Recovery Plan
For
Arabis perstellata Braun
(Braun's Rockcress)

U.S. Fish and Wildlife Service
Southeast Region
Atlanta, Georgia

RECOVERY PLAN

for

Arabis perstellata Braun (Braun's Rockcress)

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Approved: _____
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EXECUTIVE SUMMARY

Current Species Status: *Arabis perstellata* was listed as endangered by the U.S. Fish and Wildlife Service in 1995. Factors contributing to its endangered status are its extremely limited range, loss of habitat, competition from invasive exotic plants, and other detrimental impacts that result from site disturbance.

Habitat Requirements and Limiting Factors: Threats to Braun's rockcress are loss of habitat through exotic plant invasion, grazing and other direct impacts, and development (home and road construction). Pressure from these threats will increase. Also, because this species is a poor competitor, it may be particularly vulnerable to exotic plant invasions and other disturbances that make its habitat more suitable for aggressive competitors.

Recovery Objective: Delisting.

Recovery Criteria: *Arabis perstellata* will be considered for reclassification from endangered to threatened when ten geographically distinct self-sustaining populations consisting of 50 plants or more each are protected within a significant portion of its historic range in Kentucky and Tennessee. At least half of these should be populations consisting of 100 plants or more. It must also be shown that these populations are stable or increasing through 5 years of monitoring.

Delisting *Arabis perstellata* will be considered when 20 geographically distinct self-sustaining populations are protected in Kentucky and Tennessee and it has been shown that they are stable after another 5 years of monitoring following reclassification. The estimated date for recovery completion is 2020.

Actions Needed:

1. Develop a site protection plan for all occurrences rangewide.
2. Conduct inventories in an effort to locate new populations.
3. Determine the species' demographic trends.
4. Determine whether populations are self-sustaining and determine the population attributes needed to attain viability.
5. Determine optimal habitat conditions.
6. Develop a site management strategy for the species.
7. Secure and store viable seeds.
8. Annually review recovery efforts.
9. Develop a public education plan.

Total Estimated Cost of Recovery ($000s): Unable to determine at this time.

Date of Recovery: The year 2020, provided that recovery actions are funded and recovery criteria are met.

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PART I

INTRODUCTION

Arabis perstellata (Braun's rockcress) is a perennial herb that grows in calcareous mesophytic and sub-xeric forests in north-central Kentucky and north-central Tennessee. It was originally described by E. Lucy Braun (1940) based on her discovery of the taxon in Kentucky several years earlier.

The species is listed as endangered by the U.S. Fish and Wildlife Service (Service) under the Endangered Species Act (Act) (Service 1995). Factors contributing to this species' endangered status are its extremely limited range, loss of habitat, competition from invasive exotic plants, and other detrimental impacts that result from site disturbance.

DESCRIPTION

Braun's rockcress is distinguished from other members of the genus *Arabis* by the white stellate (star-shaped) hairs on stems and leaves that give the plant a grayish appearance. These stellate hairs are mixed with simple hairs on the upper surface of the leaves. Additionally, Braun's rockcress is a perennial, while most other *Arabis* species are biennials. Information from a general description provided in Gleason and Cronquist (1991) was used in the following summary. The stem, which can reach 80 centimeters (cm) or 31.5 inches in length (but is usually much smaller), is branched at the base and can be decumbent or partially erect. The mostly lanceolate stem leaves are auriculate at the base where they clasp the stem. Leaf size (2 to 5 cm) becomes reduced on the upper stem, and the shape may become more ovate. Small white to lavender flowers are produced in a terminal raceme and are barely emergent beyond the sepals. The fruit is a round, elongate, and densely hairy silique. Flowers are produced from late March to early May; fruits mature from mid-May to early June.

Although varieties of this species are not recognized in recent treatments (Rollins 1993), in the past, two varieties were distinguished based on size and degree of pubescence (Rollins 1960). The formerly recognized varieties are also geographically separated, with the larger variety (*ampla*) occurring in Tennessee and *perstellata* occurring in Kentucky (Rollins 1993, Kentucky State Nature Preserves Commission [KSNPC] 1996a).

Arabis shortii is very similar in appearance to *A. perstellata* and is co-occurring within its range. As noted previously, the stellate pubescence, in this case particularly on the upper side of the leaves, is distinctive. Rollins (1993) uses the longer petioles (>4 millimeters [mm] long) and the larger siliques (>1 mm wide) to distinguish *A. perstellata* from *A. shortii*.

