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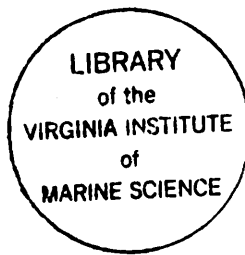
**Distribution of *Aeschynomene virginica* and *Bacopa innominata*
along the proposed alternative routes for the SR629 Mattaponi
River crossing upgrade project**

James E. Perry

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**Distribution of Aeschynomene virginica and Bacopa innominata
Along the Proposed Alternative Routes
for the SR629 Mattaponi River Crossing Upgrade Project**

tb **Final Report Submitted To**

**Department of Transportation
Environmental Division**

Submitted By

**Center for Coastal Management and Policy
Virginia Institute of Marine Science
College of William and Mary
Gloucester Point, Virginia 23062**

EC **Prepared By**

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CMAP 92-3**

INTRODUCTION

Four wetland macrophytes of interest are found in the region of the proposed upgrade of the State Route 629 bridge crossing of the Mattaponi River. Two of these are State listed endangered or threatened species: the sensitive joint vetch (Aeschynomene virginica) and the mat-forming water-hyssop (Bacopa innominata). Two species, Long's bittercress (Cardamine longii) and Parker's pipewort (Eriocaulon parkeri) are included on the Virginia watch list (Ludwig, 1992).

The purpose of this study was to locate and describe plant populations of the specified species (i.e. determine the size, spatial distribution, and density of extant populations) within a specified range of each proposed alternative, to investigate and describe the possible impacts each alternative of the project may have on extant populations, and to describe potential mitigation measures that could be used to minimize the impacts.

SITE DESCRIPTION

State Route (SR) 629 crosses the Mattaponi River in the town of Walkerton, Virginia (Fig. 1). The river is approximately 150 m. wide, 3 m. deep in the deepest section (averages depth is approximately 1.5 m.). Mean tidal range at Walkerton is 1.2 m. (3.9 ft, largest range in the Chesapeake Bay) and the spring tide range is 1.4 m. (U.S. Dept. Comm., 1991). Salt is not an important parameter in the project area as the farthest upstream that the 1 parts per thousand salinity halocline is known to travel in the Mattaponi River is 21 k. upstream from West Point, thus approximately 30 k. downstream of Walkerton (Brooks, 1983).

The shore on both sides of the river and the shore of the island located on the west side are populated with freshwater hydrophytes. The populations represented three distinct ecotones: submerged to immersed vegetated zone (dominated by Nuphar luteum); emergent zone (dominated by a large diversity of

herbaceous species); and a low bank zone dominated by trees and shrubs.

Submerged to Immersed Zone: Dominated by yellow spatter dock (Nuphar luteum), the zone extends from the mean tide line to spring low water. It varies in width from a few meters on the west side of the river to 10 to 20 m on the south and north ends of the island and northeast corners of the work site. Other species found in this zone, albeit in very small numbers, included Pontederia cordata, Polygonum punctatum, Scirpus americanus, and Zizania aquatica. Both Cardamine longii and Eriocaulon parkeri populations reached their lower waterward limit at the landward edge of this zone.

Emergent Zone: The zone extends from the mean tide line to the mean high tide mark. The zone was dominated by mixed herbaceous and/or graminoid vegetation. The south shore was dominated by Zizania aquatica, Juncus effusus, Pontederia cordata, and Scirpus americana. Large populations of Eriocaulon parkeri, Eleocharis parvula, and Sagittaria subulata form extensive mats throughout the zone. Other species present, but not dominant, included Boehmeria cylindrica, Helenium autumnale, Polygonum punctatum, Cinna arundinacea, Acorus calamus, Impatiens capensis, Lobelia cardinalis, Orontium aquaticum, Ludwigia palustris, and Pilea pumila. The substrate was a clayey-sand with large amounts of gravel. Organics were present in the soil and stained the fingers when the soil was rubbed between them.

Low Bank Zone: Zone above mean high tide. Dominated by shrubs and trees. Soil of the zone was a clayey-loam. The dominant trees were Platanus occidentalis and Salix nigra. The dominant shrub was Alnus serrulata. Also present were Acer rubrum, Betula nigra, Cephalanthus occidentalis, and Liquidambar styraciflua. This zone partially shaded the emergent zone on both sides of the river. Its presence and resultant shading on the island was minimal.

PROJECT DESCRIPTION

Six options have been forwarded for enhancing the SR 629 Mattaponi River crossing. A description of each with potential construction activities associated with each is provided below. Information was taken from maps provided by VDOT.

OPTION #1: BUILD BRIDGE UPRIVER. A new bridge would be constructed upriver, northwest of the existing bridge. The south approach would cross the river at an existing bulkhead approximately 300 ft. shoreward of the existing bridge. The new bridge would cross the marsh island approximately 125 ft. upstream of the existing bridge and come ashore at the existing deteriorated bulkhead just south of the old cannery buildings. **ACTIVITIES:** Vehicular access points would need to be constructed to connect the new bridge to SR 629. Dredge and fill activities would be necessary to construct footings. The old bridge would be removed.

