Northern Bobwhite Quail Management Plan for Pennsylvania 2021-2030

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EXECUTIVE SUMMARY

The northern bobwhite quail (*Colinus virginianus)* has been a long-standing resident of Pennsylvania until only recently. A native of North America, and the Keystone state, this game bird has been beloved by all including landowners, hunters, and birdwatchers alike. The familiar "bob…bob-white!" whistle associated with these quail was a sure sign of spring and could be heard in the early mornings across the farms and fields of the commonwealth. Coveys of quail were often seen scooting single file across dirt lanes and country roads or would sometimes give fright to the hapless wonderer as a dozen little missiles rocketed skyward. Unfortunately, bobwhites in Pennsylvania have disappeared due largely to habitat loss and changing agricultural practices.

Following the *Northern Bobwhite Quail Management Plan for Pennsylvania 2011-2020*, surveys were conducted in 2013 & 2014 finding that wild quail had been extirpated from the state. Examining both harvest trends and Breeding Bird Survey data, more than likely extirpation occurred towards the end of the 20th century or possibly the first several years of the 21st. Many of the goals associated with the previous management plan were completed including surveying for existing distribution and population status (Goal 1), developing a suitable habitat statewide spatial model (Goal 2), establish a Bobwhite Quail Focus Area (BQFA) within the Commonwealth (Goal 3), begin baseline monitoring and plans for translocation of wild bobwhite quail into the BQFA (Goal 4), and develop a strong information and education effort surrounding the bobwhite quail recovery effort (Goal 5). Goal 6, which is focused on expansion of quail restoration outside of BQFA's is ongoing and will be carried over to this current draft of the management plan.

The mission of the Northern Bobwhite Quail Management Plan for Pennsylvania is "*to establish suitable habitat and restore wild breeding populations of Northern Bobwhite Quail in Pennsylvania.*"

Although the mission has largely stayed the same, focus for this plan has been narrowed thanks to findings from the previous plan. Much of that focus is on the Letterkenny Army Depot Bobwhite Quail Focus Area that was established in 2017, and this document includes a considerable amount of language from what was previously the *Letterkenny Army Depot Bobwhite Quail Focus Area Management Plan*. This plan will not include many of the previous sections such as *Taxonomy & Range, Biology and Habitat Requirements, Population Trends, and Hunting.* These sections have not changed noticeably since written and for those wishing to learn more about these specific details please reference the *Northern Bobwhite Quail Management Plan for Pennsylvania 2011-2020.*

To see this mission fulfilled, the current plan is broken into 6 goals with associated objectives and strategies.

Goal 1 – Habitat Establishment: Establish and maintain suitable habitat in and surrounding the BQFA in Franklin County.

Objective 1.1 Establish a minimum of 1,500 acres of year-round, suitable quail habitat within the Letterkenny Army Depot (LEAD) BQFA by spring of 2023 and maintain habitat through 2030.

Strategy 1.1.1 – Complete 1,470 acres of ground clearing operations within focal area by 2024.

Strategy 1.1.2 – Ensure 1,500 acres of suitable quail habitat exist by 2023.

Strategy 1.1.3 – Annually complete between 1,129-1,219 acres of habitat management using a combination of prescribed fire, mulching, disking, and herbicide practices within focal area.

Strategy 1.1.4 – Restore 201 acres of expiring agriculture leases to native herbaceous vegetation by 2028.

Strategy 1.1.5 – Identify, establish, and maintain properly spaced shrub units making up 15% of total habitat within the focal area by 2030.

Objective 1.2 Establish suitable habitat in public and private land holdings surrounding the LEAD BQFA.

Strategy 1.2.1 – Conduct landowner focus group and in-depth interviews concerning private lands habitat establishment in Franklin County and surrounding counties by 2022.

Strategy 1.2.2 – Establish a private lands focal area surrounding the LEAD BQFA to target landowner habitat establishment participation by 2022.

Strategy 1.2.3 – Partner with PF farm bill biologists & NRCS to assist landowners with habitat establishment and maintenance through existing conservation program opportunities beginning in 2021.

Strategy 1.2.4 – Establish and maintain suitable quail habitat within State Game Lands 235 beginning in 2023.

Strategy 1.2.5 – Evaluate Letterkenny owned property surrounding the focal area to determine availability and interest in improving quail habitat by 2025.

Goal 2 – Translocation: Translocate wild bobwhite quail from cooperating source states into the BQFA in Franklin County.

Objective 2.1 Establish source locations, partner agencies and logistics for translocation efforts.

Strategy 2.1.1 Complete final round of official requests with potential source states by September 2021.

Strategy 2.1.2 Develop resource requirements and responsibility assessments with cooperating source states by September 2021.

Strategy 2.1.3 Establish official translocation agreements with source states by August 2022.

Objective 2.2 Complete final translocation planning.

Strategy 2.2.1 Identify trapping resources and personnel for individual cooperating source states by September 2021.

Strategy 2.2.2 Develop detailed plans for each trapping location and communicate with trapping personnel by October 2022.

Strategy 2.2.3 Develop detailed transportation plan for shipping and receiving by October 2022.

Objective 2.3 Conduct translocation following plan and guidelines starting in February 2023.

Strategy 2.3.1 Coordinate pre-baiting and trapping efforts across all locations with cooperating agencies.

Strategy 2.3.2 Coordinate transportation including shipment and receiving of translocated birds.

Strategy 2.3.3 Coordinate release of translocated birds following plan methods.

Objective 2.4 Conduct short-term additional practices to enhance successful establishment of quail populations.

Strategy 2.4.1 Conduct nest predator removal operations within the focal area during spring and summer prior to translocations and as necessary post-translocation.

Strategy 2.4.2 Conduct supplemental feeding as necessary and during periods of persistent snow and ice during translocation years and post-translocation.

Goal 3 – Research & Monitoring: Complete research and monitoring of wildlife populations and habitat.

Objective 3.1 Conduct wildlife population and habitat monitoring within the LEAD BQFA

Strategy 3.1.1 Conduct habitat monitoring beginning in 2022 following National Bobwhite Conservation Initiative's (NBCI) Coordinated Implementation Program (CIP) protocol

Strategy 3.1.2 Conduct spring bird surveys annually following NBCI CIP protocol.

Strategy 3.1.3 Following initial release, conduct fall covey count surveys annually using the NBCI CIP protocol.

Strategy 3.1.4 Conduct LEAD Breeding Bird Survey route survey annually.

Strategy 3.1.5 Conduct American woodcock singing-ground surveys (BQFA and control) annually.

Strategy 3.1.6 Conduct pollinator surveys annually

Strategy 3.1.7 Conduct lagomorph surveys annually

Objective 3.2 Conduct research on quail population dynamics and habitat use

Strategy 3.2.1 Estimate survival, mortality and sources of mortality of translocated quail and Pennsylvania hatched quail.

Strategy 3.2.2 Monitor dispersal of translocated and PA hatched quail.

Strategy 3.2.3 Identify limiting habitat factors for translocated quail and Pennsylvania hatched quail.

Strategy 3.2.4 Monitor nesting success and nesting habitat of wild quail.

Goal 4 – Information & Education: Assess and improve the public's knowledge, awareness and understanding of bobwhite quail restoration and management in Pennsylvania and promote current quail conservation efforts.

Objective 4.1 Annually inform and educate partners and the public on quail restoration efforts within Pennsylvania.

Strategy 4.1.1 Conduct annual partner meeting focusing on habitat management and translocation efforts.

Strategy 4.1.2 Annually report research and management findings and conclusions to the public through all forms of media, including annual reports posted to the PGC website, social media posts, and articles in lay publications, and via meetings with stakeholders.

Objective 4.2 Promote restoration efforts through popular public information formats.

Strategy 4.2.1 With help from the Bureau of Information and Education and Bureau of Marketing, create a schedule for social media promotion of the project by May 2021.

Strategy 4.2.2 Create promotional video focusing on entirety of project including habitat establishment, translocation, research/monitoring, and maintenance.

Strategy 4.2.3 Develop multiple articles for popular formats such as *Game News*, other magazines, newspapers, blogs, and online platforms.

Goal 5 – Cooperative Partnerships: Establish, maintain and enhance partnerships to support quail restoration efforts within Pennsylvania.

Objective 5.1 Establish new partnerships to assist with quail restoration efforts.

Strategy 5.1.1 Pursue additional partnerships by actively engaging non-government organizations (NGO), NGO chapters, federal/state agencies, and private organizations and individuals.

Objective 5.2 Maintain and enhance existing partnerships to continue supporting quail restoration efforts in Pennsylvania.

Strategy 5.2.1 Renew 10-year Memorandum of Understanding (MOU) with LEAD concerning quail restoration project by 2026.

Strategy 5.2.2 Renew 10-year MOU with Quail Forever concerning quail restoration project by 2026.

Strategy 5.2.3 Continue open communications and coordination of monitoring efforts with various educational institutions including Harrisburg University & Shippensburg University.

Goal 6 – Expansion: Based on success of initial translocation efforts, identify additional locations within Pennsylvania where there is potential expansion of quail populations into the future.

Objective 6.1 Identify possible locations for successful quail habitat restoration and translocation projects.

Strategy 6.1.1 Based on results from the bobwhite population dynamics research, establish thresholds for when and how many bobwhites can be transferred from LEAD BQFA.

Strategy 6.1.2 Develop a list of standards an area must meet to qualify as a potential reintroduction site and rank all potential sites.

Strategy 6.1.3 Assess support of bobwhite reintroduction and management with public and private landowners in potential reintroduction sites through surveys.

Strategy 6.1.4 Begin improving habitat on highest ranked potential reintroduction site(s).

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PROJECT PURPOSE

This plan has been created in conjunction with Letterkenny Army Depot (LEAD), the Pennsylvania Game Commission (PGC), and Quail Forever (QF) in order to restore wild northern bobwhite quail to Pennsylvania at the Letterkenny Army Depot, northcentral Franklin County, Pennsylvania. A 3,757-acre Bobwhite Quail Focus Area (BQFA) has been established within the boundaries of the depot (Fig. 1). This plan will serve as a guiding tool for current and future managers of this project. It provides a summary of the project, translocation plans, habitat and management objectives, and a proposed timeline for completion spanning 10 years of the project.

PROJECT GOAL

To establish a self-sustaining wild northern bobwhite quail population at Letterkenny Army Depot.

PROJECT OBJECTIVES

- Establish at least 1,500 acres of year-round suitable quail habitat within the focus area as expeditiously as resources will allow to accommodate translocation.
- Maintain established suitable habitat through the length of this plan (2030).
- Translocate wild quail from partner state(s) for release into the focus area once sufficient suitable habitat has been established.
- Measure project progress and success through monitoring vegetation, quail population dynamics, and other similar habitat specialist surveys (American woodcock, grassland passerines, etc.).
- Answer research questions that benefit the greater good of the species and contribute to the overall understanding of bobwhite quail ecology and management.

PROJECT FOUNDATION

1. Memorandums of Understanding
   A Memorandum of Understanding (MOU) was developed between LEAD and the PGC and between PGC and QF to work cooperatively to restore bobwhite in Pennsylvania. These MOU's outlined the general responsibilities of each party in implementing quail restoration work within Pennsylvania. There are several points within the LEAD/PGC MOU that should be highlighted within this document:
   - Prohibition of wildlife species release excepting wild bobwhite quail within the focus area
   - Prohibition of dog training within the focus area
   - Prohibition of quail and pheasant hunting within the focus area

   These will be critical in order to prevent accidental take and avoid unnecessary harassment through hunting and dog training which could affect survival.

2. Project Management Plan (this document)
   This plan includes initial planning, habitat management monitoring, translocation planning, population monitoring, a proposed timeline of tasks, reporting recommendations, and current available resources. This plan will provide specific habitat management objectives and strategies for the next 10 years. The plan was developed in close coordination with LEAD personnel and reviewed by both internal and external partners.

3. Habitat Assessment
   By developing a detailed habitat management practices geodatabase and conducting habitat surveys at random points throughout the focus area, managers will be able to assess and monitor habitat suitability throughout the life of the project. This will inform decisions regarding translocation and assist in determining the feasibility of its timing.

