Hydrilla (*Hydrilla verticillata*) growth on Lake Austin, Austin, Texas 2005

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Abstract

In July 1999, 23 acres of the non-native aquatic plant hydrilla (Hydrilla verticillata) was first documented in Lake Austin by Texas Parks and Wildlife Department (TPWD). Within one year, the plants covered over 200 surface acres, growing from the shoreline out to at least 18 feet deep and producing dense mats in many near- shore areas. Annual winter drawdowns and incidental harvesting were implemented, but by May 2002, there were nearly 320 acres of hydrilla in the lake, growing in some areas from bank to bank. In July 2002, a major flood event removed almost 100 acres of topped out vegetation, but TPWD quarterly vegetation surveys showed increases in hydrilla continuing through October 2004, in spite of a phased, incremental stocking of sterile Asian grass carp. In November 2004, with over 240 acres of hydrilla and more than 8100 fish stocked, the lake experienced another significant flood event that lowered the hydrilla coverage to 83 acres. After a winter drawdown, only 25 acres were documented in May 2005, and in July 2005 the lake experienced its first decrease in hydrilla unrelated to floods or drawdowns, when less than 9 acres of hydrilla were documented by TPWD. September 2005 saw this trend continuing, with only 9 acres of hydrilla and 115 acres of Eurasian watermilfoil, for a total of 150 acres of aquatic vegetation in the lake.

Introduction

Lake Austin, a 1,600 acre run-of-the river reservoir in Travis County, Texas, was created in 1939 and is sixth in a chain of seven reservoirs known as the Highland Lakes on the Texas Colorado River. The reservoir is 20.5 miles long, with an average depth of 11.5 feet, and a maximum depth of 52.4 feet (TWDB 1999). Located just upstream of Austin, Texas, it is a drinking water source for 13 municipal suppliers as well as over 1,000 private homes. It also provides flood and irrigation water conveyance for the Lower Colorado River Authority and is a popular recreation spot for water skiing, wake boarding and sport fishing. It is considered the top trophy largemouth bass lake in the area, with 91% of all angling effort directed towards largemouth bass. (TPWD 2005)

With only one major tributary, most of the lake's flow comes from deep water releases from Lake Travis, the reservoir directly upstream. Under baseflow conditions, this water is very clear (secchi depth 3-9m) and cold, with temperatures in the upper end of the lake rarely reaching above 70 degrees F in the summer. Nutrient levels are also very low, with a 10 year mean of 0.147 mg/L for nitrate-nitrite and 0.060 mg/L for total phosphorus (LCRA 2005) Outside of periodic flood events and winter drawdowns, the operating level of the lake typically only varies by one foot.

Some of these lake characteristics (such as clear, constant level water) provide excellent growing conditions for aquatic vegetation, and since 1989 the community was dominated by non-native Eurasian watermilfoil (*Myriophyllum spicatum*) (TPWD 2005). In 1999, TPWD documented the presence of the

invasive non-native hydrilla (*Hydrilla verticillata*) and from July 2000 until September 2004, it was the dominant submersed species, comprising up to 60% of the community as measured in acreage. After several years of control efforts such as winter drawdowns and incremental stocking of triploid grass carp, along with unplanned flood events, hydrilla coverage was finally reduced and by September 2005, represented less than 6% of the vegetation community on the lake.

Methods

Texas Parks and Wildlife Department (TPWD) conducted periodic aquatic vegetation surveys on Lake Austin from 1989 to 1999, when approximately 23 acres of hydrilla were documented. The presence of submerged vegetation was determined using a fathometer from a boat moving parallel to the shoreline at various depths. When vegetation was noted on the fathometer, a weed hook was used to retrieve plant material for field identification. This was noted on a USGS quad or topographic map of the lake. After the field survey, the areas on the map were measured with a map wheel and converted to acreage. The acreage and type (by genus or group, such as pondweed) of vegetation were reported, along with percent of total vegetation each type represented. Maps were kept as hard copy for reference as to location of vegetation.

From 2000 through 2002, survey frequency increased to twice per year, to track the progress of the more aggressive hydrilla. In addition to increased frequency, methodology was improved as new technology became available. The field surveys still involved traversing the lake using the fathometer to identify areas of submerged vegetation, but a global positioning system (GPS) unit was used to map the vegetation. After the field survey, the GPS data was converted to polygons in Geographic Information Systems (GIS) software to create a map of the lake's vegetation. Each polygon was measured and area values converted to acreage for each type of vegetation. As with the previous method, the data was reported in acres, by type and by percent of total vegetation. Maps were made in GIS, saved as jpg or pdf files and provided electronically or by hard copy to other agencies and stakeholders.

In 2003, survey frequency increased to quarterly as a tool for the Lake Austin Hydrilla Management Plan developed by TPWD, the City of Austin, Lower Colorado River Authority and Friends of Lake Austin. Survey results were instrumental in determining the need for and stocking level of sterile White Amur, or grass carp. Methods were unchanged from 2000.

