Wildlife and Vegetation Monitoring Report at the National Wind Technology Center

ERO Resources
Denver, Colorado

NREL Technical Monitor: Tom Ryon

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Subcontract Report
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June 2018

Contract No. DE-AC36-08GO28308

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ERO

Consultants in Natural Resources and the Environment

2016 Wildlife and Vegetation Monitoring Report
National Wind Technology Center
Jefferson County, Colorado

Prepared for—

National Renewable Energy Lab
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Golden, Colorado 80401

Prepared by—

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EXECUTIVE SUMMARY

As part of the five-year monitoring update of its natural resources, the National Renewable Energy Laboratory (NREL) contracted with ERO Resources Corporation (ERO) to conduct avian, small mammal, amphibian, and vegetation surveys at the National Wind Technology Center (NWTC). This update to the baseline survey conducted in 2010-2011 will be used to evaluate and support National Environmental Policy Act (NEPA) analyses and assist in the management of natural resources at NWTC. NWTC is located on the boundary of Boulder and Jefferson Counties in Colorado (project area) and is part of the National Renewable Energy Laboratory (NREL), a laboratory of the U.S. Department of Energy (DOE). NWTC is operated by the Alliance for Sustainable Energy, LLC.

Since 1996, NREL has conducted wildlife and vegetation surveys at NWTC – in 1996, Monahan conducted a raptor study; in 2000, Plantae conducted a site characterization of all vegetation communities and noxious weeds found on-site; and in 2003, Schmidt et al. conducted a bird and bat use and fatality study. Most recently, Walsh (2011a) conducted a vegetation community and weed mapping survey along with small mammal, amphibian, and nocturnal owl surveys. Also in 2011, Tetra Tech, Inc. completed avian presence and bird and bat mortality surveys, while Walsh completed a separate bat study (Walsh 2011b).

In preparation for this monitoring report, ERO reviewed prior studies conducted by Walsh (2011a) and data from the Colorado Natural Heritage Program (CNHP 2016). Field data collection included vegetation and noxious weed mapping, live-trapping for small mammal presence, call-back surveys for nocturnal owl and amphibian presence, and point counts for detecting avian presence.

CNHP data revealed several rare and/or imperiled species potentially occurring at or within 2 miles of NWTC (CNHP 2016). One amphibian species of concern, the northern leopard frog (*Lithobates pipiens*), was heard during the 2016 surveys. No other wildlife species of concern were observed.

No rare or imperiled plant species or communities were observed during the 2016 surveys. The majority of vegetation at NWTC belongs to the xeric mixed grassland classification. Within that broad classification, ERO identified five distinct grassland community types, the largest and most widespread of which is the nonnative grassland community. Other mapped vegetation communities at NWTC include mixed grassland, disturbed native grassland, mixed yucca and nonnative grassland, degraded grassland, ponderosa pine woodland, mixed shrubland, palustrine emergent wetland, and riparian emergent wetland. Noxious weeds were identified and mapped.

General wildlife observed in conjunction with trapping and point count surveys included desert cottontail (*Sylvilagus audubonii*), coyote (*Canis latrans*), mule deer (*Odocoileus hemionus*), and American elk (*Cervus elaphus*). Evening herpefauna surveys revealed western chorus frog (*Pseudacris triseriata*), Woodhouse's toad (*Anaxyrus woodhousii*), and northern leopard frog. One tiger salamander (*Ambystoma tigrinum*) larva was also observed. Small mammal trapping revealed 5 different species, with 92 individual mammals trapped on-site. A total of 30 different species of songbirds were observed

on-site during summer 2016. In the process of conducting point counts, a variety of bird species were observed as flyovers including great egret (*Ardea alba*), great-horned owl (*Bubo virginianus*), common raven (*Corvus corax*), and double-crested cormorant (*Phalacrocorax auritus*).

Significant findings by ERO are:

- Nine vegetation community types were identified at NWTC; including five distinct grassland community types.
- A large wetland complex was observed that had previously been mapped as "mixed mesic grassland," indicating hydrology in this area has increased sufficiently enough from 2011 to support wetlands.
- Fourteen species on the Colorado Noxious Weed Lists were observed at NWTC. However, their abundance appears to have declined since 2011, particularly that of diffuse knapweed.
- The northern leopard frog was heard in wet areas adjacent to survey station A3 and at survey station A2 on the NWTC in 2016. This species had not been observed during previous baseline surveys and prior to 2015 was not known to occur at NWTC.
- Four out of six amphibian species that potentially occur within the NWTC property boundaries were documented during the 2016 surveys.
- Few large raptors were observed within and over the NWTC site, which could be due to the scarcity of perch and nest sites or other factors. American kestrels (*Falco sparverius*), which prey largely on small mammals, were observed frequently.
- The relatively high number of small mammals trapped on-site in 2016 reflects the high-quality small mammal foraging and breeding habitat at NWTC. The small mammal population likely supports several species of mammalian and avian predators.
- Avian species richness in 2016 was relatively high, which is consistent with previous findings. Species composition has changed since 2011 as follows:
  - No horned larks (*Eremophila alpestris*) were observed in 2016, whereas they were among the most abundant species observed in 2011. This may be an indication of a shift in breeding habitat or a drop in population for this once widespread songbird, which has undergone a sharp decline throughout the United States in the last half century (Sauer et al. 2014).
  - Killdeer (*Charadrius vociferous*) were observed during the 2016 surveys but not in the 2011 surveys. The presence of this species could indicate a subtle change in vegetative composition or structure.

INTRODUCTION

The National Renewable Energy Laboratory (NREL) has been monitoring wildlife and vegetation characteristics at the National Wind Technology Center (NWTC) in Jefferson and Boulder Counties, Colorado since 1996. The most recent baseline surveys were conducted in 2010-2011 by Walsh (Walsh 2011a), Tetra Tech in 2010-2011 (Tetra Tech 2011). NWTC contracted ERO Resources Corporation (ERO) in 2016 to continue wildlife and vegetation monitoring in an effort to update the baseline wildlife and vegetation conditions present at the NWTC (Figure 1).

This report updates baseline conditions at the NWTC. Components of this work include sitewide surveys for vegetation, noxious weeds, small mammals, amphibians and reptiles, small owls, migratory birds, and bats.

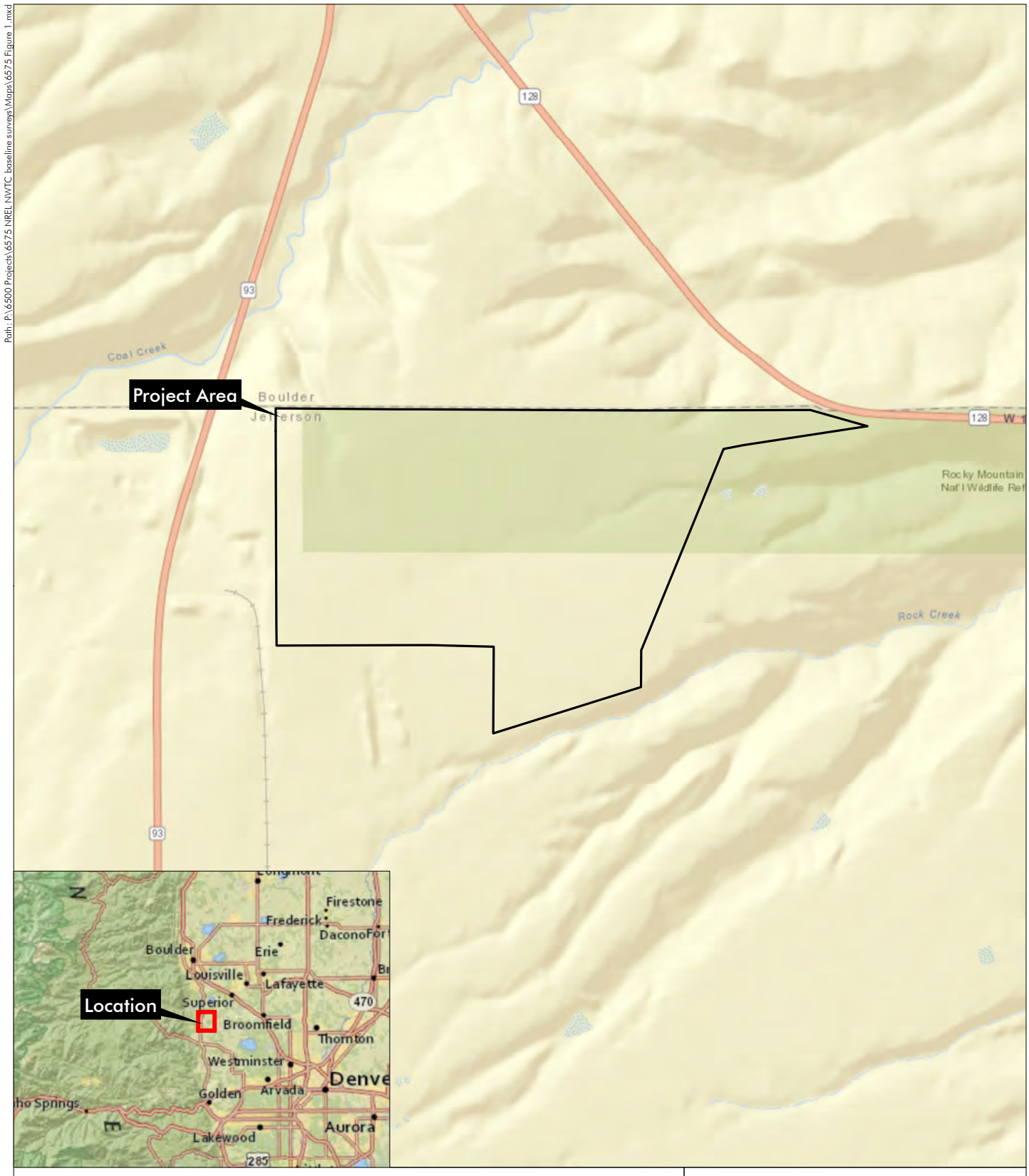
The survey work achieved four main objectives:

1. Updated baseline conditions at the site (i.e., repeated previous surveys);
2. Compared results with 2011 wildlife and vegetation surveys and identified changes in vegetation communities and species composition (includes the Walsh and Tetra Tech surveys);
3. Provided supporting information for periodic National Environmental Policy Act (NEPA) analysis/documentation for NREL research activities; and
4. Identified high value or sensitive habitats where development impacts should be minimized.

METHODS

To provide effective and repeatable methods in the field, ERO reviewed species lists and adopted portions of methods described by Walsh (2011a). The *2010-2011 Vegetation and Wildlife Surveys at the National Renewable Energy Laboratory* (Walsh 2011a) and the *Avian Monitoring and Mortality Report* (Tetra Tech 2011) were reviewed as part of the background research and fieldwork preparation for ERO's survey work at NWTC. ERO also reviewed Colorado Natural Heritage Program (CNHP) data for known locations of rare and/or imperiled plant and animal species at or within 2 miles of NWTC.

ERO completed wildlife and vegetation field surveys over a little more than three months (June through early September) in summer 2016. Vegetation and noxious weed surveys were conducted in early summer (June 21 and 22, 2016) and late summer (August 9, 2016) to account for differences in species flowering times. Point counts also were conducted during early and late summer to determine the presence of spring migrant and late summer/resident species (June 2, 3, and 10, 2016 and September 6 through 8, 2016). Small mammal live-trapping was conducted in mid-August to account for post-breeding season populations at the NWTC. Reptile, amphibian, and owl surveys were conducted the evenings of May 31 and June 2, 2016.



2016 Wildlife and Vegetation Monitoring Project

Sections 3 and 4, T2S, R70W; 6th PM

UTM NAD 83: Zone 13N; 480532mE, 4417828mN

Latitude, Longitude: 39.910314°N, 105.227773°W

USGS Louisville, CO Quadrangle

Jefferson County, Colorado

Figure 1
Vicinity Map

Prepared for: NREL
File: 6575 Figure 1.mxd (GS)
September 1, 2016

ERO Resources Corp.

Vegetation and Noxious Weed Mapping

Vegetation Mapping

ERO characterized the vegetation communities found at the NWTC site following a rapid assessment framework in which communities are differentiated by their species composition and structural layers. Emphasis was placed on dominant species when determining community boundaries. Prior to conducting fieldwork, ERO used aerial photography and topographic mapping to identify potential vegetation communities that would be ground-truthed during field surveys.

Surveyors walked meandering transects through the site to identify communities based on visual changes in species composition and structural layers. Vegetation inventory data forms were completed to document dominant species within each community (Appendix A). The data forms included visual estimates of relative species cover. The completed data forms reflect abundant and common species and are not a comprehensive species inventory. A list of all plant species observed during the surveys was compiled (Appendix B). Nomenclature follows *PLANTS Database* (U.S. Department of Agriculture/Natural Resource Conservation Service (USDA/NRCS) 2016).

To provide NREL with more information about isolated wetlands and seeps at NWTC, ERO conducted vegetation-based delineation and mapping of these communities. Formal U.S. Army Corps of Engineers jurisdictional delineation of wetlands was not conducted. ERO surveyed for occurrences of rare or imperiled plant species and communities during the vegetation mapping effort.

Noxious Weed Mapping

ERO mapped locations of noxious weeds that are listed on the State Noxious Weed Lists. During the 2016 weed surveys, emphasis was placed on areas previously identified by Walsh (2011a) as containing high-density populations of noxious weeds. Surveyors walked meandering transects throughout NWTC and locations of weeds were either drawn onto aerial photographs or mapped using a Global Positioning System (GPS) unit. High-density weed patches were mapped as individual polygons, while low-density and scattered populations are described and mapped at a broad scale. The density of noxious weed populations was estimated using the scale provided in Table 1. Noxious weed mapping was conducted concurrently with the vegetation community mapping.