OPTION #2: BUILD BRIDGE DOWNRIVER. A new bridge would be constructed downriver, southeast of the existing bridge. The south approach would cross the river at an existing structure (boathouse) approximately 100 ft. downstream of the existing bridge. The new bridge would cross the marsh island approximately 75 ft. downstream of the existing bridge and come ashore at an existing deteriorated bulkhead approximately 50 ft. downstream of the existing bridge. **ACTIVITIES:** Vehicular access points would need to be constructed to connect the new bridge to SR 629. Dredge and fill activities would be necessary to construct footings. The old bridge would be removed.

OPTION #3: REBUILD ON EXISTING LOCATION. (self explanatory) **ACTIVITIES:** Some dredging activities to replace/rebuild footings may be necessary.

OPTION #4: REBUILD IN EXISTING LOCATION, DETOUR ON FLOATING BRIDGE OR FERRY. Access for traffic is shown to the southeast, downstream of existing bridge. **ACTIVITIES:** Some dredging activities to replace/rebuild footings may be necessary. Access points to floating bridge or ferry would need to be constructed at both ends.

OPTION #5: CUL-DE-SAC ROAD ON BOTH SIDES OF BRIDGE.

ACTIVITIES: Construction would be limited to removal of old bridge and construction of terrestrial cul-de-sacs on both ends of SR 629.

OPTION #6: EXTENSIVE REBUILDING OF EXISTING BRIDGE. (self explanatory) ACTIVITIES: Some dredging activities to replace/rebuild footings may be necessary.

STUDY CORRIDOR

The study corridor was defined as the river banks on both sides of the proposed alternatives and the entire terrain of the existing island, extending 100 meters upstream of the most upstream portion of the project and 100 meters downstream of the most downstream portion of project (Fig. 1).

METHODS

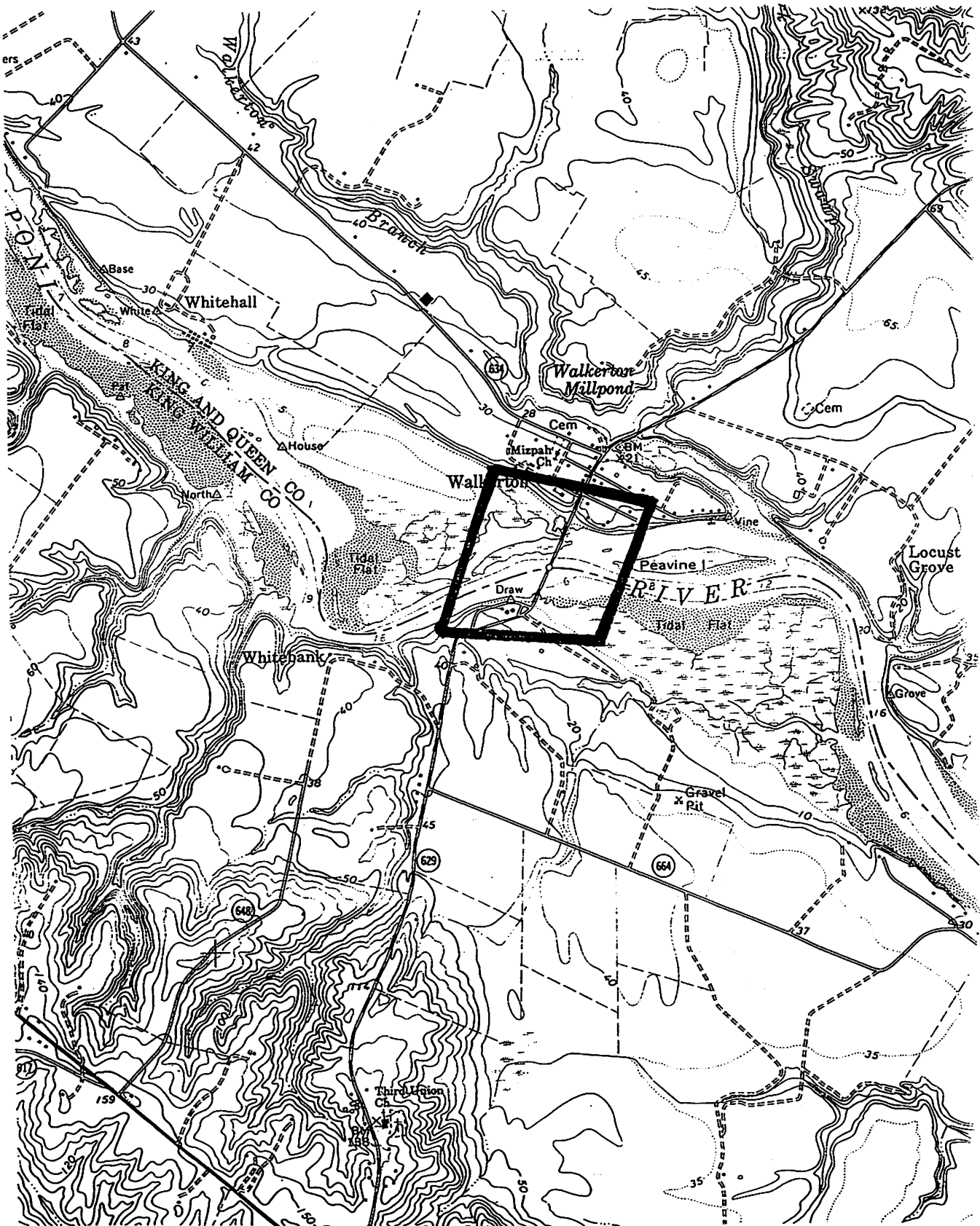
Historical data concerning plant species of significant concern (i.e. those species listed by either the federal or state authorities as endangered or threatened, or appearing on the state's watch list) was reviewed for the Walkerton area.