HABITAT MANAGEMENT

Property History

The18,486-acre Letterkenny Army Depot is found within in The Great Valley, the southeastern most portion of the ridge and valley region of Pennsylvania. Originally 20,508 acres were acquired in 1942 for the construction of the Letterkenny Ordinance Depot (now Letterkenny Army Depot). The land was re-shaped to drain water away from the newly created storage facilities, and smooth brome grass was planted throughout the depot. Over time some land was transferred to various state agencies for public use. A portion of that land was turned over to the Pennsylvania Game Commission and now makes up part of State Game Lands 235.

Land Use

Land use within the depot has changed over time, but the primary usage is semi-subterranean weapons storage facilities. A small portion is an industrial/developed area with large above-ground parking areas for vehicle storage. Most of the property is a mixture of forested areas with agricultural field openings and some brushy areas. Many of the agricultural fields are currently under lease agreements with local farmers. Most of the leased cropland is comprised of perennial hay operations. Some of the fields are managed by LEAD Natural Resources staff for wildlife food and cover There are currently two zones making up the LEAD facility. Zone 1, is the inner most area which is surrounded by fence and is highly secure with heavily controlled access. Zone 2 surrounds Zone 1 and is open to recreation such as hunting and fishing on a limited basis.

Focus Area

Approximately 3,756 acres of Zone 1 has been selected and designated as the Letterkenny Army Depot Bobwhite Quail Focus Area. The location and size of the focus area was selected based primarily on a combination of habitat type and lands available to management. The focus area is situated on the western portion of the facility, at the base of the North Mountain. The focus area

encompasses a variety of habitat types including reverting fields, forestlands, ponds and watercourses, as well as some buildings. The focus area is largely bounded by existing roads, but in some cases the boundary is not clearly distinguished without the aid of a map. It is located furthest from the developed area and is least utilized by current operations personnel.

The current boundary was revised in 2019 (Fig. 1). This occurred because of access restrictions within the demolition area or H-area and increased the acreage by 77 acres. New survey points were established within the additional portion of the new focus area and two were dropped from the area that was abandoned

Habitat Conditions

In July, August, and November of 2017 habitat surveys following the National Bobwhite Conservation Initiatives Coordinated Implementation Program estimated 1.56 acres of suitable cover within the survey points (Fig. 3) and which represents 25.6 acres total throughout the BQFA. Since the inception of the project, a substantial amount of restoration work has been completed and future surveys will be used to measure progress.

Habitat Management Practices/Techniques

1. Prescribed Fire
   Prescribed fire will be used as a habitat management tool with multiple objectives. The two primary objectives will be to control invasive vegetation and to thin and maintain native grass stands and perennial and annual forb stands. Opening stands at ground level is critical for quail movement. Another benefit will be to reduce coarse woody debris remaining from overstory removal operations. Slowing succession is a vital role for prescribed burning. Prescribed burning will be conducted by PGC personnel with close cooperation and participation by LEAD staff. As LEAD staff achieve necessary training and certification, they will begin to work towards independent operations. Decision making concerning prescribed fire is dependent upon the unit disturbance rotation and fuel availability.

2. Disking
   The use of disking to manage and enhance habitat for bobwhites has been used successfully throughout the species range. Disking will be used to thin stands of native grasses, promote forb growth within fields and to create and establish fire breaks. Disking will be conducted by Habitat Forever staff, LEAD staff and their designated volunteers.

3. Chemical Application
   Herbicide use within the focus area will assist in the creation and maintenance of quail habitat by controlling undesirable plants while establishing native forbs and grasses. Chemical application will be conducted by Habitat Forever staff, approved contractors, LEAD staff and their designated volunteers.

4. Mechanical Tree and Shrub Removal

A variety of equipment types will be used to remove overstory, maintain shrub cover, and control non-native vegetation. Heavy machinery, and hand tools will be used by contractors, Habitat Forever staff, LEAD staff and their designated volunteers. Commercial timber harvest would also fall under this category.

5. Plantings & Regeneration
   Both planting and allowing natural regeneration will be used within the focus area for suitable quail habitat establishment. These strategies will focus primarily on annual/perennial forbs, native warm-season grasses, and shrubs. Plantings will primarily be led by LEAD staff and designated volunteers, Habitat Forever staff, but may receive external partner funding or additional volunteer resources.

The overall habitat management goal is to establish, manage, and maintain a mixed mosaic of early successional habitats that incorporate the three primary habitat needs of bobwhite quail:

1. Nesting Cover – Bobwhite can nest in a variety of habitat types. Typically, this nesting habitat consists of clump or bunch grasses where bobwhites can burrow underneath and use the grass for overhead protection. Native warm season grasses generally are considered ideal for this nesting cover at low densities. One 12-inch grass clump per four square feet and a height of 6-18 inches is considered the ideal density. Warm-season grasses interspersed with some forb stands provide most of the resources needed for a nesting female and her newly hatched brood. Nesting cover is should be dispersed across and area instead of in linear stands.

2. Brood Habitat – Quail chicks need 25-75% bare ground under a canopy of forbs and grasses. This brood habitat allows chicks to move and forage while utilizing the overhead concealment from inclement weather and predators. Brood habitat in Pennsylvania has historically consisted of old -field growth. Fallow fields support a diversity of native forbs that provide food throughout the year for quail. Many legume type forbs attract insects in the summer when young chicks need large amounts of protein.

3. Protective Habitat – Shrubs provide escape cover from predators, cool areas for loafing and rest during the summer, and protection from snow and ice throughout the northern winters. Optimal protective habitat for bobwhite, occurs when woody shrubs patches are scattered within field complexes, along stream corridors, ditches, fence rows and field borders. Protective habitat must be thin enough to allow quail to fly in and through, but dense enough to keep out most avian predators such as coopers hawks or goshawks and discourage terrestrial predators such as fox, raccoons, and skunks. A dense upper level with high stem density at ground level is best when considering shrub cover. Where brushy cover is primarily saplings, management is required to maintain the optimal conditions.

The placement and relative location of these different habitat components in relation to one another and their interspersion is extremely important. Ensuring these elements are found adjacent to each other and dispersed throughout the focus area will provide secure cover increasing survival and reproductive success. The NBCI CIP manual focuses specifically on habitat structure and will be referenced continuously throughout the establishment and maintenance of habitat within the focus area.

Desired future cover within the focus area can be seen in Figure 4. Most of the future habitat cover will consist of a native herbaceous mix of warm season grass and forbs. Shrub cover represented on the map is only taking into account the water corridors along with open revetments which will also be utilized as shrub patches. Small shrub patches will be integrated throughout each unit following overstory removal as managers identify natural shrub succession or lack thereof.

Forestlands:

Two primary forested habitats are desired within the focus area. The first is an Oak Savannah type system where canopy cover is reduced to promote growth of forbs and grasses within the understory. This system will provide both a hard mast food source as well as nesting and brood habitat within the understory. The second is found along stream corridors and riparian areas, providing shade needed to maintain important water temperatures to support a variety of aquatic life.

Strategy 1: Conduct silvicultural treatments that include clearing to open canopy and allow sunlight to the forest floor to create nesting and brood rearing habitat. Implementation of treatments will depend on stand analyses through periodic habitat surveys.

Implementation Action 1: Use commercial or, if applicable, non-commercial felling to cut oak stands to reduce and maintain a basal area of 20-40 sq. feet/acre and less than 30% canopy cover. This treatment should be implemented once in each compartment during this 10-year planning cycle. Following treatment, stands will be re-evaluated for future management. If necessary, these areas may be planted to promote desired understory conditions.

Units (Fig. 5 & 7):

Years 2020-2025: Compartment G1: Designated portions of G10, G11, G13; Compartment C: Designated portion of B20; Compartment B1: Designated portions of B2, B9, B23, B14, B15, B16, B19; Compartment B2: Designated portions of B20; Compartment F1: Designated portions of F4, F5, F8, F15.

Years 2026-2030: Continue treatments from years 2020-2025 if needed.

Implementation Action 2: Use prescribed fire to control woody growth and to promote native warm season grass and annual forb growth within forest

understory. Prescribed fire will be conducted during dormant season when fuel load is heaviest or during growing season depending on weather, available fuels, and vegetation growth.

Units (units will be placed in rotation as establishment occurs and fuel becomes available):

Years 2020, 2023, 2026, 2029: Compartment K: K5a, K6a, K7, K8, K9; Compartment G: G10, G 11, G17, G17; Compartment F: F4, F5

Years 2021, 2024, 2027, 2030: Compartment F: F4, F5, F8, F15; Compartment B: B20 (small unit adjacent to F15)

Years 2022,2025, 2028: Compartment B: B2, B9, B13, B14, B15, B19, B20 (excepting small unit adjacent to F15)

Shrublands: The overall goal for this habitat type is to increase and enhance shrubland acreage along forested stand edges, surrounding agricultural fields, and most importantly throughout both native warm-season grass and forb stands. Shrub habitat within the focus area provides escape cover, thermal cover, and loafing areas for quail throughout the year. Existing shrub habitat beneath the current canopy will be utilized when considering the below strategies. Primary shrub species to promote within the project area are *rubus* sp., dogwood sp., fire cherry, choke cherry, wild plum and black locust. Shrub patches should have a minimum radius of 10' with larger being preferred. Shrub rows should have a 40' width.

Strategy 1: Use commercial or non-commercial tree felling and mulching techniques to enhance, increase, or delineate existing shrub cover for bobwhite quail and other associated species adjacent to and within brood rearing and nesting cover. Maintenance of shrub habitat is crucial to continued efficacy. Shrublands should be maintained through mechanical treatment as well as prescribed fire throughout the life of the project. The use of herbicide to control invasive shrub species and promote native young trees and shrubs should also be considered as an effective tool.

Implementation Action 1: Use commercial or non-commercial felling, clearing, or mulching techniques along ditches, steep topography or other areas largely inaccessible to most machinery in order to remove 80-100% of forested overstory canopy to allow for an early successional shrub layer. Stream corridors should maintain a 30' buffer and vernal pools should maintain a 100' buffer where overstory removal does not occur. Follow with herbicide treatments if necessary (Note: ensure herbicide is applied in accordance with label near any surface water).

Units: All units containing aforementioned characteristics.

Implementation Action 2: Use commercial or non-commercial felling, dozing, or mulching techniques within designated shrub patches or 'thickets' to reduce

forested overstory canopy by 80-100%. Follow with herbicide treatments if necessary.

Units: All Units excepting Compartment G: G7, G12, G13, G14, G17; Compartment F: F6, F13; Compartment B: B10, B11, B12, B16, B18

Implementation Action 3: Throughout overstory removal operations, identify and avoid destruction of existing shrub patches meeting minimum requirements (having a 10' radius).

Units: All Units

Implementation Action 4: Following overstory removal operations, establish, protect, and maintain shrub patches strategically throughout each unit to ensure adequate protective cover. Shrub patches should be located within 80' of another patch.

Units: All Units

Herbaceous Openings: The overall goal for this habitat type is to create and maintain herbaceous openings to provide a mosaic of both nesting and brood rearing habitat. The two primary herbaceous cover types are native warm season grasses and annual/perennial forbs. These should be managed in combination, not as separate stands. Three additional herbaceous opening types found within the focus area are food plots, which will be managed to provide annual winter forage, agricultural leases, many of which will be converted to a desirable grass and forb mix as they expire, and 'igloos' or munitions storage containers. The priority grass species for this project are little blue stem, and specifically the native seed found onsite. If this is not available, the Fort Indiantown Gap Ecotype should be selected. Priority forb species are ragweed, partridge pea, showy tick-trefoil, a variety of pollinator species, and some clovers.

Strategy 1: Warm Season Grass/Annual & Perennial Forbs . Establish, maintain and enhance a mixture of warm-season grass and Forbs (G&F) for habitat structure and vigor as well as control invasive species through disking, prescribed fire, mowing, herbicide treatment and/or reestablishment plantings.

