

Home Range & Habitat Preferences of Eastern Box Turtles at Jug Bay Wetlands Sanctuary

Jennifer Lentz

Summer 2004: Jug Bay Fellow

Geographic Distribution of the Eastern Box Turtle



Adapted from Dodd 2001

Upland Habitats



Meadow (M)



Open Forest (OF)



Dense Forest (DF)

Non-Tidal Wetland



Flood Plain (FP)

Tidal - Wetlands Habitats



Tidal Wetlands (TW)

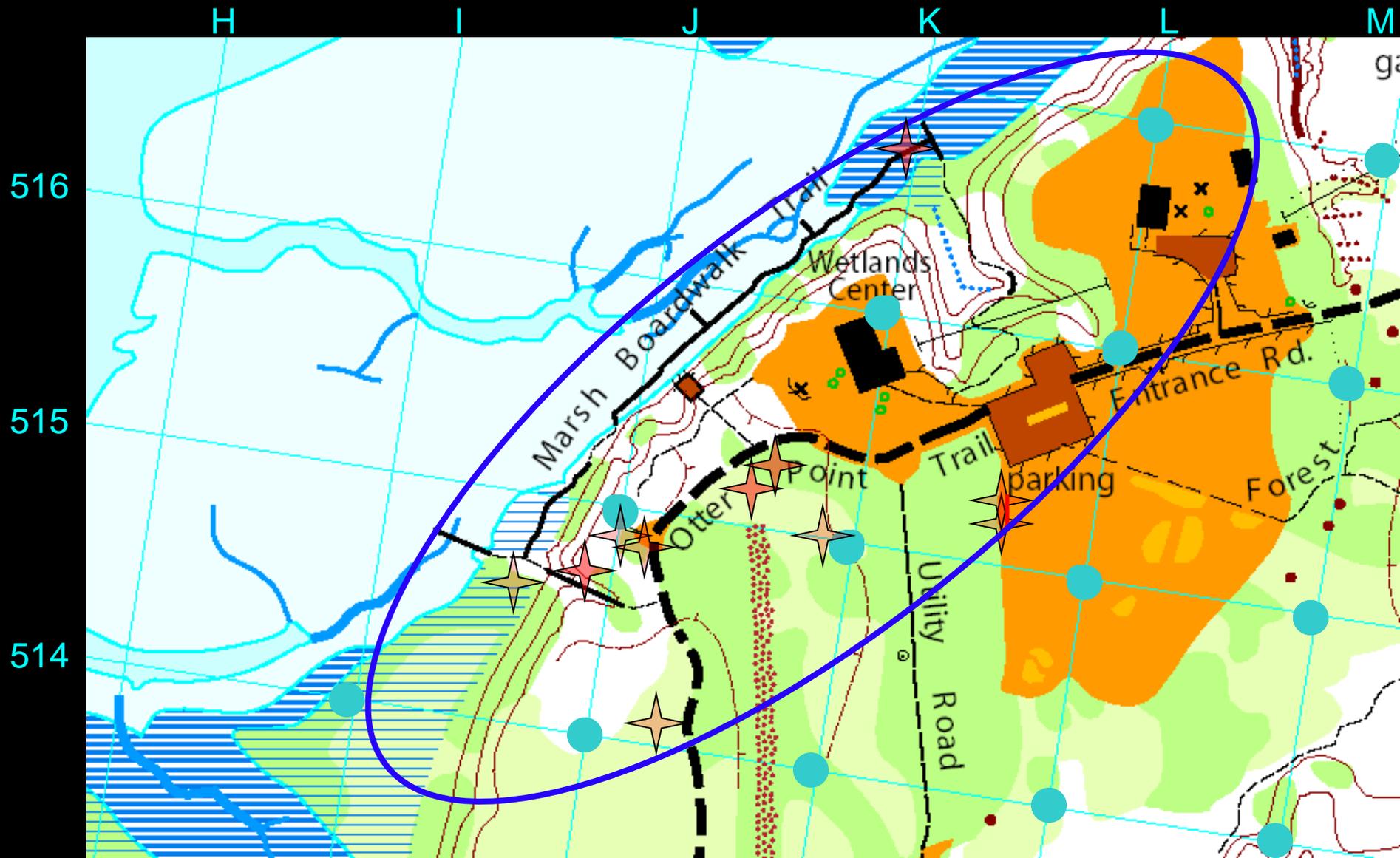


Scrub - Shrub (SS)

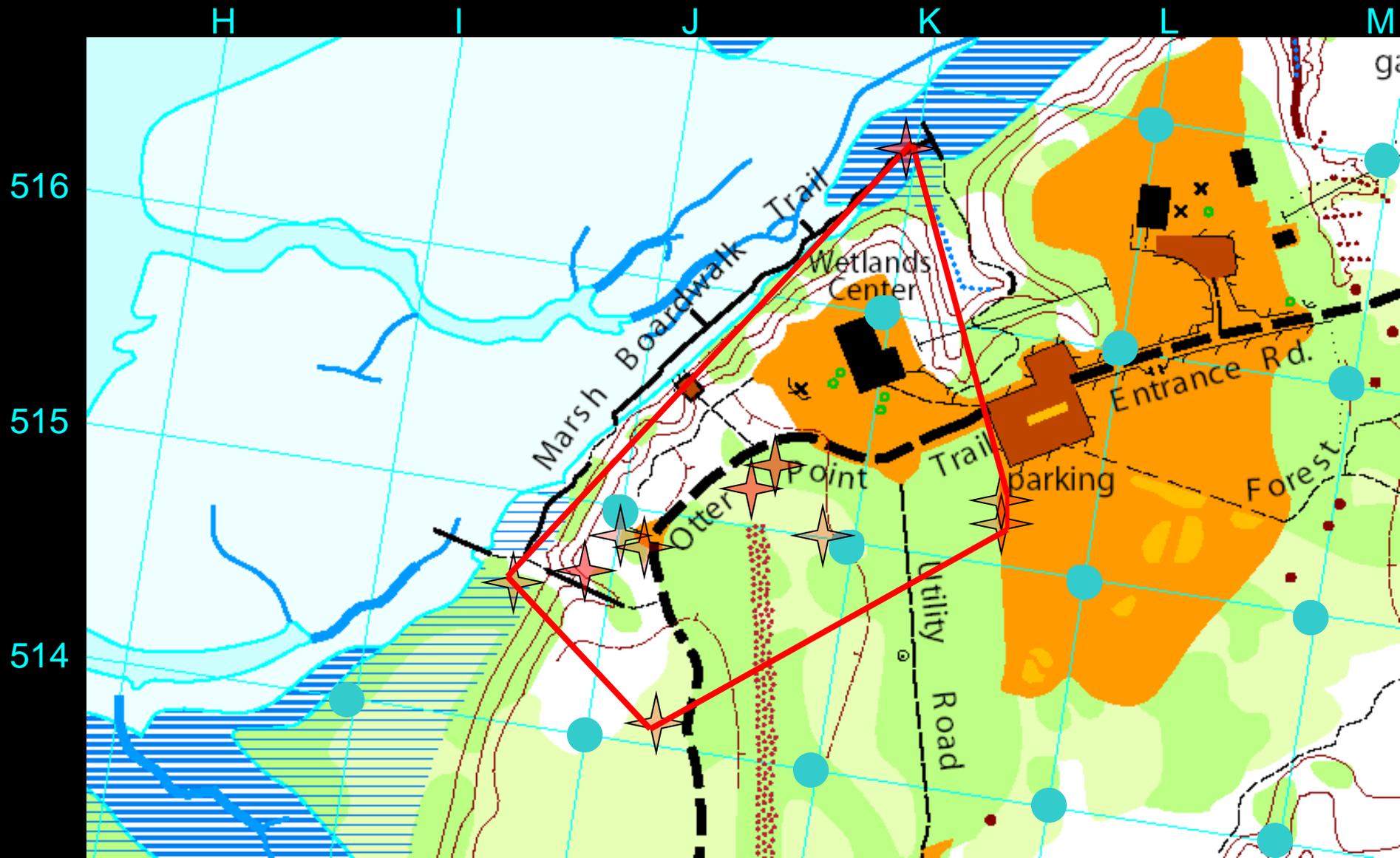


Phragmites (PH)

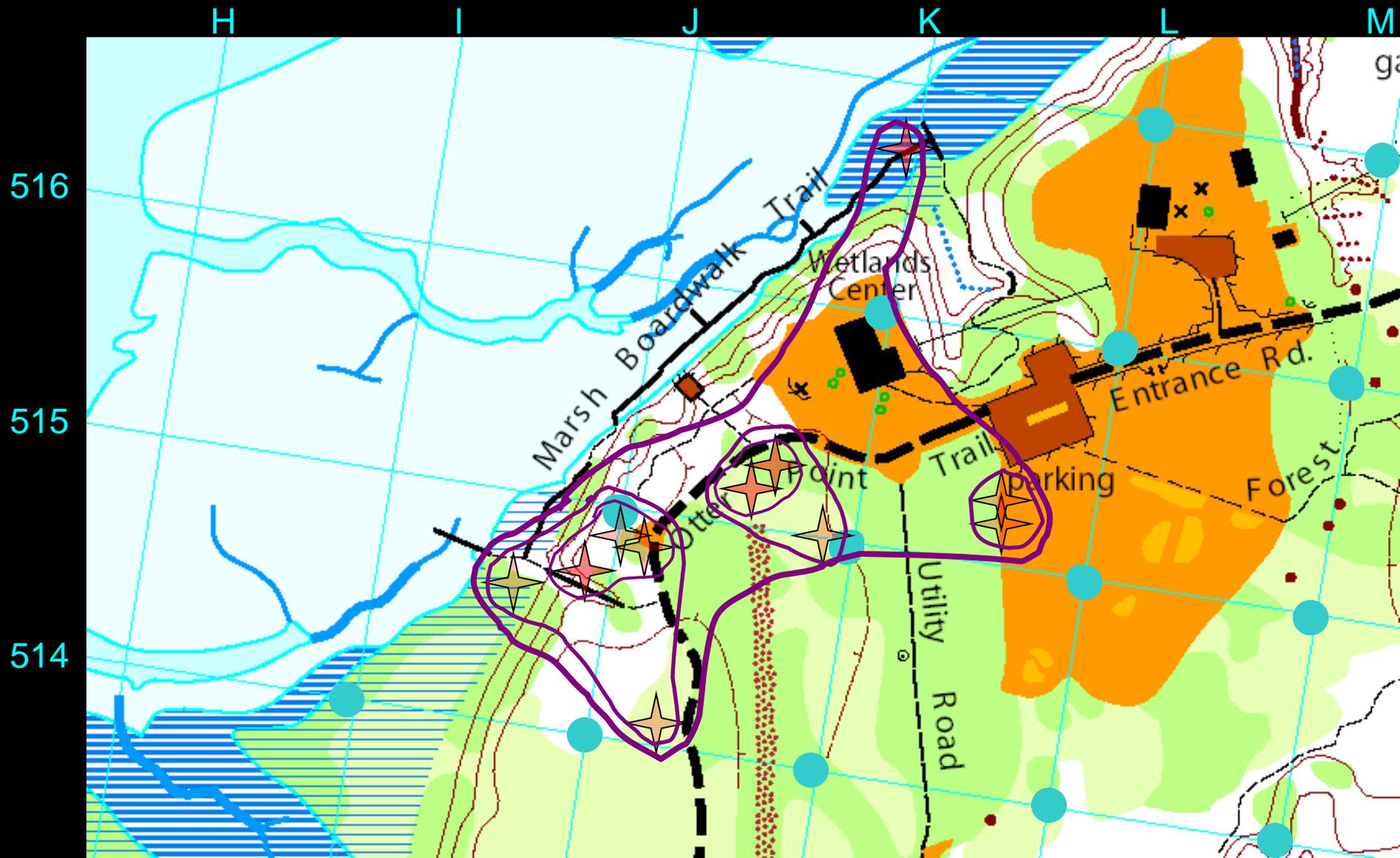
Bivariate Normal Home Range (Jennrich and Turner, 1969)



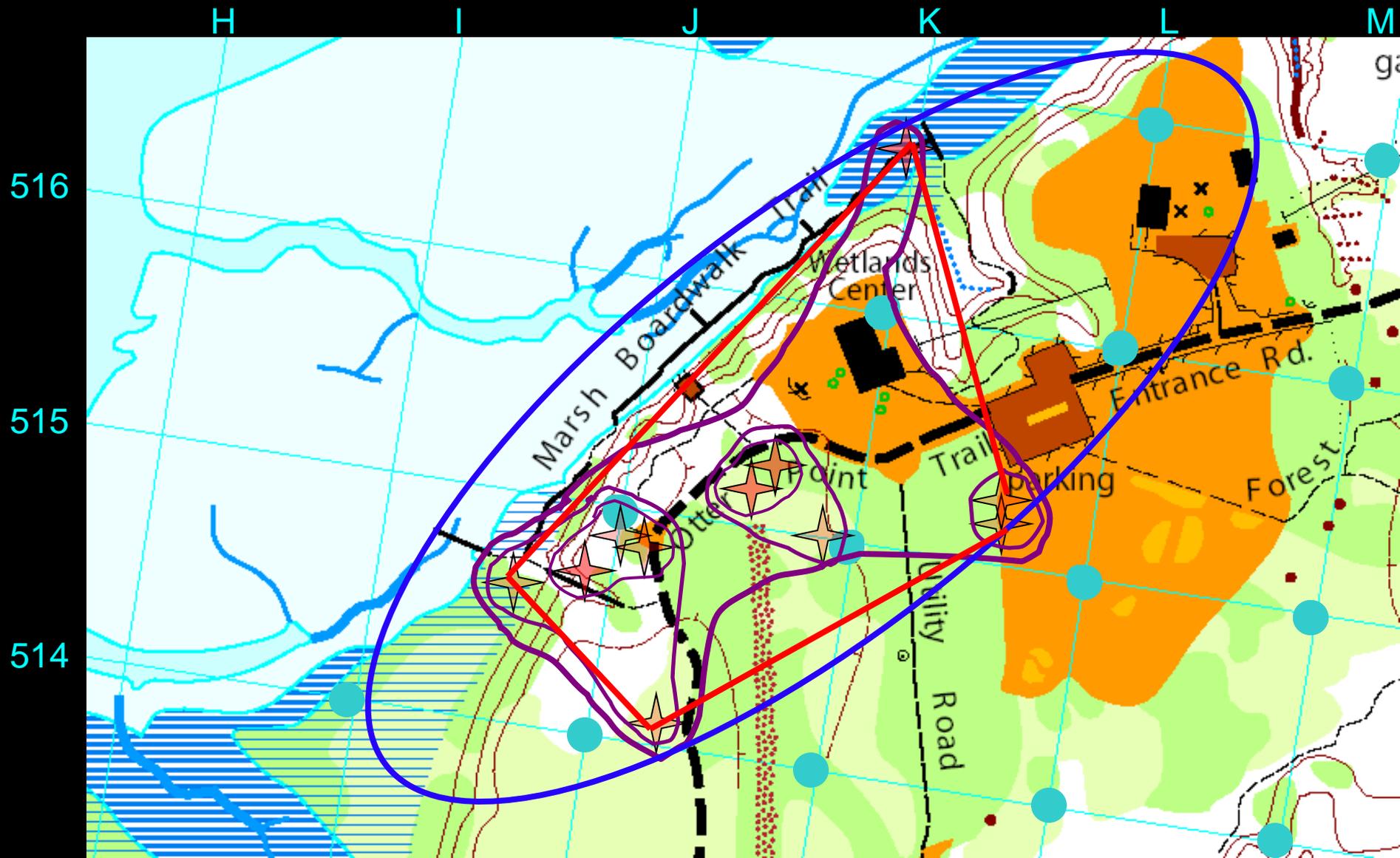
Minimum Convex Polygon (Mohr, 1947)



Kernel Home Range (Worton, 1989)



Home Range Measurement comparison



Study Objectives

To determine...

- Home range size and whether male and female range size differ
- The habitats included within each home range
- The differences between home range measuring techniques (Mark-Recapture vs. Telemetry)
- Whether turtles prefer certain habitats over others