A survey of these historical sites within the project area was conducted to determine the current population status of the above identified species. As well, a survey of the entire project area was conducted to determine if other populations of the identified species of significant concern, or any other significant species not historically noted from the area, occurred within the general vicinity of Walkerton, Virginia. Specific attention was paid to habitats that are similar to those which contain populations of the significant species.

When located, a diagram (map) of the limits of the extant rare plant populations in the project area was prepared, and status of each of the mapped populations including species density, vigor, reproductive history and habitat (associated species, substrate, relationship to tidal zone).

Potential impacts of the project on extant populations was determined by measuring the distance of the nearest edge of the

Figure 1. Project location map. Study corridor is marked by heavy lines and extended a minimum of 100 m. upstream and downstream of proposed options. See project description for an explanation of the options. SCALE: 1in.= 2000ft.



population from the alternative, the distance of center of the population from the alternatives, and the type of disturbance that would be associated with the activity needed to accomplish the alternative (e.g. placement and location of equipment, earth moving, turbidity, dredging, fill placement, etc.).

Plant nomenclature follows Gleason and Cronquist, 1991. Species distributions were confirmed with Harvill et al., 1986. Species status was confirmed through personal communications with Mr. John Tate and Mr. Christopher Ludwig.

SPECIES DESCRIPTIONS

Aeschynomene virginica

(Sensitive or northern joint vetch)

DESCRIPTION: A tall (0.5-2.0 m) annual legume; stems erect, bristly, branched; leaves even-pinnate (a few may be odd-pinnate), 2-12 cm long; leaflets 30-56, 1 nerved, entire, 2-3 mm wide, oblong; pedicels 3-8 mm long, with sessile toothed bractlets about 4 mm long and 2-3 mm wide immediately below flowers; pea-shaped flowers 1-6, yellow with red veins, standard (uppermost petal) 10-15 mm long; legume fruit a legume, 2-7 cm long, stipe 1-1.5 cm long; joints 4-10, sparsely pustulate hairy, breaking into 1-seeded segments (modified from Gleason and Cronquist, 1991; Terwilliger, 1991).

HABITAT: On sandy or muddy river banks and tidal shores (Hershner and Perry, 1987; Perry and Hershner, 1989; Gleason and Cronquist, 1991; Terwilliger, 1991). Usually found associated with grazing or other activities that remove or decrease vegetation cover (Hershner and Perry, 1987; Perry and Hershner; Terwilliger, 1991). Found in areas often dominated by a diverse mixture of emergent macrophytes, including Bidens laevis, Chamaecrista fasciculata var. macroperma, Hibiscus moscheutos, Leersia oryzoides, Polygonum punctatum, P. arifolium, and Zizania aquatica.

DISTRIBUTION: Southern New Jersey south to Craven County, North Carolina. Has been extirpated from Delaware and Pennsylvania. In our region it has been recorded from the coastal plain in oligohaline and tidal freshwater marshes of the Chicahominy, Mattaponi, Pamunkey, Rappahannock, and Potomac Rivers. The population of A. virginica has declined from over 10,000 plants at one point in the past to about 700 individuals in 1986 (modified from Terwilliger, 1991). No specimen of A. virginica were present within the study corridor during this study nor do any historical records place this species within the study corridor. However, historical records do show that the species was present in wetlands approximately 1 k. downstream of the proposed project area (Hershner and Perry, 1987).

STATUS: Globally and state ranked as very rare and imperiled with 6 to 12 occurrences or few remaining individuals; or because of some factor(s) making it vulnerable to extinction (G2, S2, respectively) (Table 1, Appendix 1). It has recently been assigned federal Threatened status under Section 4(a)(1) of the endangered Species Act (16 U.S.C. 1531 et seq.) and federal regulations (50 CFR part 424) (see Federal Register, Vol. 57, No. 98, May 20, 1992, pg. 21569-21574, 50 CFR part 17) (see Appendix 2 for definitions of state and federal status terms).

