BYRON CONSERVATION BANK
LAND MANAGEMENT PLAN
ALAMEDA COUNTY, CA

Submitted to:

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1.0 INTRODUCTION

The California Department of General Services (DGS) has acquired the Byron Conservation Bank in order to mitigate adverse impacts to special-status wildlife resulting from development and construction activities at other parcels in the vicinity.

The primary impetus for the acquisition of the property was to mitigate for impacts associated with development of the Agnews West Campus development in Santa Clara in Santa Clara County. Under a Mitigation Agreement between DGS and the California Department of Fish and Game (CDFG), 19.5 acres of land were purchased to provide habitat for the western burrowing owl (*Athena (=Speotyto) cunicularia hypugea*), a CDFG Species of Special Concern. The remainder of the site will be made available as mitigation for anticipated development and construction projects in biologically sensitive areas. Details of the terms and conditions of the Conservation Bank are described in an Implementing Agreement between CDFG and DGS.

A burrowing owl survey and habitat assessment identified approximately 132 acres of appropriate burrowing owl habitat at the Mitigation Bank parcel, as well as potential habitat for the San Joaquin kit fox (*Vulpes macrotis mutica*), a state-threatened and federally-endangered species (Biosearch Wildlife Surveys 1998c). Subsequent focused surveys documented the presence of the California red-legged frog (*Rana aurora draytonii*), a federally threatened species, the California tiger salamander (*Ambystoma californiense*), a federal candidate and state Species of Special Concern, and the Western pond turtle (*Clemmys marmorata*), a state Species of Special Concern (Biosearch Wildlife Surveys 1999). Several other special-status species have also been observed on the parcel, including golden eagle (*Aquila chrysaetos*), white-tailed kite (*Elanus leucurus*), northern harrier (*Circus cyaneus*), ferruginous hawk (*Buteo regalis*) and loggerhead shrike (*Lanius ludovicianus*) (Biosearch Wildlife Surveys 1998c; 1999).

The property will be dedicated to CDFG on behalf of DGS through a Transfer of Control and Possession (TCP). This Management Plan is a requirement of a Management Agreement between the DGS and the CDFG. An endowment will be established to provide funding for the long-term conservation and management of the Mitigation Bank.

2.0 PROPERTY DESCRIPTION

2.1 Geographical Setting

The Byron Mitigation Bank is situated at the western edge of the San Joaquin Valley at the base of the northern Diablo Range (Figure 1). It is in the northeast corner of Alameda County five miles SSE of the town of Byron (Clifton Court Forebay Quad; T1S; R3E; SE ¼ Section 35). The subject parcel covers approximately 140 acres and is bordered by Bruns Avenue on the east and by Kelso Road on portions of the south and west (Figure 2). Access to the site is via either Bruns Road or Kelso Road, which both intersect County Road J-4 (Byron-Bethany Highway).

2.2 Adjacent Land Uses

All adjacent surrounding lands are privately owned. Lands to the south, southwest, and southeast are used to graze cattle (Figure 3). Horses are grazed on the pasture to the north. A PG&E Compression Station is present across Bruns Road to the east and the Delta Pumping Plant is situated at the end of Kelso Road to the northwest. Lands surrounding the pumping plant are ungrazed. Two residences are situated along the southern border of the parcel. Bethany Reservoir is located 1½ miles to the south. Extensive open space is present surrounding the reservoir. Lands further to the south and west in the hills are currently used for grazing and wind energy production while lands further to the east on the floor of the San Joaquin Valley have been largely converted to row crops. Several canals are present in the vicinity of the parcel, including the California Aqueduct, Delta-Mendota Canal and 70 Canal.

The Byron Airport is situated 1½ miles to the northwest of the parcel. A Habitat Management Area of approximately 800 acres has been set aside in a conservation easement with CDFG to offset impact associated with expansion of the airport in the early 1990's.

2.3 Geology, Soils, Climate and Hydrology

Two low ridges cross the parcel from southwest to northeast. The steepest slopes, above the drainage courses in the western part of the site, are approximately 10% grade. The northeast corner of the site is generally flat and slopes towards the east. Elevations on the site range from 80 feet along Bruns Road to 160 feet along the central ridge.

Two drainage courses, one of which roughly bisects the site and one of which flows along a portion of the western edge, cross the site flowing from southwest to northeast. Both drainages have been impounded into a series of permanent ponds (Figures 2 and 3). Both of the drainage basins are impounded upstream by Bethany Reservoir, but continue to receive seepage year-round. The central drainage contains eight ponds and the western drainage contains five ponds. All the ponds have a deep layer of sediment. A seasonal impoundment is present near the southeastern corner of the site (Pond 8). In 1999, the pond held water into mid-summer, while in 2000, it dried in late spring.

The Byron Mitigation Bank property is dominated by the Linne Clay Loam soil mapping unit with low slopes, which is characterized by reduced productivity and elevated alkalinity.

The area is semi-arid, and sits in the rain-shadow presented by the Diablo Range to the west. Average annual precipitation is 11.8 inches, with the majority of this amount falling between November and March (Table 1). Summers are hot and dry, with normal maximum temperatures over 90 degrees in July and August. Winters are mild, and temperatures are rarely below freezing.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Min Temp (°F)	36.7	40.7	44.0	47.0	52.4	57.0	60.2	60.2	57.6	51.8	43.4	37.2	49.0
Max Temp (°F)	53.7	61.2	65.5	71.3	79.0	86.1	92.1	91.1	86.4	77.8	63.7	53.8	73.5
Daily Temp (°F)	45.2	51.0	54.8	59.2	65.7	71.6	76.2	75.7	72.1	64.8	53.6	45.5	61.3
Precipitation (in.)	2.38	1.92	1.71	0.80	0.22	0.14	0.05	0.10	0.26	0.67	1.88	1.72	11.85

Table 1. Average climate conditions (1961-1990) for Tracy Pumping Plant, 1.5 miles east of the Byron Conservation Bank. (Source: National Weather Service).

2.4 Cultural Features

A warehouse is situated in the southeastern corner. A fence surrounding the warehouse excludes cattle. A metal pole transmission line and a wood pole transmission line cross the site and two underground pipelines pass across the site. Four gates are present – two off of Bruns Road, one off of Kelso Road and one along the northern border of the site. An area in the southwestern portion of the site was used for exploratory drilling for minerals (Jess, pers. comm.) Numerous roads have been graded on the site during the previous owners' attempts to find other uses for the parcel, including as a vineyard (Jess, pers. comm.). A survey for archeological resources on the site has not been conducted.

