CHARACTERISTIC PHOTOGRAPHS OF SPOTTED DOG WMA

The following photographs (Photos 1 through 71) show the overall landscape of Spotted Dog WMA, interesting features, and interesting plants.

Photo 1. From left to right, Montana Department of Fish, Wildlife and Parks personnel Dave Dziak, Steve Knapp (retired), and Mike Frisina (retired) discussing management issues for Spotted Dog WMA (2011 photo)

Photo 2. A *Dendragapus obscurus* (dusky grouse; blue grouse) observed along Freezeout Creek (2011 photo)

Photo 3. A riparian wet meadow with an obscured small perennial stream on an unnamed tributary of Trout Creek (Record ID 2043389) (2014 photo)

Photo 4. Typical view of the main stem of Fred Burr Creek near the south end of the WMA, where the tributary joins (Record ID 2024159) (2011 photo)

Photo 5. A small lentic fen wetland near the central eastern edge of Spotted Dog WMA (Record ID 2043411) (2014 photo)

Photo 6. The native *Lewisia rediviva* (bitterroot) in flower on very dry, harsh upland sites (2011 photo)

Photo 7. *Purshia tridentata* (antelope bitterbrush) in flower along the hillside below the radio tower in the western portion of Spotted Dog WMA (2011 photo)

Photo 8. A stand of the *Agropyron spicatum/Poa secunda* (bluebunch wheatgrass/Sandberg's bluegrass) habitat type in the central portion of Spotted Dog WMA (Record ID 2024212) (2011 photo)

Photo 9. Closeup view in a stand of the *Agropyron spicatum/Poa secunda* (bluebunch wheatgrass/Sandberg's bluegrass) habitat type lacking adequate litter cover (Record ID 2024212) (2011 photo)

Photo 10. Closeup view in an undisturbed stand of the *Festuca scabrella/Festuca idahoensis* (rough fescue/Idaho fescue) habitat type in the central portion of Spotted Dog WMA (Record ID 2024213) (Note the brown colored *Carex filifolia* [threadleaf sedge]) (2011 photo)

Photo 11. A greener area marking a stand of mesic vegetation in a shallow swale with slightly more moisture, due to the topographic concentration of surface water (Record ID 2024216) (2011 photo)

Photo 12. Small *Pseudotsuga menziesii* var. *glauca* (Douglas fir) trees left in a logged stand (Record ID 2024219) (2011 photo)

Photo 13. Mortality caused by *Choristoneura occidentalis* (western spruce budworm) among young *Pseudotsuga menziesii* var. *glauca* (Douglas fir) trees in a logged stand (Record ID 2024219) (2011 photo)

Photo 14. An intensely browsed and depleted stand of the *Purshia tridentata/Festuca idahoensis* (antelope bitterbrush/Idaho fescue) habitat type (Record ID 2024222) (2011 photo)

Photo 15. Intensive browsing and resulting decadence on *Purshia tridentata* (antelope bitterbrush) plants (Record ID 2024222) (2011 photo)

Photo 16. Moose (*Alces americanus*) pellets in a *Purshia tridentata* (antelope bitterbrush) stand (Record ID 2024223), one of many polygons with moose sign (2011 photo)

Photo 17. Looking northwest in the western portion of the WMA, showing the open rolling hills, small drainages, and pockets of shrublands (Record ID 2024267) (2011 photo)

Photo 18. A large stand of intensely browsed *Purshia tridentata* (antelope bitterbrush) and *Lupinus argenteus* (silvery lupine) in the western portion of Spotted Dog WMA (Record ID 2024267) (2011 photo)

Photo 19. A site with non-merchantable *Pseudotsuga menziesii* var. *glauca* (Douglas fir) and *Pinus ponderosa* var. *scopulorum* (ponderosa pine) remaining on a harvested stand (Record ID 2024197) (2011 photo)

Photo 20. An exposed, wind-swept, ridge crest showing the stoney soil, bare ground, and low-growing forbs such as *Phlox hoodii* (Hood's phlox) typical on such a harsh site (Record ID 2024199) (2011 photo)

Photo 21. Bird nest with eggs in an open, grassland area in Spotted Dog WMA (2011 photo)

Photo 22. Highly browsed *Prunus virginiana* (chokecherry), protected here within the canopy of a *Purshia tridentata* (antelope bitterbrush) (Record ID 2024202) (2011 photo)

Photo 23. Volcanic rock outcrop in the northwestern portion of Spotted Dog WMA (Record ID 2024205) (2011 photo)