Bacopa innominata

(Mat-forming water-hyssop)

DESCRIPTION: Emergent, prostrate perennial herb, sometimes forming mats 5-30 cm in diameter; stems succulent, slightly angled (often appearing four-sided), glabrous, much branched, rooting at the nodes; leaves opposite, fairly thick, obscurely 3-5 veined, round ovate, sessile, somewhat clasping at the base, 5-10 mm long, 3-5 mm wide; flowers axillary; pedicels ascending or spreading, recurved in fruit, 3-6 mm long; sepals 5, fused basally, upper broadly ovate-cordate, 4-6 mm long; corolla

tubular, 5-lobed, whitish, 4-5 mm long; capsule ovoid, 2-4 mm long; seeds numerous (modified from Fernald, 1950; Gleason and Cronquist, 1991; Terwilliger, 1991).

HABITAT: Wet places and shallow waters, found along the fringe tidal oligohaline and fresh water areas of our Chesapeake Bay tributaries. Substrate varies from soft, silty loam to a fine sand-gravel-clay mix. The most robust specimens are found in a partially shaded eastern exposure shore with a sand-gravel substrate located between the mean tide and mean high tide marks (Hershner and Perry, 1987; personal observations). Vegetation areal coverage is usually moderate to low where B. innominata thrives. It is associated with dominant emergent macrophytes including Eriocaulon parkeri, Juncus effusus, J. scirpoides, Polygonum punctatum, Pontederia cordata, Sagittaria subulata, Scirpus americanus, and Zizania aquatica (modified from Hershner and Perry, 1987; Terwilliger, 1991; personal observations).

DISTRIBUTION: Common in the West Indies and Central America, north to southeastern U.S. where populations are small, rare in North Carolina and in the intertidal zone of Virginia and Maryland. May be extirpated from Maryland and North Carolina. B. innominata has been recorded in Virginia on the tidal freshwater shores of the Chickahominy, Mattaponi, and Pamunkey Rivers and the non-tidal portion of the Chickahominy River. Several populations have been reported from the Walkerton, Virginia area (Hershner and Perry, 1987). A relatively large, healthy population of B. innominata was found on the southwest upstream section of the SR 629 bridge in previous work (Hershner and Perry, 1987) and during this study (Fig. 2). The present population consist of 20 to 22 plants, ten which were robust and healthy, and most with reproductive structures (fruit). The population was located approximately halfway between the proposed upriver crossing and the existing bridge. It extended from approximately 13 m. downstream of the existing bulkhead a

distance of approximately 27 m. Distribution of the population within the 27 m. can be defined as radiating upstream and downstream from the center with decreasing robustness and health, i.e., plants found on the upstream and downstream margins are noticeably smaller and had fewer flower structures, leaves, and branches than those in the center. The population was limited to the emergent marsh zone. A RARE SPECIES SIGHTING FORM has been filed with the Division of Natural Heritage Program (Appendix 3).

STATUS: Ranked federally as very common and demonstrably secure globally, though it is rare in our part of its range (G5). Virginia list the element as very rare and imperiled with 6 to 12 occurrences or few remaining individuals within the state; or because of some factor(s) making it vulnerable to extinction (S2) (Table 1, Appendix 1). It has been listed in the state of Virginia as **Endangered** under the Endangered plant and Insect Species Act, Chapter 39, Section 3.1-1020 through 1030 (see Appendix 2 for definitions of state and federal status terms).

Cardamine longii

(Long's bittercress)

DESCRIPTION: Annual plant with weak and diffuse stems from fibrous roots, 1-3 dm high; leaves all petiolate, sub-rotund to reniform, rounded or cordate at base; raceme poorly developed, elongating after anthesis; flowers apetalous, petioles lacking, mature pedicels 1-3 mm (up to 6 mm in some cases) long; fruit a silique, lanceolate, ascending, 5-12 mm long, the beak 0.5-1 mm long (modified from Fernald, 1950; Gleason and Cronquist, 1991).

HABITAT: Intertidal edge of oligohaline salt and tidal fresh water marshes on muck or peaty soil (Gleason and Cronquist, 1991; personal observations).