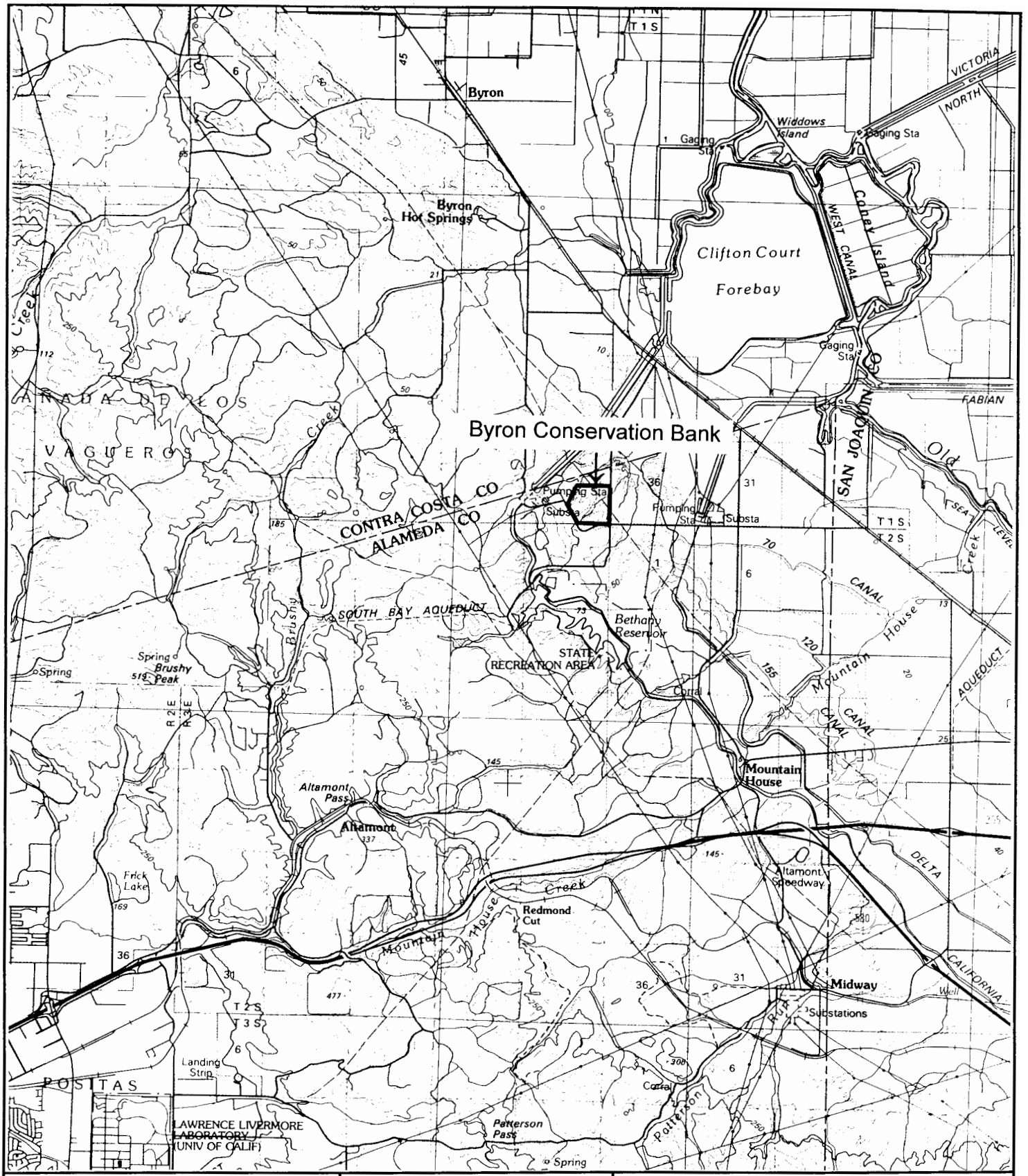

Figure 1. Vicinity Map of Byron Conservation Bank

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Scale in Miles

0 1 2 3 4

Source: USGS Stockton 1:100,000 Scale

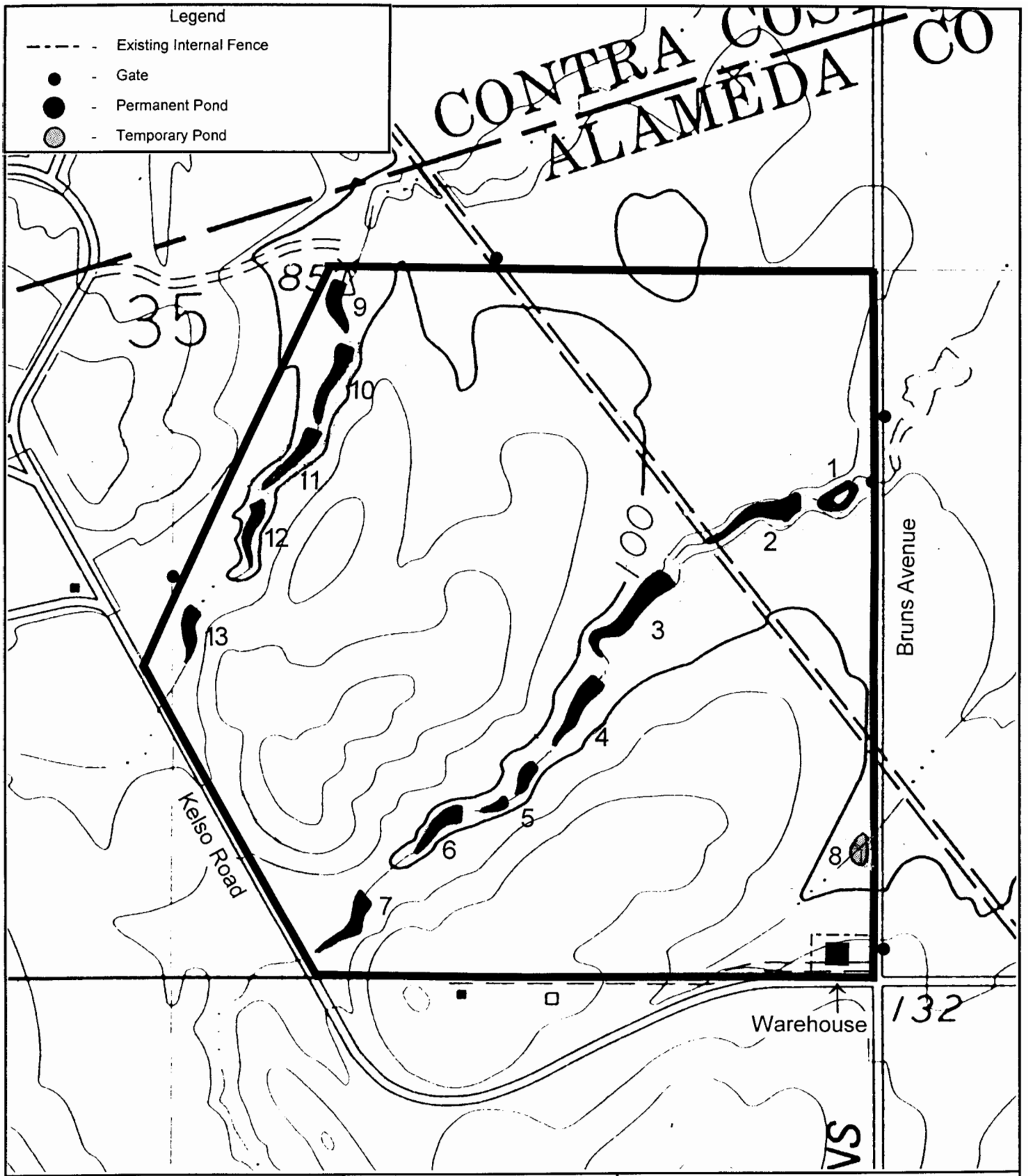

Figure 2. Byron Conservation Bank Boundaries and Features

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Scale in Miles
0 1/8 1/4

Source: Clifton Court Forebay USGS Quad

Figure 3. Byron Conservation Bank. From aerial photograph taken August 18, 1996 (Pacific Aerial Surveys).

3.0 HABITAT AND SPECIES DESCRIPTION

3.1 Vegetation Communities

The primary vegetation community on the site is annual grassland. This habitat type is referred to as Non-native Grassland by Holland (1986) and the Natural Diversity Data Base. The grassland on the site is typical of the region and is dominated by annual grasses and forbs, many of which are introduced and naturalized from the Mediterranean region of Europe. The dominant grasses include *Bromus* spp. and *Poa* spp., while the common forbs include *Erodium* spp., *Eremocarpus* spp., *Eriogonum* spp., and *Lupinus* spp. The lower-lying portions of the site are dominated by herbaceous species adapted to alkaline soils, primarily *Distichilis* spp.

Emergent freshwater marsh habitat is present in the drainage basins. The dominant species include *Typha* spp. and *Scirpus* spp. The emergent vegetation in most areas has been kept in check by cattle grazing, and is only abundant in those portions of the ponds and creeks that are inaccessible to cattle.

All habitats on the site have been altered by decades of heavy grazing, and there is no woody vegetation present, with the exception of a row of cypress trees near the warehouse and a few coyote brush growing near the northeast corner, both in areas inaccessible to cattle.

3.2 Wildlife

The site is situated in a transition between the San Joaquin Valley and the foothills of the Diablo Range, and its wildlife assemblage reflects that of both regions. Common breeding birds include Western meadowlark (*Sturnella neglecta*), mourning dove (*Zenaida macroura*), and red-winged blackbird (*Agelaius phoeniceus*). Common wintering birds include savannah sparrow (*Passerculus sandwichensis*), American pipit (*Anthus rubescens*) and several species of raptors. Mammals typical of the area include black-tailed jackrabbit (*Lepus americanus*), Audubon's cottontail (*Sylvilagus audubonii*), striped skunk (*Mephitis mephitis*) and coyote (*Canis latrans*). Common reptiles include Western fence lizard (*Sceloporus occidentalis*) and gopher snake (*Pituophis melanoleucus*), while the most common amphibian is the Pacific tree frog (*Hyla regilla*).

3.3 Special-Status Species

3.3.1 Western burrowing owl (*Athena (=Speotyto) cunicularia hypugea*)

Natural History. The western burrowing owl is a resident of the grassland and scrub communities of the western United States and Canada. The species occupies burrows excavated by other species, which in the region include California ground squirrel (*Spermophilus beecheyi*) and American badger (*Taxidea taxus*). These burrows are used for nesting and escape from predators. Burrowing owls will also use manmade cover-sites such as culverts and artificial dens, particularly when natural cover-sites are uncommon (CBOC 1993, 1997; Trulio 1997). Burrowing owls prefer areas with no trees,

minimal shrub cover and short grass height, including non-native grasslands grazed by livestock (Plumpton and Lutz 1993). The species shows strong site fidelity from year to year, often returning to the same burrows to nest (Feeney 1992; Plumpton and Lutz 1993). It is active both at night and during the day, hunting a variety of small prey including insects, mammals, birds and reptiles (Haug, *et al.* 1993). Habitat conversion and secondary poisoning resulting from ground squirrel control efforts have caused declines throughout much of its range, particularly in the Bay Area (DeSante and Ruhlen 1995). Although there is evidence supporting generic status for *Speotyto*, it has been merged with the genus *Athena* (AOU 1998). The western subspecies *A. c. hypugea* is listed as a state Species of Special Concern, while the species as a whole is a federal Special Concern Species.

Regional Observations. Numerous observations of burrowing owls have been made in the vicinity of the parcel. Two pairs of burrowing owls were observed along Kelso Road approximately one mile north of the site in 1998 (Biosearch Wildlife Surveys 1998b). A colony of eight pairs of burrowing owls was observed just south of Byron Airport Habitat Management Lands in 1994, one mile NW of the site (Biosearch Wildlife Surveys, 1995). Surveys for burrowing owls on the 714-acre Byron Airport Habitat Management Lands between northwest of the parcel conducted in 1994, 1996 and 1998 detected ten, four and seven pairs of owls, respectively (Biosearch Wildlife Surveys 1999b). Burrowing owls were observed at the parcels immediately south and southeast in 1998 (Biosearch Wildlife Surveys 1998c). Burrowing owls were observed and subsequently relocated from a pipeline route 2.5 miles southeast of the parcel in 1993 (NDDB). A burrowing owl was observed during the nesting season 3.5 miles southeast of the parcel in 1992 (NDDB). Burrowing owls were observed approximately 3.5 miles west of the site in 1990 (CCWD 1993).

Survey Results. Active burrowing owl burrows were observed on the Byron Conservation Bank between 1992 and 1994 (NDDB). A complete ground survey and habitat assessment of the site was conducted in October 1998 (Biosearch Wildlife Surveys 1998c). Ten burrowing owls were observed on the site at this time. Four were seen in the northeastern part of the site, three were observed near the old quarry in the southwestern portion, two individuals were seen in the main drainage course, and a single individual was observed in the northwestern portion of the site. Twenty-four burrows showing evidence of burrowing owl occupation (pellets, feathers, whitewash) were identified. These burrows are fairly well distributed throughout the site. California ground squirrels were abundant across most of the site. A total of 1,993 ground squirrel burrows were tallied, for an average of 14.2 burrows/acre.

3.3.2 California red-legged frog (*Rana aurora draytonii*)

Natural History. The California red-legged frog is the largest native frog in California and can reach a body length of 5½". It historically occupied many of the Pacific drainage basins in California, but has been eliminated from 70-75% of its range (Jennings & Hayes 1994; Miller, *et al.* 1996). The species requires still or slow-moving water during the breeding season, where it deposits large egg masses, usually attached to submergent

or emergent vegetation. Breeding typically occurs between December and April, depending on annual environmental conditions. Eggs require 6 to 12 days before hatching and metamorphosis occurs 3.5 to 7 months after hatching (Stebbins 1985), normally between July and September. Radio-telemetry data indicates that during the breeding season, adults engage in straight-line movements irrespective of riparian corridors, and may move up to two miles between non-breeding and breeding sites (Bulger 1999). They may take refuge in small mammal burrows, leaf litter or other moist areas in order to avoid dessication (Rathbun, *et al.* 1993; Jennings and Hayes 1994). California red-legged frogs may move up to 300 feet from aquatic habitats into surrounding uplands, especially following rains, when individuals may spend days or weeks in upland habitats (Bulger 1999). During the non-breeding season, a wider variety of aquatic habitats are used, including small pools in coastal streams (Bulger 1999). Occurrence of this frog has shown to be negatively correlated with presence of introduced bullfrogs (Moyle 1973; Hayes & Jennings 1986, 1988), although both species may be able to persist at certain locations. On 23 May 1996, the California red-legged frog was listed as Threatened under the federal Endangered Species Act (USFWS 1973; Miller, *et. al.* 1996).

Regional Observations. California red-legged frogs are known from numerous localities to the north, west and south of the property, and observations have been recorded over the past 20 years. Red-legged frogs are known from the Brushy Creek, Mountain House and Kellogg Creek watersheds and can be found in stock ponds and slow-moving creeks throughout much of the region (Jones & Stokes 1990; Stromberg 1994; NDDB). In 1982, California red-legged frogs were recorded near Christensen Road, 0.7 miles S of the site. In 1997, the species was documented near the end of Byron Hot Springs Road, 0.7 miles W of the site, and along Christensen Road near the California Aqueduct, 0.8 miles SW of the site (NDDB). This latter record is further upstream one of the drainage courses that cross the subject property. The species has been observed in numerous localitites at the Byron Airport Habitat Management Lands between 1 and 3 miles to the northwest (Biosearch Wildlife Surveys 1997).

Survey Results. A focused survey for California red-legged frogs was conducted on the site in June 1999 (Biosearch Wildlife Surveys 1999a). California red-legged frog adults were observed in twelve ponds on the parcel during two diurnal and two nocturnal surveys. A high number of 99 red-legged frogs were observed on 22 June 1999. An estimated 60-75% of these individuals were considered to be of reproductive age based on size (greater than or equal to approximately 80mm, snout-vent length). A single adult bullfrog (*Rana catesbeiana*) was observed at Pond 9 on 22 June. Aquatic sampling was performed at twelve of the fourteen ponds in June 1999 (Biosearch Wildlife Surveys 1999a). Ponds 7 and 12 are filled with sediment, and are not currently deep enough to allow for development of red-legged frog tadpoles. Red-legged frog tadpoles were captured in six ponds (Ponds 1, 2, 3, 5a, 10 and 11). All tadpoles appeared healthy, and within the expected range of development for the time of year. Pacific tree frog (*Hyla regilla*) tadpoles were present in all permanent ponds.

3.3.3 California tiger salamander (*Ambystoma californiense*)

Natural History. The California tiger salamander inhabits grassland and oak savanna habitats in the valleys and low hills of central and coastal California. Adults spend most of their lives underground, typically in burrows of ground squirrels and other burrowing mammals. During winter rains between November and March, adults emerge from underground retreats to breed (Jennings & Hayes 1994; Loredo and Van Vuren 1996). Vernal pool and semi-permanent, quiet waters provide sites for egg-laying. After hatching in two to three weeks, larvae are 10-15 mm in length. They continue to develop in the pools for three to four months until they metamorphose at about 100-125mm (50-70mm snout-vent length). Annual recruitment is variable and appears to be related to the timing and amount of rainfall (Loredo and Van Vuren 1996). Following transformation, juvenile salamanders seek refugia in which they may remain until the next winter rains (Stebbins 1985; Jennings 1996). However, movements of juveniles are unpredictable and mass migrations have been observed in the summer months and during the first fall rains (Holland et al. 1990). Habitat conversion has eliminated the species from much of its former range (Shaffer *et al.* 1993; Fisher and Shaffer 1996). The California tiger salamander is currently listed as a federal Candidate species following a ruling by the USFWS (Sorensen 1994), which found Endangered status "warranted but precluded" by higher priority species. It is also listed as a Species of Special Concern by CDFG and is listed as a Protected Species under the California Code of Regulations.