Photo 24. An impacted site with both livestock and elk sign throughout, in the western portion of the WMA. This site has 30 percent *Festuca idahoensis* (Idaho fescue) canopy cover, which is important forage for elk winter range due to its late senescence (Record ID 2024207) (2011 photo)

Photo 25. *Bromus tectorum* (cheatgrass) and other weedy species along a timber harvest cut/fill road, typical along the many such roads on Spotted Dog WMA (2014 photo)

Photo 26. A robust stand of *Festuca campestris* (rough fescue) in the northern portion of Spotted Dog WMA (2014 photo)

Photo 27. Closeup of a typical stand of *Festuca campestris* (rough fescue) in the northern portion of Spotted Dog WMA (2014 photo)

Photo 28. Overview of the grasslands in the northern portion of Spotted Dog WMA (looking toward the north) (2014 photo)

Photo 29. A very old *Pinus ponderosa* var. *scopulorum* (ponderosa pine) in a draw in the northern portion of Spotted Dog WMA (2014 photo)

Photo 30. Overview of Spotted Dog WMA from the eastern edge looking back toward the west (2014 photo)

Photo 31. Closeup of a typical stand of the *Festuca scabrella/Festuca idahoensis* (rough fescue/Idaho fescue) habitat type (Note the large amount of forb species) (2014 photo)

Photo 32. Looking back to the northwest from a hillside southeast of the Pauly Place (2014 photo)

Photo 33. Overview of Spotted Dog WMA from the southeastern portion of the WMA looking toward the west (2014 photo)

Photo 34. Overview of the extensive grassland in the eastern portion of Spotted Dog WMA (looking toward the north) (2014 photo)

Photo 35. Inside a coniferous forest stand showing regeneration of *Populus tremuloides* (quaking aspen) (2014 photo)

Photo 36. A typical forest site along Trout Creek in the eastern portion of Spotted Dog WMA (2014 photo)

Photo 37. Sunset at Spotted Dog WMA (2014 photo)

Photo 38. Sunrise at Spotted Dog WMA (2014 photo)

Photo 39. Overview of a tributary of Spotted Dog Creek (looking toward the northwest) (2014 photo)

Photo 40. A moose (*Alces americanus*) in one of the lentic sites (i.e., pond) in Spotted Dog WMA (2014 photo)

Photo 41. A highly impacted stand of *Populus tremuloides* (quaking aspen) (notice the missing size classes of saplings and poles) (2014 photo)

Photo 42. Looking north to the dam on Spotted Dog Reservoir (2014 photo)

Photo 43. An isolated wetland high on the hillside in the Trout Creek drainage (2014 photo)

Photo 44. Interesting growth of *Pseudotsuga menziesii* var. *glauca* (Douglas fir) in a recently logged site (2014 photo)

Photo 45. A dense conifer stand along the edge of a large grassland site (notice the extensive use of shade by livestock) (2014 photo)

Photo 46. A wide view of coniferous species encroachment in a large grassland (2014 photo)

Photo 47. A typical view of a robust *Festuca campestris* (rough fescue) stand (2014 photo)

Photo 48. A typical view of the gentle slopping nature of many of the grasslands in the WMA with some conifer encroachment (2014 photo)

Photo 49. A wide view in Spotted Dog WMA with snowcapped Mount Powell in the background (2014 photo)

Photo 50. Young, browsed *Populus tremuloides* (quaking aspen) near a lentic area (2014 photo)

Photo 51. The headwaters of O'Neil Creek (Record ID 2043403) (2014 photo)

Photo 52. A lone *Juniperus communis* (common juniper) in a grassland community injured by antler rubbing (Record ID 2043393) (2014 photo)

Photo 53. A southwesterly facing, disturbed site with infestations of *Centaurea maculosa* (spotted knapweed) and *Bromus tectorum* (cheatgrass) in the northeastern portion of the WMA (Record ID 2043394) (2014 photo)

Photo 54. An intensely browsed *Purshia tridentata* (antelope bitterbrush) on a southwest facing, disturbed site in the northeastern portion of the WMA (Record ID 2043394) (2014 photo)

Photo 55. Looking south at an overview of Trout Creek and a forested area on MTDNRC lands in the northeastern portion of the WMA (2014 photo)

Photo 56. Pedestaled bunchgrasses due to soil disturbance and wind erosion in the eastern portion of the WMA (Record ID 2043396) (2014 photo)

