Recovery Outline for *Lomatium cookii* (Cook's Lomatium) and *Limnanthes floccosa* ssp. *grandiflora* (Large-flowered Woolly Meadowfoam)

June 2003

Species names:

Common: Cook's lomatium
Scientific: *Lomatium cookii*

Common: Large-flowered woolly meadowfoam
Scientific: *Limnanthes floccosa* ssp. *grandiflora*

Status: Endangered

Date Listed: December 9, 2002

Population Trend: Decreasing

Recovery Priority Numbers:

Lomatium cookii: **2C**
Limnanthes floccosa ssp. *grandiflora*: **3C**

These priority rankings, on a scale from 1C (highest) to 18 (lowest), are determined in accordance with the Recovery Priority Criteria at 48 FR 51985 and are based upon a high degree of threat, a high potential for recovery, and a taxonomic classification as a species for *Lomatium cookii* and as a subspecies for *Limnanthes floccosa* ssp. *grandiflora*. The "C" indicates the potential for conflict with construction or other development projects or other forms of economic activity.

Scope of Recovery Effort: Multi-species. The recovery plan will include *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* in Jackson and Josephine Counties, Oregon.

Lead Region and Office: Region 1, Oregon Fish and Wildlife Office - Roseburg Field Office, 2900 NW. Stewart Parkway, Roseburg, Oregon 97470. Telephone: 541-957-3474.

Introduction: *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* (Figures 1 and 2) were listed as endangered species on December 9, 2002 (U.S. Fish and Wildlife Service 2002), under authority of the Endangered Species Act (16 United States Code (U.S.C.) 1531 et seq.) (Act). Both species are listed as endangered by the State of Oregon as well. These plants share similar specialized habitat requirements, as both are restricted to isolated vernal pool or seasonal wetland habitats in Jackson and Josephine Counties in southwestern Oregon. The extremely restricted geographic range of these species and continuing threats to their limited habitat warrant the development of a recovery plan for these species. The development of this recovery outline is the first step in that process, providing a preliminary strategy for conservation of the species in the interim between listing and recovery plan approval.

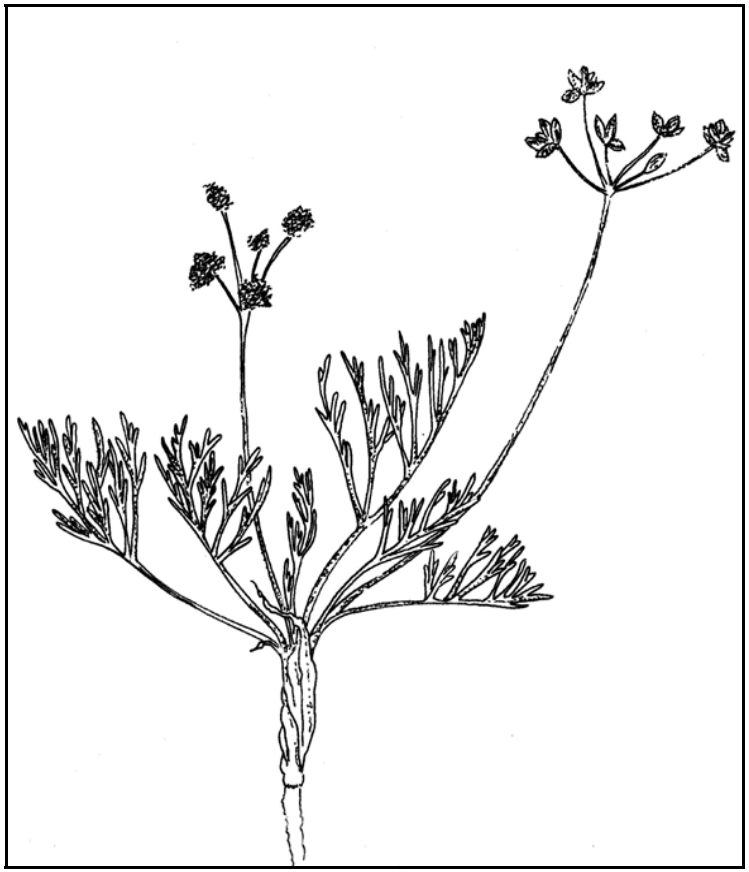

Figure 1. *Lomatium cookii* (Cook's lomatium). Illustration by Mary T. Brennon, used with permission.