Regional Observations. California tiger salamanders have been recorded in several locations to the north, west and south of the property. California tiger salamanders are known from the Brushy Creek, Mountain House and Kellogg Creek watersheds, and can be found in stock ponds and vernal pools throughout much of the region (Jones & Stokes 1990; NDDB). In 1981, an adult tiger salamander was seen on the adjacent parcel just west of Bruns Avenue (NDDB). In 1982, juvenile tiger salamanders were observed at a stock pond near the California Aqueduct 0.8 miles north of the parcel (NDDB). In 1986, tiger salamander larvae were observed at two locations near the intersection of Christensen Road and Bruns Avenue, one mile south of the parcel (NDDB). The species breeds in numerous localities at the Byron Airport Habitat Management Lands, including in several artificial ponds (Stromberg 1997).

Survey Results. Aquatic surveys for California tiger salamander larvae were conducted in June 1999 (Biosearch Wildlife Surveys 1999a). California tiger salamander larvae were captured in a single pond on the parcel (Pond 8). This is the only man-made pond onsite that dries during the summer on the site. All tiger salamander larvae appeared healthy and within the expected stage of development for the time of year. The abundance of California ground squirrel burrows on the site makes it likely that tiger salamanders aestivate on the site.

3.3.4 Western pond turtle (*Clemmys marmorata*)

Natural History. The Western pond turtle ranges from western Washington to northern Baja California, mostly west of the Sierra Nevada-Cascade crest (Stebbins 1985). It can

reach a length of just over 8 inches (21cm) with a low carapace that is generally olive, brownish or blackish (Stebbins 1985; Jennings and Hayes 1994). It primarily inhabits permanent water sources including ponds, streams and rivers. It is often seen basking on logs, mud banks or mats of vegetation. Pond turtles can move across terrestrial habitats in response to fluctuating water level, an apparent adaptation to the variable rainfall and unpredictable flows that occur in many coastal California drainage basins (Rathbun, *et al.* 1992). In addition, it can over-winter on land or in water or remain active in the winter, depending on environmental conditions (Rathbun, *et al.* 1993; Jennings and Hayes 1994). Females travel from aquatic sites into open, grassy areas to lay eggs in shallow nests (Holland 1992; Rathbun, *et al.* 1992). Nests have been reported from 2-400 meters or more away from water bodies (Jennings and Hayes 1994). It appears that most hatchlings over-winter in the nest (Holland 1992; Jennings and Hayes 1994). Pond turtles may live for 40 years or more (Jennings and Hayes 1994), and are therefore able to persist in certain degraded areas even without successful reproduction. The western pond turtle has been separated into two subspecies (*C. m. marmorata* is the northwestern subspecies and *C. m. pallida* is the southwestern subspecies), both of which are listed as Species of Special Concern by the CDFG. Current research suggests, however, that the taxon may be represented by three distinct populations throughout its range in California and may therefore require a taxonomic revision (Jennings and Hayes 1994).

Regional Observations. Western pond turtles are known from scattered localities in the Brushy Creek, Mountain House and Kellogg Creek watersheds (Jones & Stokes 1990; NDDB). In March 1996, four adult pond turtles were observed in a pond 0.5 miles to the northeast on the Barnet mitigation parcel, along the same drainage that crosses the study site (Laabs, pers. obs.).

Survey Results. Visual surveys were conducted for Western pond turtles on two occasions on the site in June 1999 (Biosearch Wildlife Surveys 1999a). Western pond turtles were observed in six of the permanent ponds onsite (Ponds 1, 2, 3, 5a, 6 and 11). A high number of ten pond turtles were observed. All individuals except one were adults (>140 mm). A single juvenile turtle was observed in Pond 1, indicating that the species breeds in the area.

3.3.5 San Joaquin kit fox (*Vulpes macrotis mutica*)

Natural History. The San Joaquin kit fox is a small canid (1.7-2.5 kg) that occupies open habitats such as grassland, saltbush scrub and oak savannah. It was historically widely distributed throughout the San Joaquin Valley and adjacent foothills. Population declines are largely attributable to conversion of native habitats for commercial agricultural that began in the late 1800's and has accelerated to the present time. More recently, oil and gas production, urbanization and mineral development have contributed to significant habitat loss (Jensen 1972; O'Farrell 1983). The subspecies is listed as federally Endangered and as Threatened by CDFG.

The habitat requirements of northern San Joaquin kit fox populations differ from populations residing in the south (Orloff et al. 1986). Essential elements are similar

between the two areas, however, and center on availability of den sites and prey. Kit fox in the vicinity of Byron depend largely on dens dug by other species, notably California ground squirrel and American badger. Kit fox in the project area feed primarily on California ground squirrels, as well as other small mammals, birds and insects (Hall 1983). The presence of predators such as coyote (*Canis latrans*) may affect kit fox abundance (Ralls 1989). The effects of introduced red fox are not clear, although it is possible the two species compete for prey and den sites.

Regional Observations. San Joaquin kit fox have been observed periodically in the vicinity of the Byron Conservation Bank over the past 25 years. Swick (1973) compiled observations of the species in eastern Alameda and Contra Costa Counties in an attempt to delineate the northern range of the species. Five of these locations are within two miles of the parcel. A radio-telemetry study of eight kit foxes was conducted in the Bethany Reservoir area in the early 1980s (Hall 1983), between ½ and 3 miles to the south of the parcel. In 1987, a radio-collared female was observed with two to three pups ½ mile northwest of the parcel. Presumably the female had been collared as a pup during Hall's study (NDDB). A kit fox was observed on the parcel immediately adjacent to the north in 1987 and on the parcel immediately adjacent to the east in 1992 (Bell 1994). In 1993, a kit fox was sighted approximately one mile north during surveys along a PGT/PGE pipeline (Barclay, pers. comm.).

Survey Results. A complete ground survey of the site was conducted in June 1998 (Biosearch Wildlife Surveys 1998c). Numerous potential San Joaquin kit fox burrows were observed on the site at his time. Fox-sized scat was observed at the entrance to one of these burrows, indicating possible recent used of the parcel by the species. Focused surveys for the kit fox were not conducted.

3.3.6 Other special-status species

Several other special-status species have been observed on the Byron Mitigation Bank. American badgers (*Taxidea taxus*) are present on the site, based on the presence of recent diggings and fresh burrows. A white-tailed kite (*Elanus leucurus*) and a northern harrier (*Circus cyaneus*) were observed on 29 October 1998. An immature golden eagle (*Aquila chrysaetos*) was found dead near the southwestern corner of the site on 29 October 1998. Loggerhead shrikes (*Lanius ludovicianus*) were present on 1 June, 16 June and 15 December 1999. Two ferruginous hawks (*Buteo regalis*) were observed over the site on 15 December 1999.

4.0 MANAGEMENT GOALS

4.1 Biological Elements

The primary goal of the management strategy is to maintain and enhance habitat quality for special-status wildlife – specifically burrowing owls, but also California red-legged frogs, California tiger salamanders, Western pond turtles, San Joaquin kit fox, and special-status raptors.

This objective will be accomplished through management of both upland and aquatic habitats, as detailed in Section 5.0. Upland management will include a flexible grazing management plan. Other management elements may include exotic species control, pond maintenance, and exclusion of grazing from portions of the parcel.

Regular monitoring of resident special-status species, forage production and utilization, and the integrity of physical structures on the site are recommended to identify potential problems and formulate appropriate management actions.

4.2 Public Use Elements

A secondary objective of the management strategy is to allow for educational use of the mitigation area and for research opportunities regarding resident special-status species. However, such uses must be subordinate to the primary goal of providing and enhancing habitat for special-status species, and there may be certain research activities that are not compatible with that goal. A review process is therefore recommended to ensure that the primary management goal is met.

4.2.1 Warehouse/Utility Building

CDFG has accepted the warehouse/utility building at the southeastern corner of the site and has further agreed to cooperate with third parties to make the building available for educational purposes. Potential uses include interpretive displays to highlight the natural history of the resident and wintering specials-status species and research facilities to house equipment for research projects ongoing on the site.

4.2.2 Research Opportunities

The presence of numerous listed species and species of concern on the site provides an opportunity for research regarding their natural history, behavior and habitat requirements. Such information could be useful in conservation efforts elsewhere in the region. At the same time, the sensitivity of the resident special-status species requires that care be taken in the design and execution of any research project. The timing and intrusiveness of each project must be balanced against the value of the information to be gained. Also, there must be a limit on the number of projects on-going at any one time.

A review process should be established for all proposed research projects. Research proposals should be reviewed by CDFG staff biologists. CDFG staff should take into careful consideration the proposed methods and the hypothesis of each project. If the hypothesis is unclear, or if it does not provide a meaningful addition to the knowledge of the species, the project should not be approved. If the methods involve habitat manipulation, these should be compared with the overall management goals to ensure that they are consistent. If research proposals provide a clear hypothesis that will add to the body of knowledge concerning resident or wintering special-status species, the proposal should be reviewed with respect to research projects that have already been approved. If the project would interfere with the results of ongoing projects, it should not be approved.

Researchers must secure all appropriate permits from both CDFG and USFWS to conduct research activities on special-status species on the site.

5.0 OPERATIONS AND MAINTENANCE

5.1 Prioritization of Management Elements

Funding for the management of the Byron Conservation Bank will come in part from an endowment created for the project by DGS. In the future, additional funding for site management and enhancement may be secured (Wilson, pers. comm.). Some management actions must be carried out immediately to maintain habitat suitability for special-status species, while others should be carried out if funds become available. Certain annual monitoring activities are essential to determining the success of the management plan, while others would be useful if additional funding became available. And finally, other actions are recommended to enhance special-status species habitat, but are not immediate management needs. Therefor, management elements are prioritized below in terms of their importance in meeting the overall management goals. Details for each management element are provided in Sections 5.2 – 5.4.

Essential Management Elements
- Grazing Management Plan
- Annual Monitoring

Habitat Enhancement Opportunities
- Dam Improvements
- Fencing of Ponds
- Sediment Removal
- Exotic Wildlife Control
- Exotic Plant Control
- Special-Status Species Monitoring

5.2 Essential Management Elements

5.2.1 Grazing Management Plan

By far the most important element of the management strategy is the Grazing Management Plan. The site was not grazed in late winter and spring of 2000 during the period of transition of the land from private ownership to state control. Although the site is not expected to suffer from a break in the grazing regimen, it is imperative that grazing resume in 2001. Maintaining lowered grass height is essential to provide appropriate habitat conditions for the burrowing owl and other resident species. The Grazing Management Plan is attached as Appendix A.

The primary management tool will be livestock grazing. However, the focus of grazing management will shift from the production of livestock to the conservation of special-status species habitat. The grazing management plan is designed to use grazing effectively as a management tool to maintain grass height within an optimum range and to minimize its potentially adverse effects.

Burrowing owls are known to prefer short, sparse vegetation (Haug et al. 1993; Plumpton & Lutz 1993) and will not generally nest in areas with tall grass that form in the absence of grazing. Numerous examples from the vicinity of the Byron Conservation Bank can be cited in which burrowing owls occupy moderately- to heavily-grazed grassland (Stromberg 1994; Biosearch Wildlife Surveys 1998). The discontinuation of grazing can result in the abandonment of nesting areas by burrowing owls (Biosearch Wildlife Surveys 1997).

The California tiger salamander is well adapted to moderate to heavy grazing. Numerous examples from the vicinity can be found in which California tiger salamanders breed in stock ponds with no emergent vegetation (NDDB; CCWD 1983; Stromberg, 1994). At Byron Airport Habitat Management Lands, California tiger salamanders bred in artificial ponds that were both grazed and ungrazed (Stromberg, 1997).

Grazing of riparian systems can reduce habitat quality for California red-legged frogs by reducing or eliminating cover (Jennings and Hayes 1994). However, numerous examples are available from the region in which the species breeds in stock ponds with little emergent vegetation (CCWD 1983; Stromberg 1994).

Grazing is not considered detrimental to the San Joaquin kit fox (Morrell 1975; O'Farrell 1986). In the northern portion of the range, grazing allows for increased abundance of California ground squirrels, which in turn provide potential burrows for kit fox (Orloff, et al. 1986). Moreover, California ground squirrels area primary food source in the northern portion of the range of the kit fox (Orloff, et al. 1986). On the other hand, overgrazing may decrease relative abundance of other potential kit fox prey such as kangaroo rats, pocket mice and rabbits (O'Farrell, et al, 1983).

5.2.2 Annual Monitoring

Assessment of Grazing Plan

To ensure that the management goals are being met by the ongoing management strategy, regular monitoring will be necessary. A monitoring protocol and schedule is presented in the Grazing Management Plan, and includes monitoring of grass height at the beginning and end of the season, recording stocking levels throughout the grazing season, and coordination with CDFG personnel at the end of each grazing season.