Table 1. Dominance categories of noxious weeds.

Dominance Category	Description	Vegetative Cover
1	Uncommon and scattered individuals	Less than 10%
2	Infrequent and small populations	10-20%
3	Common, moderately dense populations	20-50%
4	Dominant within the community; dense populations	50-80%
5	Monotypic populations	Greater than 80%

Wildlife Surveys

Targeted surveys for small mammals, reptiles, amphibians, owls, and songbirds were conducted as outlined below. Observations of other wildlife, including small and large mammals and raptors, observed incidentally during targeted surveys were also recorded.

Small Mammals

Small mammal (rodent) live-trapping was conducted at six transect locations previously surveyed in 2010 and 2011 (Photo 1; Walsh 2011a). Transects were replicated to provide repeatability in analysis and allow comparison of results. These transects were selected to account for the small variation in vegetation communities found on-site. Over a period of 4 nights, 176 live-traps were set collectively, for a total of 704 trap nights. Traps were closed during daylight hours and opened shortly before sunset. All individual species captured were identified to genus and species, and age and sex were documented. Captured animals were marked on the right foot with nail polish. ERO conducted the trapping survey using protocol approved by the Animal Care and Use Committee of the American Society of Mammalogists from *Guidelines of the American Society of Mammalogists for the Use of Wild Mammals in Research* (Sikes 2016).

Bats

Acoustic recording devices were used to monitor bat activity at NWTC using a Song Meter SM2BAT+ at two locations; one at NWTC Site 4.4 met tower and on the Rocky Flats Refuge along the Lindsey Ranch tributary of Rock Creek. This effort was conducted by an NREL wildlife biologist and recording was conducted from mid-April to mid-September, 2015 in locations different than previous efforts (Walsh 2011a). The NWTC and the adjacent Rocky Flats Refuge are assumed to be within the roosting, foraging, and commuting ranges of bats in the general area and therefore observations at one site are likely at the other, limited only by specific habitats present. For example, the lack of trees on NWTC may limit roosting habitat, but not foraging habitat. Mist netting at NWTC and the Rocky Flats Refuge were conducted in 2016 under a separate effort (Rodriguez 2016).

Mammalian Predators

Observations of mammalian predators were made by the use of camera traps installed by NREL. Bushnell Model 119446 trophy trail cameras were used with unscented and scented posts within the field of view of the cameras. Cameras were set to deliver two photos within 2 seconds of each other once the camera sensor was triggered. Camera traps were located along the pine ridge in the northwestern portion of the NWTC and at the eastern boundary where the Rock Creek tributary crosses onto the Rocky Flats Refuge for the entire year, January 1, 2015 to December 31, 2015 and January 1, 2016 to September 15, 2016. These methods represent a monitoring effort greatly expanded from previous efforts (Walsh 2011a).

Reptiles and Amphibians

Nocturnal amphibian surveys were conducted on May 31 and June 2, 2016 using methods adapted from the U.S. Geological Survey Protocol (Droege 2010). Species were documented via vocalization and a

calling index score was designated. Calling index scores range from 1 to 3. An index score of 1 means that individual frog calls can be counted and there are quiet periods between calls. An index score of 2 means that calls of individual frogs can be counted – but there is some overlap, while an index score of 3 means that there is a full chorus of amphibian calls that are continuous and overlapping. Because amphibians are known to be attracted to roads at night, surveys also included searching roads in NWTC. Seven predesignated survey stations from 2011 surveys (Figure 2; Walsh 2011a) were visited near wetland areas in NWTC (A 1 through A7). Survey stations were visited 30 minutes after sunset over a period of two nights, instead of a period of three nights due to the late season start date.

Daytime surveys for reptiles and amphibians were conducted prior to nocturnal amphibian surveys and were focused on habitat features likely to be inhabited by reptiles or amphibians such as rocky outcrops, isolated wetlands, and riparian emergent wetland habitats. During the surveys, objects that could provide important habitat for amphibians and reptiles, such as logs, boards, and rocks, were searched. Amphibian habitat was surveyed for the presence of eggs, tadpoles, or adults. Any amphibians or reptiles observed were identified to species, and the general habitat in which they were found was recorded.

Owls

Nocturnal playback surveys for small owl species were conducted on May 31 and June 2, 2016 at three predesignated points from the 2011 surveys (Figure 2). Using methods adapted from Cilimburg (2007), a playback caller was used to attempt to locate any owls present in or near NWTC.

Migratory Birds

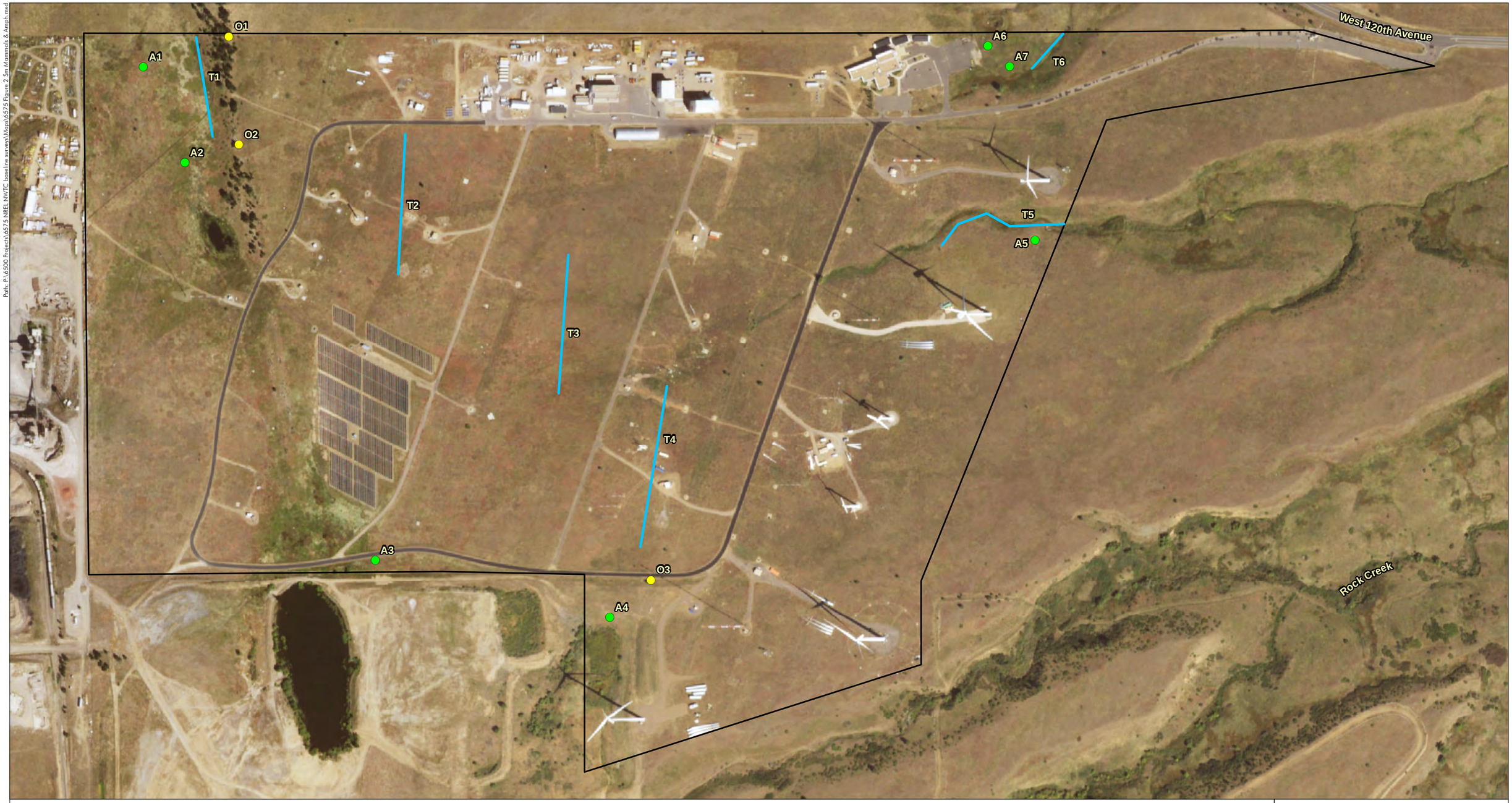
Songbird point counts were conducted in early summer and fall following methods adapted from Rocky Mountain Bird Observatory's 2009 point-transect protocol (Hanni et al. 2009). Previous point counts were conducted in 2010 and 2011. The six point count survey locations were replicated from the previous surveys (Figure 3; Photos 2 through 7). Points in 2010 and 2011 were assigned to allow for a survey within the various habitat types found in NWTC. Birds seen and heard at each point within a 20-minute period once per morning were recorded. Species, age, sex, and number of individuals was noted. Sitewide diversity and evenness were estimated using the Shannon-Weiner Diversity Index and the Simpson's Index of Diversity. The Shannon-Weiner Index assumes that individuals are randomly sampled from an independent large population and all species are represented in the sample; this index is widely used for comparing diversity between various habitats (Hutchison 1970):

$$H' = \sum - (P_i * \ln P_i)$$

Where H' = Diversity Index; P = is the proportion of each species in the sample; $\ln P_i$ = natural logarithm of this proportion.

Typical values are generally between 1.5 and 3.5 in most ecological studies, and the index is rarely greater than 4. The Shannon-Weiner index provides a simple synthetic summary of diversity and is most appropriate for comparing communities that do not differ greatly in richness.

Path: P:\6500 Projects\6575 NREL NWTC baseline surveys\Maps\6575 Figure 2 Sm Mammals & Amph.mxd



2016 Wildlife and Vegetation Monitoring Project

- Nocturnal Amphibian Survey Station
- Nocturnal Owl Survey Station
- Small Mammal Trapping Transect
- Project Area Boundary

Image Source: USDA FSA, 2015

0 225 450 Feet

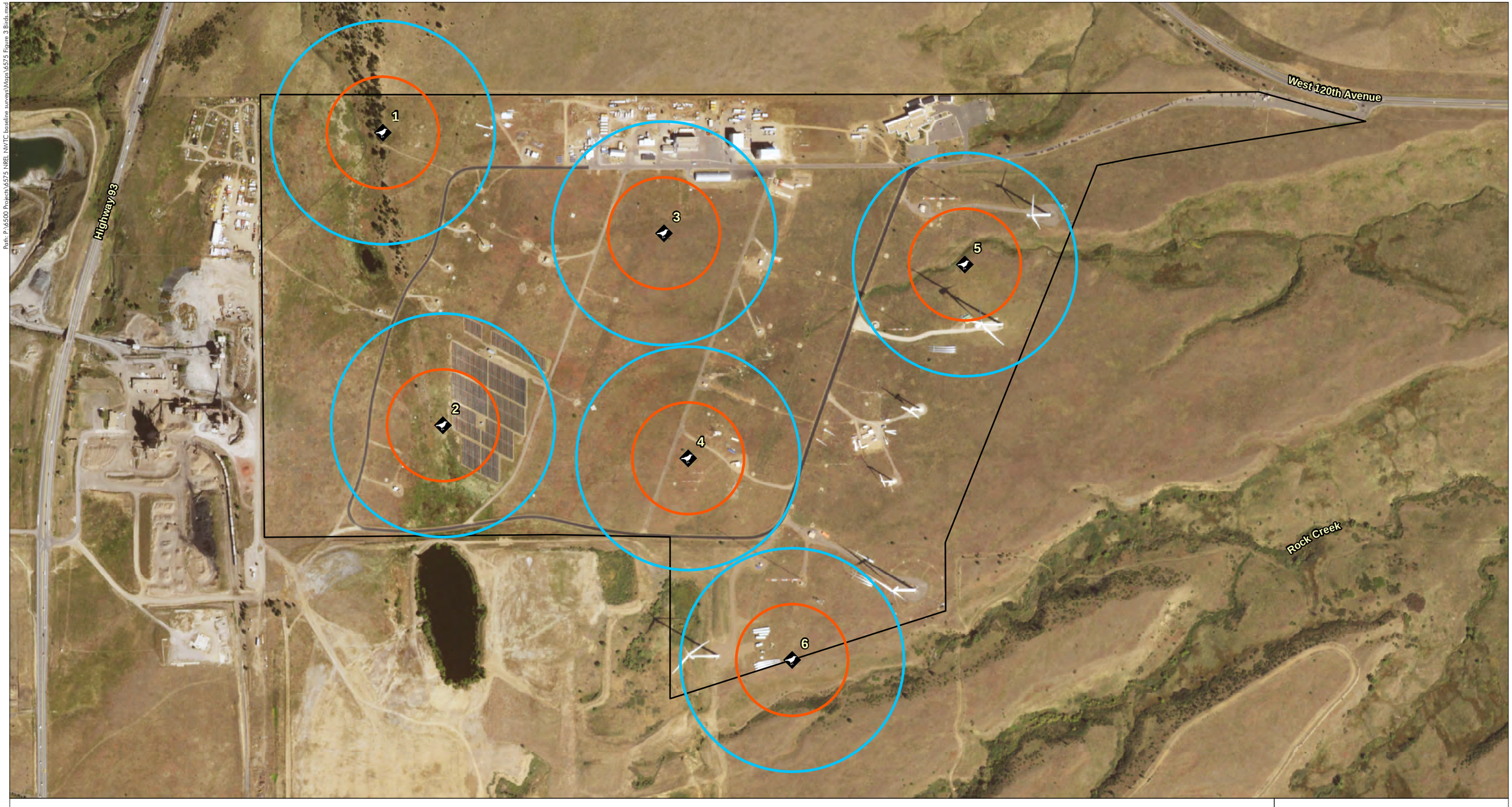
N

Figure 2
Small Mammal Trapping and Nocturnal Survey Locations at NWTC, August 2016

Prepared for: NREL
File: 6575 Figure 2 Sm Mammals & Amph.mxd (GS)
October 14, 2016

ERO Resources Corp.