Materials and Methods



Data entry in the lab

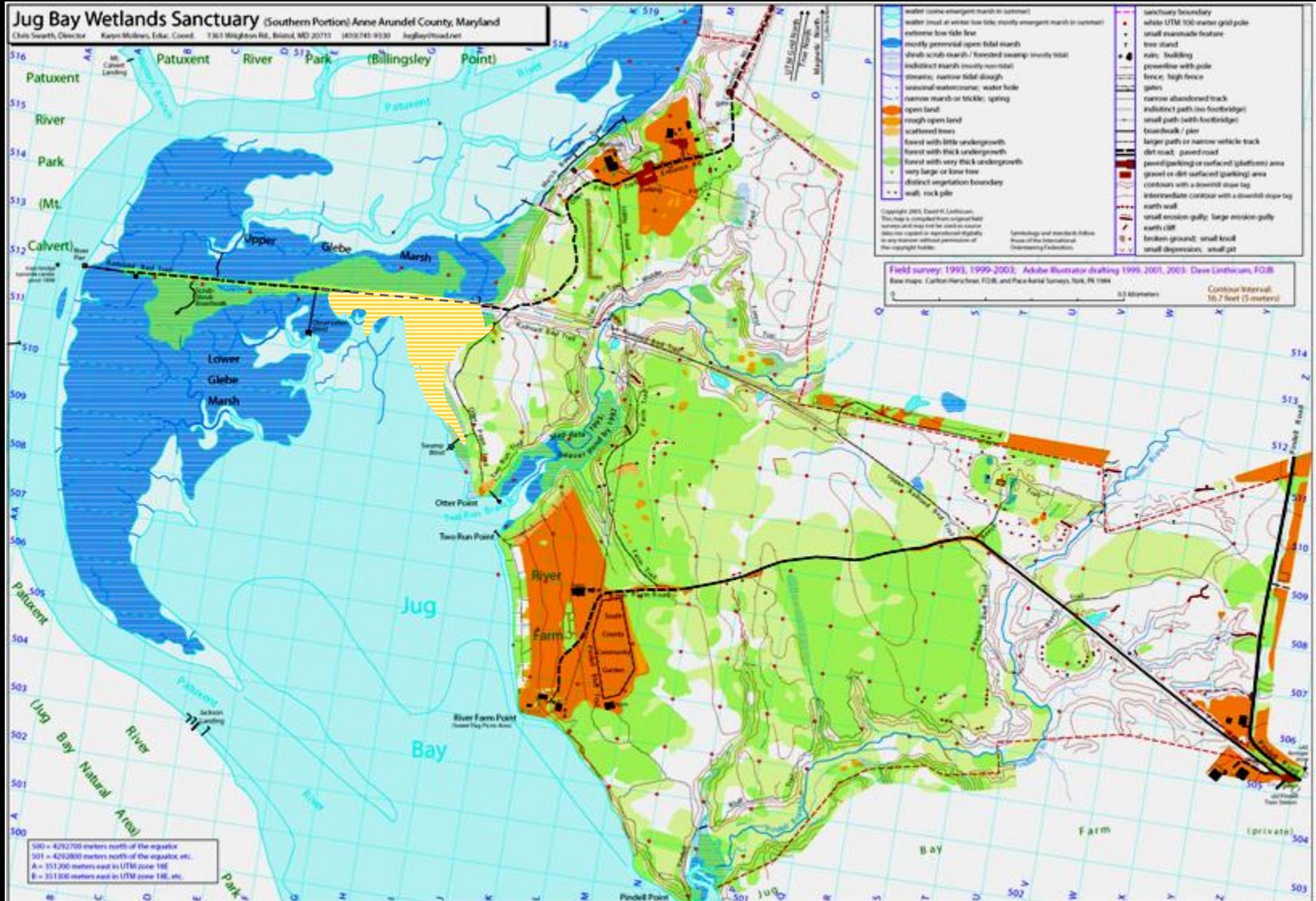


Mark -
Recapture



Radio -
Telemetry

Data Collection Process



Upland Habitats

-  Meadow
-  Open Forest
-  Dense Forest

Non-Tidal Wetlands

-  Flood Plain

Tidal Wetlands

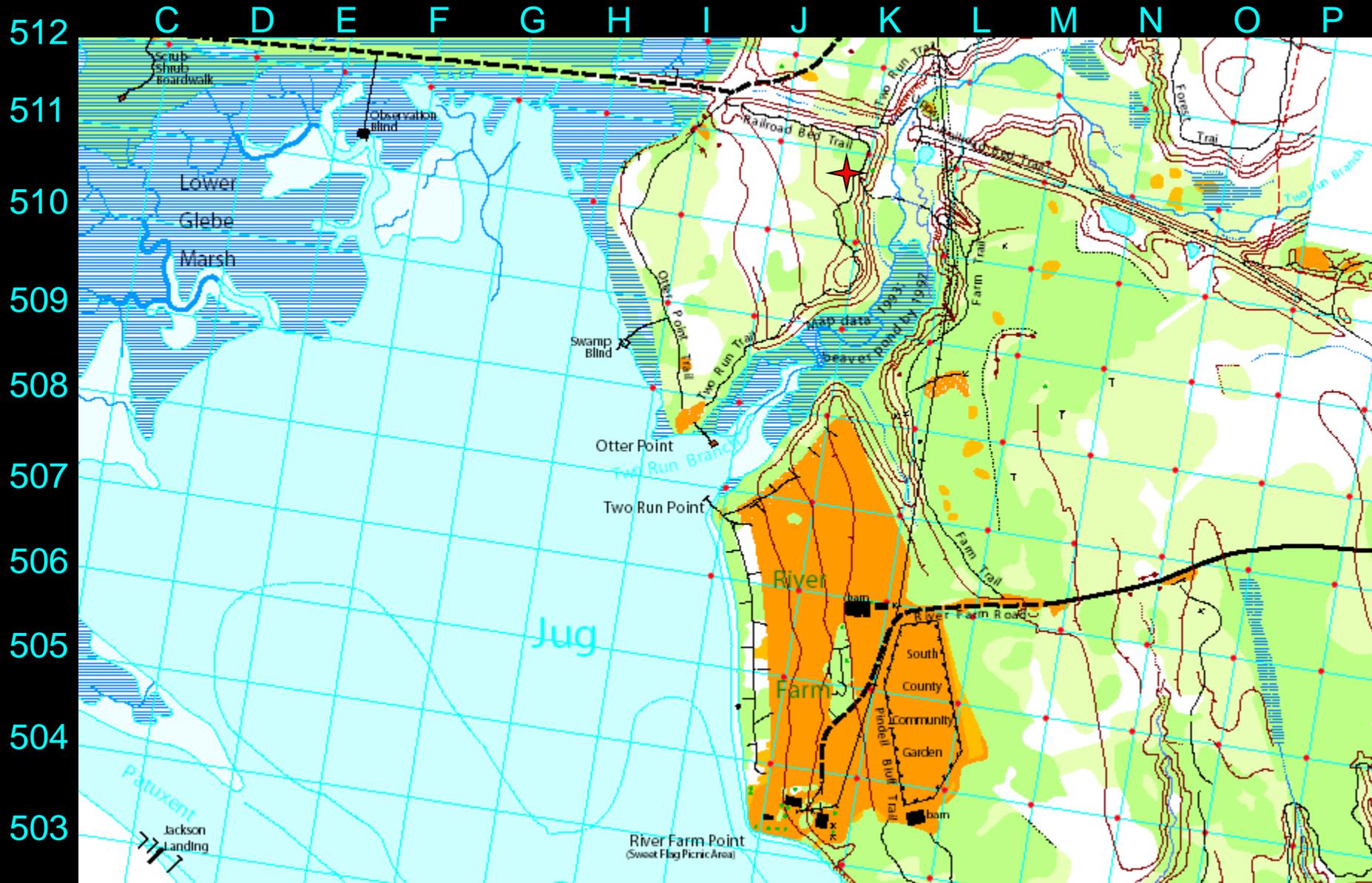
-  Scrub-Shrub
-  Phragmites
-  Tidal-Wetland (Marsh)