Implementation Action 1: Establish G&F stands through commercial or non-commercial felling, dozing, or mulching techniques to remove 100% of the canopy and woody cover. Slash or coarse woody debris associated with the removal of woody cover can be used in creating loose brush piles or linear rows (wind rows) to provide temporary shrub habitat and protective cover for quail. Other options would be piling for burning.

Units:

Year 2020: Compartment K: K0, K1, K2, K4, K5b, K6b, K12, K13, K14; Compartment F: F0, F1, F2, F3, F4, F5; Compartment G: G0, G1, G2, G3;

Year 2021: Compartment F: F5, F9, F10, F13, F14, F15; Compartment B: B20

Year 2022: Compartment B: B0, B1, B2, B3, B13, B14, B15, B16, B18, B19

Year 2023: Compartment B: B9, B10, B11, B12, B17; Compartment C: C0, C3, C4, C5, C6, C7

Year 2024: Compartment D: D11, D12, D13, D14, D15; Compartment G: G10, G11, G15, G16, G17

Implementation Action 2: Establish G&F stands through the removal of cool season grass/fescue by way of prescribed fire, heavy disking, or herbicide treatment. These units should then be followed with successive treatments to prevent cool season/fescue from returning and eventual plantings in the absence of native seed establishment. Planting rates should follow current best management practices and/or research findings.

Units:

Year 2020-2023: Compartment K: K0, K1, K2, K3, K7, K12, K15; Compartment G: G3, G4, G5, G6, G8, G12, G17; Compartment F: F12; Compartment D: D15; Other units as identified throughout the life of the project.

Implementation Action 3: Maintain G&F stands through disking, prescribed fire, mowing, or selective herbicide treatments to reduce woody invasion, thatch layer, and high density of plants within the stand as well as increase bare ground at ground level (50-70% bare ground needed). Optimal density of warm season grass within stands should be one 12-inch clump per 4 square feet. Prescribed fire and disking should be used within a 3-year rotation on G&F units. If disking is the primary technique, units should be broken into thirds, with a third being disked each year within the 3-year rotation (Fig. 6). Any technique used should occur outside of the nesting season and between the months of mid-October – mid-March post-release of quail. Timing is of less concern pre-release.

Units (units will be placed in rotation as establishment occurs and fuel becomes available):

Years 2020, 2023, 2026, 2029: Compartment K: K0-b, K1-a, K2-b, K4-c, K5-a, K6-c, K7-a, K8-b, K10-c, K11-a, K11-a, K13-b, K14-a, K15-a, K15-e, K16; Compartment F: F0-b, F0-d, F0-g, F1-a, F2-b, F3-c, F4-a, F5-a, F5-c, F6, F9, F12-b, F15-a; Compartment B: B1-b, B2-a, B9-b, B16-b, B17, B19, B20-c; Compartment C: C0-b, C1-b, C3-a, C6; Compartment D: D11-a, D12-b, D14-a; Compartment G: G1-a, G2-c, G3-a, G4-b, G5-a, G7, G8-a, G10-b, G11-a, G14-b, G14-c, G16-b.

Years 2021, 2024, 2027, 2030: Compartment K: K0-a, K1-c, K2-a, K4-a, K5-b, K6-a, K7-c, K8-a, K8-c, K9-b, K10-a, K12-b, K13-a, K15-c; Compartment F: F0-c, F0-f, F1-b, F3-a, F4-b, F7, F11-a, F13-a, F14-a, F15-b; Compartment B: B0-b, B1-a, B3-b, B10, B12, B13, B15, B18, B20-a, B20-d; Compartment C: C0-c, C4, C7; Compartment D: D11-b, D13-a, D14-b, D15; Compartment G: G1-b, G2-a, G3-b, G4-c, G5-b, G6-a, G6-c, G8-b, G9-a, G11-b, G13, G15-a.

Years 2022,2025, 2028: Compartment K: K1-b, K3, K4-b, K5-c, K6-b, K7-b, K9-a, K10-b, K12-a, K14-b, K15-c; Compartment F: F0-a, F0-e, F2-a, F2-c, F3-b, F5-b, F5-d, F8, F10, F13-b, F14-b; Compartment B: B0-a, B2-b, B3-a, B9-a, B11, B14, B16-a, B20-b; Compartment C: C0-a, C1-a, C3-b, C5; Compartment D: D12-a, D13-b; Compartment G: G0-a, G0-b, G2-b, G3-c, G4-a, G6-b, G8-c, G9-b, G10-a, G12, G14-a, G15-a; Compartment H: H1

Strategy 3: Food Plots. Maintain established non-leased agricultural areas as annual winter forage plots.

Implementation Action 1: Seed designated food plots on a rotational basis, with annual grains. Crops should be left standing, pushed over, or mowed >15" above ground level and not removed or tilled until immediately prior to replanting the unit. Suggested crop species are milo, sorghum, wheat, corn, soybeans, Egyptian wheat, German foxtail millet, sunflower, or proso millet. Limited herbicide usage should occur and only if absolutely necessary for the success of the crop. Insecticides should not be used. [Note: Examine past herbicide applications to assist in determining plantings due to potential carryover.]

Units:

All Years: Compartment K: K4, K5b; Compartment F: F4, F8; Compartment G: G9, G10, G11; Compartment C: C0, C1, C3, C8

Strategy 4: Agricultural Leases. Because active agricultural leases cannot be considered year-round quail habitat, any available habitat creation within these areas should be pursued such as field border edges through government set-aside programs.

Implementation Action 1: Evaluate all agricultural leases to determine eligibility to enroll lessees in FSA CP-33 field border practices. Investigate cropping history, natural resources concern, and lessee interest. If fields would qualify, enroll and establish maximum acreage of field borders (30 – 120' with 80' being optimal) within leased fields. Field borders should consist of native warm season grasses and be managed as such under strategy one above. As leases expire, consider building in field border edges to successive lease. [Note: Examine past herbicide applications to assist in determining plantings due to potential carryover.]

Units:

Years 2020-2025: Compartment C: C4, C5; Compartment F: F0

Implementation Action 2: Expiring agricultural leases that are being entirely converted to quail habitat should be first evaluated for past crops and practices. Row crop residue should be reduced through mowing or tillage. Cool season grass should be treated with herbicide, followed by prescribed fire to reduce thatch for planting. Fields can than be planted with an appropriate G&F mix and managed in rotation as instructed in Strategy 1, Action 3 within this section.

Units:

Years 2022-2030: Compartment K: K0, K1, K2, K4, K5b, K7, K10; Compartment F: F2, F3, F11

Strategy 5: Igloo Management. Munitions storage facilities, often referred to as 'Igloos' are built with 2' of concrete and then covered with 2' of soil. Igloo surface must be managed to prevent any and all woody growth from occurring. Currently igloos are largely covered with cool season grasses, with some having a mix of cool and warm season, while others have a mix of cool season and forbs. These areas are best managed as and utilized by quail as brood habitat.

Implementation Action 1: Igloo management should focus on 3-year rotational burning as the primary control of woody intrusion (Fig. 6). If prescribed fire cannot be achieved within the needed rotation, then mowing or herbicide treatments should be used to set back woody succession. Treatments can occur any time pre-release but should be conducted between mid-October and mid-March post-release of quail.

Units (units will be placed in rotation as surrounding establishment occurs and fuel becomes available):

Years 2020, 2023, 2026, 2029: Compartment K: K0-b, K1-a, K2-b, K4-c, K5-a, K6-c, K7-a, K8-b, K10-c, K11-a, K11-a, K13-b, K14-a, K15-a, K15-e, K16; Compartment F: F0-b, F0-d, F0-g, F1-a, F2-b, F3-c, F4-a, F5-a, F5-c, F6, F9, F12-b, F15-a; Compartment B: B1-b, B2-a, B9-b, B16-b, B17, B19, B20-c; Compartment C: C0-b, C1-b, C3-a, C6; Compartment D: D11-a, D12-b, D14-a; Compartment G: G1-a, G2-c, G3-a, G4-b, G5-a, G7, G8-a, G10-b, G11-a, G14-b, G14-c, G16-b.

Years 2021, 2024, 2027, 2030: Compartment K: K0-a, K1-c, K2-a, K4-a, K5-b, K6-a, K7-c, K8-a, K8-c, K9-b, K10-a, K12-b, K13-a, K15-c; Compartment F: F0-c, F0-f, F1-b, F3-a, F4-b, F7, F11-a, F13-a, F14-a, F15-b; Compartment B: B0-b, B1-a, B3-b, B10, B12, B13, B15, B18, B20-a, B20-d; Compartment C: C0-c, C4,

C7; Compartment D: D11-b, D13-a, D14-b, D15; Compartment G: G1-b, G2-a, G3-b, G4-c, G5-b, G6-a, G6-c, G8-b, G9-a, G11-b, G13, G15-a.

Years 2022,2025, 2028: Compartment K: K1-b, K3, K4-b, K5-c, K6-b, K7-b, K9-a, K10-b, K12-a, K14-b, K15-c; Compartment F: F0-a, F0-e, F2-a, F2-c, F3-b, F5-b, F5-d, F8, F10, F13-b, F14-b; Compartment B: B0-a, B2-b, B3-a, B9-a, B11, B14, B16-a, B20-b; Compartment C: C0-a, C1-a, C3-b, C5; Compartment D: D12-a, D13-b; Compartment G: G0-a, G0-b, G2-b, G3-c, G4-a, G6-b, G8-c, G9-b, G10-a, G12, G14-a, G15-a; Compartment H: H1

Private Lands Habitat Focus

Focusing on private lands habitat management should be kept in mind from the outset of the project. Due to annual quail dispersal, managers need to remember that a portion of birds each year will emigrate from the focus area seeking other populations of quail and/or suitable habitat. Currently, Letterkenny is surrounded primarily by farms practicing modern 'clean' agriculture, which is not compatible with suitable quail habitat. Working with these landowners and lease holders will be critical in ensuring an expansion of range for this initial population. To do that, the Commission should continue its partnership with Pheasants/Quail Forever in developing a private lands habitat plan that incorporates the Bobwhite Quail Focus Area. A 39,184-ac. area surrounding the Depot has been selected for initial focus (Fig. 8). Boundaries for this area were selected using major roads or highways as well as the mountain to the West, which not only make it easier for managers to delineate, but also may act as barriers. Other grassland habitat restoration projects have attempted large tracts that were unmanageable, but this acreage should present the ability to work individually with each landowner while at the same time have the potential for a meaningful suitable habitat.

A first step in developing a private lands habitat program should be further understanding local landowner views towards wildlife habitat development. Landowner focus groups or individual interviews can help instruct questions for a broader landowner questionnaire. Once these views, needs, or wants are analyzed and synthesized, managers can develop a focused approach with relevant tools and programs designed to ultimately establish suitable quail habitat surrounding the BQFA. Most currently available habitat establishment programs are administered through the Farm Service Agency or Natural Resources Conservation Service, both within the US Dept. of Agriculture. Fortunately, Pheasants Forever has a Farm Bill Biologist that services Franklin County and is the best vehicle for reaching out to landowners and assisting them through the process of sign-up and maintenance. Partnering with both Farm Bill Biologist and local USDA office staff will be critical to seeing success on private lands within the surrounding area.

Public Lands Habitat Focus

After completing habitat establishment within the BQFA, managers should assess ability to expand within Letterkenny property boundaries. Examining available land within Zone I & II will be important in allowing population expansion throughout the facility and beyond into surrounding private lands.

Besides the focus area itself, additional public lands found adjacent to or within a reasonable distance to Letterkenny should also be the focus of suitable habitat management. State game lands 235, immediately adjacent to Letterkenny, is a prime candidate for concentrating efforts for developing quail habitat. Close partnership with the Commission's southcentral region and bureau of habitat management will be important in developing a long-term plan for the game lands.

A proposal to convert 207 acres of compartment 1 within SGL 235 into grassland and shrubland habitat has been drafted and preliminarily approved within the region. The primary goal is to provide a mixed mosaic of early successional habitats that will meet the needs of both quail and woodcock with a secondary goal of becoming a demonstration area for private landowners in order to highlight the needed practices and their benefits.

