fremont Cottonwood Riparian Forest*	5,080–7,280	87	<0.1				X
Shrub & Herb Wetland Formation							
Western Baltic Rush - Mexico Rush Wet Meadow*	3,390–3,440	228	<0.1				X
Temperate to Polar Freshwater Marsh, Wet Meadow & Shrubland							
Arroyo Willow Wet Shrubland*	4,440–6,960	346	<0.1				X

Note: *Riparian alliance

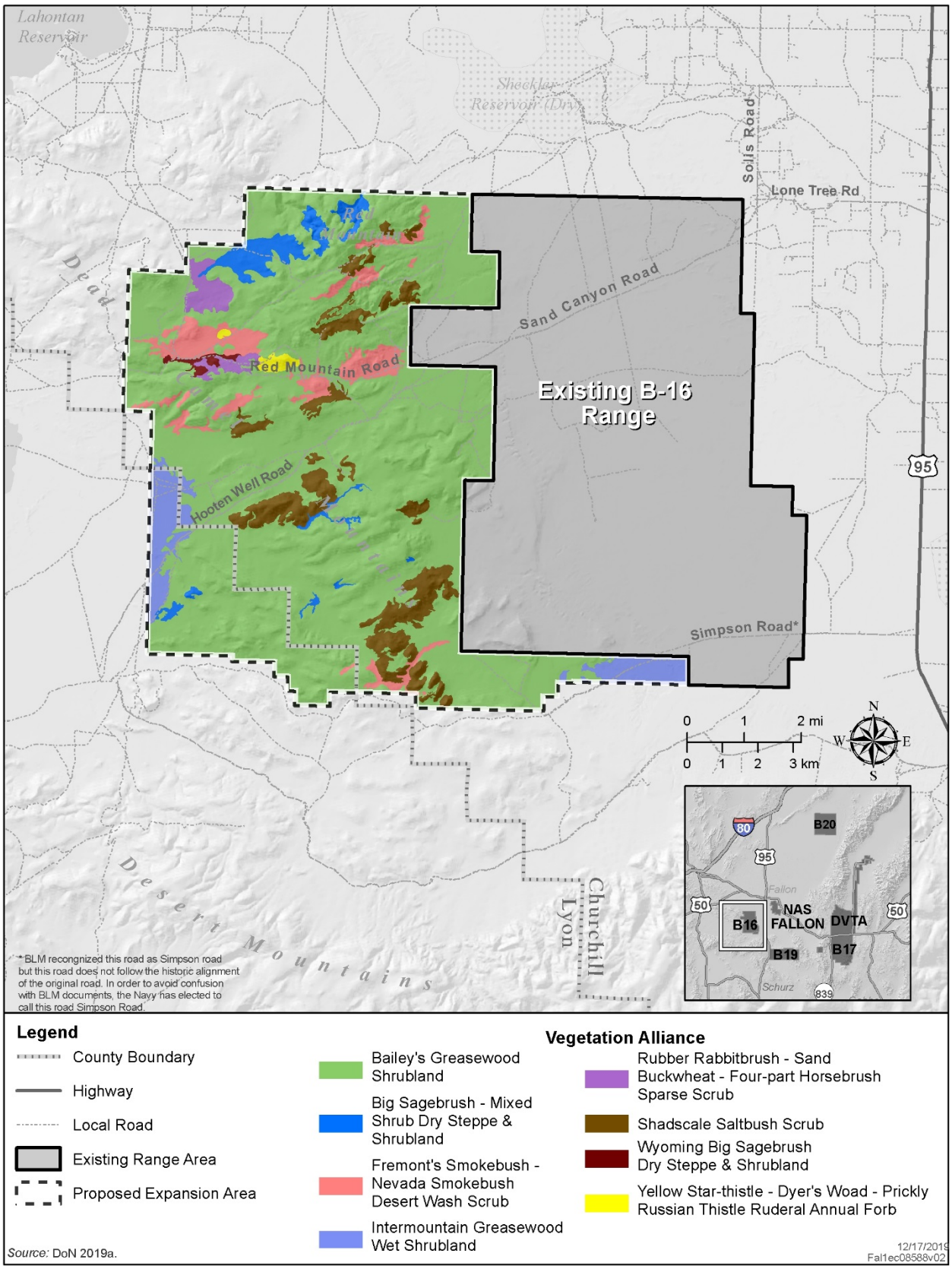

Figure 1-2. Vegetation Alliances within the Proposed B-16 Expansion Area

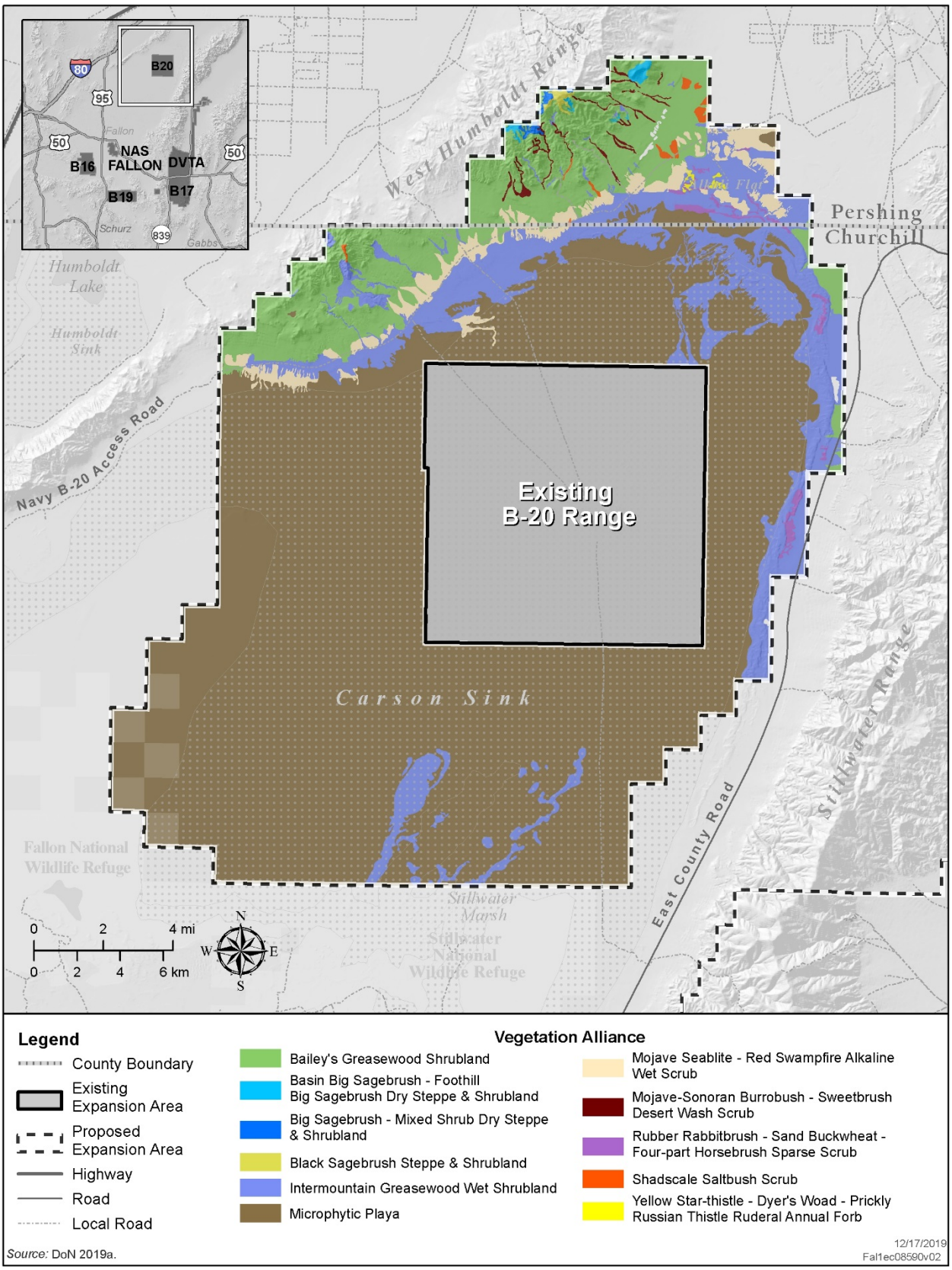

Figure 1-3. Vegetation Alliances within the Proposed B-20 Expansion Area

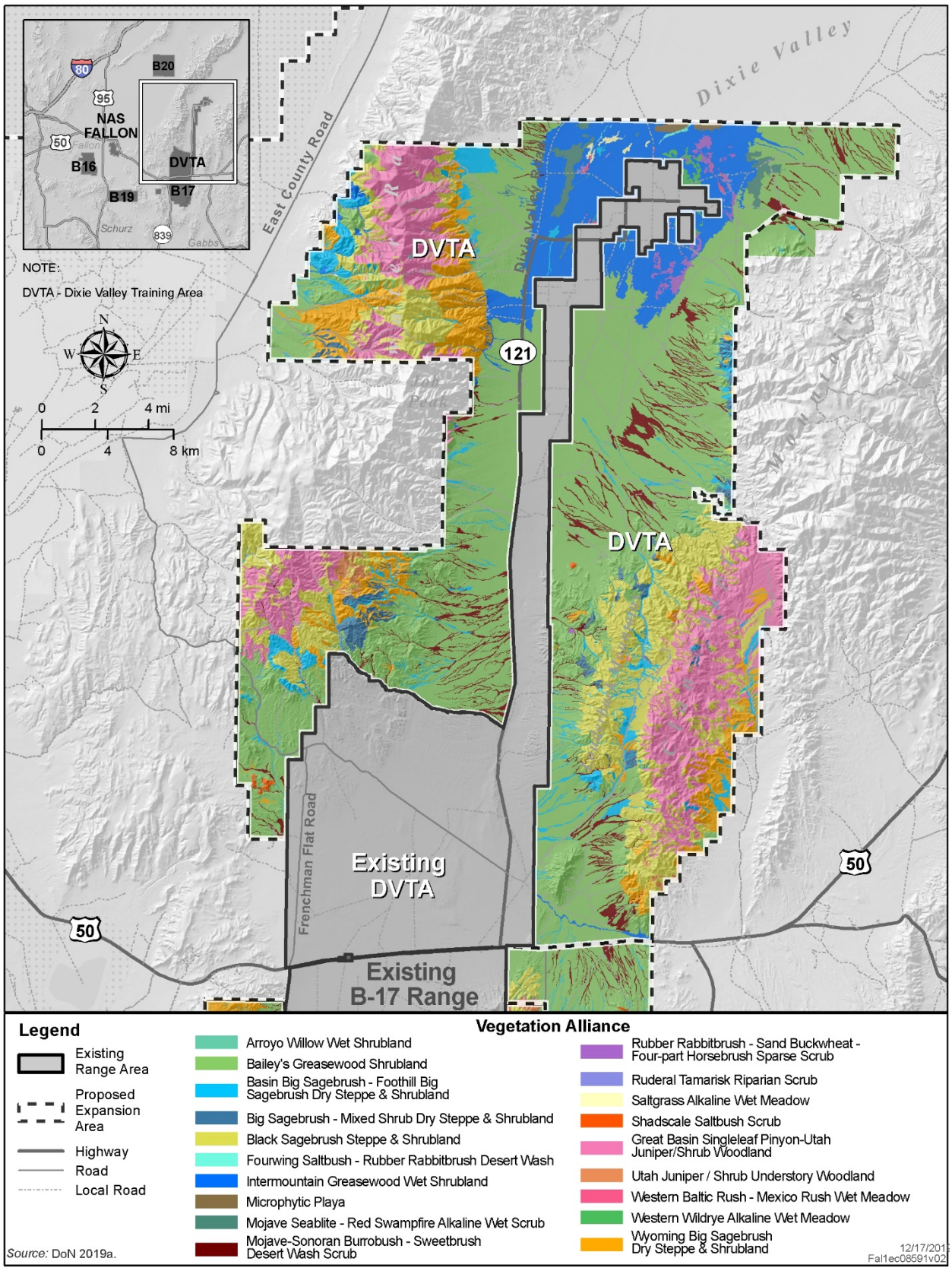

Figure 1-4. Vegetation Alliances within the Proposed Northern DVTA Expansion Area

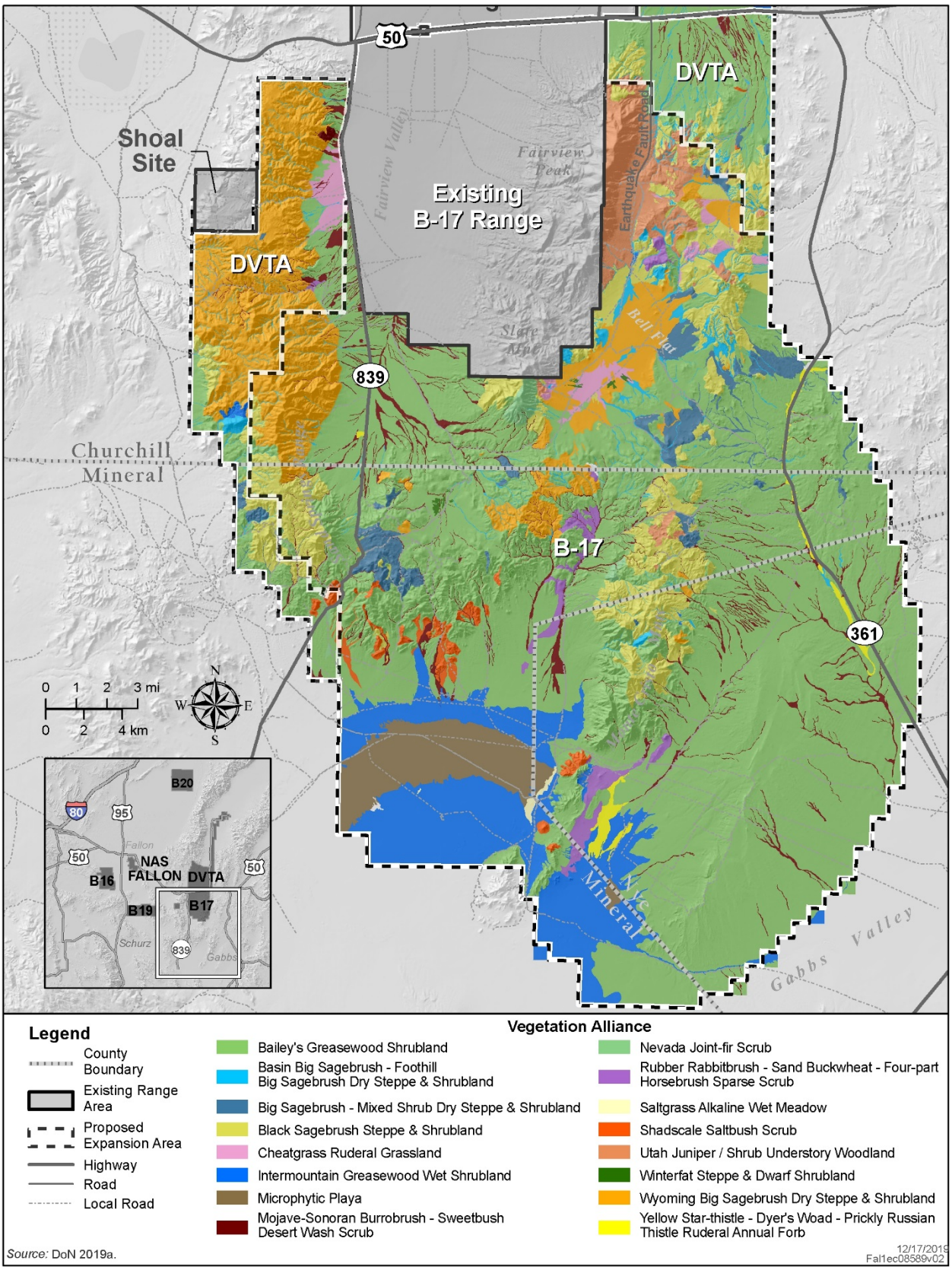

Figure 1-5. Vegetation Alliances within the Proposed B-17 and Southern DVTA Expansion Areas

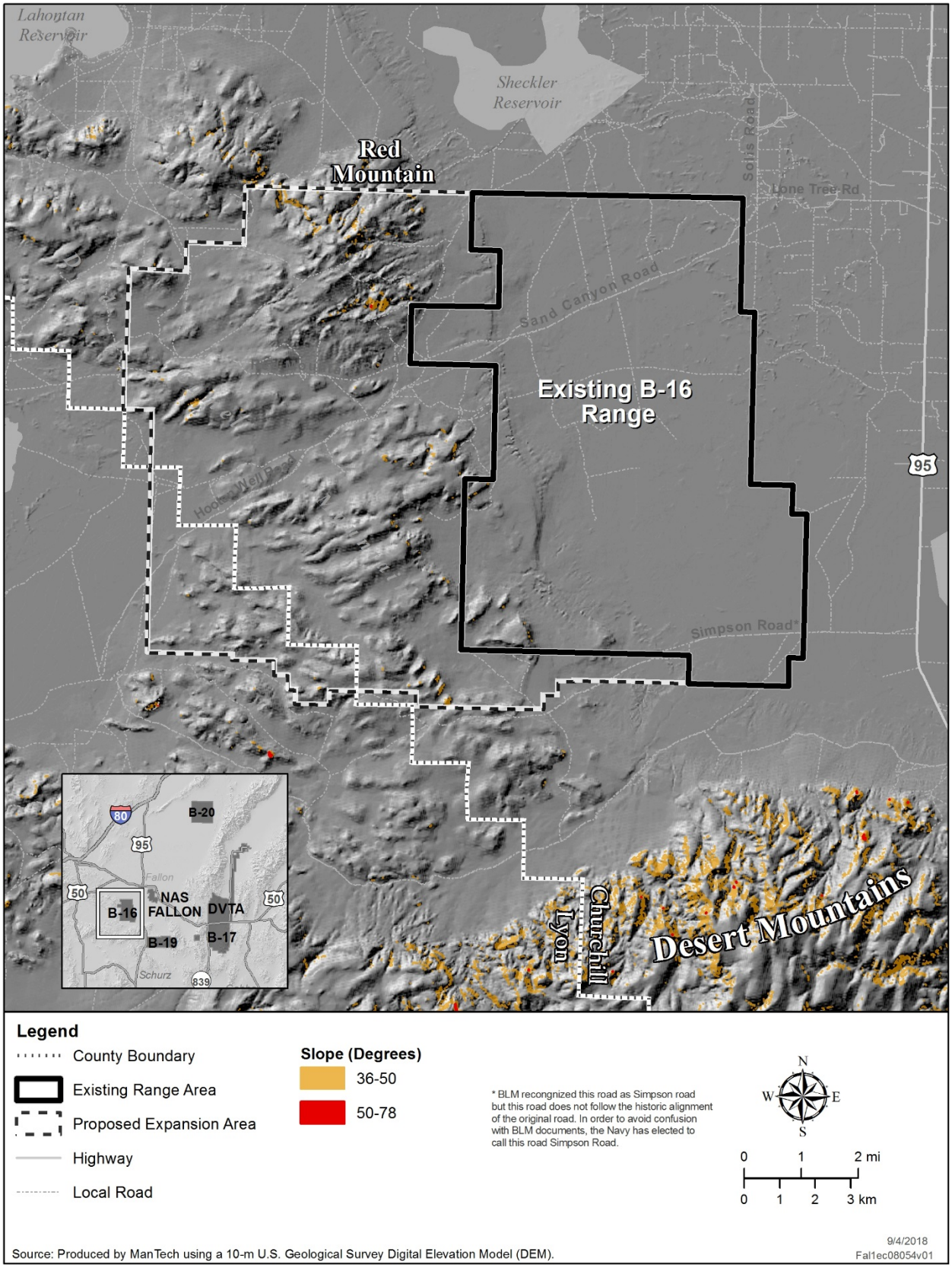

Figure 1-6. Topography and Slope within the Proposed B-16 Expansion Area

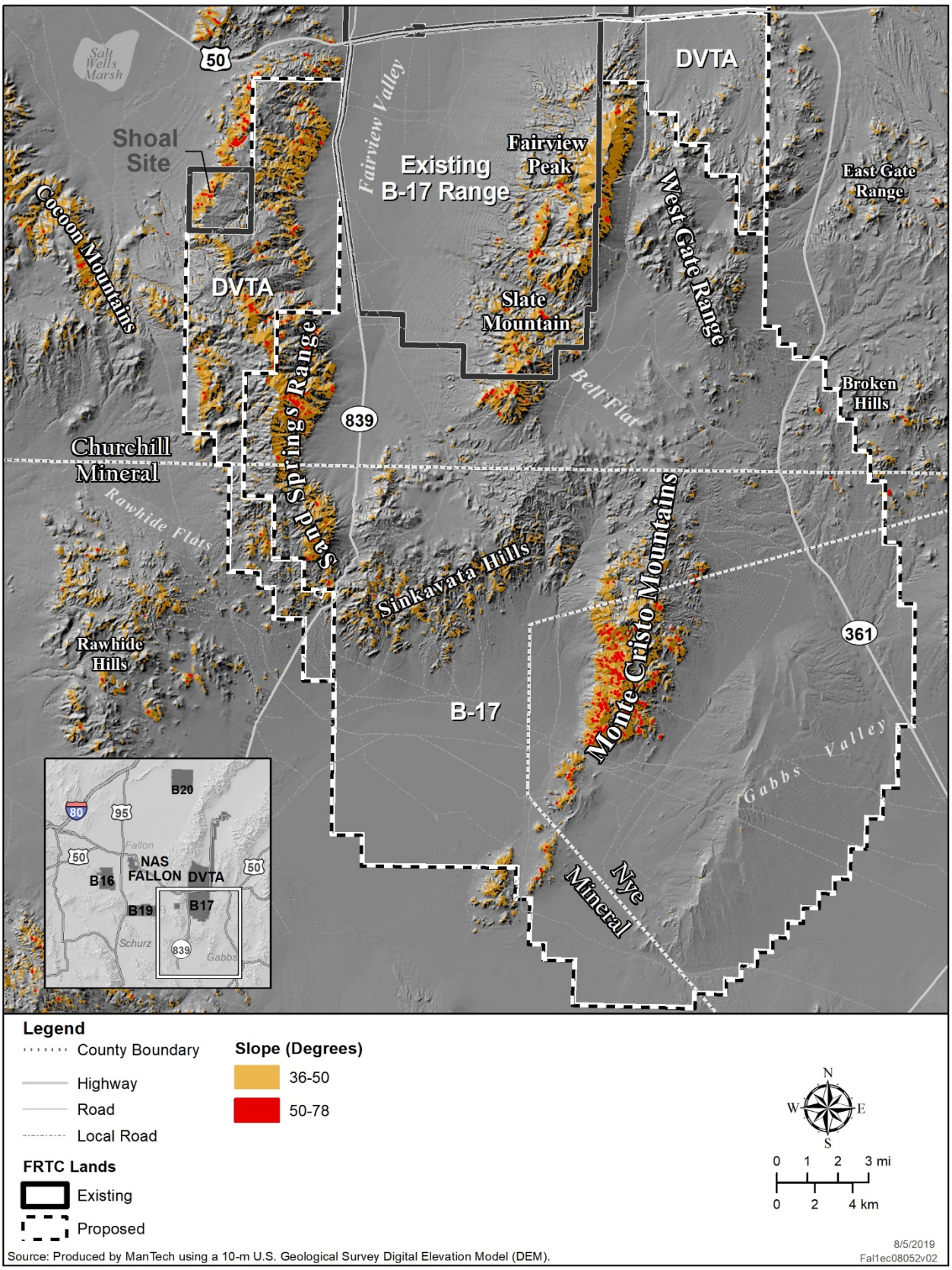

Figure 1-7. Topography and Slope within the Proposed B-17 and Southern DVTA Expansion Areas