Home Range Maps

For Female # 71

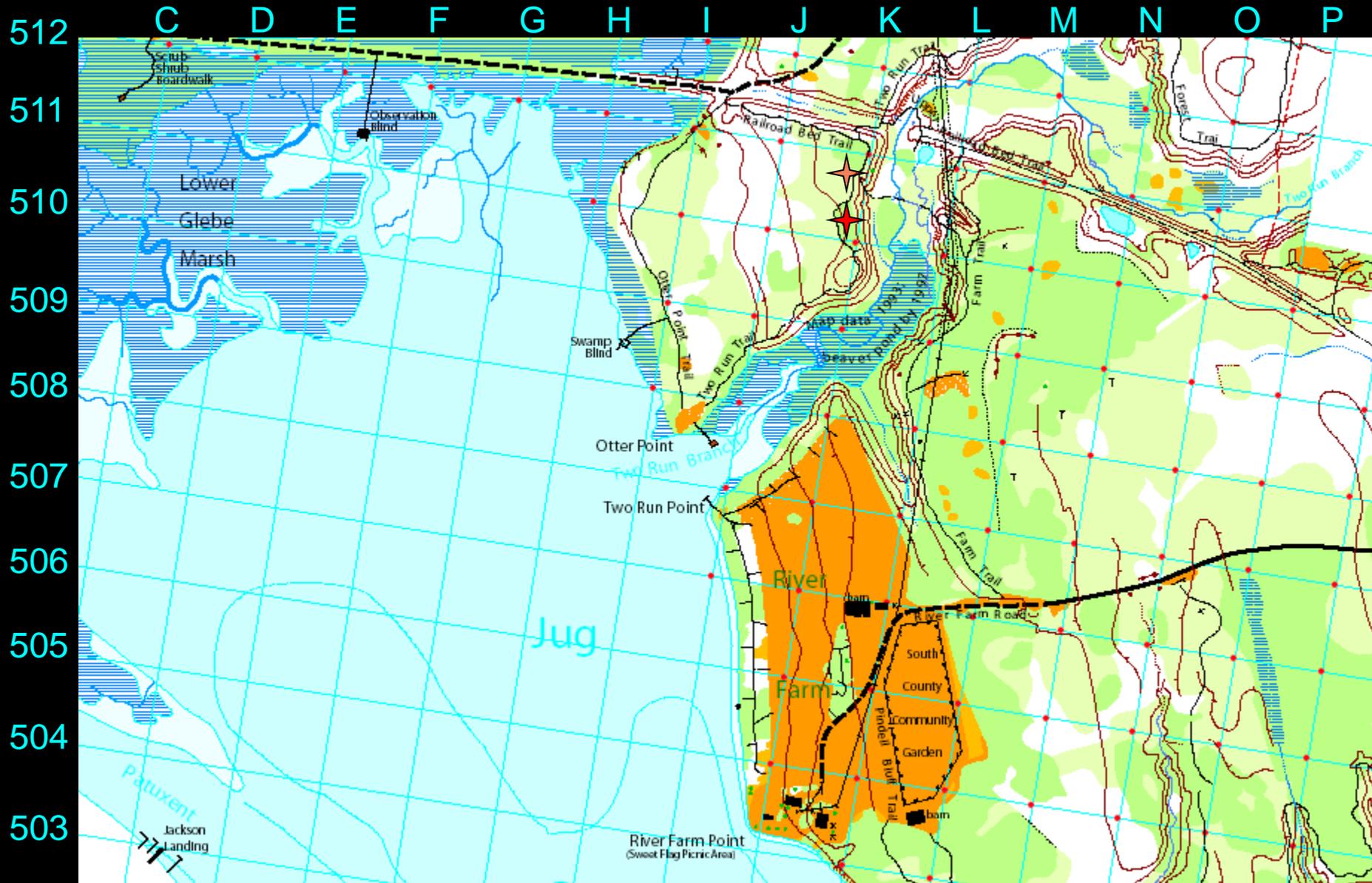
Female #71

June 25th, 1996



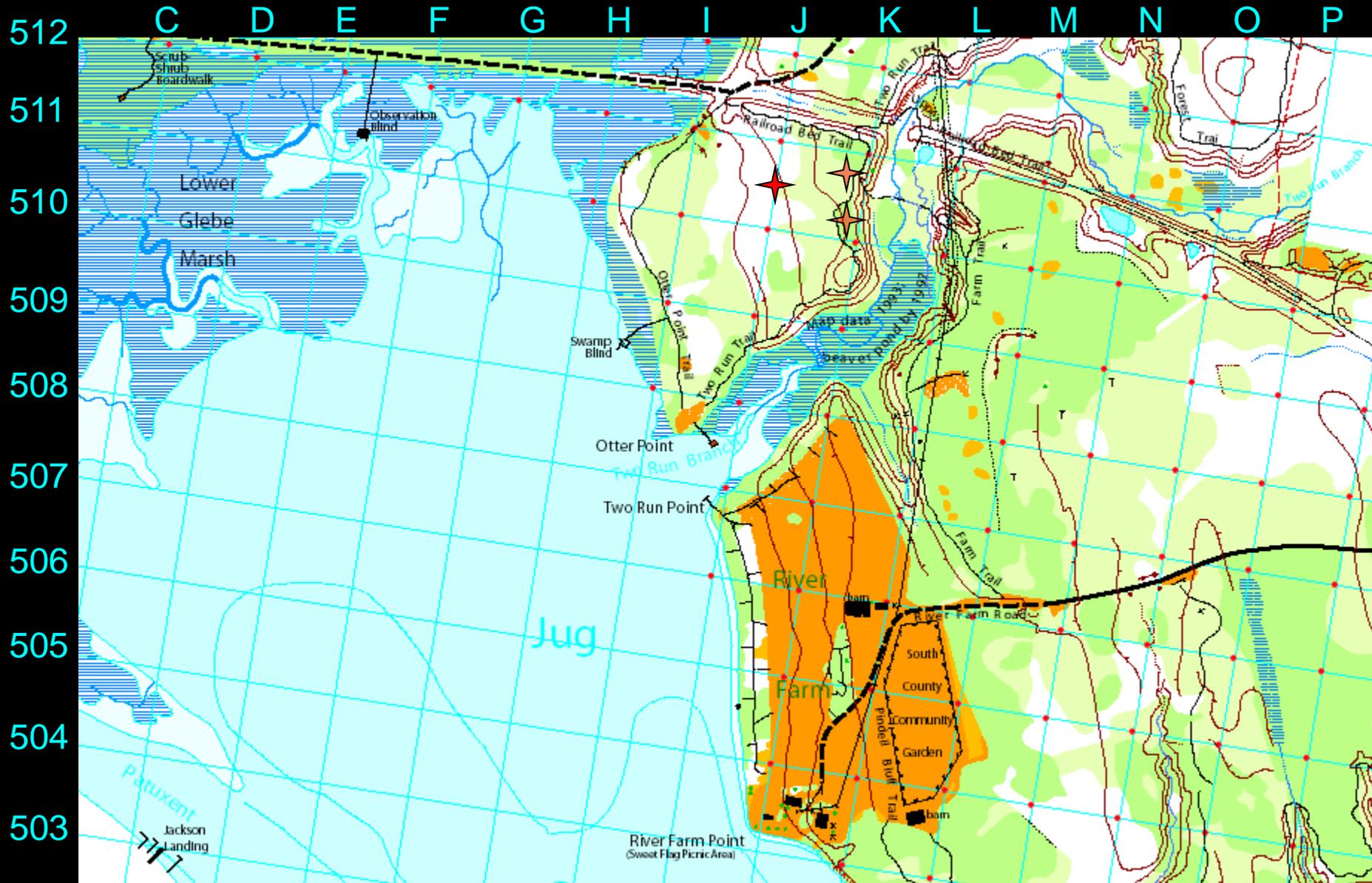
Female #71

June 28th, 1999



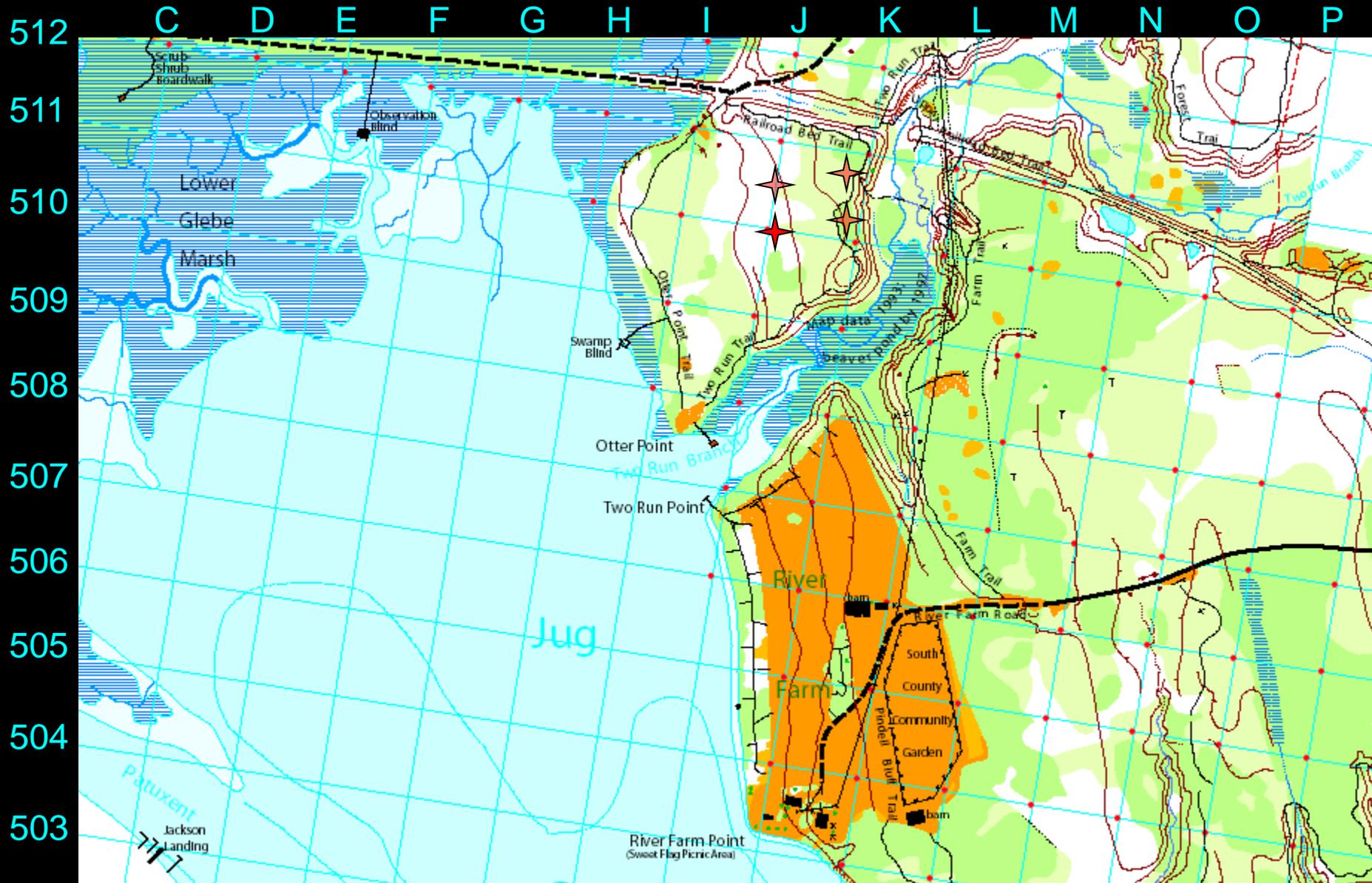
Female #71

July 11th, 2000



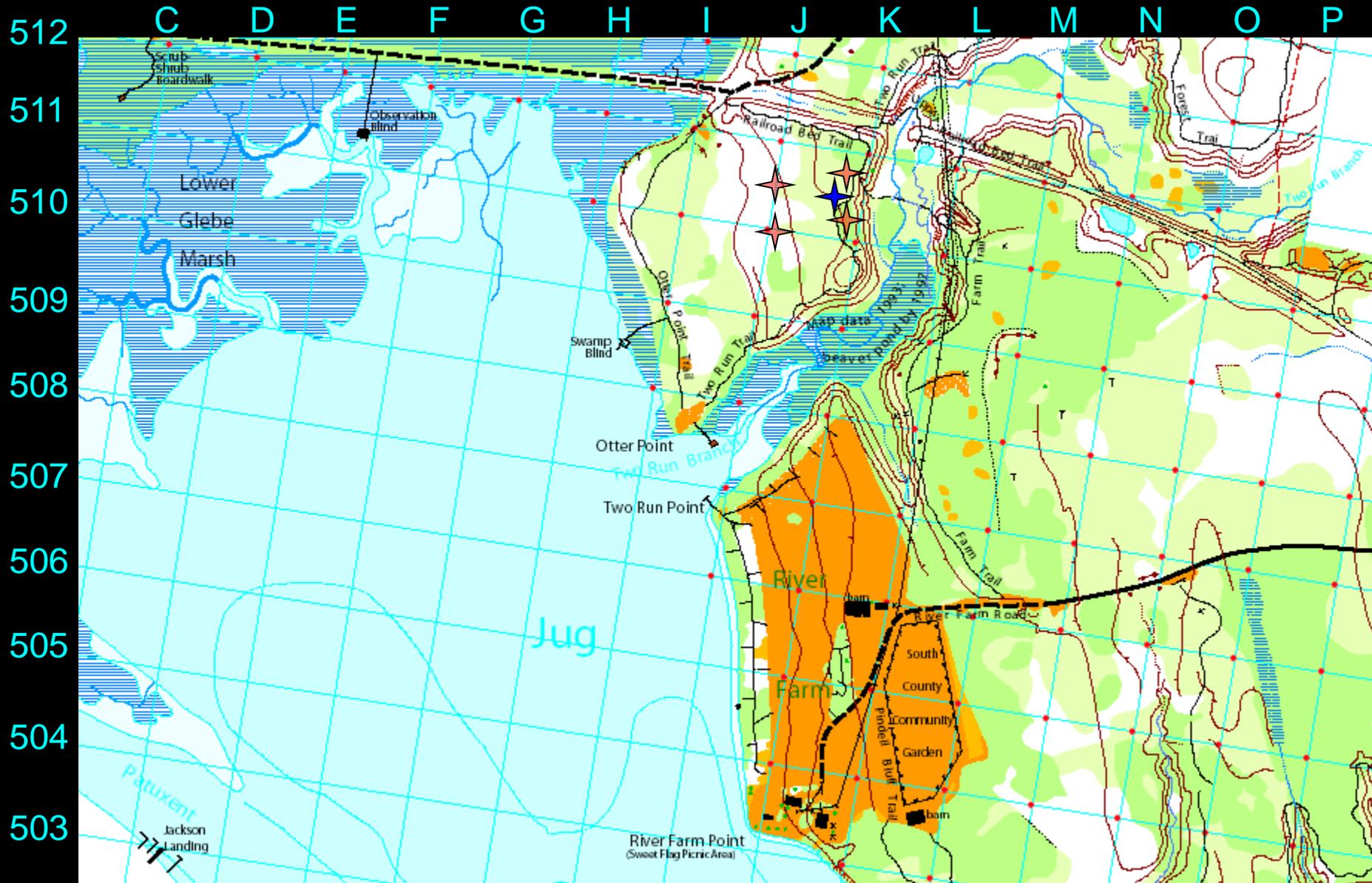
Female #71

May 19th, 2001



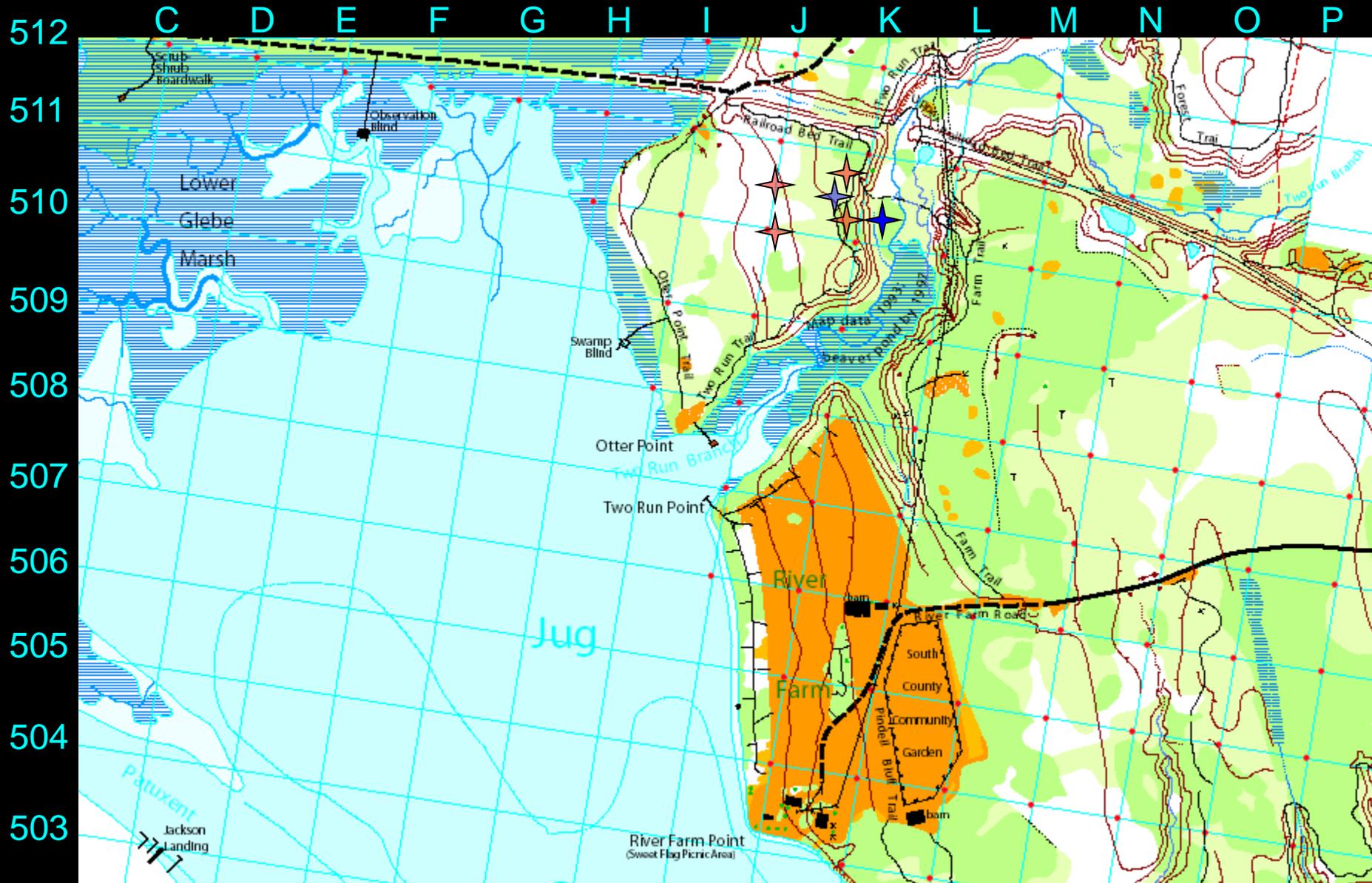
Female #71

May 20th, 2001



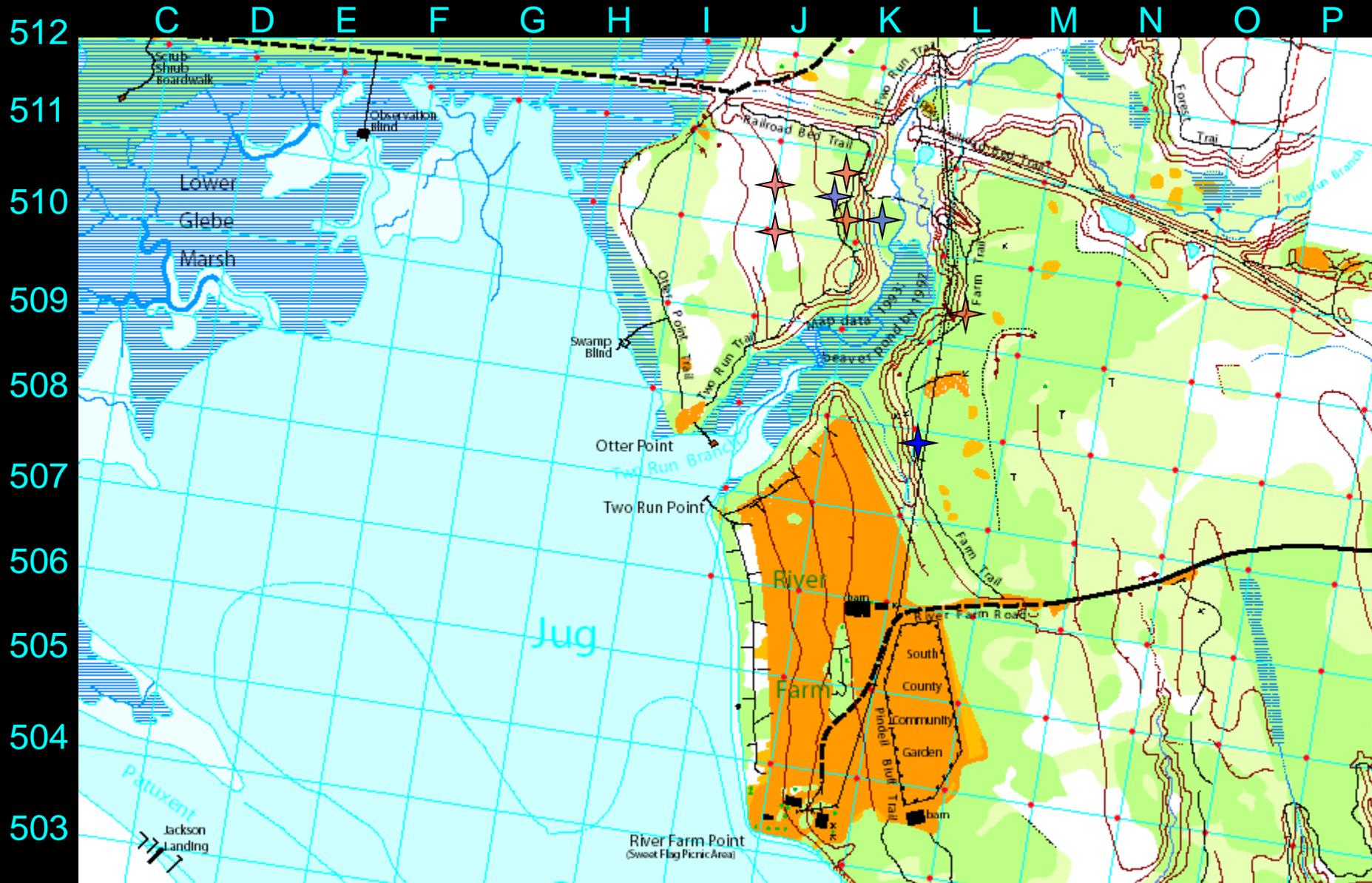
Female #71