Burrowing Owl Surveys

Surveys for burrowing owls during both the breeding season and non-nesting season must be carried out to quantify use of the site by the species. Three surveys should be conducted during the breeding season to determine the number of pairs utilizing the site. The three breeding season surveys should be spread out through the nesting season, with one early in the season (1 February – 14 April), a second during the peak of the nesting season (15 April – 15 July) and third during the late nesting season when young are present (16 July – 31 August). All surveys should be carried out within two hours of

sunrise. All exterior and interior roads should be driven slowly to search for owls. Frequent stops should be made to scan for burrowing owls with binoculars. In addition, the ridgelines of the property should be walked to allow for visual coverage of the entire site. All burrowing owls observed should be mapped, and their behavior recorded. All active burrowing owl burrows should be avoided by 50 meters during the breeding season. During the final breeding season survey, an estimate of productivity should be made for each pair identified in the first two surveys. Productivity should be based on the number of young present just prior to fledging. A fourth survey should be carried out in the non-breeding season (1 September – 31 January) to assess use of the site by non-breeding burrowing owls. Survey methods should follow those outlined above.

5.3 Enhancement Opportunities

The following management items should be considered if and when additional funding sources for management of the Byron Conservation Bank are secured. They are presented in order of prioritization.

5.3.1 Dam Improvements

Maintenance of the dams on the site will be critical to maintaining appropriate habitat conditions for special-status amphibians. The dams are currently in fairly good condition, and are fitted with spillways to reduce erosion risks to the berms themselves. An assessment of these structures should be carried out to determine repair priorities.

All dams on the site should be examined annually to determine their integrity and sediment levels of each pond. Recommends regarding the immediate actions to ensure continued success of the dams should be made and implemented.

5.3.2 Fencing of Ponds

The California tiger salamander and California red-legged frog have clearly adapted to breeding in stock ponds in Byron Area. Fencing of ponds is not considered critical to the maintenance of habitat conditions for that reason. However, it is reasonable to assume that habitat conditions for red-legged frog could be enhanced by additional emergent vegetation along the perimeter of the pond. Such vegetation should provide additional protection from predators and additional shading from high temperatures. Excluding cattle from ponds should accomplish this relatively quickly. Western pond turtles are also expected to benefit from the growth of emergent and perimeter vegetation.

Fencing of ponds would also create the opportunity to test the assumption that excluding cattle would increase the numbers of red-legged frogs and western pond turtle.

Initially, two ponds, one in each drainage course, should be fenced. Ponds 3 and 11 are recommended, since they are known to provide breeding habitat for red-legged frogs and are known to support western pond turtles. Fencing should be of a design that will effectively exclude cattle, such as 5-strand barbed wire or livestock fencing with two

strands of barbed wire. The fences should be constructed approximately 100 feet from the water line except on the side where the existing dirt road is situated, where they should be constructed parallel to the road. Fences should be fitted with a gate to allow for access by monitors. Approximately 2,500 feet of fencing would be required to fence ponds 3 and 11.

5.3.3 Sediment Removal

Large amounts of sediment enter both drainage courses from upstream, partly the result of grazing practices on the parcel upstream. Additional sediment comes off of Kelso Road. Sediment from upstream has caused the uppermost ponds in each drainage course (Ponds 7 and 13) to fill with sediment. These upper ponds appear to be acting as sedimentation basins in which a large amount of the sediment drops out prior to entering the remainder of the watercourses. These ponds are no longer suitable breeding habitat for the red-legged frog, since they are too shallow. Eventually, other downstream ponds will also fill with sediment, which will decrease their suitability as habitat for red-legged frogs and pond turtles.

If management funds become available, Ponds 7 and 13 should be maintained as sediment basins. This should reduce the need to clean the remainder of the ponds for some time. Ponds should be cleaned to a depth of 4 feet and the sediment removed from the site. A diversion pipe should be installed prior to cleaning to reduce the amount of silt released downstream. Additional sediment control measures should also be installed downstream from Ponds 7 and 12 for the duration of the cleaning process.

Removing sediment from the permanent ponds would be highly disruptive and could result in the take of red-legged frogs. Therefore, it will be necessary coordinate with USFWS to develop appropriate measures to reduce impacts to the species.

5.3.4 Exotic Wildlife Control

Nonnative wildlife can pose a major threat to native species. In certain cases, non-native species can affect special-status species directly, through predation or displacement, while in other cases, can affect them indirectly through competition for resources including food and cover sites. At least five non-native species have been observed on the Byron Conservation Bank. Some of these species, namely bullfrog, red fox and domestic cat are currently present in relatively low numbers, and do not appear to pose an immediate threat to special-status species on the site. Others, namely red swamp crayfish and mosquitofish, are currently present in relatively high numbers on the site, and may pose immediate threats to the California red-legged frog through predation of eggs and larvae. However, available control methods are either not available or impractical. Each species is addressed below.

Bullfrog

The bullfrog (*Rana catesbeiana*) is a large ranid that is native to the eastern United States. It was introduced to California around the turn of the century, in part to replace red-legged frogs that had been depleted by over-harvesting. Since then, the species has spread widely, and has displaced native ranids throughout much of California (Hayes & Jennings 1986). The presence of bullfrog larvae has markedly negative effects on the survival of red-legged frog larvae (Lawler, et al. 1998). Bullfrogs likely affect red-legged frogs both through direct predation and through competition for resources. The presence of California tiger salamanders is negatively correlated with bullfrogs (Shaffer 1993). Bullfrogs are also known to prey on juvenile Western pond turtles.

The bullfrog is currently present, though relatively infrequent, on the Byron Mitigation Bank. Only a single bullfrog was observed during nocturnal surveys in June 1999, as compared with a high count of 99 red-legged frogs. However, given the rapid expansion of bullfrogs that has been documented in other parts of the state, it is critical that the species not become established on the site.

Direct removal of bullfrogs has proven to be an effective control method where they co-exist with red-legged frogs (Keel, pers. comm.). A bullfrog removal program at Año Nuevo State Reserve has resulted in an immediate positive response in the relative proportion and abundance of red-legged frogs (Keel, pers. comm.).

Bullfrog control should be carried out opportunistically whenever they are observed on the site. All bullfrogs of reproductive size should be killed with frog gigs. Particular focus should be placed on removal of reproductive-aged individuals, particularly breeding females.

Red Fox

Red fox (*Vulpes vulpes*) have been reported in numerous localities in the vicinity of the Byron Mitigation Bank. The species has been established in eastern Alameda and Contra Costa County for some time (Lewis 1992). Red fox were observed on several occasions during surveys conducted at the Byron Airport in 1990-1994 (Stromberg 1990). An adult red fox was observed on the site in December 1999.

Red fox have a highly variable diet dependent upon the availability of food resources (Samuel & Nelson 1982). Red fox are known to kill and cache excess prey if the opportunity arises (Lariviere and Pasitschniak-Arts 1996). Red fox have been documented preying on avian special-status species including clapper rails and least terns.

Red fox control must be carried out with extreme caution in the area, due to the possible presence of San Joaquin kit fox. Also, because of the relatively small size of the parcel, a red fox control program would only be effective if it were part of a more comprehensive, region-wide effort.

If a red fox natal den is located on the site, individuals should be trapped and euthanized. Alameda County Animal Damage Control should be contacted to carry out this work. All trapping should be conducted in a manner that is appropriate for trapping within the range of the San Joaquin kit fox.

Domestic Cat

Domestic and free-ranging cats (*Felis catus*) are a significant cause of mortality for native wildlife (Jurek 1994). Free-roaming cats (cats without an owner) may be of even greater concern, because they depend on native food resources to a greater degree. Cats have been documented preying upon numerous special-status species (Harris and Ogan 1997).

Two cats were observed on the site in the fall of 1999 (Bean, pers. comm.). There are currently cats resident at the homes immediately south of the parcel (pers. obs.). A free-ranging cat appears to be living in the warehouse on the site (pers. obs.). There may also be free-ranging cats associated with the Delta Pumping Plant and/or PG&E Compression Station.

Literature should be distributed to the homes adjacent to the parcel and to the facilities mentioned above informing that the parcel has been dedicated as a wildlife preserve and explaining the dangers of free-ranging cats to native wildlife. Furthermore, homeowners and facility operators will be sent a request to not feed free-ranging cats and to keep owned cats indoors. If repeated observations of free-ranging cats are made on the parcel, the SPCA should be contacted for trapping and removal.

Red Swamp Crayfish

Red swamp crayfish (*Procambarus clarkii*) are present in both permanent drainage courses on the site. This species is a native of the southeastern United States, and has become became established throughout much of central and southern California in the early 1900's (Reigel, 1959). Non-native crayfish are known to prey on the eggs of certain amphibians (Gamradt and Kats 1996), and it is possible that they would feed on the eggs of red-legged frogs as well.

Control of this species is problematic. Direct control measures such as poisoning or draining of the ponds are precluded by the presence of sensitive species in the aquatic habitats. Moreover, the drainages both upstream and downstream are likely to support the species as well, providing a source for re-colonization even if control measures on the site were to be successful. Therefore, no immediate control measures for crayfish are recommended.

Mosquitofish

Mosquitofish (*Gambusia affinis*) are native to the midwestern United States, and have become established throughout California in low and mid elevations (McGinnis, 1984). They are regularly introduced into fresh and brackish waters to control mosquitoes by mosquito control agencies. Unfortunately, the omnivorous nature and high reproductive output of the species poses a threat to numerous native species as well. Mosquitofish have been implicated in the decline of the red-legged frog (Miller et al. 1996), and they have been shown to reduce the average size at metamorphosis of red-legged frogs (Lawler, et al. 1998), which could lead to lowered survival and reproductive success. However, the presence of mosquitofish does not preclude breeding by red-legged frogs in ponds (Lawler, et al. 1998), and there are numerous examples from the region in which the two species co-exist (pers. obs.).

As with the red swamp crayfish, control of this species is problematic. The presence of sensitive species in the ponds precludes physical or chemical control methods, while continual recolonization of the area is possible from both upstream and downstream sources. Therefore, no immediate control measures for mosquitofish are recommended.

5.3.5 Invasive Plant Control

Invasive non-native plant species can proliferate to the point where they displace native species. Certain species are of particular concern, because they have the ability to reduce the quality of grazing land, and therefore affect the primary management strategy on the site.

Thistles

At least two forms of thistle have been identified on the site, bull thistle (*Cirsium vulgare*) and yellow starthistle (*Centaurea solstitialis*). The primary infestation of bull thistle is near the warehouse and in the central drainage. Although the invasion of this species is fairly minor, it is important to ensure that the problem does not worsen. Infestations of yellow star thistle have been noted near the warehouse and near the old quarry area.

Control of thistle should be possible through proper grazing management (See Appendix A). The timing of livestock grazing, as detailed in the Grazing Management Plan (Appendix A), was determined in part to allow for grazing of yellow starthistle, which does not normally flower until late summer. It is hoped that the grazing schedule will help to prevent the spread of this species.

If grazing proves to be ineffective in checking the spread of thistle, and funds become available for more intensive management, bull thistle should be removed manually in early spring before flowers form. This should prevent further spread by preventing seed production. Efforts will need to be repeated for up to 5 years to follow up on the initial

removal effort. The same approach should be used for yellow starthistle. However, if this proves ineffective, the herbicide Transline should be used in spot applications.

Tamarisk

Tamarisk (*Tamarix* sp.) is a highly invasive tree that can spread quickly and become difficult to control if not held in check. Although no tamarisk is currently found on the site, it is known from the area, and is present in Brushy Creek to the north, the 70 Canal to the east and in Mountain House Creek to the south (pers. obs.). Any tamarisk observed during monitoring surveys should be removed by hand.

5.3.6 Special-Status Species Monitoring

Data regarding the relative abundance of California red-legged frogs, California tiger salamanders and western pond turtles would be valuable to assess the effects of management practices on these species. If grazing exclosures are created, the relative abundance of California red-legged frogs and western pond turtles at ponds within grazing exclosures and under the proposed grazing regimen could be compared. A survey schedule that includes nocturnal surveys in the winter for breeding adults, aquatic surveys in the spring for larvae, and diurnal surveys in the fall for metamorphs is recommended. These surveys would also be useful in determining the relative abundance of bullfrogs on the site.