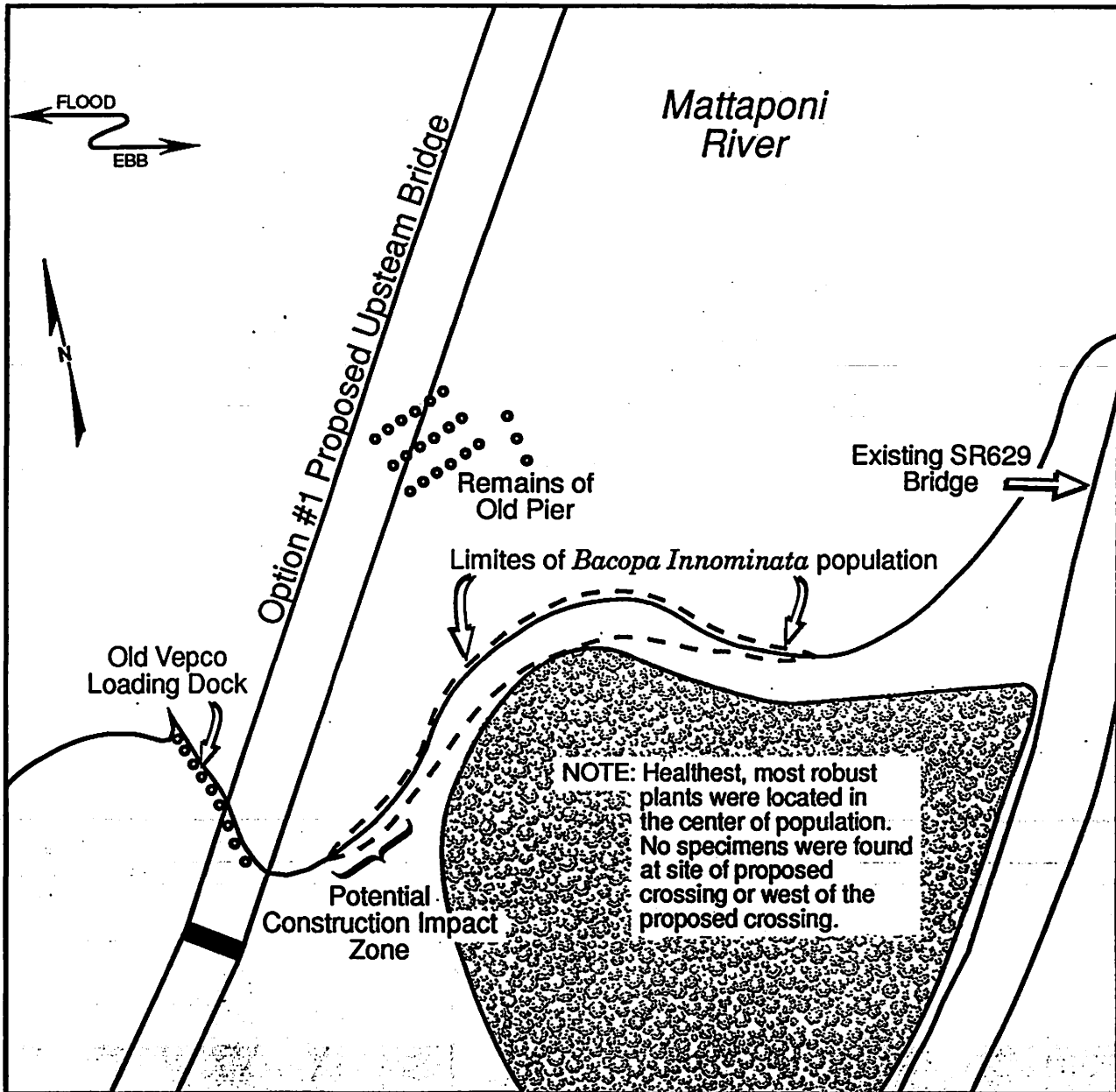


Figure 2. Distribution of *B. innominata* population southwest (upstream) of SR 629. The most robust plants were located in the center of population. Several plants located on the western edge of the population are located in the construction zone of option #1 (see project description for details).

DISTRIBUTION: Coastal estuaries from Maine to Virginia. A northern species that reaches its southern most limits in our region. C. longii was common in the emergent zone along the shores of the island and the north shore of the study corridor. The population extends well upstream and downstream of the study corridor.

STATUS: Globally and statewide ranked as either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range; or vulnerable to extinction because of other factors (G3). C. longii has been assigned to the federal status of 3C, i.e. "The taxon has proven to be abundant, widespread, and unthreatened so that listing is currently inappropriate" (see Table 1, Appendix 1).

Eriocaulon parkeri

(Parker's pipewort)

DESCRIPTION: Plant green to purple; leaves 1-6 cm long; scapes 0.1-2 dm high; mature heads rather loosely flowered, drab, depressed-hemispherical, 2.5-7 mm broad; involucre pale; bracts appressed, ascending to merely spreading, not hidden in fruit; chaff and flowers glabrous or merely ciliolate with minute trichomes; seeds mostly ellipsoid, rarely sub-globose.

HABITAT: Tidal flats and muddy shores, often submerged; in fresh to slightly brackish water (Fernald, 1950; Gleason and Cronquist, 1991). Common along tidal margins of the tidal fresh water marshes of the Mattaponi River (Hershner and Perry, 1987).

DISTRIBUTION: Tidal mud and estuaries, Estuary of St. Lawrence, Maine to Virginia, North Carolina (Fernald, 1950; Gleason and Cronquist, 1991). Found in Arlington, Caroline, Charles City, Essex, Fairfax, James City, King and Queen, King William, New Kent, Prince William, Stafford counties, and City of Suffolk

(Terwilliger, 1991). E. parkeri was very common in the emergent zone along the shores of the island and both sides of the river. The population extends well upstream and downstream of the study corridor.