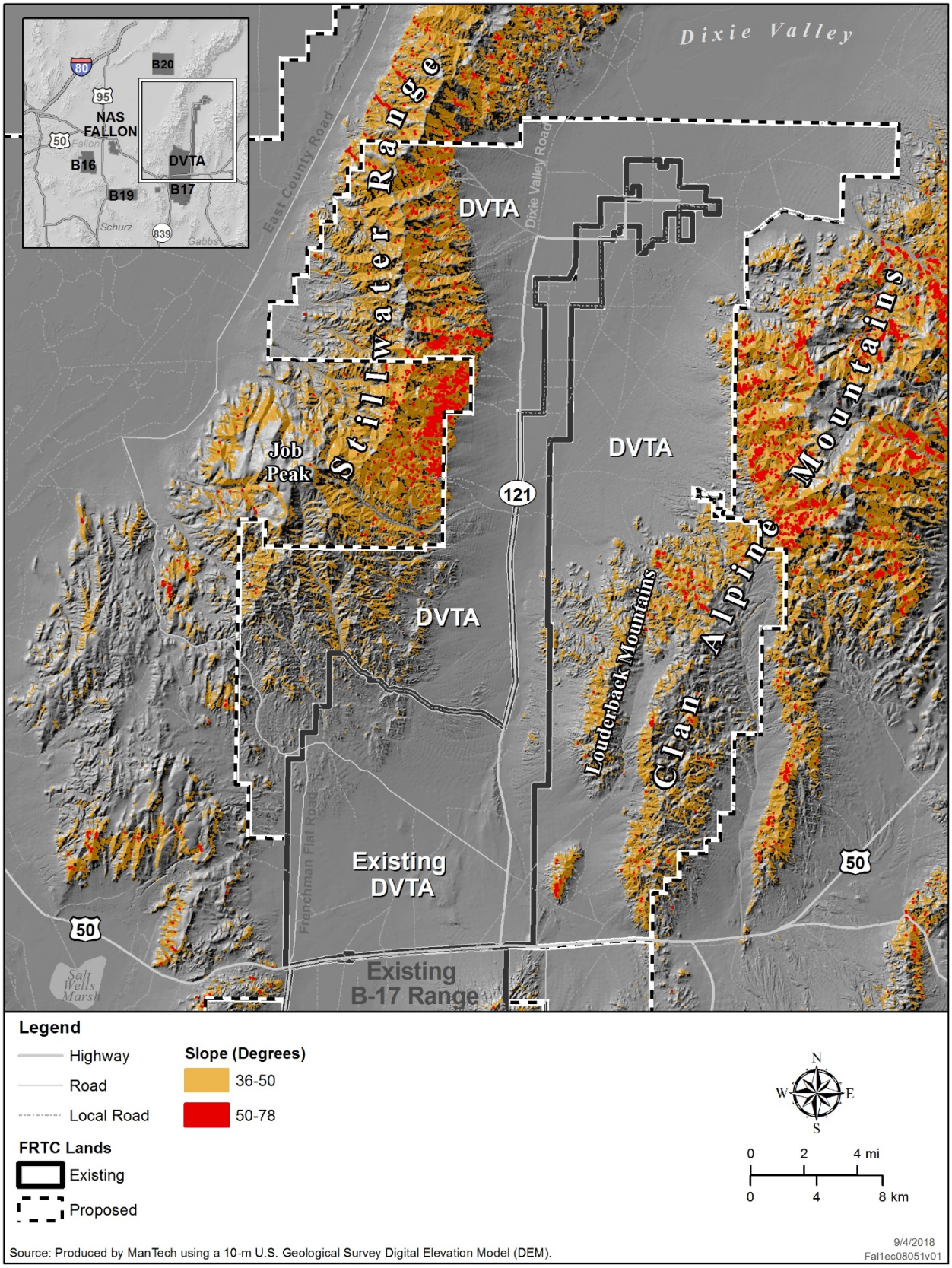

Figure 1-8. Topography and Slope within the Proposed Northern DVTA Expansion Area

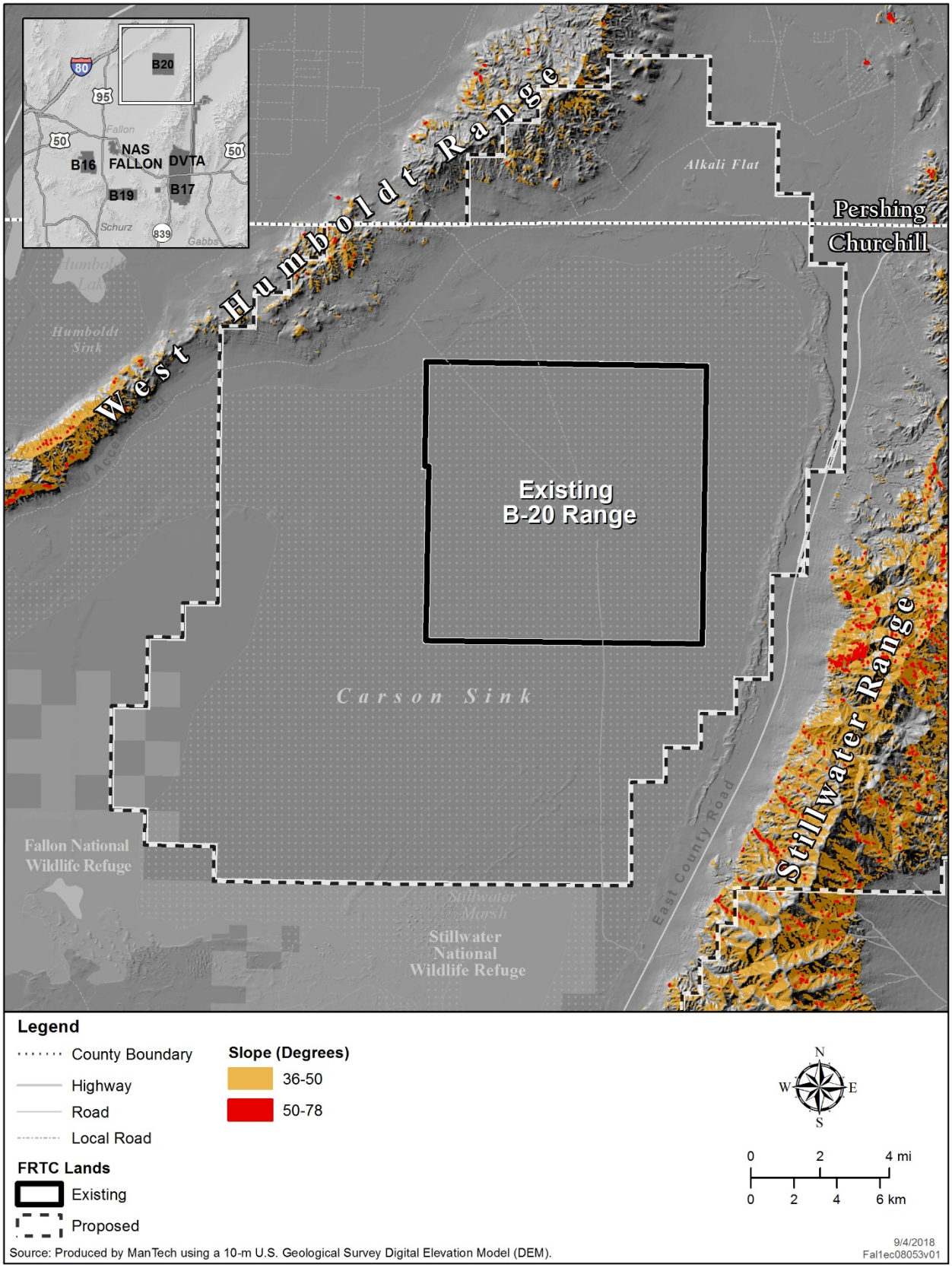

Figure 1-9. Topography and Slope within the Proposed B-20 Expansion Area

1.2 RAPTOR SPECIES ADDRESSED

North American raptors are currently placed in three orders: the diurnal raptors in the Falconiformes and Accipitriformes, and the nocturnal raptors in the Strigiformes (Table 1-2) (Clements et al. 2019). The Falconiformes consists of the family Falconidae which includes the falcons and caracaras. The Accipitriformes consists of the families Pandionidae (osprey) and Accipitridae (hawks, eagles, and kites). Lastly, the Strigiformes (owls) consists of two families: Tytonidae (barn owls) and Strigidae (all other owls).

Table 1-2. Classification of Raptors

Group	Order	Family	Common Name
Diurnal Raptors	Falconiformes	Falconidae	Falcons and Caracaras
	Accipitriformes	Pandionidae	Osprey
		Accipitridae	Hawks, Eagles, and Kites
Nocturnal Raptors	Strigiformes	Tytonidae	Barn Owls
		Strigidae	All other owls

Source: Clements et al. 2018.

The survey efforts covered in this report focus on diurnal raptors (i.e., hawks, eagles, falcons, and osprey; kites and caracaras do not occur within the study area). Although the current surveys did not focus on owls, incidental observations of owls are included (see Chapter 5). Owl surveys were conducted in 2017, 2018, and 2019 as part of general avian surveys and specific burrowing owl (*Athene cunicularia*) surveys were conducted in 2017, 2018, and 2019. Those results are presented in separate survey reports (DoN 2019b, c). In addition, as the common raven (*Corvus corax*) is an important species that influences raptor populations, observed ravens and associated nests were recorded.

1.3 KNOWN RAPTOR OCCURRENCES WITHIN THE STUDY AREA

A total of 16 species of diurnal raptors have been recorded within the study area. These species have various regulatory and conservation status as defined by the U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), Nevada Department of Wildlife (NDOW), and the Nevada Natural Heritage Program (NNHP) (Table 1-3).

- USFWS
  - All 16 raptor species are listed under the Migratory Bird Treaty Act (MBTA).
  - Bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*) are protected pursuant to the Bald and Golden Eagle Protection Act (BGEPA).
  - Four species within the study area are considered Birds of Conservation Concern (BCC) as identified by the USFWS. BCC are species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) (USFWS 2008). The study area falls within Bird Conservation Region 9, Great Basin.
  - No ESA-listed raptor species is known to occur within the study area.
- BLM: 6 species are listed as sensitive species (BLM 2017).
- State of Nevada
  - 2 species are listed as endangered, 1 is listed as sensitive by the State of Nevada.
  - 6 species are listed as Species of Conservation Priority by NDOW in the 2013 Nevada Wildlife Action Plan (WAP) (Nevada WAP Team 2013).
- NNHP: all 16 species are given a conservation status ranking for the State of Nevada (NNHP 2018a).

Table 1-3. Regulatory Status and Occurrence of Raptor Species within the Study Area

Common Name (Scientific Name) [Residency]*	Status*				Occurrence within the Study Area‡[source]						
	USFWS	BLM	State	NNHP	NAS Fallon	DVTA/ EA	B-16/ EA	B-17/ EA	B-19	B-20/ EA	Other
American kestrel (*Falco sparverius*) [BR]	MBTA	-	-	S4	X[2]	X[2,10]		X[2,4]			X[6-8,10,13]
Bald eagle (*Haliaeetus leucocephalus*) [W]	MBTA, BGEPA, BCC	S	E, WAP	S1B,S3N	X[5]	X[6]		X[6]		X[10]	X[6-12,13]
Cooper's hawk (*Accipiter cooperi*) [BR]	MBTA	-	-	S3	X[2]	X[1,2,4]					X[2,6,8,13]
Ferruginous hawk (*Buteo regalis*) [BR]	MBTA, BCC	S	WAP	S2	X[2]					X[6,9]	X[6,8-10,13]
Golden eagle (*Aquila chrysaetos*) [BR]	MBTA, BGEPA, BCC	S	WAP	S4		X[1,2,3,4,5,10]	X[2,5]	X[1,4,5]	X[10]		X[6-10,13]
Merlin (*Falco columbarius*) [M/W]	MBTA	-	-	S3N		X[4]	X[2]				X[6,8,10,13]
Northern goshawk (*Accipiter gentilis*) [BR]	MBTA	S	S, WAP	S2							X[6,8,9]
Northern harrier (*Circus cyaneus*) [BR]	MBTA	-	-	S4		X[1,2,4,10]	X[2]	X[2,4]		X[10]	X[6,7,10,13]
Osprey (*Pandion haliaetus*) [M]	MBTA	-	-	S1B, S3M	X[1,5]						X[8,10]
Peregrine falcon (*Falco peregrinus*) [M]	MBTA, BCC	S	E, WAP	S2		X[4]				X[10]	X[6,8,10,12]
Prairie falcon (*Falco mexicanus*) [BR]	MBTA	-	WAP	S4	X[1,2,5]	X[2,4,5]	X[5]	X[3,4]		X[3]	X[2,6-8,10,12,13]
Red-shouldered hawk (*Buteo lineatus*) [W]	MBTA	-	-	S1							X[6,8, 13]
Red-tailed hawk (*Buteo jamaicensis*) [BR]	MBTA	-	-	S5	X[2,10]	X[2,3,4]	X[10]		X[2]	X[10]	X[2,6-8,10,13]
Rough-legged hawk (*Buteo lagopus*) [W]	MBTA	-	-	S4N		X[1]		X[4,6]			X[8,10,12,13]
Sharp-shinned hawk (*Accipiter striatus*) [BR]	MBTA	-	-	S3		X[1,2]	X[2]				X[6,8,13]
Swainson's hawk (*Buteo swainsoni*) [SB]	MBTA	S	-	S2B	X[1,2,5,10]	X[5]					X[6-10]

Notes:*BCC = Bird of Conservation Concern (USFWS 2008); BGEPA = Bald and Golden Eagle Protection Act; BR = breeding and year-round resident in the study area; E = endangered; EA = Proposed Expansion Area; M = migratory through the study area; MBTA = Migratory Bird Treaty Act; S = sensitive (BLM 2017; Nevada WAP Team 2013); SB = summer resident/breeder within the study area;
W = winter resident in the study area; WAP = Wildlife Action Plan Species of Conservation Priority (Nevada WAP Team 2013).
NNHP Rank Definitions (NNHP 2018a):
S1 = Critically Imperiled – at very high risk of extirpation in the state due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.
S2 = Imperiled – at high risk of extirpation in the state due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
S3 = Vulnerable – at moderate risk of extirpation in the state due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
S4 = Apparently Secure – at fairly low risk of extirpation in the state due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
S5 = Secure – at very low or no risk of extirpation in the state due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.
B = Breeding – conservation status refers to the breeding population of the element in the state.
M = Migrant – migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention.
N = Non-breeding – conservation status refers to the non-breeding population of the element in the state (e.g., wintering bird population).
‡Occurrences do not include data from the raptor-specific surveys addressed in this report. EA = proposed FRTC expansion area; Other = all areas within the study area outside of the existing FRTC ranges and proposed expansion areas.

Sources: [1]NAS Fallon 2008; [2]NAS Fallon 1997; [3]DoN 2019d; [4]DoN 2019c; [5]DoN 2014; [6]NDOW 2017, 2018; [7]Floyd et al. 2007; [8]Alcorn 1988; [9]NNHP 2018b; [10]Herron et al. 1985; [11]McIvor 2005; [12]Lahontan Audubon Society 2007; [13]Hinde and HawkWatch 2011.

1.4 SPECIES DESCRIPTIONS

The sections below provide a brief description of the raptors found, or potentially found, within the study area. This summary is not intended to be a thorough literature review of each species, but is background information to familiarize the reader with the species. A summary of the past occurrences of each species within the study area is provided in Sections 1.5 (Winter Occurrences) and 1.6 (Nesting Occurrences) of this report. Chapter 3 (Results) provides a summary of occurrences of species within the study area based upon the 2018 and 2019 winter and breeding surveys covered in this report.

Unless referenced otherwise, the following descriptions are based upon the following sources: Herron et al. (1985), Floyd et al. (2007), Great Basin Bird Observatory (GBBO) (2010), and Nevada WAP Team (2013).

Osprey (*Pandion haliaetus*)

Habitat. As ospreys feed almost exclusively on fish, they are found near bodies of water such as lakes, reservoirs, rivers, and coastlines.

Breeding. Breeding in Nevada begins in April with courtship, copulation, and nest building. The nest platform is large, typically composed of sticks, and is placed in live or dead trees near water, although they do nest on cliffs, the ground, and man-made structures (e.g., power poles, channel buoys, cell towers, and nesting platforms designed specifically for ospreys). Eggs are typically laid in late April/early May but may extend into June with a clutch size of 2-4. Young fledge in late July and early August and are dependent on their parents for another 4-6 weeks.

Osprey
(*Photo*: P. Schiesser)

Prey. Feeds almost exclusively on fish, but also rarely on small waterfowl, amphibians, and reptiles.

Status in Nevada. The NNHP considers the breeding population in Nevada as critically imperiled due to its restricted range and few breeding populations, and considers the migratory population as vulnerable due to its restricted range and relatively few populations or occurrences (Table 1-3).

Seasonal Occurrence in the Study Area. Although often observed during the summer months in Nevada, most birds are wandering non-breeders or migrating individuals. Floyd et al. (2007) lists the only breeding occurrences as Lake Tahoe and Lahontan Reservoir. Ospreys leave Nevada beginning in September to migrate to their southern winter ranges. Within the study area, ospreys have been observed on NAS Fallon (NAS Fallon 2008). There are no NDOW or NNHP records of osprey within the study area (NDOW 2018; NNHP 2018b). Ospreys are considered rare within the study area during summer and spring and fall migration.

Northern harrier (*Circus cyaneus*)

Northern Harrier (male)
(*Photo*: T. Avery, Macaulay Library)

Habitat. Occurs in open country including grasslands, sagebrush, agricultural areas, and marshes (note: its previous common name was marsh hawk).

Breeding. Courtship displays typically begin in late March/early April. The nest is constructed on the ground and consists of sticks and grasses, lined with finer vegetation. Eggs are typically laid from late April to late May with a clutch size of 4-6. Young fledge in July or August and are dependent on their parents for several more weeks. Harriers exhibit sexually dimorphic coloration as adults with the female being brownish, whereas the male is grayish.

Prey. Harriers feed on a wide variety of prey such as small birds (usually juvenile passerines), reptiles, amphibians, and insects but rodents, particularly voles and mice, are the primary prey. Harriers can be easily identified by their characteristic hunting method: coursing low and slow over open, usually grassy, flat, or rolling habitat. They locate prey by sight and sound, and the harrier is the only hawk with an owl-like facial disc with stiff facial feathers helping to direct sound to the ears, helping it hear mice and voles beneath the vegetation.

Status in Nevada. The NNHP considers the northern harrier as apparently secure due to its extensive range and numerous populations (Table 1-3).

Seasonal Occurrence in the Study Area. The northern harrier is a common year-round resident within the study area (refer to Sections 1.5 and 1.6).

Sharp-shinned hawk (*Accipiter striatus*)

Sharp-shinned Hawk
(*Photo*: R. Spaulding)

Habitat. The smallest of the three accipiter hawks in the study area, sharp-shinned hawks typically occur in mid-elevation coniferous forests and brushy habitats. In winter, they can move down in elevation and can be found in deciduous woodlands, agricultural areas, and city suburbs and parks.

Breeding. A clutch of 4-5 eggs are typically laid in a stick nest beginning in late May/early June. Fledging occurs in late July/early August.

Prey. The sharp-shinned hawk feeds almost exclusively on small birds; however, small mammals, reptiles, and insects are also utilized.

Status in Nevada. The NNHP considers the species as vulnerable due to its restricted range and relatively few populations or occurrences (Table 1-3).

Seasonal Occurrence in the Study Area. The sharp-shinned hawk is an uncommon, secretive year-round resident within the study area (refer to Sections 1.5 and 1.6).

Cooper's hawk (*Accipiter cooperi*)

Cooper's Hawk
(*Photo*: J. Corcoran)

Habitat. The most common accipiter hawk in Nevada, Cooper's hawks are found primarily in montane forested habitats such as cottonwood, aspen, and conifer, and pinyon-juniper woodlands often near riparian habitat. Wintering birds are found in open or broken habitats including river bottoms, foothills, grasslands, agricultural areas, marshes, and urban areas with woodlands such as parks, cemeteries, and backyards.

Breeding. Pair bonding and courtship begins around mid- to late April with egg laying starting in early May. A typical clutch of 3-5 eggs is laid in stick nests typically constructed in deciduous trees, with aspen and cottonwood being the most common, although conifers are also used. Fledging occurs around end of June/early August and the young are dependent on their parents for another 6-7 weeks.

Prey. Primarily a bird-hunting hawk, Cooper's hawks also prey on small mammals (e.g., chipmunks, squirrels) and reptiles.

Status in Nevada. The Cooper's hawk is considered vulnerable by the NNHP (Table 1-3).

Seasonal Occurrence in the Study Area. The Cooper's hawk is a relatively common year-round resident within the study area (refer to Sections 1.5 and 1.6).

Northern goshawk (*Accipiter gentilis*)

Northern Goshawk
(*Photo*: N. Kenntnern)

Habitat. The largest of the three accipiter species in North America, northern goshawks are found mostly in extensive mature forests, and within the study area is expected to be found primarily within upper elevation montane areas supporting aspen and coniferous woodlands. In the winter, they can be found in forested areas within lower foothill and valley bottoms.

Breeding. Goshawks in Nevada usually nest in mature aspen stands with trees large enough to support their substantial stick nest. This association with aspen in Nevada is somewhat unique, for in most other parts of the western U.S. goshawks more typically nest in coniferous forests. Eggs are laid from mid-April to mid-June with a typical clutch of 2-4 eggs. Fledging occurs around mid-June to August.

Prey. Goshawks typically prey on small and medium-sized birds and mammals, including tree squirrels, ground squirrels, as well as cottontails (*Sylvilagus* spp.).

Status in Nevada. The goshawk is a BLM and Nevada Sensitive Species, Species of Conservation Priority under the Nevada WAP, and ranked by the NNHP as imperiled due to its restricted range and few populations within the state (Table 1-3).

Seasonal Occurrence in the Study Area. The goshawk is a year-round resident within the study area (refer to Sections 1.5 and 1.6).

Ferruginous Hawk (*Buteo regalis*)

Ferruginous Hawk
(*Photo*: M. Ball)

Habitat. The largest North American buteo, ferruginous hawks occupy arid, open country with grasslands, sagebrush, saltbush-greasewood shrubland, and periphery of pinyon-juniper and other woodland communities. In Nevada, they reportedly prefer landscapes where human presence is minimal, and are generally more sensitive to nest disturbances than most other raptors.

Breeding. Nest construction begins in March and ferruginous hawks build their large stick nests in trees, on cliffs, bluffs and cutbanks, rock pinnacles, and even on the ground, but also on man-made structures such as power poles. A clutch of 2-4 eggs is laid in early April with fledging occurring around late June.

Prey. The primary prey of ferruginous hawks is small and medium-sized mammals, particularly ground squirrels, black-tailed jackrabbits (*Lepus californicus*), and cottontails. Birds, reptiles, amphibians, and even insects are also occasionally taken.

Status in Nevada. The ferruginous hawk is a USFWS Bird of Conservation Concern, BLM Sensitive Species, Conservation Priority Species under the Nevada WAP, and ranked by the NNHP as imperiled due to its restricted range and few populations within the state (Table 1-3).

Seasonal Occurrence in the Study Area. Ferruginous hawks are an uncommon year-round resident within the study area (refer to Sections 1.5 and 1.6).

Red-tailed hawk (*Buteo jamaicensis*)

Red-tailed Hawk
(*Photo*: M. Ball)

Habitat. The most common and widespread raptor in North America, red-tailed hawks occupies a wide variety of habitats but generally favors open habitat studded with elevated natural or man-made perches. They can be found in forest edges bordering grasslands, shrub-scrub, or other open areas, as well as parks, cemeteries, and agricultural areas.

Breeding. Courtship and nest building begin in early spring. The large stick nest can be built in a tree, on a cliff ledge or pothole, telephone or power pole, and cell towers. A clutch of 2-4 eggs are laid in April with the young fledging in July or August. After fledging, the young may remain with the parents for a month before becoming independent.

Prey. This species hunts a wide array of small to medium-sized prey including rodents, jackrabbits, cottontails, ground squirrels, snakes, and birds.

Status in Nevada. The red-tailed hawk is considered secure by the NNHP (Table 1-3).

Seasonal Occurrence in the Study Area. The most common year-round raptor in the study area (refer to Sections 1.5 and 1.6).

Swainson's hawk (*Buteo swainsoni*)

Swainson's Hawk
(*Photo*: D. Burkett)

Habitat. Swainson's hawks are typically found in open areas, particularly grasslands and shrub/scrub habitats with scattered trees often near riparian areas; also found in proximity to agricultural fields.

Breeding. Swainson's hawks arrive on their nesting territories within the study area in April and May. A typical clutch of 2 eggs is laid in a buteo-style stick nest often in an isolated tree or small clump of trees. Fledging occurs around July or August

Prey. Preys primarily on small mammals including ground squirrels, rabbits, and voles and other rodents, but will also capture snakes, small birds, and reptiles.

Status in Nevada. The Swainson's hawk is a BLM Sensitive Species and the NNHP considers the breeding population in Nevada as imperiled due to its restricted range and few breeding populations (Table 1-3).

Seasonal Occurrence in the Study Area. Swainson's hawks are uncommon within the study area during summer and spring and fall migration (refer to Sections 1.5 and 1.6). Wintering in South America, Swainson's hawks typically arrive within the study area in April and depart in October.

Rough-legged hawk (*Buteo lagopus*)

Rough-legged Hawk
(*Photo*: National Audubon Society)

Habitat. While wintering in the study area, rough-legged hawks favor open treeless habitat with a grassy or shrub/scrub component, but also agricultural lands.

Breeding. Breeds in the Arctic tundra.

Prey. During winter, rough-legged hawks feed primarily on small to medium-sized mammals such as rodents, ground squirrels, and rabbits.

Status in Nevada. The NNHP considers the species wintering population in Nevada as apparently secure due to its extensive range and numerous populations (Table 1-3).

Seasonal Occurrence in the Study Area. A species that nests in the North American Arctic, rough-legged hawks are relatively common within the study area during spring and fall migration and winter (refer to Sections 1.5 and 1.6). They typically arrive in late October/early November and head back north in March or April.