Aquatic sampling during the spring at Pond 8 would indicate whether the pond continues to function as a breeding site for California tiger salamanders. The pond should be surveyed with dip-nets or a seine between 1 April and 1 May to optimize the probability of detecting larvae. Since this is the only breeding location on the site, it is important to identify potential problems with the pond as early as possible.

5.5 Potential Impacts of Management Actions

Implementation of the grazing management plan is expected to have minimal effects on resident special-status species. The plan is expected to improve habitat conditions for the burrowing owl. The grazing schedule is designed to reduce reliance on wetland vegetation and resultant impacts to red-legged frogs and Western pond turtles.

Implementation of the species monitoring program is expected to have minimal effects on resident special-status species. During burrowing owl surveys, all active burrows will be avoided by at least 50 meters to reduce impacts.

Fencing of ponds is expected to increase habitat quality for resident special-status species. However, the effects of this action on the relative abundance of the bullfrog are unknown. If increased vegetation allows for colonization by bullfrogs, then the action would have a negative effect on red-legged frogs. Such an eventuality is addressed in Section 6.0.

Pond improvements and maintenance could affect red-legged frogs during construction of drainage structures or physical cleaning of ponds. Consultation with USFWS will be required prior to implementation of pond improvement or maintenance activities. Overall, sediment removal is expected to benefit red-legged frogs by providing improved conditions for breeding by the species.

Implementation of the bullfrog control program could have effects on resident red-legged frogs. In order to ensure that no red-legged frogs are harmed during control efforts, only qualified biologists should carry out the work. The program is expected to benefit the red-legged frog in the long run by removing competition for resources.

Trapping for red fox on the parcel, if it becomes necessary, could affect the San Joaquin kit fox. Consultation with USFWS will be necessary prior to proceeding with any control effort.

Hand removal of exotic invasive plants, if it becomes necessary, is not expected to have a significant effect of specials-status species. The potential effects of Transline on resident special-status species should be analyzed prior to its use.

6.0 ADAPTIVE MANAGEMENT

The effectiveness of managing natural resources at the Byron Conservation Bank will be enhanced through adaptive management – the ability to identify whether the goals of the management plan are being met and to respond with appropriate management actions if they are not. The information on which these decisions will be made will be provided through regular monitoring.

An annual review of stocking levels and vegetation height will be made by a grazing manager in consultation with CDFG staff. As described in the grazing management plan, the amount of residual forage will be used to modify and refine the stocking levels to maintain the desired grass height to maintain optimal habitat conditions for the burrowing owl and other special-status species.

Burrowing owls are dependent on the presence of California ground squirrel burrows for nesting sites. If the density of California ground squirrel burrows decreases to less than 10 burrows/ acre (67% of the current level), an increase in stocking rates should be considered. The presence and abundance of California ground squirrels in the region makes it unlikely that installation of artificial burrows will be necessary or effective. Annual monitoring will determine the relative abundance of burrowing owls present on the site in both breeding and non-breeding season. If no burrowing owls are detected during annual monitoring, the grazing management plan should be re-assessed and modified. CDFG personnel should coordinate with a grazing specialist to identify and address potential reasons for the lack of burrowing owls, including grass height, burrow availability and prey availability.

As part of the review by the grazing manager, an assessment of the level of infestation of invasive plants, particularly yellow starthistle, will be made. If current methods prove to be ineffective in keeping the species in check, other measures should be considered, including herbicides or controlled burning.

Regular inspections of the ponds on the site should be made to address immediate maintenance needs. Cleaning of ponds 7 and 13 should reduce the amount of sediment received by the remainder of the ponds. However, it may eventually become necessary to clean other ponds. Sufficient funding should be identified to clean ponds if they become unsuitable as breeding ponds for the California red-legged frog. If Ponds 1, 2, 3, 4, 5a, 9, 10, or 11 become less than two feet deep due to sediment accumulation, sediment removal should be considered.

A review process will be used to assess the suitability of proposed research projects. In addition, the effects of on-going research projects will be compared against the primary goal of the conservation bank - protection and enhancement of special-status species habitat. If particular research projects or research activities as a whole are in conflict with the primary goal, the review process should be modified and made more rigorous.

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APPENDIX A.

DRAFT GRAZING MANAGEMENT PLAN
BYRON CONSERVATION BANK

Prepared for:

California Department of General Services
Real Estate Services Division
1102 Q Street, Suite 6000
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and

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2 July, 2000

GRAZING MANAGEMENT PLAN
BYRON CONSERVATION BANK

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1.0 ECOSYSTEM MANAGEMENT BACKGROUND

The Byron Conservation Bank is a 140-acre wildland property located approximately five miles south of Byron in Alameda County. Its borders are Bruns Avenue on the east and Kelso Road on the south and west. The property was recently acquired by the State of California (the State) as a mitigation bank to be managed as habitat for special status animals. Its history includes some farming and other soil disturbance activities as well as livestock grazing. Livestock grazing will continue as the primary management tool with the focus shifted from production of livestock to conservation of the ecosystem qualities and functions that compose the habitat for the special status animals. The negative impacts of livestock use will be minimized.

1.1 Habitat of Special Status Animals

The property will be managed for the long-term conservation of habitat for several special status animals, including the burrowing owl (*Athena cunicularia*), California red-legged frog (*Rana aurora draytonii*), California tiger salamander (*Ambystoma californiense*), western pond turtle (*Clemmys marmorata*), and San Joaquin kit fox (*Vulpes macrotis mutica*; presence unverified) (Biosearch Wildlife Surveys 1999). These animals have persisted at the site as a group because of the presence of common habitat requirements, including dependence on perennial and ephemeral ponds and streams as well as populations of California ground squirrel (*Spermophilus beecheyi*). The ground squirrel constructs burrow systems that are subsequently used by all but the turtle, and are a primary prey of the fox. The open terrain and low vegetation are primary habitat requirements for the squirrel, owl, and fox. The amphibians and the turtle require the streams and ponds and access across the open grasslands.

1.2 Grassland and Riparian Vegetation

The open grassland character reflects a long history of livestock grazing and relatively dry climate. Annual grasses and forbs typical of the California Annual Grassland dominate the vegetation with no shrubland or oak savanna components. Absence of these

[1] Certified Rangeland Manager, California Board of Forestry, #70; Certified Professional in Rangeland Management, Society for Range Management, #CP99-07

two woody components is largely due to the long history of livestock grazing as well as soil and climate conditions that are unfavorable to establishment. Two of the three drainage courses flow year-long. Thirteen artificial ponds were formed, all but one of which holds water year-long. No significant woody riparian vegetation is present along these streams and ponds, also due to the long history of grazing. But the herbaceous freshwater marsh plant, cattails (*Typha* sp.) is present in a few ponds where access by cattle has been limited. On the opposite side of the fence at the southwest border, the extensions of two streams flow through neighboring property that has not been grazed recently. Those sites support abundant willows (*Salix* sp.) and coyote brush (*Baccharris pilularis*), which are normally reduced or eliminated by grazing. The absence of woody vegetation on the grazed side of the fence indicates the effects of repeated cattle herbivory and trampling. This comparison also presents an important opportunity to study the potential effects of livestock exclosure from streams and ponds within the conservation bank property. Such studies might reveal the value of grazing exclosures to the special status animals within the property[2]. Several relatively small patches of significant invasive pest plants, including yellow starthistle (*Centaurea solstitialis*), are present within the grassland. Management of yellow starthistle is included minimally in this grazing management plan, but a separate management plan should be developed to manage pest plants generally.

Native grasses are present on the property in scattered stands of low density[3]. The open grassland aspect of the property suggests that extensive stands of native perennial and annual grasses and forbs occupied the area prior to the establishment of the first Spanish settlements in California. Since then, non-native annual grasses and forbs have dominated the region's grasslands as they have elsewhere in California. Fewer remnant stands of native perennial grasses are found today within the non-native annual grasslands in the drier East Bay hills and the San Joaquin Valley generally than in the moister north and central coastal regions. The density and vigor of the common native perennial grasses of California Annual Grassland can improve when intensive spring grazing is curtailed just in time for the existing perennial grasses to re-grow and set seed (Menke 1992). This process removes much of the density of annual grasses until their growing season is near its end, but allows time for perennial grass growth before soil moisture is exhausted. Since relatively few native perennial grass stands are apparent on the Byron Conservation Bank property, grazing management for native grasses will not be a priority. If native grass expansion becomes a priority, then the curtailing of grazing in late spring would be important. However, such a practice would be difficult to achieve, and it would be in conflict with the grazing management to reduce the spread of yellow starthistle (see Section 4.1 below).

1.3 Grassland Habitat Maintained by Grazing

The 136.9 acres of upland (excluding the areas of the warehouse, ponds, and channels) suitable for habitat of the special status animals are also suitable for livestock grazing.

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[2] Such supplementary studies should be integrated with the wildlife monitoring described elsewhere.

[3] During a brief field reconnaissance of the property May 9, 2000 with David Laabs and representatives of the Department of Fish and Game, I observed low density stands of purple needlegrass (*Nassella pulchra*) in narrow strips adjacent to the streams.

Historically, grazing has been beneficial in maintaining that wildlife habitat quality, and its removal could significantly reduce that habitat quality. The report of a wildlife survey and habitat assessment recommended continuation of cattle grazing to optimize grass height, which is the primary characteristic of the grassland that affects the habitat quality of the special status animals (Biosearch Wildlife Surveys 1999). This grazing management plan was designed to use grazing effectively as a management tool to maintain grass height within an optimum range and to minimize its potentially adverse effects.

A specialized spring and summer grazing system will be used to maintain the grassland in optimum conditions for wildlife habitat. The grazing management standards are outlined in Section 3 below. The optimum grass height range for this property is 3 to 12 inches (with occasional spring increases to18 inches) mean foliage height year-long (and a minimum of 700 pounds/acre minimum fall mean Residual Dry Matter). A livestock grazing program that uses grazing only in the late spring and early summer seasons can maintain the prescribed grass height.

The 3-inch minimum standard for residual foliage height is required to achieve optimum forage production and good rangeland condition in California Annual Grassland under moderate grazing (adjusted upward slightly from that described by Clawson, McDougald, and Duncan 1982). The upper end of the height range (12 or 18 inches) is above that recommended for moderate grazing. Those recommendations reflect the possibility of somewhat reduced forage production the next year, which will be considered an acceptable risk in this case. But the prescribed stocking rates and schedule (refer to Section 2 below) should keep grass height closer to the lower limit of the range at the end of the grazing period in years of normal precipitation. This standard will be tested and adapted to more appropriate levels following periodic monitoring, which is described in Section 6 below.

1.4 Soil Erosion

Soil erosion affects the quality of habitat for soil dwelling organisms, and poses risks to water and air resources. Excessive soil erosion could reduce the quality of ground squirrel habitat, including their burrows, and thereby affect the special status animals.

Livestock grazing that exceeds the moderate level of foliage removal and that continues at excess levels for several years can cause soil erosion problems. It can also affect the composition of the California Annual Grassland by excessive compaction and reduction of plant cover and regrowth. Increased runoff or exposure to winds lead to erosion of surface soil particles, and in some cases, the development of gullies or wind-rows of shifting sediment. In the California Annual Grassland, inadequate foliage cover is usually the first and best indicator of potential erosion problems followed by the direct indications of erosion, such as gullying or accumulations of sediment in waterways or wind-rows.

Erosion of stream and pond banks is a common problem, but it has not been common on this property recently[4]. The contribution of livestock grazing to erosion of soils on the grasslands and wetland banks will be minimized to the extent practical.

1.5 Fire Fuel Management

The risk of direct and indirect damage by grassland wildfire to structures and human health can be severe[5]. Reduction of fire hazards associated with fuel loads in the grasslands of the property is an important goal that can be influenced by grazing. Accumulations of highly flammable herbaceous fuels in California Annual Grasslands are a well-known problem during the dry seasons. In this case, livestock grazing is the preferred alternative, among the common methods of fuel reduction. Mowing is expensive and impractical in hilly terrain. Prescribed fire causes smoke pollution and can escape to cause severe damage to property and human health. Both of these latter practices would pose conflicts with the management of habitat quality for the special status animals and their prey.