Photo 57. An area of dense *Phleum pratense* (timothy) along an unnamed tributary to Trout Creek (Record ID 2043405) (2014 photo)

Photo 58. A historic cabin adjacent to an unnamed tributary to Trout Creek (2014 photo)

Photo 59. Highlined *Pseudotsuga menziesii* var. *glauca* (Douglas fir) which are encroaching into a grassland area (Record ID 2043398) (2014 photo)

Photo 60. An area of streambank damage, erosion, and the beginning of willow canopy opening on a reach of an unnamed tributary to Trout Creek (Record ID 2043409) (2014 photo)

Photo 61. An excessive deposit of sediment transported approximately 300 yards downstream from the channel disturbance shown in the photo above, being stabilized for the time being by herbaceous species (Record ID 2043409) (2014 photo)

Photo 62. A small infestation of *Bromus tectorum* (cheatgrass) on a low knob in the north-central portion of the WMA (Record ID 2043401) (2014 photo)

Photo 63. A volcanic rock area in the central portion of the WMA (Record ID 2043413) (2014 photo)

Photo 64. A small lentic wetland with stagnant standing water in the central portion of the WMA (Record ID 2043412) (2014 photo)

Photo 65. An example of the introduced invasive species *Carduus nutans* (nodding plumeless thistle), which was observed on over half of all inventoried polygons across the WMA (2014 photo)

Photo 66. A very old road, now mainly a cattle trail, in the central portion of the WMA (2014 photo)

Photo 67. A rock pile (one of several) in the central portion of the WMA, original purpose is unknown (possibly a cairn) as most of the rocky and dry surrounding area is not suitable for crop or hay production (2014 photo)

Photo 68. A robust stand of *Festuca campestris* (rough fescue) in the south-central portion of the WMA (Record ID 2043417) (2014 photo)

Photo 69. An overview of Spotted Dog Creek looking north, near the southeastern WMA boundary (2014 photo)

Photo 70. An opening in a forested area with multiple species of introduced invasive species including *Cirsium arvense* (Canada thistle), *Cynoglossum officinale* (houndstongue), *Carduus nutans* (nodding plumeless thistle), *Bromus tectorum* (cheatgrass), and *Linaria vulgaris* (butter and eggs) (Record ID 2043423) (2014 photo)

Photo 71. A northeast facing slope with young *Picea engelmannii* var. *engelmannii* (Engelmann spruce) and *Pinus contorta* var. *latifolia* (lodgepole pine) (Record ID 2043424) (2014 photo)

METHODS

Site Types for Inventory and Ecological Health Assessment

Lotic Wetlands—Lotic wetlands are associated with running water systems, such as rivers, streams, and drainage ways. They are often referred to as riparian areas. Such wetlands usually contain a defined channel and floodplain. The channel is an open conduit which periodically, or continuously, carries flowing water with dissolved and suspended material. In many cases beaver ponds, seeps, springs, and wet meadows on the floodplain are associated with the stream; and these are usually included as part of the lotic wetland.

Lentic Wetlands—Lentic wetlands typically occur in basins, and lack a defined channel and floodplain. Included are permanent (perennial) or intermittent bodies of water such as lakes, reservoirs, potholes, fens, bogs, marshes, ponds, and stockponds. Other examples may include wet meadows, seeps, or springs that are not associated with a defined channel (i.e., ones not part of a lotic system).

Uplands—Uplands are areas that do not qualify as wetland because the associated hydrologic regime is not sufficiently wet to elicit development of vegetation, soils, and/or hydrologic features characteristic of wetlands. Such areas occurring in riverine situations (i.e., floodplains) are more appropriately termed non-wetlands.

Lotic, Lentic, and Upland Inventory and Ecological Health Assessments

Public and private land managers are being asked to improve or maintain stream (lotic) habitat, wetland (lentic) habitat, and upland habitat on lands throughout western North America. Three questions that are generally asked about a wetland site are: 1) What is the potential of the site (e.g., climax or potential natural community)? 2) What plant communities currently occupy the site? and 3) What is the overall health (condition) of the site?

For a lotic site (flowing water), the first two questions can be answered by using the Lotic Wetland Inventory Form along with a document such as *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995), *Classification and Management of USDI Bureau of Land Management's Riparian and Wetland Sites in Eastern and Southern Idaho* (Hansen and Hall 2002), *Classification and management of upland, riparian, and wetland sites of USDI Bureau of Land Management's Miles City Field Office, eastern Montana USA* (Hansen and others 2008), or a similar publication written for the region in which you are working.