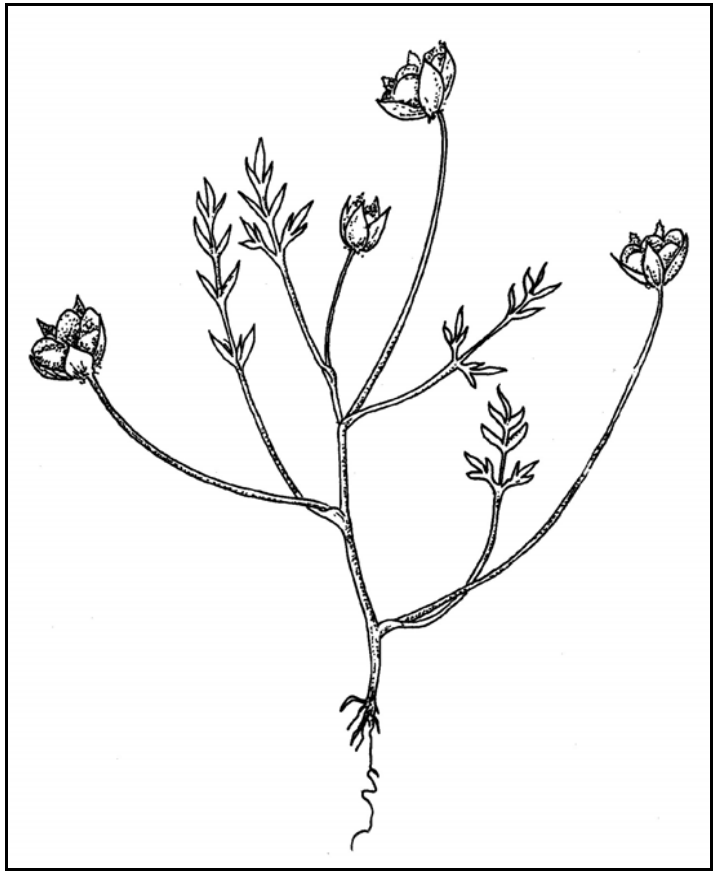

Figure 2. *Limnanthes floccosa* ssp. *grandiflora* (large- flowered woolly meadowfoam). Illustration by Mary T. Brennon, used with permission.

Overview: *Limnanthes floccosa* ssp. *grandiflora* and *Lomatium cookii* both occur in and around shallow seasonal wetlands known as vernal pools. Vernal pools form only in regions where specialized soil and climatic conditions exist. During fall and winter rains, water collects in shallow depressions in areas where downward percolation of water is prevented by the presence of an impervious hard pan or clay pan layer below the soil surface (Keeley and Zedler 1998). As the rains decrease and the weather warms in late spring, the water evaporates, and the pools generally disappear by May. Plants adapted to these ephemeral wetlands, including *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*, are capable of growing, flowering, and setting seed during the short time that water is available in the spring, and have finished their life cycle before the dry hot summer.

In southwestern Oregon, both *Limnanthes floccosa* ssp. *grandiflora* and *Lomatium cookii* are found in vernal pool habitats within an 8,300 hectare (20,510 acre) landform known as the Agate Desert in Jackson County. Located on the floor of the Rogue River basin north of Medford, the Agate Desert is characterized by shallow, Agate-Winlow complex soils, a relative lack of trees, sparse prairie vegetation, and agates commonly found on the soil surface (Oregon Natural Heritage Program (ONHP) 1997). These species are currently known to occur at about 15 sites each in the Agate Desert region. In addition, *Lomatium cookii* is also known to occur on seasonally wet soils at about 21 sites in the Illinois Valley in adjacent Josephine County (Figure 3). These populations are found in Brockman Clay Loam soils, 60 to 90 centimeters (24 to 35 inches) in depth, in open wet meadows and along roadsides adjacent to meadows. These seasonally wet areas are similar to the vernal pools of the Agate Desert, but lack that region's distinctive mound and swale topography. Composition of soils in the Illinois Valley are partially derived from serpentine formations that occur on surrounding slopes and hilltops.

The primary threat to *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* is habitat loss and degradation. Vernal pool habitat, formerly widespread south of the Rogue River, has been almost completely eliminated (Brock 1987; ONHP 1997). In the Agate Desert, recent studies of vernal pool hydrology and vegetation indicate that no undisturbed vernal pool habitat remains (ONHP 1997; 1999). The ranges of both plants have declined by roughly 50 percent in this area, and while the majority of vernal pool wetlands were altered prior to the 1980's, habitat alterations are continuing at a rapid rate (D. Borgias, pers. comm. 1999). Over 60 percent of the habitat in the Agate Desert is estimated to have been destroyed, and none of the remaining habitat has escaped the invasion of weedy competitors. The primary threats to the vernal pool habitat of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* in the Agate Desert are industrial, commercial, and residential development. Related road and utilities construction and maintenance activities including mowing, herbicide spraying, and firebreak construction, as well as altered hydrology, particularly through the conversion of non-irrigated land to irrigated agricultural use, all contribute to the deterioration of habitat quality for these plants (D. Borgias, pers. comm. 2001). Non-native annual grasses also pose a threat, as *Lomatium cookii* tends to decrease over time if these non-native competitors are not controlled through mowing, managed grazing, or prescribed burns (D. Borgias, *in litt*. 2002).