The fire hazard reduction benefit alone makes enough incentive for many grassland managers to employ grazing on their lands[6]. However, it is important to note that grazing of California Annual Grasslands at proper levels has been shown to reduce the hazard of fuel loads and to alter the behavior of wildfires, but not to significantly reduce the risk of fire ignition and spread (Stechman 1983). Fire risks are another matter that involve ignition sources, probabilities, and the proximity of property and persons subject to the risk. A separate fire management plan should be developed for the property that specifically addresses the fire hazards and risks present and the best measures to avoid damages.

1.6 Livestock-borne Pathogens

Pathogens might be present in the bodies of cattle used in the grazing program. These pathogens can be transmitted to other animals, including humans, by distribution in water bodies and ingestion of contaminated foods or other materials. The source is the feces of infected animals, including livestock, wildlife, and humans. One important pathogen, *Cryptosporidium* is common in untreated surface waters of North America, including the San Francisco Bay Area. Although livestock are often thought to be the sources of this parasite in infected lakes and streams, the link has not been clearly established (UC Cooperative Extension 1997). A recent study at UC Davis indicated that in an infected herd of cattle, only the calves up to four months old shed *Cryptosporidium* in their feces, and the older animals were not significant sources.

When the surface waters of grazed lands flow into waters used for drinking by humans, and the volume of the water from the grazed land source is significant, the conventional

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[4] During a brief field reconnaissance of the property on February 15, 2000 with David Laabs, I observed that livestock trampling of stream and pond banks was evident in moderate degrees, but I found no indications of gullying or ground widely exposed to bare surfaces on the uplands.

[5] The previous lessee, Don Jess, reported two wildfires in the region in 1999 (personal communication, February 9, 2000).

[6] Acceptance of this report by Biosearch Wildlife Surveys, the State, other parties to management planning for the Byron Conservation Bank, and their managers assures that the author and his organization will not be held responsible in any way for any fire risk or damage that occurs on the property or as a result of grazing management on the property.

recommendation is to exclude calves from the respective watersheds. A drinking water destination is not indicated for this property. Also, it would be difficult to distinguish the contributions of pathogens from this property from those due to grazing on neighboring properties within the same stream systems. A general provision of the Water Quality Control Plan for the San Joaquin River Basin requires compliance with municipal water quality requirements associated with pathogen pollution, but it does not apply to non-point sources, such as grazing in this case (California Regional Water Quality Control Board, Central Valley Region 1998:II-2). The California Rangeland Water Quality Management Plan (CRWQMP) for non-point source pollution associated with grazing applies to non-federal public grazing lands in California, such the Byron Conservation Bank (State Water Resources Control Board 1995). The CRWQMP requires voluntary compliance by resource managers with a series of planning requirements, which are met by this document. Unless the surface waters of the property flow into surface waters used for human consumption purposes, *Cryptosporidium* does not appear to be a management priority[7]. If this issue is determined to be important, then calves will be excluded and/or a network of vegetation buffer strips will be fenced and maintained along the streams and ponds to minimize pathogen pollution. A separate watershed management plan should be developed for the property that specifically addresses the disease hazards and risks present, those associated with properties and land uses elsewhere in the watershed, and the best measures to avoid damages.

1.7 Timeline and Summary of Management Requirements of Ecosystem Components

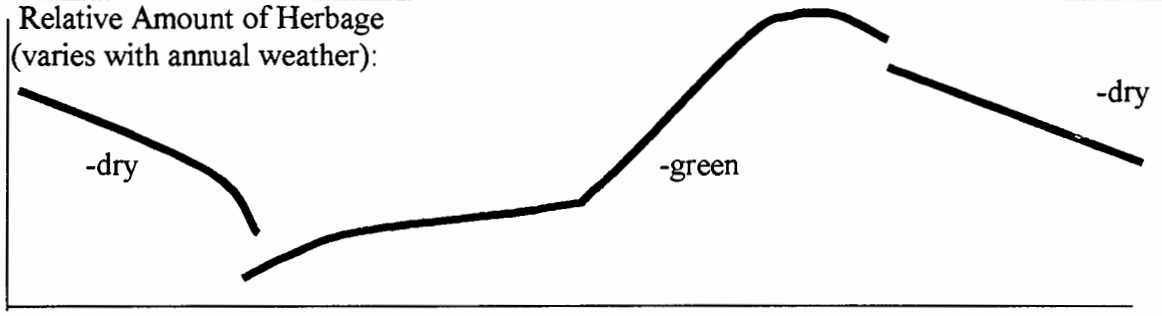
The figure below displays timelines (heavy lines) and notes (with asterisks) of grassland herbaceous growth and the management requirements associated with the special status animals and other key ecosystem components[8]. Grazing applied between March and August would maximize the benefits of reduced height of annual grasses and minimize adverse effects of grazing during the wet season. Potential conflicts with early summer grazing include the protection of turtle nests and hatchlings and migrating tiger salamanders.

[7] Acceptance of this report by Biosearch Wildlife Surveys, the State, other parties to management planning for the Byron Conservation Bank, and their managers assures that the author and his organization will not be held responsible in any way for any disease risk or damage that occurs on the property or as a result of grazing management on the property.

[8] Sources include: Behler, J.L. and F.W. King 1979; Biosearch Wildlife Surveys 1999; Thelander, C. and M. Crabtree 1994; Thomsen, C.D. et. al. 1996; Trulio, L. 1998; and US Fish and Wildlife Service 1998.

Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug

Grassland Forage Production



* requires minimum residual mulch for optimum grass production
* requires abundance of seed production and persistence of viable seed bank from summer to fall (for animal food and grass reproduction)

Burrowing Owl

* requires populations of ground squirrels and their burrows for refuge and nesting
* requires adequate seed production for prey populations

-favored by low grass

California Red-legged Frog

* requires populations of ground squirrels and their burrows for refuge
* requires litter accumulation for refuge; riparian woody species improve refuge
* protect from introductions of crayfish, fish, and bullfrogs

-protect pond edges and emergent vegetation for eggs

-protect corridor of 100m band around waters for movements to breed and feed

California Tiger Salamander

* requires populations of ground squirrels and their burrows for refuge
* requires temporary ponds for reproduction, Nov-Aug

-favored by protection of ponds from hoof traffic and sedimentation

-protect corridor of 1km band around temporary ponds for movements of adults from burrows to breed

-protect corridor of 1km band around temp ponds for movements of juveniles from ponds to burrows

Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Western Pond Turtle											
* requires permanent waters * requires emergent vegetation and protected basking sites -protect corridor of 400m band around permanent waters for movements of adults and juveniles between water and nests; and hatchlings in nests											
San Joaquin Kit Fox											
* requires pops of ground squirrels and their burrows for refuge and reproduction * requires adequate seed production for prey pops -favored by low grass											
Yellow Star Thistle											
* invasion and expansion of this pest plant is inevitable, but grazing should be managed to decrease it and to minimize its introduction or expansion -disfavored by grazing of elongated stems before seed set											
Riparian Woody Plants											
* requires propagules source and protection from herbivory to establish new riparian woody cover * requires preferable alternative non-riparian forage (green grass) to reduce damage due to grazing herbivory and trampling -protect seedlings and mature stems from grazing											
Soil Surface											
* protect from erosion due to livestock traffic, concentration, trails, bank trampling, and excess removal of vegetation cover -protect from livestock traffic during wet season											
Wildfire											
* protect property and lives from wildfire damage * protect surface nests of turtles -greatest fire hazard											

2.0 GRAZING CAPACITY

The special status animal species have persisted on the property in populations of viable sizes for an extended time. The history of livestock grazing and the resulting low height of grassland vegetation have been critical to the animals' persistence by providing suitable habitat conditions, including those that support populations of ground squirrels

(Biosearch Wildlife Surveys 1999). This ecosystem function associated with grazing has probably occurred in a fashion that maintains the current grassland, which is composed of abundant non-native annuals, in conditions similar to those of the low production zones of native grasslands or other disturbed areas, such as road banks. Livestock grazing appears to be the most effective management tool available to continue to provide the conditions to support the special status animals. More specifically, the grazing practices of the previous property owner and grazing lessee as well as those of adjacent property managers appear to have been adequate to maintain the present populations and conditions of the special status animals[9]. Consequently, the capacity of the property to support grazing that benefits the special status animals appears to be high. This poses the challenge to maximize the benefits of grazing while minimizing its negative effects on the health of the supporting ecosystem.

The following estimates of the property's grazing capacity were based on an approximation of forage production from reliable measurements in similar settings in the region and from the stocking rate history of the property as managed in recent years by the previous grazing lessee. The recommended monitoring studies will produce site-specific forage production and utilization measurements and other results that will serve as references to make stocking rate adjustments for revisions of this document in the future.

The history of grazing practices by the previous property owner and grazing lessee provides a useful model of successful grazing management, and an estimate of grazing capacity, that can be applied to the present grazing plan[10]. The previous lessee normally grazed approximately 25 cows and their calves on the natural forage of the property for six to eight months[11]. That equates to a normal forage demand of 157,500 pounds (or 1150 pounds/acre), based on conventional estimates of animal weights and forage requirements, a seven month period of grazing the natural forage, and the 136.9 acres of grazeable grassland (in one relatively uniform grazing unit).[12] The normal total forage

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[9] During a brief field reconnaissance of the property on February 15, 2000 with David Laabs, I observed abundant populations of ground squirrels and burrowing owls on the severely grazed property to the southwest.

[10] During a brief field reconnaissance of the property on February 15, 2000 with David Laabs, I observed evidence of a fairly uniform distribution of about 3 inches of Residual Dry Matter throughout the property, and no obvious indications of erosion or ground exposed to the bare surface, with the exception of the two flat areas that had been used for supplemental feeding during the period up to mid January. From that reconnaissance and telephone interviews with the lessee, Don Jess on February 9 and 29, 2000, these conditions indicate that proper practices were used effectively to conserve the rangeland resources in recent years.

[11] The lessee reported he had access to the property for grazing year-long, but the herd normally grazed less. Supplemental feed was normally required when the animals were not moved elsewhere. During the winter of 1999-2000, forage production was low, and supplemental feed was required to maintain the herd on the property longer than usual.

[12] Based on the formula 157,500 lbs = (25 cows x 600 lbs/mon x 7 mons) + (25 calves x 300 lbs/mon x 7 mons); forage weights after air drying; forage requirements from Holechek, Pieper, and Herbel (1989).

production would be about 239,640 pounds total (or 1750 pounds/acre) based on the normal demand plus 600 pounds/acre of Residual Dry Matter in the fall[13].

Forage production estimates are available from the Natural Resource Conservation Service (NRCS; formerly the Soil Conservation Service) based on mapping and testing of regional soils. The Byron Conservation Bank property is dominated by the Linne Clay Loam soil mapping unit with low slopes, which is characterized by reduced productivity and elevated alkalinity. Annual rangeland forage production estimates were adjusted for a mean of 10 inches of precipitation—1333 pounds/acre in a normal year and 1050 pounds/acre in an unfavorable year (USDA Soil Conservation Service 1966:5,44-49; USDA Soil Conservation Service 1981:2)[14]. That forage production would be equivalent to 182,488 pounds total in a normal year and 143,745 pounds total in an unfavorable year on the grazeable lands of the property.

The following approximations of future forage production and forage available for grazing on the property were based on a conservative mid-point between the recent grazing history and NRCS estimates described above. These amounts are notably less than the estimate based on previous cattle numbers, and will be used as a starting point for future adaptation of this document[15]. In this approximation, the amount of Residual Dry Matter (700 pounds/acre) to be left ungrazed is the amount recommended by the Soil Conservation Service (1981:2).

Grazing Capacity:

	Normal Year	**Unfavorable Year**
Total Herbaceous Production	200,000 pounds (1461 pounds/acre)	157,539 pounds (1151 pounds/acre)
Recommended Ungrazed Fall Residual Dry Matter	95,830 pounds (700 pounds/acre)	95,830 pounds (700 pounds/acre)
Forage Available	104,170 pounds (761 pounds/acre)	61,709 (451 pounds/acre)

These estimates did not include potential forage use by deer, rodents, or other wildlife because it is probably very small.

[13] A conservative estimate of the equivalent of the 3 inches of Residual Dry Matter (RDM) observed at the property February 15, 2000 and adjusted for the low precipitation and gentle terrain of the site; RDM equivalents from Clawson, McDougal, and Duncan 1982.

[14] A normal year is one with average precipitation and a combination of winter and spring precipitation and temperatures that favors normal forage production; an unfavorable year is one with below average precipitation and a combination of factors that does not favor normal forage production.