Path: P:\6500 Projects\6575 NREL NWTC baseline survey\Maps\6575 Figure 3 Birds.mxd



2016 Wildlife and Vegetation Monitoring Project

- Point Count Location
- 100-Meter Point Count Location Buffer
- 200-Meter Point Count Location Buffer
- Project Area Boundary

Image Source: USDA FSA, 2015

0 275 550 Feet

N

Figure 3
Avian Point Count Locations at NWTC, June and September 2016

Prepared for: NREL
File: 6575 Figure 3 Birds.mxd (GS)
September 1, 2016

ERO Resources Corp.

The Simpson's Index of Diversity measures the probability that two individuals randomly selected will belong to the same species (Peet 1975):

$$D = 1 - \{\sum n (n-1) / N (N-1)\}$$

Where D = Diversity index; n = the total number of birds of a particular species; and N = the total number of birds of all species.

The value of D ranges between 0 and 1, where 1 is complete equitability between the proportions of each species. Simpson's Index provides an intuitive proportional measure of diversity by giving more weight to the more abundant species in a sample and is much less sensitive to species richness.

The two diversity indices were calculated for the 2010-2011 and 2016 surveys to allow comparison in diversity between the two periods across all point count locations combined.

RESULTS

Background Research

Based on the CNHP database query, NWTC is within the Rocky Flats Grassland Network of Conservation Areas (NCA). The southeast section of NWTC is located within the Rocky Flats Potential Conservation Area (PCA). Within 2 miles of NWTC, 2 mammal, 3 bird, 1 amphibian, and 19 vascular plant species considered rare and/or imperiled have been documented (Table 2). Based on CNHP data, within NWTC, the ferruginous hawk (*Buteo regalis*), ottoe skipper *(Hesperia ottoe*), cross-line skipper (*Polites origenes*), and forktip three-awn (*Aristada basiramea*) are known or likely to occur within NWTC. The northern leopard frog was observed by NREL staff and ERO in NWTC and was not previously known to occur at this location.

Table 2. Rare and/or imperiled species and natural communities known from or likely to occur within a 2-mile radius of NWTC.

Scientific Name	Common Name
MAMMALS	
Zapus hudsonius preblei	Preble's meadow jumping mouse
Cynomys ludovicianus	Black-tailed prairie dog
BIRDS	
Haliaeetus leucocephalus	Bald eagle
*Buteo regalis**	Ferruginous hawk*
Melanerpes lewis	Lewis's woodpecker
AMPHIBIANS	
Lithobates pipiens	**Northern leopard frog**

Scientific Name	Common Name
INSECTS	
Speyeria idalia	Regal fritillary
Atrytone arogos	Arogos skipper
Callophrys mossii schryveri	Moss's elfin
Erynnis martialis	Mottled dusky wing
*Hesperia ottoe**	Ottoe skipper*
*Polites origenes**	Cross-line skipper*
Celastrina humulus	Hops feeding azure
VASCULAR PLANTS	
Amorpha nana	Dwarf wild indigo
Carex oreocharis	Grassyslope Sedge
Liatris ligulistylis	Meadow blazing star
Mentzelia sinuata	Wavy-leaf stickleaf
*Aristada basiramea**	Forktip three-awn*
Crataegus chrysocarpa	Yellow hawthorn
Viola pedatifida	**Prairie violet**
Oenothera coloradensis spp. coloradensis	**Colorado butterfly plant**
Physaria vitulifera	**Rydberg twinpod**
Spiranthes diluvialis	**Ute ladies'–tresses orchid**
Carex saximontana	Rocky Mountain sedge
Helianthemum bicknellii	Hoary frostweed
NATURAL COMMUNITIES	
Andropogon gerardii – Schizachyrium scoparium	Xeric tallgrass prairie
Hesperostipa neomexicana	Great Plains mixed grass prairie
Populus angustifolia/Salix irrorata	Foothills riparian woodland
Pinus ponderosa/Cercocarpus montanus/Andropogon gerardii	Foothills ponderosa pine scrub woodlands

*Rare and/or imperiled species known or likely to occur within NWTC.
New species since 2011 are indicated in bold.
Source: CNHP 2016.

Vegetation and Noxious Weed Mapping

Vegetation Mapping

ERO identified nine vegetation community types within NWTC (Figure 4). Descriptions of vegetation communities are provided below. The majority of NWTC can broadly be described as xeric mixed grassland (Walsh 2011a). These areas are largely dominated by introduced pasture grasses including Kentucky bluegrass (*Poa pratensis*), Canada bluegrass (*Poa compressa*), and smooth brome (*Bromus inermis*). Common native species include purple threeawn (*Aristida purpurea*), big bluestem (*Andropogon gerardii*), and switchgrass (*Panicum virgatum*). To provide NREL with greater detail on the grasslands at NWTC, ERO identified five distinct grassland community types that are discussed in greater detail below. Several changes in the vegetation communities were observed since NWTC was last mapped (Walsh 2011a). Specific changes are discussed by community type.

Path: P:\6500 Projects\6575 NREL NWTC baseline surveys\Maps\6575 Figure 4 Vegetation.mxd

2016 Wildlife and Vegetation Monitoring Project

- Data Point
- Project Area Boundary

Image Source: USDA FSA, 2015

- Degraded Grassland
- Disturbed Native Grassland
- Mixed Grassland
- Mixed Shrubland
- Mixed Yucca and Nonnative Grassland
- Nonhabitat
- Nonnative Grassland
- Ponderosa Pine Woodland
- Palustrine Emergent Wetland
- Riparian Emergent Wetland

0 225 450 Feet

N

Figure 4
Vegetation Communities

Prepared for: NREL
File: 6575 Figure 4 Vegetation.mxd (GS)
October 14, 2016

ERO Resources Corp.

A total of 19 vegetation inventory data forms were completed and are provided in Appendix A. Locations corresponding to individual data forms are shown on Figure 4. A list of all species observed during the 2016 field surveys is provided in Appendix B. This list is not comprehensive and primarily reflects abundant or common species. No rare or imperiled plant species or vegetation communities were observed during the 2016 field surveys (Table 2).

Nonnative Grassland

The nonnative grassland community is the most common community type at NWTC (Photo 8). This community is dominated by introduced pasture grasses including smooth brome, Kentucky bluegrass, and Canada bluegrass. Nonnative species make up 65 to 90 percent of the vegetative cover in this community. Commonly observed forb species include alyssum (*Alyssum simplex*), Canada horseweed (*Conyza canadensis*), fringed sage (*Artemisia frigida*), prairie sage (*Artemisia ludoviciana*), scurfpea (*Psoralidium tenuiflorum*), and hairy golden aster (*Heterotheca villosa*). Native grasses within this community, particularly big bluestem and switchgrass, occur most frequently along roadside depressions. This may be due to higher soil moisture as a result of the roadsides capturing precipitation runoff. Datasheets 8, 12, 14, 18, and 19 correspond to this community type (Appendix A).

Mixed Grassland

This community is distinguished from the nonnative grassland community by the higher cover of native grasses and forbs (Photo 9). Native species typically make up 50 to 60 percent of the vegetative cover.

Common grasses in this community include smooth brome, Kentucky bluegrass, Canada bluegrass, big bluestem, little bluestem, switchgrass, and purple threeawn. Common forbs in this community include scurfpea, fringed sage, prairie sage, and hairy golden aster. Datasheets 15 and 17 correspond to this community type.

Disturbed Native Grassland

This community occurs along the northern fence line of NWTC. Total vegetative cover in this community ranges from 30 to 70 percent, and exposed soil in this community consists of coarse gravel. The proximity of this community to machinery and buildings, the abundance of exposed ground, and the gravelly soil texture indicate that this area has been significantly disturbed by human activity. However, this community had the highest vegetative cover of native grasses within NWTC (Photo 10). This community is dominated by purple threeawn, big bluestem, and switchgrass. Other commonly observed species in this community include nonnative grasses, such as smooth brome, and ruderal weed species including annual sunflower (*Helianthus annuus*), prickly lettuce (*Lactuca serriola*), common mullein (*Verbascum thapsus*), and bigbract verbena (*Verbena bracteata*). Datasheet 9 corresponds to this community type.

Mixed Yucca and Nonnative Grassland

This community is very similar in composition to the nonnative grassland community; however, it is distinguished by the presence of stands of yucca (*Yucca glauca*) shrubs (Photo 11). Yucca typically occurs

as scattered individuals throughout the grassland communities at the NWTC. In the areas identified as mixed yucca and nonnative grassland, yucca occurs at a higher density than in the surrounding grassland, and the structural change from the surrounding grasslands warrants its inclusion as a separate community. Dominant grass species in this community include downy brome (*Bromus tectorum*), smooth brome, Kentucky bluegrass, and intermediate wheatgrass (*Thinopyrum intermedium*). Datasheet 2 corresponds to this community type.

Degraded Grassland

The degraded grassland community has been heavily influenced by human disturbance and is dominated by nonnative and noxious grass species with minimal native vegetation (typically less than 10 percent) (Photo 12). The dominant species in this community are downy brome and intermediate wheatgrass. Downy brome is a List C Noxious Weed in Colorado. Near the southwest corner of the NWTC is an area containing significant bare soil that is dominated by annual and biennial weed species including kochia (*Bassia scoparia*), downy brome, and common sunflower (Photo 13). The soil in this area has a distinctive red color that is visible on recent aerial imagery. The degraded grassland community along the western boundary of the NWTC is possibly influenced by historic and ongoing disturbance that originates from off-site activities. Datasheets 3, 4, and 16 correspond to this community type.

Ponderosa Pine Woodland

This community occurs along a granite outcrop located in the northwestern corner of the project area (Photo 14). Dominant tree and shrub species include ponderosa pine (*Pinus ponderosa*), skunkbrush sumac (*Rhus trilobata*), wax currant (*Ribes cereum*), and wild plum (*Prunus americana*). Understory vegetation consists of native and nonnative grass and forb species. Common species include smooth brome, crested wheatgrass (*Agropyron cristatum*), junegrass (*Koeleria macrantha*), sulphur cinquefoil (*Potentilla recta*), golden banner (*Thermopsis rhombifolia*), harebell (*Campanula rotundifolia*), and James' nailwort (*Paronychia jamesii*). Previous surveys of NWTC indicated that a large and dense population of diffuse knapweed (*Centaurea diffusa*), a List B noxious weed, occurred in this community (Plantae 2000; Walsh 2011a). ERO observed diffuse knapweed within this community as low-density patches and scattered individuals. Datasheet 7 corresponds to this community type.

Mixed Shrubland

The mixed shrubland community occurs on the southeast end of the same granite outcrop that supports the ponderosa pine woodland. The southeast end of this outcrop is lower and less exposed than where the ponderosa pine woodland occurs. Dominant shrub species include wax currant, skunkbrush sumac, chokecherry (*Prunus virginiana*), and western serviceberry (*Amelanchier alnifolia*) (Photo 15). This community supports higher cover and diversity of native grasses and forbs than the surrounding nonnative grassland community. Common grasses in this community include smooth brome, Kentucky bluegrass, big bluestem, junegrass, and sideoats grama (*Bouteloua curtipendula*). Common forbs include scurfpea, prairie sage, golden banner, hairy golden aster, and sulphur flower (*Eriogonum umbellatum*). Datasheet 5 corresponds to this community type.

Palustrine Emergent Wetland

ERO identified six wetlands within NWTC that fall into the palustrine emergent category (Cowardin et al. 1979). Dominant species in this community type include broadleaf cattail (*Typha latifolia*), Arctic rush (*Juncus arcticus*), common spikerush (*Eleocharis palustris*), and Nebraska sedge (*Carex nebrascensis*). Other commonly observed species include foxtail barley (*Hordeum jubatum*), Torrey's rush (*Juncus torreyi*), cloaked bulrush (*Scirpus pallidus*), and willowherb (*Epilobium*) species. Patches of smooth brome, Kentucky bluegrass, big bluestem, and western wheatgrass (*Pasocpyrum smithii*) occur on the fringes of these wetland communities.

A large palustrine emergent wetland (PEM) occurs south of the solar array in Row 1 (Photo 16). The southernmost road separates this large wetland from a second smaller wetland located along the southern fence line of NWTC. These wetlands appear to be hydrologically connected and supported by seepage from a reservoir located south of the property boundary. Capture of surface water runoff may provide additional hydrology to these wetlands. The large wetland north of the road was previously identified by Plantae (2000); however, Walsh (2011a) mapped this area as "mixed mesic grassland" dominated by big bluestem. Hydrological support has evidently increased since 2011 as this area was dominated by obligate wetland species and surface water was present throughout the area during the 2016 field surveys. Datasheet 1 corresponds to this wetland.

A second large PEM occurs in a seasonal pond located southwest of the ponderosa pine woodland community (Photo 17). Walsh (2011a) indicated that wetlands at this location depend on an elevated spring and early summer water table to support the wetland community. ERO observed standing water in the pond during both of the 2016 field surveys. Dominant species in this wetland are common spikerush and broadleaf cattail. Canada bluegrass is the dominant grass species in the uplands adjacent to this wetland community. Canada thistle (*Cirsium arvense*) and common mullein, both noxious weeds, were abundant on the west-facing slope above the pond. Datasheet 6 corresponds to this community.

A third large PEM occurs south of the solar array in Row 3 (Photo 18). This wetland consists of a large stand of cattails (*Typha* species) and foxtail barley surrounded by sandbar willow (*Salix exigua*) and plains cottonwood (*Populus deltoides*) trees. Datasheet 13 corresponds to this community type.