DISTRIBUTION

Arabis perstellata is presently known from two separate sections of the Interior Low Plateaus Physiographic Province; the Blue Grass Section (Kentucky), and the Central Basin Section (Tennessee). Both areas where this plant is found are predominantly underlain by sediments of Ordovician age (Quarterman and Powell 1978). In the Blue Grass Section of Kentucky, Braun's rockcress is found in three counties--Franklin, Henry, and Owen. In Tennessee's Central Basin it is found in Davidson and Rutherford Counties. In Kentucky the species is associated with a single river drainage--the Kentucky River. In Tennessee it is principally found in the Stones River drainage but is also found along the Cumberland River several miles downstream of the Stones River confluence.

HABITAT

Braun's rockcress occurs on the slopes of calcareous mesophytic and sub-xeric forest types. The occurrence of this species does not appear to be limited to a particular slope aspect, elevation, or moisture regime within the slope forests. It is, however, sun intolerant and always occurs in at least partial shade. The largest and most vigorous populations occur on moist mid- to upper slope sites. Plants are often found around rock outcrops, protected sites on the downslope side of tree bases, and sites of natural disturbance, such as talus slopes and animal trails. It is rarely found growing among the leaf litter and herbaceous cover of the forest floor.

GEOLOGY

Within the Bluegrass Section of the Interior Low Plateaus in Kentucky, the Lexington Limestone Formation is common on the slopes entrenched by the Kentucky River and its major drainages (McDowell 1986). All but one of the Kentucky occurrences[1] of *Arabis perstellata* are on the Grier and Tanglewood members of this formation. Even where other members with a more substantial shale component (Clays Ferry) occur immediately adjacent to sites for this plant, the populations are confined to the Grier and Tanglewood members. The exception is the population in Henry County, Kentucky, occurring on what is mapped as Kope and Clays Ferry members that have a higher shale component than Lexington Limestone. However, the plants occur on limestone outcrops at this site, and Calloway Creek limestone (75 to 85 percent limestone) is mapped at slightly higher elevations on this same slope, so the habitat may be consistent with other sites in its high limestone component.

In reviewing the distribution of Lexington Limestone Formation, particularly the Grier and Tanglewood members, it is clear that *Arabis perstellata* is not limited by availability

[1]The term "occurrence" is used to describe a geographically isolted set of plants. In this plan an occurrence is defined as a group of plants separated from other plants by geographic and/or habitat discontinuity, such as roads or streams, or by a distance of approximately one-half mile. This may or may not be a true population. Until more detailed demographic studies are conducted, it is not possible to determine the degree of geographic/habitat isolation needed to be considered a true population.

of this type of limestone. Areas with this type of geologic substrate, having the same topography and plant communities as those at which Braun's rockcress is known, continue south into Woodford and Anderson Counties, Kentucky. However, this species has not been found in these areas despite several inventory attempts (Jones 1991, KSNPC 1996a).

In Tennessee, *A. perstellata* sites are restricted to the Central Basin Section, which, like the Blue Grass Section, is underlain by Ordovician limestones. The primary rocks of the *Arabis* occurrences in Davidson County are Lebanon and Carters Limestone, while the sites in Rutherford County are characterized by Leipers and Catheys Limestone, as well as Bigby-Cannon Limestone (Wilson 1965, 1966a, 1966b).

SOILS

The soils are limestone-derived at *Arabis perstellata* sites, and a rock outcrop component is usually present in the soil complex. Jones (1991) reviews the specific soils occurring at these sites. A clay subsoil is also common, but a notable difference is the acidity of the Tennessee soils compared with the neutral to moderately alkaline Kentucky soils (Jones 1991, McDonald *et al.* 1985).

VEGETATION AND ASSOCIATES

Common canopy trees of the slope forests where Braun's rockcress grows are *Acer saccharum* (sugar maple); *Quercus muhlenbergii* (chinquapin oak); *Celtus occidentalis* (hackberry); and *Aesculus glabra* (Ohio buckeye). Jones (1991) listed the species that are most indicative of *Arabis perstellata* habitat as *Saxifraga virginiensis* (early saxifrage); *Sedum pulchellum* (stonecrop); *Arabis laevigata* (smooth rockcress); *Draba ramosissima* (branched whittlowgrass); *Phacelia bipinnatifida* (forest phacelia); *Asplenium rhizophyllum* (walking fern); *Pellaea atropurpurea* (purple cliff-brake); and *Heuchera* sp. (alum root). These herbaceous species are all common forest forbs in Kentucky and Tennessee, with the exception of *Draba ramosissima*, which is rare in Tennessee and considered of Special Concern by the Tennessee Department of Environment and Conservation's Division of Natural Heritage. Jones (1991) also provides a comprehensive list of associates.