TRANSLOCATION

Population Sources - Identify available suitable source populations and develop an agreement with responsible stewards.

A. Suitable source populations – Past translocation efforts have shown success with short distance movements, many within state or county boundaries (Martin et al. 2017, Sission et al. 2017). Unfortunately for Pennsylvania, the populations nearest the release site are of low density and in danger of extirpation (MD, DE, NJ, OH, and WV). Therefore, suitable source populations must come from where birds are available and in surplus. The below considerations are important to recognize and consider:

    a. Body Size – Within the wild bobwhite range, quail body size varies dependent upon latitude and climate following Bergmann's rule (Martin et al. 2017). Although basic biology points to the fact that a larger body would allow for increased survival in a colder environment, there is little research available to assist in understanding the importance of body size for quail when translocating from one environ to another.
    b. Similar Environments – Bobwhite range is quite diverse, from the deserts of Texas, to the pine plantations of Georgia, the salt marsh agriculture of Maryland, to the rolling plains of the mid-west. This certainly speaks to the adaptability of quail in utilizing available food and cover types. The concern of many researchers is transferring quail from one completely different habitat type to another and determining how quickly those birds can adapt. The basic habitat requirements are the same for quail range wide, however, with a need for early successional cover providing both protection and food. It is recommended that quail from a similar source & release environment be selected for translocation efforts.
    c. Distance – The distance that birds are transferred plays an important role in the success of a translocation effort. What may be even more crucial however is holding time between capture and release (initial handling, shipping, and handling for banding or telemetry attachment), a significant amount of stress can accumulate affecting both short and long-term survival (Terhune et al. 2006). A

shorter distance of transfer thus reducing holding time is recommended for translocation of quail. Distance may not be an issue if holding time is kept below 30 hours with less than 24 ideal.

d. Source Density – While little published literature exists on what a minimum density should be for a source population to experience no negative effects from translocation, there is expert opinion. Some experts have recommended that density be greater than one bird per acre and that not more than 10% of the estimated fall density be removed in any given year (translocation + harvest; Martin et al. 2017). Others recommend that source sites should determine what density is appropriate when considering locations of removal. There may be locations where bobwhites have relatively little to no value and thus lower densities could be utilized.
e. Multiple Sources – The idea of translocating quail from multiple source populations which may differ greatly in both location and phenotypic traits into a single focal area has both concerned and intrigued researchers. Because Pennsylvania has no native quail remaining, if a single source population was established, inbreeding depression would be of greatest concern. By releasing multiple source populations into the same focal area, genetic diversity should increase, but there is potential for outbreeding depression to occur. Most researchers would recommend stocking multiple source populations to increase genetic diversity and better understand how this would affect future population dynamics.
f. Due to the high number of birds needed for an effort focusing on an extirpated population (800-1000 birds), it is unlikely all birds could be translocated from one specific source. This will allow us to test the adaptability of various source populations and may answer the questions of differences in body size, environment, and distance from capture to release.

B. Source Population Agreements – With long-term historical bobwhite population declines range-wide (Martin et al. 2017), this resource has become increasingly scarce and managers understandably more protective. Many stewards responsible for this resource have placed restrictions or requirements on translocation of birds under their watch. Most past efforts saw no requirements of receiving entities besides what was involved with a trade or purchase. Most efforts also experienced failure (Martin et al. 2017), due to lack of habitat suitability prior to transfer and/or some other variable.

a. Source Requirements - Many source entities have different requirements, but often ask for a comprehensive management plan specific to the release site, annual or mid-project update reports detailing monitoring and research efforts, and a project final report covering what was learned. This information helps the source location manager make sound decisions on the partnership and contributes to the body of research available to all bobwhite stewards in making management decisions or directing future translocation efforts.
b. Agreements – Past wildlife translocation efforts have generally fallen into one of three categories:

- Trade – one species of wildlife is traded for another with an agreement on how many of each species, when each translocation effort will occur, who is responsible for effort and costs, etc.
- Purchase – the receiving entity in agreement with the source determines a fair value for the species in question or makes a 'contribution' to the source entities program of choice.
- Good Faith – the source entity requires no payment or trade of the receiving entity believing that it is for the betterment of the species or to strengthen political relationships between both parties.

c. This restoration effort fully supports transparency and accountability through any reasonable and ecologically sound requirements that source population stewards might have. The importance of an ethical process, monitoring and contributing to the broader knowledge of bobwhite conservation is crucial. Selection of source populations will occur first through communication amongst managers to determine feasibility. Following that, an official request will be sent to the source agencies Director of Wildlife Management (or similar). The source agencies will then negotiate and set terms for translocation.

Capture - Identify trapping locations and prepare for and conduct capture efforts.

A. Trapping Locations – To properly identify trapping locations for capture, the source upland game bird supervisor or quail biologist will be consulted. Communication will be key to ensure that all parties involved are well informed and supportive. Several important aspects will be considered when determining a trap location:
    - Access – the site should be easily accessible to a vehicle for equipment movement, supplies, and transportation of birds.
    - Protection – the site should provide proper protection from predators, weather, and external human disturbance. Covering traps with vegetation or something similar addresses protection and reduces stress.
    - Density – the site should be located where the highest probability of success will occur. By focusing on only the highest densities of quail on a particular property and anticipating where they will most easily be captured, effort is most efficiently expended.
B. Pre-baiting – Prior to any baiting, the site should be cleared and prepped for trapping. This prevents both escape and injury to captured birds. A minimum of two weeks should be given to pre-baiting trapping locations. If bait is being utilized it is often prudent to make use of a trail camera to determine what is using the bait and if it is a sufficient number of birds to begin trapping. Timing of pre-baiting can be very important and should be consistent. If possible, baiting prior to dawn is optimal as to not disturb birds and have bait available throughout the day. Bait usage should be consistent before setting traps. Amount of bait is also important and should be regulated carefully. Bait types vary but most managers use shelled corn, cracked corn, millet, or something similar.
C. Timing – The timing of trapping can play a very important role in the success of the effort.

a. Chronology – It is recommended that trap and transfer efforts occur late winter/early spring and be timed just before covey break-up going into spring. This should reduce mortality of released bobwhite prior to the first breeding season. It is advised to try to capture coveys together and transport/release together also. Translocation should occur 3-4 weeks prior to this break up period allowing birds to acclimate to their new environment.
b. Weather – It can be difficult to attract quail to bait without the proper conditions. Bobwhite food availability is lowest during the late winter/early spring. Snow or ice cover can also prevent quail from reaching needed natural food sources and having extended periods of inclement weather will help focus quail on bait and thus reduce their inhibitions of entering a trap.

D. Equipment – The walk-in funnel trap is the most common trap for catching bobwhite. Coated wire is recommended with a small diameter opening for material used. Funnels and corners should have all sharp edges or points removed. Traps should be as compact as possible to allow for stacking and ease of transportation.
E. Resources – This aspect of translocation is generally what can make or break an effort. There are three primary categories to consider:
    a. Personnel –Using personnel from the source entity may be more efficient than the receiving entity sending their own staff on travel. Partner with local colleges or universities or using volunteers can also be a great source of labor when properly trained and if dedicated to the project. Managers should consider the direct correlation between number of personnel and length of capture effort.
    b. Equipment & Supplies – Most equipment and supplies will be reimbursed by the receiving entity. Although traps may be borrowed, new traps or maintaining pre-existing traps can be costly. Bait is a supply that can be expensive depending on the length of the effort. Telemetry equipment is always a large portion of the budget and must be considered closely to determine total cost.
    c. Transportation – This cost is highly dependent on how birds will be moved from the source to receiving entity as well as how many and how often.
F. Effort – Although somewhat of a general term, the level of effort for a large-scale translocation project can dictate cost, timing, and many other important aspects.
    a. Length – The length of a project is dependent on a plethora of things including objectives, available resources, and climate limitations. Most managers would prefer effort length to be as short as possible and efficient. Number of traps, personnel, and trap check period are all crucial parts of effort length. For this project preference is on a large number of traps (200-300/night), as many personnel as can be afforded (4-5 technicians), and short intervals between checks in order to both expedite translocation process and reduce holding time for captured birds.
G. Capture Goal – According to past research (Guthery et al. 2000, Martin et al. 2017), a minimum starting number of 800 quail is recommended for a self-sustaining population. To account for annual losses (65% mortality in GA), therefore, it is recommended to release additional birds (>200). There is some uncertainty on if it is better to capture and release all birds in a single year or multiple years. It is unlikely that we would be able to capture and transport 1,000 wild bobwhites in a season. Therefore, a more realistic

approach will be to capture between 250-334 birds annually translocated for 3-4 years. A sex ratio of 1:1 is recommended for quail translocation.

Disease Management - Ensure proper measures to reduce risk of disease threats to receiving location.

A. Disease Mitigation – As with any wildlife translocation effort, disease threats are very real and have proved disastrous in past efforts. Translocation efforts in the past have seen requirements of blood testing, quarantine periods, and other methods to avoid these issues. Different source states may have specific requirements and Pennsylvania is dedicated to observing those in their entirety. The Pennsylvania Department of Agriculture requires testing for both Pullorum and Avian Influenza prior to translocation. These tests can be accomplished through a simple blood draw and with overnight shipping, test results should be obtainable within 24-48 hours upon receipt. The Pennsylvania Game Commission veterinarian will also request fecal samples to screen for parasites. Sampling a subset of captured birds will be preferred to reduce holding time after capture. Testing of birds that may die during the trapping process will also provide important samples.

Transport & Release - Transport quail and release captured birds into focal area.

A. Holding – Reducing stress and physical damage from capture and transport is important to ensuring successful reintroductions. Past efforts have used large flight pens built to house quail for several weeks before being released, (Wiley & Stricker 2017). However, recent research has recommended a short turnaround time between capture and release to avoid both acute and chronic stress as well as external damage (Terhune 2010). Quail should be kept within their familiar groups (coveys) if possible, limited handling should occur, and birds should be released into a similar environment as they were taken from. For Pennsylvania, these issues could be very challenging to address and may be very dependent on where source populations exist.
B. Transport – During transport, quail will be placed within a container that limits light and potential for injury. Container will have ample airflow, low headroom, and be lined with soft material such as felt. Optimal temperature during transport is around 15.6ºC (60ºF) to avoid overheating. Time of transport should be as minimal as is possible.
C. Release – Many different methods exist for release of game birds as part of translocation. Two general terms have been used to describe differing methods; ‘Hard’ releases are generally when birds are immediately released from the container during the daylight hours, often taking flight while ‘Soft’ releases refer to a slow release where containers are left open before daylight, and birds can walk out when ready or are held in a large pen to acclimate to habitat before actual release. Although initial Pennsylvania release of a small portion of birds will more than likely be a ‘hard’ release for promotional purposes, majority of releases will follow a ‘soft’ release to prevent birds from leaving the focus area immediately. Holding pens are not recommended due to chronic effects of stress.

Additional Practices – Conduct short-term, additional practices to favor successful translocation and population establishment.

a. Recent research from some quail restoration efforts have found predator control and supplemental feeding to be important components to success. Predator Management – Targeted removal of nest predators such as raccoons, skunks, and opossums has proven to be successful in reducing nest predation and increasing nest success (Jackson et al. 2017). This method can be utilized year-round or on a limited basis directly before and during the quail nesting season. This technique is costly and not generally considered a long-term solution to predation issues but may be worthwhile when considering a small-scale isolated restoration project. The Letterkenny project will plan to conduct targeted nest predator removal during spring and summer of each translocation year and one-year post-translocation.
b. Supplemental Feeding – The use of supplemental feed within a quail focus area has assisted in not only providing a consistent food source even during times of the year when many resources are not available, but also can be targeted to areas where quail won't have to travel or expose themselves to predation (Buckley et al. 2018). Some managers argue that supplemental feeding can both congregate quail causing disease spread and increased predation, although disbursement methods can help mitigate these concerns. Another concern is conditioning quail to rely on supplemental feed and like predator management, some managers don't consider this a long-term solution. The Letterkenny project will plan to conduct supplemental feeding during periods of persistent snow and/or ice for translocation years and one-year post-translocation. Additional supplemental feeding will be done as deemed necessary.