Two small PEMs occur on slopes along the northern boundary of the project area. The first PEM is located in the northwest corner of NWTC (Photo 19), and the second occurs along the northern fence line adjacent to the parking lot of the administration and engineering building in the northeast portion of NWTC. Dominant species in the westernmost wetland are Nebraska sedge and Arctic rush. Prairie cordgrass and Arctic rush are dominant in the easternmost wetland. These wetlands occur on gentle slopes and appear to be supported by ground water seeps. Both of these wetlands were previously identified and mapped by Walsh (2011a). The community type for these two wetlands is most similar to datasheets 1 and 6.

Riparian Emergent Wetland

Riparian emergent wetland communities occur within the two prominent drainages located in the eastern half of NWTC (Figure 4; Photos 20 and 21). Both drainages show evidence of intermittent flow. The northernmost drainage is a tributary to Coal Creek, and the southern drainage is a tributary to Rock Creek. Dominant species within these wetlands include Arctic rush, foxtail barley, Nebraska sedge, and prairie cordgrass (*Spartina pectinata*). Significant patches of Canada thistle, bull thistle (*Cirsium vulgare*), and common teasel (*Dipsacus fullonum*), all List B noxious weeds, occur within the northernmost drainage. Other observed species include shortbeak sedge (*Carex brevior*), swordleaf rush (*Juncus ensifolius*), longstyle rush (*Juncus longistylis*), Torrey's rush, common spikerush, and switchgrass. Occasional plains cottonwood trees and sandbar willow shrubs occur along these drainages. Datasheets 10 and 11 correspond to this community type.

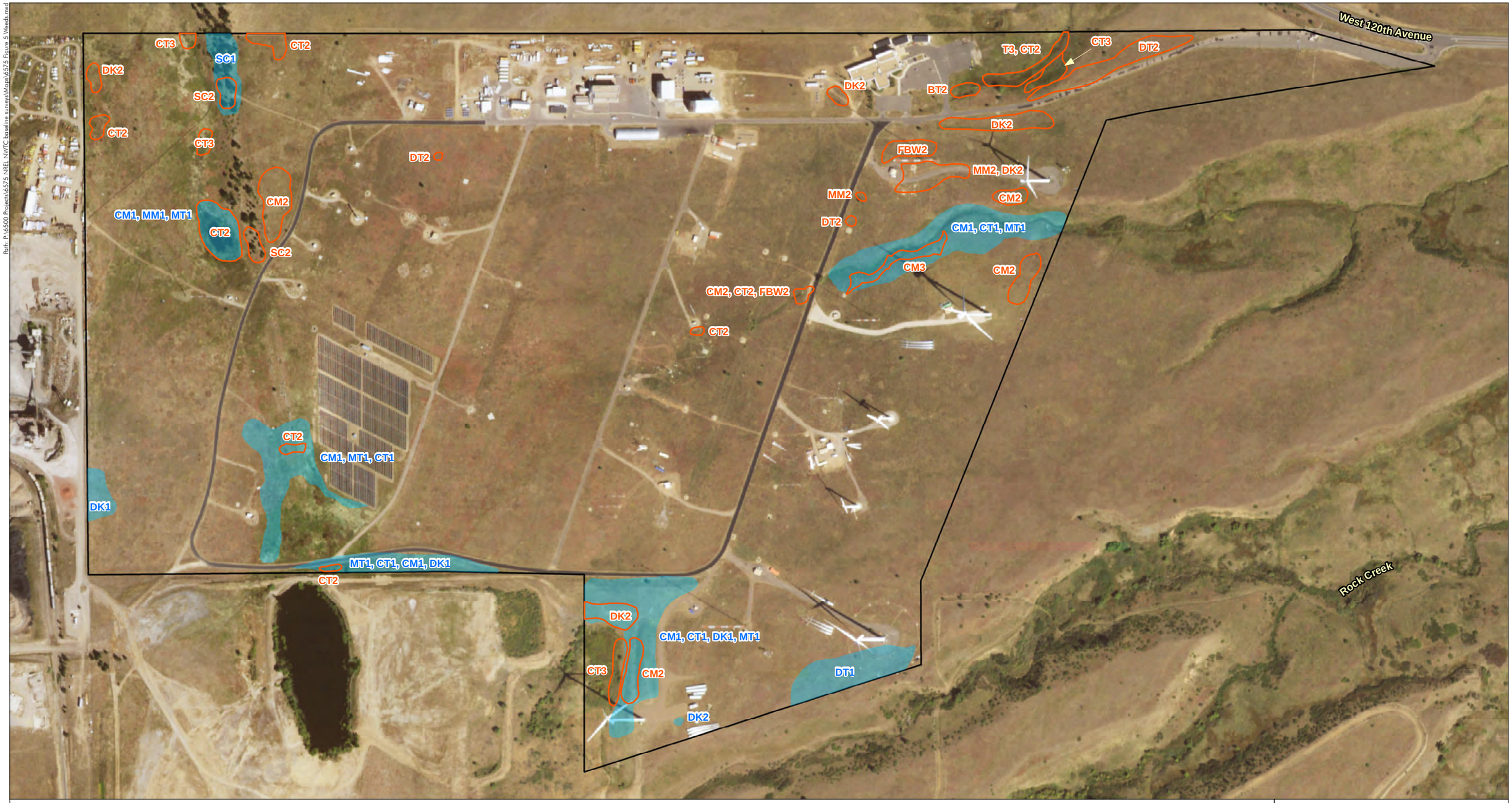
Noxious Weed Mapping

Locations of noxious weeds are shown on Figure 5, and a complete list of noxious weeds observed during the 2016 field surveys is provided below (Table 3). Downy brome, Canada thistle, common mullein, and musk thistle (*Carduus nutans*) were the most commonly observed noxious weed species at NWTC. Areas of high-density downy brome are captured in the degraded grassland community mapping (Figure 5). In general, noxious weeds occurred in a scattered low-density pattern throughout the project area. Dense patches of Canada thistle, bull thistle, and common teasel were observed within the large riparian drainage located east of the parking lot of the administration and engineering building (Photo 22). Dense patches of common mullein were observed on slopes in the vicinity of the seasonal pond, the ponderosa pine woodland, and the two large riparian drainages. Sulphur cinquefoil was only observed within the ponderosa pine woodland. Recent efforts to control diffuse knapweed appear to largely be successful. Diffuse knapweed was only observed in scattered low-density patches throughout the project area.

Table 3. Noxious weeds observed at NWTC.

Common Name	Scientific Name	Status
Bull thistle	*Cirsium vulgare*	List B
Canada thistle	*Cirsium arvense*	List B
Common mullein	*Verbascum thapsus*	List C
Common St. Johnswort	*Hypericum perforatum*	List C
Common teasel	*Dipsacus fullonum*	List B
Dalmation toadflax	*Linaria dalmatica*	List B
Diffuse knapweed	*Centaurea diffusa*	List B
Downy brome	*Bromus tectorum*	List B
Field bindweed	*Convolvulus arvensis*	List C
Moth mullein	*Verbascum blattaria*	List B
Musk thistle	*Carduus nutans*	List B
Quackgrass	*Elymus repens*	List C
Redstem filaree	*Erodium cicutarium*	List C
Sulphur cinquefoil	*Potentilla recta*	List B

Path: P:\6500 Projects\6575 NREL NWTC baseline surveys\Maps\6575 Figure 5 Weeds.mxd



2016 Wildlife and Vegetation Monitoring Project

- Noxious Weed Colony, 10% or Greater Cover
- Noxious Weed Colony, Less than 10% Cover
- Project Area Boundary

Image Source: USDA FSA, 2015

Noxious Weed Species

BT - Bull thistle
CM - Common mullein
CT - Canada thistle
DK - Diffuse knapweed
DT - Dalmation toadflax
FBW - Field bindweed
MM - Moth mullein
SC - Sulphur cinquefoil
T - Common teasel

Noxious Weed Density

1 - Less than 10% Cover
2 - 10-20% Cover
3 - 20-50% Cover
4 - 50-80% Cover
5 - Greater than 80% Cover

0 225 450 Feet

N

Figure 5
Noxious Weeds

Prepared for: NREL
File: 6575 Figure 5 Weeds.mxd (GS)
September 15, 2016

ERO Resources Corp.

Wildlife Surveys

General Wildlife

Wildlife observed incidentally at NWTC during targeted surveys included desert cottontail (*Sylvilagus audubonii*), coyote (*Canis latrans*), mule deer (*Odocoileus hemionus*), and American elk (*Cervus elaphus*). These species had been previously observed on-site. American elk were observed with calves in June 2016 in NWTC, photographed with trail cameras in July, August, and September, and observed calling in early September 2016 in the area directly south of NWTC. In the process of conducting point counts, a variety of bird species were observed as flyovers including great egret (*Ardea alba*), common raven (*Corvus corax*), and double-crested cormorant (*Phalacrocorax auritus*).

Small Mammals

Small mammal trapping was conducted over a period of 4 nights, resulting in a total of 704 trap nights during late summer (August) of 2016. Trapping revealed 5 different species of small mammals, with 92 individual mammals trapped on-site (Table 4). Deer mice (*Peromyscus maniculatus*) were the most common species trapped, followed by meadow voles (*Microtus pennsylvanicus*). Four of the captured species were observed in previous surveys, with the exception of the least shrew (*Cryptotis parva*) found along a wet seep located in the northwest section of NWTC. This shrew was found with worn teeth, indicating an older individual. A total of 19 recaptures were recorded (deer mice and meadow voles).

Table 4. Small mammal species captured within the NREL NWTC Area of Interest, August 2016.

Species	Total	Recaptured
Deer mouse (*Peromyscus maniculatus*)	**83**	16
Female Adult	32	
Female Juvenile	15	
Male Adult	24	
Male Juvenile	12	
Meadow vole (*Microtus pennsylvanicus*)	**18**	3
Female Adult	6	
Female Juvenile	1	
Male Adult	9	
Male Juvenile	2	
Prairie vole (*Microtus ochrogaster*)	**3**	0
Female Adult	1	
Female Juvenile	0	
Male Adult	2	
Male Juvenile	0	
Mexican woodrat (*Neotoma Mexicana*)	**6**	0
Least shrew (*Cryptotis parva*)	**1**	0
Female Adult	1	
TOTAL	**111**	

Deer mice captures resulted in a greater number of females (56 percent) than males (44 percent), with a total of 50 percent juveniles (both females and males). Captures of meadow voles resulted in a greater

number of males (61 percent) than females (39 percent), with a total of 16 percent juveniles (both females and males). Woodrats were not sexed due to difficulty of handling.

Bats

Bat acoustic monitoring was conducted by NREL in 2015 and mist netting was conducted by Zotz Ecological Consulting (Rodriguez 2016). Seven species of bats have been observed at NWTC and the Rocky Flats Refuge using a combination of continuous acoustic monitoring and mist netting (Table 5). The species of myotis that are known to inhabit this region (Adams 2003) include western small-footed myotis (*Myotis ciliolabrum*), western long-eared myotis (*Myotis evotis*), little brown myotis (*Myotis lucifugus*), and long-legged myotis (*Myotis volans*).

No federal- or state-listed threatened, endangered, or candidate species or species of special concern were positively identified during surveys (USFWS 2016; CPW 2016).

Table 5. Bat monitoring results conducted by NREL, 2015-2016.

Species	Acoustic Monitoring at NWTC, 2015	Mist Netting at NWTC and Rocky Flats Refuge, 2016	Observed by Walsh 2011	Observed by Schmidt et al. 2003
Western small-footed myotis (*Myotis ciliolabrum*)	X	X		X
Western long-eared myotis (*Myotis evotis*)			P	
Little brown myotis (*Myotis lucifugus*)	X	X	X	X
Fringed myotis (*Myotis thysanodes*)		X	X	
Long-legged myotis (*Myotis volans*)			P	X
Eastern red bat (*Lasiurus borealis*)	X	X	X	
Hoary bat (*Lasiurus cinereus*)	X	X	X	X
Silver-hair bat (*Lasionycteris noctivagans*)	X	X	X	X
Big brown bat (*Eptesicus fuscus*)	X	X	X	
Townsend's big-eared bat (*Corynorhinus townsendii*)	P			
Mexican (Brazilian) free-tailed bat (*Tadarida brasiliensis*)	P			P

P – Possible occurrence, but not confirmed.

Mammalian Predators

Coyotes were observed at the scented and unscented camera traps during all seasons sampled. A bobcat was observed periodically in April and July at scented camera trap locations and only at night. In August 2015, a mountain lion was photographed moving through the pine ridge area at night.

Other non-predator observations in 2015 and 2016 include elk and mule deer. A white-tailed deer was also observed in the spring of 2016.

Reptiles and Amphibians

Nocturnal amphibian surveys at NWTC revealed the presence of three frog species and one salamander species – western chorus frog (*Pseudacris triseriata*), Woodhouse's toad (*Anaxyrus woodhousii*), northern leopard frog (*Lithobates pipiens*), and tiger salamander (*Ambystoma tigrinum*). During the May 31, 2016 surveys, western chorus frog adults, tadpoles, and egg masses were identified visually or aurally at six of the seven listening stations at NWTC. No other amphibian species were detected on May 31, 2016. On June 2, 2016, western chorus frog, northern leopard frog, and Woodhouse's toad were all heard calling simultaneously from a pond located immediately southwest of call station A3. A larval tiger salamander was also observed in the same pond. Additionally, western chorus frogs and a single northern leopard frog were heard calling near a small pond in the northwestern portion of NWTC (near call station A2). Adult western chorus frogs and Woodhouse's toads were also visually identified on June 2. Table 6 summarizes the results of amphibian surveys conducted on May 31 and June 2, 2016. Table 7 shows calling index scores recorded during surveys.

Table 6. Amphibian survey results from 2016 on the NWTC property.