Red-shouldered hawk (*Buteo lineatus*)

Red-shouldered Hawk
(*Photo*: J.C. Avise)

Habitat. Generally considered an eastern species, a western population of red-shouldered hawks is found in California and Oregon where it favors forested bottomlands, deciduous and deciduous-coniferous forests, and riparian stands of oak.

Breeding. Not known to breed in the study area.

Prey. The red-shoulder's diet is broad, although small mammals (especially chipmunks, mice, and voles) comprise the bulk of its diet, with small birds and insects also occasionally taken.

Status in Nevada. Although considered critically imperiled by the NNHP (Table 1-3), this is primarily due to its recent range extension from California into Nevada and the few records in the state.

Seasonal Occurrence in the Study Area. The red-shouldered hawk is considered a rare winter visitor to the study area, with the few records occurring near urban areas (refer to Sections 1.5 and 1.6).

Bald eagle (*Haliaeetus leucocephalus*)

Bald Eagle
(*Photo*: M. Ball)

Habitat. The bald eagle is associated with open water areas including lakes, reservoirs, wetlands, and rivers.

Breeding. Not known to nest within the study area; a small breeding population of 3-5 nesting pairs occurs west of the study area at the Lahontan Reservoir.

Prey. Feeds primarily on fish and waterfowl, but also carrion.

Status in Nevada. The bald eagle is protected under the provisions of BGEPA. It is also a USFWS Bird of Conservation Concern, a BLM sensitive species, listed as endangered by the State of Nevada, a Nevada Species of Conservation Priority under the Nevada WAP, and ranked as critically imperiled (breeding)/vulnerable (non-breeding) by the NNHP (Table 1-3).

Seasonal Occurrence in the Study Area. Bald eagles primarily occur in the study area during the winter (refer to Sections 1.5 and 1.6).

Golden eagle (*Aquila chrysaetos*)

Golden Eagle
(*Photo*: M. Ball)

Habitat. The golden eagle typically occupies open canyon land, desert, grassland, and shrub habitat.

Breeding. Although golden eagle pairs remain in the vicinity of nest sites/territories year-round and courtship may occur during any month, courtship and pair bonding typically begins in earnest in late January/February. Construction of a new or refurbishment of an existing stick nest begins soon after. Nest sites are most often on cliffs or bluffs, less often in trees, and occasionally on the ground. Pairs typically have multiple nests, which they may use in rotation. Nests that are reused year after year can become quite large. Typically, two eggs are laid in March/April and fledging occurs around June/July.

Prey. Feeds predominantly on small to medium-sized mammals (e.g., ground squirrels, jackrabbits, marmots); may also eat snakes, birds (e.g., chukar [*Alectoris chukar*], quail), and carrion.

Status in Nevada. The golden eagle is protected under the provisions of BGEPA. It is a USFWS Bird of Conservation Concern, BLM Sensitive Species, Nevada Species of Conservation Priority under the Nevada WAP, and ranked by the NNHP as apparently secure (Table 1-3).

Seasonal Occurrence in the Study Area. Although found year-round in Nevada, golden eagles are especially abundant during winter when transients from other states overwinter. Golden eagles are expected to occur year-round throughout the study area in canyons, foothills, valley bottoms, and mountains (refer to Sections 1.5 and 1.6).

American kestrel (*Falco sparverius*)

American Kestrel
(*Photo*: National Audubon Society)

Habitat. The smallest falcon and most common raptor in Nevada, kestrels occur in almost any open habitat supporting open ground or short vegetation, including agricultural lands or riparian vegetation that supports an abundant prey base.

Breeding. Breeding generally occurs from April through June. Like other falcons, kestrels do not build a nest but nest in tree cavities typically excavated by woodpeckers. However, in areas lacking suitable tree cavities, they commonly nest on cliffs, and will also appropriate the nests of corvids. They also utilize man-made structures such as barns and artificial nest boxes. A typical clutch is 4-5 eggs and young fledge approximately 2 months after laying, generally around June or July.

Prey. The kestrel's diet is varied and ranges from earthworms to small birds, reptiles, and mammals. During summer, large insects such as grasshoppers and crickets are taken. However, in winter, small rodents are the primary food item, supplemented with small birds.

Status in Nevada. Kestrels are ranked by the NNHP as apparently secure (Table 1-3).

Seasonal Occurrence in the Study Area. Kestrels are common year-round residents within the study area (refer to Sections 1.5 and 1.6).

Merlin (*Falco columbarius*)

Merlin
(*Photo*: B. Sullivan, Macaulay Library)

Habitat. Found within the study area only in winter and during migration, merlins are generally associated with open habitats, especially wetlands, riparian edges, and agricultural areas.

Breeding. Merlins breed in the northern states and are not known to nest within the study area.

Prey. Merlins are hunters of small to medium-sized birds, and in winter within the study area, probably prey on horned larks (*Eremophila alpestris*), sparrows, and finches near agricultural fields and shorebirds near lakes and reservoirs.

Status in Nevada. The NNHP considers the nesting populations as vulnerable due to its restricted range and relatively few populations or occurrences (Table 1-3).

Seasonal Occurrence in the Study Area. Merlins are considered rare visitors within the study area during winter and migration.

Peregrine falcon (*Falco peregrinus*)

Peregrine Falcon
(*Photo*: R. Spaulding)

Habitat. The peregrine falcon can be found in a wide variety of habitats but is typically found in open, unencumbered terrain, especially near water (e.g., lakes, reservoirs). They frequent cliffs where they have a wide view of the surrounding airspace and potential avian prey.

Breeding. Peregrines nest on steep cliffs where nest 'construction' consists merely of making a scrape or depression in the soil or litter that accumulates on ledges and potholes. They will occasionally adopt old common raven nests. Historically uncommon in Nevada, there are no records of nesting peregrines in the study area.

Prey. An aerial and high-speed specialist, the peregrine falcon preys on a wide variety of predominantly avian prey, ranging in size from small passerines to waterfowl, with a preference for doves and pigeons.

Status in Nevada. The peregrine falcon is a USFWS Bird of Conservation Concern, BLM sensitive species, Species of Conservation Priority under the Nevada WAP, listed as endangered by the State of Nevada, and ranked as imperiled by the NNHP (Table 1-3).

Seasonal Occurrence in the Study Area. Peregrine falcons are expected to be uncommon year-round visitors in the study area in areas where prey concentrate, including marshes, lake shores, rivers, and river valleys.

Prairie falcon (*Falco mexicanus*)

Prairie Falcon
(*Photo*: M. Ball)

Habitat. A cliff-nesting raptor typically found adjacent to arid valleys with low vegetation such as sagebrush, salt desert, and scrub shrublands; also occur in agricultural lands, especially during the winter months.

Breeding. Similar to the peregrine, typically nests in pothole or well-sheltered ledge on rocky, vertical cliff by making a scrape or depression in the soil or litter that accumulates on ledges and potholes. May also use an old nest of common ravens or other raptors. A typical clutch of 4-5 eggs are laid in March and fledging generally occurs around May or June.

Prey. Primarily feeds on mammals (especially ground squirrels and rabbits), lizards, snakes, and birds, generally up to size of quail.

Status in Nevada. The prairie falcon is a Species of Conservation Priority under the Nevada WAP and ranked by the NNHP as apparently secure (Table 1-3).

Seasonal Occurrence in the Study Area. Prairie falcons are uncommon year-round residents in the study area (refer to Sections 1.5 and 1.6).

1.5 WINTER OCCURRENCES OF RAPTOR SPECIES WITHIN THE STUDY AREA (2003-2018)

Previous occurrences of wintering raptors within the study area are based upon two sources: 2003-2011 survey data from Hinde and HawkWatch International (Hinde and HawkWatch 2011) and 2012-2018 NDOW survey data (NDOW 2018). They are briefly summarized below. In addition, while NNHP data for raptors within the study area were obtained, the data were simply a compilation of the NDOW data (NNHP 2018b) and no additional occurrences were included.

Hinde and HawkWatch (2011) provides a summary of roadside counts of wintering raptors conducted in 10 different areas of Nevada and Utah. Surveys were conducted in December and January of each year from 2003 through 2011 (i.e., December 2003 and January 2004, December 2004 and January 2005, etc.). Surveys encompassed locations known to be major concentration areas for wintering raptors. Three of the five survey areas in Nevada are within the study area: Fallon, Lovelock (approx. 46 miles north of Fallon), and Yerington (approx. 36 miles southwest of Fallon) (Figure 1-10). The survey areas consist of agricultural, pasture, and natural grassland/woodland habitats bounded by mountains and low desert.

Table 1-4 summarizes the species and numbers of each species that were observed during each survey period and Figures 1-10 through 1-13 depict the occurrences (Hinde and HawkWatch 2011). Data from the three survey areas are combined for each December/January survey period. Although geographic information system (GIS) data were not available for the Hinde and HawkWatch data, all raptor observations were within the vicinity of the towns for which the survey areas are named (i.e., Fallon, Lovelock, and Yerington).

Of the 16 raptor species known to occur within the study area, 14 are expected to occur during winter (Table 1-3), and 12 were observed during at least 1 of the 8 HawkWatch survey periods (Table 1-4). Only the peregrine falcon and northern goshawk were not observed (Hinde and HawkWatch 2011). Overall, the most common species was the red-tailed hawk followed by American kestrel, northern harrier, and rough-legged hawk. The least observed were red-shouldered hawk, merlin, and bald eagle.

Table 1-4. Winter Occurrences of Raptor Species within the Study Area (2003-2011)*

Species	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Bald Eagle	2	0	0	0	1	0	0	0
Golden Eagle	3	1	0	1	1	0	0	2
Ferruginous Hawk	24	31	11	11	6	5	5	24
Red-shouldered Hawk	0	0	0	0	1	0	0	0
Red-tailed Hawk	164	169	119	136	127	109	82	281
Rough-legged Hawk	24	11	10	18	21	23	11	14
Cooper's Hawk	0	0	0	1	2	0	0	2
Sharp-shinned Hawk	0	1	0	0	1	0	0	6
American Kestrel	41	20	12	52	30	37	23	67
Merlin	0	0	0	0	0	3	0	1
Prairie Falcon	15	15	13	7	13	11	9	27
Northern Harrier	39	11	26	37	28	26	22	89
No. Species Observed	8	8	6	8	11	7	6	10

Source: Hinde and HawkWatch 2011.

Notes: *Listed data are combined from only those survey routes within the study area: Lovelock, Fallon, and Yerington. Fallon data are from 2003-2009, Lovelock data are from 2003-2011, and Yerington data are only from 2010/11.

Since 2007, NDOW has conducted annual winter raptor road surveys throughout Nevada in January and February (Jeffress 2017). Of the approximate 55 routes, 5 are within the study area: Timber Lake, Foxtail Lake, Lahontan Reservoir, Lovelock, and Walker Lake. Although habitat within the NDOW survey areas is similar to that of the Hinde and HawkWatch surveys, the NDOW surveys also included areas of open water such as lakes, reservoirs, and rivers. Table 1-5 summarizes the species and numbers of each species that were observed during January and February of each year from 2012 through 2018. Figure 1-10 through Figure 1-13 depict the occurrences (NDOW 2018). Note that some occurrences are recorded from the same location in the same year and across years, so the figures do not depict all the individual detections listed in Table 1-5.

Table 1-5. Winter Occurrences of Raptor Species within the Study Area (2012-2018)*

Species	2012	2013	2014	2015	2016	2017	2018
Bald Eagle	0	5	2	1	1	4	2
Golden Eagle	1	4	4	1	8	4	7
Ferruginous Hawk	1	0	17	20	28	6	1
Red-shouldered Hawk	0	0	0	1	0	0	0
Red-tailed Hawk	4	17	111	272	323	88	69
Rough-legged Hawk	1	6	28	26	14	24	16
Swainson's Hawk	1	0	0	0	0	0	3
Cooper's Hawk	0	0	3	3	1	3	2
Sharp-shinned Hawk	0	0	0	2	0	0	2
American Kestrel	2	0	20	24	24	8	13
Merlin	0	0	0	0	0	0	1
Peregrine Falcon	0	0	0	1	0	0	0
Prairie Falcon	0	0	14	16	9	5	10
Northern Harrier	0	19	23	81	25	30	17
No. Species Observed	6	5	9	12	9	9	12

Source: NDOW 2018.

Note: *Listed data are combined from only those survey routes within the study area: Timber Lake, Foxtail Lake, Lahontan Reservoir, Lovelock, and Walker Lake.

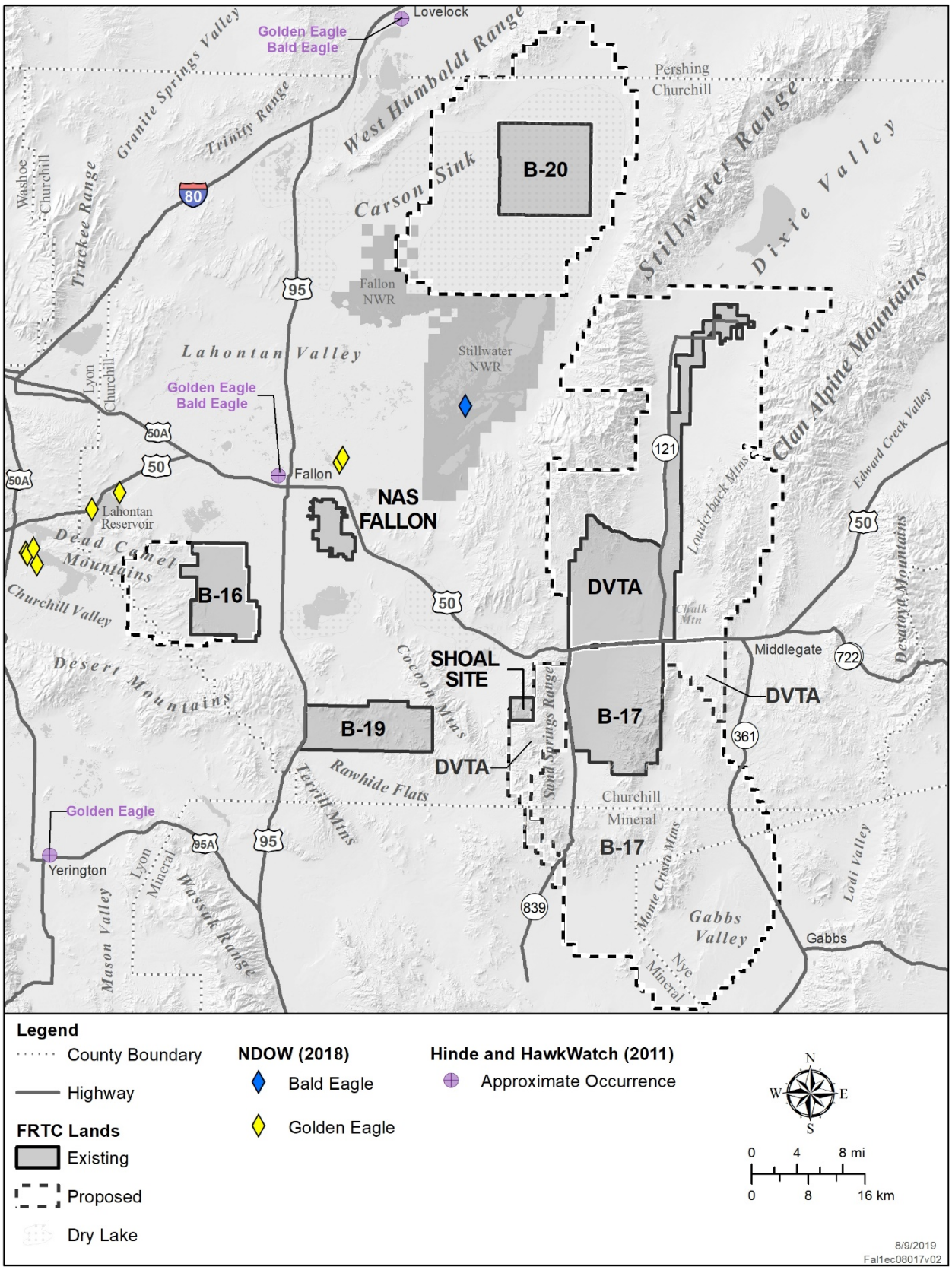

Figure 1-10. Winter Occurrences of Bald and Golden Eagles within the Study Area (2003-2018)

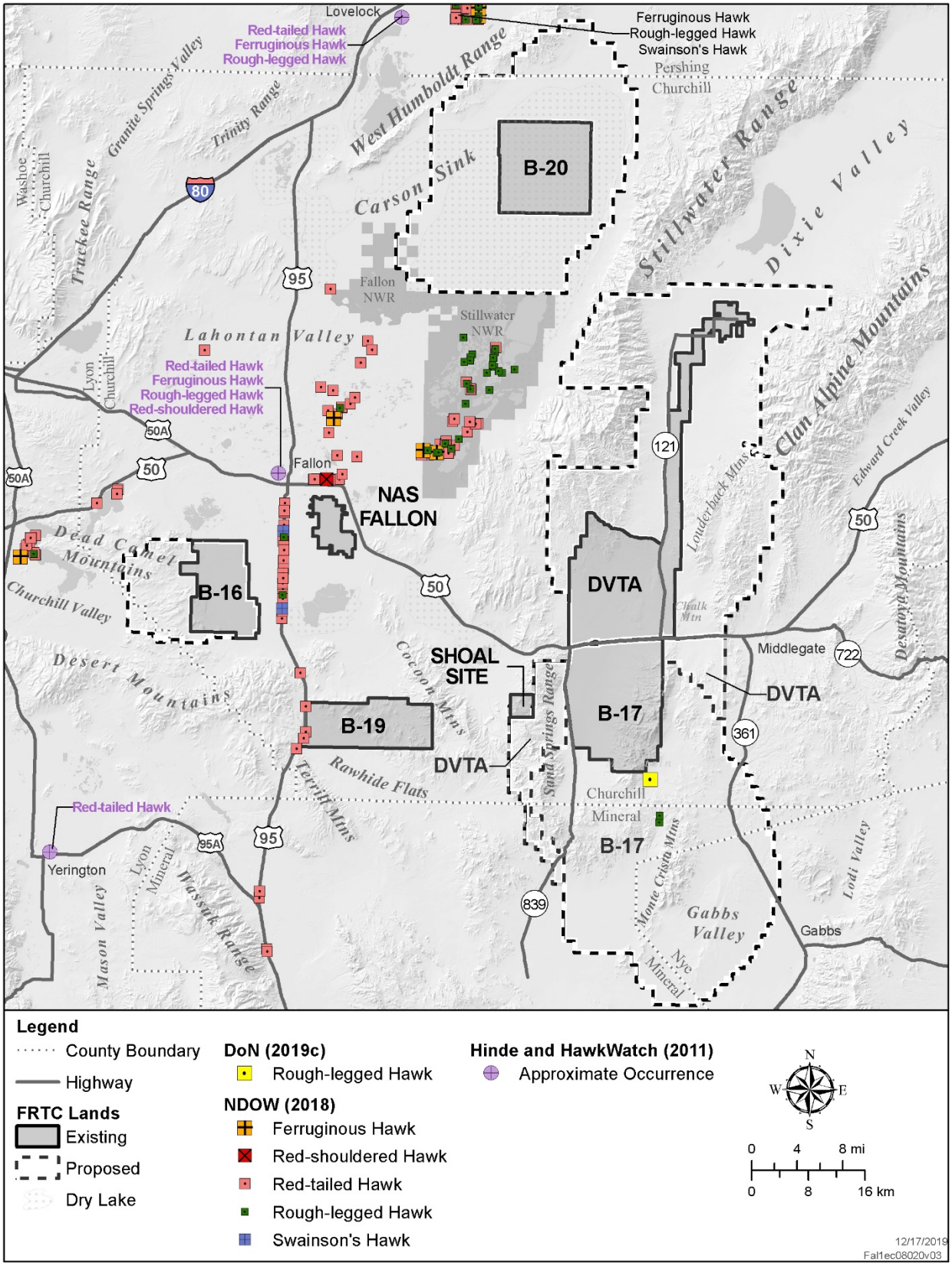

Figure 1-11. Winter Occurrences of Ferruginous, Red-shouldered, Red-tailed, Rough-legged, and Swainson's Hawks within the Study Area (2003-2018)

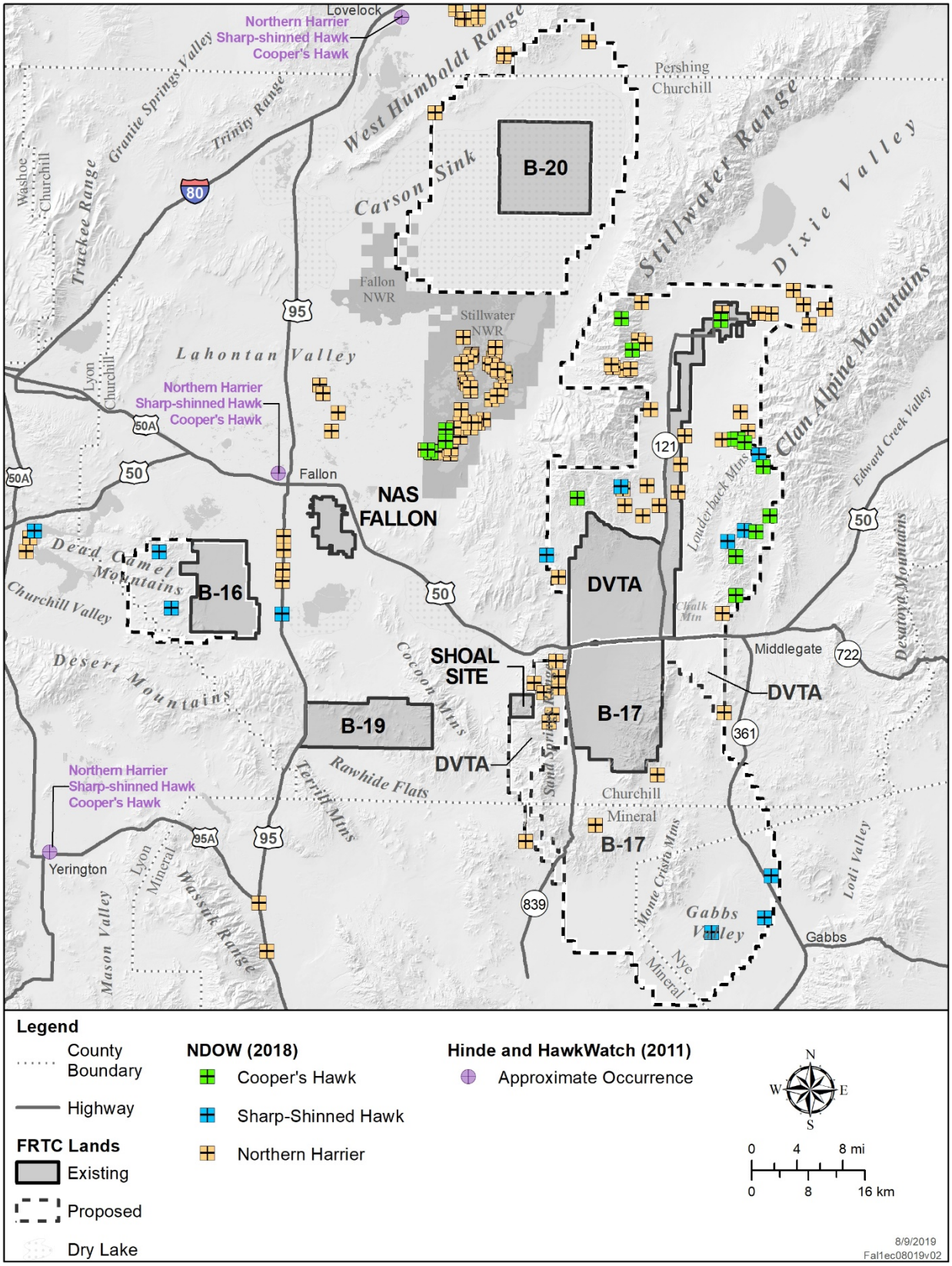

Figure 1-12. Winter Occurrences of Cooper's Hawks, Sharp-shinned Hawks, and Northern Harriers within the Study Area (2003-2018)

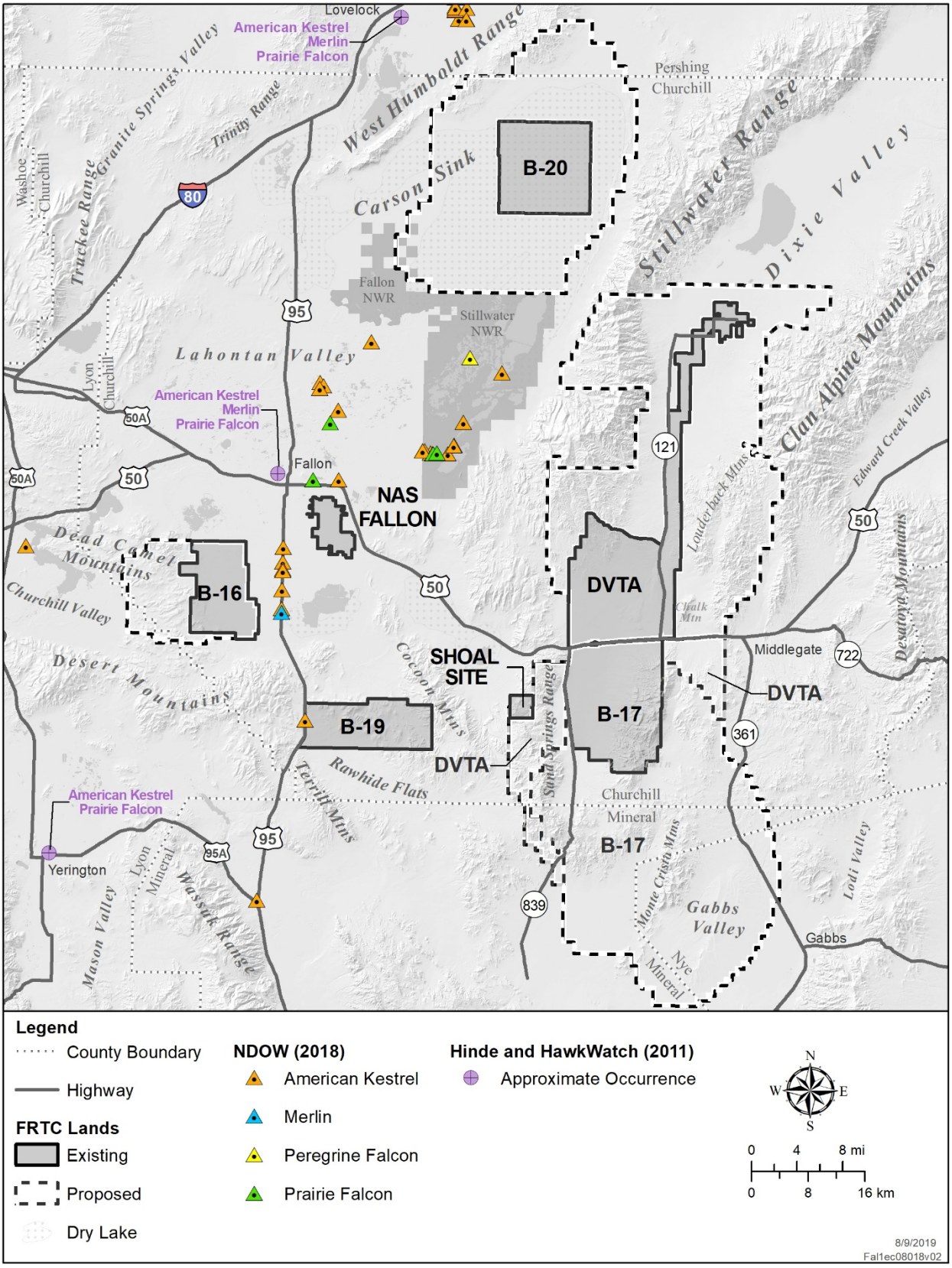

Figure 1-13. Winter Occurrences of American Kestrels, Merlins, Peregrine Falcons, and Prairie Falcons within the Study Area (2003-2018)

Of the 14 raptor species expected to occur within the study area during winter (Table 1-3), all but the northern goshawk were observed during at least 1 of the 7 NDOW survey years (Table 1-5) (NDOW 2018). Bald eagles were observed at the Lahontan Reservoir and the Stillwater National Wildlife Refuge, which supports Nevada's largest bald eagle winter population (Lahontan Audubon Society 2007). Golden eagles were observed primarily within the eastern portion of the study area near the Dead Camel Mountains (Figure 1-10). However, the Swainson's hawk, a species that typically is only seen in Nevada as a summer breeder, was observed during 2012 and 2018 along Highway 95 south of Fallon (Figure 1-11). In addition to the NDOW data, a rough-legged hawk was observed within the proposed B-17 expansion area during separate general avian surveys in support of the FRTC EIS (Figure 1-11) (DoN 2019c).