STATUS: Globally and statewide ranked as either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range; or vulnerable to extinction because of other factors (G3). E. parkeri has been assigned to the federal status of 3C, i.e. "The taxon has proven to be abundant, widespread, and unthreatened so that listing is currently inappropriate" (see Table 1, Appendix 1).

POTENTIAL IMPACTS AND RECOMMENDATIONS

Aeschynomene virginica: No specimens were present in the study corridor during this study. Therefore, no existing plant will be impacted by any of the proposed options. We have no information on seed bank availability of the species. Thus, the potential for loss of propagule source due to construction activities associated with all options is unknown. However, since the construction areas are narrow and relatively well defined, any propagule loss could probably be kept to a minimum. Also, habitat loss and damage to the seed bank could be minimized by removing the old bridge structure, regrading to the appropriate elevations, and relocating any marsh soil that is to be filled or dredged in the new bridge area to the appropriate zone in the new marsh area.

Bacopa innominata: Any construction activities on the southeast (upstream) side of the existing bridge may possibly impact the existing B. innominata population. In particular this includes OPTION #1: BUILD BRIDGE UPRIVER (see above for description of option). If constructed as proposed, a minimum of two plants would fall within the construction zone. Also it is likely that

two other plants within 10 ft. of the construction area would also be impacted by foot or construction vehicle traffic. Turbidity associated with dredging and placement of fill for new bridge footings or repair work on the old footings (associated with all OPTIONS with possible exception of OPTION #6) may impact the entire population of plants by coating them with a thin layer of sediment. Care must be taken to use proper turbidity control procedures.

Several steps could be taken to minimize the impacts of OPTION #1 on the extant B. innominata population:

- 1) If possible, establish a no work zone around the population to protect as much of the population as possible. This should include not only construction equipment, but construction workers as well. If encroachment into the population is necessary, limit the encroachment to the less healthy upstream or downstream region of the population. Consideration could be given to transplanting any single specimen that would be impacted to a region of the population that would not be impacted. It is not recommended that they be moved to the center of the population, as working in that region may further impact the more healthy plants.

- 2) Make certain that sediment and turbidity control devices and procedures are strictly adhered to. If turbidity does become a problem (can be seen as an abnormal amount of sediment on the leaves of the plants, causing them to arch toward the soil surface), a light washing may be necessary. If washing becomes necessary, extreme care must be taken to not alter nor disturb the sediment around the plants.

- 3) To minimize damage to the seed bank and any loss of habitat, the same mechanisms as recommended for the A. virginica can be used. The old bridge structure could be removed, the shore area regraded to the appropriate marsh zone elevations, and any marsh soil that is to be filled or dredged can be relocated to the appropriate zone in the new marsh area.

Cardamine longii: any construction activities that involve the island and north shore of the river will impact extant populations of C. longii. However, since the species "... has proven to be abundant, widespread, and unthreatened so that listing is currently inappropriate" (Table 1), no special action is deemed necessary.

Eriocaulon parkeri: any construction activities that involve the island and both shores of the river will impact extant populations of E. parkeri. However, since the species "... has proven to be abundant, widespread, and unthreatened so that listing is currently inappropriate" (Table 1), no special action is deemed necessary.

Table 1. Endangered, threatened, or plant species of special concern historically located in the Walkerton vicinity of the Mattaponi River. All but Aeschynomene virginica were present during this study (see text for further details). All RANK and STATUS codes are taken from Ludwig, 1992, with the exception of the federal status of Aeschynomene virginica taken from Federal Register, Vol. 57, No. 98, May 20, 1992, pg. 21569-21574. NL means there is no listing available.

SCIENTIFIC NAME	COMMON NAME	GLOBAL STATE RANK	STATE RANK	FEDERAL STATE STATUS	STATE STATUS
<u>Aeschynomene virginica</u>	Sensitive joint-vetch	G2	S2	LT	C
<u>Bacopa innominata</u>	Water hyssop	G5	S2	NL	LE
<u>Cardamine longii</u>	Long's Bittercress	G3	S3	3C	NL
<u>Eriocaulon parkeri</u>	Parker's pipewort	G3	S3	3C	NL

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APPENDIX 1

Explanation of rare plant RANK and STATUS codes.
(from Ludwig, 1992)

LIST FORMAT

The rare plant list and the watchlist are ordered alphabetically by scientific name. Each listing has an identical format which presents six fields: scientific name, common name, global rank, state rank, federal status, and state status. To aid in the interpretation of the list, a brief explanation of each field follows:

Column 1. Scientific name:

In all but a few cases, nomenclature follows J.T. Kartesz, A Synonomized Checklist of the Vascular Flora of the United States (in press). Since the user may not have access to this reference, a line is provided below the scientific name. This line provides the user with a synonymy when other names are used in popular regional botanical references including the 2nd edition of the Atlas of the Virginia Flora by A.M. Harvill, Jr., T.R. Bradley, C.E. Stevens, T.F. Wieboldt, D.M.E. Ware, and D.W. Ogle, 1986. The synonymy field is also used to give other pertinent taxonomic information, and note when the nomenclature does not follow Kartesz.