RESEARCH & MONITORING

Most surveys protocols to monitor bobwhite populations and habitat within the BQFA are based upon the National Bobwhite Conservation Initiative's (NBCI) Coordinated Implementation Program (CIP) manual (Morgan et al. 2016). This monitoring program is being used by many states within the bobwhite range so data can be combined for multi-state analysis showing bobwhite response to habitat management. The below monitoring programs are being implemented on the BQFA and other may be added in the future.

1. Spring Call Counts (Reference Points Pre- & Post-Release)
   The spring survey was designed to estimate density or presence of bobwhite and other bird species within the BQFA (NBCI 2016). Surveys within the BQFA have occurred since 2017. Surveys are completed at 15 random point's along roads in the BQFA (Fig. 2). Points are at least 500 m apart. Spring surveys are completed during the 6-week peak calling period for bobwhites which in Pennsylvania should be in early June through mid-July. Two replications are completed with a minimum of 2 weeks between surveys. The five-minute surveys start 30 minutes prior to sunrise and are completed within 3 hours after sunrise. Besides bobwhite quail, 10 other

indicator species have been monitored and recorded including dickcissel (*Spiza americana*), Eastern meadowlark (*Sturnella magna*), grasshopper sparrow (*Ammodramus savannarum*), loggerhead shrike (*Lanius ludovicianus*), song sparrow (*Melospiza melodia*), indigo bunting (*Passerina cyanea*), common yellowthroat (*Geothlypis trichas*), eastern bluebird (*Sialia sialis*), bobolink (*Dolichonyx oryzivorus*), and golden-winged warbler (*Vermivora chrysoptera*). Beginning in FY 2020, an additional 5 species should be monitoring and recorded, to include yellow-breasted chat (*Icteria virens*), willow flycatcher (*Empidonax traillii*), white-eyed vireo (*Vireo griseus*), field sparrow (*Spizella pusilla*), and yellow warbler (*Setophaga petechia*).

2. Fall Covey Call Counts (Reference Points Pre- & Post-Release)
   The fall covey count survey also provides density or presence information for the population headed into the late fall and winter (NBCI 2016). Baseline surveys within the BQFA have occurred from 2016-2019. No bobwhite were detected during the baseline surveys. They will resume the year prior to the initial release. Surveys are completed at 4 random points along roads within the BQFA (Fig. 2). Points are be at least 1,000 m apart. Fall surveys are completed surrounding the 6-8 week calling peak for bobwhites which in Pennsylvania should be mid-September through mid-November. This survey begins 45 minutes prior to sunrise and lasts until sunrise. Two replications are completed during the survey period. The number of individuals per covey is estimated by flushing at least 10 coveys detected during the survey period.

3. Habitat Monitoring (Pre- & Post-Release)
   The habitat monitoring surveys are used to estimate the amount of bobwhite habitat within the BQFA. Surveys occur during growing season (June-September) and within 250 m of each of the 15-spring bird monitoring point (Fig. 2). Due to boundary changes in 2019, two points were dropped and two added to the new boundary. Survey observers used an aerial photo datasheet to divide the area into 'patches'. Patches are units of habitat having similarities that can be separated from other units due to composition and structure of vegetation. Observers then identified protective cover within the area and record data for each patch.
   Following the field portion, data was digitized and entered into a geodatabase for further analysis using the CIP Habitat Classification System (NBCI 2016) determine what is suitable bobwhite habitat. The estimated percent habitat per point is then extrapolated to the entire BQFA, providing an overall estimate of suitable habitat. This information is important for managers to understand how their practices are affecting habitat suitability and is critical for this project in order to know when translocation can occur.
   Habitat monitoring will occur annually if external funding or personnel resources can be obtained. Habitat monitoring is currently planned to occur 2017, 2020, 2022, 2025, and 2030.

   Photo points have been established throughout the focus area to visually represent change in habitat through time and provide relative changes to previous vegetative structure. A minimum of 65 photo points have been established with at least one found within each management unit.

4. Post-Release Survival and Mortality
   Radio telemetry will be conducted post-release to monitor survival, nesting habitat use, nesting habitat relations, nest success, sources of mortality, dispersal and home range. Methods or protocols used for telemetry will follow current best management practices to

ensure optimal bird health and survival success. Final protocols will be developed prior to the initial release. (See *Translocation* section)

5. Breeding Bird Survey Route
   A Breeding Bird Survey route has been established withing the LEAD boundary. This route has been completed prior to the advent of the BQFA and has been continually run since that point. Approximately half of the route survey stops are found within the BQFA. Although BBS routes are not meant to be analyzed on a point by point basis, comparing data between years should provide a good assessment of changes in habitat by changes in overall diversity.

6. American Woodcock Singing Ground Surveys
   Two American Woodcock Singing Ground Survey (SGS) routes have been established within LEAD. The first is found within the boundaries of the BQFA while a second SGS route is established outside of the focus area for comparison (Fig. 2). Woodcock SGS routes will follow current US Fish & Wildlife Service protocol. Because woodcock are a shrubland obligate species, this survey will assist in determining how habitat manipulation has affected use of the area by this species. Surveys are conducted once per route within the recommended survey window for latitude. Surveys should be completed by the same observers for the life of the survey.

INFORMATION & EDUCATION

Annual Project Updates

The importance of providing annual updates to the many partners as well as the public cannot be stated enough. This project has held an annual partners meeting since it's inception in 2017 and this should be continued. This meeting provides a vehicle to deliver not only information pertaining to what was completed within the past year by hearing directly from each partner, but an interactive field tour that allows all involved to see firsthand the changes on the landscape. This meeting also serves as a way for potential partners to attend and determine if they would like to become part of this important effort. Another important aspect of providing annual updates is through the Commission's annual report system. This allows all Pennsylvanians access to what is occurring within the project.

Promotion & Marketing

With so many competing interests currently within the field of wildlife management, keeping this project front and center for both managers, partners, and the public is of utmost importance. Project managers should work closely with available resources such as PGC Bureau of Information & Education, Letterkenny Army Depot marketing personnel, Pheasants Forever, Inc. marketing personnel, other partner resources, as well as popular outlets such as magazines, newspapers, and online platforms. Providing regular social media content as well as articles, blogs, and video will assist in establishing and maintaining continued support. An overall

project video should be released on completion of translocation highlighting the habitat establishment, translocation, research/monitoring as well as partner contributions to the program.

COOPERATIVE PARTNERSHIPS

Establishing & Enhancing Partners

This project has become one of the greatest examples of partners working together to return an extirpated species to Pennsylvania. No one agency, NGO, or individual has the ability to complete this task, but working together to fill each need, many partners are affecting great change for this species. Although this project has developed some strong partners, managers should continue to enlist new partners to assist in filling gaps and sharing resources. Recruiting new partners can be completed through promotion, marketing, and making specific requests for assistance.

The Keystone Quail Restoration Initiative was established in 2018. This initiative was designed as an umbrella to capture all partners and their contributions and provide a shared identity and focus. Just as important as building new partners is maintaining established partners. There are several MOU's that were developed between key partners, and these should be continually renewed. Managers should also continue open communications and present needs to partnering educational institutions to garner assistance as well as providing experience to students. Partners are varied within this project, from federal and state agencies, to NGO's to universities, and contributing individuals. Each one is critical no matter how great or small.

EXPANSION

Project Analysis for In-state Translocation

The results from this initial translocation project will dictate potential for moving forward with in-state translocation considerations. Many of the research objectives will hopefully point towards either confirmation or revision of both habitat and translocation goals used for this current attempt. Based on that information managers can make informed decisions on whether the LEAD BQFA was a success and if so, if and when there might be an adequate surplus of quail for a second translocation attempt within state.

Focal Area Requirements & Selection

If it is determined that the initial reintroduction has been successful and warrants in-state translocation to another location, managers will need to develop strict standards for potential focal area sighting. Much of this can be gleaned from this current project and what was learned as well as the available literature and best management practices provided by NBCI & other state agencies.

Once these standards have been established, managers can begin to assess potential areas statewide. One suggestion would be to revise the current GIS habitat model based on the LEAD BQFA findings. Ensuring a public land core to any future focal areas is of utmost importance to provide long-term habitat stability to the project. Prior to selection, potential sites can be ranked based on meeting the pre-determined standards, available habitat, climate, available resources

including funding, as well as both public and surrounding private landowner support, in addition to many other potential variables.

After a focal area has been chosen, a base-line habitat survey should be completed. Once suitable habitat availability has been determined, additional habitat needs can be identified, and a specific management plan should be developed for the area. No quail should be translocated to the focal area until it has met the minimum needed suitable habitat acreage.

RESOURCES

1. **Letterkenny Army Depot**
   - Staff (3 part time) & Volunteers (~12 part time)
   - Equipment (tractors, implements, skid steer w/forestry head, loader & dozer)
   - Expertise on federal land management & security
2. **Pennsylvania Game Commission**
   - Staff (1 full time)
   - Rx Fire (full complement of staff as well as needed equipment, fuel, etc.)
   - Approved budget for habitat management and translocation
   - Expertise on species management & plan writing
   - Project coordination
3. **Habitat Forever**
   - Staff (1 full time specialist & 1 part time technician)
   - Equipment operation, GIS, contract management
   - Expertise on habitat management & seed mix availability
   - Coordination of USDA set-aside programs
   - Chapter funding
4. **Partners**
   - Pheasants Forever, Inc. (to include Quail Forever Subsidiary) technical support
   - Cumberland Valley Pheasants Forever Chapter financial support
   - Big Covey Quail Forever Chapter financial support
   - National Bobwhite Conservation Initiative technical support
   - Shippensburg University survey and analysis support
   - Harrisburg University survey and analysis support
   - Private individual donor support

COST

An estimated cost breakdown is provided based on both previous project actual costs as well as published costs from relevant literature completed on other projects. Please note that this is only estimated and is subject to change based on resource availability throughout the life of the project.

The PGC habitat column includes Habitat Forever personnel, ground clearing contracting, and herbicide application contracting costs. The PGC translocation column includes a graduate student, research supplies and equipment, as well as additional direct translocation costs. The LEAD habitat column includes natural resources staff time,

herbicide materials, volunteer time, and fuel costs. The cost estimate for LEAD is based on past expenditures since project inception.