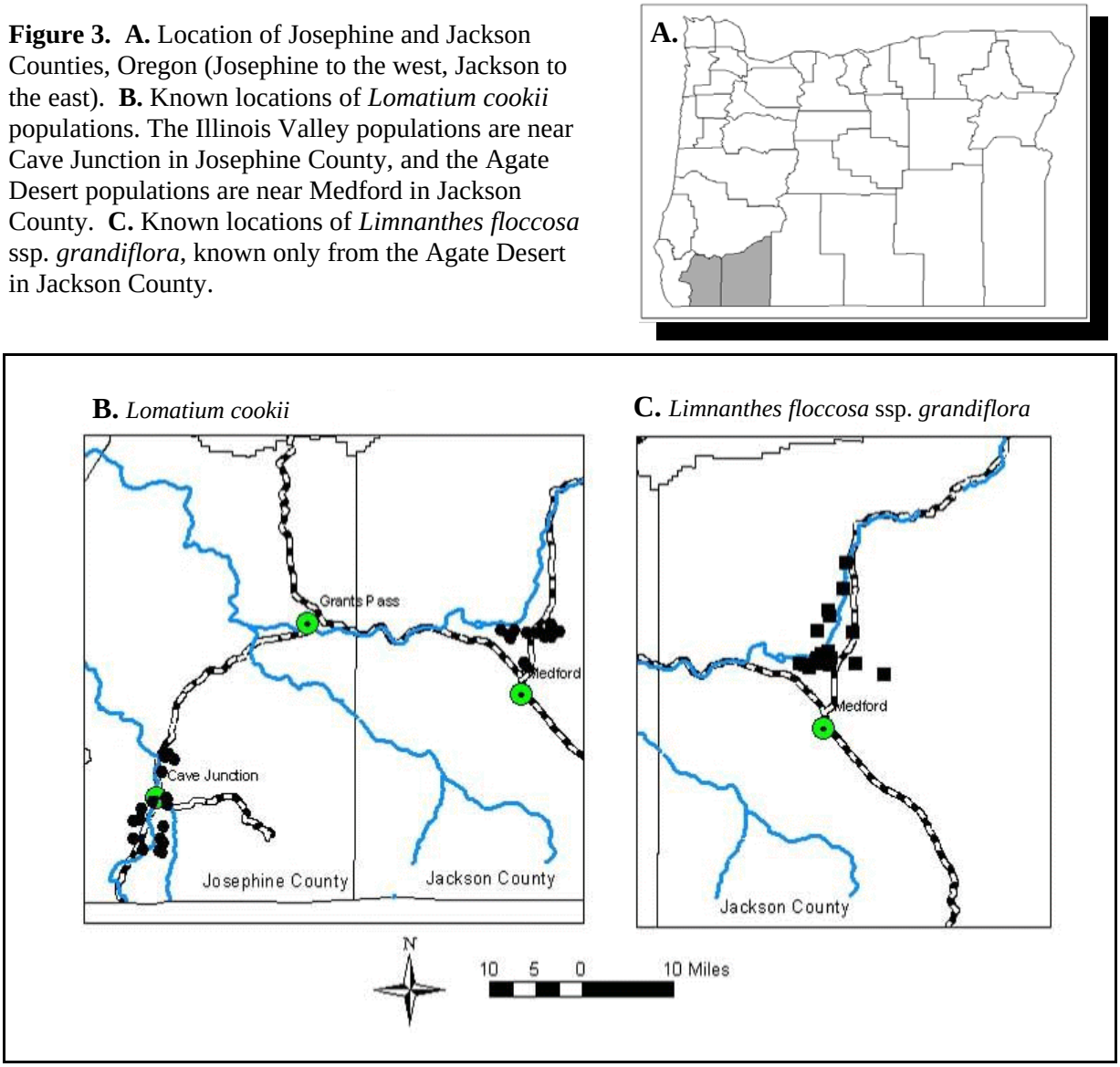

Figure 3. **A.** Location of Josephine and Jackson Counties, Oregon (Josephine to the west, Jackson to the east). **B.** Known locations of *Lomatium cookii* populations. The Illinois Valley populations are near Cave Junction in Josephine County, and the Agate Desert populations are near Medford in Jackson County. **C.** Known locations of *Limnanthes floccosa* ssp. *grandiflora*, known only from the Agate Desert in Jackson County.

Many of the same threats are at work on the *Lomatium cookii* populations in the Illinois Valley, but in addition habitats in this area have been altered by gold mining operations, the uncontrolled use of off road vehicles, certain timber sale activities, inappropriate grazing practices, tree and shrub encroachment as a result of fire suppression, and the potential direct impacts of fireline construction activities. As an example, off road vehicle use is estimated to have destroyed at least 20 percent of the remaining *Lomatium cookii* habitat on federally managed land in the Illinois Valley, and gold mining operations threaten approximately 600 plants at the French Flat site within the Valley (J. Seevers, pers. comm. 1998).