Common Name	Call Station	Date	Detection Method	Life Stage
Western chorus frog	A2, A3, A4, A5, A6, A7	5-31-16	Aural	Adult
Western chorus frog	A5	5-31-16	Visual	Adult
Western chorus frog	A2, A3, A5	5-31-16	Visual	Tadpole
Western chorus frog	A5	5-31-16	Visual	Egg mass
Western chorus frog	A2	6-2-16	Visual	Adult, tadpoles
Northern leopard frog	A2, A3	6-2-16	Aural	Adult
Woodhouse's toad	A3	6-2-16	Aural	Adult
Woodhouse's toad	On road between A3 and A4	6-2-16	Visual	Adult
Tiger salamander	Pond southwest of A3	6-2-16	Visual	Larva

Table 7. Amphibian call index scores.

Station	Species Identified*	Index Score[1]
May 31, 2016		
A1	N/A	0
A2	Western chorus frog	2-3
A3	Western chorus frog	2
A4	Western chorus frog	3
A5	Western chorus frog	3
A6	Western chorus frog	2
A7	Western chorus frog	1
June 2, 2016		
A1	N/A	0
A2	Western chorus frog; Northern leopard frog	WCF = 3; NOLF = 1
A3	Western chorus frog; Woodhouse's toad	WCF = 2; WT = 1
A4	Western chorus frog; Northern leopard frog; Woodhouse's toad	WCF = 3; NOLF = 3; WT = 3
A5	Western chorus frog	3
A6	Western chorus frog	2
A7	Western chorus frog	1

*N/A – no amphibians detected; [1]Index Scores: 0 = no calling heard; 1=individual calls with silence between calls; 2 = individual calls with overlap between calls; 3 = Full chorus with constant overlap between calls.
WCF = western chorus frog.
NOLF = northern leopard frog.
WT = Woodhouse's toad.

A single snake was photographed by NWTC staff on June 27, 2016 after the field survey date. ERO later identified the snake as an eastern yellow-bellied racer (*Coluber constrictor*). NREL staff also observed a painted turtle crossing the main access road on June 7, 2015 and northern leopard frogs in a wetland area in the southwest part of the NWTC in October 2015 (see Palustrine Emergent Wetlands in the Vegetation section).

Owls

During June 2016, nocturnal surveys revealed no owl species via callback method. One great-horned owl was observed at NWTC during an early morning point count. A great-horned owl was photographed at the pine ridge camera trap location.

Migratory Birds

Early summer point counts revealed 30 species of birds within NWTC (Table 8). Of these species, western meadowlarks were the most prevalent songbird, followed by vesper sparrows and red-winged blackbirds. During the second point survey conducted in early September, 18 bird species were observed primarily through visual detection due to the late season time frame (Table 9). In September, the most common bird found was the barn swallow, followed by the western meadowlark, vesper sparrow, and black-billed magpie. In total, 242 individual birds were heard or seen in June and 180 individual birds were observed in September.

Table 8. Avian species observed at NWTC, June 2, 3, and 10, 2016.

Common Name	Scientific Name	Code	Total
American kestrel	*Falco sparverius*	AMKE	6
American robin	*Turdus migratorius*	AMRO	1
Barn swallow	*Hirundo rustica*	BARS	13
Black-billed magpie	*Pica hudsonia*	BBMA	16
Blue-grey gnatcatcher	*Polioptila caerulea*	BGGN	4
Brewer's blackbird	*Euphagus cyanocephalus*	BRBL	4
Broad-tailed hummingbird	*Selasphorus platycercus*	BTAH	1
Bullock's oriole	*Icterus bullockii*	BUOR	1
Canada goose	*Branta canadensis*	CANG	1
Common nighthawk	*Chordeilis minor*	CONI	1
Common raven	*Corvus corax*	CORA*	1
Double-crested cormorant	*Phalacrocorax auritus*	DCCO*	3
European starling	*Sturnus vulgaris*	EUST	3
Grasshopper sparrow	*Ammodramus savannarum*	GRSP	1
Great egret	*Ardea alba*	GREG*	4
Great-horned owl	*Bubo virginianus*	GHOW	1
Green-tailed towhee	*Pipilo chlorurus*	GTTO	5
House wren	*Troglodytes aedon*	HOWR	5
Killdeer	*Charadrius vociferous*	KILL	8
Lark sparrow	*Chondestes grammacus*	LASP	1
Mourning dove	*Zenaida macroura*	MODO	4
Red-winged blackbird	*Agelaius phoeniceus*	RWBL	23
Say's phoebe	*Sayornis saya*	SAPH	11
Spotted towhee	*Pipilo maculatus*	SPTO	14
Unidentified duck		UNDU*	1
Vesper sparrow	*Pooecetes gramineus*	VESP	35
Western kingbird	*Tyrannus verticalis*	WEKI	12
Western meadowlark	*Sturnella neglecta*	WEME	59
Western wood pewee	*Contopus sordidulus*	WEWP	1
Wilson's snipe	*Gallinago delicata*	WISN	2
TOTAL			**242**

**Birds observed flying through NWTC.*

Table 9. Avian species observed at NWTC, September 2016.

Common Name	Scientific Name	Code	Total
American kestrel	*Falco sparverius*	AMKE	8
American robin	*Turdus migratorius*	AMRO	1
Barn swallow	*Hirundo rustica*	BARS	51
Black-billed magpie	*Pica hudsonia*	BBMA	18
Brewer's blackbird	*Euphagus cyanocephalus*	BRBL	4
Broad-tailed hummingbird	*Selasphorus platycercus*	BTAH	1
Canada goose	*Branta canadensis*	CANG	10
Double-crested cormorant	*Phalacrocorax auritus*	DCCO*	3
European starling	*Sturnus vulgaris*	EUST	2
Gray catbird	*Dumetella carolinensis*	GRCA	5
Lark sparrow	*Chondestes grammacus*	LASP	1
Mourning dove	*Zenaida macroura*	MODO	13
Red-tailed hawk	*Buteo jamaicensis*	REHA	2
Say's phoebe	*Sayornis saya*	SAPH	12
Song sparrow	*Melospiza melodia*	SOSP	1
Unidentified finch*		UNFI*	9
Vesper sparrow	*Pooecetes gramineus*	VESP	18
Western meadowlark	*Sturnella neglecta*	WEME	21
TOTAL			**180**

**Birds observed flying through NWTC.*

The Shannon -Weiner diversity index and the Simpson's diversity index were calculated for the 2010/2011 surveys and the 2016 surveys and are shown below (Table 10).

Table 10. Comparison of diversity of bird species in NWTC, 2010-2011 and 2016.

Diversity Index	Years	Results
Shannon-Weiner Index	2016	H' = 2.77
	2010-11	H' = 2.92
Simpson's Index	2016	D = 0.91
	2010-11	D = 0.93

DISCUSSION AND MANAGEMENT RECOMMENDATIONS

Vegetation and Noxious Weed Mapping

Vegetation Mapping

The vegetation communities observed during the 2016 field surveys were largely consistent with previous mapping efforts (Walsh 2011a). The majority of NWTC consists of nonnative grasslands dominated by introduced pasture grasses such as smooth brome, Kentucky bluegrass, and Canada bluegrass. Patches of native grasses, such as big bluestem and switchgrass, occur throughout the project area, particularly along roadsides where soil moisture may be higher than in surrounding areas. The palustrine emergent and riparian emergent wetland communities typically had greater species diversity than the surrounding grasslands. The wetland communities also provide important habitat for amphibian species found at NWTC. The mixed shrubland and ponderosa pine woodlands contained the

greatest diversity of forbs at NWTC and these communities provide important habitat for wildlife, particularly songbird species. The above communities should be protected from future development or disturbance and efforts should be made to encourage native vegetation within these communities.

Degraded grasslands, which are dominated by downy brome, occur along the western boundary of NWTC and are the result of historic and ongoing disturbances caused by off-site activities. Restoring degraded grassland areas and increasing the cover of native vegetation would benefit the surrounding grassland communities. Downy brome can be controlled through mechanical means such as grazing, tilling, or prescribed burn strategies. Chemical control can also be effective but may not be desirable for large populations. If cheatgrass has been established for several years the soil will likely have a large bank of cheatgrass seeds, and as a result, these strategies will require intensive control and reseeding efforts to prevent reestablishment of cheatgrass (Colorado Natural Areas Program 1998). Ongoing disturbance from off-site activities may make restoration of these communities challenging.

ERO identified a large PEM wetland south of the large solar array at NWTC. This wetland complex was previously identified by Plantae (2000); however, Walsh (2011a) indicated this area had dried substantially and that it consisted of a big bluestem-dominated grassland at the time of that study. The presence of wetlands at this location during the 2016 field surveys indicates that hydrology has increased substantially since 2011. The hydrological regime of this wetland appears to be dynamic, and installation of ground water wells at this location would facilitate long-term monitoring of these fluctuations.

To date, the vegetation studies at NWTC have been largely qualitative in design. As a result, discussions of changes to the vegetation must be broad in nature. Future quantitative studies would facilitate more detailed discussions of long-term vegetation trends at NWTC. Establishing a series of permanent monitoring transects throughout the vegetation communities of NWTC, such as point-intercept transects, would provide an efficient and repeatable method of measuring changes in vegetation cover and community composition over time.

Noxious Weeds

ERO observed 14 noxious weed species at NWTC. No List A species were observed during the 2016 field surveys. In general, weeds occur in low-density patches or as scattered individuals. High-density patches of common teasel and Canada thistle were concentrated within the riparian drainages. Large patches of common mullein occurred on the slopes above the riparian drainages and on the slopes above the seasonal pond. Recent weed-control efforts appear to have largely been successful at reducing the density of weed populations, particularly populations of diffuse knapweed. Walsh (2011a) identified a high-density population of diffuse knapweed within the ponderosa pine woodland. During the 2016 field surveys, diffuse knapweed was observed throughout the site as scattered individuals or in low-density patches. At a minimum, ERO recommends continuing the current weed-control program at NWTC. Additional weed-control efforts within the riparian drainages would be beneficial to reduce the high-density populations of common teasel and Canada thistle at these locations. Increasing weed control within the ponderosa pine woodland community would also be beneficial. This community had higher

forb diversity than the surrounding grasslands and reducing competition from noxious weeds would help support the diversity of native forbs and grasses. In most cases, combining weed treatments with reseeding efforts is more effective than weed control alone, and using a more comprehensive restoration approach on specific communities and locations at NWTC may greatly improve the overall habitat quality and ecological integrity of the site.

Wildlife Surveys

Wildlife incidentally observed during the 2016 field surveys had been previously observed at NWTC during the 2011 surveys. The observation of bugling elk (*Cervus canadensis*) in the vicinity of NWTC, along with the presence of young in early June within NWTC and photographs from trail cameras in July, August, and September, indicate that elk use NWTC and the surrounding area for mating grounds. This is not unexpected due the known presence of elk on the Rocky Flats National Wildlife Refuge southeast of NWTC.

Small Mammals

Live-trapping of small mammals resulted in a capture rate of 27 percent with a total of 92 individuals captured from five different species, indicating that small mammals are abundant in NWTC. Transects located near seeps and drainages (T5 and T6) resulted in the greatest diversity of small mammals, suggesting that the presence of water and tall vegetation cover not present in the other transects supports a wider variety of species and should be protected.

Deer mice and meadow voles were prevalent and these species were also observed in previous surveys. A single least shrew was trapped along a seep, which was the first documented occurrence on-site. Based on tooth wear, the shrew was likely about one year old. Colorado is the western limit of the distribution of the least shew, and they are not considered rare on the Colorado Piedmont from Denver to Fort Collins. The least shrew probably is a fairly recent arrival in Colorado and the current distribution of this shrew may be a consequence of perennially moist habitats created by irrigation and riparian vegetation associated with flood control (Armstrong 1972). Compared with previous studies conducted in 2010-2011 (Walsh 2011a), small mammal species composition was generally similar with a few differences – masked shrews and western harvest mice were captured in 2010 and 2011, respectively, and not in 2016, whereas a least shrew was captured in 2016 (Table 11).

Table 11. Comparison of small mammals species captured in NWTC, 2010-2011 and 2016.

Species	2010-2011	2016
Deer mouse (*Peromyscus maniculatus*)	✓	✓
Least shrew *(Cryptotis parva)*	**x**	✓
Masked shrew *(Sorex cinereus)*	✓	x
Meadow vole (*Microtus pennsylvanicus*)	✓	✓
Mexican woodrat (*Neotoma Mexicana*)	✓	✓
Prairie vole (*Microtus ochrogaster*)	✓	✓
Western harvest mouse (*Reithrodontomys megalotis*)	✓	x

✓=species captured, ✗=species not captured.

Overall, the success of trapping can depend on a number of factors, such as evening and morning temperatures, precipitation, and ease of trap activation. Weather during the trapping session was mostly mild, with a few scattered rain showers in the evening, and likely had a minor influence on trapping success.

Bats

Seven species of bats have been observed on or adjacent to the NWTC and have had their calls recorded on the NWTC. The only exception is the fringed myotis which has not been recorded on NWTC but has been captured there. These seven species make up the typical bat community at NWTC and either roost or forage at the site with the eastern red bat occurring only occasionally (Adams 2003). Other species are probable as presented in Table 5 with the Townsend's big-eared bat being the only species of concern that could potentially frequent the NWTC. These bats are most often found at higher elevations and are associated with caves or abandoned mines where they roost daily and hibernate.

All species observed by Walsh (Walsh 2011b), were observed in 2016 with mist netting efforts helping to confirm these species, especially Myotis species, in the area. Myotis calls are very similar and are difficult to differentiate. For example, the Walsh Bat Survey Report (Walsh 2011b) suspected that fringed myotis were present but did not get representative calls recorded and could not conclude that these bats were present.