	PGC		LEAD
Fiscal Year	**Habitat**	**Translocation**	**Habitat**
2019	$266,351.67		$146,150.68
2020	$266,351.67		$146,150.68
2021	$266,351.67		$146,150.68
2022	$155,841.00	$153,333.34	$146,150.68
2023	$155,841.00	$153,333.34	$146,150.68
2024	$155,841.00	$153,333.34	$146,150.68
2025	$155,841.00		$146,150.68
2026	$155,841.00		$146,150.68
Total	**$1,578,260.01**	**$460,000.02**	**$1,169,205.44**

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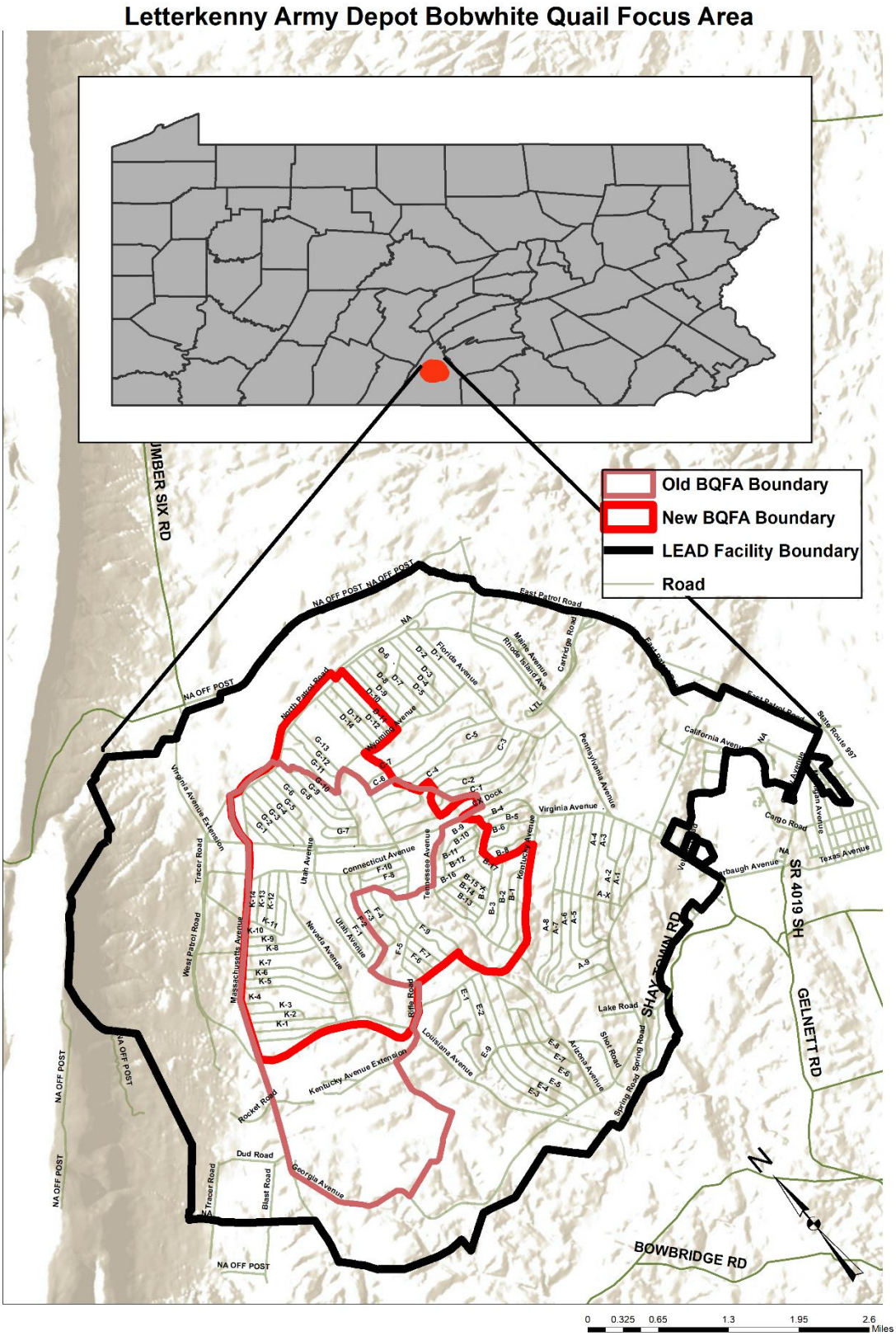

Figure 1. LEAD BQFA Boundary Map. Background image is shaded relief imagery to highlight topographic details

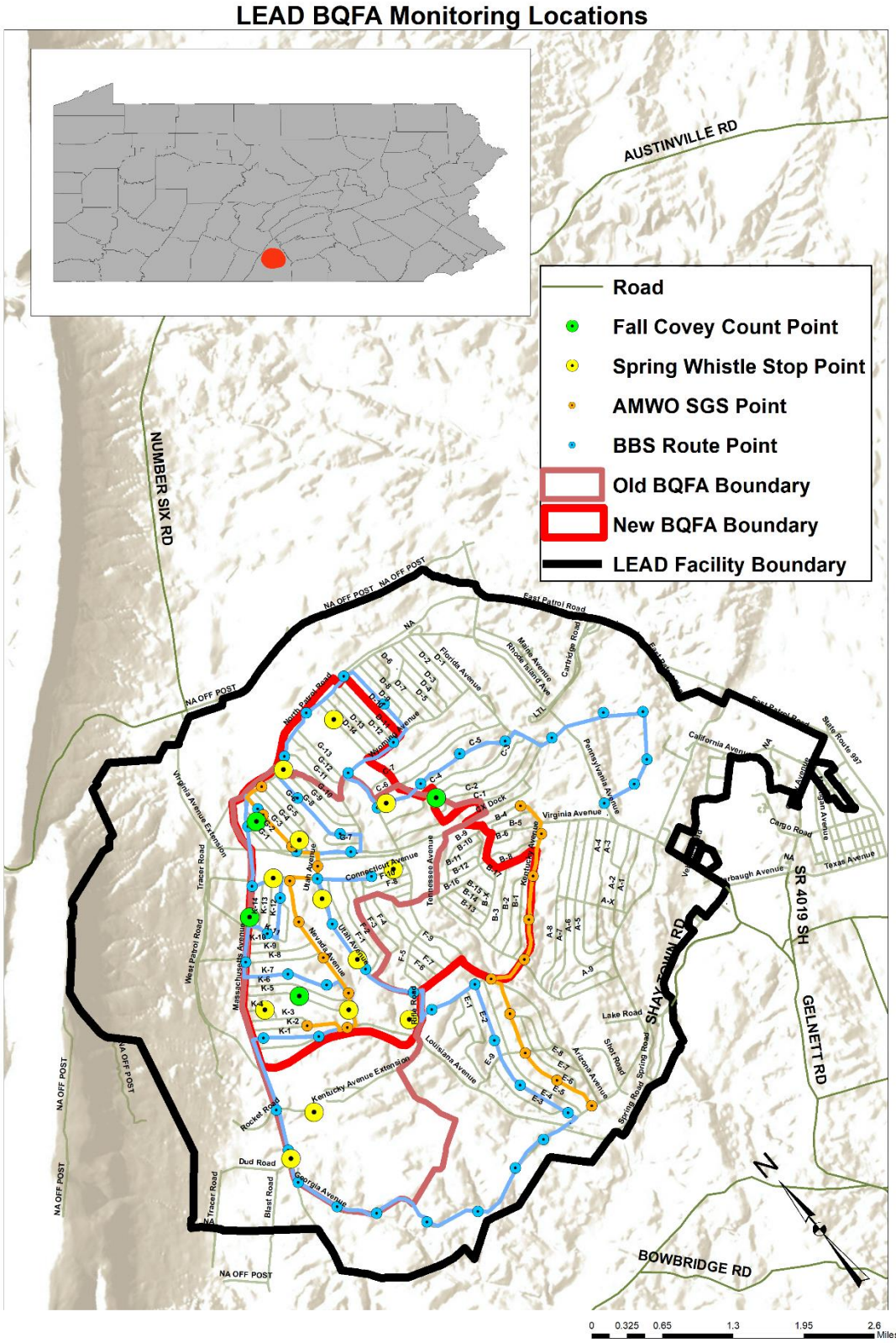

Figure 2. Wildlife Survey & Monitoring Locations Map showing both current BBS survey route with stops, fall covey count, and planned spring whistle stops (call counts), and AMWO routes with stops.

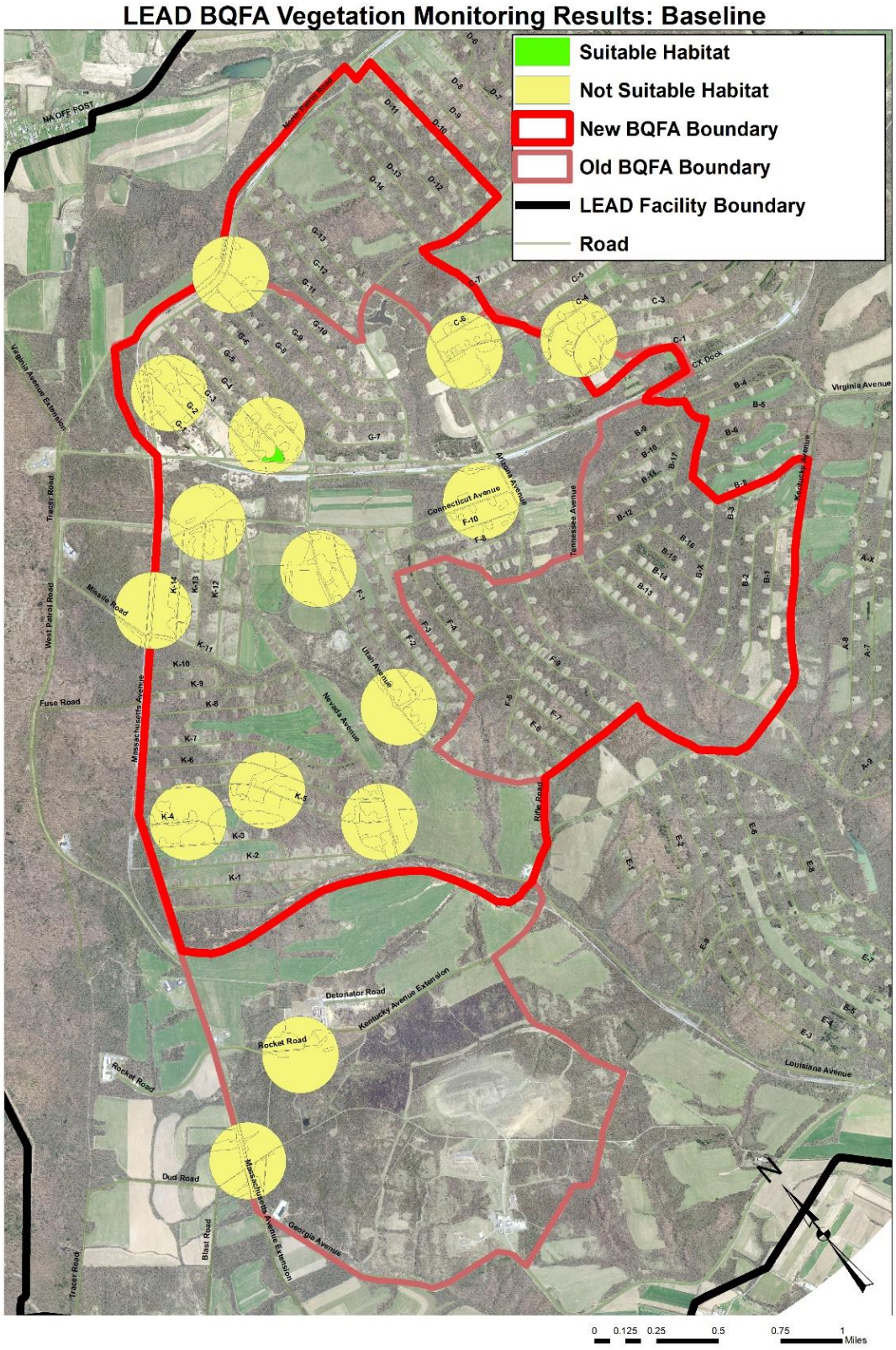

Figure 3. Habitat survey locations conducted in 2017-18 to gather baseline habitat data and determine amount of suitable habitat.