The U. S. Lotic Wetland Ecological Health Assessment Form is a method for rapidly addressing the third question above: what is the site's overall health (condition)? It provides a site rating useful for setting management priorities and stratifying riparian sites for remedial action or more rigorous analytical attention. It is intended to serve as a first approximation, or coarse filter, by which to identify lotic wetlands in need of closer attention so that managers can more efficiently concentrate effort. We use the term riparian health to mean the ability of a riparian reach (including the riparian area and its channel) to perform certain functions. These functions include sediment trapping, bank building and maintenance, water storage, aquifer recharge, flow energy dissipation, maintenance of biotic diversity, and primary production. Excellent sources of practical ideas and tips on good management of these streamside wetland sites are found in *Caring for the Green Zone* (Adams and Fitch 1995), *Riparian Areas: A User's Guide to Health* (Fitch and Ambrose 2003), and *Riparian Health Assessment for Streams and Small Rivers* (Fitch and others 2001).

For a lentic site (wetlands adjacent to non-flowing water bodies), the first two questions can be answered by using the Lentic Wetland Inventory Form along with a document such as *Classification and Management of Montana's Riparian and Wetland Sites* (Hansen and others 1995), *Classification and Management of USDI Bureau of Land Management's Riparian and Wetland Sites in Eastern and Southern Idaho* (Hansen and Hall 2002), *Classification and management of upland, riparian, and wetland sites of USDI Bureau of Land Management's Miles City Field Office, eastern Montana USA* (Hansen and others 2008), or a similar publication written for the region in which you are working. The health question can be answered by using this *U. S. Lentic Wetland Ecological Health Assessment*, which summarizes data collected in the *U. S. Lentic Wetland Inventory Form.*

The U. S. Lentic Wetland Ecological Health Assessment Form is a method for rapidly addressing the third question above: what is the site's overall health (condition)? The health of a lentic site (a wetland located adjacent to a still water body) may be defined as the ability of that system (including the saturated and inundated near-shore emergent wetland and all the shoreline area that is influenced by the lentic waters) to perform certain wetland functions. These functions include sediment trapping, shoreline maintenance, water storage, aquifer recharge, wave energy dissipation, primary biotic production, and wildlife habitat. A site's health rating may also reflect management considerations. For example, although *Centaurea maculosa* (spotted knapweed) or *Euphorbia esula* (leafy spurge) may help to trap sediment and provide soil-binding properties, other functions (i.e., productivity and wildlife habitat) will be impaired; and their presence should be a management concern. Excellent sources of practical ideas and tips on good management of these wetland sites in Alberta are found in *Caring for Shoreline Properties* (Valastin and others 1999) and *Caring for the Green Zone* (Adams and Fitch 1995), and *Riparian Areas: A User's Guide to Health* (Fitch and Ambrose 2003). In Saskatchewan some excellent resources are *Streambank Stewardship, Your Guide to Caring For Riparian Areas in Saskatchewan* (Huel 1998) and *Managing Saskatchewan Wetlands—A Landowner's Guide* (Huel 2000).

Finally, for upland sites, the first two questions can be answered by using the Upland Inventory Form along with a document such as the *Forest Habitat Types of Montana* (Pfister and others 1977), *Grassland and shrubland habitat types of Western Montana* (Mueggler and Stewart 1980), and for eastern Montana use *Classification and Management of Upland, Riparian, and Wetland Sites in the USDI Bureau of Land Management's Miles City Field Office, Northern Great Plains, Eastern Montana* (Hansen and others 2008). When the name of the habitat type(s) or successional community type(s) on the site are known, then one can compare the vegetation on the site to that described in the document for late seral to climax, or relatively undisturbed, stands of that type.

The U. S. Upland Ecological Health Assessment Forms (i.e., forest/woodland, shrubland, grassland, and modified) define methods for rapidly addressing the third question above: what is the site's overall health (condition)? Upland ecological health assessments evaluate the ability of a site to perform natural functions (such as primary production, maintenance of natural biotic diversity, provision of wildlife habitat, retention of water incident to the site, the development and maintenance of the soil resource). They are designed for use in conjunction with an ecological site classification such as a vegetation-based site classification (habitat type and/or community type) that has been written for the region. The resulting health rating is a measure of departure of a site from full functional capacity that may be attributed to human-caused disturbance. Due to differing site processes and characteristics that are reflected in the dominant vegetation physiognomy, four different ecological health assessment formats are used.