May 22nd, 2001



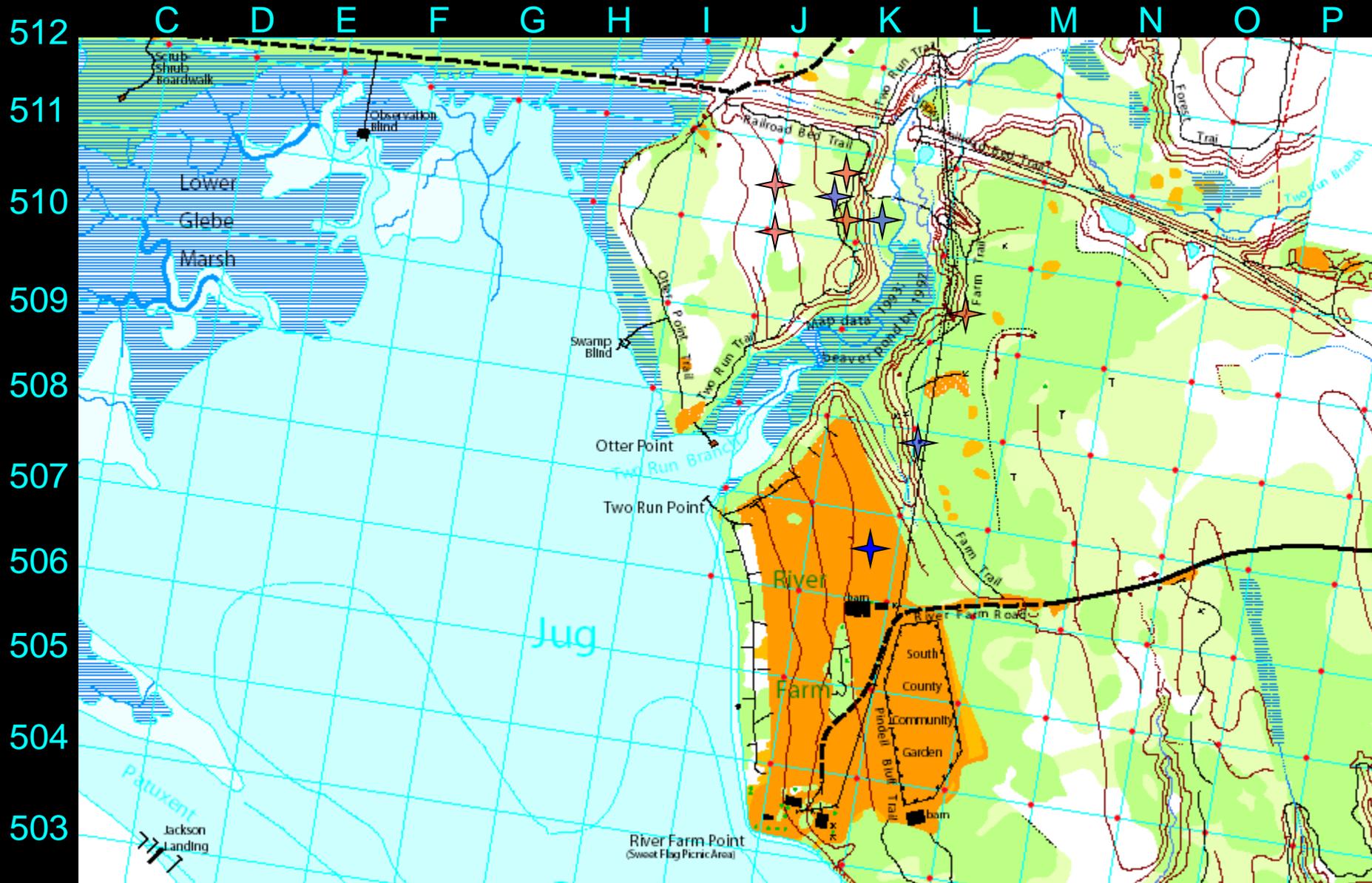
Female #71

May 24th, 2001



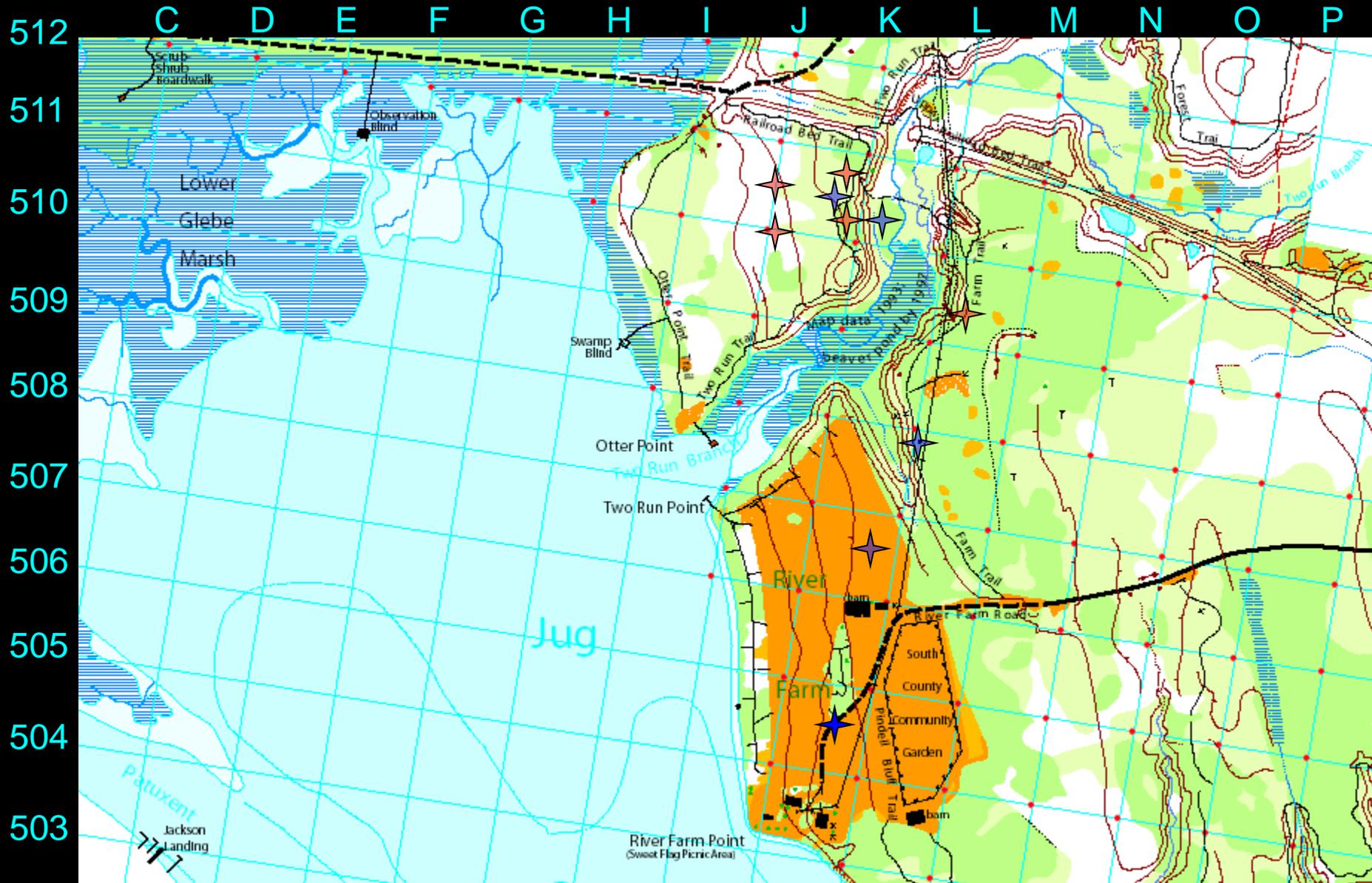
Female #71

May 29th, 2001



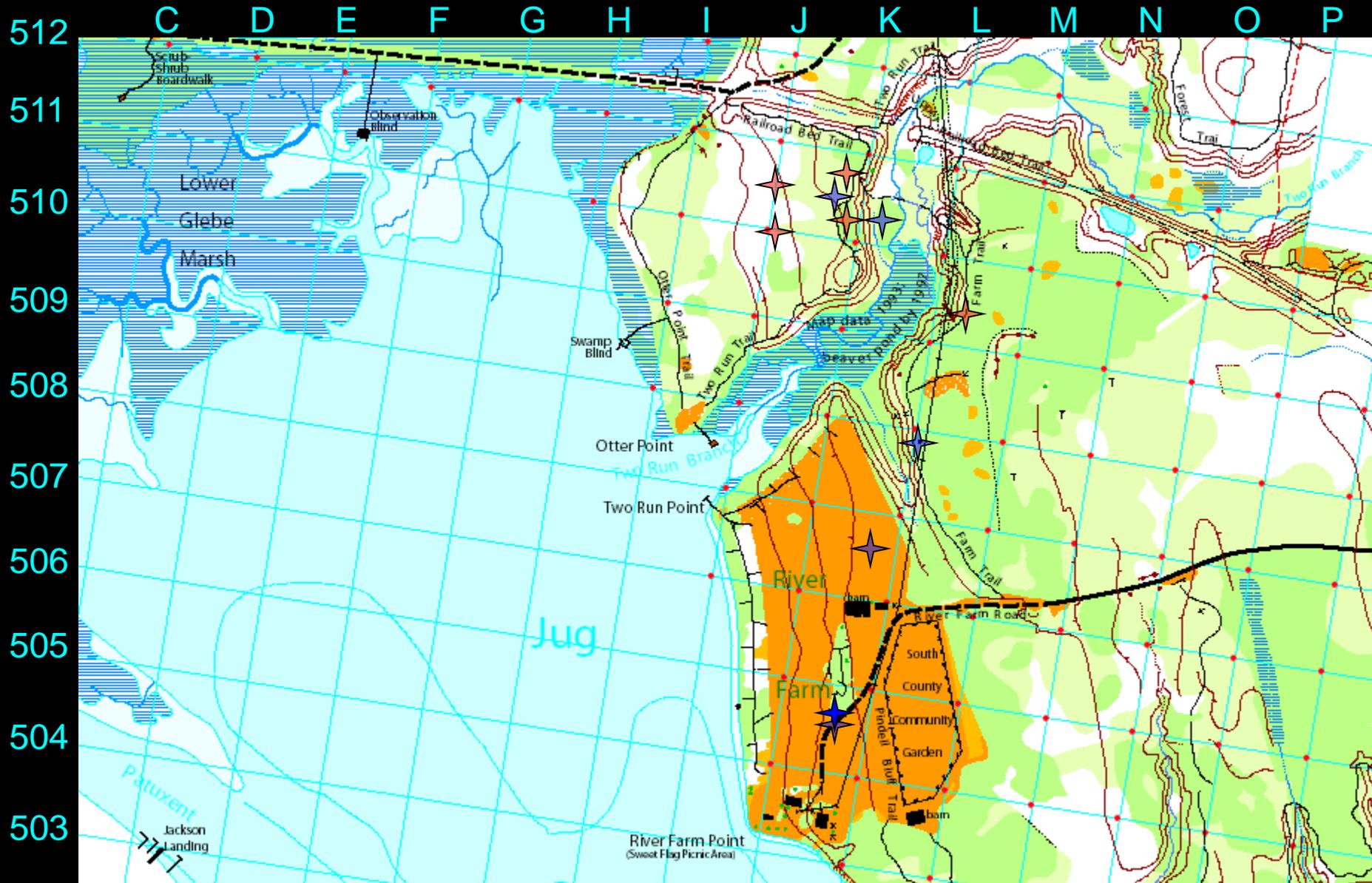
Female #71

June 3rd, 2001



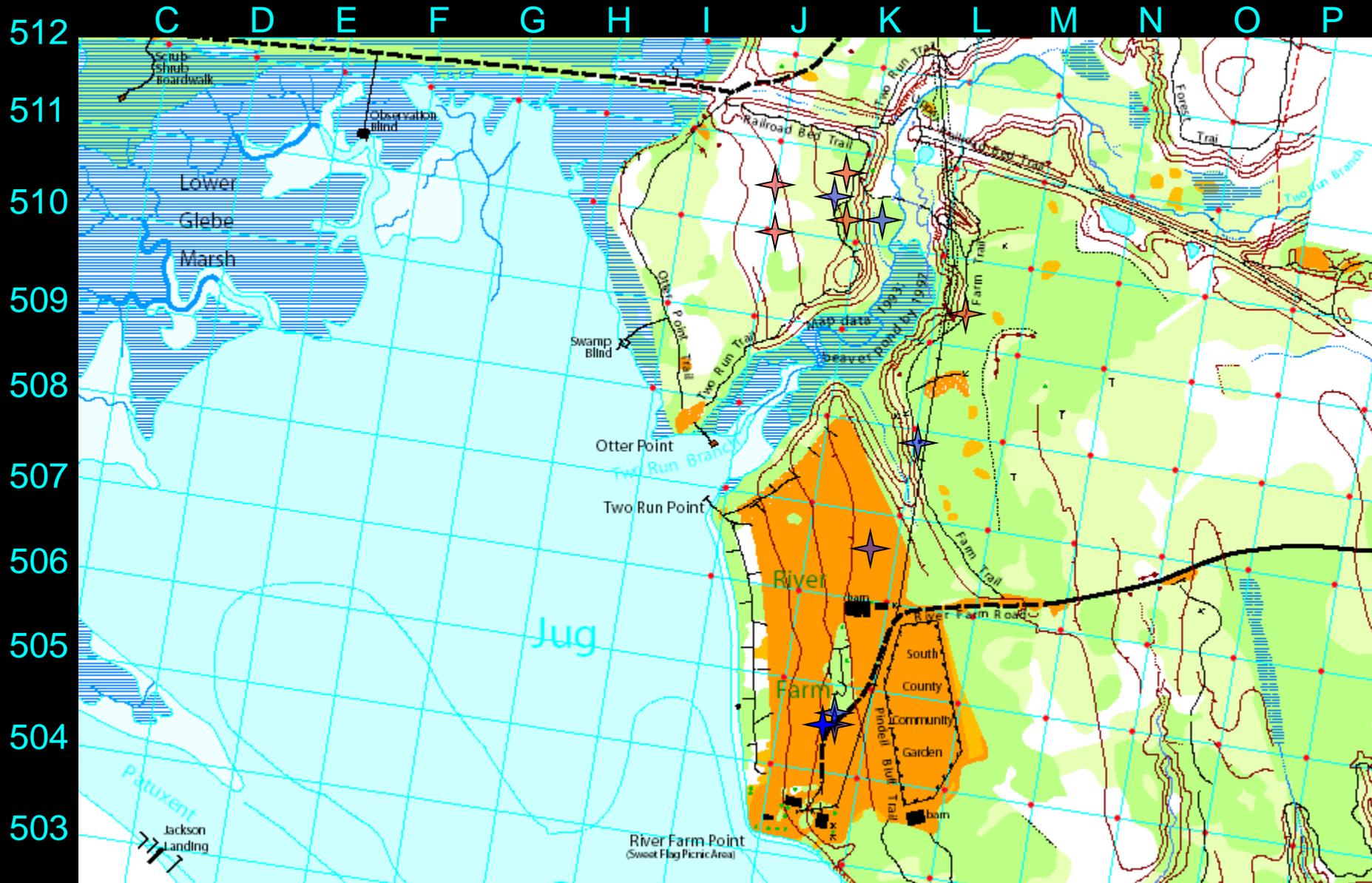
Female #71

June 7th, 2001



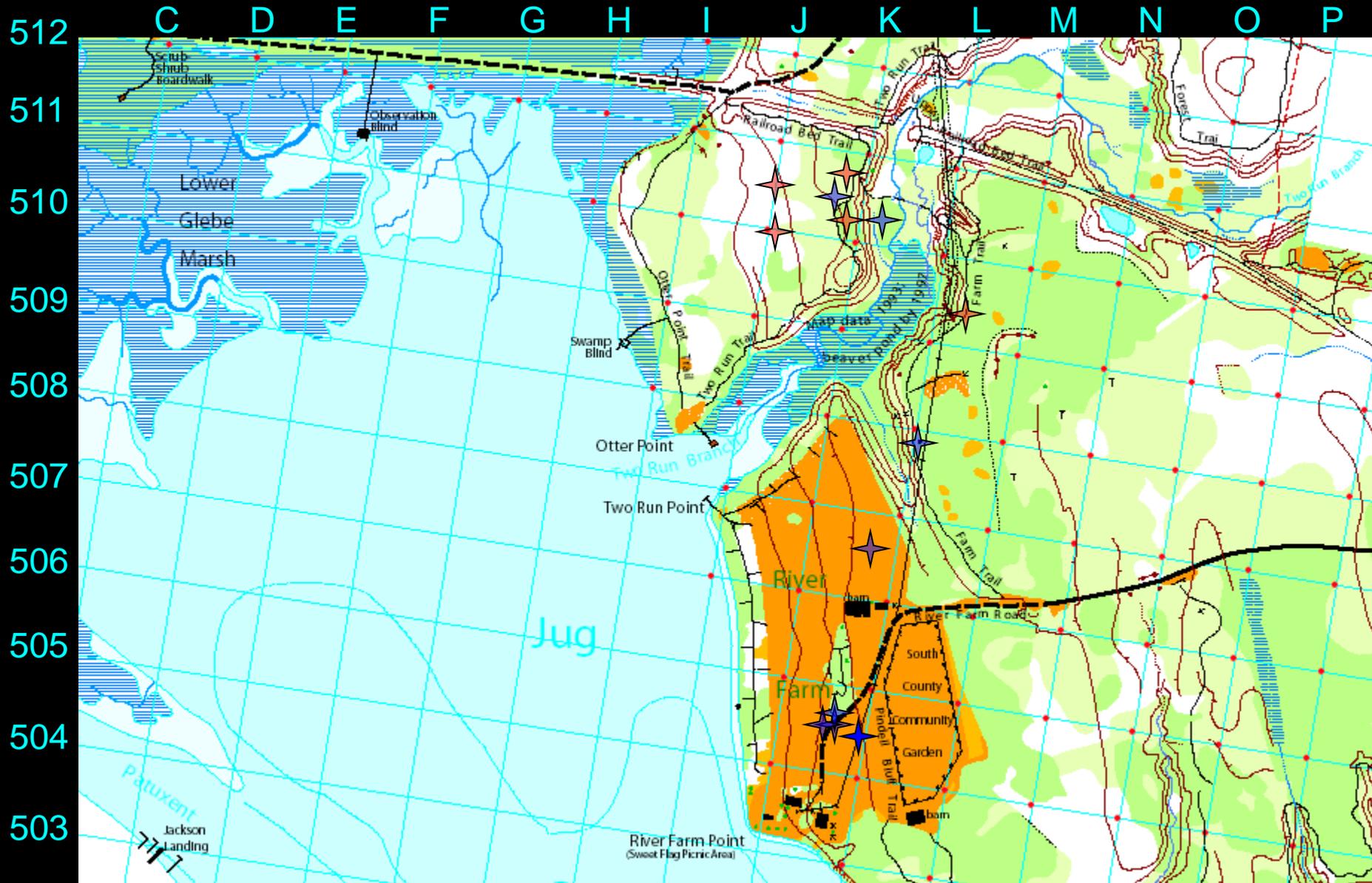
Female #71

June 9th, 2001



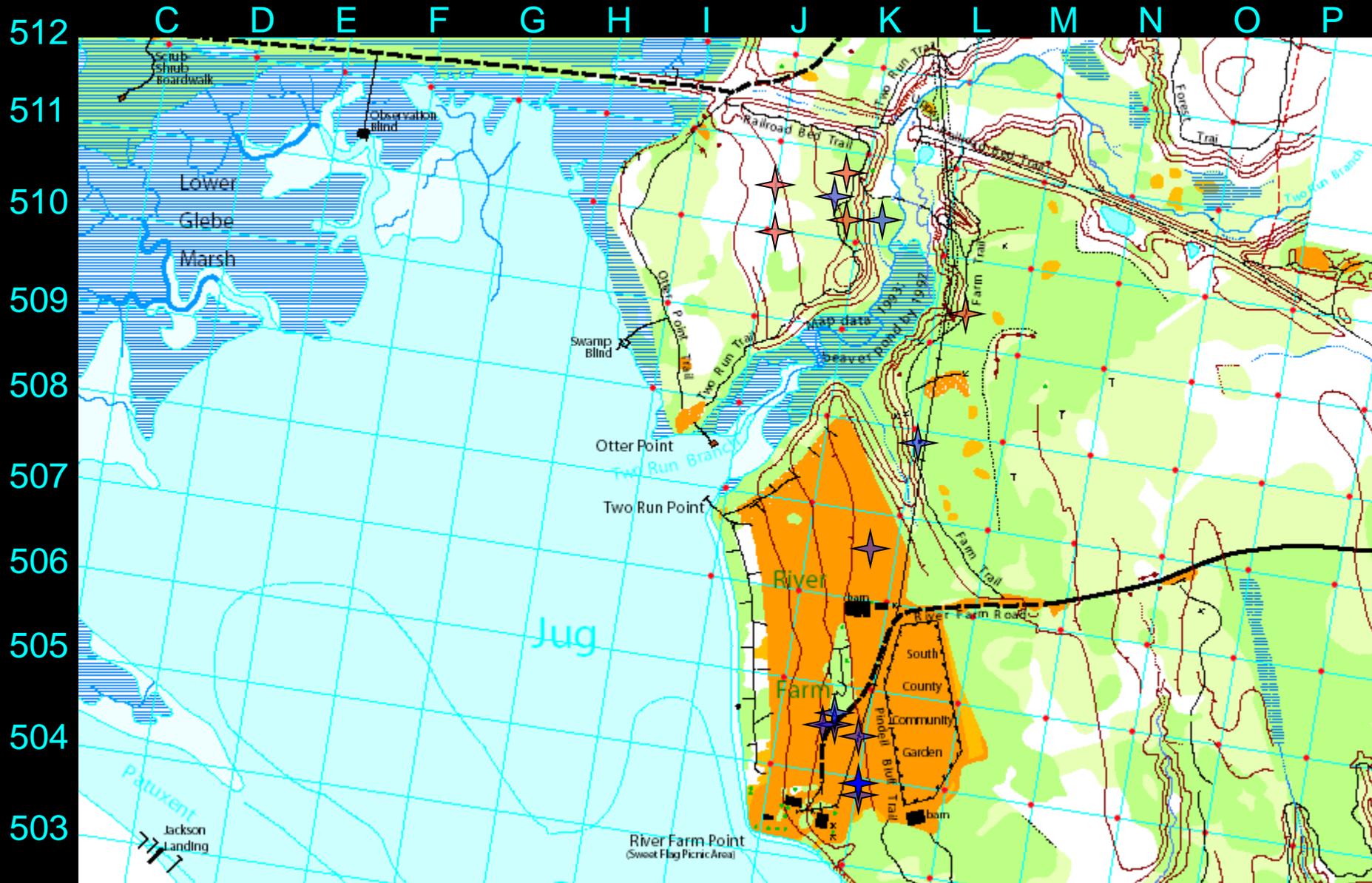
Female #71