Overall, and consistent with the Hinde and HawkWatch (2011), the most common species was the red-tailed hawk followed by northern harrier, rough-legged hawk, and American kestrel. The least observed were red-shouldered hawk, merlin, and peregrine falcon, each only observed during a single survey year.

1.6 Spring/Summer Occurrences of Raptor Species within the Study Area (2008-2015)

Previous occurrences of individual and nesting raptors within the study area during spring/summer are based upon GIS data obtained from NDOW and NNHP (NDOW 2018; NNHP 2018b). Although some of the data included occurrences from as early as 1975, for the purposes of this summary, only data from 2008 through 2015 were used, 2015 being the latest record in either the NDOW or NNHP datasets. In addition, data from general avian surveys and camera trap surveys conducted within the proposed FRTC expansion areas in support of the FRTC EIS were also used (DoN 2019c, d).

Figure 1-14 through Figure 1-17 depict the occurrence of individual raptors and active nests within the study area. Of the 10 raptor species expected to nest within the study area (Table 1-3), 8 were recorded during 2008-2015; the northern harrier and sharp-shinned hawk do not have nesting records within the study area for the period 2008-2015 (Table 1-6) (NDOW 2018; NNHP 2018b).

Table 1-6. Nesting Records of Raptor Species within the Study Area (2008-2015)

Species	No. Nests
Red-tailed Hawk	12
Golden Eagle	10
Prairie Falcon	5
American Kestrel	2
Northern Goshawk	2
Cooper's Hawk	1
Swainson's Hawk	1
Ferruginous Hawk	4

Sources: NDOW 2018; NNHP 2018b.

Golden Eagle. The only available data regarding occurrences of individual golden eagles were from the general avian surveys conducted in 2017 and all records are from the proposed DVTA and B-17 expansion areas (DoN 2019c). A total of 10 nests have been recorded within the study area, with the majority (7) occurring within or in the vicinity of the proposed DVTA and B-17 expansion areas; the remaining 3 nests were near B-20 and 1 nest was south of NAS Fallon (Figure 1-14). Based on available information for the nest sites, four were classic stick nests on cliff ledges. To provide some context regarding regional nesting chronology, on May 23, 2014, the nest to the NW of B-20 had two, 6-week old chicks and on May 24, 2014 the nest to the east of B-20 had one, 2-week old chick (NDOW 2018).

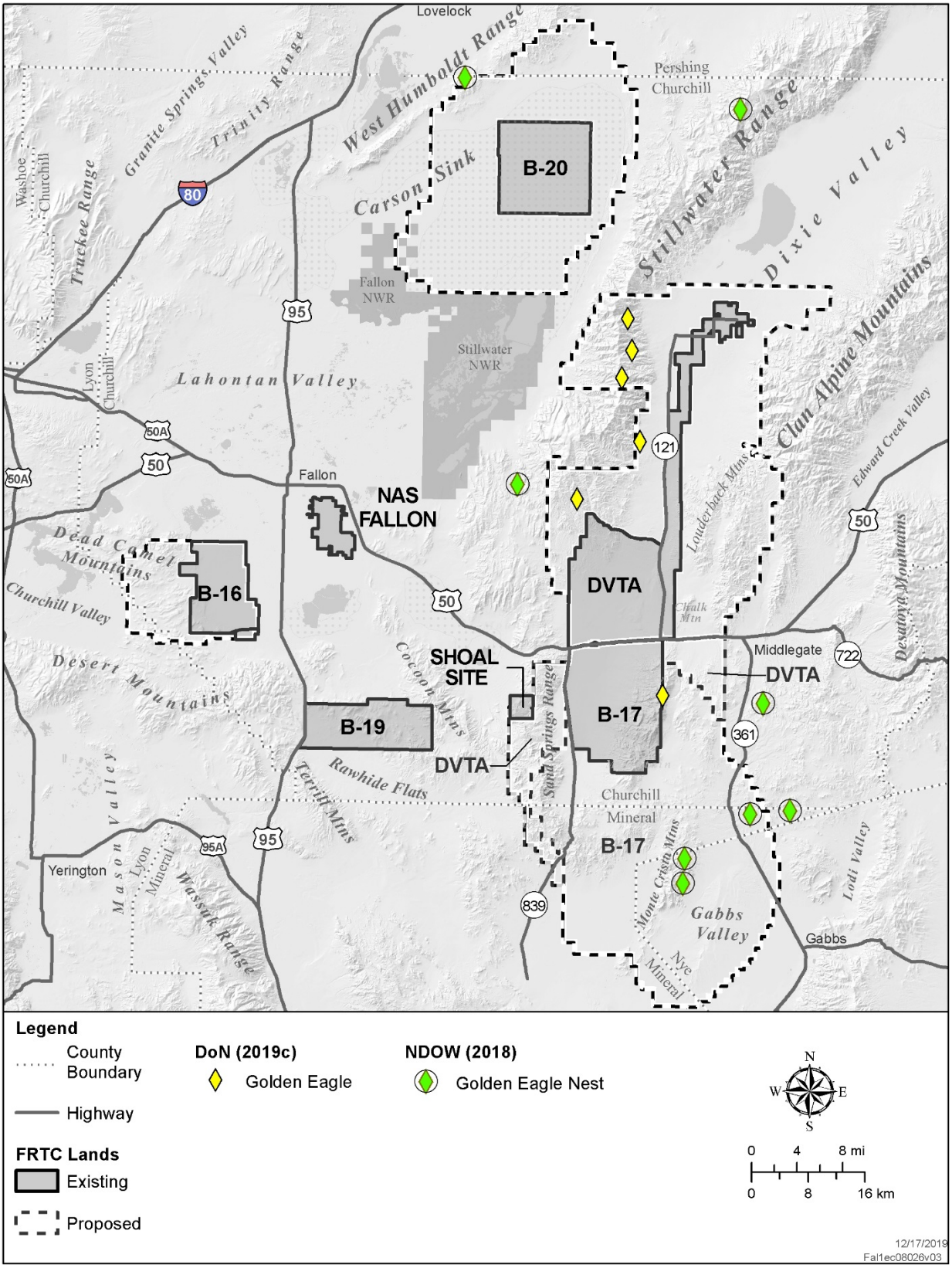

Figure 1-14. Spring/Summer Occurrences of Golden Eagles and Active Nests within the Study Area (2008-2015)

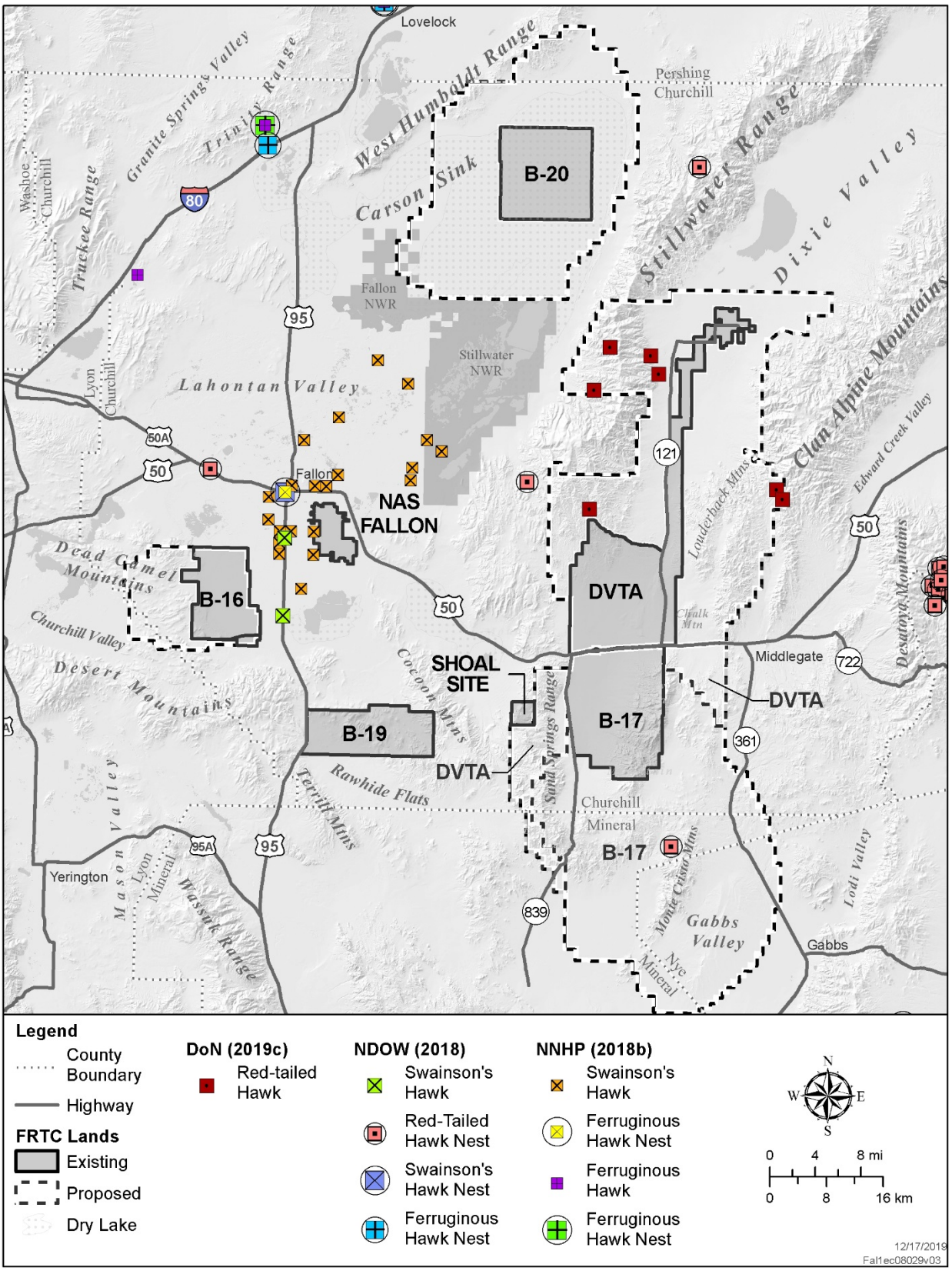

Figure 1-15. Spring/Summer Occurrences of Ferruginous, Red-tailed, and Swainson's Hawks and Active Nests within the Study Area (2008-2015)

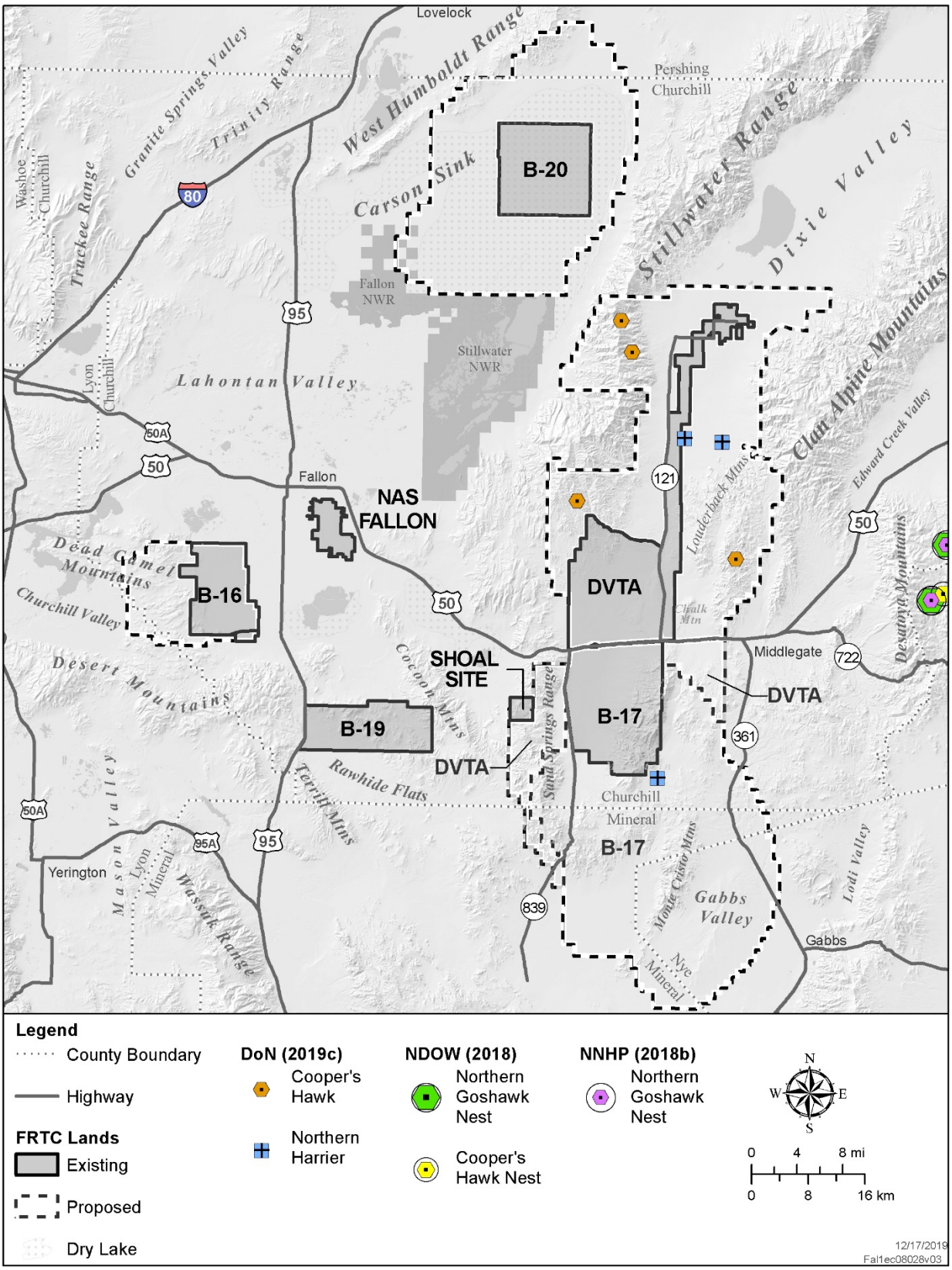

Figure 1-16. Spring/Summer Occurrences of Cooper's Hawks, Northern Goshawks, Northern Harriers, and Active Nests within the Study Area (2008-2015)

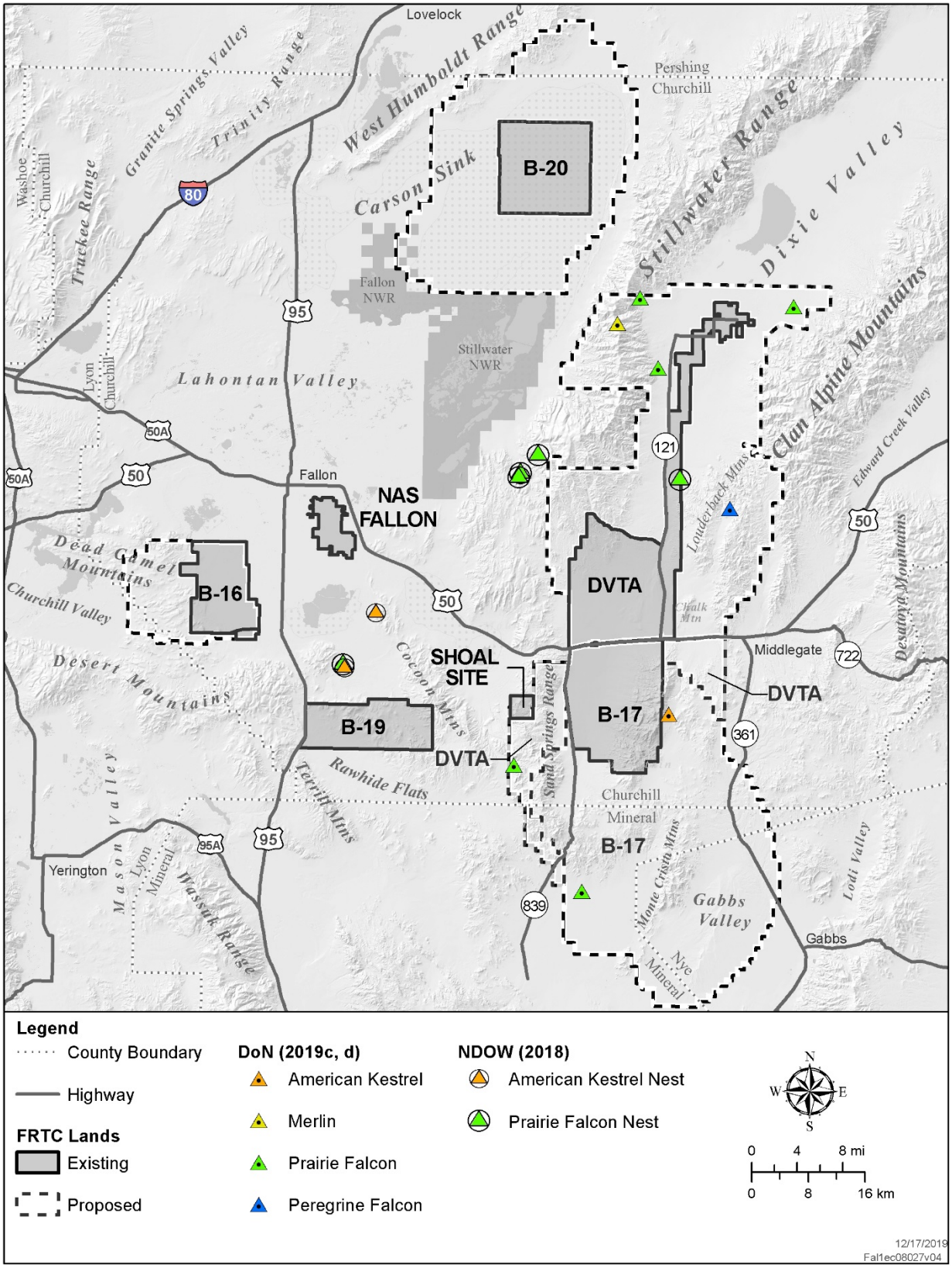

Figure 1-17. Spring/Summer Occurrences of American Kestrels, Prairie Falcons, Merlins, Peregrine Falcons, and Active Nests within the Study Area (2012-2018)

Buteo Hawks. Three buteo species have been recorded as nesting within the study area: red-tailed hawk, ferruginous hawk, and Swainson's hawk (NDOW 2018; NNHP 2018b). The most common raptor species, red-tailed hawk, had 12 nesting records, mostly found in the eastern portion of the study area in the Desatoya Mountains. All were stick nests in aspen. There were four ferruginous hawk nest records and a single Swainson's hawk nest (Table 1-6 and Figure 1-15). The ferruginous hawk nest north of Interstate 80 near the Trinity Range had three, 5-week old chicks on June 24, 2014. The Swainson's hawk nest in a cottonwood in a backyard in Fallon, had two, 1-2-day old nestlings on June 20, 2014.

Accipiter Hawks and Northern Harrier. During the general avian surveys conducted in 2017 within the proposed DVTA and B-17 expansion areas in support of the FRTC EIS, only Cooper's hawk and northern harrier were recorded (DoN 2019c) (Figure 1-16). The NNHP and NDOW data provide the same two goshawk nesting records within the Desatoya Mountains. The single Cooper's hawk nest and two goshawk nests were all within aspen (Table 1-6 and Figure 1-16) (NDOW 2018; NNHP 2018b).

Falcons. All four falcon species that are expected to occur within the study area have been recorded as individuals and two have nest records within the study area (Table 1-6 and Figure 1-17). There are two nest records for American kestrel (north of B-19) and both were recorded as stick nests on cliffs. The five prairie falcon nests were all observed as stick nests on cliffs (NDOW 2018; NNHP 2018b).

2. METHODS

To assess the raptor community within the FRTC proposed expansion area, aerial surveys were determined to be the most efficient approach for identifying the raptor species present and quantifying their numbers and nest locations in a cost-effective and systematic manner. The area's diverse raptor community required a survey effort that allowed for identification of both localized species (e.g., those with comparatively small home ranges such as the American kestrel), as well as wide-ranging species (e.g., those with comparatively large home ranges such as the golden eagle). Aerial survey methods provide an effective means of monitoring large areas of potential habitat to identify territorial raptors (Pagel et al. 2010) and search for nests of both tree-nesting (Craig and Dillard 2013) and cliff-nesting species (Ritchie et al. 2003; Booms et al. 2010). Booms et al. (2010) found that during aerial helicopter surveys in western Alaska, detection rates of cliff-nesting species were variable but greater than 75% for some species. Although similar quantified detection rates associated with aerial raptor surveys within the comparatively open habitats of the Great Basin have not been published to date, comprehensive aerial surveys of golden eagles in the western U.S. (e.g., Nevada, Arizona, Utah, Idaho) have shown detection rates to be very suitable for detecting population trends and conducting status assessments and are considered a standard methodology for these assessments (Nielson et al. 2014, 2016; McCarty et al. 2016).

2.1. AERIAL SURVEY METHODS

Aerial surveys were conducted with a McDonnell Douglas 500 helicopter to systematically detect raptor species throughout the proposed expansion areas during two survey periods in 2018 and 2019: winter and spring. The winter surveys documented the occurrence of wintering, non-breeding birds. The spring surveys were conducted to document breeding birds and were timed to occur when Nevada breeding raptors would be actively tending to a nest and incubating eggs or tending young. Surveys were scheduled to best avoid desert big horn sheep (*Ovis canadensis nelsoni*) lambing season and to conduct surveys based on past historic breeding events when golden eagles were on eggs rather than fledgling-aged chicks. Survey protocols generally followed accepted raptor survey guidelines (e.g., *Interim Golden Eagle Inventory and Monitoring Protocols, and Other Recommendations* [Pagel et al. 2010]; *Inventory Methods for Raptors* [Ministry of Sustainable Resource Management 2001]).