All the field forms and user manuals are found in Appendix F.

Lotic (Riparian) Ecological Health Assessment

As noted above, the health of a lotic site (a wetland, or riparian area, adjacent to flowing water) may be defined as the ability of that system to perform certain wetland functions. These functions include sediment trapping, bank building and maintenance, water storage, aquifer recharge, flow energy dissipation, maintenance of biotic diversity, and primary biotic production. A site's health rating may also reflect management considerations. For example, although *Cirsium arvense* (Canada thistle) or *Euphorbia esula* (leafy spurge) may help to trap sediment and provide soil-binding properties, other functions (i.e., productivity and wildlife habitat) will be impaired; and their presence should be a management concern.

No single factor or characteristic of a wetland site can provide a complete picture of either site health or the direction of trend. The lotic ecological health assessment is based on consideration of physical, hydrologic, and vegetation factors. It relies heavily on vegetative characteristics as integrators of factors operating on the landscape. Because they are more visible than soil or hydrologic characteristics, plants may provide early indications of riparian health as well as successional trend. These are reflected not only in the types of plants present, but also by the effectiveness with which the vegetation carries out its wetland functions of stabilizing the soil, trapping sediments, and providing wildlife habitat. Furthermore, the utilization of certain types of vegetation by animals may indicate the current condition of the wetland and may indicate trend toward or away from potential natural community (PNC).

In addition to vegetation factors, an analysis of site health and its susceptibility to degradation must also consider physical factors (soils and hydrology) for both ecologic and management reasons. Changes in soil or hydrologic conditions obviously affect the function of a wetland ecosystem. Moreover, degradation in physical factors is often (but not always) more difficult to remedy than vegetative degradation. For example, extensive incisement (down-cutting) of a stream channel may lower the water table and thus change site potential from a *Salix lutea/ Carex rostrata* (yellow willow/beaked sedge) habitat type to a *Bromus inermis* (smooth brome) community type or even to an upland (non-riparian) type. Sites experiencing significant hydrologic, edaphic (soil), or climatic changes will likely also have new plant community potential.

Lentic Wetland Ecological Health Assessment

The health of a lentic site (a wetland located adjacent to a still water body) may be defined as the ability of that system (including the saturated and inundated near-shore emergent wetland and all the shoreline area that is influenced by the lentic waters) to perform certain wetland functions. These functions include sediment trapping, shoreline maintenance, water storage, aquifer recharge, wave energy dissipation, primary biotic production, and wildlife habitat. A site's health rating may also reflect management considerations. For example, although *Centaurea maculosa* (spotted knapweed) or *Euphorbia esula* (leafy spurge) may help to trap sediment and provide soil-binding properties, other functions (i.e., productivity and wildlife habitat) will be impaired; and their presence should be a management concern.

No single factor or characteristic of a wetland site can provide a complete picture of either site health or the direction of trend. The lentic wetland ecological health assessment is based on consideration of physical, hydrologic and vegetation factors. It relies heavily on vegetative characteristics as integrators of factors operating

on the landscape. Because they are more visible than soil or hydrological characteristics, plants may provide early indications of riparian health as well as successional trend. These are reflected not only in the types of plants present, but also by the effectiveness with which the vegetation carries out its wetland functions of stabilizing the soil, trapping sediments, and providing wildlife habitat. Furthermore, the utilization of certain types of vegetation by animals may indicate the current condition of the wetland and may indicate trend toward or away from potential natural community (PNC).

In addition to vegetation factors, an analysis of site health and its susceptibility to degradation must also consider physical factors (soils and hydrology) for both ecologic and management reasons. Changes in soil or hydrologic conditions obviously affect the function of a wetland ecosystem. Moreover, degradation in physical characteristics are often (but not always) more difficult to remedy than vegetative degradation. For example, downcutting of an unstable overflow point may lower the water table and thus change site potential from a *Typha latifolia* (common cattail) habitat type to an *Agropyron smithii* (western wheatgrass) habitat type or even to an upland type. Sites experiencing significant hydrologic, edaphic (soil), or climatic changes will likely also have new plant community potential.

This ecological health assessment is not designed to serve as an in-depth and comprehensive analysis of ecologic processes. Such analysis may be warranted on a site and can be done after this evaluation has identified particular areas of concern. Nor does this approach yield an absolute rating to be used in comparison with wetlands in other areas or of other types. Appropriate comparisons using this rating can be made between neighboring wetlands of similar size and type and between subsequent assessments of the same site.