Table 1 TPWD Lake Austin vegetation survey dates

Year	Survey Date	Year	Survey Date
1999	July (Figure 1)	2003	March May September November
2000	May July (Figure 2)	2004	March May July September November (Figure 6)
2001	May July (Figure 3)	2005	February May July (Figure 7) September
2002	May (Figure 4) August (Figure 5)		

Results

First documented at 23 acres in July 1999 (Figure 1), hydrilla grew to nearly 200 acres by July 2000. (Fig 2). Even with winter drawdowns and landowner efforts (bottom barriers and private lakeshore harvesting), acreage increased to 244 acres in July 2001 (Fig 3) and 320 acres by May 2002 (Fig 4). Then a significant flood event in July 2002 removed about 100 acres of top growth from the lake so that August 2002 survey showed only 219 acres (Fig 5).

The damage to water intakes and increased flooding attributed to dense hydrilla growth spurred the development of a Lake Austin Hydrilla Management Plan in late 2002, and TPWD increased the survey frequency to quarterly in 2003 and bimonthly in 2004 and 2005 to provide a tool for determining stocking numbers of triploid grass carp. Even with 3825 sterile grass carp in the lake, the growth still reached over 240 acres by Nov 2003, and additional fish, harvesting and drawdowns continued until another significant flood event in Nov 2004 reduced coverage from 240 to only 83 acres (Figure 6). A final fish stocking (bringing the total to 8125) and winter drawdown followed the flood, and hydrilla coverage continued to drop until July 2005, when only 9 acres were documented in the lake (Figure 7). By September 2005, hydrilla was only 6 % of the total vegetation, while Eurasian watermilfoil increased in coverage to 76% of the vegetation.

Table 2 Hydrilla acres by survey date

Date of Survey	Acres of Hydrilla	Acres of Total Vegetation	Hydrilla as percent of total vegetation
July 1999	23	257	9 %
May 2000	152		
July 2000	196	512	38 %
May 2001	221		
July 2001	244	379	64 %
May 2002	320		
August 2002 (post-flood)	219	384	57 %
March 2003	74		
May 2003	124		
September 2003	197	395	50 %
November 2003	242		
March 2004	145		
May 2004	182		
July 2004	201		
September 2004	241	400	60 %
Dcember 2004	83		
Feb 2005	1.67		
May 2005	26	55	47 %
July 2005	9		
September 2005	9	150	6 %

Discussion

When first documented in July 1999, the hydrilla infestation was localized to three public boat ramps, Loop 360, Emma Long Metropolitan (City) Park and Mary Quinlan Park (Figure 1). No hydrilla was found downstream of Loop 360, possibly because the most downstream public boat ramp (Walsh Landing) had been closed that summer for construction. This association with boat ramps indicates the most likely invasion pathway to be hydrilla fragments on boat trailers brought from other hydrilla-infested area lakes, such as Walter E. Long Lake or Lake Bastrop. Within one year, the plants had spread downstream from Mary Quinlan Park to Commons Ford Preserve, and towards City Park, with many areas growing bank to bank (Figure 2). By 2001, the original patch near Mary Quinlan Park was no longer documented, but the growth near Commons Ford had merged with the City Park infestation, forming a continuous line of hydrilla all the way from Commons Ford to Loop 360 (Figure 3). The area between Commons Ford and City Park was nearly all bank to bank, and much of it was topped out, while the growth downstream of City Park remained as dense bands along the shoreline, with some open water in mid-channel. In addition, hydrilla had moved downstream of Loop 360, to either side of the Bull Creek confluence with the lake, as well as far downstream to the eastern shore of the lake by Tom Miller Dam.

In May 2002, when the plants reached their maximum coverage of 320 acres, hydrilla had spread well upstream of Commons Ford, and formed solid bank to bank growth from there to City Park (Figure 4). Between City Park and Loop 360, the areas expanded out from both sides of the lake, with a very small area of open water in mid-channel. Navigation concerns increased, as the dense growth pushed traffic into an increasingly limited hydrilla-free space. No hydrilla was noted around the Bull Creek confluence, but the patch near Tom Miller Dam was still present.

The pattern of hydrilla spread upstream of Loop 360 was probably driven by depth, as shallow water near Commons Ford allowed for dense bank to bank growth, while the deeper channel near Loop 360 limited hydrilla in this area. Lack of hydrilla upstream of Mary Quinlan Park was due in part to very cold water and higher flow releases from Mansfield Dam, although the plants did appear in this area later in the infestation. Hydrilla never established in the lake between Bull Creek and Tom Miller Dam, possibly due to increased turbidity, although turbidity is not a limiting factor for hydrilla growth in other Texas reservoirs (Chilton 2005). Sediment quality and flow could also have contributed, but these were not examined for this report.

The flood in July 2002 removed over 100 acres of topped-out plant material from the lake; this material clogged the hydroelectric intakes at Tom Miller dam and moved downstream into Town Lake. Although that lake had very little vegetation prior to that time, (Tenant and Magnelia 1999) the large influx of hydrilla did not result in a new infestation there. While individual rooted plants have been found in Town Lake, no established stands of hydrilla have been documented to date.