Flights were conducted with the doors removed to maximize detections. All surveys were conducted at 50-100 ft above ground level and flight speeds were maintained at 15-20 miles per hour. The flight routes were recorded digitally to ensure thorough coverage of the survey area and reviewed by the aerial survey team following each flight to ensure all survey areas were adequately covered.

McDonnell Douglas 500 Helicopter
(*Photo*: M. Ball)

Flight Team

The flight team consisted of a total of two trained observers and a pilot experienced in raptor identification that coordinated efforts to ensure complete visual coverage of the terrain in front of and along both sides of the helicopter: pilot, observer with data recorder, and observer/photographer.

The photographer used a Canon 5D Mark III with an EF 600mm f/4L IS II USM lens to capture images of birds or nests from a distance. This aided in the documentation and confirmation of gender and age class determination for raptors and also allowed the observers to later assess nest stage while minimizing animal and nest-site disturbance. To increase the quality of photographs captured from a moving platform, the camera was fitted with a Kenyon Labs KS 4x4 gyroscope stabilizer. The camera recorded global positioning system (GPS) coordinates for each image using a Canon GP-E2 GPS receiver.

The data recorder logged all observations using Esri Collector on a handheld iPad®. The data recorder mapped the start and stop location of each approximate 2-hour survey flight and noted the weather conditions during each (wind speed, temperature, and percent cloud cover). In addition, the recorder mapped all raptors, common ravens, stick and cliff nests (both active and inactive), and incidental observations of large and medium-sized mammals observed during each survey flight. The recorder was also responsible for uploading the data to a secure cloud server periodically during each flight, as well as at the end of each day.

Transect Pattern

The pattern of the aerial raptor survey varied based on terrain. In flat or open landscapes, transects were established along north-south running routes roughly evenly-spaced with a 1-km spacing consistent with Pagel et al. (2010). This distance enabled the flight team to optimally detect raptors at the survey altitude from either side of the aircraft while minimizing double counts. During the winter survey period the transect spacing was modified within Carson and Gabbs Sink and Dixie Valley Dry Lake to a roughly 4-km spacing to account for higher visibility; however, it became apparent that portions of the sink devoid of water or vegetation did not support raptors. The pattern was then modified to survey only portions of the sinks that possessed vegetation or surface water at the time of the survey (Figure 3-1). When executing the transect pattern on flat or in open landscapes, the flight team deviated from the transects to more closely inspect possible perches and/or nesting structure such as trees, incised or eroded channels, utility poles, or abandoned buildings. Within open terrain, the transect pattern was the same between winter and spring survey periods.

To improve coverage of complex areas such as mountainous or steep terrain, the transect pattern would deviate from established north-south transects. In these instances, topography would dictate the optimal flight path. For example, the aerial team would systematically survey individual watersheds by first flying a transect through the bottom-center of a drainage and then a pattern like contour lines on a map or ever

diminishing circles throughout the entirety of the watershed. The pilot would be directed to contour each watershed at regular intervals until the watershed had been completely surveyed before moving on to the next area. During the winter survey period, contours were spaced to optimally detect birds; however, during the spring survey period, the distance between contours was tightened to identify all nests in addition to birds.

To avoid poor lighting and backlighting, eastern slopes were surveyed in the morning and western slopes in the afternoon. A portion of the higher elevation slopes of the Clan Alpine Mountains were avoided to minimize potential disturbance to big-horned sheep ewes and their lambs.

Species Observations and Nests

The data recorder noted wind speed (miles per hour), temperature (degrees Fahrenheit), and percent cloud cover at the start and end of each flight. During each flight, the survey team recorded all raptors, common ravens, raptor nests, and mammals that they observed. The animal or nest location, as well as the date and time of the observation was recorded automatically for each observation using Esri Collector on a handheld iPad. In addition to location and date/time information, the flight team noted the sex for adult birds, age class, paired status, and behavior, as well as any additional notes pertinent to each raptor observation (Table 2-1 and Table 2-2).

Table 2-1. Observation Data Recorded for Each Individual Raptor Observed

Category	Definition	
Survey Date	Month Day Year	
Proposed Expansion Area	B-16, B-17, B-20, DVTA	
Species	Full common name	
Behavior	(see Table 2-2)	
Age	Adult	Adult – Unknown
		Adult – Male
		Adult – Possible Male
		Adult - Female
		Adult – Possible Female
	Subadult	Immature*
		Year 1
		Year 2
		Year 3
	Young of the Year	
	Unknown	
Pair Status	Yes/No	
Nesting Status	See Table 2-3	

Note: *Immature is a generic term for a bird that ranged in age from year 1 to year 3. It was used when exact age could not be identified

Table 2-2. Bird Behaviors Noted for Each Individual Raptor Observed

Behavior	Definition
Actively Hunting	Animal observed in active pursuit of prey.
Brooding	Bird in nest atop a chick(s).
Incubating	Bird in nest atop an egg(s).
Incubating/Brooding	Bird in nest with contents not visible; unclear if egg(s) or chick(s) present.
Food Provisioning	A male raptor providing food or the female raptor feeding offspring.
Nest Building	Bird carrying nest material or actively building a nest.
Direct Flight	A bird actively flying in a single direction (not foraging or displaying).
Display	Territorial flight display.
Dispute	Aggressive action between two birds, this is applied to either one bird chasing a bird or one bird being chased by another bird.
Perched	Bird observed sitting atop a structure.
Pair Perched	Paired birds sitting in close proximity to each other.
Patrol	A foraging strategy of some raptors low on the wing covering large areas, typically applied to northern harriers.
Slope Soar	A raptor riding lift created by wind deflected up and over hills and mountains.
Soar	Bird flying in a thermal (hot ascending air) or dynamic soaring when wind flows actively over top wings creating lift.
Flock Flight	Groups or gatherings of the same species of birds (mostly raven activity).
Night Roost Congregation	A communal sleeping group, usually applied to ravens.

The team photographed raptors when plumage subtleties made it difficult to quickly ascertain the birds' species, age, or sex. Once a suitable photograph or series of photographs were taken, they could be reviewed upon completion of the flight, substantially minimizing the amount of disturbance to the animals.

For the purposes of the current survey efforts, a territory or complex refers to an observation or cluster of observations of territorial behavior, breeding activity, or persistence within a particular location and any subsequent observations of the same birds within the vicinity. A territory is defined based on the following:

- Active Territory or Complex
  - One or more birds observed in the same location between the winter and spring (breeding) survey period.
  - A bird(s) accompanying a nest.
  - Pair perching behavior between two birds.
  - A bird or birds perched adjacent to an active or inactive nest.
  - Territorial displays such as undulating flight displays.
- Unoccupied Territory or Complex
  - A group of unoccupied and unaccompanied nests of a similar size and structure in close proximity to each other.

To provide baseline information about common raven numbers, all observed individuals were mapped, but ancillary information was not recorded to allow the team to prioritize raptors and large mammals. Similar to raptors, all individuals and groups of large mammals were also mapped, and the number of identifiable males, females, and immature individuals was recorded along with additional pertinent information.

All nest locations were also recorded. Each nest was mapped and the attending species, or the species that the nest likely belonged to, was noted along with the type of nest, the substrate it was built on, and its contents (Table 2-3). At one location, there could be multiple nests; often more than 1 old nest or 1 vacant nest and an active nest for the current year. When possible, active nests were photographed to help determine nest contents and to identify the stage of nesting. Photographing nests allowed the team to quickly identify the contents and determine the nesting stage with minimal disturbance to the attending birds. Photographs were reviewed following each flight to confirm or further assess the status of each nest.

Table 2-3. Information Recorded for Each Nest Observed

Nest Status*	Nest Substrate	Nest Type	No. Eggs	No. Chicks	Age of Chick(s)
Active	Cliff/tree/other	Stick/ledge	#	#	in days or weeks
Vacant	Cliff/tree/other	Stick/ledge	NA	NA	NA
Old	Cliff/tree/other	Stick/ledge	NA	NA	NA

Notes: *Active = containing eggs or chicks or nest actively under construction with fresh nest lining with associated territorial behaviors. Vacant = recent defecation and/or nest lining present but territorial bird(s) not present. Old = no signs of recent defecation and/or nest lining.

2.2. Data Curation and Summary

All animal observations were uploaded to a secure GIS-based cloud server periodically during the flight, as well as after the completion of the flight. After each survey period (winter and breeding surveys), all observations were additionally backed up onto the ManTech server and reviewed for quality assurance prior to being summarized.

Following each flight, all photographs were downloaded to a backup hard-drive and curated in Adobe® Lightroom CC Classic where they were sorted, identified, and tagged by species. Metadata were also embedded and included the file name, photo location, camera settings, etc. Photographs provided an opportunity to review, corroborate, and supplement the data collected during the flight.

3. RESULTS

The 2018 winter surveys covered a total of 3,118 transect miles (5,018 km) over a survey period of 9 days and detected 11 raptor species. The 2018 spring surveys covered 5,519 transect miles (8,882 km) over a survey period totaling 13 days and detected 10 raptor species (Table 3-1; Figure 3-1).

Table 3-1. Summary of Survey Periods, Transect Miles, and Raptor Species Observed during 2018 and 2019 Surveys within the Proposed FRTC Expansion Areas

Year Survey	Survey Period	Total Days	Total Helicopter Transect Miles	Number of Raptor Species Observed
2018				
Winter	Jan 28-Feb 5	9	3,118	11
Spring	Apr 26-May 3; May 5-9	13	5,519	10
2019				
Winter	Mar 9-10	2	424	5
Spring	Apr 27-28	2	877	11

The 2019 winter surveys covered a total of 424 transect miles (682 km) over a survey period of 2 days and detected 5 raptor species. The 2019 spring surveys covered 877 transect miles (1,411 km) over a survey period totaling 2 days and detected 11 raptor species (Table 3-1; Figure 3-2).

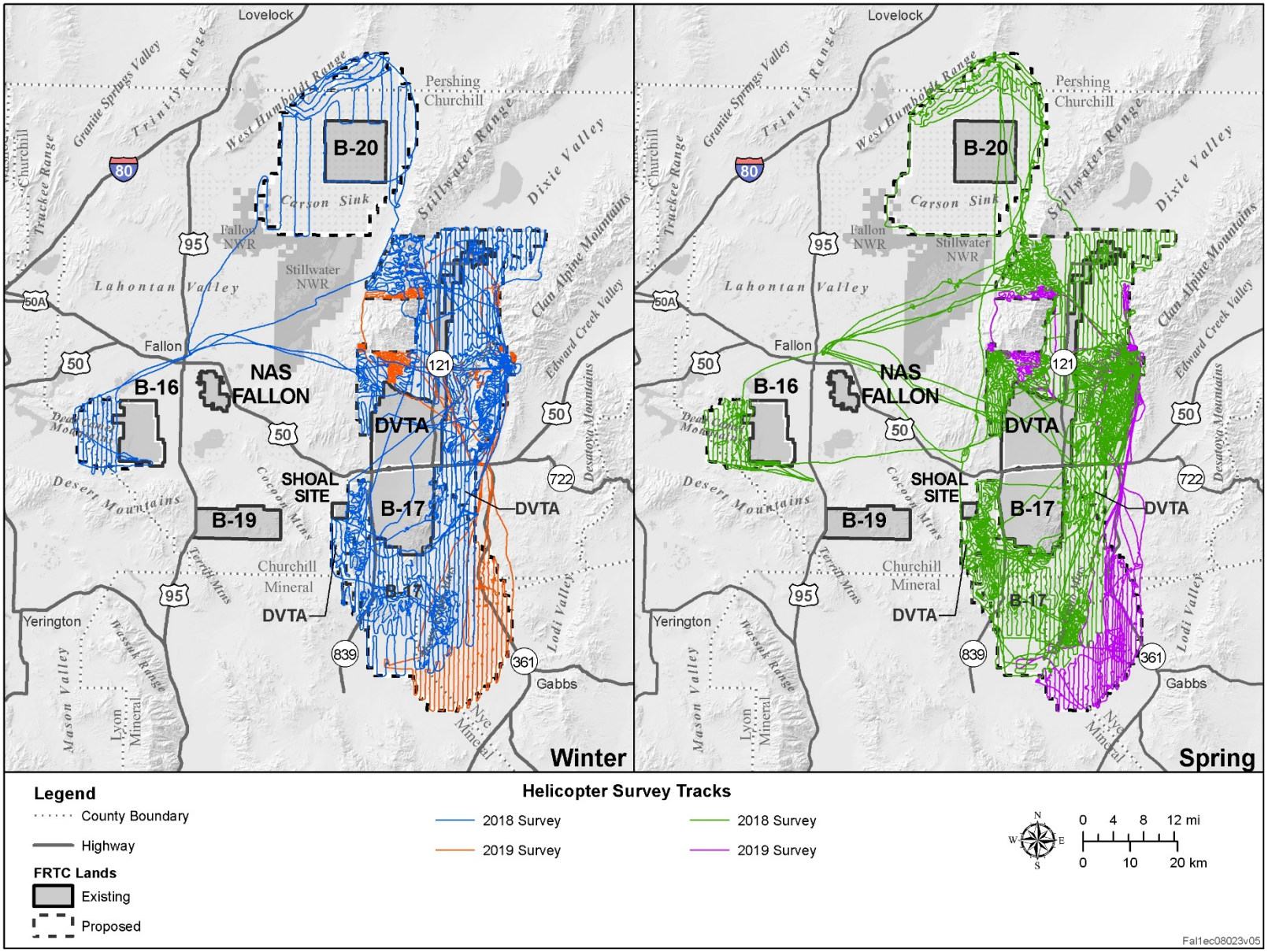

Figure 3-1. Helicopter Survey Tracks during Winter and Spring 2018 Raptor Surveys within the Proposed FRTC Expansion Areas

Although the current raptor surveys focused on occurrences within the proposed FRTC expansion areas, 69 occurrences (34 in winter and 35 in spring) were recorded within 5 km of, and not within, a proposed expansion area. These records are due to the following reasons:

- A raptor may be observed within the surveyor's search window and fall outside the expansion area. A total of 61 records were within 1 km of a proposed expansion area boundary.
- A raptor may be observed while the helicopter was transiting between survey areas or while turning at the end of a transect.

Of the 8 records greater than 1 km from an expansion area boundary, 4 records were within 2 km, 1 record was within 3 km, 1 record was within 4 km, and 2 records were within 5 km. For this report, these 69 occurrences are included within the nearest proposed expansion area.

3.1. WINTER SURVEYS

Of the 14 raptor species expected to occur within the study area during winter (Table 1-3), 11 were observed within at least one of the proposed expansion areas during the winter 2018 surveys (Table 3-2; Figure 3-2 through Figure 3-5). Only peregrine falcon, sharp-shinned hawk, and red-shouldered hawk were not observed. Overall, the most common species during the winter 2018 surveys was the golden eagle followed by red-tailed hawk.

Table 3-2. Observed Raptors within Proposed FRTC Expansion Areas during Winter 2018 Surveys

Species	B-16	B-17	B-20	DVTA	Total Individuals
Golden Eagle	8	21 (1 Nb)*	3	55 (1 Nb)*	87
Red-tailed Hawk	5	5	0	51	61
Northern Harrier	0	1	4	29	34
Rough-legged Hawk	1	6	0	8	15
Prairie Falcon	1	3	0	7	11
Ferruginous Hawk	2	0	0	1	3
Cooper's Hawk	0	0	0	3	3
Bald Eagle	0	0	0	3	3
American Kestrel	1	0	0	1	2
Northern Goshawk	0	0	0	2	2
Merlin	0	0	0	1	1
No. Species Observed	6	5	2	11	

Notes: *Nb = nest building – number of observations of adult birds carrying nest material and/or actively building a nest.

During the winter 2019 surveys, five species were observed across both the B-17 and DVTA expansion areas (Table 3-3; Figure 3-2 through Figure 3-5). Red-tailed hawk and golden eagle were again the two most common species observed.

Table 3-3. Observed Raptors within Proposed FRTC Expansion Areas during Winter 2019 Surveys

Species	B-17	DVTA	Total Individuals
Golden Eagle	7	5	12
Red-tailed Hawk	4	8	12
Prairie Falcon	2	1	3
Ferruginous Hawk	1	0	1
American Kestrel	0	2	2
No. Species Observed	4	4	

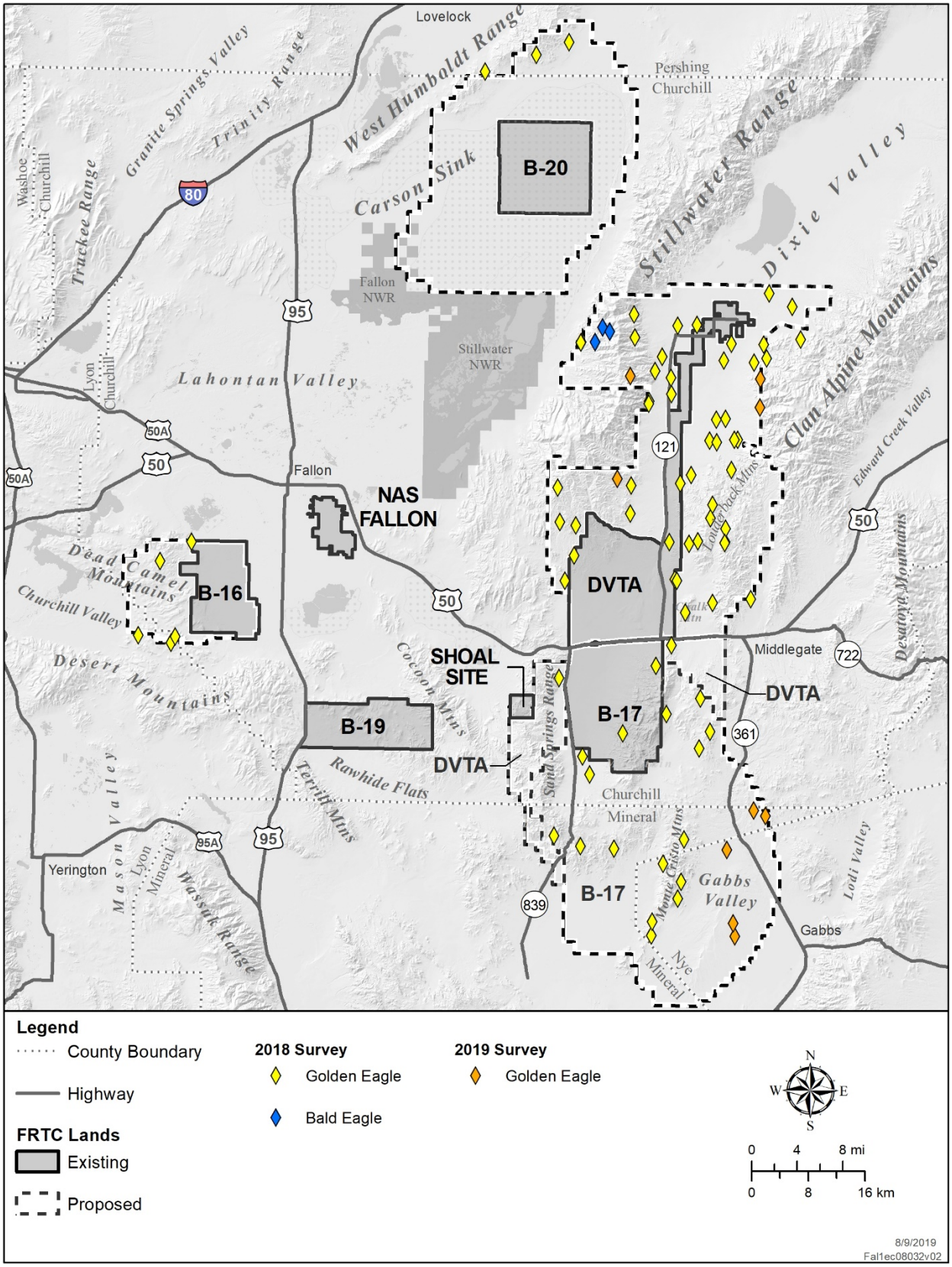

Figure 3-2. Occurrences of Bald and Golden Eagles within the Proposed FRTC Expansion Areas during Winter 2018 and 2019 Surveys

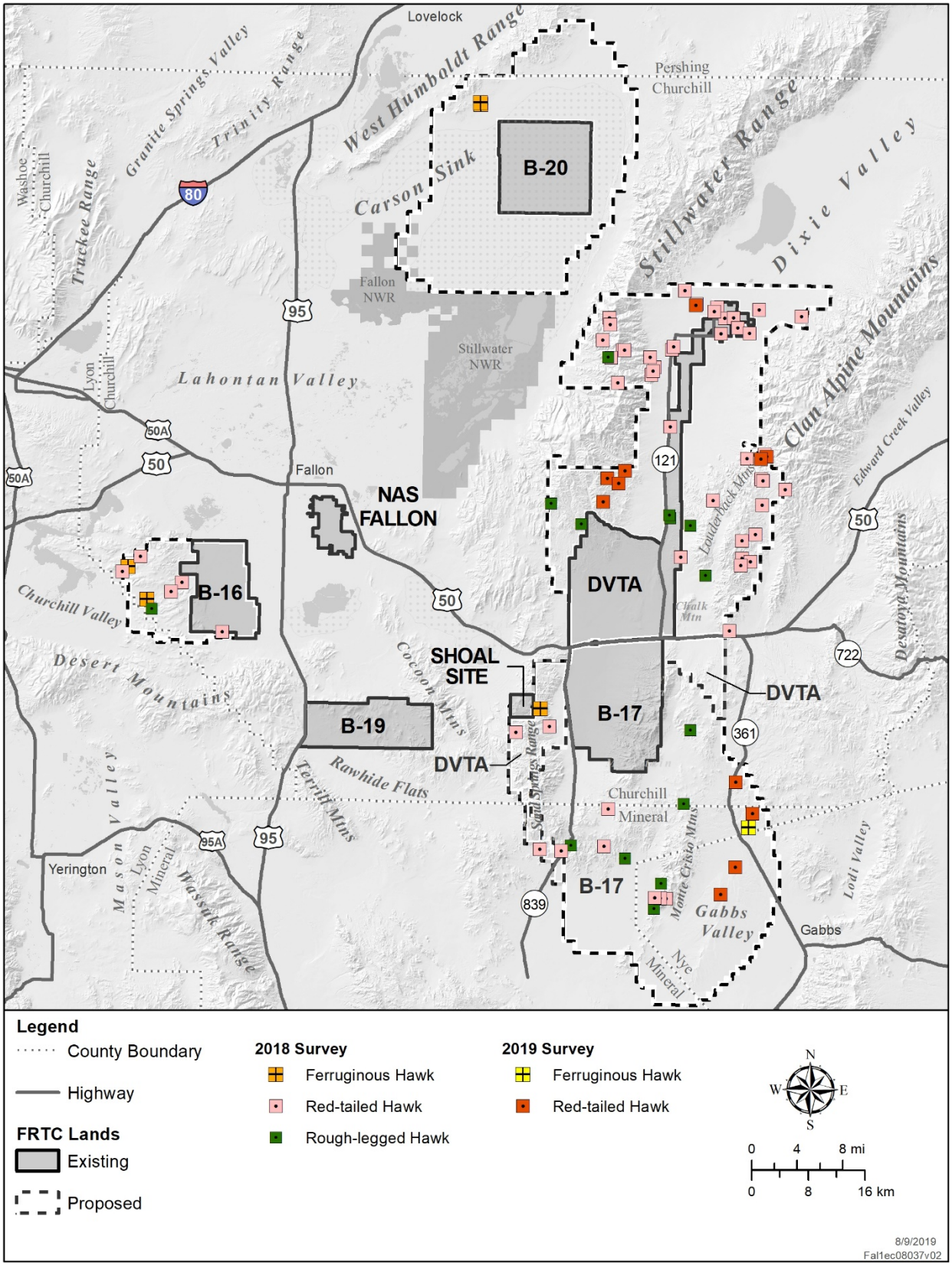

Figure 3-3. Occurrences of Ferruginous, Red-tailed, and Rough-legged Hawks within the Proposed FRTC Expansion Areas during Winter 2018 and 2019 Surveys