[15] These estimates of future forage production are more conservative than the amounts apparently available in the recent past. The estimates are based on a 30% midpoint between the lower estimate of range productivity from the Soil Conservation Service and the higher estimate based on imprecise accounts of cattle grazed from the previous grazing lessee. The lessee might have grazed more animals during recent years than would be appropriate during a normal (not an El Nino Southern Oscillation cycle) period. Consequently, the planned starting point for grazing animal numbers is based on a low target of forage production.

3.0 GRAZING MANAGEMENT OBJECTIVES AND STANDARDS

The following objectives will be achieved by the means described in the sections below. The standards by which the results of grazing management will be judged, are indicated in brackets below each objective.

- Maintain grassland herbaceous cover and height within a range that is conducive to the establishment and persistence of the populations of the special status animals and associated ground squirrel.
  [70% or greater mean absolute foliar cover of the combined herbaceous species year-long; 3 to 12 inches (with occasional spring increases to18 inches) mean herbaceous foliage height year-long; 700 pounds/acre minimum mean fall Residual Dry Matter]

- Maintain a reasonable degree of heterogeneity in height structure between patches of the grazed grassland to favor grassland habitat diversity.
  [Qualitative judgment of professional ecologist based on herbaceous foliage height monitoring data]

- Avoid to a reasonable degree the introduction and expansion of invasive non-native pest plants.
  [10% maximum net annual increase in mean foliar cover]

- Reduce to a reasonable extent the fire hazard associated with the mass of dry herbaceous vegetation in the grasslands during the summer and fall seasons.
  [Equivalent to herbaceous cover and height]

- Reduce soil erosion on the uplands and sedimentation of the drainage courses and ponds to a reasonable extent.
  [Grassland cover as indicated above; livestock excluded from the property during the fall and winter seasons (when excess vegetation removal and soil surface damage can occur)]

- Minimize the impacts of livestock herbivory and trampling on riparian vegetation and the banks of streams and ponds.
  [Livestock excluded from the property during the late summer, fall, and winter seasons (when little or no nutritious herbaceous forage is available, and livestock prefer to browse woody plants; banks and standing waters are exposed to more livestock traffic during these seasons)]

- Improve and maintain high quality grassland and riparian/wetland conditions and ecosystem functions of the property to sustain the habitat and composition of the set of native and non-native species representative of the Inner Coast Range, with the exception of extirpated or nearly extirpated native species (Lidicker 1989).
  [Qualitative judgment of professional ecologist]

- Maintain quality forage and other conditions of rangeland ecosystem health to sustain use by a healthy herd of grazing livestock.
  [Qualitative judgment of professional ecologist]

- Provide the contractual and working environment conditions for the Livestock Operator to maintain a cooperative relationship with the State and to assure a prosperous enterprise.
  [Mutual agreement between the State and the Operator]

4.0 GRAZING MANAGEMENT SPECIFICATIONS

Central to the development and maintenance of a successful grazing management program at the Byron Conservation Bank will be the cooperation of the Livestock Operator. To achieve the greatest degree of cooperation, efficiency, and benefits for the special status animals, the Operator should be given responsibility for developing specific implementation plans, monitoring results, and assessing problems and solutions. The following specifications should be regarded as a framework of guidelines for implementation by the Operator and evaluation of his practices. For example, the number of animals grazed in any month will be flexible to allow decisions about additions or subtractions through the grazing period to meet the grazing objectives, and to allow a feasible grazing operation by Livestock Operator. These specifications should be used as starting points for discussion and agreement, then future adaptation of this document, by the State and the Operator.

Annual planning for grazing during the coming year will commence following the close of the grazing period of the previous year, and receipt of monitoring results (refer to Section 6 below). Annual planning will be initiated by a letter from the Operator to the State that describes the following plan components:

- Proposed schedule of month to month stocking rates with AU equivalence calculations and a summary of justifications
- Observations of grazing management circumstances during the previous year
- Assessment of the results of monitoring
- Summary of predictions of weather and forage production
- Recommendations for fencing, exclosures, buffer strips, other structural improvements, and other measures
- Explanation of adaptations of the grazing specifications from those described in this document.

4.1 Grazing Prescription

The period of grazing will begin March 1 and terminate August 31, which totals 6 months. This grazing period begins just before the non-native herbaceous forage normally commences rapid spring growth, extends past the shift from live green to dead dry annual grass and grass seed set, and ends a few months after the annual grass has stopped growing. This corresponds to the period when grazing is required to limit grass growth and to avoid heights in excess of those required to maintain the habitat of the

special status animals. The starting date was set to delay grazing until after the wet season period of vulnerability of the special status amphibians, riparian woody plants, wet soils, and banks of streams and ponds (refer to the figure in Section 1.7 above). The termination date was set to allow grazing of yellow starthistle, which flowers in the summer. This termination date will help to control the expansion of yellow starthistle. Grazing during this period will reduce the growth of grasses during their spring growth, but save forage for grazing during the dry summer. Grazing exclusion during the late summer, fall, and winter months will reduce impacts on soils, stream and pond banks, riparian vegetation, and water quality when grazing animals prefer the woody browse and water of riparian areas. During the spring and early summer, nutritious herbaceous forage normally attracts grazing animals to the uplands.

The schedule of stocking rates within the 6 month period will be based primarily on the standards to meet the objectives for grassland herbaceous height and cover, height structure heterogeneity, fire hazard reduction, and forage quality. The normal stocking rate will be based on the estimated number of pounds of forage available in a normal year—104,170 pounds total or 761 pounds per acre. That is equivalent to 30 Animal Units (AUs), which is the total number of mature cows (without any calves) grazing at the property each month for six months. So the grazing schedule would average 30 mature (1000 lbs.) cows per month for six months. Cows, stockers, or calves may be grazed. Each type of animal will be included separately in a stocking rate formula based on their equivalent forage requirements by age categories, and substituted accordingly. During the spring months, green grass will be likely to grow faster than the cattle consume it, and heights will be at (or temporarily exceed) the high end of the optimal range. During the summer months, the grass will stop growing, die, and be reduced by grazing to the low end of the optimal height range. It will be the Livestock Operator's responsibility to increase or decrease the number of cattle to achieve the standards for each objective.

When the weather predictions indicate a normal year and normal forage production, the normal stocking rate will be used. Such predictions can be made with reasonable precision in the late winter and early spring. The monthly stocking rates for the current year will be reduced to appropriate levels from the planned normal year rates when a substantial deficit of forage is predicted. Such reductions will be implemented within no less than one month, if feasible for the Operator. When a substantial forage deficit occurs, but was not predicted, the stocking rates will be reduced within no less than one month, if feasible for the Operator. For years following an unexpected drought year, the stocking rates for the next year will be reduced (anticipating a repeat of unfavorable conditions) whether or not the predictions indicate unfavorable forage production the next year. The reduced stocking rate will be based on the expected number of pounds of forage available in the next unfavorable month or year, which would usually be no less than 61,709 pounds total or 451 pounds per acre on an annual basis. That reduced rate would be equivalent to 17 AUs for each of six months. In extremely severe drought years, the available forage might be less. The potential deferral allows for a maximum of one year of excessive grazing as a result of unexpected drought, but repeated years of excessive grazing would be avoided.

Rest from grazing is not a critical requirement in well-managed healthy California Annual Grassland. Rest need not be planned for the property unless merited by poor ecosystem health conditions and as long as the predicted forage production for the year will be poor enough to maintain average grass height below the upper limit of the optimal range without grazing. In this case, the excess grass height due to rest in a normal production year would probably reduce habitat quality for the special status animals[16].

The populations of invasive non-native pest plants, such as yellow starthistle, will be controlled to the extent possible using the adjustment of grazing period described above. If early summer grazing were not conducted, then yellow starthistle would be likely to produce flowering stems and seeds above the grass in greater abundance than if early summer grazing was conducted. Control of new introductions and expansion of these pest plants will be minimized by avoiding the creation of bare ground or disturbed soils that would be associated with over-grazing and areas of cattle concentration around corrals and supplemental feed stations. The prescription for stocking rates will prevent over-grazing with the potential exception of the first year of unexpected drought. Cattle concentration areas for supplemental feeding will not be allowed. Corrals for holding of cattle will be temporary and portable, and be situated when needed in an area designated for repeated use. All areas of cattle concentration or other soil disturbance will be monitored for introductions or expansion of pest plants (refer to Section 6).

4.2 Grazing and Exclusion Areas

The entire grazeable uplands area of the property will be available for grazing as one pasture within the perimeter fence. Recent grazing in the existing single pasture system appears to have been sufficient to achieve proper animal distribution and utilization of forage[17]. Experiments with grazing exclosures of stream and pond segments, if any, will be defined in the wildlife management plans elsewhere.

4.3 Structural Improvements and Maintenance

All existing perimeter fences and gates will be maintained in good working quality to contain the grazing cattle, prevent passage by trespassing livestock, limit unauthorized vehicle access, and allow authorized access for management activities. The grazing agreement will specify responsibilities and other requirements for maintenance of existing structural improvements on the property.

If warranted by excess cattle traffic in the streams and ponds, one or two watering structures will be constructed and maintained in the least vulnerable areas as part of a strategy to attract the cattle to the uplands and reduce damage to the drainage courses or ponds.

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[16] This plan did not assess the degree and tolerance limits of reduced habitat quality for the special status animals.

[17] refer to Footnote #10 above.

4.4 Additional Grazing Management to Protect and Improve Sensitive Resources

Buffer strips of ungrazed vegetation around streams and ponds will be maintained by fencing of exclusion areas if warranted by excess cattle traffic in the streams and ponds or by excess concentrations of pollutants, pathogens, or sediments contributed by cattle activities into the water. Such exclusion fencing will be constructed after testing of the alternative watering structures noted in Section 4.3 above. Since such exclusion fencing might have significant effects on habitat qualities for the special status animals, it will be prescribed following tests that will be defined in the wildlife management plans elsewhere.

The dimensions and qualities of stream buffers that would be required to reduce sediment, fecal material, and pathogen transport into the waters of the property should be prescribed based on four factors: (1) resource functional value; (2) intensity of adjacent land use; (3) buffer characteristics; and (4) specific buffer functions required (Castelle, Johnson, and Conolly 1994). In general, the minimum stream buffer width should be greater than 15 meters (about 45 feet) for the maintenance of natural physical characteristics of aquatic resources on this gently sloping property. For comparison, the San Francisco Public Utilities Commission requires a 300 feet stream buffer for the same purposes on its grazed watershed lands (EDAW, Inc. et al. 1997).

The Soil Conservation Service report recommended exclusion of grazing on the property's soil type during the wet season (1981:3). As noted in Section 4.1 above, the grazing period will begin March 1 to avoid impacts to soils during the rainy months when the soil is most exposed.

4.5 Management Other Than Grazing

The populations of invasive non-native pest plants, such as yellow starthistle, will be controlled to the extent possible using the grazing management prescribed in Section 4.1 above. Non-grazing management means will also be used to control the introduction and expansion of these pest plants. Such measures will include the avoidance of any ground disturbing activity (other than fence repair) and the transport of soil. The monitoring program will determine the status of pest plants, and need for their control. When destruction of stands of pest plants is required, hand labor will be used to remove individual pest plants. No chemical pesticides will be used for pest plant control or any other purpose unless approved by the State. If populations of yellow starthistle increase on the property and additional control is required, prescribed burning of the infested sites should be investigated as a tool in coordination with grazing.

Ground squirrels and other rodents are often regarded as "pests" by cattle ranchers because they dig burrows that could cause injury to livestock, and they can denude areas of forage. No control of ground squirrels or other animals will be conducted on the property unless approved by the State. This restriction includes the use of poisons, pesticides, shooting, or any other means. The Livestock Operator and representatives of the State will not bring or release dogs or other domestic animals (except the approved livestock) onto the property unless approved by the State.

During the dry summer and fall, grasses in California annual grassland can constitute a significant fire hazard associated with build-up of fine fuels. As noted in Section 1.5 above, a fire management plan should be developed for the property. The prescribed grazing will substantially reduce the summer and fall fire hazard on the property. In addition, fire risk will be reduced by disking or mowing a bare soil swath around the perimeter of the property twice during the spring growing season to discourage the persistence of plant mass. Such practices will be prescribed in the wildlife management plan elsewhere.