For detailed information on the life histories of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*, their habitat requirements, and the factors contributing to their decline,

the reader is referred to the Determination of Endangered Status for *Lomatium cookii* (Cook's lomatium) and *Limnanthes floccosa* ssp. *grandiflora* (Large-flowered Woolly Meadowfoam) From Southern Oregon; Final Rule (U.S. Fish and Wildlife Service 2002).

Associated Species of Conservation Interest: Several other species of conservation concern share the wetland habitats of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*. The Agate Desert vernal pool complex supports populations of the vernal pool fairy shrimp *(Branchinecta lynchi*), a species listed as threatened under the Act. In addition, several plants that are species of concern (former candidates for listing) may also be found in the vernal pools of the Agate Desert, including *Meconella oregana* (white meconella), *Microseris laciniata* ssp. *detlingii* (Detling's microseris), and *Plagiobothrys figuratus* ssp. *corallicarpus* (coral-seeded allocarya). All of these plants are considered threatened or endangered throughout their range by the Oregon Natural Heritage Program (Oregon Natural Heritage Information Center (ONHIC) 2002). In the wetlands of the Illinois Valley, species of concern that may occur in association with populations of *Lomatium cookii* include *Limnanthes gracilis* (slender meadowfoam), *Calochortus howellii* (Howell's mariposa-lily), *Camassia howellii* (Howell's camassia), *Microseris howellii* (Howell's microseris), and *Senecio herperius* (western senecio).

Historical Range and Population Status: James Kagan (1986) first collected *Lomatium cookii* in 1981 from vernal pools in Jackson County's Agate Desert and subsequently described the species. Additional populations were found at the French Flat site in the Illinois Valley of Josephine County in 1988 (ONHIC 2002). The historical range of *Lomatium cookii* in the Illinois Valley area may have included seasonally wet meadows along the East Fork of the Illinois River in Josephine County, but the geographic extent of this historical coverage is not known. The historical range for *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* in the Agate Desert is believed to have originally encompassed over 130 square kilometers (50 square miles) within an 18 kilometer (11 mile) radius of White City, Oregon (ONHP 1997).

Current Range and Population Status: At present, *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* are estimated to range over a total area of approximately 83 square kilometers (32 square miles) in the Agate Desert region, and *Lomatium cookii* is additionally found within an area of approximately 10 square kilometers (4 square miles) in the Illinois Valley region. Of the plant occurrences originally mapped in the Agate Desert during the 1980's, over 50 percent of *Lomatium cookii* sites and nearly 50 percent of *Limnanthes floccosa* ssp. *grandiflora* sites have been severely altered. The highest quality habitat remaining in the Agate Desert, with intact hydrology but altered vegetation, is now present on approximately 17.6 percent of the area that historically contained vernal pools (ONHP 1999).

There is some considerable degree of variation in plant population numbers between years, fluctuating primarily according to seasonal precipitation levels. In the Agate Desert, existing *Limnanthes floccosa* spp. *grandiflora* plant numbers are relatively stable, and numbers of *Lomatium cookii* are stable to increasing. Extant patches may range from fewer than 100 plants to more than 10,000 individuals. While some populations have shown local increases in

abundance, overall the ranges of both plants have declined by roughly 50 percent in the Agate Desert, and habitat loss or degradation continues to be a significant threat to these species.

Lomatium cookii: *Lomatium cookii* is currently estimated to occur in a total of 84 patches covering some 123 hectares (304 acres). In the Agate Desert, *Lomatium cookii* occurs in 54 patches comprising 58 hectares (143 acres). In the Illinois Valley, *Lomatium cookii* occupies an additional 30 patches comprising 65 hectares (161 acres).

Limnanthes floccosa* ssp. *grandiflora: In the Agate Desert, *Limnanthes floccosa* ssp. *grandiflora* occupies 22 patches comprising 80 hectares (198 acres). *Limnanthes floccosa* ssp. *grandiflora* does not occur in the Illinois Valley.

Land Ownership Pattern: The following estimates represent data provided by the Oregon Natural Heritage Program database (ONHIC 2002). Patches describe all reported population areas, which may or may not have been recently revised depending upon accessibility for inventory and monitoring, especially on private lands.

Federal: In the Illinois Valley there are 15 patches of *Lomatium cookii* on Bureau of Land Management land, comprising 14 hectares (35 acres). There is no Federal ownership of *Limnanthes floccosa* ssp. *grandiflora* or *Lomatium cookii* habitat in the Agate Desert.