LIFE HISTORY/ ECOLOGY

The life history of Braun's rockcress has been described by Braun (1956) and is briefly summarized here. A rosette that persists for 2 years is formed the first year following germination. During this time the taproot becomes established. The following year a stem is produced from the rosette; in subsequent years, new growth is produced, especially additional branching and stems. Plants are reported to live up to 5 years (Jones 1991).

Braun's rockcress is never a common component of the ground flora. It usually occurs in small groups (especially around rock outcrops) or as scattered individuals. The small size of the populations, the species' specialized habitat, and its apparent inability to expand into available or similar habitats suggests that Braun's rockcress is a poor competitor. This inability to compete has likely limited its distribution and abundance. Although its habitat is usually disturbance-mediated, it is adapted to a highly specialized set of environmental conditions. It appears that this species cannot withstand vigorous competition from invasive weeds or even native herbaceous species.

Arabis perstellata apparently declines after certain levels of disturbance, such as heavy grazing, and large populations are not found in degraded forests where weedy opportunistic plant species have replaced the native ground flora. The most common and aggressive weed in these forest types is *Alliaria petiolata* (European garlic mustard), a naturalized biennial pest that poses a severe threat to woodlands in the United States. Disturbed forests are most susceptible to rapid European garlic mustard invasion, and disrupted soil is most suitable for its establishment (Nuzzo 1991). European garlic mustard directly competes with Braun's rockcress for areas of natural disturbance once it has become established in a forest. It also destroys the forest composition and structure as it rapidly colonizes and supplants native vegetation. Although management schemes for the control of European garlic mustard are being tested, the work is being attempted at only a few sites, and the species continues to spread into natural areas.

Arabis perstellata may depend on diverse small natural disturbances that expose bare ground, such as tree falls, erosion around surface rock, deer trails, and turkey scratching. If these processes have been interrupted, habitat for this species may no longer be available. This disruption of natural processes created by changes in land use is likely affecting the status of *Arabis perstellata*.

Arabis perstellata is probably pollinated by insects, but the vector is not known nor is it clear whether it is self-fertile. It has no specific morphological mechanism for seed dispersal; it is likely that dispersal is occurring through wind or gravity rather than animal movements. Seeds are probably most commonly dispersed downslope. Jones (1991) suggested that plants in the stable upper slopes (usually among the rock outcropping at a slope break) may be supplying seeds to chronically eroded areas below. He suggests that mortality would be high on these lower slopes.

Arabis perstellata produces viable seeds, and plants can easily be grown from seeds under greenhouse conditions. It is not known, however, whether the plant depends on a seed bank to take advantage of opportunities for seed germination and establishment. Bloom (1988) found that seeds of *Arabis laevigata*, a biennial rockcress co-occurring with *A. perstellata*, remained germinable for several years and found evidence of a seed bank. It was also found that the presence of leaf litter suppressed germination in *A. laevigata* (Bloom 1988); this is likely a common factor affecting germination in woodland herbaceous species and, considering the habitat for *A. perstellata*, could also be a factor in its germination. Medley (University of Illinois, *in. litt.*) noted that in several of the larger populations in Kentucky, the species occurs mostly in areas cleared of herbaceous vegetation and leaf litter by past colluvial slippage and believes the lack of leaf litter is likely a requirement for seed germination or seedling survival.

Seedlings of *Arabis perstellata* have been observed in the field, sometimes in good numbers (KSNPC 1996a). The dry conditions at some sites likely increase mortality rates. Autecological evidence from *A. laevigata* indicates water availability may be a factor affecting seed germination (Bloom 1988). Seedling survival of *A. laevigata* may increase in years of high rainfall through the spring and early summer months. This additional rainfall would create moist soil conditions through this critical period of seedling growth.