Upland Ecological Health Assessments

Upland ecological health assessments evaluate the ability of a site to perform natural functions (such as primary production, maintenance of natural biotic diversity, provision of wildlife habitat, retention of water incident to the site, the development and maintenance of the soil resource). They are designed for use in conjunction with an ecological site classification such as a vegetation-based site classification (habitat type and/or community type) that has been written for the region. The resulting health rating is a measure of departure of a site from full functional capacity that may be attributed to human-caused disturbance. Due to differing site processes and characteristics that are reflected in the dominant vegetation physiognomy, four different ecological health assessment formats are presented. (***NOTE: A project area may include various amounts of any, or all, of the vegetational site types defined below.***) Following are definitions of the terms used to differentiate these forms and a key to assist in determining which one to use on a site.

Upland Vegetative Lifeform Site Types Defined

A ***forest/woodland*** is a site dominated by trees that are generally distributed (i.e., not limited to microsites of special hydrologic or edaphic conditions) at a density of at least 10 per acre, and that are reproducing successfully (i.e., there are well established seedlings and/or saplings present in the population). As compared to a forest, a woodland is generally defined as a site with vegetation dominated by a rather open stand of trees of short stature. For example, some woodland stands of *Juniperus scopulorum* (Rocky Mountain juniper) may form an open canopy of stunted trees, especially in xeric sites.

A ***shrubland*** (or shrub steppe) is a form of grassland (steppe) where zonal soils are too dry for trees, and herbaceous perennial grasses are well represented. Shrubs may be aggregated into thickets confined to relatively moist micro-environments or the shrubs may rise above the grasses and form a discontinuous upper layer on the landscape. Therefore, shrublands (shrub steppe) are a grassland (steppe) with a conspicuous shrub element, with the shrubs usually forming an open overstory above the grass layer. ***NOTE:*** Some sites may have varying amounts of low-growing shrubs, such as *Artemisia frigida* (fringed sagewort), *Gutierrezia sarothrae* (broom snakeweed), *Yucca glauca* (soapweed), *Juniperus horizontalis* (creeping juniper), *Opuntia polyacantha* (plains prickly-pear), or *Opuntia fragilis* (fragile cactus). Since these low-growing shrubs are typically shorter than the associated grasses, these sites are considered grassland sites.

A ***grassland*** (or steppe) is also a site where zonal soils are too dry for trees, and where herbaceous perennial grasses are well represented. The dominant grasses of steppe vary greatly in height, but all die back to the ground each year. They may be rhizomatous so that a continuous or interrupted sod is formed, or they may be cespitose, forming bunchgrass or tussock grassland. Forbs are less important in the drier portions of the steppe, but toward the wetter edge they become conspicuous, and may even exceed the graminoids in dry-matter production. Such forb-rich steppe is called meadow steppe. Some shrubs may be present, but these are few and are usually dwarfed and/or shorter than the herbaceous vegetation and interspersed amongst them. Examples include sites with varying amounts of the low-growing shrubs *Artemisia frigida* (fringed sagewort), *Gutierrezia sarothrae* (broom snakeweed), *Yucca glauca* (soapweed), *Juniperus horizontalis* (creeping juniper), *Opuntia polyacantha* (plains prickly-pear), or *Opuntia fragilis* (fragile cactus). Medium-to-tall shrubs may be present in limited microsites. Trees may also be present, but with less than 10 trees per acre and/or not successfully reproducing.

Modified sites are dominated by vegetation that has been modified by human manipulation. These sites essentially lack naturally occurring native perennial plants, as the result of human manipulation, such as plowing and seeding (i.e., tame pasture mixes, crops, etc.), hydrologic alteration, irrigation, etc. This designation does not include sites that still have enough native perennial plant components present to key them to a natural habitat type or community type (e.g., a site heavily altered by livestock grazing). Examples of a ***modified upland vegetation site*** include: tame pastures of seeded introduced or cultivar grass species or varieties, Conservation Reserve Program (CRP) lands seeded to species like *Agropyron cristatum* (crested wheatgrass), and improved forest stands (e.g., monoculture stands of trees planted by humans).

Inventory and Ecological Health Assessment Protocols

Details of the inventory and ecological health assessment protocols, as well as the ecological reasoning underlying the process, may be viewed in Appendices A and F accompanying this document.