Federal/State: Two patches of *Lomatium cookii* overlap both Bureau of Land Management and State lands in the Illinois Valley comprising 1 hectare (2.47 acres).

Federal/Private: Four patches of *Lomatium cookii* overlap both Bureau of Land Management and private lands comprising 40 hectares (99 acres) in the Illinois Valley.

State: Four patches comprising 5 hectares (12 acres) of *Lomatium cookii* occur on State land. *Limnanthes floccosa* ssp. *grandiflora* occupies five patches comprising 6 hectares (15 acres) on State land.

State/Private: *Lomatium cookii* occurs on 10 patches of both State and private lands in the Illinois Valley comprising 5 hectares (12 acres). *Limnanthes floccosa* ssp. *grandiflora* occupies one 30 hectare (74 acre) patch that overlaps both State and private land.

City: At least one patch of *Lomatium cookii* (0.87 hectares (2 acres)) is managed by the city of Medford.

County: Five patches of *Lomatium cookii* comprising 3 hectares (7 acres) are located on county managed lands.

County/Private: One patch of *Lomatium cookii* constituting 5 hectares (12 acres) overlaps both county and private land.

Private: *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* habitat occurs on a multitude of various private lands throughout the Agate Desert and the Illinois Valley not shared with government holdings. The most current information delineates *Lomatium cookii* occurring on 39 patches constituting 45 hectares (111 acres) on private lands. *Limnanthes floccosa* ssp. *grandiflora* occupies 14 patches on private lands, constituting 49 hectares (121 acres) within the Agate Desert.

Within the privately owned patches, a 7-hectare (17-acre) patch of *Lomatium cookii* and two patches of *Limnanthes floccosa* ssp. *grandiflora* habitat, totaling 19 hectares (47 acres), exist on the Agate Desert Preserve owned by The Nature Conservancy, where the land is managed for the protection of these species. The Agate Desert Preserve contains the only large populations on private land specifically managed for the protection of these endangered plants.

Unknown: Three patches of *Lomatium cookii* constituting 9 hectares (22 acres) and two patches of *Limnanthes floccosa* ssp. *grandiflora* constituting 0.53 hectare (1 acre) are on land whose ownership cannot be determined by the most current information.

Listing Factors/Threats:

A. The present or threatened destruction, modification, or curtailment of habitat or range.

The primary cause of a decline in range for *Limnanthes floccosa* ssp. *grandiflora* and *Lomatium cookii* is habitat loss or degradation. The majority of these plants' remaining occupied habitat is threatened by commercial, industrial, and residential development, conversion to agricultural uses, road and utilities construction and maintenance (including herbicide spraying), ill-timed grazing or mowing, competition with introduced plants, mining operations, off-road vehicle use, encroachment of trees and shrubs associated with fire suppression, and random natural events. Any activities that result in altered hydrology, either inundation of the normally shallow vernal pools, or conversely, draining of these pools, will adversely impact the habitat for these species.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

Lomatium cookii has no known commercial, recreational, or scientific use at this time. However, *Limnanthes floccosa* ssp. *grandiflora* may be of interest to collectors and researchers since some members of the genus possess a seed oil with potential for industrial applications. About 80 percent of the remaining patches of *Lomatium cookii* and 40 percent of the extant patches of *Limnanthes floccosa* ssp. *grandiflora* are concentrated in small areas of 2 hectares (5 acres) of land or less. Easy access exists to occurrences of these plants in the Agate Desert, and to *Lomatium cookii* sites near Cave Junction in the Illinois Valley, since they occur near heavily traveled roads. Most sites for these species lack fences, barriers, or appropriate signs to discourage collectors or others from accessing the sites, making the plants vulnerable to collection.

C. Disease or predation.

Poorly managed cattle grazing can have serious deleterious consequences for *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*. Tracts heavily grazed from October to April are less likely to support these taxa, as the majority of plant growth occurs during this time period. Plants grazed during fall, winter, and spring are less likely to survive to produce seed in the spring or early summer (Brock 1987). If properly timed and managed, however, grazing may potentially benefit these species by reducing competition with introduced grasses (D. Borgias, pers. comm. 2002). Preliminary survey results indicate that early fall grazing may be beneficial by reducing the populations of non-native competitors (D. Borgias, *in litt.* 2002).

Although disease (fungus) and herbivory have been identified as potential problems, no data exists to suggest that these factors pose a substantial threat to either species at this point in time.

D. The inadequacy of existing regulatory mechanisms.

Lomatium cookii and *Limnanthes floccosa* ssp. *grandiflora* are listed as endangered species under the State of Oregon Endangered Species Act (Oregon Administrative Rules 603-73-070). In general, State-listed plant populations on private lands are not subject to this law. The law prohibits the "take" of State-listed plants only on State, county, and city-owned or leased lands. However, the State law does not guarantee the protection of State-listed plants on these lands because it allows for the loss of populations if a proposed project or activity is considered to be a public benefit (T. Kaye, pers. comm. 1999).