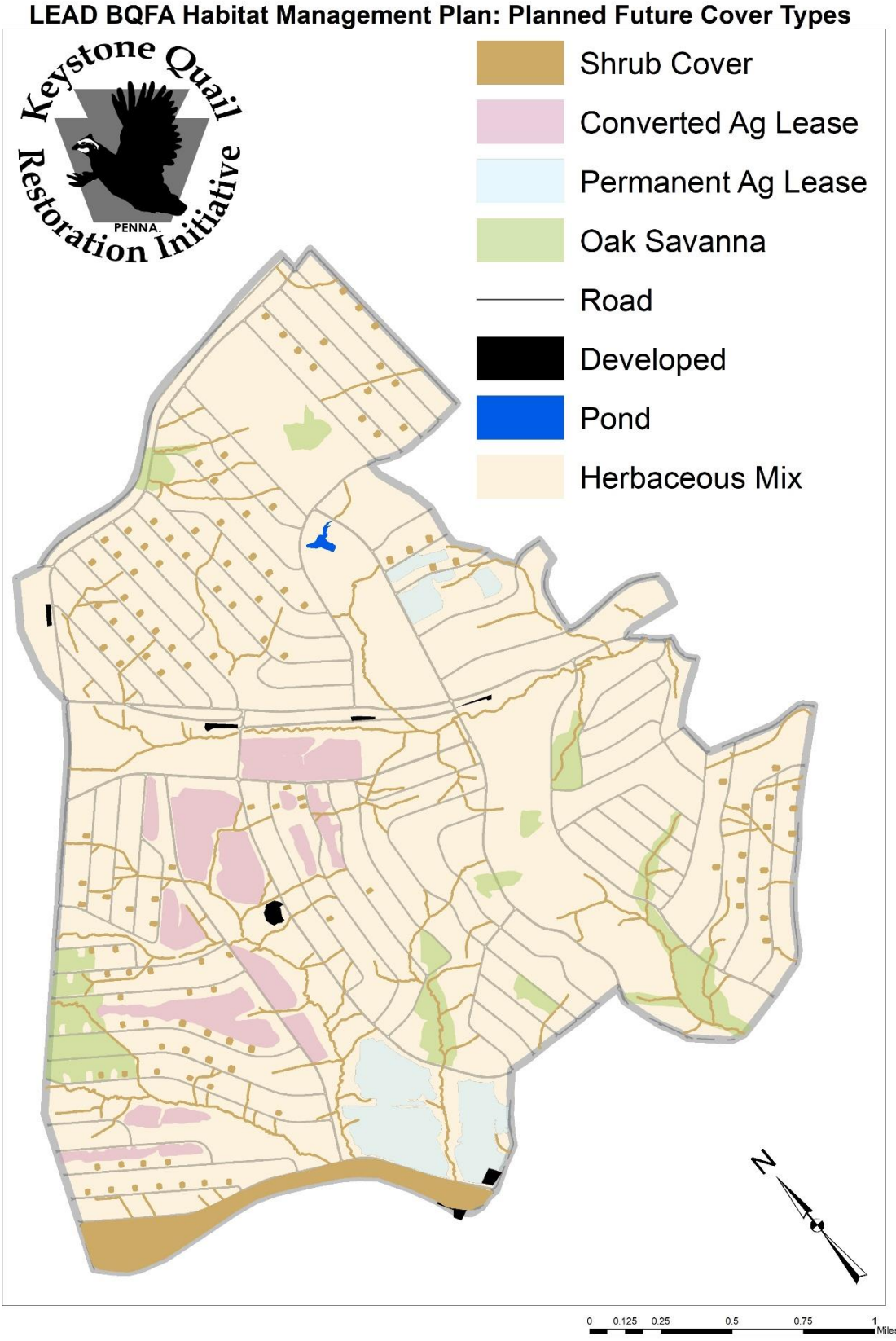

Figure 4. Future cover map for LEAD BQFA. Not all shrub cover is represented on map.

Figure 5. Habitat management units within the focus area.

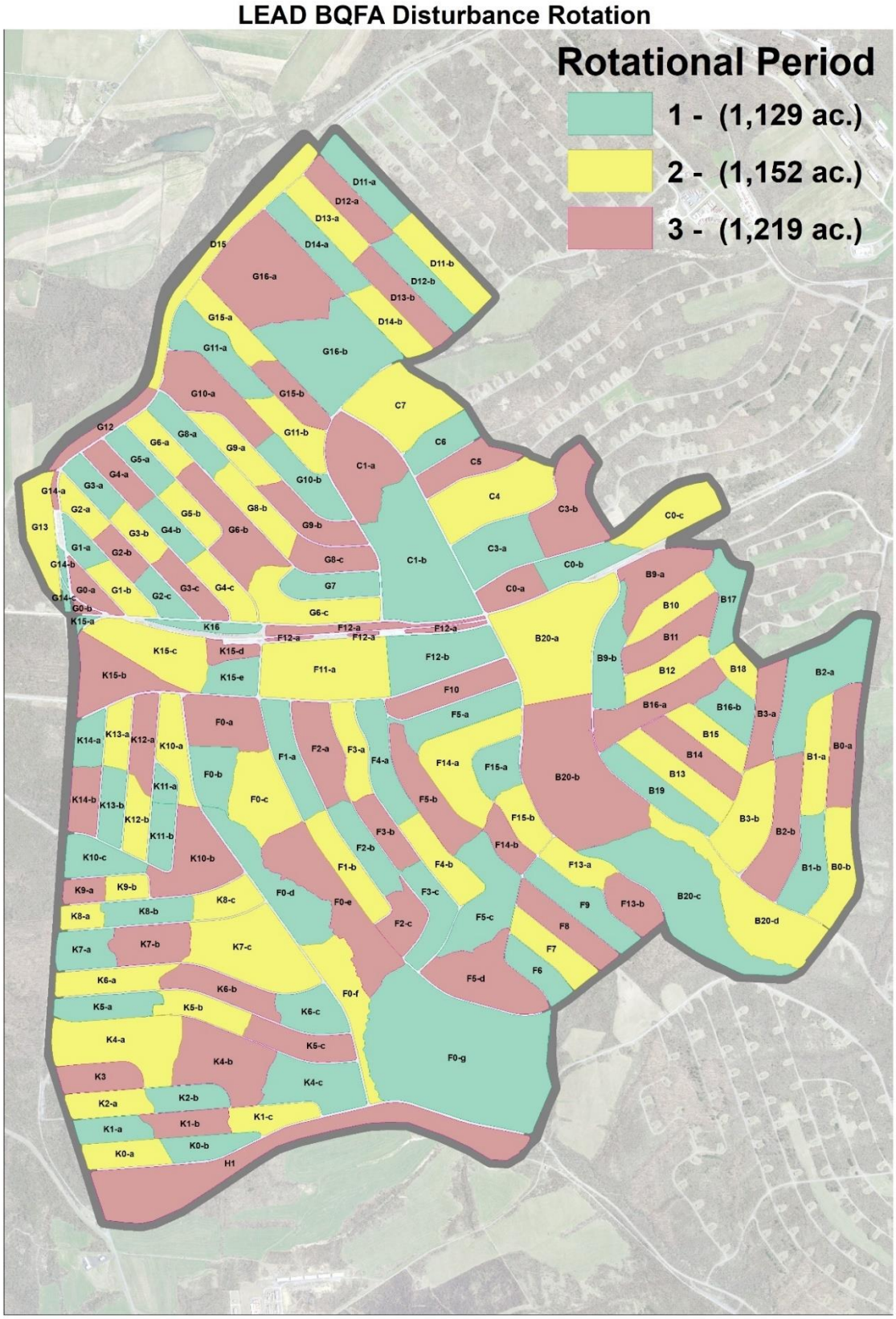

Figure 6. Disturbance rotation map broken down by sub-management units within BQFA.

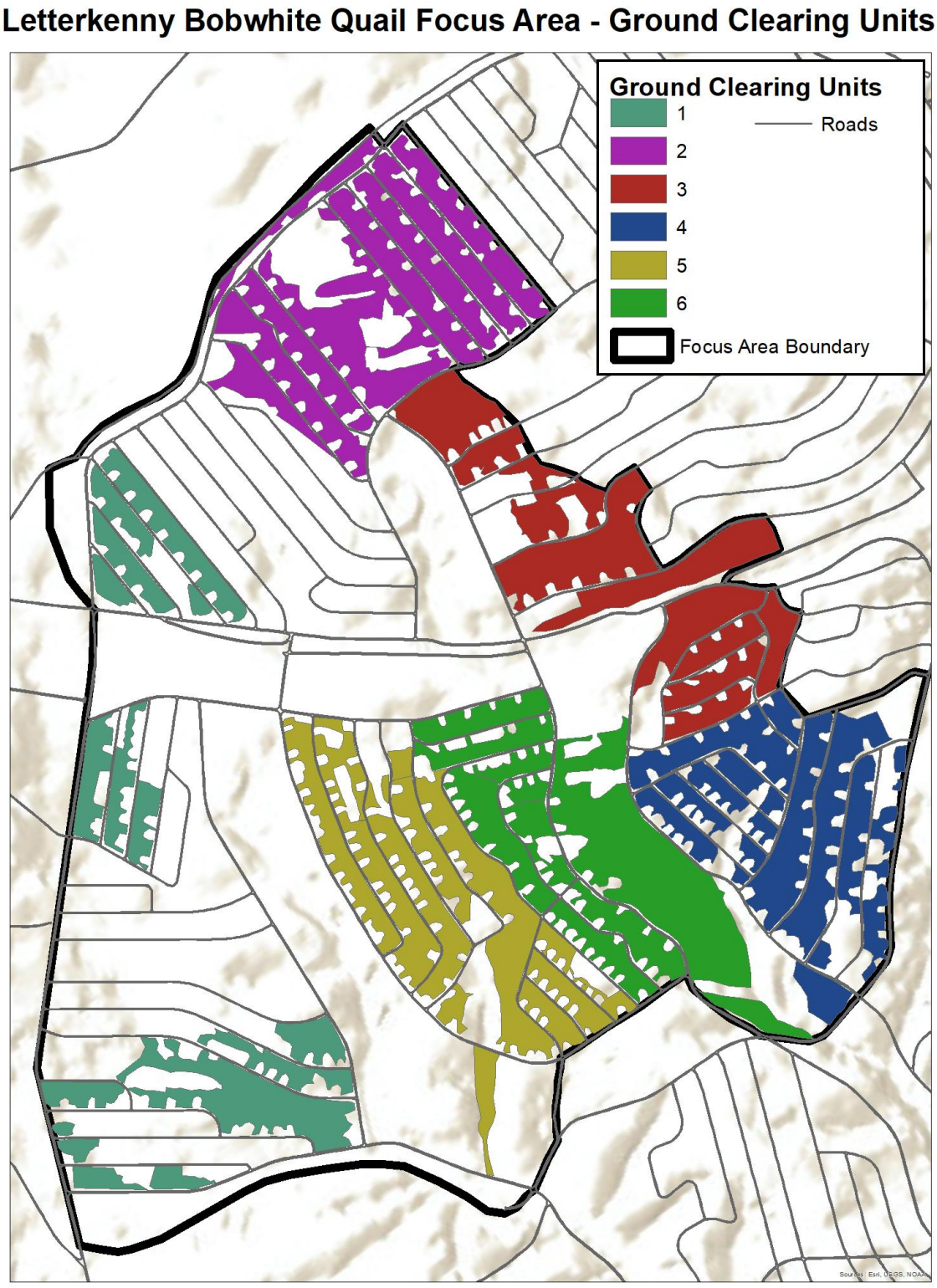

Figure 7. Ground clearing contract units within the LEAD BQFA.