June 18th, 2001



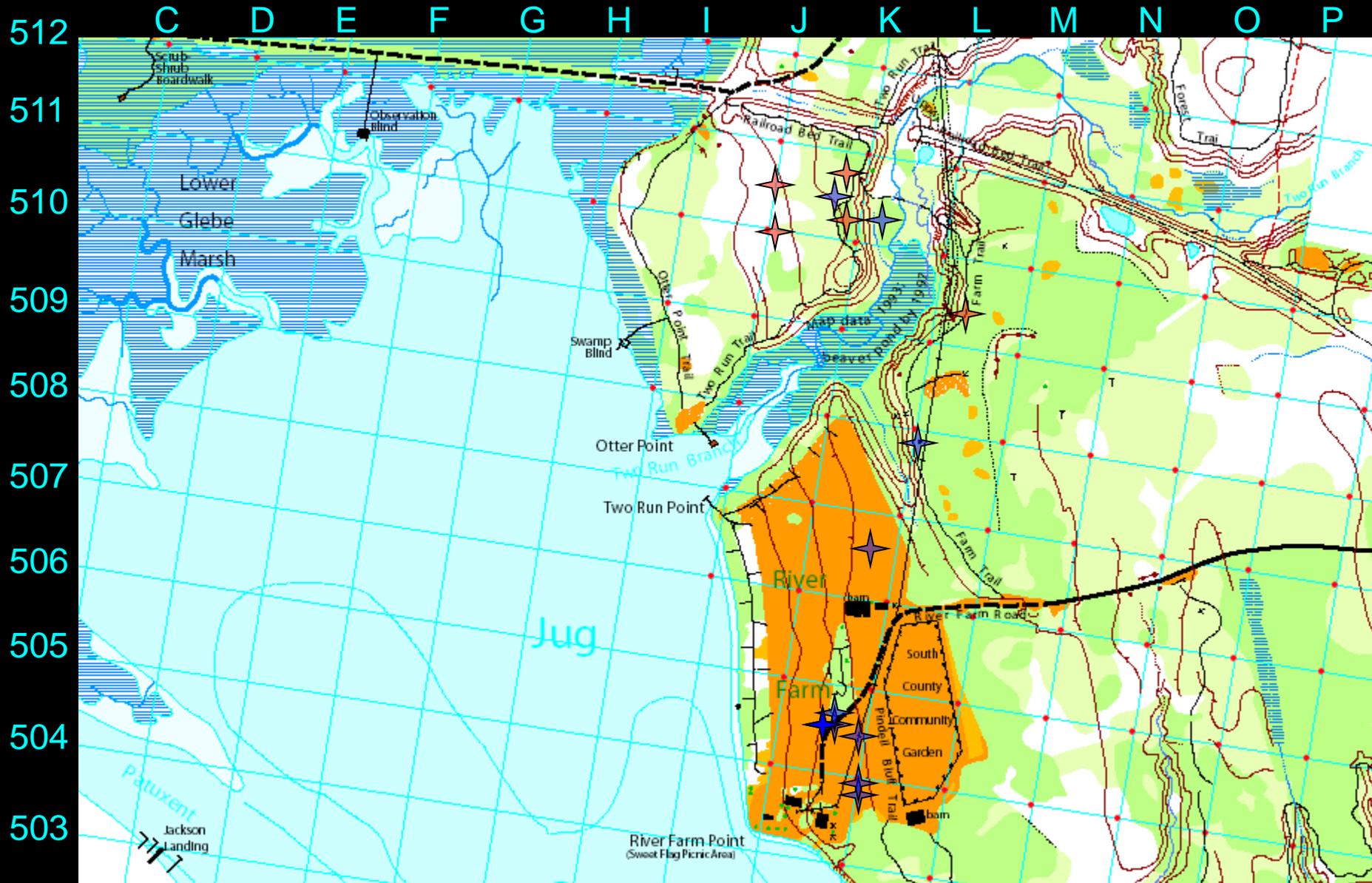
Female #71

June 22nd, 2001



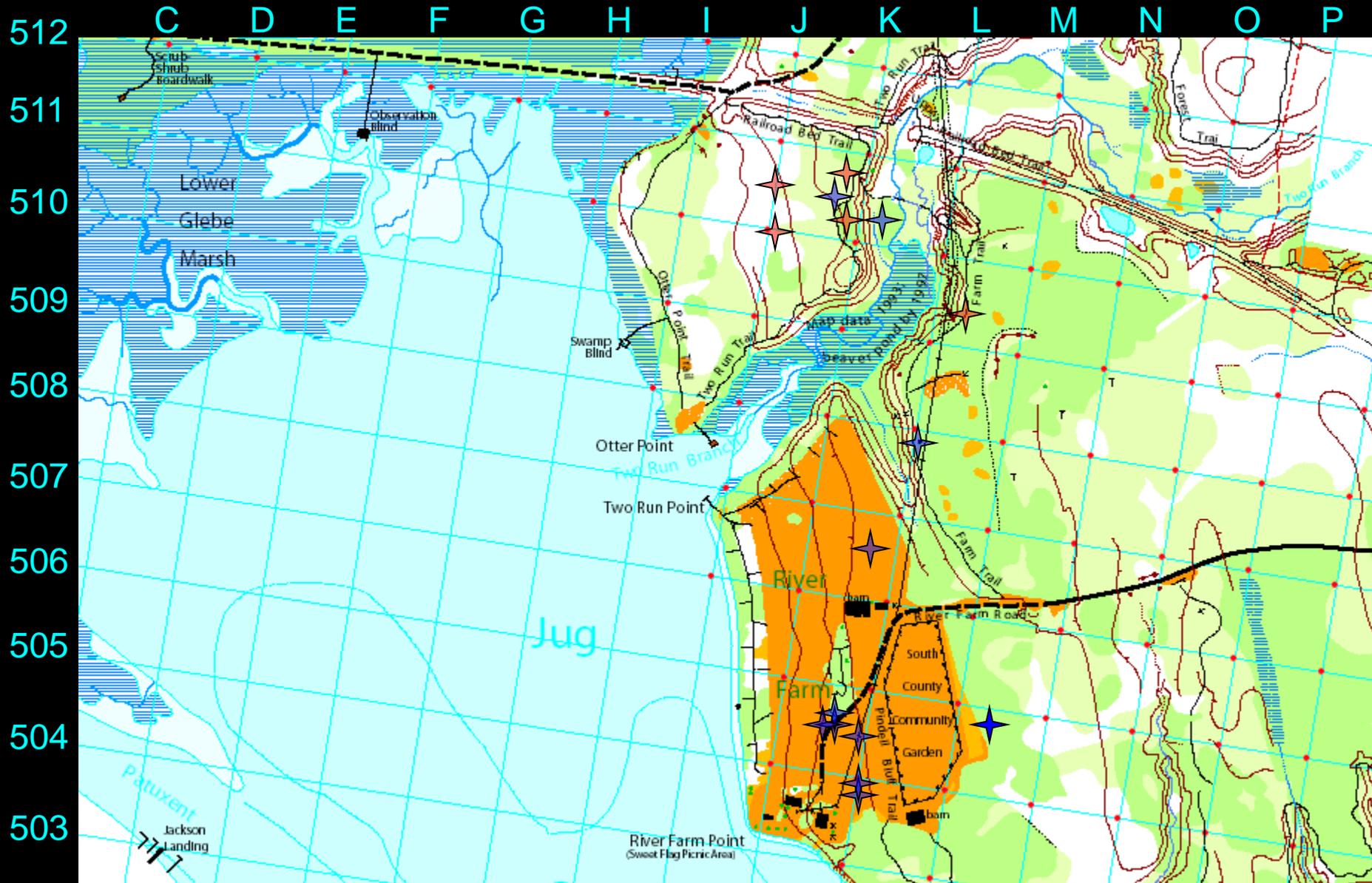
Female #71

July 2nd, 2001



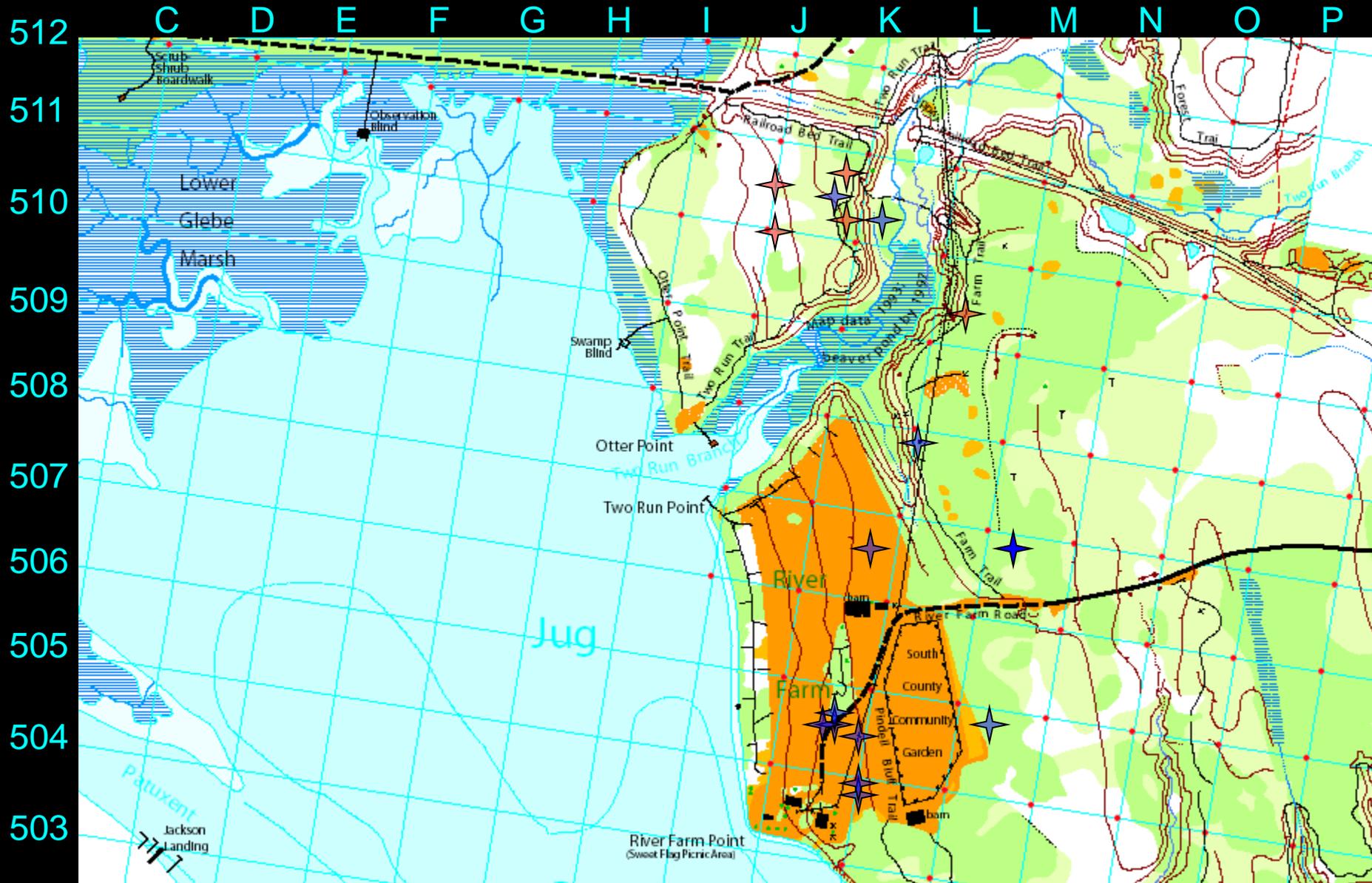
Female #71

July 9th, 2001



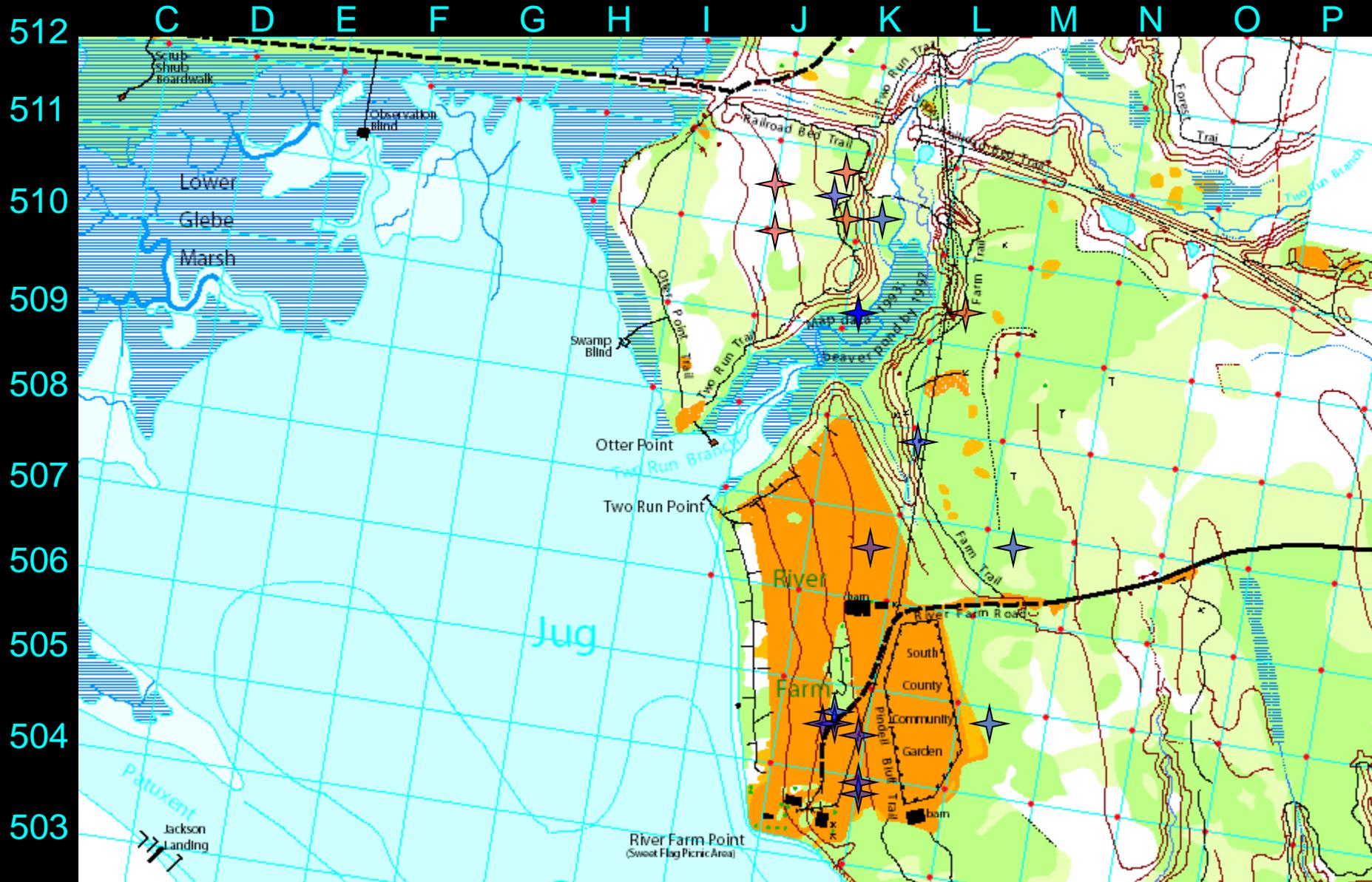
Female #71

July 11th, 2001



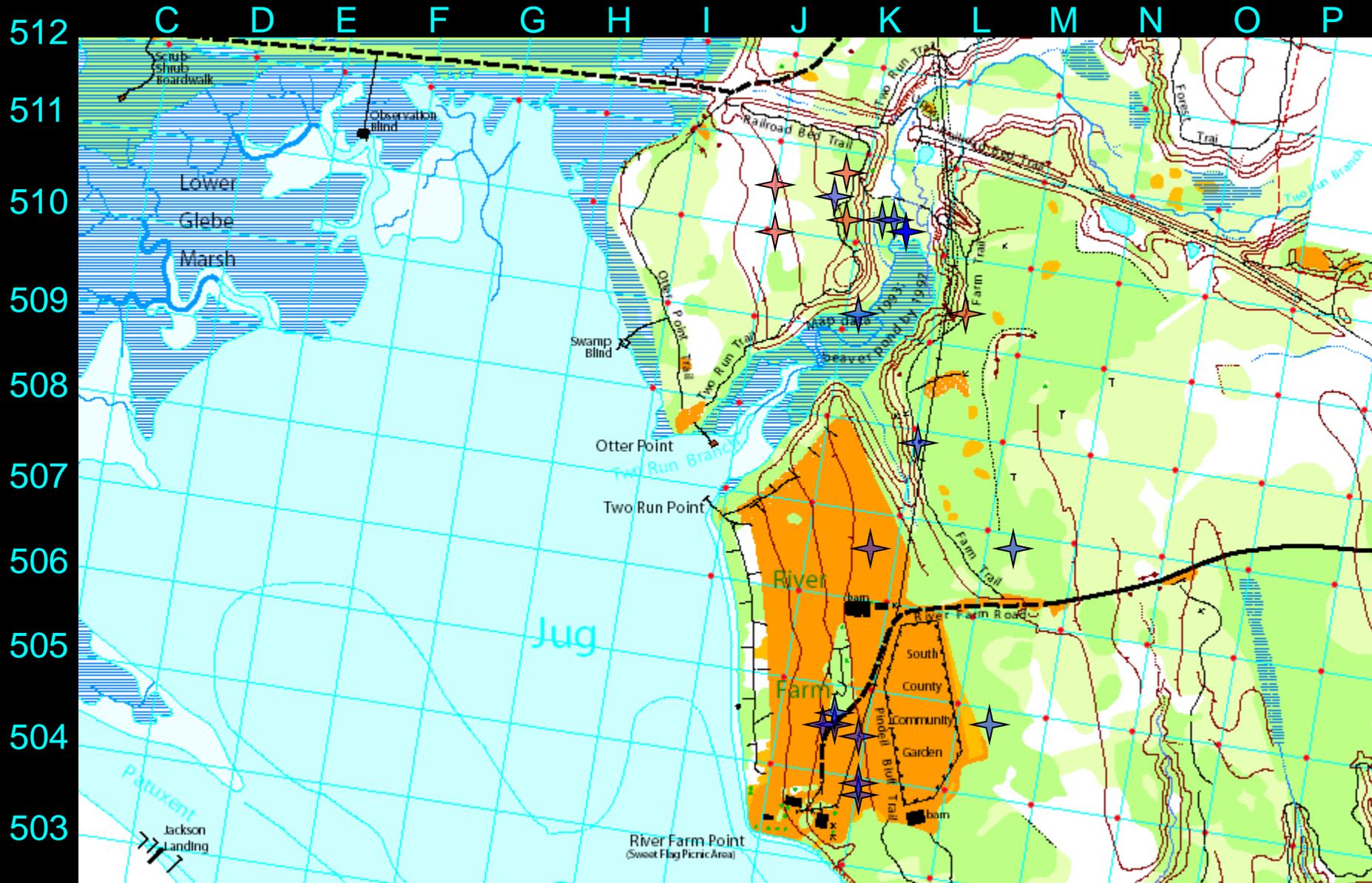
Female #71

July 17th, 2001



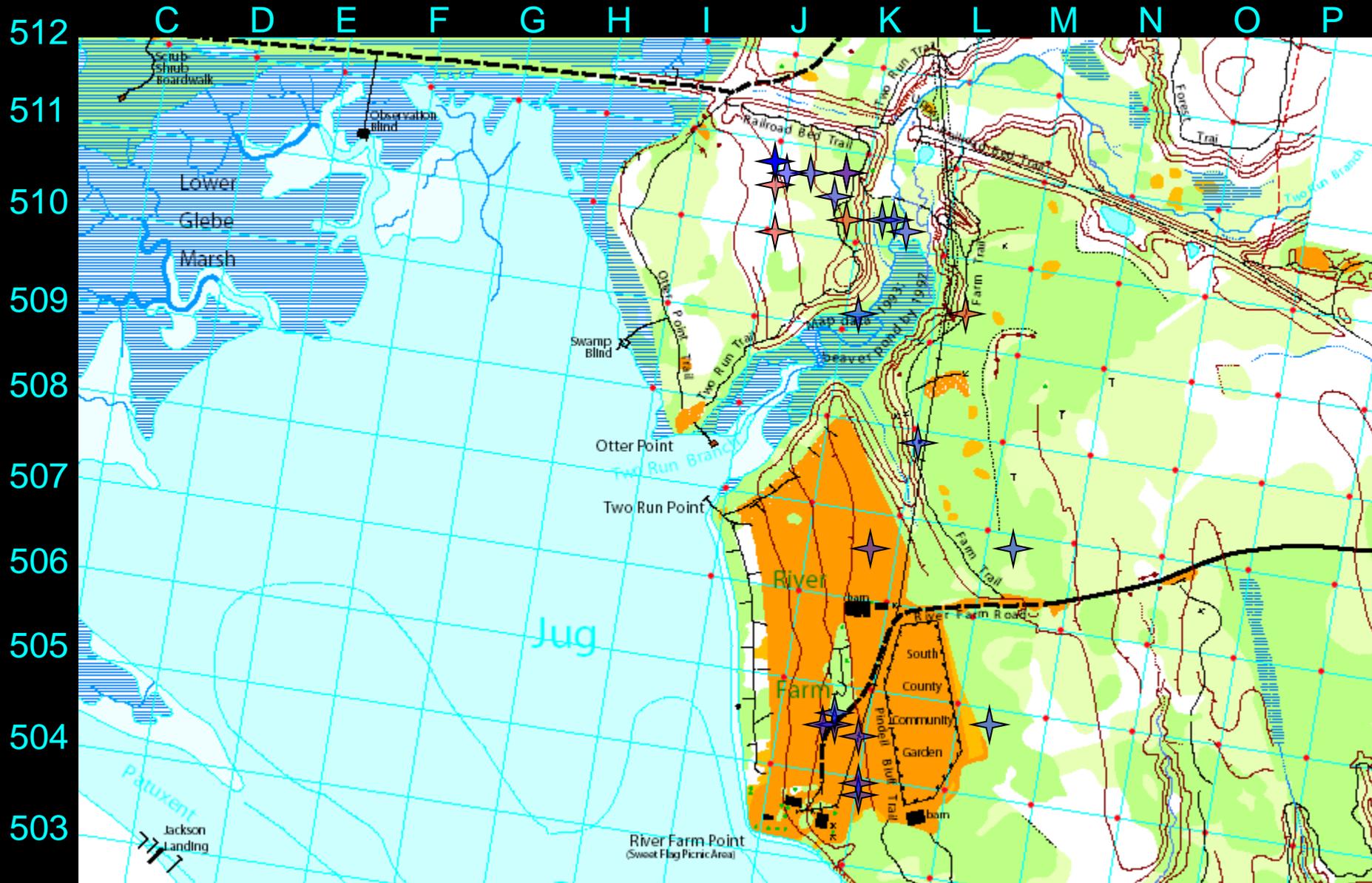
Female #71

August 6th, 2001