If suitable habitat is available, reproduction appears to be successful, but it is not clear whether it is successful at sufficient levels to maintain population viability. The factors affecting seedling establishment are not known nor is it known whether seed production changes in different environments. Studies of a congeneric perennial species *(Arabis fecunda*) suggest that multiple life history strategies are employed where the environmental conditions are highly dynamic (Lesica and Shelly 1995). Life history studies of *Arabis perstellata* are critical to understanding how this plant adapts to its dynamic habitat and yet is not an aggressive competitor.

REASONS FOR LISTING

Arabis perstellata is vulnerable to extinction because of its very small range, low abundance, and declining number of occurrences. Twenty-five extant occurrences are known from Kentucky and three from Tennessee. The full range of this species in Kentucky is an approximately 200-square-mile area, with three disjunct populations in Tennessee. This narrow range makes the species vulnerable to potential catastrophic phenomena, such as disease and the effects of weather and climate. Also, population levels are declining; eight sites previously known in Kentucky were found to be extirpated during 1996 (KSNPC 1996a). Four historical occurrences in Tennessee are presumed extirpated (Jones 1991), including one submerged by dam construction.

Primary threats to this species are loss of habitat through exotic plant invasion, grazing and other direct impacts, and development (primarily home and road construction). Pressure from these threats will increase. Also, because Braun's rockcress is not an aggressive competitor, it may be particularly vulnerable to exotic plant invasion and other

disturbances, making its habitat more suitable for aggressive competitors. Other threats may also be playing a role, as one of the populations on Elkhorn Creek, Franklin County, Kentucky, has declined by 80 to 90 percent (Medley *in litt.*) with no readily observable changes in the habitat.

CONSERVATION MEASURES

Site Protection

Site protection efforts in Kentucky have resulted in natural area registry agreements with two adjacent landowners to protect a single occurrence. A registry agreement is also in place for the Scales Mountain occurrence in Rutherford County, Tennessee. Registry agreements are nonbinding formal agreements made with landowners who are amenable to voluntary conservation of their property; in these cases, specifically for the protection of Braun's rockcress population(s).

All of the occurrences in Kentucky have been quality ranked by assigning a letter designation (Figure 1) based on the following criteria:

A - A population of 200 or more plants, where little to no habitat restoration is needed; site is at least 10 acres of continuous forest.

B - A population of 100 to 199 plants, where little habitat restoration is needed; site is at least 10 acres of continuous forest.

C - A population of 50 to 100 plants, where the habitat is degraded; site with less than 10 acres of continuous forest.

D - A population of fewer than 50 plants, where the habitat is degraded; site with less than 10 acres of continuous forest.

In assessing an occurrence, some ranking criteria overlap between levels. In these cases the degree of threat and the probability of successfully protecting the site are considered in the final ranking assignment. The distribution map can be used in developing a comprehensive strategy for site protection, particularly in achieving a good representation of genetic diversity (based on geographic distribution) for the species and in assessing the importance of individual sites.

Eighteen landowners in Franklin County, Kentucky, were informed about the occurrence of Braun's rockcress on their property by letter from the KSNPC. They were invited to an informational meeting about the species. One property owner attended and another called to express interest in receiving more information by mail.

Current Legal Protection

Although it is listed as endangered by the State of Kentucky (KSNPC 1996b), there is no State legislation that provides protection for *Arabis perstellata*. In Tennessee, the State's rare plant law restricts the sale of endangered plants without a license to ensure that plants are being propagated rather than collected from the wild. Collection or disturbance of *A. perstellata* on private land without the permission of the landowner or on public land is also prohibited by this law (Tennessee Department of Conservation 1987 [now known as the Tennessee Department of Environment and Conservation]).

The Act provides additional protection to populations that are on Federal land and to other populations when the taking is in violation of any State law, including State trespass laws. Protection from inappropriate interstate commercial trade is also provided.

Surveys

An inventory for potential additional populations was conducted in 1996; twelve new sites were found (KSNPC 1996a). In spite of efforts to find new occurrences outside the known range (adjacent counties, drainages, or topographic quadrangles), none were found.

Seed Depository

The Center for Plant Conservation at the Missouri Botanical Garden collected an estimated 3,000 seeds from seven populations of *Arabis perstellata* in 1996 (six from Kentucky and one from Tennessee). Seed viability was confirmed, and the remaining seeds were either stored at their facility or deposited at the National Seed Storage Laboratory at Fort Collins, Colorado. They will test the seeds for viability every 5 years and re-collect as needed.