Mammalian Predators

Camera traps on NWTC helped to reveal coyotes and bobcats that are rarely observed. Coyotes were photographed day and night, all months of the year and are the primary mammalian predator at NWTC. Occasionally, a bobcat was observed (April and July) but only at night.

Reptiles and Amphibians

Four amphibian species were identified during field surveys on May 31, 2016 and June 2, 2016 – western chorus frog, northern leopard frog, Woodhouse's toad, and tiger salamander. During the May 31, 2016 field survey, all life stages (egg masses, larval, and adult) of the western chorus frog were observed in a wetland near survey station A5 and were heard calling at six of the seven listening stations (A2 through A7). No other amphibian species were detected during the May 31, 2016 field survey. On June 2, 2016, western chorus frog, northern leopard frog, Woodhouse's toad, and a tiger salamander larva were identified. Chorus frogs, northern leopard frogs, and Woodhouse's toads were heard calling simultaneously from a pond southwest of survey station A3. Additionally, two adult Woodhouse's toads were also identified on roads on the NWTC between 9:30 and 10:30 p.m.

Northern leopard frogs were not recorded on NWTC prior to 2015. This amphibian, although not currently listed as threatened or endangered by the U.S. Fish and Wildlife Service, is experiencing declines in populations and range due to the introduction of invasive species, habitat degradation, overharvesting, and disease (U.S. Fish and Wildlife Service 2009). The northern leopard frog is considered a state species of concern and its protection should be considered in future NWTC land use decisions.

Amphibian diversity on the NWTC is relatively high for this location in Colorado. There are a total of six native species of amphibian that potentially occur in this portion of the county. In addition to the four species observed during the 2016 surveys, only the plains spadefoot toad (*Spea bombifrons*) and the Great Plains toad (*Anaxyrus cognatus*) have the potential to occur on the NWTC, and were not documented during the 2016 surveys.

No reptiles were observed during the 2016 field surveys. NWTC staff have observed at least five reptile species in the past including (painted turtle (*Chrysemys picta*), garter snake (*Thamnophis* sp.), eastern yellow-bellied racer (*Coluber constrictor*), western rattlesnake (*Crotalus viridis*), and bullsnake (*Pituophis catenifer*). Several other species including mountain short-horned lizard (*Phrynosoma hernandesi*), six-lined racerunner (*Aspidoscelis sexlineata*), and central plains milksnake (*Lampropeltis triangulum*) potentially occur on the NWTC property.

Numerous factors, including climate change, expansion of invasive species into NWTC, and surrounding changes in land use such as increased commercial and residential development, could contribute to changes in species composition – especially amphibian species which are declining worldwide (Gascon et al. 2005). Conducting future surveys may reveal changes in species composition or overall abundance over time.

The widest variety of reptiles and amphibians were observed in wetlands, ponds, streams and rocky outcrops. Establishing a buffer around sensitive habitats such as wetlands, rock outcrops, streams, and ponds where development or disturbance would be avoided would help preserve herpetile diversity.

Owls

Prior to ERO's work at the NWTC, NREL staff reported an owl perching on a utility building and one perching on a fence post west of the pine ridge area at NWTC (Ryon, pers. comm. 2016). Owl pellets had also been found at the base of a utility building on-site. During a point count in June, a great-horned owl was seen flying from the direction of the building across NWTC to a tree just outside the boundary to the south. This owl is most likely hunting on or near the site.

Migratory Birds

NWTC supports a rich diversity of birds, with songbirds making up the majority of the species. The point counts conducted by ERO during the mid-summer and early fall resulted in a total of 30 different species of birds, both migratory and resident. Tetra Tech's 2010/2011 surveys were conducted in all seasons for one year, whereas the 2016 field surveys were conducted only once in early summer and once in late summer. The differences in duration and frequency of the surveys limit direct comparison of the data, but comparison of values for the Shannon -Weiner diversity index and Simpson's diversity index gives some indication of the relative diversity and species composition. Values for both diversity indices were comparable between the 2010/2011 surveys and the 2016 surveys (Table 10) and demonstrate that species diversity at NWTC is relatively high and the numbers of individuals of all species were evenly distributed. The similar number of different species in late spring/early summer surveys by ERO and Tetra Tech shows a consistency in viable habitat and resources available to local grassland and migratory

birds. Of the 6 point count locations in ERO's June 2016 survey, the greatest diversity of migratory birds was recorded in the mixed shrubland and ponderosa pine woodlands (Point 1) located in the northwest part of the NWTC; this area provides a patch of tree cover amidst a predominantly grassland community in an area where grasslands are dominated by grasslands predominantly grassland community. If possible, disturbance of the mixed shrubland and ponderosa pine woodlands should be avoided to preserve the ecological integrity of the NWTC

The survey conducted in September 2016 yielded a total of 18 different species and a total of 180 individual birds, compared with a total of 205 individual birds observed in fall 2010. The difference in the number of birds observed is likely the result of differences in frequency and duration of surveys. ERO completed 3 consecutive mornings in early September, while the previous survey was completed over the course of 12 mornings in September and October 2010.

Of the species observed during the 2010/2011 and 2016 surveys, 30 were unique to either the 2010/2011 or 2016 survey period, suggesting a possible shift in species composition at NWTC (Table 12). In 2016, most bird species using the site for breeding were likely observed during the early June surveys; however, an additional survey earlier in the season (i.e., late May) in future studies would allow observation of more migratory birds. Additional surveys during fall and winter would also allow a more complete evaluation of bird use of NWTC and a more thorough analysis of site-specific trends. Numerous factors, including climate change, expansion of invasive species into NWTC, and surrounding changes in land use, could contribute to changes in species composition. Comparing vegetation structure over time may also reveal some potential sources of change in species composition.

Table 12. Comparison of all bird species observed in NWTC, 2010-2011 and 2016.

Species	2010-2011	2016
American kestrel	✓	✓
American crow	✓	×
American goldfinch	✓	×
American robin	✓	✓
American tree sparrow	✓	×
Barn swallow	✓	✓
Black-billed magpie	✓	✓
Black-capped chickadee	✓	×
Blue-grey gnatcatcher	×	✓
Brewer's blackbird	✓	✓
Brewer's sparrow	✓	×
Broad-tailed hummingbird	✓	✓
Bullock's oriole	×	✓
Canada goose	×	✓
Chipping sparrow	✓	×
Common nighthawk	×	✓
Common raven	✓	✓
Dark-eyed junco	✓	×
Double-crested cormorant	×	✓
Downy woodpecker	✓	×

Species	2010-2011	2016
Eurasian collared dove	✓	×
European starling	✓	✓
Grasshopper sparrow	✓	✓
Gray catbird	✓	✓
Great egret	×	✓
Great-horned owl	×	✓
Green-tailed towhee	×	✓
Horned lark	✓	×
House finch	✓	✓
House wren	×	✓
Killdeer	×	✓
Lark sparrow	×	✓
Loggerhead shrike	✓	×
Mountain chickadee	✓	×
Mourning dove	✓	✓
Northern flicker	✓	×
Red winged blackbird	✓	✓
Red-tailed hawk	✓	✓
Sandhill crane	✓	×
Say's phoebe	✓	✓
Sharp-shinned hawk	✓	×
Song sparrow	✓	✓
Spotted towhee	×	✓
Townsends solitaire	✓	×
Tree swallow	✓	×
Vesper sparrow	✓	✓
Western kingbird	✓	✓
Western meadowlark	✓	✓
Western wood pewee	×	✓
Wilson's snipe	×	✓

✓= bird present, ×=bird absent.

The most notable difference between the 2010 and 2016 surveys was the total lack of horned larks in 2016. Horned larks were observed during all seasons in 2011, with the highest mean use occurring during summer. Horned larks are year-round residents of Colorado and are social birds, foraging in pairs or small groups during the breeding season, and are sometimes found in huge flocks outside of the breeding season (Beason 1995). They are considered numerous but their populations throughout the United States have declined by 71 percent since 1966 (Sauer et al. 2014). The horned lark was noted as a Common Bird in Steep Decline in the 2014 State of the Birds Report (North American Bird Conservation Initiative 2014). Overall, the declining trend in population is not fully understood.

Species abundance varies seasonally and from year to year and is influenced by a multitude of local and regional factors, including precipitation, disease, etc. Larks prefer bare ground in open space with very short or no vegetation, including bare agricultural ground. Subtle changes in vegetative structure that may have occurred at NWTC since 2011 could be a contributing factor to the absence of horned larks in 2016. It is also possible that horned larks may be avoiding the wind turbines. Shaffer and Buhl (2015)

found that seven of the nine grassland species they studied in North Dakota (which did not include horned larks) avoided wind turbines. However; Johnson et al. (2000) found that horned lark use of turbine plots in Minnesota was higher than expected, while in Oregon (Erickson et al. 2004) found no evidence that horned larks were either attracted to or displaced by wind turbines. The analysis of the distribution of horned larks with respect to wind turbines at NWTC conducted by Walsh (2011) was limited by a small sample size. Based on the information available for NWTC, it is not possible to draw any conclusions about the effects of wind turbines on horned larks at NWTC.

A bird present in 2016 but absent from NWTC in 2011 is the killdeer. This plover often observed far from beaches and shorelines is considered common in open ground with low or no vegetation (Jackson and Jackson 2000). The presence of killdeer in 2016 is an indication that they are making use of the bare ground areas and dirt roads in NWTC that may have increased from 2011. Shaffer et al. (2016) found that killdeer densities increased nearest to newly constructed turbines, which probably reflects their attraction to the associated habitat disturbance.

Relatively few large raptors were observed within and around NWTC, which could be due to the lack of suitable perches or nesting habitat. Another possibility is that raptors are avoiding the wind turbines; Tetra Tech recorded low encounter rates in their 2010/2011 surveys. American kestrels were commonly observed during surveys. This small falcon hunts for insects and small mammals in open territory and perches on wires or poles, all of which are prevalent in the NWTC (Smallwood and Bird, 2002). The kestrel is the most common and widespread falcon in North America but populations have declined 66% since 1966 (NABCI, 2014). Current declines stem from clearing of land and felling of snags these birds depend on for nesting, loss of prey sources due to “clean” farming practices which remove hedgerows, trees, and brush, and exposure to pesticides, which can reduce clutch size and hatching success and destroy insects and other prey species (USGS 2014). Available prey and perch sites at NWTC support what appears to be a healthy American kestrel population.

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Appendix A Vegetation Inventory Data Forms

DATA FORM – Vegetation Inventory Site 1

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Poa pratensis	15	13 Polypogon monspeliensis	2
2 Bromus inermis	15	14 Echinochloa crus-galli	2
3 Juncus arcticus	10	15 Juncus torreyi	2
4 Eleocharis palustris	10	16 Cirsium arvense	2
5 Carex nebrascensis	7	17 Asclepias incarnata	1
6 Scirpus pallidus	7	18 Epilobium sp.	1
7 Typha latifolia	6	19 Juncus ensifolius	1
8 Andropogon gerardii	5	20 Juncus sp.	1
9 Pascopyrum smithii	5	21	
10 Hordeum jubatum	3	22	
11 Oenothera elata	3	23	
12 Verbascum thapsus	2	24	

Remarks: Wetland/mesic prairie complex. Areas of inundation adjacent to upland mesic grasslands.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

2 Slope	_____ Disturbance History
East Aspect	Cirsium arvense and Verbascum thapsus Weeds
_____ Topographic Position	_____ Other
Palustrine Emergent Wetland Other	

Remarks:

SOILS

Map Unit name: Flatirons very cobbly sandy loam, 0 to 3 percent slopes

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks: Wetlands likely supported by seepage from reservoir south of road, and surface flow from adjacent roads.