In Lake Austin, the 2002 flood served to slow, but not stop, the spread of hydrilla. It did reduce the hydrilla from 320 to 220 acres, primarily in deeper water, but by August (Figure 5), much of the growth was topped out and covered with algae, possibly encouraged by higher nutrient inputs from floodwaters. Still, the 2003 post drawdown coverage (March 2003, 74 acres) was substantially less than the following year (March 2004, 145 acres) as the plants were restricted to a 12 to 18 foot ‘hedgerow’, bounded on each side by the drawdown (shallow) and flood (deep) impacts. The plants were able to recover, with acreage reaching 241 by November 2003.

Growth rate slowed in 2004 to only 15.9 acres/month, compared to 20.5 acres/month in 2003 (TPWD, 2005), possibly due to the continued input of sterile grass carp to the lake. However, a flood in the fall of

2004 precluded a November survey, so no true end-of-season comparison was possible for these two years.

This late November 2004 flood knocked back the hydrilla again, this time dropping the coverage from 240 acres in September to only 83 acres post-flood (Figure 6). As in 2002, the post-flood growth was in shallow water, but the 2004 flood was followed immediately by a winter drawdown, which again substantially impacted the surviving shallow water growth. The process was similar to 2002, except the recovery time between flood and drawdown was much shorter (30 days vs 180 days), and the starting acreage was much lower (240 acres vs 320 acres). The resulting coverage in February 2005 was less than 2 acres of hydrilla, apparently providing the grass carp with the necessary conditions for hydrilla control. Since that time, hydrilla coverage has held steady for two consecutive surveys in 2005 at only 9 acres (Figure 7), while other vegetation (primarily Eurasian watermilfoil) has increased to over 140 acres, growing in less than 12 feet of water, primarily from City Park upstream to Mansfield Dam.

Conclusion

Hydrilla growth on Lake Austin has been limited to some degree by water depth, as hydrilla was absent from some deeper areas of the lake throughout the study period. Water level manipulation through winter drawdowns served to maintain hydrilla-free near-shore (shallow) areas for most of the recreation season, but plants showed the ability to recover by the end of the growing season.

The more critical driving forces have been natural high velocity flood events and stocking of triploid grass carp (Figure 8). Prior to stocking fish, one flood event (July 2002) removed 100 acres of hydrilla from the mid-channel, while a late season flood (Nov 2004) combined with large numbers of grass carp and a winter drawdown to reduce growth to its lowest documented coverage (<2 acres, March 2005). The drop in coverage from 26 acres in May 2005 to 9 acres in July 2005 was the first decline not resulting from floods or drawdowns, and should be attributed to grass carp herbivory. While these fish are not host specific, they have shown a preference for hydrilla over Eurasian watermilfoil in Lake Austin, allowing milfoil to provide the needed benefits from aquatic plants without the severe impacts from hydrilla. Although hydrilla is currently under control on Lake Austin, vegetation surveys will be continued to determine the need for any additional control efforts.

References

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Texas Parks and Wildlife Department. 2005. Hydrilla Management Plan, Lake Austin, 2005.

Tenant, M.A. and S.J. Magnelia, 1999. Statewide Freshwater Fisheries Monitoring and Management Program, Survey Report for Town Reservoir. Texas Parks and Wildlife Department, Inland Fisheries Branch, District 2-C, San Marcos Texas.

Texas Water Development Board. August, 2001. Volumetric Survey of Lake Austin. Prepared for City of Austin in conjunction with Lower Colorado River Authority.