Selection of Sites for Inventory and Ecological Health Assessment

Selection of lotic and lentic wetland sites on which to conduct the inventory and ecological health assessment was made by MTFWP personnel. Streams and lentic sites were identified on a map of Spotted Dog WMA, and these features were inventoried in their entirety on MTFWP land. Inside the outer boundary of Spotted Dog WMA there is a complex “checkerboard” pattern of ownership, with sections of MTDNRC land and a few parcels of private land being interspersed with MTFWP lands throughout. Lotic and lentic wetlands on, or crossing, lands of non MTFWP ownership (e.g., MTDNRC or private parcels) were not inventoried. Although we did not sample wetlands on MTDNRC lands, we did estimate the extent of lotic and lentic wetlands on these lands within the WMA boundary, and we extrapolated the general findings onto those MTDNRC wetland sites.

The upland inventory and ecological health assessment was conducted as a representative sampling. This sampling was proportionally distributed among the various vegetation types (i.e., forest/woodland, shrubland, grassland, and modified sites), with the goal of achieving a sampling rate of between 5 to 10 percent within each vegetation type. As with the lotic and lentic wetlands, we were instructed to avoid sampling on MTDNRC land, if possible, but rather to estimate the proportion of each vegetation type contained therein. We extrapolated the inventory and ecological health assessment findings from MTFWP lands onto those MTDNRC sections. Therefore, with one exception, all upland sample polygons are located on MTFWP lands. In order to achieve the desired sampling rate, when extrapolating the results from MTFWP land onto the MTDNRC lands, the sampling rate on MTFWP land had to exceed the design rate by the proportion of MTDNRC land to MTFWP land.

Polygon Selection and Location

Lotic Wetland Sites—Lotic wetland inventory data is collected on a polygon basis. A polygon is the area upon which a record of site data is collected. It is bounded at the ends by upstream and downstream end points, and laterally by the outer extent of the riparian characteristics on both sides. The lateral extent of the polygon may be quite variable along a stream. This variable width area is not mapped in detail, but rather is indicated in the data record as an average width within a minimum/maximum range. A reach of stream for inventory may be broken into polygons of various length along management breaks (e.g., ownership boundaries, fences, roads, and geomorphic features) to provide land units for inventory and analysis. The ends of each polygon are monumented with coordinates by using a Wide Area Augmentation System (WAAS) compatible, Garmin eTrex 30 Global Positioning System (GPS) unit, with a position accuracy of ± 9 ft (± 3 m), utilizing the World Geodetic System 84 (WGS 84) reference system.

Lentic Wetland Sites—Lentic wetland inventory data is also collected on a polygon basis. Many lentic polygons are small, and include the entire wetland site. Such wetlands as springs, seeps, and ponds are typically entirely included in a single polygon. Larger lentic wetlands, such as lake shores or large marsh complexes, may be broken into polygons that include portions of the wetland. Often the polygon break will occur at an ownership boundary. A lentic polygon along the shore of a body of open water extends out into the water as far as emergent vegetation, but does not extend into the deep, open water area (aquatic habitat). The polygon extends landward to the wetland/upland interface, which is usually indicated by a change in vegetation or a topographic feature. The polygon is monumented with coordinates at four corners by using a Wide Area Augmentation System (WAAS) compatible, Garmin eTrex 30 Global Positioning System (GPS) unit, with a position accuracy of ± 9 ft (± 3 m), utilizing the World Geodetic System 84 (WGS 84) reference system.

Upland Sites—The upland inventory is usually conducted on a representative sample basis, stratified by vegetation type (i.e., forest/woodland, shrubland, grassland, and modified sites). The goal on this project was to sample each vegetation type at a rate of 5 to 10 percent. Initial estimates of the area of each vegetation type, made using aerial imagery, were used to determine the number of sample sites necessary to achieve the required sample rate within each vegetation type. Once in the field, the upland area was walked to understand the distribution of various terrain and vegetation types. Sample polygons were placed to capture this variation and to assure that the various important types were represented at a minimum 5-10 percent sample rate. The corners of each polygon were monumented with coordinates using a Wide Area Augmentation System (WAAS) compatible, Garmin eTrex Vista HCx Global Positioning System (GPS) unit, with a position accuracy of ± 9 ft (± 3 m), utilizing the World Geodetic System 84 (WGS 84) reference system. Figure 5 shows the location of the upland polygons.