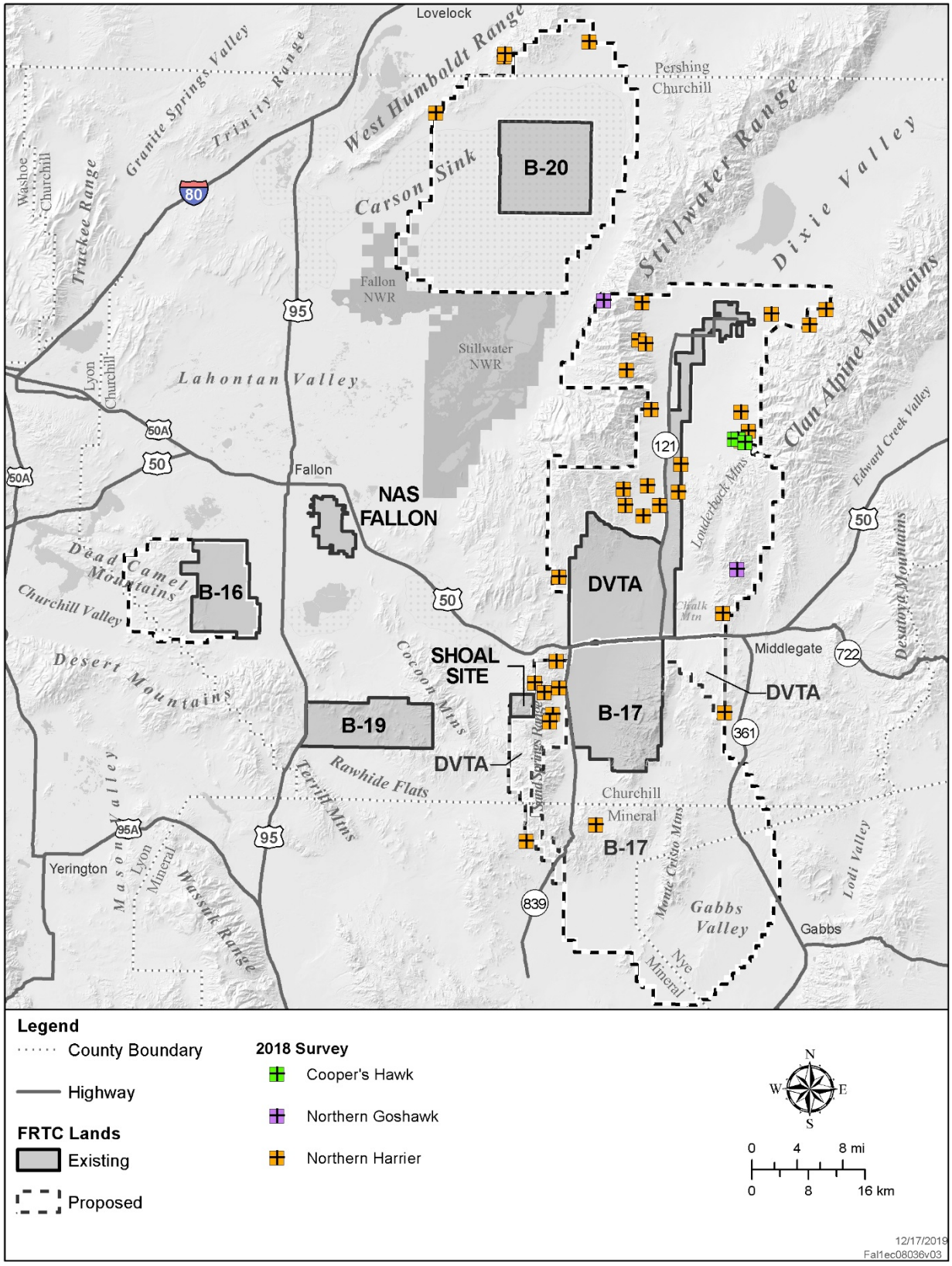

Figure 3-4. Occurrences of Cooper's Hawks, Northern Goshawks, and Northern Harriers within the Proposed FRTC Expansion Areas during Winter 2018 Surveys

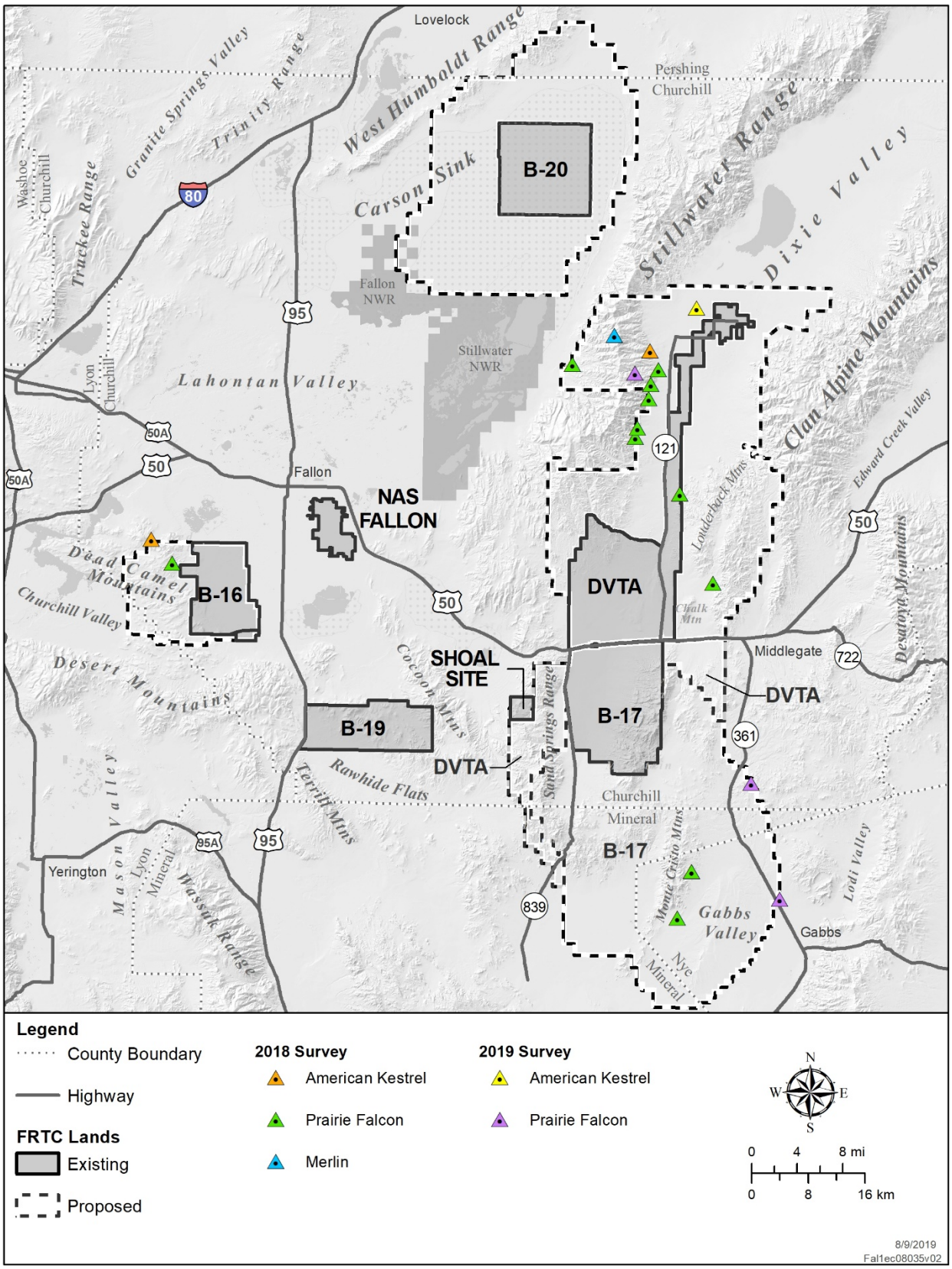

Figure 3-5. Occurrences of American Kestrels, Prairie Falcons, and Merlins within the Proposed FRTC Expansion Areas during Winter 2018 Surveys

3.2. SPRING SURVEYS

A total of 11 raptor species were recorded during surveys of the proposed FRTC expansion areas: 10 in April/May 2018 and 9 in April 2019 (Table 3-4 and Table 3-5). A total of 228 individual raptors were observed in spring 2018 and 50 individuals were observed in spring 2019, not including chicks or young-of-the-year. The proposed DVTA expansion area had the highest species diversity with 9 raptor species observed in both 2018 and 2019. Only 4 species were recorded in each of the other 3 proposed expansion areas in 2018 and 2019. Of the 10 raptor species expected to nest within the study area, only 4 were observed with active nests: golden eagle, red-tailed hawk, ferruginous hawk, and prairie falcon (Table 3-4 and Table 3-5; Figure 3-6 through Figure 3-9). A total of 38 active nests were observed: 2 in winter 2018, 34 in spring 2018, and 2 in spring 2019 (Table 3-6).

Golden Eagle. The golden eagle was the most frequently recorded raptor within the survey area in both 2018 and 2019 (Table 3-4; Table 3-5). A total of 12 chicks were observable within 8 of the 9 active nests in 2018 (Table 3-6). The golden eagle had the second highest number of active nests (9) within the survey area (Table 3-4 through Table 3-6; Figure 3-6A).

- In spring 2018, the highest number of golden eagles were observed in the proposed DVTA expansion area with 24 adults, 14 subadults, and 1 unknown age, followed by 16 adults, 7 subadults, and 2 unknown age in the proposed B-17 expansion area, 3 adults within the proposed B-20 expansion area, and 1 adult and 1 subadult within the proposed B-16 expansion area (Table 3-4). In spring 2019, only the proposed B-17 and DVTA expansion areas were surveyed and the highest numbers of golden eagles were observed in the proposed B-17 expansion area (Table 3-5).
- There were 4 active nests in both the proposed DVTA and B-17 expansion areas and 1 active nest in the proposed B-20 expansion area in spring 2018 (Table 3-4; Figure 3-6A). No active nests were observed in spring 2019 (Table 3-5).
- A total of 2 nests were observed being built during the winter 2018 survey, but had failed by the time of the spring 2018 survey: 1 in DVTA and 1 in B-17 (Table 3-6).
- Of the 9 total active nests observed during the last week of April 2018 and first week of May 2018, the contents of 8 were visible: 2 nests had chicks that were 2 weeks old, 1 nest had a chick that was 3 weeks old, 4 nests had chicks that were 3-4 weeks old, and 1 nest had chicks that were 4-5 weeks old. Of these 8 nests, 4 had 1 chick and 4 had 2 chicks (Table 3-6).
- During the 2018 surveys, the proposed DVTA expansion area also included the highest number of vacant and old nests (3 and 12, respectively), with 2 vacant nests and 13 old nests in the proposed B-17 expansion area, 1 vacant nest and 1 old nest in the proposed B-20 expansion area, and no vacant or old nests in the proposed B-16 expansion area (Table 3-3 and Table 3-5; Figure 3-6B). During 2019 spring surveys, 9 vacant nests and 8 old nests were observed within the southeastern portion of the proposed B-17 expansion area.

Buteo Hawks. Three *buteo* hawks were observed within the survey area: red-tailed, ferruginous, and Swainson's hawk. Two species were observed nesting in the survey area during the spring 2018 and 2019 surveys: red-tailed hawk and ferruginous hawk (Table 3-4 and Table 3-5). The Swainson's hawk was only observed twice in the proposed DVTA expansion area and only during the spring 2018 surveys.

Red-tailed Hawk. A total of 73 red-tailed hawks (39 adult, 32 subadults, and 2 unknown age) were observed within the survey area in 2018 (Table 3-4). A total of 6 chicks were observable within 2 of the 8 active nests in 2018 (Table 3-6). A total of 13 red-tailed hawks (12 adults and 1 unknown age) were observed in the survey area in 2019. A total of 2 active nests were observed in 2019 with 1 egg visible (Table 3-5).

- In spring 2018, the highest number of red-tailed hawks was observed in the proposed DVTA expansion area with 29 adults, 27 subadults, and 1 unknown age; followed by 8 in the proposed B-16 expansion area (5 adults, 2 subadults, and 1 unknown); 5 within the proposed B-17 expansion area (2 adults and 3 subadults); and 3 adults in the proposed B-20 expansion area (Table 3-4; Figure 3-7A). In spring 2019, the proposed DVTA expansion area also had the highest number of red-tailed hawks observed (Table 3-5).
- Of the 8 active red-tailed hawk nests in spring 2018, 7 were within the proposed DVTA expansion area and 1 was in the proposed B-20 expansion area (Table 3-4; Figure 3-7B). The 2 active red-tailed hawk nests observed in spring 2019 were also within the proposed DVTA expansion area (Table 3-5; Figure 3-7B).
- Of the 7 active red-tailed hawk nests in the DVTA observed during the last week of April 2018 and first week of May 2018 and where the contents were visible (Table 3-6), 4 nests had eggs (1 nest had 2 eggs, 3 nests had 3 eggs) and 2 nests had chicks 1-2 weeks old (one nest had 4 chicks and 1 nest had 2 chicks).
- No vacant or old nests were observed.

Ferruginous Hawk. The ferruginous hawk was the only other nesting *buteo* observed in the survey area, with 2 active nests observed in the proposed B-20 expansion area in spring 2018 (Table 3-4 and Figure 3-7B). The only active nest with visible contents had 2 eggs in April 2018 (Table 3-6).

Falcons. The prairie falcon and American kestrel had the 3rd and 4th highest number of occurrences within the spring 2018 survey area (42 and 20, respectively) (Table 3-4). During the spring 2019 surveys, 1 prairie falcon and 13 American kestrels were observed (Table 3-5). In 2018, the prairie falcon had the highest number of active nests (15) with 8 found in the proposed B-17 expansion area, 5 in the proposed DVTA expansion area, and 1 each in the proposed B-16 and B-20 expansion areas (Figure 3-8A). Of the 15 active prairie falcon nests observed during the last week of April 2018 and first week of May 2018, the contents of 7 were visible and all had eggs (Table 3-6). A total of 4 vacant nests and 11 old nests were recorded, the majority within the proposed B-17 expansion area (Table 3-6 and Figure 3-8B). No falcon nests were observed during the spring 2019 surveys (Table 3-5).

Accipiter Hawks and Northern Harrier. Although nesting was not observed for Cooper's hawk, sharp-shinned hawk, northern goshawk, and northern harrier, all were recorded in relatively low numbers within the proposed DVTA expansion area, with the sharp-shinned hawk also recorded from the proposed B-16 and B-17 expansion areas (Table 3-4 and Table 3-5; Figure 3-9).

Osprey. Two ospreys were observed during the 2018 and 2019 survey efforts, both during the spring 2019, with 1 each found within the proposed B-17 and DVTA expansion areas (Table 3-5 and Figure 3-9).

Table 3-4. Summary of Observed Raptors and Associated Nests within the Proposed FRTC Expansion Areas during Spring 2018 Surveys

Species	Proposed FRTC Expansion Area																Total Across All Expansion Areas*			
	B-16*				B-17*				B-20*				DVTA*							
	Ind	AN† (e/c)	VN	ON	Ind	AN† (e/c)	VN	ON	Ind	AN† (e/c)	VN	ON	Ind	AN† (e/c)	VN	ON	Ind	AN† (e/c)	VN	ON
Golden Eagle	A: 1 S: 1 U: 0 Tot: 2	0	0	0	A: 16 S: 7 U: 2 Tot: 25	4 (0/4)	1	4	A: 3 S: 0 U: 0 Tot: 3	1 (0/1)	1	1	A: 24 S: 14 U: 1 Tot: 39	4 (0/3)	3	12	A: 44 S: 22 U: 3 Tot: 69	9 (0/8)	5	17
Red-tailed Hawk	A: 5 S: 2 U: 1 Tot: 8	0	0	0	A: 2 S: 3 U: 0 Tot: 5	0	0	0	A: 3 S: 0 U: 0 Tot: 3	1	0	0	A: 29 S: 27 U: 1 Tot: 57	7 (4/2)	0	0	A: 39 S: 32 U: 2 Tot: 73	8 (4/2)	0	0
Prairie Falcon	A: 2 U: 0 Tot: 2	1 (1/0)	0	1	A: 14 U: 0 Tot: 14	8 (4/0)	2	6	A: 5 U: 0 Tot: 5	1	0	0	A: 18 U: 3 Tot: 21	5 (2/0)	2	4	A: 39 U: 3 Tot: 42	15 (7/0)	4	11
American Kestrel	0	0	0	0	A: 1 U: 1 Tot: 2	0	0	0	0	0	0	0	A: 18 U: 0 Tot: 18	0	0	0	A: 19 U: 1 Tot: 20	0	0	0
Northern Harrier	0	0	0	0	0	0	0	0	0	0	0	0	A: 9	0	0	0	A: 9	0	0	0
Sharp-shinned Hawk	A: 1 S: 1 Tot: 2	0	0	0	0	0	0	0	0	0	0	0	A: 3 S: 1 Tot: 4	0	0	0	A: 4 S: 2 Tot: 6	0	0	0
Ferruginous Hawk	0	0	0	0	0	0	0	0	A: 3	2 (1/0)	0	5	0	0	0	0	A: 3	2 (1/0)	0	5
Cooper's Hawk	0	0	0	0	0	0	0	0	0	0	0	0	A: 2 S: 1 Tot: 3	0	0	0	A: 2 S: 1 Tot: 3	0	0	0
Swainson's Hawk	0	0	0	0	0	0	0	0	0	0	0	0	A: 2	0	0	0	A: 2	0	0	0
Northern Goshawk	0	0	0	0	0	0	0	0	0	0	0	0	S: 1	0	0	0	S: 1	0	0	0
No. Species per Expansion Area	4				4				4				9				10			

Notes: *Ind = number of observed individuals, by age: A = adult, S = subadult, Tot = total, U = unknown.
AN = active nest; number of active nests with observed eggs/chicks (e/c) – the contents of all active nests were not always visible. VN = vacant nest; ON = old nest.
†A detailed summary of nesting activities is provided in Table 3-6.

Table 3-5. Summary of Observed Raptors and Associated Nests within the Proposed FRTC Expansion Areas during Spring 2019 Surveys

Species	Proposed FRTC Expansion Area								Total Across Expansion Areas*			
	B-17*				DVTA*							
	Ind	AN† (e/c)	VN	ON	Ind	AN† (e/c)	VN	ON	Ind	AN† (e/c)	VN	ON
Golden Eagle	A: 8 S: 1 Tot: 9	0	1	8	A: 2 S: 2 Tot: 4	0	0	0	A: 10 S: 3 Tot: 13	0	1	8
Red-tailed Hawk	A: 1	0	0	0	A: 11 S: 1 Tot: 12	2 (1/0)	0	0	A: 12 S: 1 Tot: 13	2 (1/0)	0	0
Prairie Falcon	0	0	0	0	U: 1	0	0	0	U: 1	0	0	0
American Kestrel	0	0	0	0	A: 13	0	0	0	A: 13	0	0	0
Northern Harrier	0	0	0	0	A: 1	0	0	0	A: 1	0	0	0
Sharp-shinned Hawk	A: 2 S: 1 Tot: 3	0	0	0	A: 1	0	0	0	A: 3 S: 1 Tot: 4	0	0	0
Cooper's Hawk	0	0	0	0	A: 1 S: 1 Tot: 2	0	0	0	A: 1 S: 1 Tot: 2	0	0	0
Northern Goshawk	0	0	0	0	S: 1	0	0	0	S: 1	0	0	0
Osprey	A: 1	0	0	0	U: 1	0	0	0	A: 1 U: 1 Tot: 2	0	0	0
No. Species per Expansion Area	4				9				9			

Notes: *Ind = number of observed individuals, by age: A = adult, S = subadult, Tot = total, U = unknown.
AN = active nest; number of active nests with observed eggs/chicks (e/c) – the contents of all active nests were not always visible. VN = vacant nest; ON = old nest.
†A detailed summary of nesting activities is provided in Table 3-6.

Table 3-6. Summary of Active Raptor Nests Observed during 2018 and 2019 Spring Surveys within the Proposed FRTC Expansion Areas

Proposed Expansion Area	Survey Period	Species	Active Nests	Nests under Construction	Failed Nests	Nest Contents Not Visible	Nest Contents Visible	Nests with Eggs	Total Eggs	Nests with Chicks	Total Chicks
B-16	Spring 2018	Prairie Falcon	1	-	-	-	1	1	2	-	-
B-17	Winter 2018	Golden Eagle	1	1	-	-	-	-	-	-	-
	Spring 2018	Golden Eagle	4	-	1	-	4	-	-	4	6
		Prairie Falcon	8	-	-	4	4	4	15	-	-
B-20	Spring 2018	Ferruginous Hawk	2	1	-	-	1	1	2	-	-
		Golden Eagle	1	-	-	-	1	-	-	1	2
		Prairie Falcon	1	-	-	1	-	-	-	-	-
		Red-Tailed Hawk	1	-	-	1	-	-	-	-	-
DVTA	Winter 2018	Golden Eagle	1	1	-	-	-	-	-	-	-
	Spring 2018	Golden Eagle	4	-	1	-	3	-	-	3	4
		Prairie Falcon	5	-	-	3	2	2	6	-	-
		Red-Tailed Hawk	7	-	-	1	6	4	11	2	6
	Spring 2019	Red-Tailed Hawk	2	-	-	-	-	1	2	-	-

Table 3-7. Summary of Active and Non-active Raptor Territories within the Proposed FRTC Expansion Areas during 2018 and 2019 Surveys

Proposed Expansion Area	Survey Period	Species	Number of Birds (not including young-of-the-year)			Number of Territories			
			Non-territorial	Assoc. with Active Breeding Territories	Assoc. with Non-breeding Territories	Active Breeding Territories	Non-active Territories	Nest Pairs	Failed Nest Territories
B-16	Winter 2018	American Kestrel	1	-	-	-	-	-	-
		Ferruginous Hawk	2	-	-	-	-	-	-
		Golden Eagle	4	-	2	-	-	1	-
		Prairie Falcon	1	-	-	-	-	-	-
		Red-tailed Hawk	5	-	-	-	-	-	-
		Rough-legged Hawk	1	-	-	-	-	-	-
	Spring 2018	Golden Eagle	2	-	-	-	-	-	-
		Prairie Falcon	1	1	-	1	1	-	-
		Red-tailed Hawk	8	-	-	-	-	-	-
		Sharp-shinned Hawk	2	-	-	-	-	-	-
B-17	Winter 2018	Golden Eagle	12	2	7	2†	1	3	1‡
		Northern Harrier	1	-	-	-	-	-	-
		Prairie Falcon	1	-	2	-	-	1	-
		Red-tailed Hawk	5	-	-	-	-	-	-
		Rough-legged Hawk	6	-	-	-	-	-	-
	Spring 2018	American Kestrel	2	-	-	-	-	-	-
		Golden Eagle	7	9	3	4	3	-	1
		Prairie Falcon	3	11	-	8	2	-	-
		Red-tailed Hawk	5	-	-	-	-	-	-
B-20	Winter 2018	Ferruginous Hawk	0	-	-	-	-	-	-
		Golden Eagle	3	-	-	-	-	-	-
		Northern Harrier	4	-	-	-	-	-	-
	Spring 2018	Ferruginous Hawk	0	3	-	2	2	-	-
		Golden Eagle	1	2	-	1	-	-	-
		Prairie Falcon	3	2	-	1	-	-	-
		Red-tailed Hawk	-	3	-	1	-	1	-

Table 3-7. Summary of Active and Non-active Raptor Territories within the Proposed FRTC Expansion Areas during 2018 and 2019 Surveys

Proposed Expansion Area	Survey Period	Species	Number of Birds (not including young-of-the-year)			Number of Territories			
			Non-territorial	Assoc. with Active Breeding Territories	Assoc. with Non-breeding Territories	Active Breeding Territories	Non-active Territories	Nest Pairs	Failed Nest Territories
DVTA	Winter 2018	American Kestrel	1	-	-	-	-	-	-
		Bald Eagle	3	-	-	-	-	-	-
		Cooper's Hawk	3	-	-	-	-	-	-
		Ferruginous Hawk	1	-	-	-	-	-	-
		Golden Eagle	46	2	6	1	-	3	1‡
		Merlin	1	-	-	-	-	-	-
		Northern Goshawk	2	-	-	-	-	-	-
		Northern Harrier	29	-	-	-	-	-	-
		Prairie Falcon	7	-	-	-	1	-	-
		Red-tailed Hawk	37	-	14	-	-	7	-
		Rough-legged Hawk	8	-	-	-	-	-	-
	Spring 2018	American Kestrel	17	-	-	-	-	-	-
		Cooper's Hawk	3	-	-	-	-	-	-
		Golden Eagle	22	4	13	3	2	6	1 + 1*
		Northern Goshawk	1	-	-	-	-	-	-
		Northern Harrier	7	-	2	-	-	1	-
		Prairie Falcon	10	8	3	5	5	-	-
		Red-tailed Hawk	46	11	-	7	-	-	-
		Sharp-shinned Hawk	4	-	-	-	-	-	-
		Swainson's Hawk	2	-	-	-	-	-	-
	Spring 2019**	Red-tailed Hawk	10	2	-	2	-	-	-

Notes: † = nest active: nest building observed in winter and successful in spring.
‡ = nest active: nest building observed in winter, but nest failed in spring.
* = nest active with eggs but raided by common raven and failed (see Section 3.3 for further details).