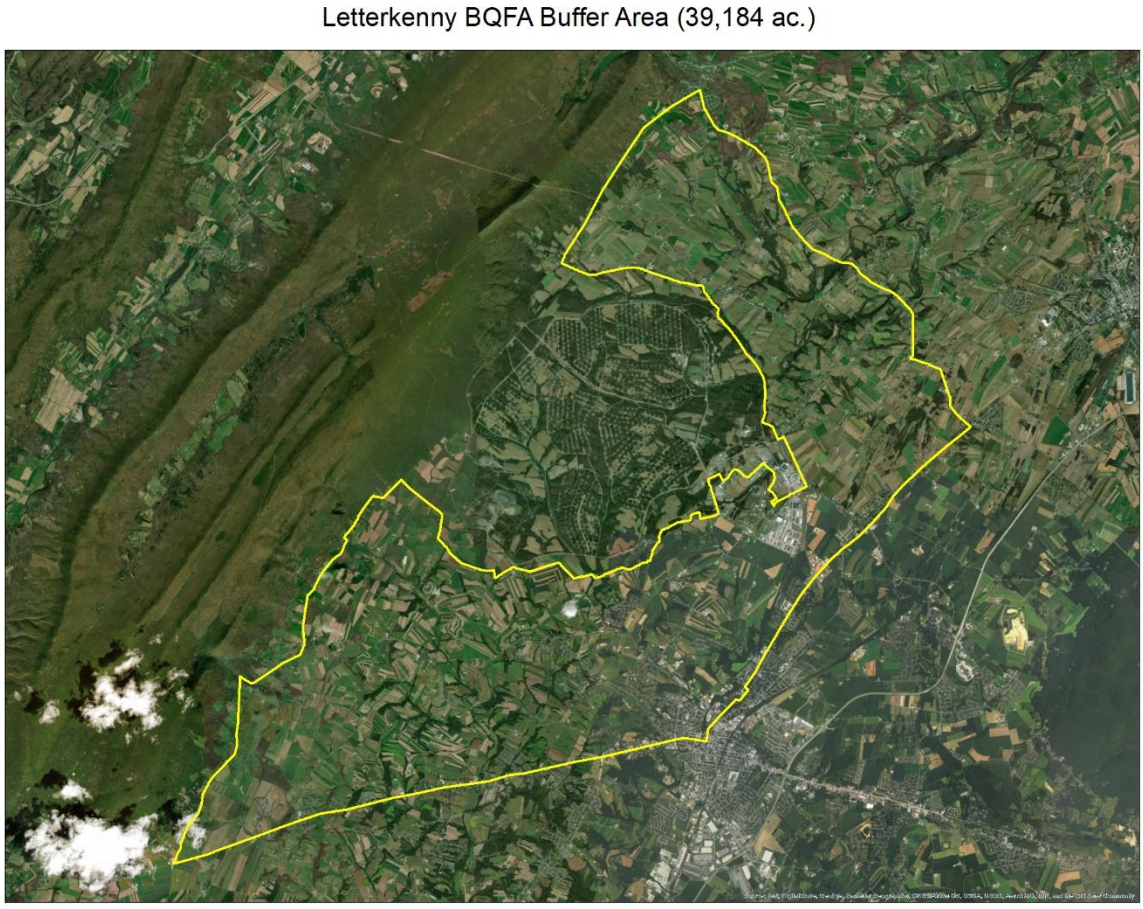

Figure 8. Private lands focus area surrounding the LEAD BQFA.

Appendix 1. Implementation schedule for Pennsylvania bobwhite quail management plan, 2020-2030*.

OBJECTIVES & STRATEGIES	By end of Fiscal Year (eg FY2020 = July 2020 through June 2021)										
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
GOAL 1: Habitat Establishment											
Objective 1.1 - Establish and maintain a minimum of 1,500 acres of year-round, suitable habitat.											
Strategy 1.1.1 - Complete ground clearing operations within focal area.	•	•	•	•	•	•					
Strategy 1.1.2 - Complete 1,500 acres of suitable quail habitat establishment.	•	•	•								
Strategy 1.1.3 - Complete 1,129-1,219 acres of annual habitat maintanence.				•	•	•	•	•	•	•	•
Strategy 1.1.4 - Complete desired herbaceous seeding in expring ag leases.			•								
Strategy 1.1.5 - Establish/maintain shrub units.	•	•	•	•	•	•	•	•	•	•	•
Objective 1.2 - Surrounding habitat establishment (public/private lands)											
Strategy 1.2.1 - Conduct private landowner focus groups/interviews.		•									
Strategy 1.2.2 - Establish private lands focal area surrounding BQFA.		•	•								
Strategy 1.2.3 - Partner with PF & NRCS to establish habitat on private lands surrounding BQFA.		•	•	•	•	•	•	•	•	•	•
Strategy 1.2.4 - Establish and maintain quail habitat on SGL 235 compartment 1.				•	•	•	•	•	•	•	•
Strategy 1.2.5 - Evaluate LEAD property surrounding BQFA for quail habitat expansion.					•	•	•	•	•	•	•
GOAL 2: Translocation											
Objective 2.1 - Source partnering and logistics planning											
Strategy 2.1.1 - Complete 2nd round of official requests with source states for confirmation.		•									
Strategy 2.1.2 - Develop resource requirments and responsibility assessments with coorperating source states.		•	•								
Strategy 2.1.3 - Establish official translocation agreements with source states.		•	•								
Objective 2.2 - Complete final translocation planning											
Strategy 2.2.1 - Identify trapping resources and personnel for individual cooperating source states.			•	•	•	•					
Strategy 2.2.2 - Develop detailed plans for each trapping location and communicate with trapping personnel.			•	•	•	•					
Strategy 2.2.3 - Develop detailed transportation plan for shipping and receiving.			•	•	•	•					
Objective 2.3 - Conduct translocation following plan and guidelines											
Strategy 2.3.1 - Coordinate pre-baiting and trapping efforts across all locations with cooperating agencies			•	•	•	•					
Strategy 2.3.2 - Coordinate transportation including shipment and reciving of translocated birds.			•	•	•	•					
Strategy 2.3.3 - Coordinate transmittering and release of translocated birds following plan methods.			•	•	•	•					
Objective 2.4 - Conduct short-term additional practices to enshance successful establishment of quail populations.											
Strategy 2.4.1 - Conduct nest predator removal operations within focal area (spring/summer of translocation years and 1 year post-translocation)			•	•	•	•					
Strategy 2.4.2 - Conduct supplemental feeding during periods of persistent snow and ice (translocation years and 1 year post-translocation).			•	•	•	•					
GOAL 3: Research & Monitoring											
Objective 3.1 - Population and habitat monitoring within BQFA											
Strategy 3.1.1 - Conduct habitat monitoring following NBCI CIP protocol.			•		•		•		•		•
Strategy 3.1.2 - Conduct spring bird surveys annually following NBCI CIP protocol.			•	•	•	•	•	•	•	•	•
Strategy 3.1.3 - Following intial release, conduct fall covey count surveys annually using NBCI CIP protocol.			•	•	•	•	•	•	•	•	•
Strategy 3.1.4 - Conduct LEAD Breeding Bird Survey route survey annually.	•	•	•	•	•	•	•	•	•	•	•
Strategy 3.1.5 - Conduct American woodcock singing-ground surveys annually.	•	•	•	•	•	•	•	•	•	•	•
Strategy 3.1.6 - Conduct pollinator surveys annually.	•	•	•	•	•	•	•	•	•	•	•
Strategy 3.1.7 - Conduct lagamorph surveys annually.	•	•	•	•	•	•	•	•	•	•	•
Objective 3.2 - Quail population dynamics and habitat use research											
Strategy 3.2.1 - Estimate survival, mortality and sources of mortality of translocated quail and Pennsylvania hatched quail.			•	•	•						
Strategy 3.2.2 - Monitor dispersal of translocated and PA hatched quail.			•	•	•						
Strategy 3.2.3 - Determine annual habitat preference of wild quail.			•	•	•						
Strategy 3.2.4 - Determine nesting success and nesting habitat of wild quail.			•	•	•						
GOAL 4: Information & Education											
Objective 4.1 - Annual I&E project updates to partners and public											
Strategy 4.1.1 - Conduct annual partner meeting focusing on habitat management and translocation efforts as well as conducting a field tour.	•	•	•	•	•	•	•	•	•	•	•
Strategy 4.1.2 - Annualy report research and management findings to public.	•	•	•	•	•	•	•	•	•	•	•
Objective 4.2 - Project promotion and marketing											
Strategy 4.2.1 - Provide photographs and video clips to BI&E for social media promotion of the project.	•	•	•	•	•	•	•	•	•	•	•
Strategy 4.2.2 - Create promotional video focusing on entirety of project including habitat establishment, translocation, research/monitoring, and maintenance.						•					
Strategy 4.1.3 - Develop multiple articles for popular formats such as *Game News*, other magazines, newspapers, blogs, and online platforms.	•	•	•	•	•	•	•	•	•	•	•

OBJECTIVES & STRATEGIES	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
GOAL 5: Cooperative Partnerships											
Objective 5.1 - Establish new partnerships											
Strategy 5.1.1 - Pursue additional partnerships by actively engaging non-government organizations (NGO), NGO chapters, federal/state agencies, and private organizations and individuals.	•	•	•	•	•	•	•	•	•	•	•
Objective 5.2 - Enhance existing partnerships objective											
Strategy 5.2.1 - Renew 10-year MOU with LEAD concerning quail restoration project by 2026.						•					
Strategy 5.2.2 - Renew 10-year MOU with QF concerning quail restoration project tby 2026.						•					
Strategy 5.2.3 - Continue open communications and coordination of monitoring efforts with various educational institutions including Harrisburg University and Shippensburg University.	•	•	•	•	•	•	•	•	•	•	•
GOAL 6: Expansion											
Objective 6.1 - Identify further translocation opportunities within PA											
Strategy 6.1.1 - Based on results from the bobwhite population dynamics research, establish thresholds for when and how many bobwhites can be transferred from LEAD BQFA.							•				
Strategy 6.1.2 - Develop a list of standards an area must meet to qualify as a potential reintroduction site and rank all potential sites.							•				
Strategy 6.1.3 - Assess support of bobwhite reintroduction and management with public and private landowners in potential reintroduction sites through surveys.							•	•			
Strategy 6.1.4 - Begin improving habitat on highest ranked potential reintroduction sites(s).									•	•	•

* Note: This timeline represents the 'best case scenario' when considering the establishment of habitat and translocation timing. Quail should not be translocated into the focus area until the needed amount of suitable habitat has been established. This timeline represents a 10-year period within the project. Following year 2030 the project should be re-evaluated to assist in guiding it into the future.

Appendix 2. Summary of public comments for Pennsylvania bobwhite quail management plan, 2021-2030.

The draft of the Northern Bobwhite Quail Management plan for Pennsylvania from 2020-2030 was presented at the July Board of Commissioners Meeting and open for public comment for 30 days after that from July 30th to August 28th. The comment period was announced at the meeting, in the news release after the meeting, and another news release in the middle of the comment period as a reminder. We received 31 comments in total with 71% (n=22) having a supportive message. Of the comments that were not supportive, the overarching message could be summarized as the plan is a misallocation of funds and that the plan is not likely to work. Specific suggestions from both supportive and critical comments ranged from a brief message sharing support or criticism, to more detailed suggestions on how to improve the plan. There were several topics that trended through multiple comments which includes: managing habitat, supporting native species, changes to regulations and practices, and use of pen reared bobwhite.

Comments on managing habitat for bobwhite put an emphasis on the importance of habitat in maintaining bobwhite. We share that sentiment and feel as though our plan does a good job of addressing the habitat needs for a wild bobwhite population. There were comments suggesting certain vegetation that would be beneficial as well as using reclaimed coal mines. Ultimately the site and management decisions have been made in a way to maximize our potential for success with respect to winter weather, and the current and potential habitat on the BQFA. The limitations of winter weather, availability of personnel, equipment, and funding through our partner groups led to the site selection, and habitat management plans.

In addition to habitat, the concept of predator management was addressed as a factor that may limit bobwhite's success. We are exploring options to deal with predation mitigation both in the form of predator trapping of mammalian species and habitat management practices to mitigate predator presence which are outlined in the management plan.

Another topic was changing regulations to close bobwhite hunting to protect released wild birds during reintroduction and the bobwhite hunting season on the books throughout the rest of the state. Both topics are being addressed for the 2022-2023 hunting season to close bobwhite hunting surrounding the BQFA and expand opportunity for put and take bobwhite hunting elsewhere in the state.

There were several comments about focusing on helping native species. Some of which were to not focus on native bobwhite but focus on other species like grouse, while the majority were excited to put effort into helping the native bobwhite. Interestingly, there were conflicting comments saying that we should put our bobwhite funding into stocking more pheasant and also that we should stop stocking pheasant to put that funding into native species like bobwhite. While some comments were conflicting, the majority supported the bobwhite reintroduction effort and the overwhelming majority supported native species in Pennsylvania.

Finally, the use of pen-reared birds was addressed. This is a topic that is well studied and the literature has determined to be ineffective. The most effective management tool for reintroducing bobwhite is the translocation of wild bobwhite outlined in this management plan. Other agencies

and nonprofit organizations have seen success with this method and out plan follows best practices as closely as possible.

The PGC wants to thank all the people who took the time to read the drafted plan and provide comments. Those who submitted comments exemplified the knowledge and passion that the public shows for Pennsylvania's wildlife.