Column 2. Common name:

A common name is provided for the convenience of the user. Common names for plants are not standardized and many taxa have no entirely satisfactory common name.

Column 3. Global rank:

Global ranks are assigned by a consensus of the network of natural heritage programs, scientific experts, and The Nature Conservancy to designate a rarity rank based on the rangewide status of a species or variety. This system was developed by The Nature Conservancy and is widely used by other agencies and organizations as the best available scientific and objective assessment of a taxon's rarity and level of threat to its existence. The ranks are assigned after considering a suite of factors including number of occurrences, numbers of individuals, and severity of threats.

G1 = Extremely rare and critically imperiled with 5 or fewer occurrences or very few remaining individuals; or because of some factor(s) making it especially vulnerable to extinction.

G2 = Very rare and imperiled with 6 to 20 occurrences or few remaining individuals; or because of some factor(s) making it vulnerable to extinction.

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range; or vulnerable to extinction because of other factors. Usually fewer than 100 occurrences are documented.

G4 = Common and apparently secure globally, though it may be rare in parts of its range, especially at the periphery.

G5 = Very common and demonstrably secure globally, though it may be rare in parts of its range, especially at the

- periphery.
- GH = Formerly part of the world's biota with expectation that it may be rediscovered.
- GX = Believed extinct throughout its range with virtually no likelihood of rediscovery.
- GU = Possibly rare, but status uncertain and more data needed.
- G? = Unranked, or, if following a ranking, rank uncertain (ex. - G3?).
- G_Q = the taxon has a questionable taxonomic assignment, such as a G3Q.
- G_T = signifies the rank of a subspecies or variety. For example, a G5T1 would apply to a subspecies of a species that is demonstrably secure globally (G5) but the subspecies warrants a rank of T1, critically imperiled.

Column 4. State rank:

State ranks are assigned in a manner similar to that described for global ranks, but consider only those factors within the political boundaries of Virginia. For example, whereas a plant which is endemic to Virginia (found nowhere else) will have the same global and state ranks, a plant which may be common in the northeastern United States, but only known from a few occurrences in Virginia will have different global and state ranks. By comparing the global and state ranks, the status, rarity, and the urgency of conservation needs can be ascertained.

- S1 = Extremely rare and critically imperiled with 5 or fewer occurrences or very few remaining individuals in Virginia; or because of some factor(s) making it especially vulnerable to extirpation in Virginia.
- S2 = Very rare and imperiled with 6 to 20 occurrences or few remaining individuals in Virginia; or because of some factor(s) making it vulnerable to extirpation in Virginia.
- S3 = Rare to uncommon in Virginia with between 20 and 100 occurrences; may have fewer occurrences if found to be common or abundant at some of these locations; may be somewhat vulnerable to extirpation in Virginia.
- S4 = Common and apparently secure with more than 100 occurrences; may have fewer occurrences with numerous large populations.
- S5 = Very common and demonstrably secure in Virginia.
- SH = Formerly part of the Virginia biota with expectation that it may be rediscovered.
- SX = Believed extirpated from Virginia with virtually no likelihood of rediscovery.
- SE = Exotic; not believed to be a native component of Virginia's flora.
- SR = Reported for Virginia, but without persuasive documentation which would provide a basis for either accepting or rejecting the report.
- SU = Possibly rare, but status uncertain and more data needed.
- S_? = Rank uncertain, for example a S2? denotes a species or variety which may range from S1 to S3, another example

is SE?, meaning a taxon may or may not be native to Virginia.

Column 5. Federal Status:

Federal Status is determined by the U. S. Fish and Wildlife Service. This includes all species and varieties which are listed as endangered or threatened by the U. S. government and receive protection under the federal Endangered Species Act. The list also notes those taxa which are proposed for listing or assigned to categories 1, 2, or 3.

- LE = Listed Endangered. A taxon is threatened with extinction throughout all or a significant portion of its range.
- LT = Listed Threatened. A taxon is likely to become endangered in the foreseeable future.
- PE = Proposed Endangered. A taxon is proposed for listing as endangered.
- PT = Proposed Threatened. A taxon is proposed for listing as threatened.
- C1 = Candidate, Category 1. There is enough available information to propose the taxon for listing, but listing is "precluded by other pending proposals of higher priority". The U.S. Fish and Wildlife Service is "directed to make prompt use of the emergency listing if the well-being of any such species is at significant risk."
- C2 = Candidate, Category 2. The taxon is possibly rare, but there are not enough data available to support listing.
- 3A = A taxon for which there is evidence of extinction.
- 3B = A taxon name which is not valid under current taxonomic understanding.
- 3C = The taxon has proven to be abundant, widespread, and/or unthreatened so that listing is currently inappropriate.
- * = An * following the status denotes that the species or variety is possibly extinct.