In accordance with the Clean Water Act of 1977 (91 Statutes At Large 1566; 33 U.S.C. 1251 et seq.), the Agate Desert vernal pools are classified as jurisdictional wetlands. The Clean Water Act does not regulate drainage of wetlands unless that action results in the discharge of dredged or fill material into a wetland. Normal farming, silviculture, and ranching activities do not require permits for discharge or fill activities (see 33 Code of Federal Regulations (C.F.R.) § 323.4), all of which could potentially damage vernal pool habitats. Furthermore, the Nationwide Permit Program (33 C.F.R.§ 330) allows the discharge of fill in non-tidal wetlands up to 0.2 hectare (0.5 acre) in size. Since many of the vernal pools are very small in size, such an activity could have a measurable impact on these systems. A similar problem arises under State of Oregon wetland laws. The Removal-Fill Law of 1989 (Oregon Revised Statutes 196.800-196.990), administered by the Oregon Division of State Lands, does not regulate activities that involve less than 38 cubic meters (50 cubic yards) of fill. Such an amount of fill could seriously impact many smaller vernal pool wetlands in which *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* occur.

When considering compensatory mitigation for activities such as filling of wetlands, it is important to note that vernal pools are highly site specific, and most likely cannot be created, but only restored.

E. Other natural or manmade factors affecting its continued existence.

Herbicide spraying, mowing, grading, and other road maintenance activities threaten small *Lomatium cookii* sites adjacent to roads, on private lands near Cave Junction in the Illinois Valley. In the Agate Desert, *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* individuals in road or powerline rights-of-way could be accidentally destroyed by local public works departments, highway districts, fire departments, or private citizens carrying out maintenance activities (R. Hayden-Owens, pers. comm. 1998).

Fire suppression may affect the species in two ways. First, fire suppression activities may cause trampling of plants or habitat degradation when equipment is mobilized or fire lines are created. Second, the ongoing suppression and exclusion of fire may allow succession of woodland habitats and render formerly open areas unsuitable for growth of *Lomatium cookii* or *Limnanthes floccosa* ssp. *grandiflora* due to the encroachment of trees and shrubs.

The invasion of non-native annual plants in the Agate Desert has altered the native perennial plant communities (Brock 1987). Native bunch grasses on mounds between vernal pools have been replaced by introduced Eurasian herbs and grasses. The dense thatch produced by these introduced annuals prevents the germination of the seeds from *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora.*

Catastrophic events, such as severe fire, could eliminate the large patches of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* located on the Agate Desert Preserve (J. Kagan, pers. comm. 1998). Nine patches of *Lomatium cookii* in the Illinois Valley are vulnerable to demographic extinction because of their small size (fewer than 100 plants). Many of the known Illinois Valley sites are found directly adjacent to roads, increasing the possibility of extirpation.

Conservation Efforts: Through conservation easements and agreements with various parties, protection of the listed species and their habitats are currently being pursued. The Nature Conservancy owns and manages three preserves in the area. The Agate Desert Preserve, the Whetstone Savanna Preserve, and the Rogue River Plains Preserve total 140 hectares (346 acres) in the Agate Desert, of which 102 hectares (252 acres) are vernal pool habitat (D. Borgias, pers. comm. 2002). Within these preserves are one 3-hectare (7-acre) patch of *Lomatium cookii* and two patches of *Limnanthes floccosa* ssp. *grandiflora* comprising 19 hectares (47 acres). The Bureau of Land Management protects 21 patches of *Lomatium cookii* in the Illinois Valley by restricting off road vehicle access, maintaining a long-term population inventory program, and monitoring existing populations. Additionally, we signed a Conservation Agreement with the Bureau of Land Management in early January 2003, which will further enable protection of the species on Federal lands. The Oregon Department of Transportation will protect a population of *Lomatium cookii* near Cave Junction by limiting maintenance activities during the growing season and monitoring the population (K. Cannon, pers. comm. 2002).

Some protection is afforded the populations of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* in the vernal pool complex of the Agate Desert through section 404 of the Clean

Water Act. The U.S. Army Corps of Engineers (Corps) regulates discharge of fill into wetlands under this section, and the Portland District of the Corps has issued General Regulatory Conditions that accompany all nationwide permits. One of these conditions indicates that if at any time the permittee becomes aware of the presence of a listed species within the authorized project area, all work activity must cease immediately, the Corps must be notified, and work must not resume until approved by the Corps.

INTERIM RECOVERY RECOMMENDATIONS

Recovery Goal: The ultimate goal of the recovery effort is to ensure the long-term viability of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* so that these species can be removed from the Federal List of Endangered and Threatened Wildlife and Plants. The interim goal is to secure the species to the point that we may consider downlisting the species from endangered to threatened status.