Figure 1 Hydrilla Coverage July 1999

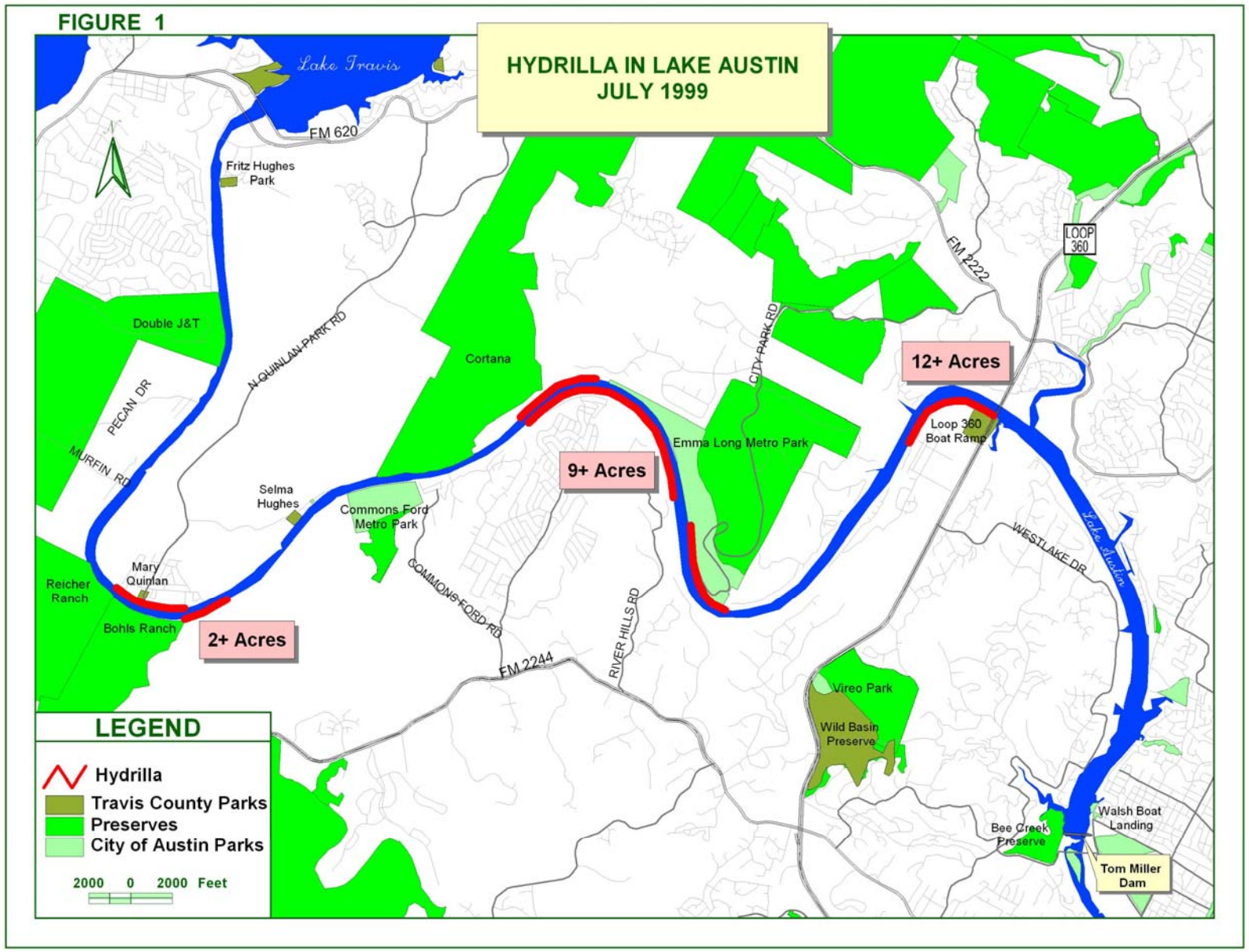

Figure 2 Lake Austin hydrilla July 2000