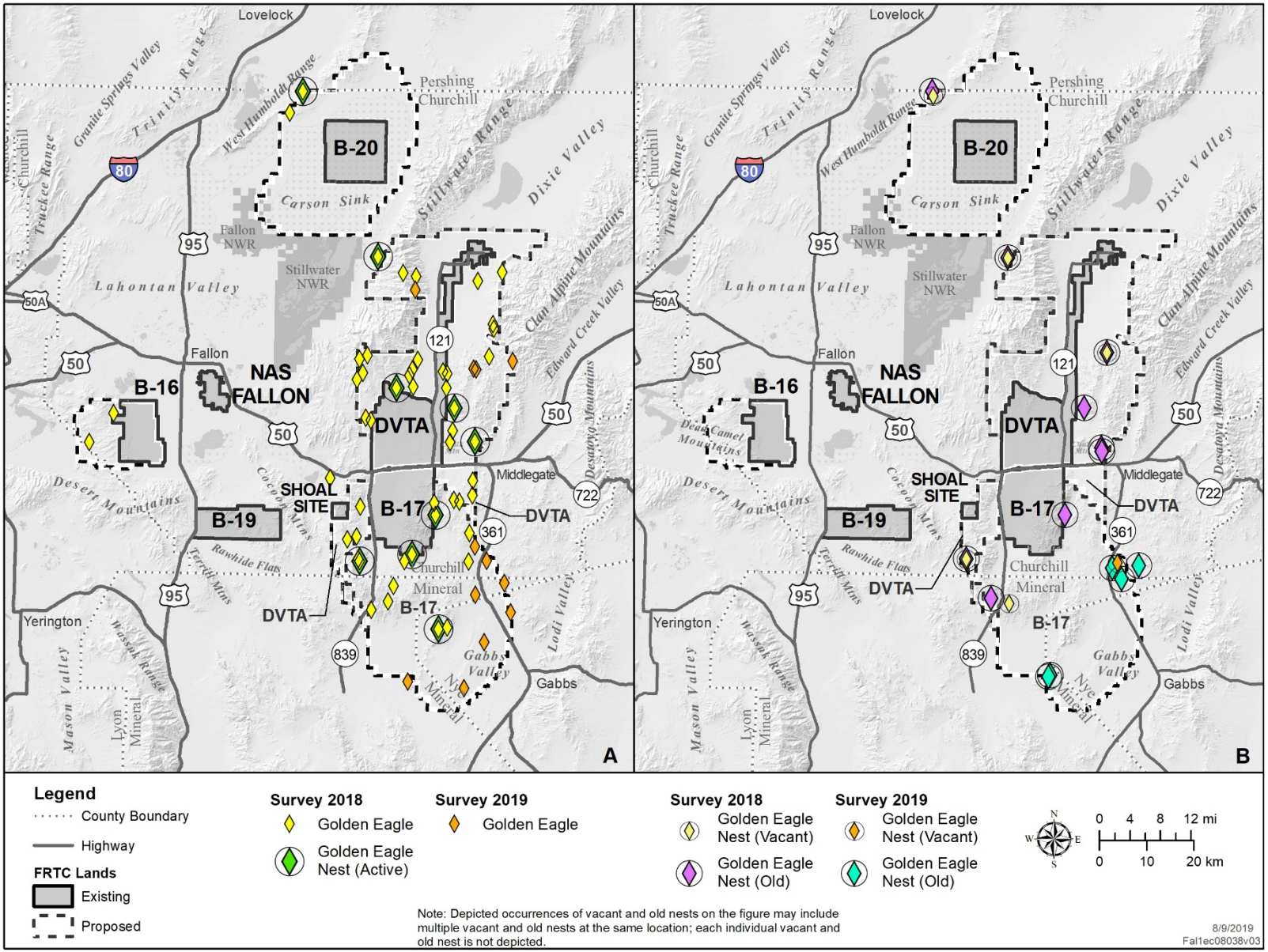

Figure 3-6. Occurrences of Golden Eagles and Nests within the Proposed FRTC Expansion Areas during Spring 2018 and 2019 Surveys

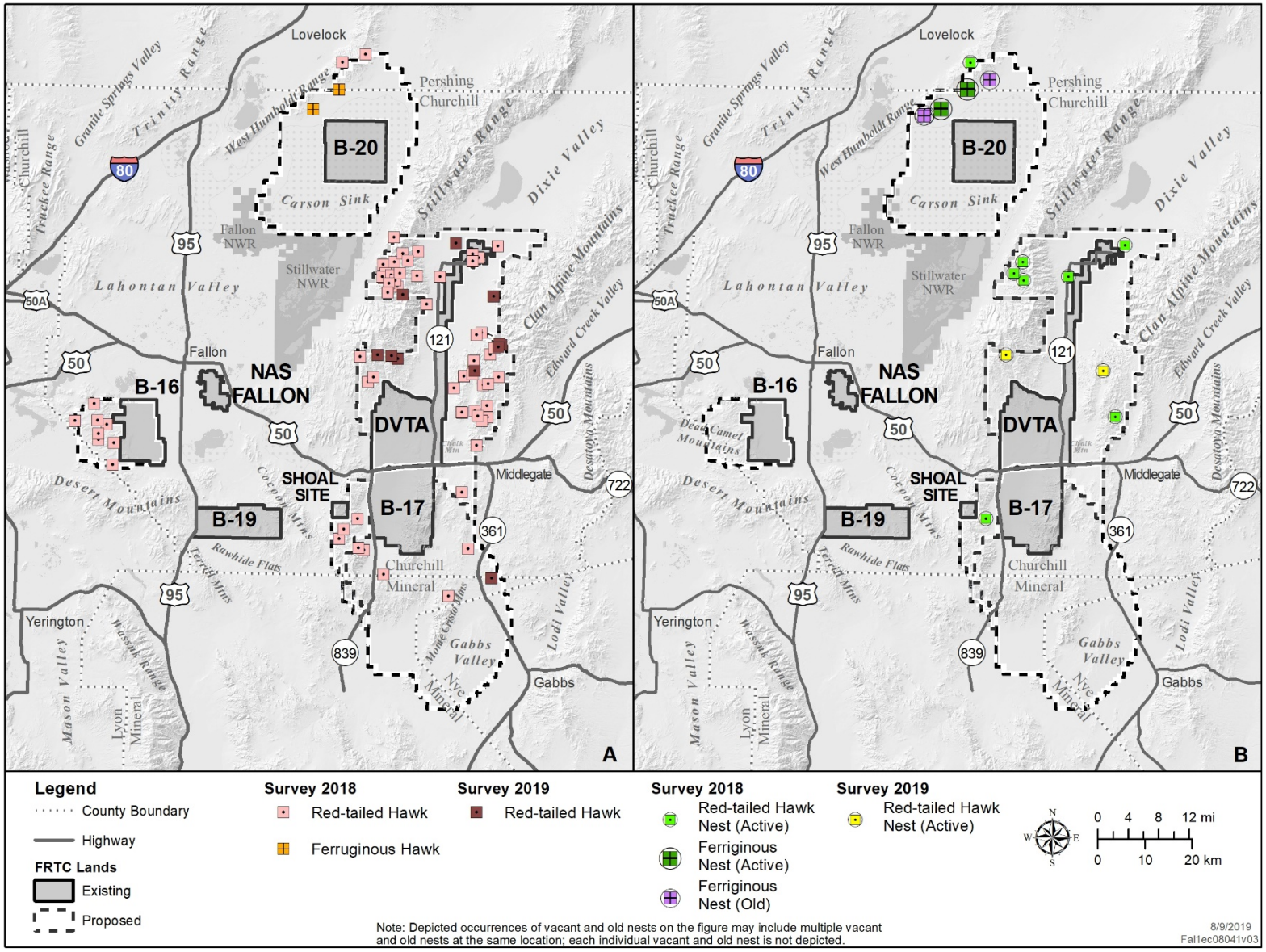

Figure 3-7. Occurrences of Ferruginous and Red-tailed Hawks and Nests within the Proposed FRTC Expansion Areas during Spring 2018 and 2019 Surveys

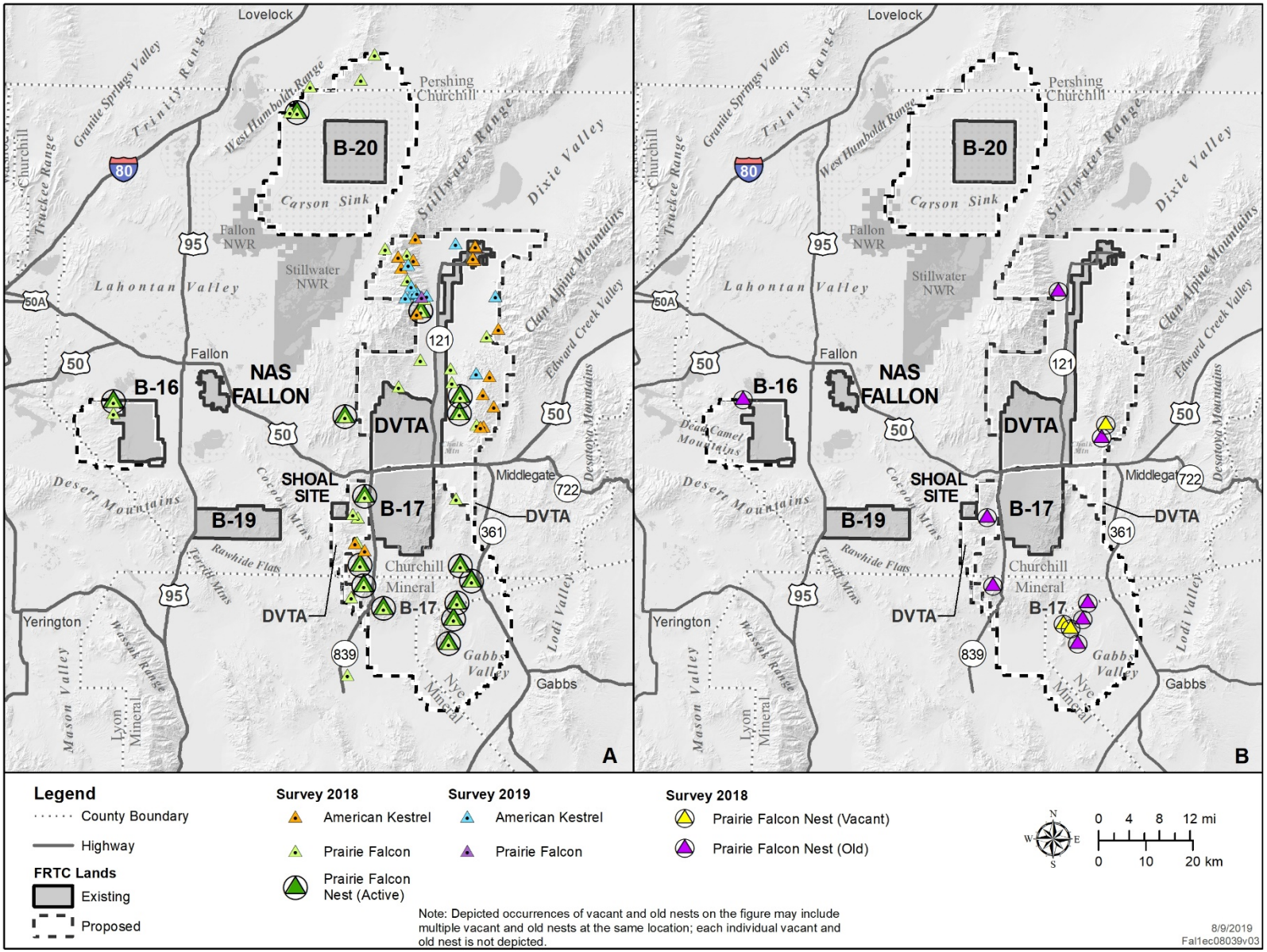

Figure 3-8. Occurrences of Falcons and Nests within the Proposed FRTC Expansion Areas during Spring 2018 and 2019 Surveys

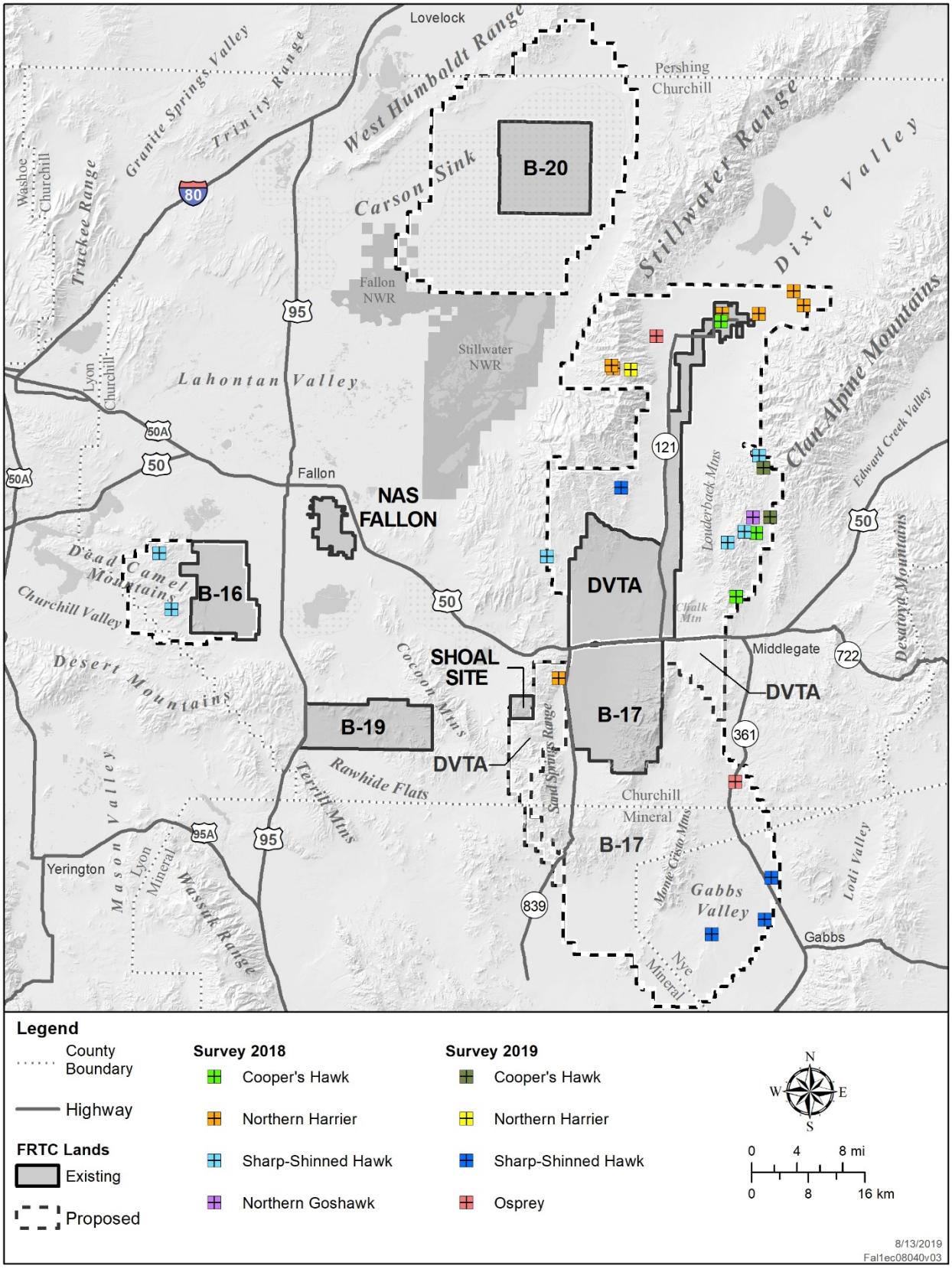

Figure 3-9. Occurrences of Cooper's Hawks, Northern Goshawks, Sharp-shinned Hawks, Osprey, and Northern Harriers within the Proposed FRTC Expansion Areas during Spring 2018 and 2019 Surveys

3.3. COMMON RAVEN AND TURKEY VULTURE OCCURRENCES AND OTHER RAPTOR-RELATED OBSERVATIONS

In addition to the collection of occurrence data for raptors and associated nests during the winter and spring surveys, data were also collected regarding common ravens, turkey vultures (*Cathartes aura*), unidentified species use of stick nests, unknown accipiters and buteos, and associated territories.

Common Raven. In the context of raptors and raptor populations, common ravens are an important species that influences raptor populations, both in terms of predation of nests (eggs and young) but also constructing stick nests that may be appropriated by a number of raptor species. Therefore, observed ravens and associated nests were recorded. Of the total of 1,073 raven records, 772 were observed during winter 2018 surveys, 229 during spring 2018 surveys, 15 during the winter 2019 surveys, and 57 during the spring 2019 surveys, with 35 active nests. The majority of raven occurrences were within the proposed DVTA expansion area (Table 3-8 through Table 3-10).

As noted in Table 3-7, one golden eagle nest with two eggs was presumed predated by ravens. On April 27, 2018, golden eagles were observed incubating two eggs. During a subsequent helicopter flight in the vicinity of the nest 13 days later (May 7, 2018), the adult golden eagles did not appear to be on territory and a single exposed egg was observed in the nest. Closer inspection revealed that the nest had been pilfered. One egg was gone, and the other had been opened from the midsection and left in the nest. This is a pattern that strongly fits raven predation. It is unclear whether the nest failed and was then pilfered, or if it was pilfered and then abandoned. In addition, the golden eagle nest was behind all the others in the area in terms of nest timing: all other golden eagle nests were well into chick rearing at this time of the nesting season.

Turkey Vulture. In addition to raven and raptor observations, observations of turkey vultures were also recorded. A total of 37 turkey vultures were observed (4 perched, 33 soaring): 33 within the proposed DVTA expansion area (30 spring 2018 and 3 spring 2019), 2 within the proposed B-16 expansion area in spring 2018, and 1 each within the proposed B-17 and B-20 expansion areas in spring 2018 (Table 3-10). No turkey vulture nests were observed.

Unknown Nests. Many unoccupied old nests and even active or recently vacant nests are difficult to associate with a specific species. Two data categories were included during surveys if a nest could not be tied to a specific species and were based on size, location, and construction: common raven/red-tailed hawk nest and red-tailed hawk/golden eagle nest. There was a total of 11 vacant nests and 47 old nests that could have been used by either a raven or red-tailed hawk, and 1 active nest, 4 vacant nests, and 21 old nests that could have been used by either a red-tailed hawk or golden eagle. The majority of each category was found in the proposed DVTA expansion area (Table 3-8 and Table 3-9).

Unknown Accipiter and Buteo. These categories include species for which a conclusive identification could not be made due to a number of factors (e.g., light, angle, unclear or complete view of the bird, etc.). There were only 8 records where a species could not be identified: 7 accipiters and 1 buteo (Table 3-10).

Table 3-8. Summary of Common Raven and Unidentified Raptor Nesting Activities within the Proposed FRTC Expansion Areas during Spring 2018 Surveys

Proposed Expansion Area	Species	Active Nests	Vacant Nests	Old Nests	Nest Contents Not Visible	Nest Contents Visible	Nests with Eggs	Total Eggs	Nests with Chicks	Total Chicks
B-16	Common Raven	5	0	1	4	1	1	4	0	0
	Common Raven/Red-tailed Hawk	0	2	2	-	-	0	0	0	0
	Red-tailed Hawk/Golden Eagle	1	0	2	0	1	0	0	0	0
B-17	Common Raven	7	1	4	7	0	0	0	0	0
	Common Raven/Red-tailed Hawk	0	4	15	1	3	0	0	0	0
	Red-tailed Hawk/Golden Eagle	0	3	5	-	-	0	0	0	0
B-20	Common Raven/Red-tailed Hawk	0	0	3	-	-	0	0	0	0
	Red-tailed Hawk/Golden Eagle	0	0	2	-	-	0	0	0	0
DVTA	Common Raven	20	1	5	9	11	3*	10	9*	38
	Common Raven/Red-tailed Hawk	0	4	20	-	-	0	0	0	0
	Red-tailed Hawk/Golden Eagle	0	1	12	-	-	0	0	0	0

Note: *One nest had one egg and one chick.

Table 3-9. Summary of Common Raven and Unidentified Raptor Nesting Activities within the Proposed FRTC Expansion Areas during Spring 2019 Surveys

Proposed Expansion Area	Species	Active Nests	Vacant Nests	Old Nests	Nest Contents Not Visible	Nest Contents Visible	Nests with Eggs	Total Eggs	Nests with Chicks	Total Chicks
B-17	Common Raven	1	0	0	-	-	0	0	0	0
	Common Raven/Red-tailed Hawk	0	1	6	0	0	0	0	0	0
DVTA	Common Raven	2	0	0	2	0	0	0	0	0
	Common Raven/Red-tailed Hawk	0	0	1	-	-	0	0	0	0

Table 3-10. Summary of Common Raven, Turkey Vulture, and Other Raptor-related Territories within the Proposed FRTC Expansion Areas during Winter and Spring 2018 and 2019 Surveys

Proposed Expansion Area	Survey Period	Species	Number of Birds (not including young-of-the-year)			Number of Territories			
			Non-Territorial	Assoc. with Active Breeding Territories	Assoc. with Non-Breeding Territories	Active Breeding Territories	Non-active Territories	Nest Pairs	Failed Nest Territories
B-16	Winter 2018	Common Raven	4	-	2	-	-	1	-
	Spring 2018	Common Raven	4	7	-	5	1	-	-
		Common Raven/Red-tailed Hawk	-	-	-	-	2	-	-
		Red-tailed Hawk/Golden Eagle	-	-	-	-	1	-	1
		Turkey Vulture	2	-	-	-	-	-	-
B-17	Winter 2018	Common Raven	41	-	-	-	-	-	-
		Unknown Buteo	1	-	-	-	-	-	-
	Spring 2018	Common Raven	30	7	-	7	2	-	-
		Common Raven/Red-tailed Hawk	-	-	-	-	14	-	2
		Red-tailed Hawk/Golden Eagle	-	-	-	-	4	-	1
		Turkey Vulture	1	-	-	-	-	-	-
	Winter 2019	Common Raven	6	-	2	-	-	1	-
	Spring 2019	Common Raven	21	3	-	-	-	1	-
B-20	Winter 2018	Common Raven	16	-	-	-	-	-	-
	Spring 2018	Common Raven	10	-	-	-	-	-	-
		Common Raven/Red-tailed Hawk	-	-	-	-	3	-	-
		Red-tailed Hawk/Golden Eagle	-	-	-	-	2	-	-
		Turkey Vulture	1	-	-	-	-	-	-
DVTA	Winter 2018	Common Raven	709	-	-	-	-	-	-
		Unknown Accipiter	2	-	-	-	-	-	-
	Spring 2018	Common Raven	143	28	0	20	1	-	-
		Common Raven/Red-tailed Hawk	-	-	-	-	20	-	-
		Red-tailed Hawk/Golden Eagle	-	-	-	-	9	-	-
		Unknown Accipiter	4	-	-	-	-	-	-
		Turkey Vulture	30	-	-	-	-	-	-
	Winter 2019	Common Raven	5	-	2	-	-	2	-
	Spring 2019	Common Raven	33	-	-	-	-	-	-
		Unknown Accipiter	1	-	-	-	-	-	-
		Turkey Vulture	3	-	-	-	-	-	-

4. DISCUSSION

4.1. WINTER SURVEYS

Overall, the winter surveys detected the raptor species that would be expected to occur within the survey area during January, February, and March. Of the three species that would be expected to occur but were not detected (red-shouldered hawk, sharp-shinned hawk, and peregrine falcon):

- The red-shouldered hawk is very rare in Nevada as a whole and is still considered a somewhat extralimital species from California.
- Accipiter hawks, such as sharp-shinned hawk, would be difficult to detect via helicopter due to their use of forested or edge habitats; however, sharp-shinned hawks were detected in the spring surveys.
- Peregrine falcons are rare within the study area as evidenced by the Hinde and HawkWatch (2011) and NDOW (2018) winter raptor survey data. Hinde and HawkWatch (2011) did not record a peregrine falcon during 8 years of surveys and NDOW (2018) has only one record from the 2012-2018 survey period.

The relative number of each species was also comparable to other winter raptor data for the study area, with golden eagle, red-tailed hawk, northern harrier, and rough-legged hawk being the most numerous species. Although American kestrels were found in relatively high numbers during previous winter raptor surveys within the study area, those previous surveys were all ground-based, road surveys which allowed for the detection of a small species such as the kestrel; helicopter surveys are not the best platform for detecting kestrels.

As expected, based on previous surveys of birds as well as other taxa within the survey areas, due to the diversity of habitats within the proposed DVTA expansion area, it supported the highest diversity of wintering raptor species as well as the greatest numbers (Table 3-2, Table 3-4, and Table 3-5).

4.2. SPRING SURVEYS

Overall, as with the winter surveys, the spring surveys detected the raptor species that would be expected to occur within the survey area in late April and early May. In terms of observed nesting species, although of the 10 raptor species known to nest within the study area (Table 1-3) only 4 were observed nesting, there may be a number of reasons for this lack of detection of nesting species.