Recovery Objectives:

1. Protect and stabilize extant populations of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*.

   Threats Addressed: A, E

2. Positively identify and remove or mitigate the threats responsible for population declines and/or range contraction for *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*.

   Threats Addressed: A, B, C, E

3. Research and develop methods for restoration of vernal pool habitats and propagation protocols for *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* sufficient to successfully establish new populations of these species.

   Threats Addressed: A, B, C, D, E

4. Restore populations of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* to levels that allow persistence despite demographic and environmental stochasticity, and that permit natural ecological and evolutionary processes to occur.

   Threats Addressed: A, B, C, D, E

Recovery Strategy: *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* will be conserved by establishing a network of protected, stable, and viable populations (population reserves) distributed throughout their native ranges. To ensure conservation of currently existing genetic variability, and to prevent stochastic and demographic collapse, a minimum number of

individuals in viable population reserves will be protected within designated management units designed to collectively achieve geographic representation of the species across their historic ranges. The strategy for each management unit will include conservation of existing sites, rehabilitation of habitat, restoration of extant historic populations, reestablishment of extirpated populations, and the creation of new population reserves (viable populations within protected areas). The objective is to first stabilize the extant populations, followed by increases in population size and range. Implementation of individual management plans for each management unit will serve to eliminate or control the identified threats to the species. Coordination with city, county, State, and Federal agencies, non-governmental organizations, and private landowners to implement best management practices for *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* will be an important facet of this conservation strategy.

The size of population reserves and the number and distribution of management units that will best ensure the long-term viability of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* will have to be determined for the recovery plan using the best science available. The plan will provide a minimum number of reserve sites for each management unit to be conserved in order to prevent stochastic and demographic collapse. Monitoring and population inventories will provide a means of measuring progress toward recovery goals, assessing the effectiveness of conservation actions implemented, and allow for the adjustment of management actions as needed to achieve recovery of the species.

The habitat of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* in the vernal pool complex of the Agate Desert is shared with another federally listed species, the threatened vernal pool fairy shrimp. Recovery for the vernal pool fairy shrimp is being covered under a separate recovery plan for vernal pool species of California's Central Valley. This species is found primarily in California, but also occurs in Oregon's Agate Desert. As the recovery actions for the vernal pool fairy shrimp in the Agate Desert are likely to overlap to a large degree with those proposed for the conservation of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*, we will coordinate the proposed actions for the two recovery plans.

Preliminary Criteria for Reclassification and/or Delisting: More specific recovery criteria for downlisting to threatened status and for delisting will be developed in the course of the formal recovery planning process and as additional data becomes available for analysis. Preliminary criteria for possible reclassification are presented here, with the understanding that these criteria are subject to change as new information is gathered.

1. **A minimum number of populations of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora* occur at sites protected by conservation measures.** To be considered protected, a site must be owned or managed by a government agency or private conservation organization that identifies the maintenance of the species as the primary management objective for the site. Alternatively, the site may be protected by a permanent conservation easement that commits present and future landowners to the conservation of the species. The minimum number required will be determined during

the recovery planning process, as will the distribution of these populations across management units.

2. **A minimum number of reserves supports self-sustaining populations in each management unit and is provided with a spatial buffer that allows room for population migration and expansion over time.** For the two species, at least 30 percent of the occupied habitat in each management unit must have reproductive plants, seedling recruitment and establishment for any 3 consecutive years. A minimum size for each reserve will need to be determined though research and monitoring.

3. ***Lomatium cookii*** **and** ***Limnanthes floccosa*** **ssp.** ***grandiflora*** **have had stable or increasing populations in each management unit for a period of 10 years.** A stable plant population is defined for purposes of this recovery outline as having less than a 33 percent decrease during the 10-year period as determined by a standardized monitoring program.

4. **Site-specific habitat management plans have been developed and implemented for each management unit**. These management plans have been specifically formulated to reduce and control the threats to the species and maintain favorable habitat characteristics that promote conditions suitable for establishment, recruitment, pollination and dispersal of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora.* Monitoring is implemented and used to ensure effectiveness of conservation management practices.

5. **A post-delisting monitoring program has been developed and implemented for each species.** A subset of the standardized monitoring program implemented during the recovery phase is continued to ensure the effectiveness of management practices and to verify the persistence of the species under the desired conditions.

ANTICIPATED RECOVERY ACTIONS

1. Actions to protect habitat.

- 1.1 Establish conservation easements, agreements, or formation of management plans through private landowners, Federal agencies, or city, county, or State governments to manage patches of *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*. Management plans must address the identified threats to the persistence of the species.
- 1.2 Coordinate with The Nature Conservancy to add lands to existing preserves.
- 1.3 Coordinate with utility companies to lessen impacts of utility maintenance activities.
- 1.4 Coordinate with Federal agencies to protect populations from off road vehicle use and mitigate impacts of gold mining operations in the Illinois Valley.