DATA FORM – Vegetation Inventory Site 2

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Bromus tectorum	40	13 Heterotheca villosa	1
2 Yucca glauca	15	14 Helianthus pumilus	1
3 Poa compressa	10	15 Artemisia frigida	1
4 Bromus inermis	10	16 Eriogonum alatum	1
5 Poa pratensis	5	17 Ambrosia psilostachya	1
6 Andropogon gerardii	3	18	
7 Koeleria macrantha	2	19	
8 Verbascum thapsus	2	20	
9 Artemisia ludoviciana	2	21	
10 Centaurea diffusa	2	22	
11 Psoralidium tenuiflorum	2	23	
12 Thinopyrum intermedium	2	24	

Remarks: Xeric grassland, distinguished by presence of Yucca which is largely absent from surrounding prairie.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	C. arvense, A. diffusa, V. thapsus Weeds
_____ Topographic Position	Non-native Yucca Grassland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Flatirons very cobbly sandy loam, 0 to 3 percent slopes

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory

Site 3

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Bromus tectorum	35	13 Heterotheca villosa	1
2 Thinopyrum intermedium	25	14 Ambrosia psilostachya	1
3 Bromus inermis	12	15 Artemisia frigida	1
4 Poa pratensis	9	16	
5 Poa compressa	5	17	
6 Alyssum simplex	3	18	
7 Yucca glauca	2	19	
8 Verbascum thapsus	2	20	
9 Artemisia ludoviciana	1	21	
10 Apocynum cannabinum	1	22	
11 Psoralidium tenuiflorum	1	23	
12 Hypericum perforatum	1	24	

Remarks: Disturbed grassland dominated by Bromus tectorum and Thinopyrum intermedium.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Cirsium arvense, V. thapsus Weeds
_____ Topographic Position	Disturbed Grassland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Flatirons very cobbly sandy loam, 0 to 3 percent slopes

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 4

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Thinopyrum intermedium	30	13	
2 Helianthus annuus	20	14	
3 Bassia scoparia	20	15	
4 Bromus tectorum	15	16	
5 Bromus inermis	5	17	
6 Elymus canadensis	3	18	
7 Mentzelia nuda	2	19	
8 Elymus lanceolatus	2	20	
9 Centaurea diffusa	2	21	
10 Oenothera elata	1	22	
11		23	
12		24	

Remarks: Highly disturbed area with significant bare ground. Dominated by annual/biennial weed species.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ _____ _____ Aspect	_Acosta diffusa, Bromus tectorum ___ ___ _____ Weeds
_____ Topographic Position	___Disturbed Grassland_____ Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: __Flatirons very cobbly sandy loam, 0 to 3 percent slopes____

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 5

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Bromus inermis	15	13 Rosa woodsii	1
2 Poa pratensis	15	14 Artemisia ludoviciana	1
3 Rhus trilobata	15	15 Eriogonum umbellatum	1
4 Prunus virginiana	10	16 Opuntia polyacantha	1
5 Ribes cereum	10	17 Heterotheca villosa	1
6 Amelanchier alnifolia	5	18 Solidago sp.	1
7 Andropogon gerardii	5	19 Prunus americana	1
8 Toxicodendron rydbergii	5	20 Thermopsis rhombifolia	1
9 Poa compressa	3	21 Bouteloua curtipendula	1
10 Symphoricarpos occidentalis	3	22 Bromus tectorum	1
11 Psoralidium tenuiflora	1	23 Verbascum thapsus	1
12 Hypericum perforatum	1	24 Koeleria macrantha	1

Remarks: Mixed shrubland on rocky outcrop. Understory is Bromus inermis/poa pratensis dominated but native grasses and forbs have higher cover than in surrounding grasslands.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Multiple species Weeds
_____ Topographic Position	Mixed Shrubland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Rock outcrop, sedimentary

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site __6____

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Eleocharis palustris	25	13 Lactuca serriola	1
2 Typha latifolia	20	14 Cirsium arvense	1
3 Poa compressa	10	15 Conyza canadensis	1
4 Poa pratensis	10	16 Carduus nutans	1
5 Bromus inermis	8	17	
6 Juncus arcticus	5	18	
7 Carex nebrascensis	5	19	
8 Pascopyrum smithii	3	20	
9 Hordeum jubatum	3	21	
10 Polygonum punctatum	3	22	
11 Andropogon gerardii	2	23	
12 Verbascum thapsus	2	24	

Remarks: Wetlands within the shallow pond, mesic grasses and occasional weeds occur on slopes surrounding pond.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Multiple species Weeds
_____ Topographic Position	___ Palustrine Emergent Wetland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: __Flatirons very cobbly sandy loam, 0 to 3 percent slopes

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 7

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Pinus ponderosa	20	13 Poa pratensis	1
2 Rhus trilobata	15	14 Centaurea diffusa	1
3 Ribes cereum	10	15 Potentilla recta	1
4 Rosa woodsii	7	16 Thermopsis rhombifolia	1
5 Prunus virginiana	7	17 Opuntia macrorhiza	1
6 Bromus inermis	7	18 Yucca glauca	1
7 Bromus tectorum	5	19 Grindelia squarrosa	1
8 Symphoricarpos occidentalis	5	20 Heterotheca villosa	1
9 Koeleria macrantha	5	21 Liatris punctata	1
10 Agropyron cristatum	3	22 Cirsium arvense	1
11 Andropogon gerardii	2	23 Carduus nutans	1
12 Verbascum thapsus	2	24 Paronychia jamesii	1

Remarks: Ponderosa pine woodland with mixed native/non-native understory. Highest concentration of Sulfur cinquefoil in the study area.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Multiple species Weeds
_____ Topographic Position	Ponderosa Pine Woodland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Rock outcrop, sedimentary

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 8

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Bromus inermis	25	13 Yucca glauca	1
2 Poa compressa	20	14 Cirsium arvense	1
3 Poa pratensis	15	15 Centaurea diffusa	1
4 Pascopyrum smithii	8	16 Alyssum simplex	1
5 Bromus tectorum	7	17 Convolvulus arvensis	1
6 Artemisia ludoviciana	5	18 Symphoricarpos occidentalis	1
7 Sporobolus cryptandrus	3	19 Thinopyrum intermedium	1
8 Koeleria macrantha	3	20 Onosmodium bejariense	1
9 Psoralidium tenuiflorum	2	21	
10 Verbascum thapsus	2	22	
11 Bouteloua dactyloides	1	23	
12 Hypericum perforatum	1	24	

Remarks: Non-native grassland dominated by smooth brome, Canada bluegrass, and Kentucky bluegrass.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Multiple species Weeds
_____ Topographic Position	Non-native Grassland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Flatirons very cobbly sandy loam, 0 to 3 percent slopes and Yoder variant-Midway complex, 15 to 60 percent slopes.

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 9

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Aristida purpurea	30	13 Juncus sp.	1
2 Andropogon gerardii	20	14 Verbascum blattaria	1
3 Panicum virgatum	10	15 Heterotheca villosa	1
4 Grindelia squarrosa	10	16 Lactuca serriola	1
5 Helianthus annuus	5	17 Solanum rostratum	1
6 Bouteloua gracilis	5	18 Verbena bracteata	1
7 Centaurea diffusa	3	19 Conyza canadensis	1
8 Ambrosia psilostachya	3	20	
9 Bassia scoparia	3	21	
10 Verbascum thapsus	2	22	
11 Bromus tectorum	1	23	
12 Bromus inermis	1	24	

Remarks: Disturbed Native Grassland. High coverage of native plants, lots of bare ground, and scattered weed species.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Multiple species Weeds
_____ Topographic Position	Native Grassland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Flatirons very cobbly sandy loam, 0 to 3 percent slopes.

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 10

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Juncus arcticus	30	13 Carex nebrascensis	1
2 Spartina pectinata	20	14 Nepeta cataria	1
3 Typha angustifolia	10	15 Populus deltoides	1
4 Hordeum jubatum	10	16 Salix exigua	1
5 Dipsacus fullonum	5	17 Cirsium vulgare	1
6 Bromus inermis	5	18 Oenothera elata	1
7 Asclepias speciosa	3	19 Symphoricarpos occidentalis	1
8 Cirsium arvense	3		
9 Glycyrrhiza lepidota	3	20 Verbascum thapsus	
10 Oenothera curtiflora	2	21 Geum aleppicum	
11 Epilobium sp.	1	22 Poa pratensis	
12 Asclepias incarnata	1	23 Panicum virgatum	
		24	

Remarks: Riparian emergent wetlands in a drainage near northern boundary of the site.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Multiple species Weeds
_____ Topographic Position	Riparian Emergent Wetland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Nederland very cobbly sandy loam, 15 to 50 percent slopes.

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 11

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Bromus inermis	20	13 Agropyron cristatum	2
2 Poa pratensis	15	14 Nepeta cataria	1
3 Carex nebrascensis	15	15 Bromus tectorum	1
4 Eleocharis palustris	15	16 Oenothera elata	1
5 Juncus arcticus	5	17 Cirsium arvense	1
6 Carex brevior	3	18 Verbascum thapsus	1
7 Polygonum punctatum	3	19 Verbascum blattaria	1
8 Panicum virgatum	3	20 Dactylis glomerata	1
9 Pascopyrum smithii	2	21 Asclepias speciosa	1
10 Juncus ensifolius	2	22 Epilobium sp.	1
11 Juncus longistylis	2	23 Glycyrrhiza lepidota	1
12 Thinopyrum intermedium	2	24 Typha latifolia	1

Remarks: Riparian emergent wetlands in a drainage. Mullein and Canada thistle occurs in large patches on the slopes down to the drainage.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Multiple species Weeds
_____ Topographic Position	Riparian Emergent Wetland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Nederland very cobbly sandy loam, 15 to 50 percent slopes.

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 12

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Bromus inermis	35	13 Psoralidium tenuiflorum	1
2 Poa pratensis	20	14 Elymus elymoides	1
3 Poa compressa	7	15 Verbascum blattaria	1
4 Andropogon gerardii	5	16 Artemisia ludoviciana	1
5 Koeleria macrantha	5	17 Ribes trilobatum	1
6 Verbascum thapsus	5	18 Lactuca serriola	1
7 Bromus tectorum	3	19 Helianthus annuus	1
8 Panicum virgatum	3	20 Conyza canadensis	1
9 Thinopyrum intermedium	2	21 Symphoricarpos occidentalis	1
10 Yucca glauca	2	22 Juncus sp.	1
11 Alyssum simplex	2	23	
12 Opuntia macrorhiza	1	24	

Remarks: Typical non-native/mixed prairie. Smooth brome dominated with scattered patches of native vegetation.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Multiple species Weeds
_____ Topographic Position	Non-Native Grassland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Flatirons very cobbly sandy loam, 0 to 3 percent slopes.

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 13

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Typha latifolia	40	13	
2 Salix exigua	20	14	
3 Populus deltoides	15	15	
4 Hordeum jubatum	10	16	
5 Bromus inermis	5	17	
6 Poa pratensis	5	18	
7 Cirsium arvense	5	19	
8		20	
9		21	
10		22	
11		23	
12		24	

Remarks: Scrub-Shrub/cattail wetland near southern boundary of the study area.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Cirsium arvense Weeds
_____ Topographic Position	Palustrine Scrub-shrub Wetland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Flatirons very cobbly sandy loam, 0 to 3 percent slopes.

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 14

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Poa pratensis	25	13 Rhus trilobata	1
2 Bromus tectorum	20	14 Psoralidium tenuiflorum	1
3 Poa compressa	20	15 Eriogonum alatum	1
4 Bromus inermis	10	16 Yucca glauca	1
5 Koeleria macrantha	5	17 Helianthus pumilus	1
6 Andropogon gerardii	3	18	
7 Elymus elymoides	2	19	
8 Artemisia ludoviciana	2	20	
9 Alyssum simplex	3	21	
10 Nassella viridula	2	22	
11 Bouteloua gracilis	2	23	
12 Opuntia macrorhiza	1	24	

Remarks: Typical non-native grassland, Kentucky bluegrass and downy brome dominated. Scattered patches of native vegetation.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Bromus tectorum Weeds
_____ Topographic Position	Non-Native Grassland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Flatirons very cobbly sandy loam, 0 to 3 percent slopes.

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 15

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Poa pratensis	25	13 Ratibida columnifera	2
2 Bromus inermis	15	14 Centaurea diffusa	2
3 Aristida purpurea	10	15 Thelesperma megapotamicum	1
4 Bromus tectorum	7	16 Elymus elymoides	1
5 Panicum virgatum	7	17 Helianthus pumilus	1
6 Andropogon gerardii	7	18 Liatris punctata	1
7 Bouteloua gracilis	7	19	
8 Psoralidium tenuiflorum	3	20	
9 Koeleria macrantha	3	21	
10 Heterotheca villosa	3	22	
11 Rhus trilobata	3	23	
12 Artemisia ludoviciana	2	24	

Remarks: Mixed Grassland, Kentucky Bluegrass is dominant, but much higher native cover than in other areas.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Bromus tectorum, Acosta diffusa Weeds
_____ Topographic Position	Mixed Grassland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Flatirons very cobbly sandy loam, 0 to 3 percent slopes.

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 16

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Bromus tectorum	35	13 Centaurea diffusa	2
2 Poa pratensis	15	14	
3 Bromus inermis	10	15	
4 Poa compressa	10	16	
5 Aristida purpurea	7	17	
6 Verbascum thapsus	7	18	
7 Yucca glauca	3	19	
8 Psoralidium tenuiflorum	3	20	
9 Ratibida columnifera	2	21	
10 Heterotheca villosa	2	22	
11 Thelesperma megapotamicum	2	23	
12 Artemisia ludoviciana	2	24	

Remarks: Disturbed Grassland, Downy brome dominated, minimal native vegetation cover.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Bromus tectorum, Acosta diffusa _____ Weeds
_____ Topographic Position	Disturbed Grassland _____ Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Flatirons very cobbly sandy loam, 0 to 3 percent slopes.

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 17

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Panicum virgatum	15	13 Nassella viridula	2
2 Poa compressa	15	14 Eriogonum alatum	1
3 Aristida purpurea	15	15 Liatris punctata	1
4 Poa pratensis	10	16 Thelesperma megapotamicum	1
5 Bromus inermis	10	17 Psoralidium tenuiflorum	1
6 Andropogon gerardii	7	18	
7 Schizachyrium scoparium	5	19	
8 Sorghastrum nutans	5	20	
9 Hesperostipa comata	5	21	
10 Dactylis glomerata	3	22	
11 Heterotheca villosa	2	23	
12 Artemisia frigida	2	24	

Remarks: Mixed Grassland with higher native cover than in other areas.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	_____ Weeds
_____ Topographic Position	Mixed Grassland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Flatirons very cobbly sandy loam, 0 to 3 percent slopes.

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 18

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Poa pratensis	25	13 Yucca glauca	2
2 Bromus inermis	15	14 Eriogonum alatum	1
3 Poa compressa	10	15 Linaria dalmatica	1
4 Aristida purpurea	10	16 Heterotheca villosa	1
5 Andropogon gerardii	5	17 Liatris punctata	1
6 Panicum virgatum	5	18 Prunus virginiana	1
7 Thinopyrum intermedium	5	19 Elymus elymoides	1
8 Artemisia ludoviciana	3	20 Bouteloua curtipendula	1
9 Psoralidium tenuiflorum	3	21 Dactylis glomerata	1
10 Opuntia macrorhiza	3	22 Hesperostipa comata	1
11 Koeleria macrantha	2	23	
12 Pascopyrum smithii	2	24	

Remarks: Mixed Grassland, Kentucky Bluegrass is dominant, but much higher native cover than in other areas.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	Bromus tectorum, Acosta diffusa Weeds
_____ Topographic Position	Non-Native Grassland Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Flatirons very cobbly sandy loam, 0 to 3 percent slopes.