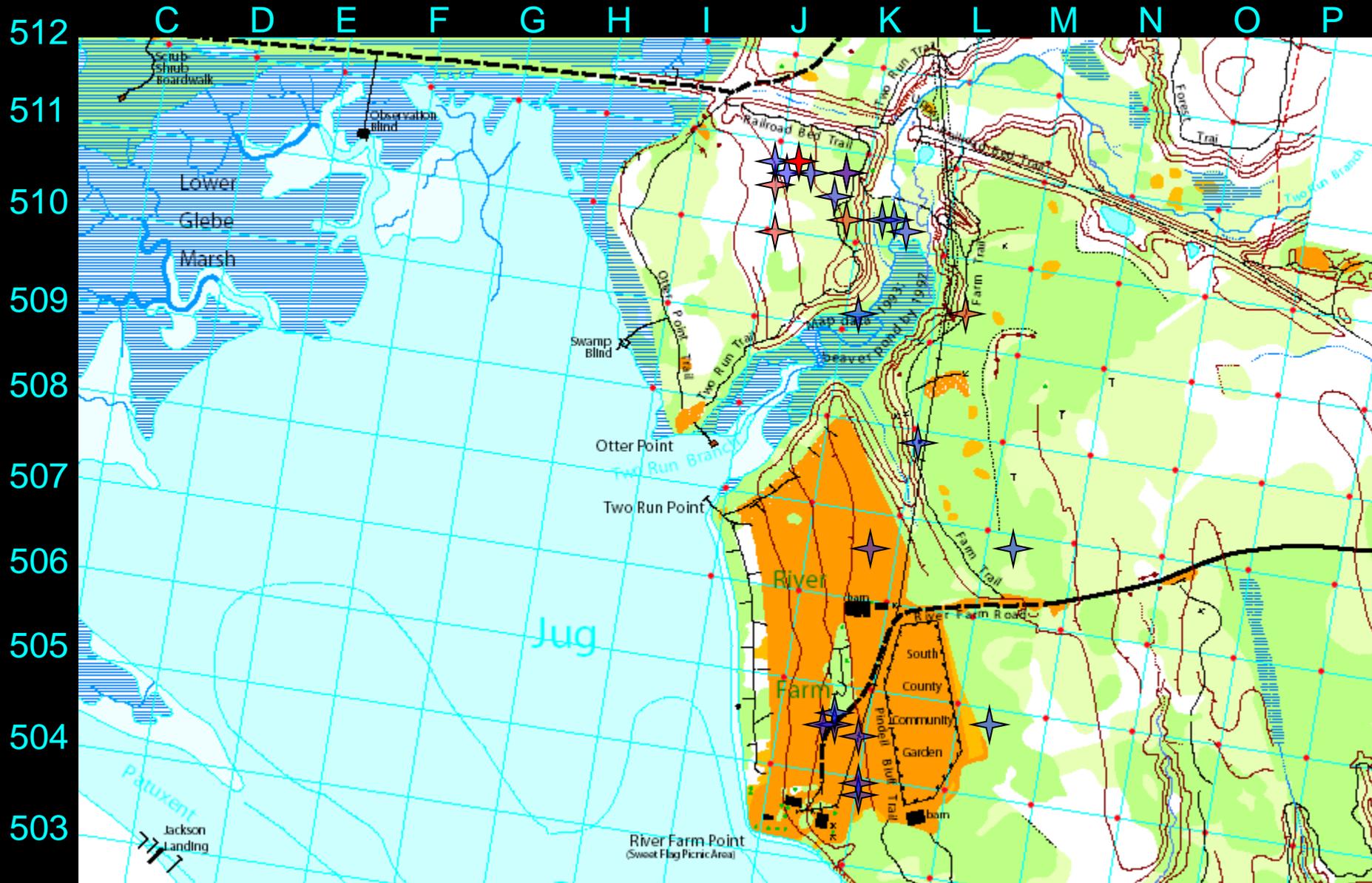
Female #71

August 29th, 2001



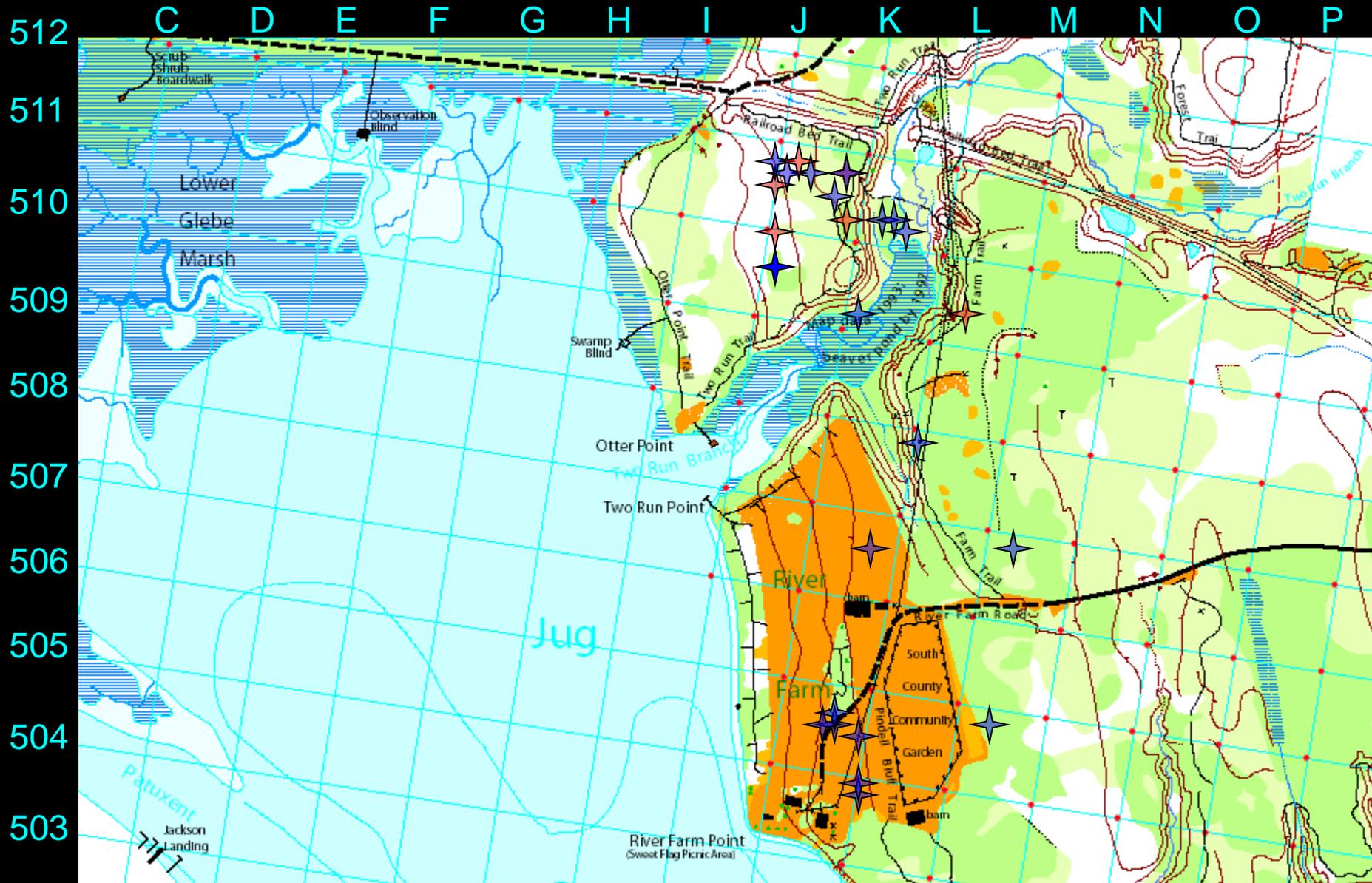
Female #71

August 30th, 2001



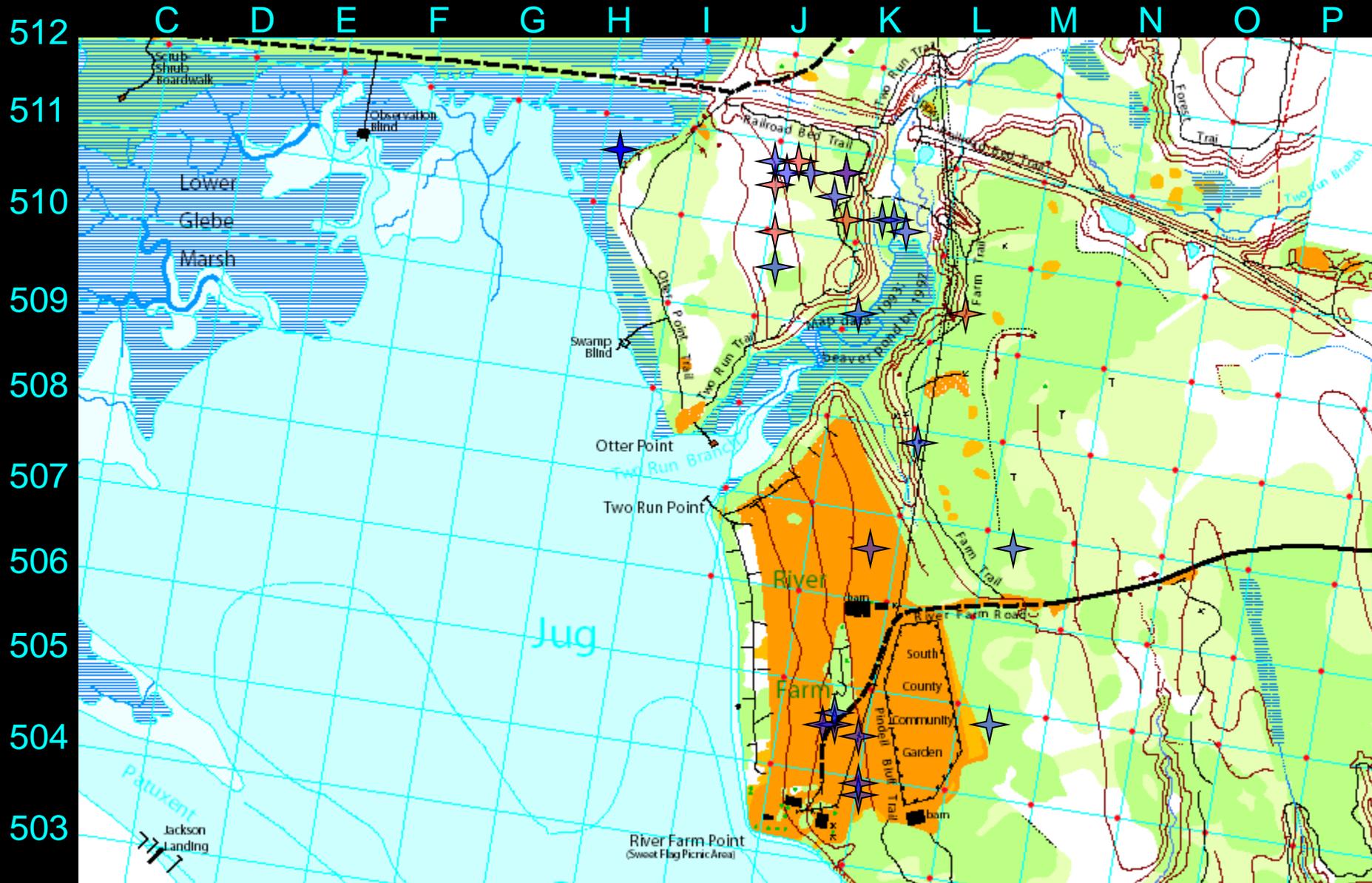
Female #71

September 5th, 2001



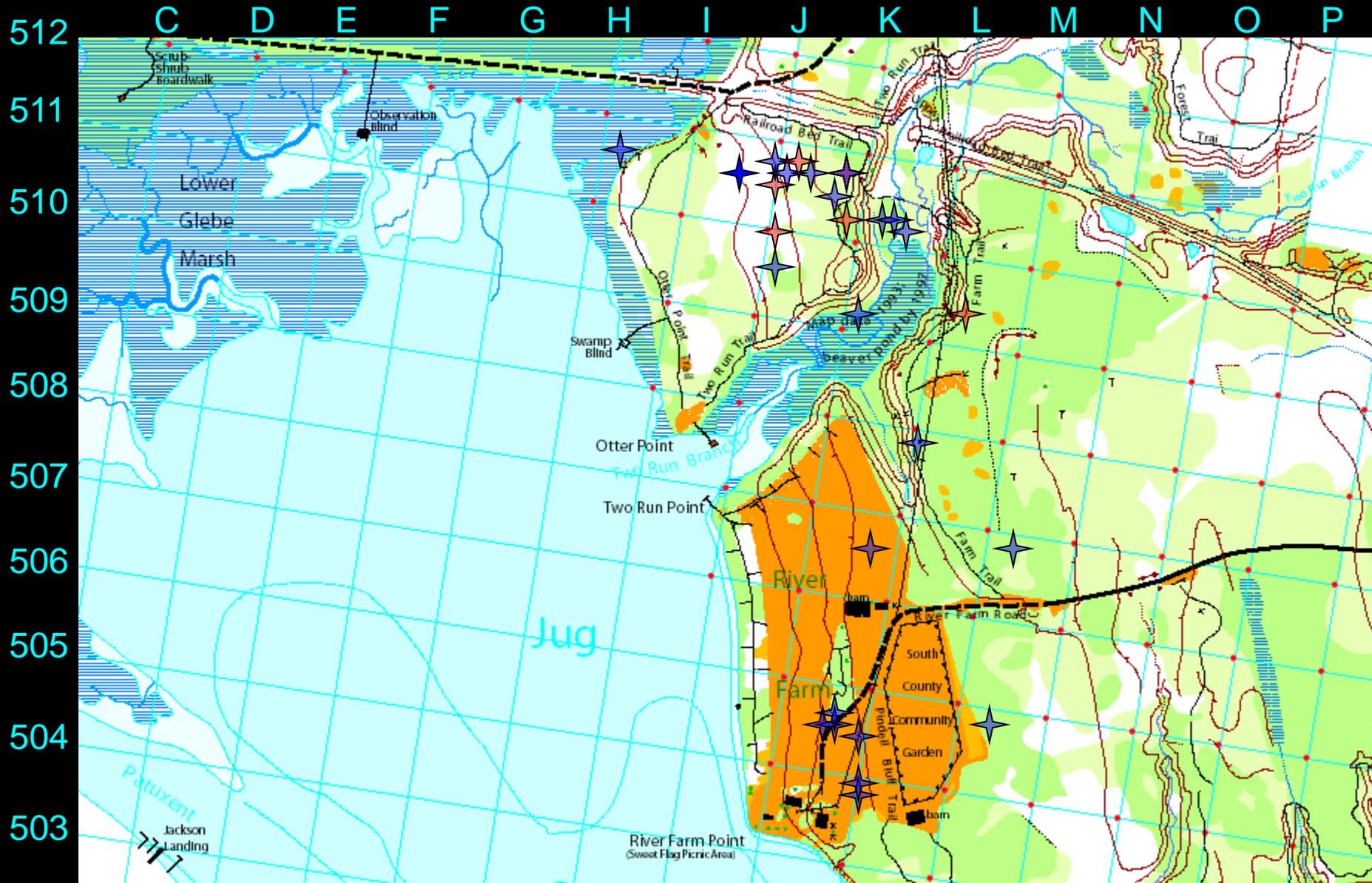
Female #71

September 6th, 2001



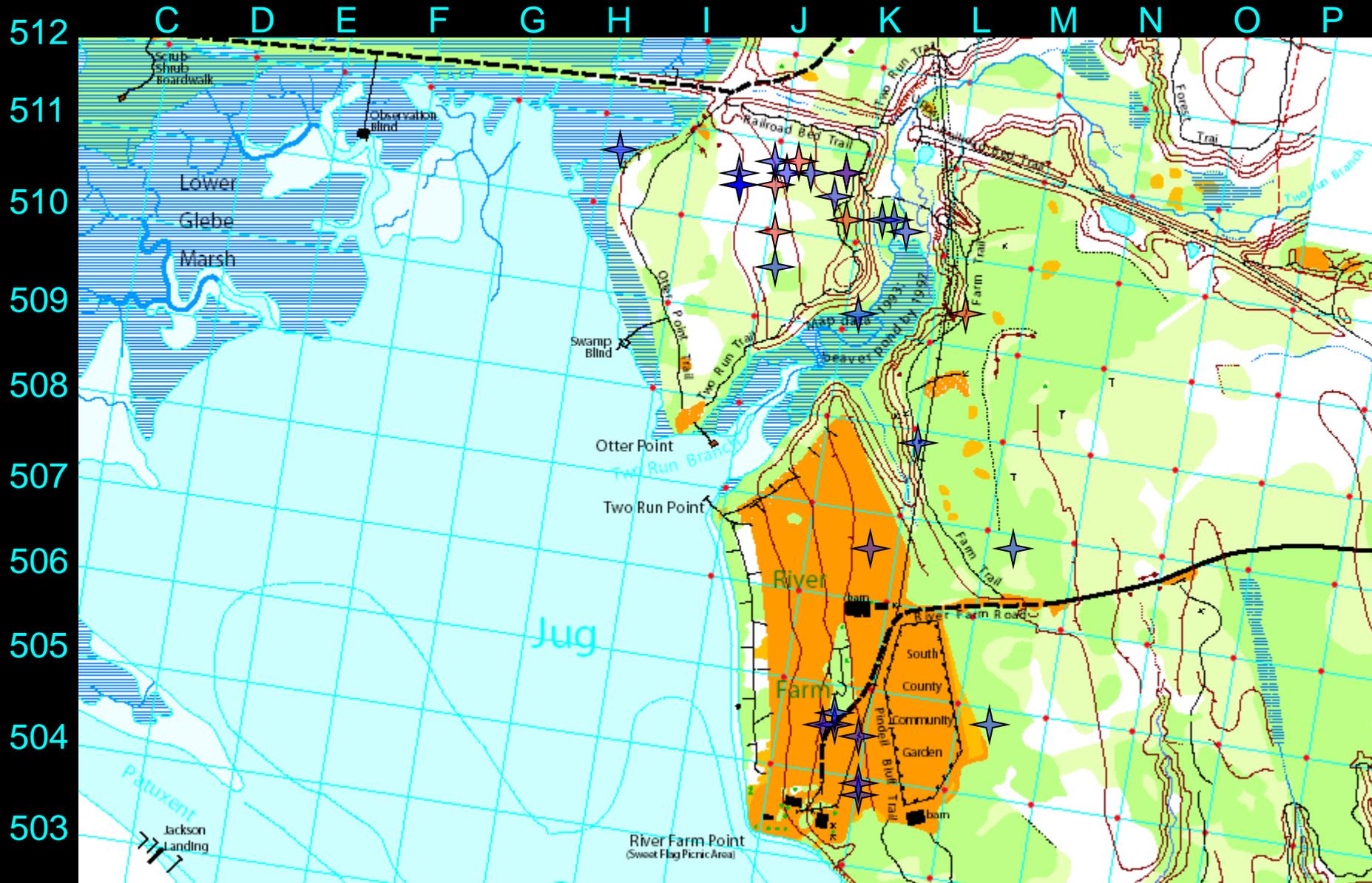
Female #71

September 12th, 2001



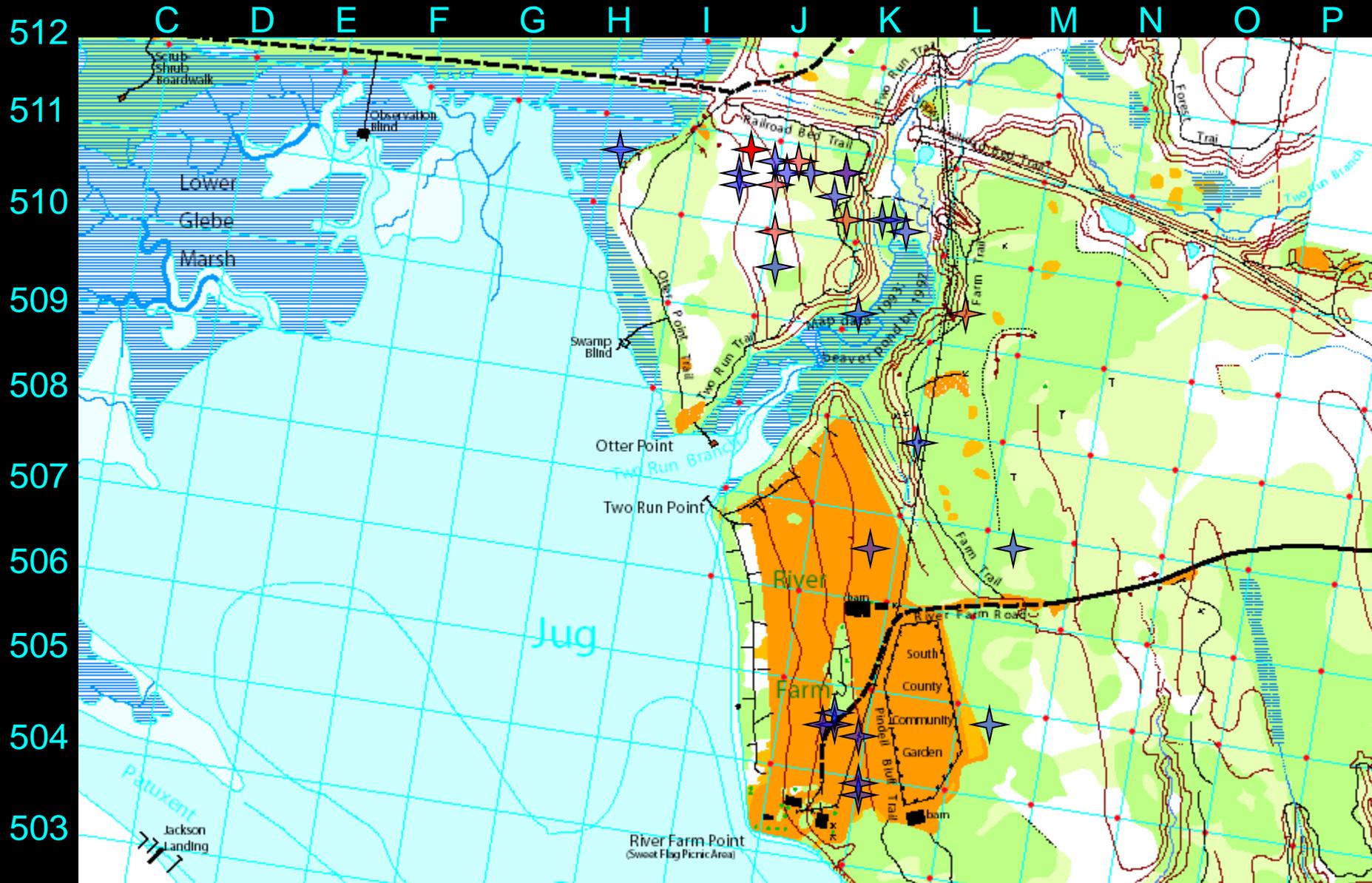
Female #71