- Accipiter species (sharp-shinned hawk, Cooper's hawk, and northern goshawk) nest in forested areas well beneath the canopy and nest sites would be difficult to detect from a helicopter.
- Nests of the ground-nesting northern harrier would also be very difficult to detect from a helicopter. Ground-based surveys are the preferred method for detection of nesting harriers.
- Although American kestrels are known to nest on cliffs, they are primarily known as tree cavity nesters and would also be difficult to detect from a helicopter. Ground-based surveys are the preferred method for detection of nesting kestrels.
- While Swainson's hawks would be expected to nest within the study area, they appear to be uncommon overall with only the observation of two individuals during the 2018 surveys and no observations during the 2019 surveys. Based on 2008-2015 NDOW and NNHP data, there was only one nesting record within the study area. In addition, all of the Swainson's hawk occurrences within the study area are centered within the area between Fallon and Stillwater National Wildlife

Refuge (Figure 1-15). It may be that the proposed expansion areas simply do not support suitable Swainson's hawk nesting habitat.

5. INCIDENTAL OBSERVATIONS

5.1. OWLS

Eight species of owls have been recorded within the study area: great-horned owl (*Bubo virginianus*), barn owl (*Tyto alba*), long-eared owl (*Asio otus*), short-eared owl (*Asio flammeus*), northern pygmy owl (*Glaucidium californicum*), northern saw-whet owl (*Aegolius acadicus*), western screech owl (*Megascops kennicottii*), and burrowing owl (Figure 5-1: *note*: burrowing owl occurrences are not included; further details can be found in DoN [2019b]).

During spring 2018 raptor surveys, great-horned owls were observed five times in the proposed DVTA expansion area and once in the proposed B-17 expansion area, and a long-eared owl was observed in the proposed DVTA expansion area (Figure 5-1). Only burrowing owl (3 individuals in total) were detected during the 2019 surveys.

5.2. MAMMALS

During the winter and spring 2018 raptor surveys, incidental occurrences of mammals were also recorded and are summarized in Table 5-1 and depicted in Figure 5-2 and Figure 5-3.

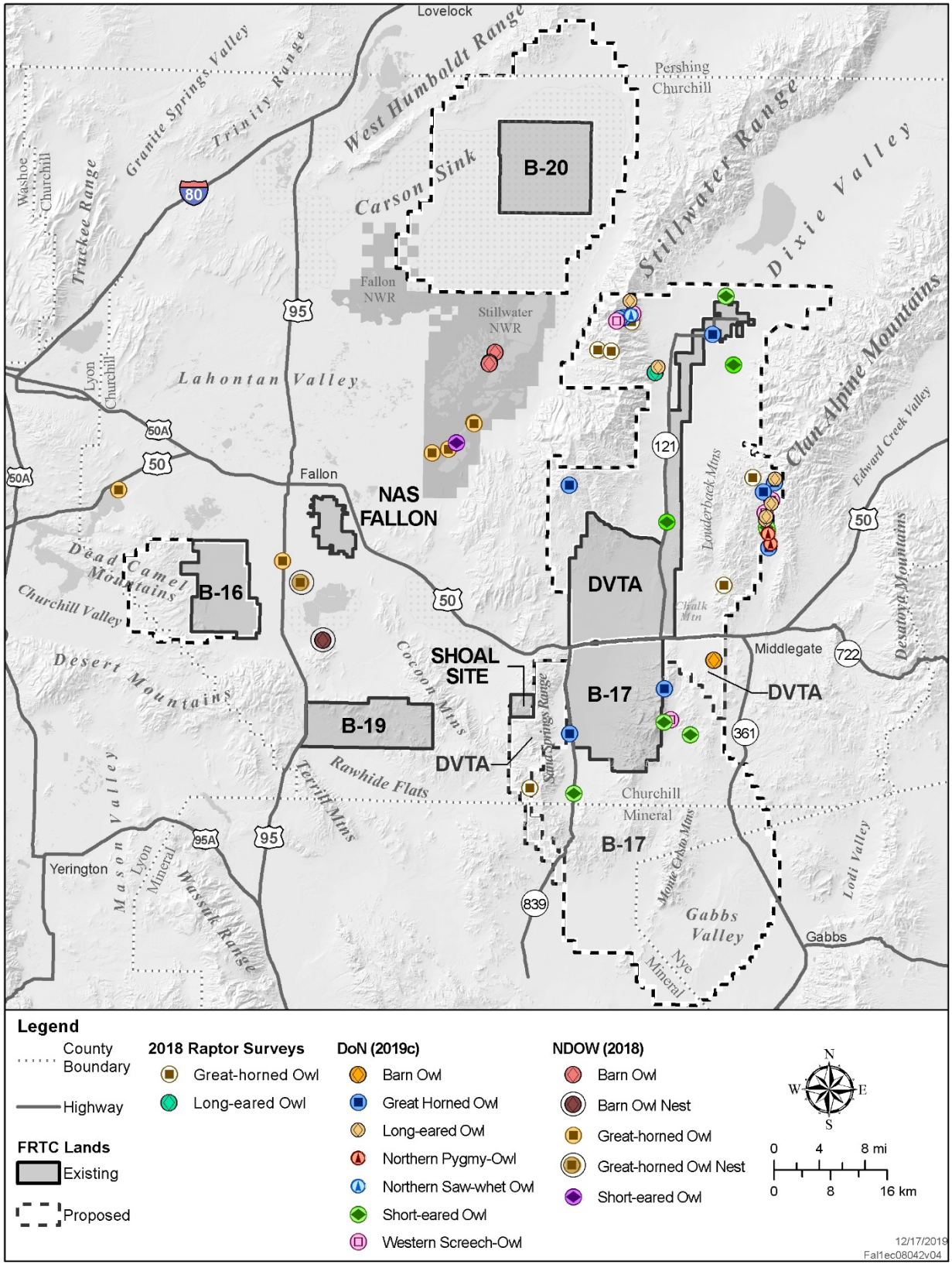

Figure 5-1. Occurrences of Owls within the Study Area
(*Note*: burrowing owl is not included)

Table 5-1. Incidental Mammal Observations during Winter and Spring 2018 Raptor Surveys within the Proposed FRTC Expansion Areas*

Species	EA	Date	Total	AD-Unk	AD-M	AD-F	IM	YR1	YOY	Unk	Notes
Bighorn Sheep (*Ovis canadensis nelsoni*)	B-17	Winter 2018	216	-	88	123	4	1	-	-	Many females pregnant in Feb.
		Spring 2018	125	-	66	42	1	-	16	-	
		Winter 2019	4	-	4	-	-	-	-	-	
	DVTA	Winter 2018	259	20	101	123	1	-	14	-	• Feb 1: single bighorn sheep ewe with six adult wild horses and one colt. • Feb: many pregnant.
		Spring 2018	491	106	42	249	6	2	66	20	
		Winter 2019	55	-	30	23	-	2	-	-	
		Spring 2019	32	-	19	9	1	-	3	-	
Mule Deer (*Odocoileus hemionus*)	B-17	Winter 2018	100	-	6	66	2	-	2	24	
		Spring 2018	6	6	-	-	-	-	-	-	
	DVTA	Winter 2018	53	14	7	28	-	3	-	1	
		Spring 2018	23	-	2	20	-	1	-	-	2 pregnant during May surveys.
		Winter 2019	26	-	-	24	-	2	-	-	
		Spring 2019	15	-	-	11	2	-	2	-	
	B-20	Spring 2018	4	-	-	4	-	-	-	-	

Table 5-1. Incidental Mammal Observations during Winter and Spring 2018 Raptor Surveys within the Proposed FRTC Expansion Areas*

Species	EA	Date	Total	AD-Unk	AD-M	AD-F	IM	YR1	YOY	Unk	Notes
Pronghorn (*Antilocapra americana*)	B-17	Winter 2018	79	-	36	37	1	5	-	-	
		Spring 2018	21	-	4	16	-	1	-	-	4 pregnant during May surveys.
		Winter 2019	44	-	7	36	-	1	1	-	
		Spring 2019	55	-	12	42	-	-	-	-	
	DVTA	Winter 2018	213	59	51	78	2	-	-	23	
		Spring 2018	67	3	25	35	-	1	2	1	15 pregnant.
		Winter 2019	2	-	2	-	-	-	-	-	
		Spring 2019	9	1	6	2	-	-	-	-	
	B-20	Winter 2018	3	-	1	2	-	-	-	-	
		Spring 2018	1	-	1	-	-	-	-	-	
Wild Horse (*Equus caballus*)	DVTA	Winter 2018	313	61	4	7	1	2	7	231	
		Spring 2018	163	94	3	1	-	1	13	51	
		Winter 2019	25	20	-	-	-	5	-	-	
		Spring 2019	151	31	3	68	2	-	1	46	
	B-20	Spring 2018	256	104	-	10	-	-	30	112	

Table 5-1. Incidental Mammal Observations during Winter and Spring 2018 Raptor Surveys within the Proposed FRTC Expansion Areas*

Species	EA	Date	Total	AD-Unk	AD-M	AD-F	IM	YR1	YOY	Unk	Notes
Coyote (*Canis latrans*)	B-17	Winter 2018	9	9	-	-	-	-	-	-	
		Spring 2018	3	3	-	-	-	-	-	-	
		Winter 2019	5	5	-	-	-	-	-	-	
		Spring 2019	7	7	-	-	-	-	-	-	
	DVTA	Winter 2018	22	22	-	-	-	-	-	-	
		Spring 2018	14	14	-	-	-	-	-	-	
		Spring 2019	1	1	-	-	-	-	-	-	
	B-20	Spring 2018	1	1	-	-	-	-	-	-	
	B-16	Winter 2018	2	2	-	-	-	-	-	-	
Red Fox (*Vulpes Vulpes*)	DVTA	Winter 2019	1	1	-	-	-	-	-	-	
Ermine (*Mustela ermine*)	DVTA	Winter 2018	1	-	-	-	-	-	-	1	
Yellow-bellied Marmot (*Marmota flaviventris*)	DVTA	Spring 2018	1	1	-	-	-	-	-	-	
		Spring 2019	8	-	-	-	-	-	-	8	

Notes: *AD-F = adult female; AD-M = Adult male; AD-Unk = adult-unknown sex; EA = proposed expansion area; IM = immature; Unk = unknown age; YOY = young of year; YR1 = year 1.

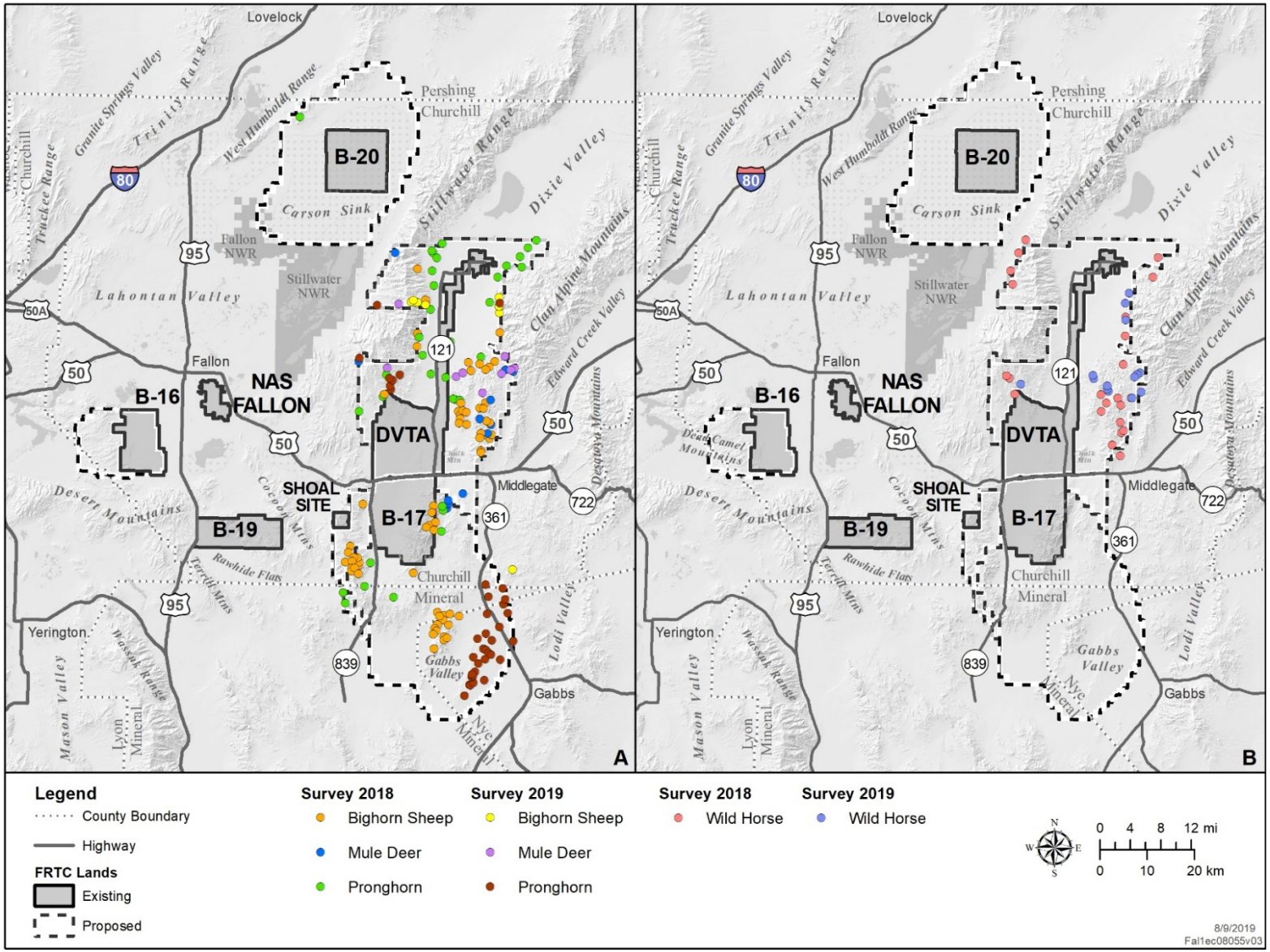

Figure 5-2. Incidental Observations of Bighorn Sheep, Mule Deer, Pronghorn, and Wild Horse within the Proposed FRTC Expansion Areas during 2018 and 2019 Raptor Surveys

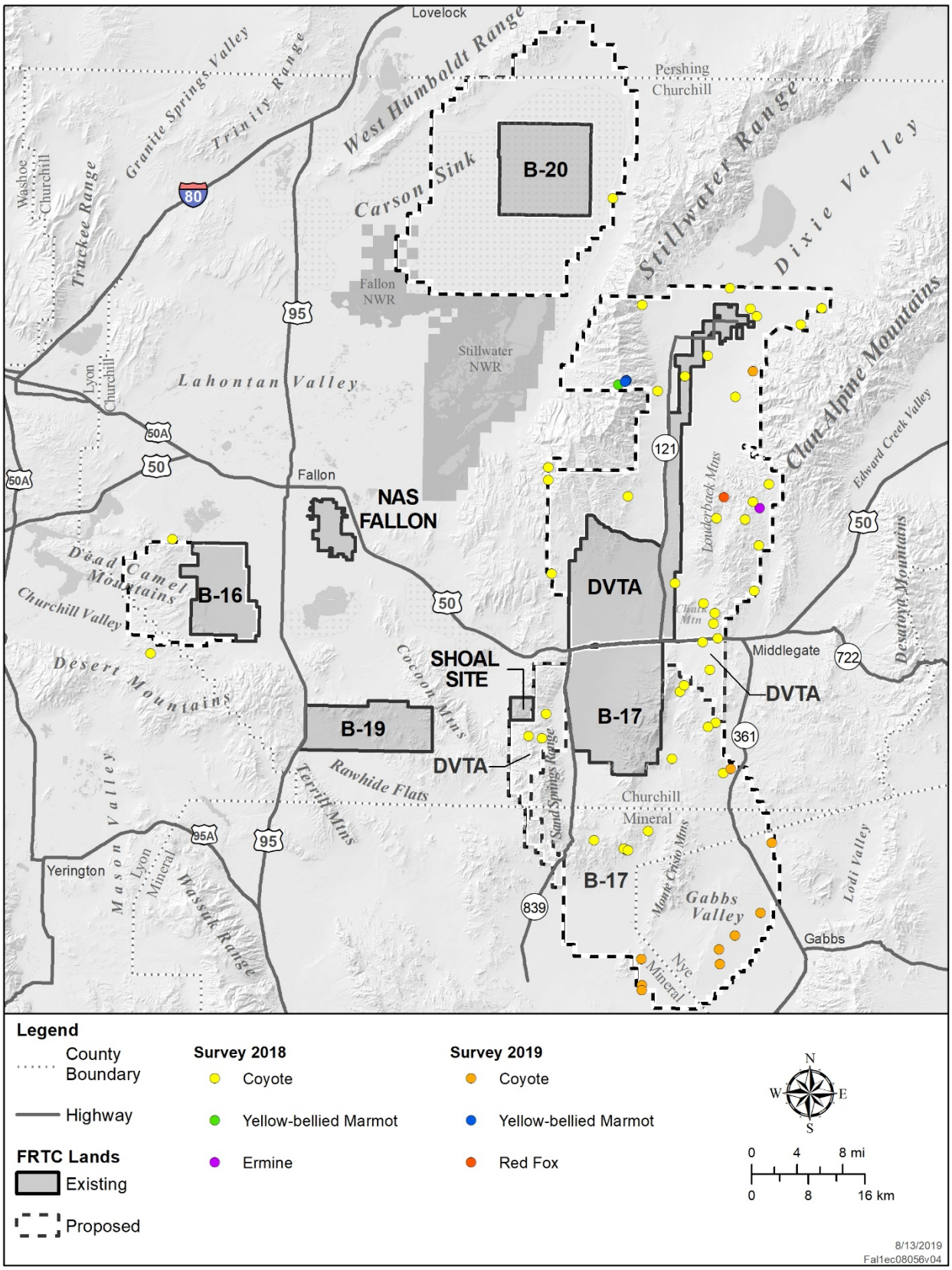

Figure 5-3. Incidental Observations of Coyote, Ermine, and Yellow-bellied Marmot within the Proposed FRTC Expansion Areas during 2018 and 2019 Raptor Surveys

6. REFERENCES

Alcorn, J.R. 1988. Birds of Nevada. Fairview West Publishing, Fallon, NV.

BLM. 2017. Updated Bureau of Land Management (BLM) Sensitive Species List for Nevada. Instruction Memorandum No. NV-IM-2018-003. Nevada State Office, Reno, NV. November 22.

Booms, T.L., P.F. Schempf, B.J. McCaffery, M.S. Lindberg, and M.R. Fuller. 2010. Detection probability of cliff-nesting raptors during helicopter and fixed-wing aircraft surveys in western Alaska. Journal of Raptor Research 44: 175-187.

Clements, J.F., T.S. Schulenberg, M.J. Iliff, S.M. Billerman, T.A. Fredericks, B.L. Sullivan, and C.L. Wood. 2019. The eBird/Clements Checklist of Birds of the World: v2019. http://www.birds.cornell.edu/clementschecklist/download/. Updated August; accessed September.

Craig, T. and L. Dillard. 2013. Aerial Raptor Stick Nest Survey – Spring 2013. Kanuti National Wildlife Refuge, Fairbanks, Alaska.

DoN. 2014. Final Integrated Natural Resources Management Plan Naval Air Station Fallon. Fallon, Nevada. Prepared for Public Works Department, Environmental Division, NAS Fallon, NV by AMEC Environment & Infrastructure, Inc., San Diego, CA. July.

DoN. 2019a. Final Plant Community Surveys and Mapping Report in Support of the Proposed Fallon Range Training Complex Expansion, Nevada. Prepared for NAVFAC Southwest, San Diego, CA by ManTech International Corporation, Lompoc and Solana Beach, CA. July.

DoN. 2019b. Final Burrowing Owl (*Athene cunicularia*) Survey Report in Support of the Proposed Fallon Range Training Complex Expansion, Nevada. Prepared for Naval Facilities Engineering Command, Southwest, San Diego, CA by ManTech International Corp., Lompoc and Solana Beach, CA. December.

DoN. 2019c. Final Avian Survey Report in Support of the Proposed Fallon Range Training Complex Expansion, Nevada. Prepared for Naval Facilities Engineering Command Southwest, San Diego, CA by ManTech International Corp., Lompoc and Solana Beach, CA. December.

DoN. 2019d. Final Wildlife Remote Camera Trapping Survey Report in Support of the Proposed Fallon Range Training Complex Expansion, Nevada. Prepared for Naval Facilities Engineering Command Southwest, San Diego, CA by ManTech International Corp., Lompoc and Solana Beach, CA. December.

Floyd, T., C.S. Elphick, G. Chisolm, K. Mack, R.G. Elston, E.M. Ammon, and J.D. Boone. 2007. Atlas of the Breeding Birds of Nevada. University of Nevada Press, Reno, NV.

GBBO. 2010. Nevada Comprehensive Bird Conservation Plan, ver. 1.0. Reno, NV.

Herron, G.B., C.A. Mortimore, and M.S. Rawlings. 1985. Nevada Raptors: Their Biology and Management. Biological Bulletin No. 8. Nevada Department of Wildlife, Reno, NV.

Hinde, A. and HawkWatch. 2011. Wintering Raptors of the Great Basin – Oases in the High Desert: Census and Banding Study 1985-2011. Salt Lake City, UT. November.

Jeffress, M. 2017. Nevada Winter Raptor Survey 2016, Annual Report. Nevada Department of Wildlife, Elko, NV. April.

Lahontan Audubon Society. 2007. A Birding Guide to Reno and Beyond. Second Edition. Reno, NV.

MacMahon, J. 1985. National Audubon Society Nature Guides: Deserts. Chanticleer Press, New York, NY.

McCarty, K.M., K.L. Licence, and K.V. Jacobson. 2016. Arizona Golden Eagle Productivity Assessment 2016. Nongame and Endangered Wildlife Program Technical Report 307. Arizona Game and Fish Department, Phoenix, AZ.

McIvor, D.E. 2005. Important Bird Areas of Nevada. Lahontan Audubon Society, Reno, NV.

Ministry of Sustainable Resource Management. 2001. Inventory Methods for Raptors. Version 2.0. Standards for Components of British Columbia's Biodiversity No. 11. Prepared by Ministry of Sustainable Resource Management, Environment Inventory Branch for the Terrestrial Ecosystems Task Force, Resources Inventory Committee, Victoria, BC.

NAS Fallon. 1997. Ecological Inventory of NAS Fallon and Environs Survey Report. Prepared for Commanding Officer, NAS Fallon, NV by Tetra Tech, Inc., EcoSystems-West, H.T. Harvey & Associates, and Wetland Research Associates. December.

NAS Fallon. 2008. Ecological Inventory Update Naval Air Station Fallon. Prepared for Fallon Range Training Complex, NAS Fallon, NV by Tierra Data, Escondido, CA.

NDOW. 2017. Known or Potential Occurrence of Wildlife Resources in the Vicinity of the Fallon NAS Withdrawal Located in Churchill, Lyon, Mineral, Nye, and Pershing Counties, Nevada. Personal communication via letter from B. Weller, GIS Specialist/Biologist III, NDOW, Reno, NV to K. Olthof, Wildlife Biologist, ManTech SRS Technologies, Inc., Lompoc, CA. January 4.

NDOW. 2018. Fallon Range Training Complex EIS Project – Raptor Nests and Winter Raptor Survey Data. Personal communication via email from B. Weller, GIS Specialist/Biologist III, NDOW, Reno, NV to R. Spaulding, Sr. Wildlife Biologist, ManTech International, San Diego, CA. April 20.

Nevada WAP Team. 2013. Nevada Wildlife Action Plan. Reno, NV.

Nielson, R.M., L. McManus, T. Rintz, L.L. McDonald, R.K. Murphy, W.H. Howe, and R.E. Good. 2014. Monitoring abundance of golden eagles in the western United States. Journal of Wildlife Management 78: 721–730.

Nielson, R.M., R.K. Murphy, B.A. Millsap, W.H. Howe, and G. Gardner. 2016. Modeling late-summer distribution of golden eagles (*Aquila chrysaetos*) in the Western United States. PLoS ONE 11(8): e0159271. doi:10.1371/journal.pone.0159271.

NNHP. 2018a. Exploring Species Information. http://heritage.nv.gov/species/. Accessed March.

NNHP. 2018b. GIS Shape Files Containing the Recorded Endangered, Threatened, Candidate, and At Risk Plant and Animal Elements (Taxa) within the NAS Fallon Modernization Environmental Impact Statement Project. Carson City, NV. April 9.

Pagel, J.E., D.M. Whittington, and G.T. Allen. 2010. Interim Golden Eagle Inventory and Monitoring Protocols; and Other Recommendations. Division of Migratory Bird Management, USFWS, Arlington, VA. February.

Ritchie, R.J., A. Wildman, and D.A. Yokel. 2003. Aerial surveys of cliff-nesting raptors in the National Petroleum Reserve, Alaska, 1999, with comparisons to 1977. Technical Note 143. Bureau of Land Management, Denver, CO.

Sowell, J. 2001. Desert Ecology: An Introduction to Life in the Arid Southwest. University of Utah Press, Salt Lake City, UT.

USFWS. 2008. Birds of Conservation Concern. Arlington, VA.