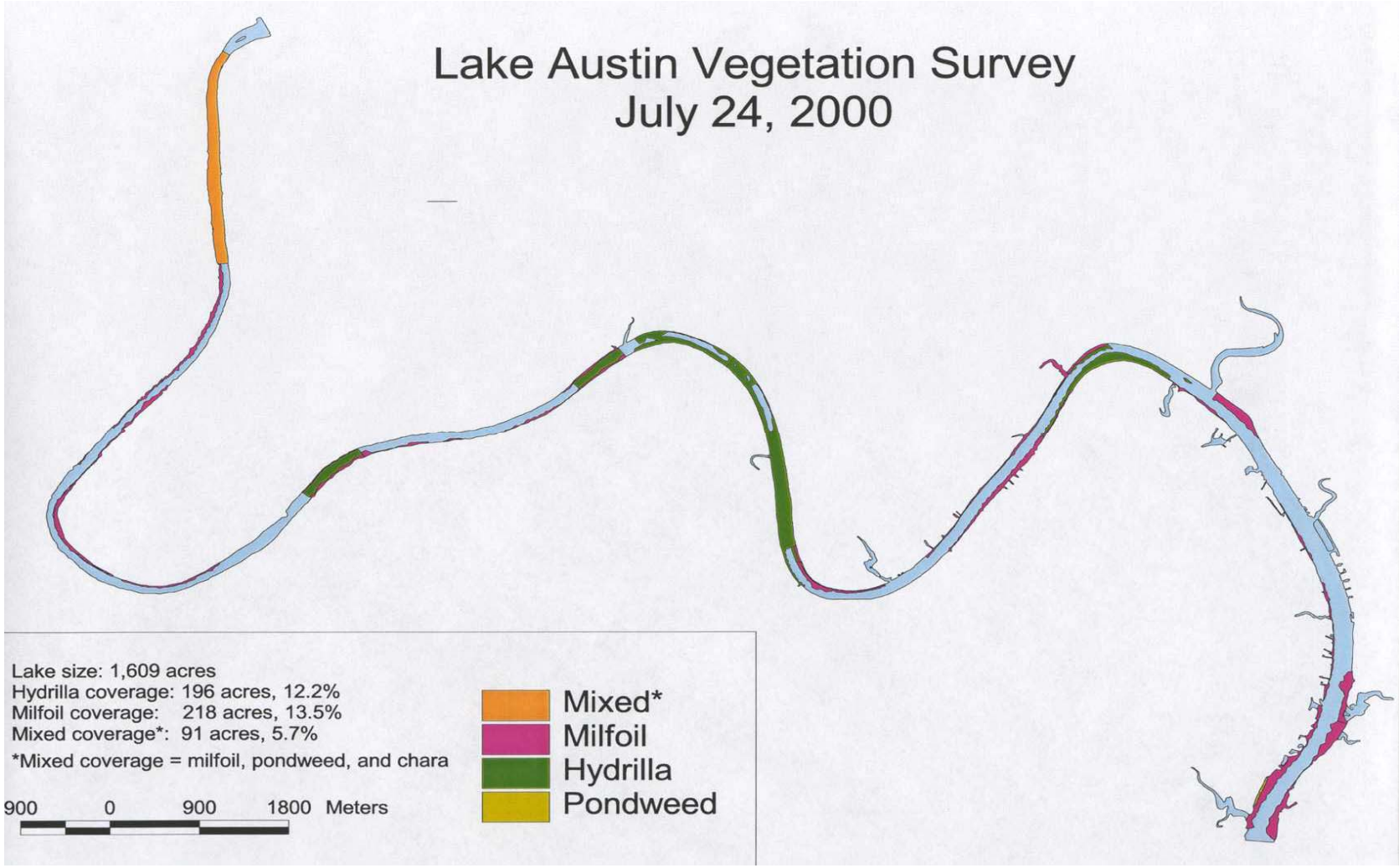

Figure 3 Lake Austin hydrilla July 2001

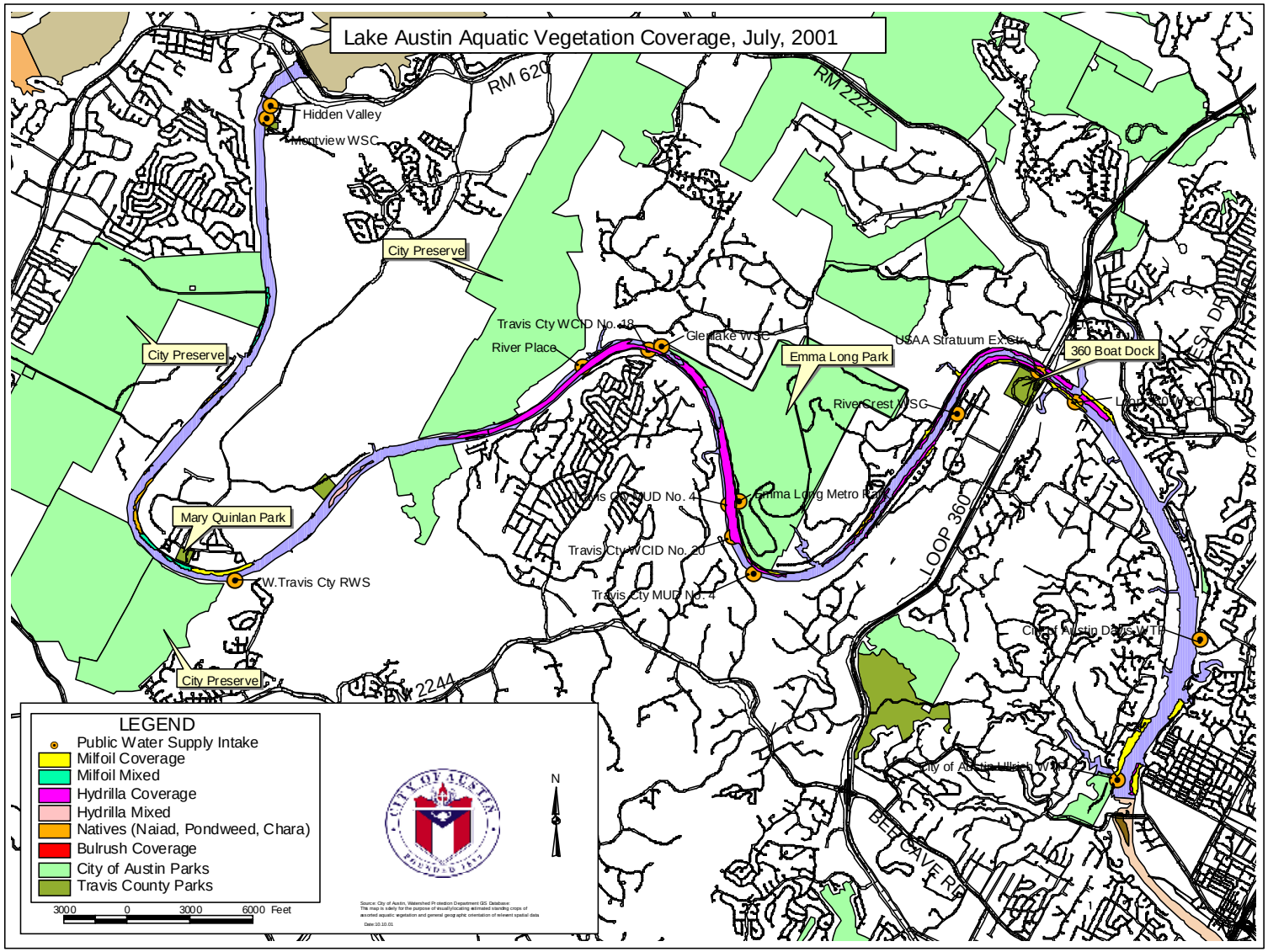