Column 6. State Status:

State status indicates those plants which are listed as state endangered or threatened under the authority of the Virginia Department of Agriculture and Consumer Services. The Department of Agriculture and Consumer Services is currently developing a recommended list of legally endangered and threatened species based upon the recommendations derived from a 1989 Virginia Endangered Species Symposium, and the Division of Natural Heritage. This list will be presented to its Board for consideration at a later date. The Board's actions will likely result in numerous changes to the current list.

- LE = Listed Endangered
- LT = Listed Threatened
- PE = Proposed Endangered
- PT = Proposed Threatened
- C = Candidate for listing as threatened or endangered.

APPENDIX 2

Definitions of state and federal STATUS terms
(from Terwilliger, 1992)

Definitions of Virginia legal status and candidate categories.

Endangered	Any species which is in danger of extinction throughout all or a significant portion of its range, other than a species of the class Insecta deemed to be a pest and whose protection under the provisions of the article (§3.1-1021) would present an overriding risk to the health or economic welfare of the Commonwealth.
Threatened	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
Protected	All wild animals under the jurisdiction of the Virginia Department of Game and Inland Fisheries, except as otherwise permitted.
Special Concern	Any species which is restricted in distribution, uncommon, ecologically specialized, or threatened by other imminent factors.
Candidate Species	A species formally recommended by the Director of the Department of Conservation and Recreation or other reliable data sources in writing to and accepted by the Commissioner for presentation to the Board of Agriculture and Consumer Services for listing under the Virginia Endangered Plant and Insect Act.

Definitions are from Code of Virginia § 3.1-1029, § 29.1-521, and § 29.1-563; VR 325-01, § 14.

Definitions of federal legal status and candidate categories.

Endangered	Any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary (of Interior) to constitute a pest whose protection under the provisions of this Act would present an overwhelming and overriding risk to man.
Threatened	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
Category 1	Taxa for which substantial information exists to support proposal to list the taxon as endangered or threatened.
Category 2	Taxa for which information exists to support proposal to list the taxon as endangered or threatened, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules.
Category 3	Taxa that were once being considered for listing as endangered or threatened, but are not currently receiving such consideration.
Subcategory 3A	Taxa for which persuasive evidence of extinction is available. If rediscovered, such taxa might warrant high priority for addition to the List of Endangered and Threatened Wildlife.
Subcategory 3B	Taxonomic names that, on the basis of current taxonomic understanding, usually as represented in published revisions and monographs, do not represent taxa meeting the legal definition of species in the Endangered Species Act. Future investigation could lead to re-evaluation of the listing qualifications of such entities.
Subcategory 3C	Taxa that are now considered to be more abundant and/or widespread than previously thought. Should new information suggest that any such taxon is experiencing a numerical or distributional decline, or is under a substantial threat, it may be considered for transfer to category 1 or 2.

Definitions of "endangered" and "threatened" from Endangered Species Act of 1973, as amended through the 100th Congress. Definitions of candidate categories condensed from 50 CFR 17 as reported in *Federal Register* volume 54 (4:January 6, 1989), pp. 554-555.

APPENDIX 3

RARE SPECIES SIGHTING FORM
for Bacopa innominata at Walkerton, VA.

VIRGINIA DEPARTMENT OF CONSERVATION AND RECREATION
DIVISION OF NATURAL HERITAGE PROGRAM
1500 EAST MAIN STREET, SUITE 312
RICHMOND, VIRGINIA 23219
(804)786-7951

RARE SPECIES SIGHTING FORM

SPECIES NAME: Bacopa innominata

DATE OBSERVED: 8/21/92, 8/25/92, 8/30/92

COUNTY: King William

USGS QUADRANGLE MAP NAME (IF KNOWN): King William

LOCATION: (Provide a detailed description. Include a topographic map showing the location or sketch a map on the back of this form.)

Walborgton, VA Upstream, southeast side of SR 629 bridge across Mattaponi River.

HABITAT DESCRIPTION: (Include associated species, elevation, natural features, natural community type, etc.)

Emergent Tidal zone between mean tide and mean high tide, Associated with Zizania aquatica, Pontederia cordata, Scirpus americanus, Eriocaulon parberi, and Sagittaria subulata. Soil clayey-sand with gravel.

POPULATION DATA: (Include data such as number of individuals, age, size, spatial distribution, evidence of reproduction.)

20 to 22 individuals, mature with fruits. Distribution declines from a central point outwards 40 ft. upstream and downstream. Most robust plants found in center of population.

OWNER:

VDOT

THREATS OR EVIDENCE OF DISTURBANCE: This is a decline of approximately 50% from 1987 data for the same site.

PROTECTION INFORMATION: (Under present conditions, will this population maintain itself over a long period of time? Why or why not?)

Population appears to be historically stable. However, monitoring would be appropriate to determine whether fluctuation in number of specimens is actual decline or natural variance.

REPORTED BY:

J. Perry

ADDRESS:

VIMS, Gloucester Point, VA 23062

PHONE:

(804) 642-5226

DATE:

9/1/92

"TO KEEP EVERY COG AND WHEEL
IS THE FIRST PRECAUTION OF INTELLIGENT TINKERING"
-ALDO LEOPOLD