Traffic by vehicles on the natural grassland surface would subject the soils to compaction, collapse of animal burrows, and potential erosion. Neither the Operator nor representatives of the State will drive vehicles across the property except along designated drives from Bruns Avenue to the warehouse or along other designated lanes.

Fencing that presents a barrier to wildlife movement would potentially subject the special status animals to reduced availability of prey or reduced ability to travel within their habitat. Fencing of the property will be limited to conventional multi-strand wire designed for cattle.

The potential health threat of *Cryptosporidium*, a livestock-borne pathogen was described in Section 1.6 above. Other pathogens and animal parasites are also transported by cattle, and pose the potential for disease transmission to the special status animals, other wildlife on the property, and humans who consume the water. To minimize such risk, the Operator will control internal and external parasites and pathogens of the cattle to be grazed on the property by the best conventional means available.

5.0 CONTINGENCIES FOR LOW FORAGE PRODUCTION

In many year-long grazing programs, supplemental feeding of the livestock is necessary during the fall and early winter period of poor forage quality or availability, if those livestock are to be maintained on the property. In addition, arrangements are sometimes made in grazing agreements whereby a "forage bank" or alternative grazing area with adequate green forage is available, and the livestock can be moved to the site during periods of emergency due to major unexpected defoliations or forage damage, such as by fire or blight from insects or disease. In this case, the risk of emergency loss of forage is lower because the grazing period precedes the normal season of fire or blight. However, drought could cause forage reductions that will require the Livestock Operator to find alternative grazing locations, provide supplemental feed, or both. In the event of emergency loss of forage on the property during the planned grazing period, the Operator will move the cattle to other locations off the property to the extent reasonably possible. Supplemental feeding of the livestock on the property is not an available option[18]. Such contingency actions should be considered by the State as an added cost to the Operator.

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[18] Caitlin Bean, March 30, 2000: personal communication. Ms. Bean is Environmental Specialist, Habitat Conservation Planning Branch, California Department of Fish and Game.

6.0 MONITORING AND ADAPTIVE MANAGEMENT

The monitoring program will provide an accurate assessment of the balance between forage supply and utilization to assure that cattle stocking rates and schedules are set to provide optimum wildlife habitat and rangeland conditions. It will provide the basis for adjustment of estimates for future forage production and utilization in revisions of this document. An ungrazed reference area with similar environmental conditions nearby, if available, should be measured using the same variables and methods to provide a comparison of production and other conditions in the absence of grazing effects. It is important to note that this monitoring program requires considerable measurements supplementary to those suitable for livestock production purposes, to accommodate the wildlife habitat protection and improvement goals. The recommended approach uses a combination of permanent photography monitoring stations and temporary sampling schemes.

This monitoring program is limited to a minimum set of variables, schedule, and reporting that will achieve the monitoring goals, and that can be accommodated within the limitations of the available personnel of the Livestock Operator and the State[19]. The Operator will perform the primary field assessments and reporting. In the event that educational institutions or other personnel resources become available for the study of grazing and habitat conditions at the property, then an expanded monitoring and research program would be useful.

6.1 Monitoring Variables, Methods, and Schedule

Monitoring will assess grassland forage production, grazing utilization, residue, herbaceous foliage cover, pest plant populations, erosion, and disturbance. Because the vegetation type and topography is relatively uniform across the property, no stratification of monitoring sites is necessary. Permanent stations for repeated photography will provide a visual record and reference for general rangeland conditions, grass height and cover, and pest plant populations. Temporary sampling stations will be used to achieve a systematic representation of the grazeable upland grasslands of the property.

[19] Scott Wilson and Caitlin Bean, May 9, 2000: personal communication during a meeting at the property. Mr. Wilson and Ms. Bean are Environmental Specialist, Central Coast Region, and Environmental Specialist, Habitat Conservation Planning Branch, respectively, both with the California Department of Fish and Game.

Annual Monitoring Summary:

Variable (units)	Method	Timing	Responsible Party
Herbaceous Foliage:			
Biomass (pounds/acre)	Obtain an average from 20 systematically distributed sample sites; clip, dry, and weigh samples from 1 sq. foot plots at each site using the methods of Frost, McDougald, and George (1990) or the UC Center for Range and Forested Ecosystems (1998; chp. 6); measure current green and dead foliage together	Once at beginning and once at end of grazing period	Operator
Height (inches)--1	Obtain an average from the 20 measured sample sites; determine average forage height of each site within one yard radius circle by visual comparison with yardstick	Once at beginning and once at end of grazing period	Operator
Height (inches)--2	Obtain an average from 10 sample sites adjacent to convenient roadside locations; make remote visual estimates of average forage height of each site within an approximate three yard radius circle	Monthly between measures of Height-1	Operator
Absolute Cover (percent)--1	Obtain an average from the 20 measured sample sites; determine the average percent cover of three variables (green foliage, litter, and bare soil/gravel [excluding rocks]) for each site within one yard radius circle by visual estimate	Once at beginning and once at end of grazing period	Operator
Absolute Cover (percent)--2	Obtain an average from 10 Height-1 sample sites; make remote visual estimates of average cover (three variables) of each site	Monthly between measures of Cover-1	Operator
Invasive Non-native Pest Plants (species and locations)	Map the general distributions of the locations of these pest plants on a baseline property map	Once in late spring	Operator

Variable (units)	Method	Timing	Responsible Party
Erosion (location; severity; changes)	Map and record descriptions of the status of sites of significant erosion	Once in late spring	Operator
Unplanned Disturbance (type; date; location; severity)	Record descriptions of events (e.g. fires, infestations, vandalism) with dates and judgments of importance and effects	Maintain a log for the year	Operator
Actual Livestock Use (types and numbers)	Record the schedule of livestock types and numbers present on the property	Maintain a log for the year	Operator
Illustrative Views	Establish stations for repeated photo documentation at 10 permanently marked locations that represent the vegetation and soils of the uplands, banks of ponds and streams, fencelines with adjoining ungrazed property	Photograph the stations at the beginning and end of grazing period; maintain a log	State

If feasible, measurements of the primary herbaceous foliage variables (Biomass, Height-1, and Cover-1) should be taken within the adjacent ungrazed lands at five sample sites of similar physical conditions to the Byron Conservation Bank property. If not feasible, five small caged exclosures should be installed within the property from which these ungrazed comparative measurements can be taken. The timing of these measurements will be the same as noted in the table above. Results will be valuable to calculate the potential total annual herbaceous production.

Collection of monitoring data for the herbaceous foliage variables by the Livestock Operator should take no more than one day per month. Data collection for the pest plants and erosion variables once in the late spring should take no longer than one day combined. The disturbance and livestock use logs should be a minimal time requirement periodically. The professional ecologist representing the State will visit the property with the Operator at least twice during the grazing period, once at the beginning and once at the end of the grazing period[20]. At that time the State representative will participate in the data collection and take photographs at the permanent stations. Sample data forms are included in Appendix A.

The data collected for the 20 samples of herbaceous foliage biomass, height, and cover will be analyzed and presented in a table of summary statistics, including mean, range, and standard error (to approximate the 95% confidence intervals). Cumulative inter-

[20] Ibid.

annual summaries will be included in these tables for each of these variables. Heterogeneity in height structure of the herbaceous foliage will be extrapolated as categories from these results. Minimization of the impacts of livestock herbivory and trampling on riparian vegetation will be judged from these results based on the frequency of below-standard results. The degree of introduction and expansion of invasive non-native pest plants will be assessed from the maps of these plants, and summarized in a plant list with area and percent change. Improvement and maintenance of high quality grassland and riparian/wetland conditions and ecosystem functions will be judged from the results for all variables. The quality of forage and other conditions of rangeland ecosystem health will also be judged from the results for all variables. Data or judgments for these variables will be presented in individual tables as defined in the methods column above. An album of prints from the photo documentation will be maintained by the State, and samples will be used to illustrate key results in each annual report.

The qualities of the cooperative relationship between the Operator and the State will be judged by both parties during an annual meeting (or phone conversation) after the monitoring results have been compiled into an annual report and distributed to both parties.

Preliminary testing of the monitoring methods, a plan for efficient monitoring, and measurement of the initial baseline conditions will be conducted by a professional ecologist in cooperation with the Operator during the fall prior to the first grazing period. Specific monitoring protocols, data forms, analysis procedures, and record keeping and reporting procedures will be determined at the conclusion of this preliminary monitoring.

Subsequent monitoring will be conducted by the Operator as a condition of the grazing agreement with the State. The State will also, at its option, conduct monitoring in a similar or different manner to validate or improve the regular monitoring program.

The data collected by the Operator will be transferred after each monitoring event to the assigned representative of the State. The State will have the responsibility to enter the data into simple spreadsheets, conduct simple analyses, develop the summary tables noted above, make the professional judgments noted above, and prepare the summary annual report. This latter set of responsibilities will be delegated to the Operator if appropriate, including availability of adequate training and means of compensation.

6.2 Adaptation of Management Plans

Adaptation of the management plans, including the objectives, stocking schedule, and other actions defined in this document, will be made following an annual evaluation of the monitoring results by the Operator and the State at an annual meeting or phone conversation. Any adaptations will be based on that evaluation and the determination of significant potential for improved results due to modified management practices or new information. The State will make final decisions and provide specific written guidance to the Livestock Operator about any changes or adaptations.

7.0 INCENTIVES TO THE LIVESTOCK OPERATOR

The cooperative relationship between the Livestock Operator and the State will be vital to both the effective operation of the grazing agreement, and to the continual improvement of the management of the property through adaptation based on the monitoring and annual evaluation. Assigning the primary responsibilities for monitoring and proposals for adaptations of the grazing plans to the Operator will add the significant opportunity to discover new information and to improve management. That responsibility will also provide an incentive to the Operator to find better ways to achieve the State's goals. Compensation in some form for voluntary reductions in stocking rates during emergencies, losses associated with ground squirrel burrows, costs for structural improvements, and costs for labor to control invasive non-native pest plants will also provide incentives to the Operator. The State's provision of information, including manuals and reference documents, invitations to workshops, and personal contact with technical representatives to discuss new ideas and scientific development will serve as incentives to the Operator to study and improve management practices.

The Operator's responsibilities are guided by the performance objectives and standards described in the sections above. The Operator should be allied with an equally or better skilled representative of the State who can provide technical assistance as a fellow professional and who has the authority to intercede if the results are not appropriate. These incentives will give the Operator the opportunity to take pride and financial reward in cooperating to achieve the State's conservation goals.

8.0 SUMMARY OF ASSUMPTIONS

The determination of management goals, estimation of grazing capacity, and development of management guidelines were based on the following assumptions:

- The primary management issues are limited to those described in the report on field surveys and habitat assessments for the special status amphibians and reptiles of the site by Biosearch Wildlife Surveys (1999). No other resource management plans or agreements, such as local zoning plans, water resource use plans, or land use plans, are in place that would conflict with the grazing management plans described here. No cultural resources impacts exist that would conflict with the grazing management plans described here.

- Development of this grazing management plan did not include direct field surveys or measurements of the affected natural resources. Estimates of forage production and grazing capacity were estimated from the reliable sources indicated. If new natural resource management issues are raised by the prescribed monitoring studies, such as expansion of pest plant populations, then this plan will be revised.

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APPENDIX A. MONITORING FORMS

The following forms serve as templates for the preliminary testing of monitoring methods for the herbaceous foliage variables. The other variables will be mapped on base maps of the property and described on simple notepaper.

DATA FORM: HERBACEOUS FOLIAGE-1
Byron Mitigation Bank Monitoring
Once at the beginning and once at the end of the grazing period
Direct measurement of 20 systematically distributed sample sites (and 5 ungrazed sites)

Date:_____

GRAZED SITES

Recorder:			Absolute Cover (percent):		
Sample Number	Biomass (pounds/acre)	Height (inches)	Green foliage	Litter	Bare soil/gravel [excluding rocks]
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

UNGRAZED SITES

Sample Number	Biomass (pounds/acre)	Height (inches)	Green foliage	Litter	Bare soil/gravel [excluding rocks]
1					
2					
3					
4					
5					

DATA FORM: HERBACEOUS FOLIAGE-2
Byron Mitigation Bank Monitoring
Monthly between measures of Herbaceous Foliage-1
Remote visual estimates at 10 sample sites adjacent to convenient roadside locations

Date:_____

Recorder:		Absolute Cover (percent):		
Sample Number	Height (inches)	Green foliage	Litter	Bare soil/gravel [excluding rocks]
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				