Figure 4 Lake Austin hydrilla May 2002

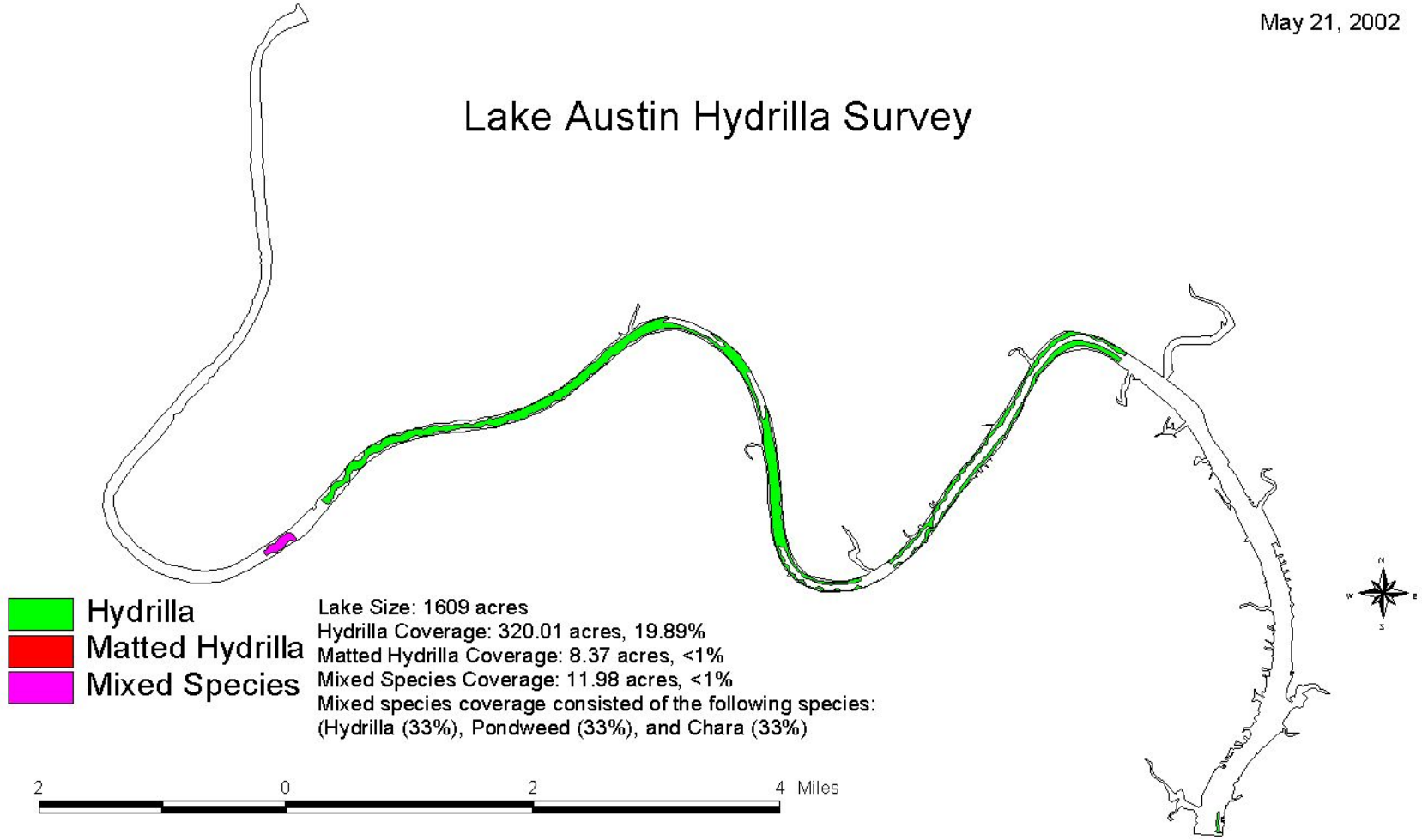

Figure 5 Lake Austin hydrilla Aug 2002