September 19th, 2001



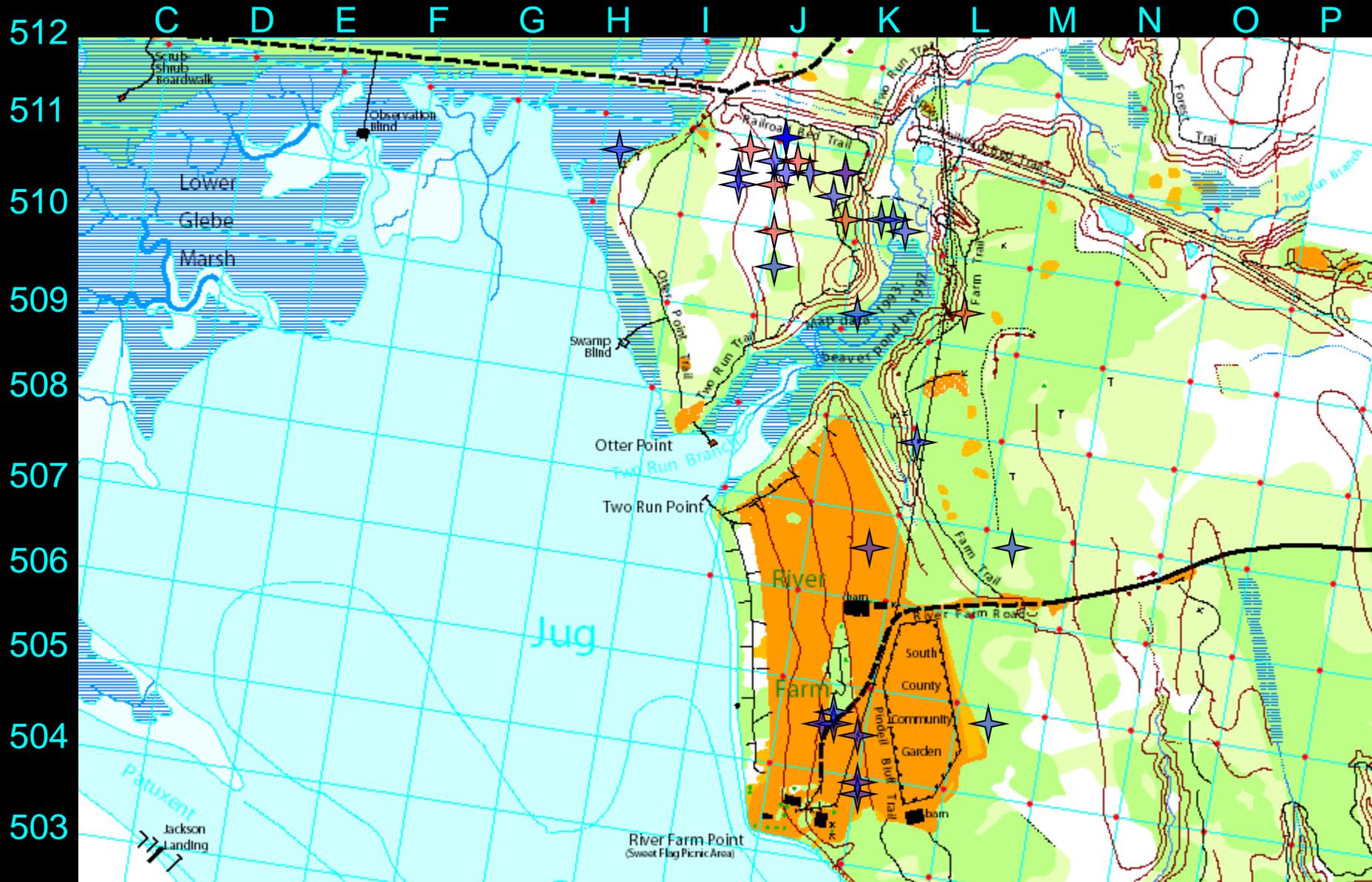
Female #71

September 20th, 2001



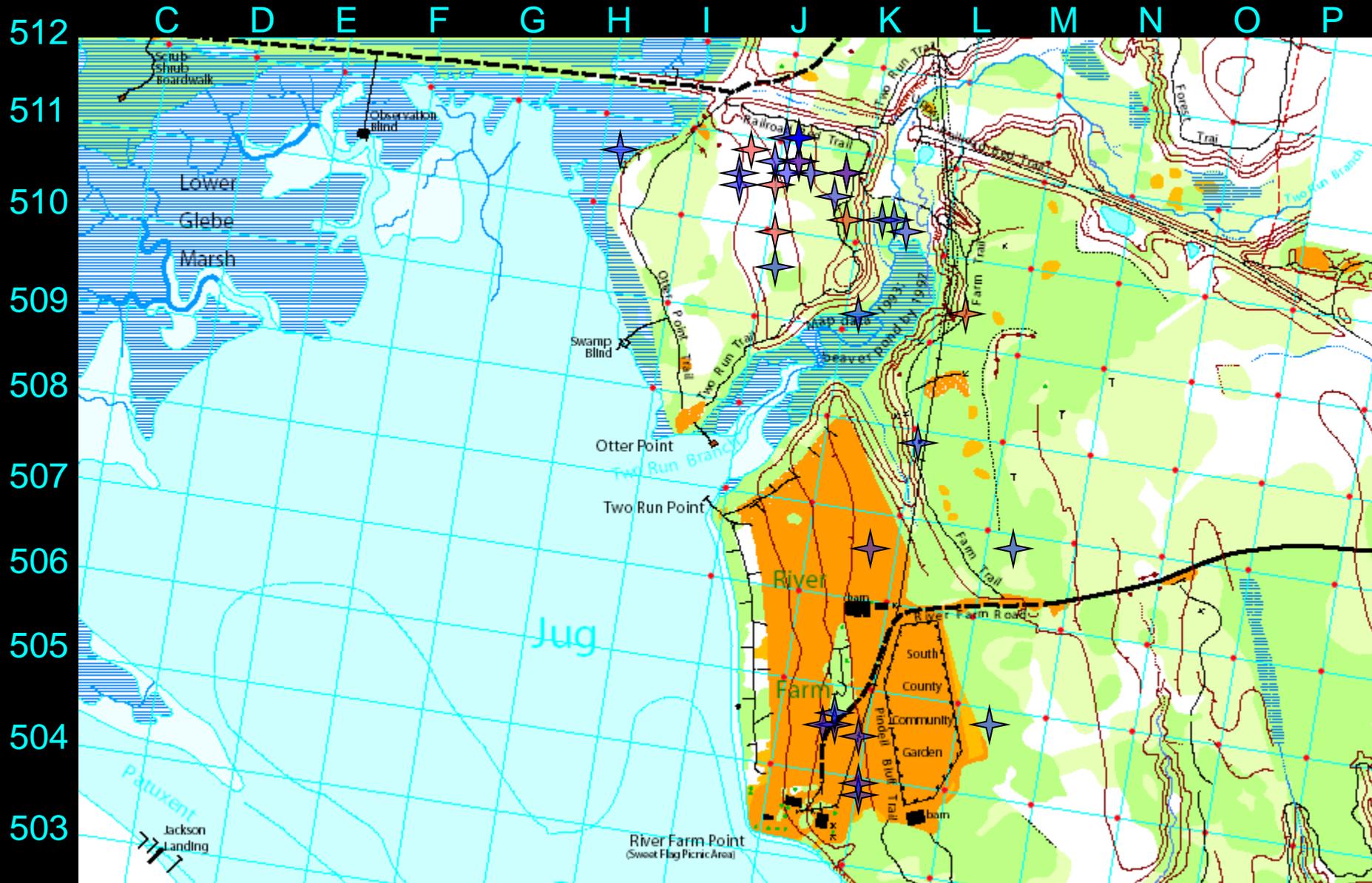
Female #71

September 24th, 2001



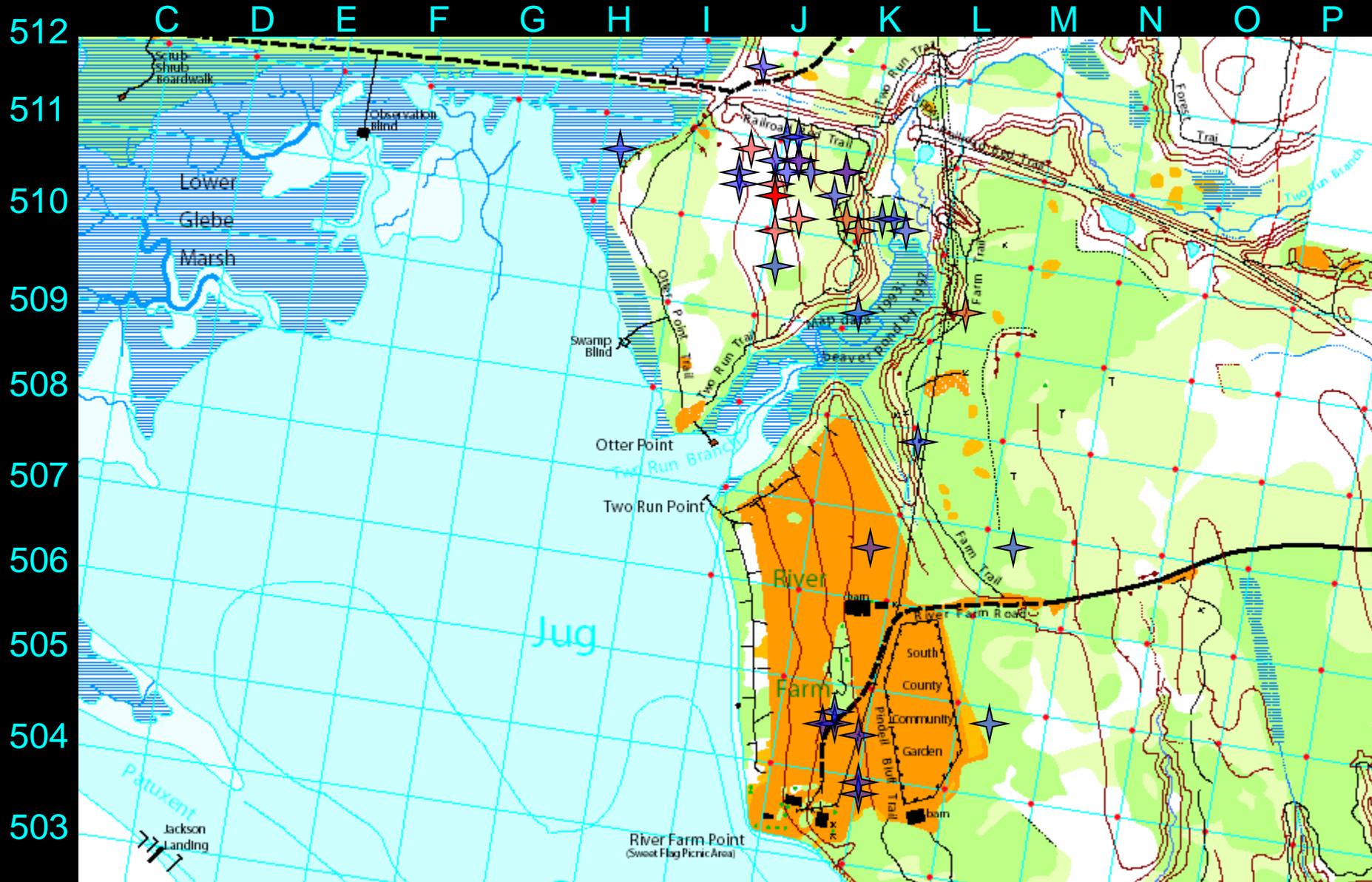
Female #71

October 16th, 2001



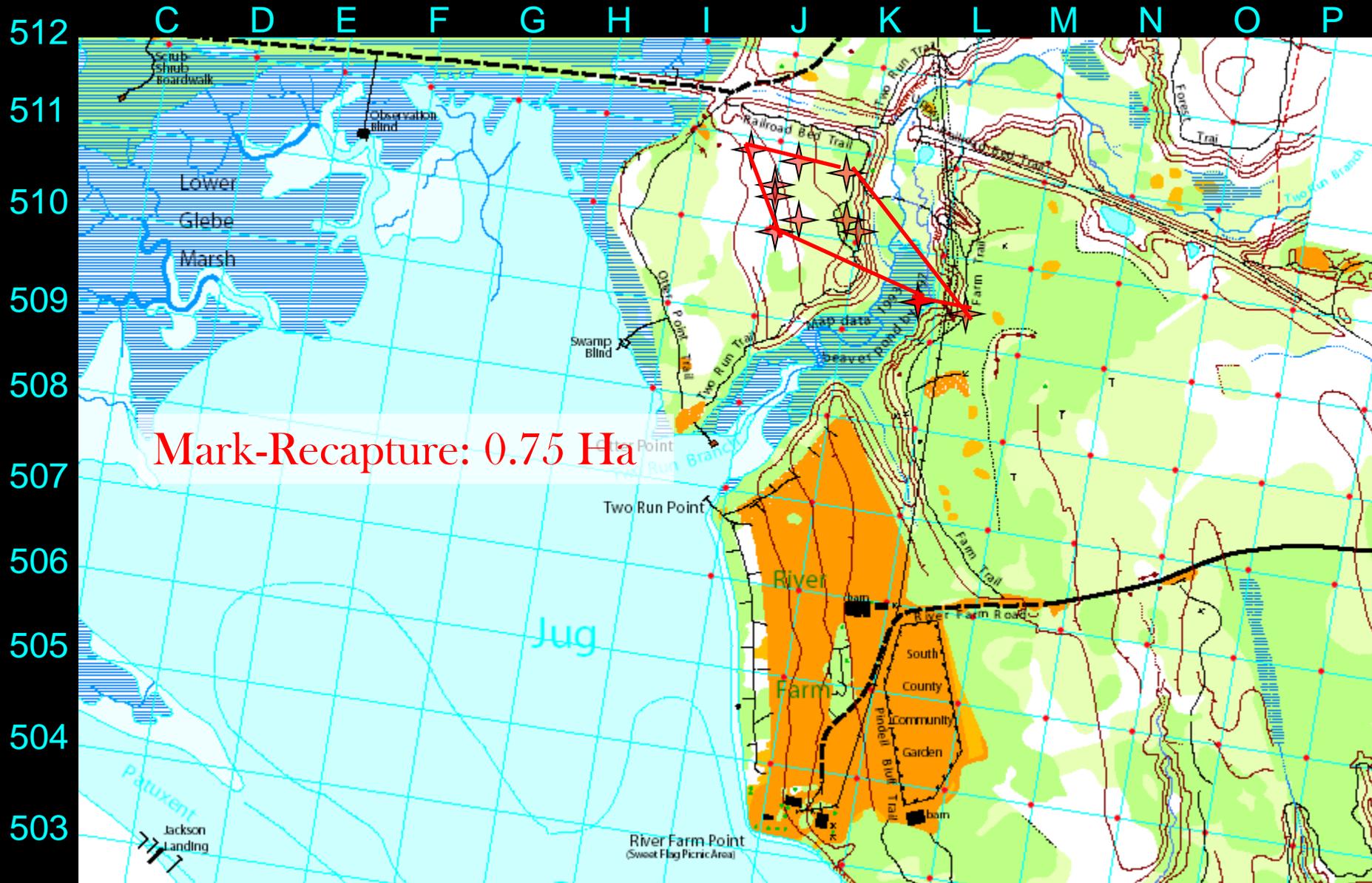
Female #71

June 19th, 2003



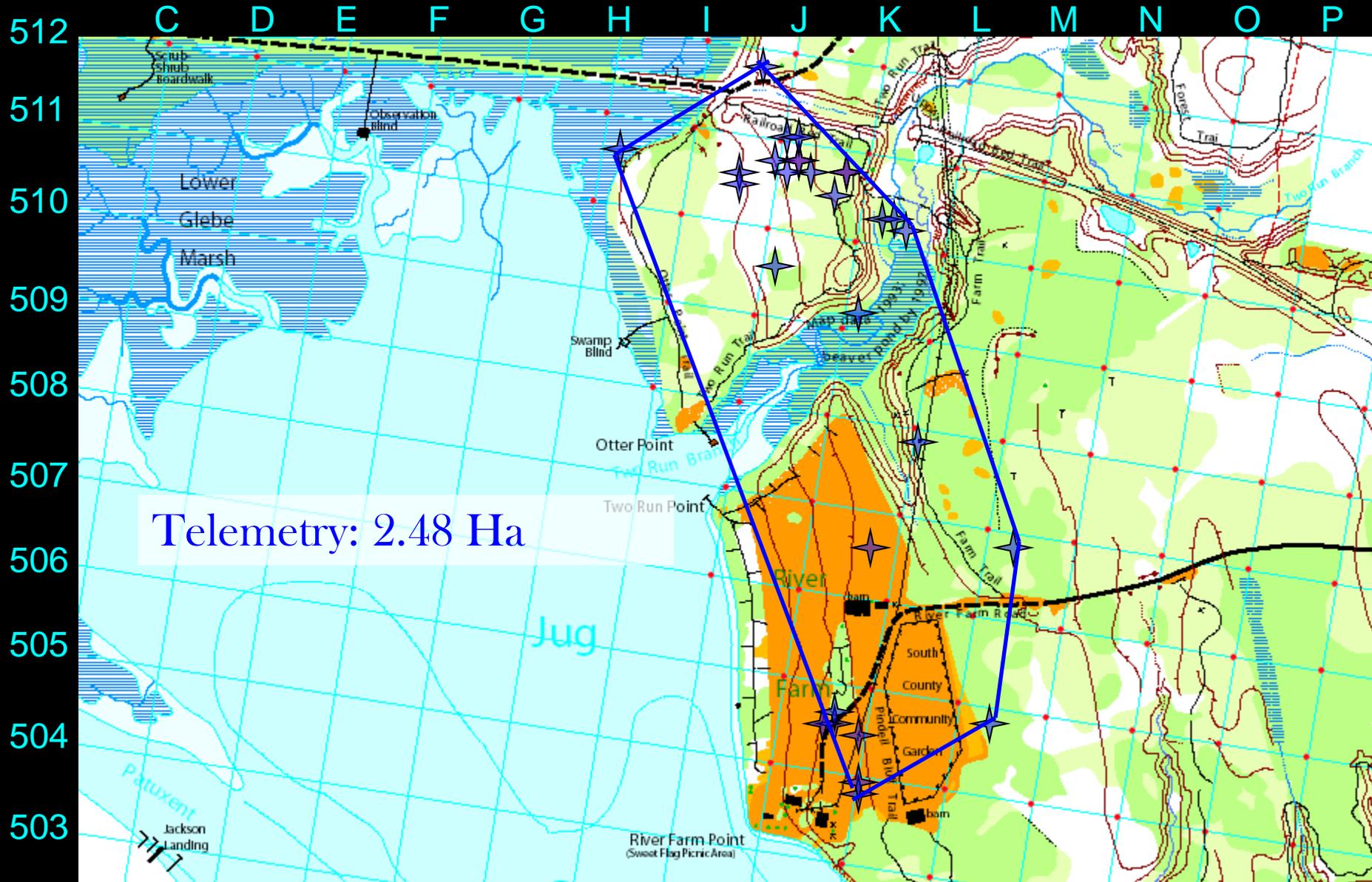
Female #71

Home Range based on Random sightings from June 1996 - July 2003