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

DATA FORM – Vegetation Inventory Site 19

Project/Site: NWTC	Date: 8/9/2016
Investigator: Tony Romano	County/State CO

VEGETATION

Dom. Plant Species	Rel. %	Dom. Plant Species	Rel. %
1 Poa pratensis	20	13 Yucca glauca	2
2 Bromus inermis	15	14 Eriogonum alatum	1
3 Poa compressa	15	15 Linaria dalmatica	1
4 Aristida purpurea	10	16 Heterotheca villosa	1
5 Andropogon gerardii	5	17 Liatris punctata	1
6 Panicum virgatum	5	18 Prunus virginiana	1
7 Thinopyrum intermedium	5	19 Elymus elymoides	1
8 Artemisia ludoviciana	3	20 Bouteloua curtipendula	1
9 Psoralidium tenuiflorum	2	21 Dactylis glomerata	1
10 Opuntia macrorhiza	2	22 Hesperostipa comata	1
11 Koeleria macrantha	2	23 Lactuca serriola	1
12 Pascopyrum smithii	2	24 Sorghastrum nutans	1

Remarks: Mixed Grassland, Kentucky Bluegrass is dominant, but much higher native cover than in other areas.

TOPOGRAPHY/GEOLOGY/SITE CONDITIONS

_____ Slope	_____ Disturbance History
_____ Aspect	_____, _____ Weeds
_____ Topographic Position	___ Non-Native Grassland _____ Community Type
_____ Other	

Remarks:

SOILS

Map Unit name: Flatirons very cobbly sandy loam, 0 to 3 percent slopes.

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Soil Indicators:
Permeability_____ Drainage_____ Coarse Fragments_____

Remarks: Did not collect soil samples.

Remarks:

Appendix B List of Species Observed During the 2016 Field Surveys

Common Name	Scientific Name	Status
Trees		
Plains cottonwood	*Populus deltoides*	Native
Ponderosa pine	*Pinus ponderosa*	Native
Shrubs		
Chokecherry	*Prunus virginiana*	Native
Hen-and-Chickens	*Echinocereus viridiflorus*	Native
Plain pricklypear	*Opuntia polyacantha*	Native
Sandbar willow	*Salix exigua*	Native
Skunkbrush sumac	*Rhus trilobata*	Native
Twistpine prickly pear	*Opuntia macrorhiza*	Native
Wax currant	*Ribes cereum*	Native
Western poison ivy	*Toxicodendron rybergii*	Native
Western serviceberry	*Amelanchier alnifolia*	Native
Western snowberry	*Symphoricarpos occidentalis*	Native
Wild plum	*Prunus americana*	Native
Wood's rose	*Rosa woodsii*	Native
Yucca	*Yucca glauca*	Native
Grasses (Poaceae)		
Barnyard grass	*Echinochloa crus-galli*	Introduced
Big bluestem	*Andropogon gerardii*	Native
Blue grama	*Bouteloua gracilis*	Native
Broadleaf cattail	*Typha latifolia*	Native
Buffalo grass	*Bouteloua dactyloides*	Native
Canada bluegrass	*Poa compressa*	Introduced
Canada wildrye	*Elymus canadensis*	Native
Crested wheatgrass	*Agropyron cristatum*	Introduced
Foxtail barley	*Hordeum jubatum*	Native
Green needlegrass	*Nassella viridula*	Native
Intermediate wheatgrass	*Thinopyrum intermedium*	Introduced
Field brome	*Bromus arvensis*	Introduced
Junegrass	*Koeleria macrantha*	Native
Kentucky bluegrass	*Poa pratensis*	Introduced
Little bluestem	*Schizachyrium scoparium*	Native
Meadow barley	*Hordeum brachyantherum*	Native
Meadow fescue	*Schedonorus pratensis*	Introduced
Narrowleaf cattail	*Typha angustifolia*	Native
Needle and thread grass	*Hesperostipa comata*	Native
Orchard grass	*Dactylis glomerata*	Introduced
Perennial ryegrass	*Lolium perenne*	Introduced
Prairie cordgrass	*Spartina pectinata*	Native
Rabbitfoot grass	*Polypogon monspeliensis*	Introduced
Redtop	*Agrostis gigantea*	Introduced
Sand dropseed	*Sporobolus cryptandrus*	Native
Sideoats grama	*Bouteloua curtipendula*	Native
Slender wheatgrass	*Elymus trachycaulus*	Native
Smooth brome	*Bromus inermis*	Introduced

Squirreltail	*Elymus elymoides*	Native
Switchgrass	*Panicum virgatum*	Native
Tall wheatgrass	*Thinopyrum ponticum*	Introduced
Thickspike wheatgrass	*Elymus lanceolatus*	Native
Threeawn	*Aristida purpurea*	Native
Western wheatgrass	*Pascopyrum smithii*	Native
Yellow indiangrass	*Sorghastrum nutans*	Native
Rushes (Juncaceae)		
Arctic rush	*Juncus arcticus*	Native
Dudley's rush	*Juncus dudleyi*	Native
Longstyle rush	*Juncus longistylis*	Native
Longstyle rush	*Juncus ensifolius*	Native
Rush species	*Juncus sp.*	n/a
Torrey's rush	*Juncus torreyi*	Native
Sedges (Cyperaceae)		
Cloaked bulrush	*Scirpus pallidus*	Native
Common spikerush	*Eleocharis palustris*	Native
Common threesquare	*Schoenoplectus pungens*	Native
Emory's sedge	*Carex emoryi*	Native
Nebraska sedge	*Carex nebrascensis*	Native
Plains oval sedge	*Carex brevior*	Native
Softstem bulrush	*Schoenoplectus tabernaemontani*	Native
Forbs		
Alyssum	*Alyssum simplex*	Introduced
Annual sunflower	*Helianthus annuus*	Native
Blanket flower	*Gaillardia aristata*	Native
Bracted verbena	*Verbena bracteata*	Native
Buffalo burr	*Solanum rostratum*	Native
Canada horseweed	*Conyza canadensis*	Native
Catnip	*Nepeta cataria*	Introduced
Common yarrow	*Achillea millefolium*	Native
Curly cup gumweed	*Grindelia squarrosa*	Native
Curly dock	*Rumex crispus*	Introduced
Erigeron species	*Erigeron sp.*	Native
Fringed sage	*Artemisia frigida*	Native
Globe mallow	*Sphaeralcea coccinea*	Native
Golden banner	*Thermopsis rhombifolia*	Native
Hairy evening primrose	*Oenothera villosa*	Native
Hairy golden aster	*Heterotheca villosa*	Native
Harebell	*Campanula rotundifolia*	Native
Velvetweed	*Oenothera curtiflora*	Native
Hooker's evening primrose	*Oenothera elata*	Native
Hopi tea	*Thelesperma megapotamicum*	Native
Indian hemp	*Apocynum cannabinum*	Native
James' nailwort	*Paronychia jamesii*	Native
Kochia	*Bassia scoparia*	Introduced
Little sunflower	*Helianthus pumilus*	Native

Marbleseed	*Onosmodium bejariense*	Native
Perennial ragweed	*Ambrosia psilostachya*	Native
Prairie coneflower	*Ratibida columnifera*	Native
Prairie gayfeather	*Liatris punctata*	Native
Prairie sage	*Artemisia ludoviciana*	Introduced
Prickly lettuce	*Lactuca serriola*	Introduced
Purple locoweed	*Oxytropis lambertii*	Native
Rosy pussytoes	*Antennaria rosea*	Native
Salsify	*Tragopogon dubius*	Introduced
Scurf pea	*Psoralidium tenuiflorum*	Native
Sego lily	*Calochortus gunnisonii*	Native
Showy milkweed	*Asclepias speciosa*	Native
Sidebells penstemon	*Penstemon secundiflorus*	Native
Solidago species	*Solidago sp.*	Native
Dotted smartweed	*Polygonum punctatum*	Native
Sulphur flower	*Eriogonum umbellatum*	Native
Swamp milkweed	*Asclepias incarnata*	Native
Wavyleaf thistle	*Cirsium undulatum*	Native
Wild licorice	*Glycyrrhiza lepidota*	Native
Wild onion	*Allium textile*	Native
Willow herb species	*Epilobium sp.*	Native
Winged buckwheat	*Eriogonum alatum*	Native
Yellow avens	*Geum aleppicum*	Native
Yellow sweetclover	*Melilotus officinalis*	Introduced
Water speedwell	*Veronica sp.*	Native
White blazingstar	*Mentzelia nuda*	Native
Noxious Weeds		
Bull thistle	*Cirsium vulgare*	Noxious
Canada thistle	*Cirsium arvense*	Noxious
Common mullein	*Verbascum thapsus*	Noxious
Common St. Johnswort	*Hypericum perforatum*	Noxious
Common teasel	*Dipsacus fullonum*	Noxious
Dalmation toadflax	*Linaria dalmatica*	Noxious
Diffuse knapweed	*Centaurea diffusa*	Noxious
Downy brome	*Bromus tectorum*	Noxious
Field bindweed	*Convolvulus arvensis*	Noxious
Moth mullein	*Verbascum blattaria*	Noxious
Musk thistle	*Carduus nutans*	Noxious
Quackgrass	*Elymus repens*	Noxious
Redstem filaree	*Erodium cicutarium*	Noxious
Sulphur cinquefoil	*Potentilla recta*	Noxious

Photo Log

Photo 1 - Live trap set up along a transect in NWTC.

Photo 2 - Point count location #1 (west).

Photo 3 - Point count location #2 (north).

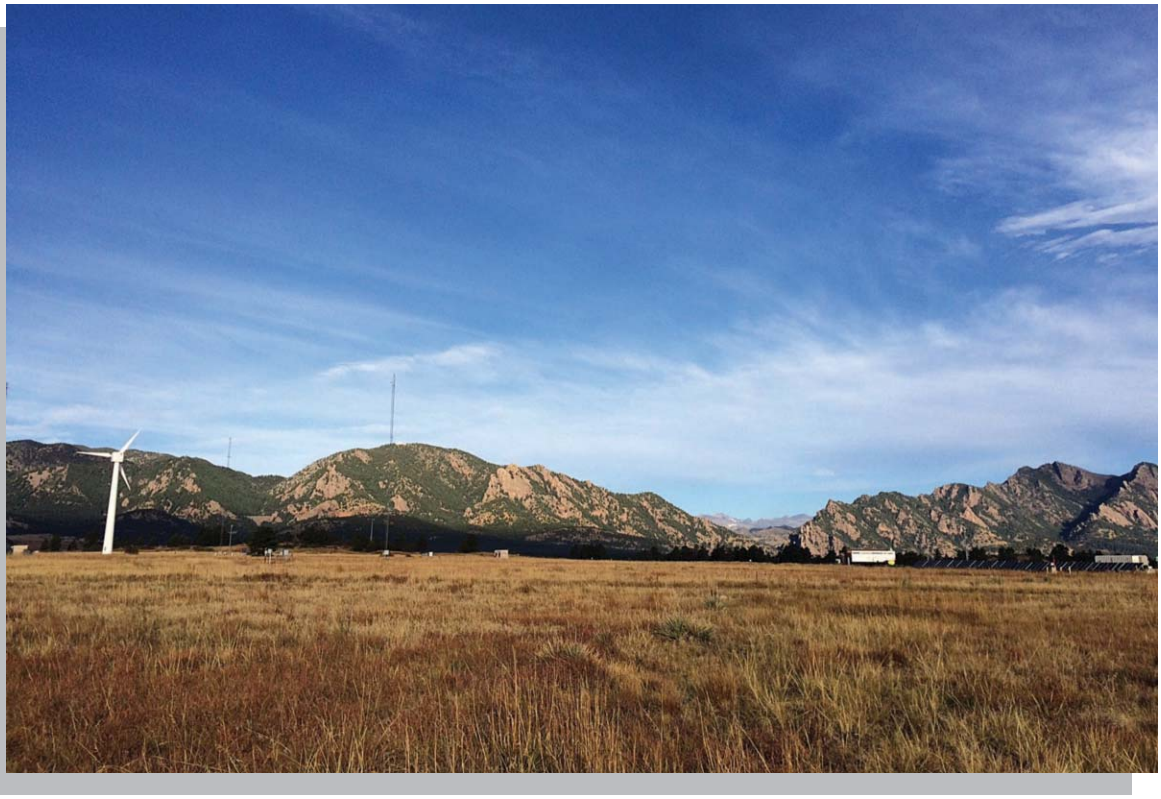

Photo 4 - Point count location #3 (west).

Photo 5 - Point count location #4 (north).

Photo 6 - Point count location #5 (north).

Photo 7 - Point count location #6 (south).

Photo 8 - Nonnative grasslands at NWTC.

Photo 9 - Mixed grasslands at NWTC.

Photo 10 - Disturbed native grasslands at NWTC.

Photo 11 - Mixed yucca and nonnative grasslands at NWTC.

Photo 12 - Degraded grasslands at NWTC.

Photo 13 - Highly disturbed area near the southwest corner of NWTC.

Photo 14 - Ponderosa pine woodlands at NWTC.

Photo 15 - Mixed shrubland at NWTC.

Photo 16 - Palustrine emergent wetlands near the large solar array at NWTC.

Photo 17 - Palustrine emergent wetlands within the seasonal pond at NWTC.

Photo 18 - Palustrine emergent wetlands south of Row 3 at NWTC.

Photo 19 - Palustrine emergent wetlands in the northwest corner of NWTC.

Photo 20 - Riparian emergent wetlands in the northernmost drainage at NWTC.

Photo 21 - Riparian emergent wetlands in the southernmost drainage at NWTC.

Photo 22 - Dense stands of common teasel and Canada thistle in the northernmost drainage at NWTC.