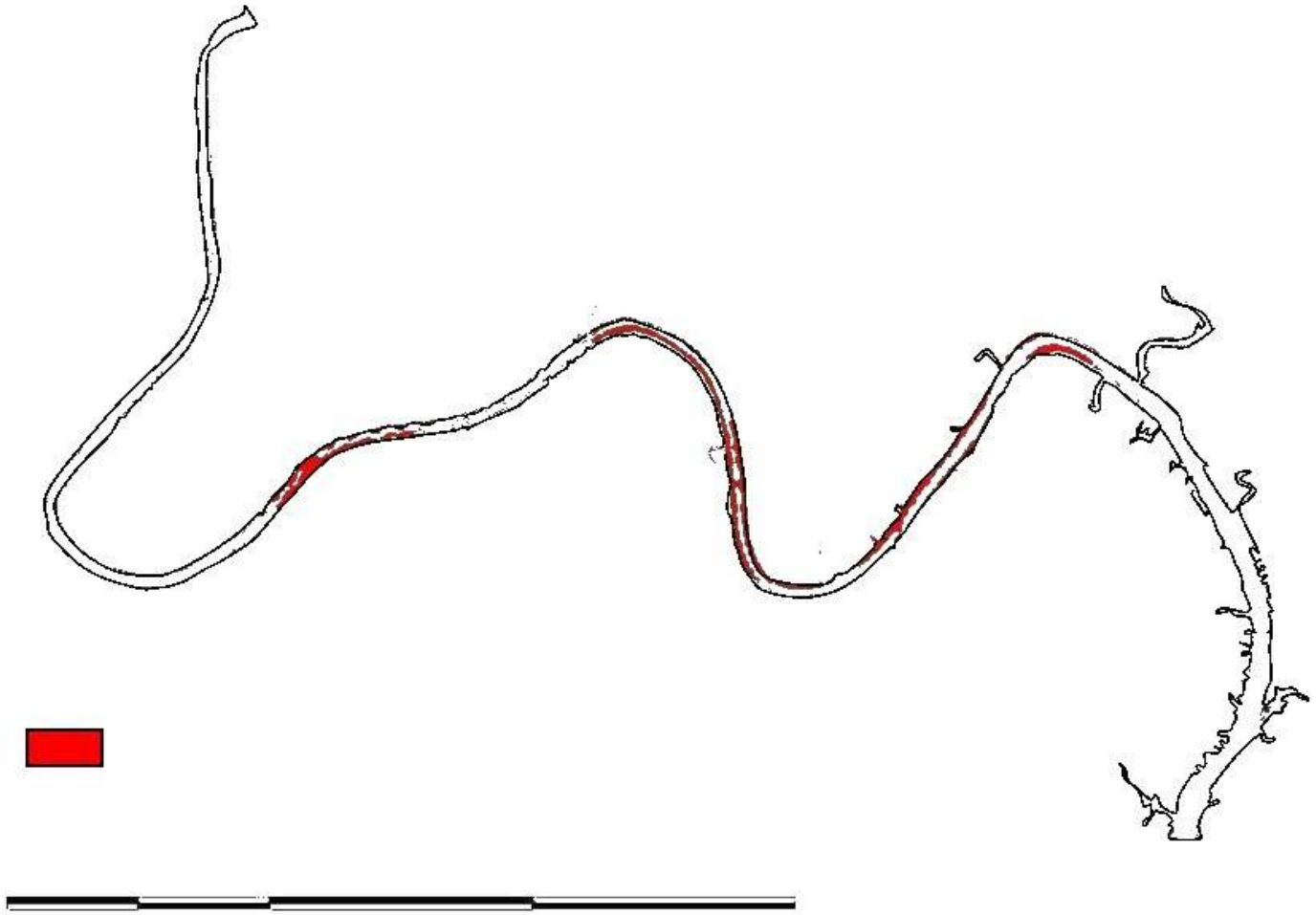

Figure 6 Lake Austin hydrilla December 2004

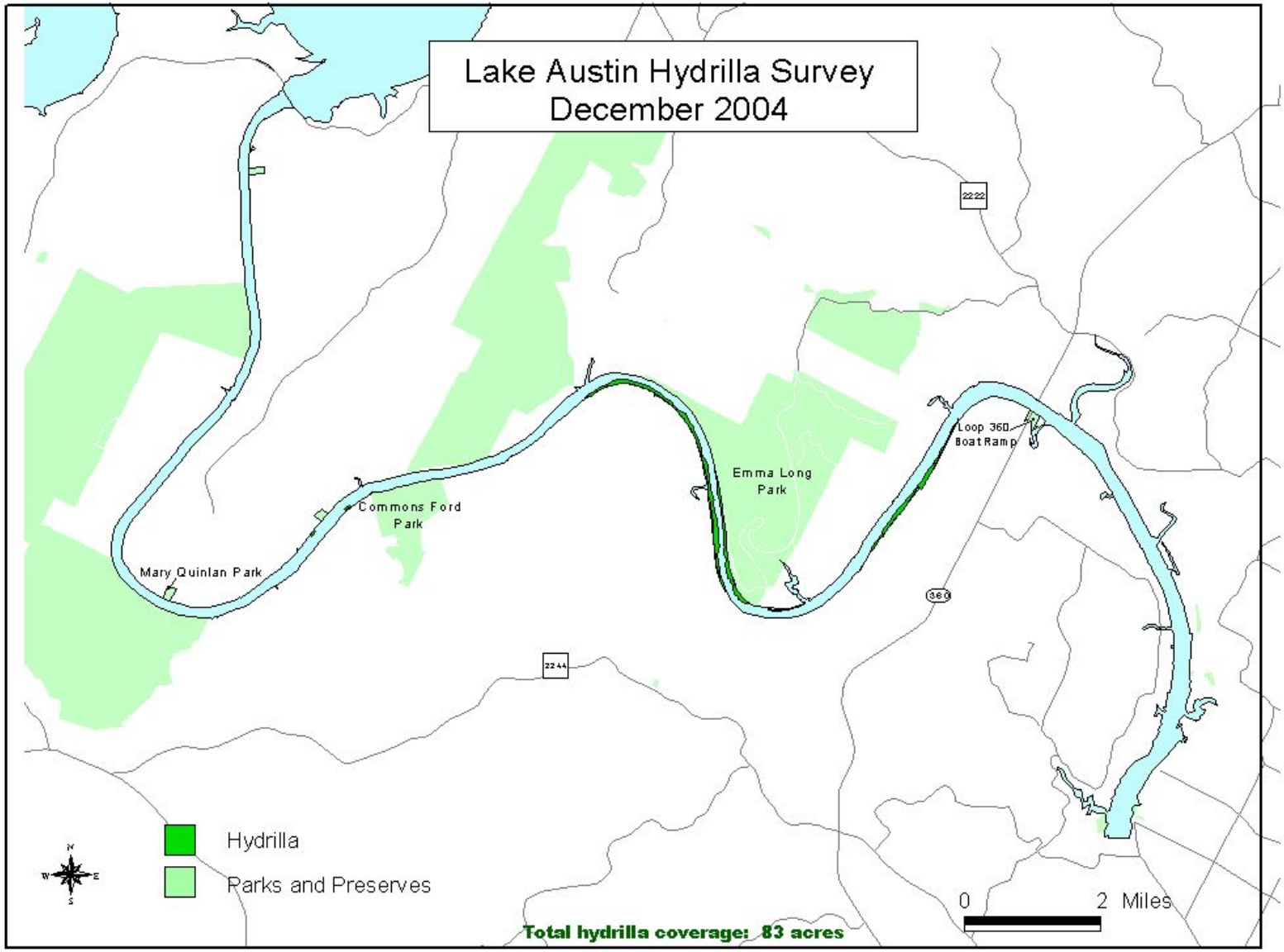