PART II

RECOVERY

A. Recovery Objectives and Criteria

Arabis perstellata will be considered for reclassification from endangered to threatened status when 10 geographically distinct self-sustaining populations consisting of 50 plants or more each are protected within a significant portion of the species' range in Kentucky and Tennessee. At least half of these should be populations of 100 plants or more. It must also be demonstrated that these populations are stable or increasing through 5 years of monitoring. Protection can be achieved through ownership by government or private actions. It can also include legal dedication or the placement of conservation easements on private land. Site registry may be used to protect up to three of the sites; it is expected that this form of protection will be preferred for lower-quality sites. All protected sites must have management plans or agreements in place that ensure the long-term maintenance of *Arabis perstellata* habitat.

Delisting *Arabis perstellata* will be considered when 20 geographically distinct self-sustaining populations, also consisting of 50 or more plants each, are protected in Kentucky and Tennessee and it has been demonstrated that they are stable or increasing after another 5 years of monitoring following reclassification. Registry agreements may be used for up to six of these sites. The estimated date for recovery completion is 2020.

Because of the proximity of the occurrences of Braun's rockcress, protected populations must be distributed throughout the range in order to decrease the probability of a catastrophic event impacting all the protected occurrences. A protection strategy should consider the distribution of occurrences in conjunction with the quality of these occurrences.

B. Narrative Outline

1. **Develop a site protection plan for all sites rangewide.**

   1.1 **Establish protection goals for each site.** Based on information obtained in the 1996 survey (KSNPC 1996a), protection goals (i.e., acquisition, voluntary landowner protection, etc.) can be determined for each site (occurrence). Site ranking will consider the site quality and number of plants and assess whether other threats hamper protection. A comprehensive protection plan is needed to ensure that good representation of genetic diversity throughout the range is accomplished.

   1.2 **Pursue land acquisition or other protection measures as identified in the site protection plan.** Contact landowners about site protection options and negotiate appropriate action.

2. **Conduct inventories in an effort to locate new populations.** An inventory conducted in Kentucky in 1996 (KSNPC 1996a) increased the number of known sites, and several of these were some of the highest-quality sites discovered to date. Additional surveys are particularly warranted in Tennessee and, to a lesser degree, in Kentucky.

3. **Determine the demographic trends**. Develop a census technique that will detect general demographic trends in the population numbers. Criteria to be used in the census must evaluate population viability and identify threats at each site. For instance, size classes should be used in conjunction with population counts to determine whether population numbers are changing and whether demographic shifts are occurring. The census technique can also be used to determine whether more intensive monitoring may be needed at a site. An effort should be made to include as many representative populations as feasible.

4. **Determine whether populations are self-sustaining and determine the population attributes needed to attain viability.** Aspects of the life history that are to be specifically addressed in these studies are: (1) age class distribution relative to population stability; (2) minimum viable population size; (3) the role of seedling establishment in population stability; (4) pollination and self-fertilization; (5) seed dispersal; and (6) longevity of seeds under natural conditions.

5. **Determine optimal habitat conditions.** Environmental factors affect population success. A description of the optimal conditions for the species is needed in evaluating management applications and evaluating sites for protection. Studies should specifically address the following: (1) the role of disturbance (as a natural factor and as a threat); (2) competition; and (3) moisture relations in seed germination and establishment and adult plant growth.

6. **Develop and implement a site management strategy for the species.**

6.1 Investigate and utilize methods for controlling exotic plant species (i.e., European garlic mustard) that are threatening *Arabis perstellata* populations.

6.2 In destabilized areas and where erosion is excessive, develop and implement methods of appropriate unobtrusive erosion control.

6.3 Develop and implement a comprehensive management plan for this species that addresses habitat restoration and population needs.

7. **Secure and store viable seeds.** This aspect of recovery has been accomplished by the Center for Plant Conservation.

8. **Develop materials to inform the public about the status of the species and the recovery plan objectives**. Public support for the conservation of Braun's rockcress could greatly encourage landowner assistance in conservation efforts. However, informational material should not identify the plant's precise locations in order to discourage vandalism to, or collection of, wild populations.

   Informational materials should stress pragmatic reasons for species conservation as well as intellectual, aesthetic, or moral considerations. Background information about the pharmacological, agricultural, or economic properties of the species, its congeners, or other plant family relatives will help address the questions frequently posed by laypersons.