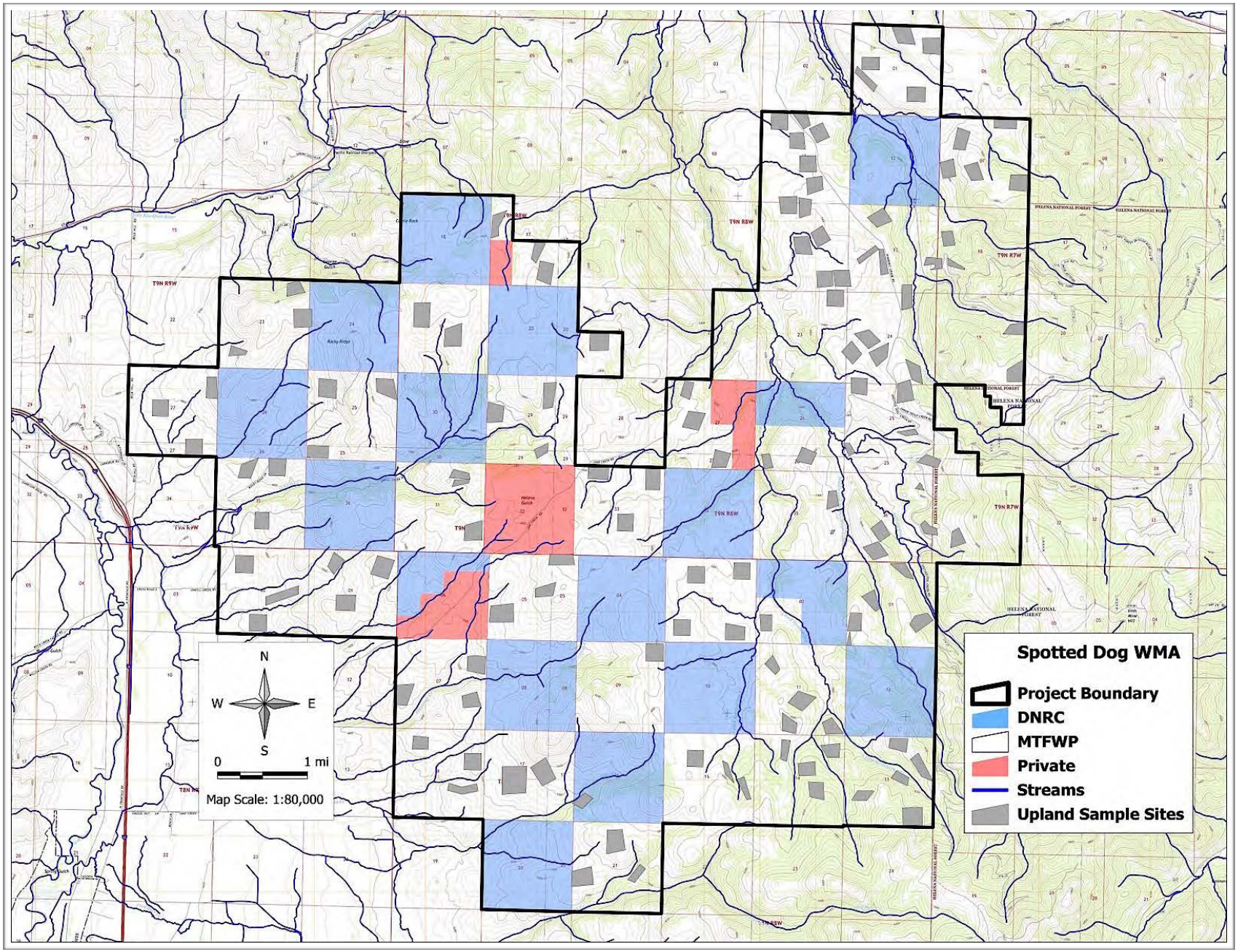

Figure 5. Topographic map of Spotted Dog WMA showing location of the 128 upland sampling sites

Ecological Health Assessment Scoring Criteria

The site health rating is derived from data collected during the ecological site inventory. A suite of factors from the inventory data are used to calculate an ecological health rating. The algorithm is separated into a vegetation rating and a soil/hydrology rating, before being combined into the overall final rating for the site. Individual factor scores can reveal particular strengths and/or weaknesses on a site, and suggest remedial efforts that might be applied to improve or maintain health on the site. From this algorithm, a health score can be derived from 0 to 100 percent. A score greater than 80 percent indicates that the site is functioning properly and healthy. A score greater than 60 percent but less than 80 percent indicates that the site is functioning at risk, or healthy but with problems. If a site scores below 60 percent, the area is not functioning and unhealthy. The scoring criteria for lotic, lentic, and upland sites is detailed further in Appendices A and F.