Figure 7 Lake Austin hydrilla July 2005

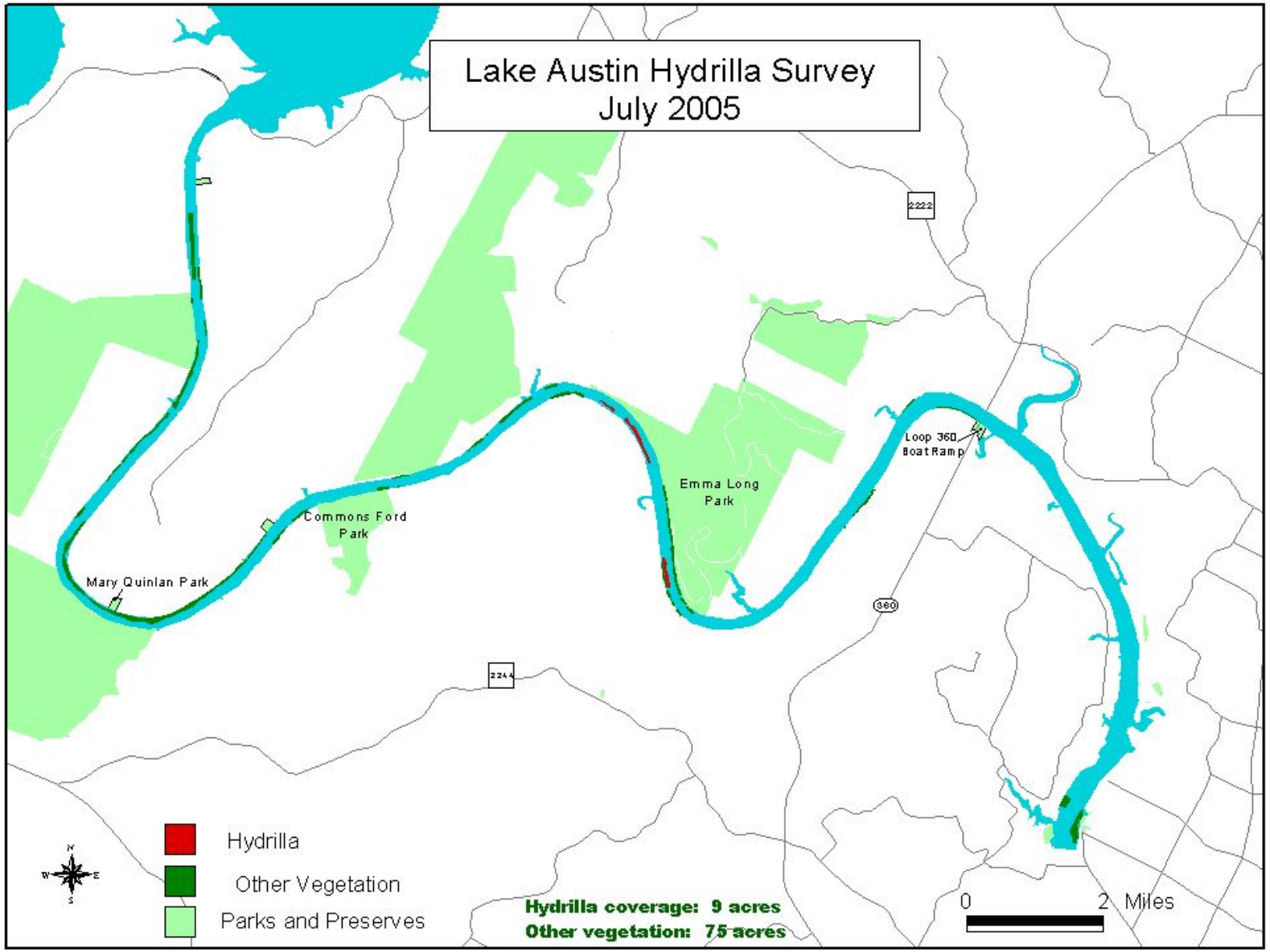

Figure 8 Lake Austin hydrilla, 1999- 2005