1.5 Coordinate with the Sacramento Fish and Wildlife Office on recovery actions identified in the vernal pool fairy shrimp recovery plan for the Agate Desert vernal pool complex.

2. Population surveys and monitoring. An on-going long term monitoring plan is being conducted in the Illinois Valley on Bureau of Land Management lands and in the Agate Desert on The Nature Conservancy lands. A local government habitat conservation plan is being assembled in the Agate Desert area that will have a monitoring plan.

2.1 Conduct an outreach program to facilitate access on private lands for surveys.

2.2 Use present Bureau of Land Management and The Nature Conservancy monitoring programs to develop and expand a standardized monitoring protocol for all management units.

3. Conduct research essential to the conservation of these species. In addition to or in conjunction with current monitoring and research efforts, provide opportunities for further research with schools, State offices, or private endeavors. The following are areas of important research needed for effective management of these species:

3.1 Determine minimum viable population size and area boundaries of management units for both *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*.

a. Research genetic and morphologic traits among individuals and populations.
b. Study pollination vectors between and among populations.
c. Investigate role of mammals, insects, birds, and wind as seed dispersal vectors.

3.2 Conduct research on appropriate grazing practices, prescribed burning, or mechanical methods for controlling thatch build-up from introduced annual grasses.

3.3 Conduct research on community habitat criteria. Determine distribution of plants and the local plant associations, microgeographic locations, hydrology, and elevations that the species prefer or will best tolerate.

3.4 Develop offsite cultivation and propagation techniques for *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*.

4. Restore vernal pool habitats and reestablish populations.

4.1 Identify areas of historically occupied habitat with favorable potential for restoration and management for the two species.

4.2 Investigate restoration and recovery of historic or current plant populations that were subject to biosolids, fill, and log debris application.

5. Secure seed source at offsite locations and nurseries through land leases, partnerships, or agreements.

5.1 Identify appropriate seed collection sites with the permission and cooperation of private landowners.

5.2 Organize seed collection activities in conjunction with nurseries, schools, conservation groups, or private consultants.

6. Establish management units for focused conservation efforts.

6.1 Create Geographic Information Systems (GIS) spatial data files identifying currently occupied habitat patches for *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*.

6.2 Define management units using watershed boundaries or other biological criteria that will maintain stable and viable populations and achieve adequate geographic distribution and representation of the species.

7. Outreach to private landowners. Through schools, local community meetings, county, city, and State fairs, or other venues, establish contacts with private landowners to provide information about *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*.

7.1 Create and distribute plant identification guides for *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*.

7.2 Create and distribute guides for good management practices and habitat restoration opportunities for the species.

8. Coordination with Federal agencies. Section 7(a) of the Act requires Federal agencies to ensure that any activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or adversely modify its critical habitat (if designated). If a Federal agency action may affect a listed species or its critical habitat, the responsible agency must enter into consultation with us.

8.1 Consult with Federal agencies on activities potentially affecting *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*. Agencies identified for potential consultations on these species include, but are not limited to: the Bureau of Land Management, the Corps, the Federal Highway Administration, the Department of Housing and Urban Development, the Federal Avian Administration, the Natural Resources Conservation Service, and the Farm Services Agency of the U.S. Department of Agriculture.

9. Stakeholder involvement. We will seek to involve stakeholders in the recovery planning process. Stakeholders are those parties that may be affected by proposed recovery actions, and may include, but are not limited to, Federal and State agencies, Tribal governments, county and city governments, non-governmental organizations, and private landowners.

9.1 Identify key stakeholders with potential interest in recovery planning for *Lomatium cookii* and *Limnanthes floccosa* ssp. *grandiflora*.

9.2 Prepare and implement an outreach strategy for enlisting stakeholder involvement in the development of the recovery plan.

RECOVERY PLANNING ACTIONS AND TIMELINE

1. Develop Recovery Plan: The Roseburg Field Office staff will explore options for the development of a draft recovery plan. The possibilities include completing a draft recovery plan with our staff or contracting the writing of the draft recovery plan. Potential contributors could include the State of Oregon and private consulting or conservation groups.

2. Appoint Recovery Team: This is a consideration in the interim period. The Roseburg staff will explore the option of organizing participants to oversee the development of the recovery plan. Participants could include the Medford Bureau of Land Management, the State of Oregon, The Nature Conservancy, researchers, and other private groups who are currently involved or interested in conservation and recovery efforts for these species.

3. Timeline: A draft recovery plan will be submitted to the regional office by December 2004.

Approval: Don Gotten 6/12/03

Regional Director, Region 1
U.S. Fish and Wildlife Service

Date

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