   8.1 Prepare and distribute news releases and informational brochures. Informational materials should be prepared about the status, significance, and recovery of the species. News releases should be distributed both to major newspapers in the species' range and to smaller newspapers in the vicinity of the species' habitat. Interpretive displays and brochures should be developed for use on public land or in public schools. These materials should stress the fragile nature of this rare plant's habitat.

   8.2 Prepare articles for popular and scientific publications. Published articles are necessary to inform local citizens and public officials about the need to protect Braun's rockcress in its native habitat and to encourage their enthusiastic cooperation in conservation efforts. Scientific publications should identify the most pressing needs for further studies and seek the assistance of college and university researchers who have studied this or closely related species.

9. **Annually assess the success of recovery efforts for the species**. The timely review of new information and the evaluation of ongoing programs are essential to ensure that full recovery occurs as rapidly and efficiently as possible. Monitoring information may reveal new problems or require shifts in the allocation of resources to monitoring, research, and management projects. Population

performance should be compared to preestablished targets, and more rigorous or frequent monitoring programs should be implemented if populations decline below the preestablished thresholds. Pilot and full-scale management projects should also be reviewed to ensure their continuing effectiveness.

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PART III

IMPLEMENTATION SCHEDULE

Priorities in column 1 of the following Implementation Schedule are assigned as follows:

1. Priority 1 - An action that **must** be taken to prevent extinction or to prevent the species from declining irreversibly in the **foreseeable** future.

2. Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

3. Priority 3 - All other actions necessary to meet the recovery objective.

Key to Acronyms Used in This Implementation Schedule

ES - Ecological Services Division, U.S. Fish and Wildlife Service
FA - Federal Agencies
FWS - U.S. Fish and Wildlife Service
R4 - Region 4 (Southeast Region), U.S. Fish and Wildlife Service
SCA - State Conservation Agencies

BRAUN'S ROCKCRESS IMPLEMENTATION SCHEDULE

Priority	Task Number	Task Description	Task Duration	Responsible Agency		Cost Estimates ($000s)			Comments
				FWS	Other	FY1	FY2	FY3	
1	1.1	Establish protection goals.	3 years	R4/ES	SCA, FA	3.0	5.0	7.5	
1	1.2	Pursue land acquisition or other protection measures identified in Task 1.1.	Continuous	R4/ES	SCA, FA	-	-	-	Concurrent with Task 1.1. Cost not determinable.
1	3.0	Determine demographic trends.	5 years	R4/ES	SCA, FA	5.0	5.0	5.0	
1	4.0	Determine whether populations are self-sustaining and attributes needed to attain viability.	5 years	R4/ES	SCA, FA	2.0	2.0	2.0	Concurrent with Task 3.0.
1	5.0	Determine optimal habitat conditions.	Continuous	R4/ES	SCA, FA	2.0	2.0	2.0	
1	6.1	Investigate and use methods for controlling competitive exotic plant species.	Continuous	R4/ES	SCA, FA	10.0	10.0	10.0	Concurrent with Task 5.0.
1	6.2	Develop and implement methods of erosion control.	3 years	R4/ES	SCA, FA	5.0	5.0	5.0	Concurrent with Task 5.0.
1	6.3	Develop and implement management plan.	3 years	R4/ES	SCA, FA	2.0	4.0	8.0	Concurrent with Task 5.0.
2	2.0	Conduct inventories in an effort to locate new populations.	Continuous	R4/ES	SCA, FA	3.0	3.0	3.0	

BRAUN'S ROCKCRESS IMPLEMENTATION SCHEDULE

Priority	Task Number	Task Description	Task Duration	Responsible Agency		Cost Estimates ($000s)			Comments
				FWS	Other	FY1	FY2	FY3	
2	7.0	Secure and store viable seeds.	Completed	R4/ES	SCA, FA	-	-	-	Task completed.
2	8.1	Prepare and distribute news releases and information brochures.	Continuous	R4/ES	SCA, FA	1.0	1.0	1.0	
2	8.2	Prepare articles for popular and scientific publication and distribute news releases and information brochures.	Continuous	R4/ES	SCA, FA	1.0	1.0	1.0	
3	9.0	Annually assess recovery efforts.	Continuous	R4/ES	SCA, FA	3.0	3.0	3.0	

PART IV

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