Female #71

Home Range based on Telemetry sightings from May 2001 – October 2001

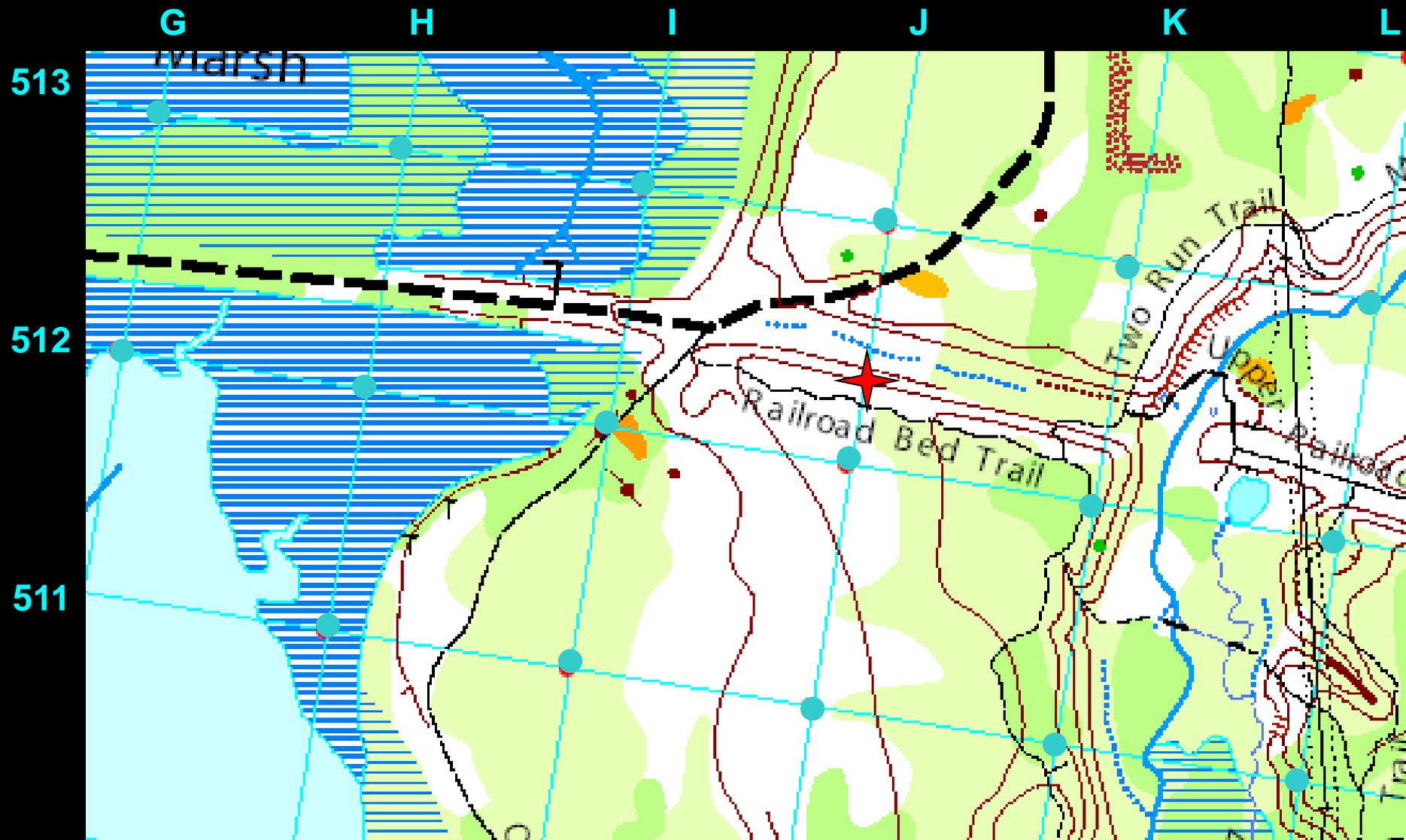


Home Range Maps

For Male # 186

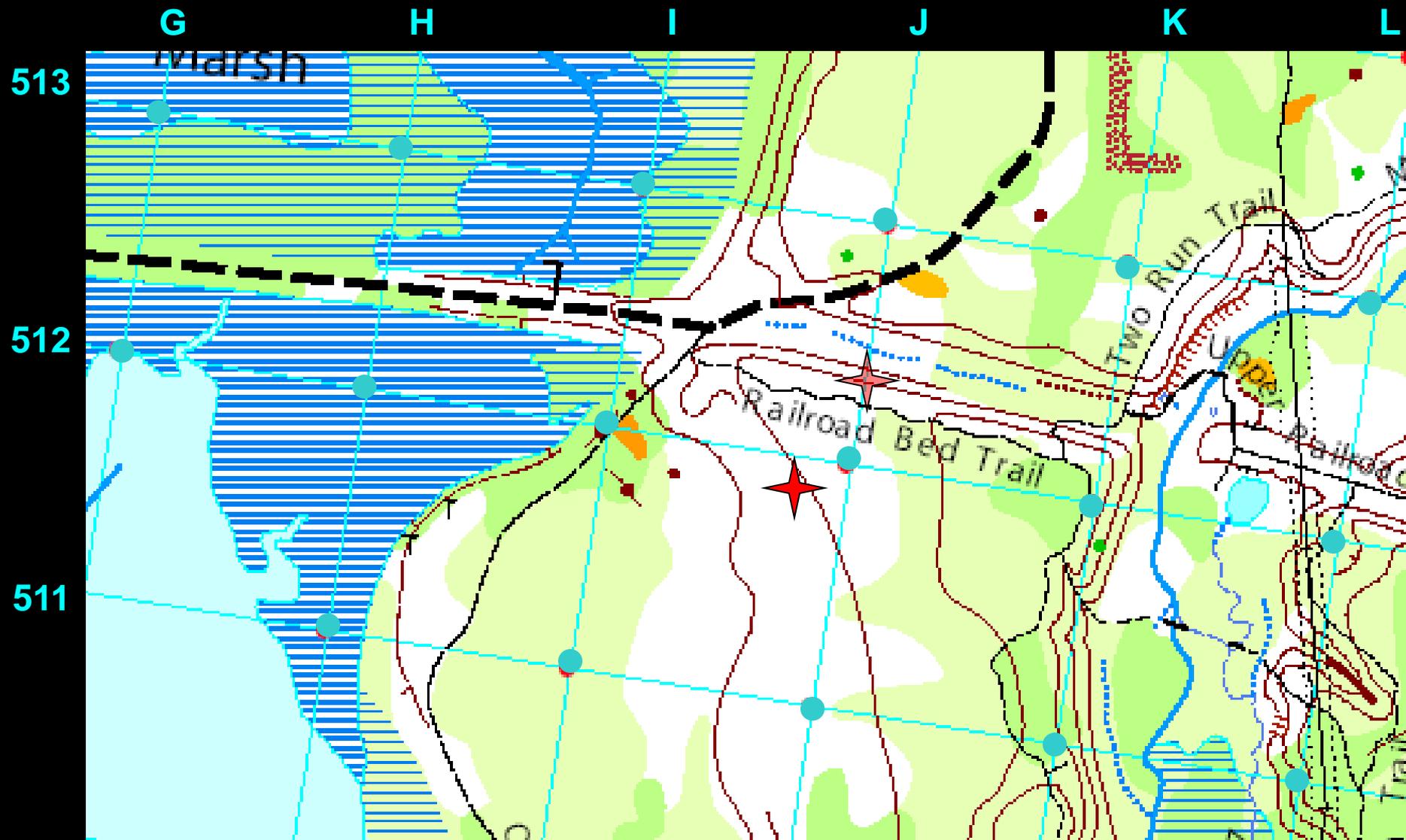
Male #186

June 26th, 1998



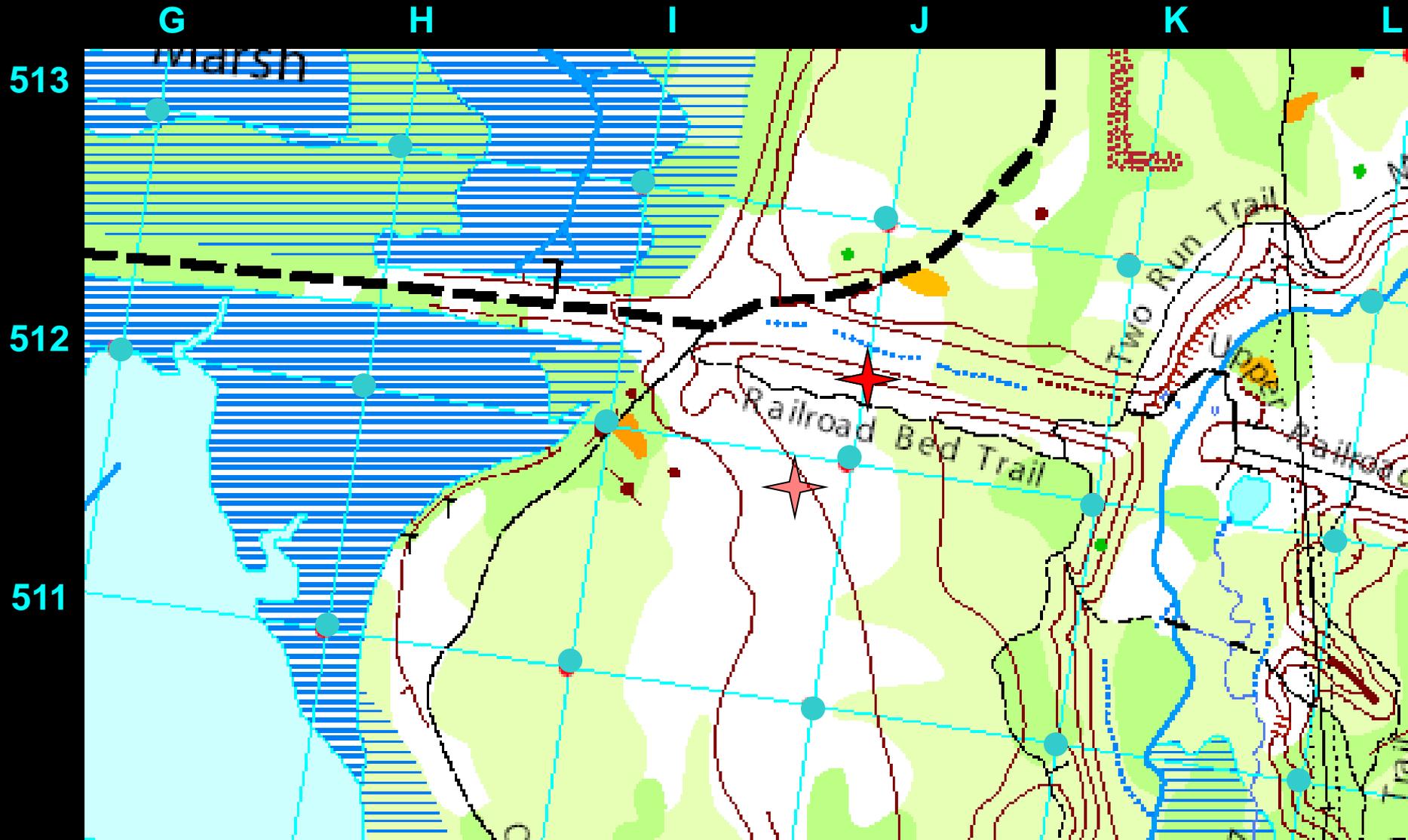
Male #186

June 15th, 1999



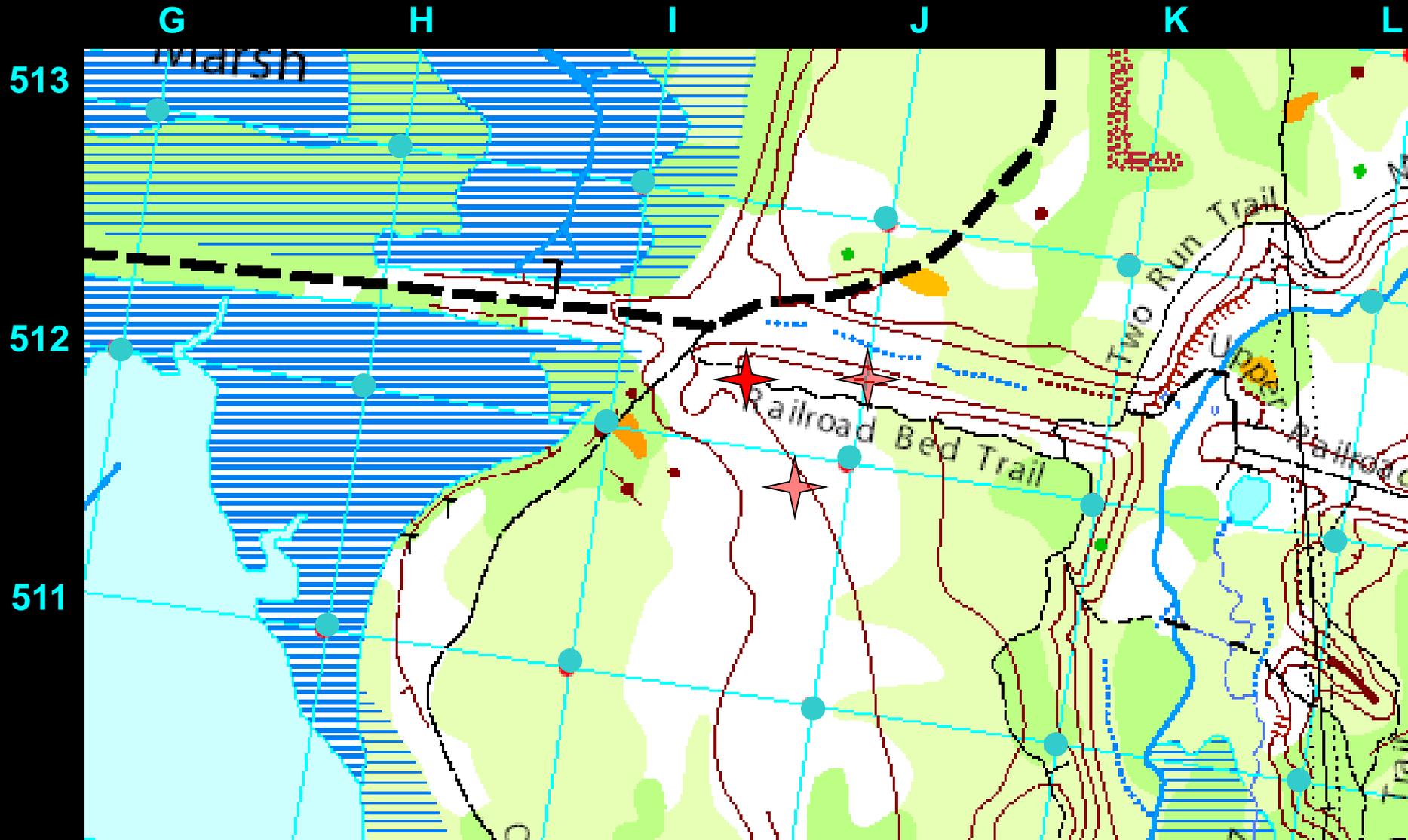
Male #186

August 22nd, 1999



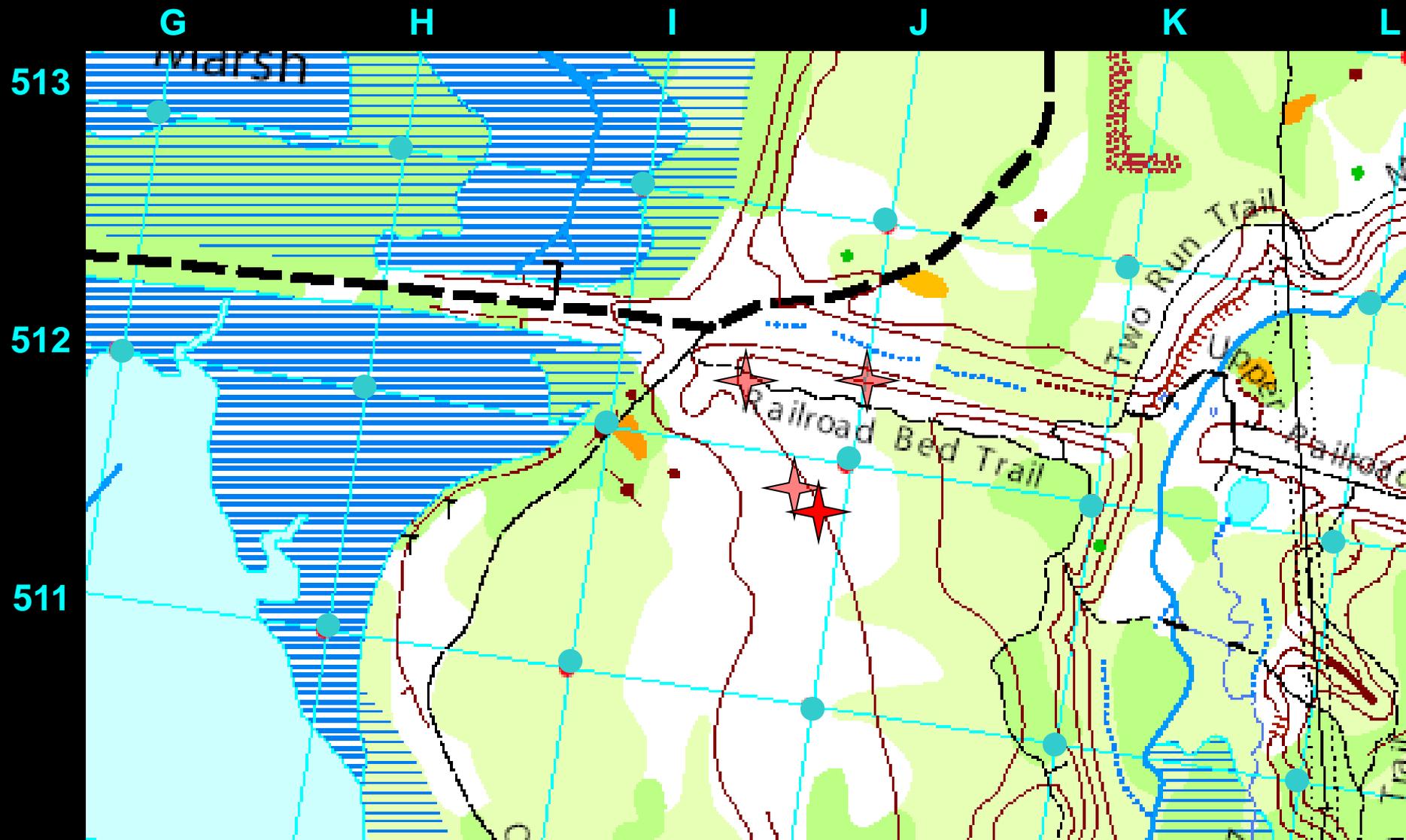
Male #186

May 22nd, 2000



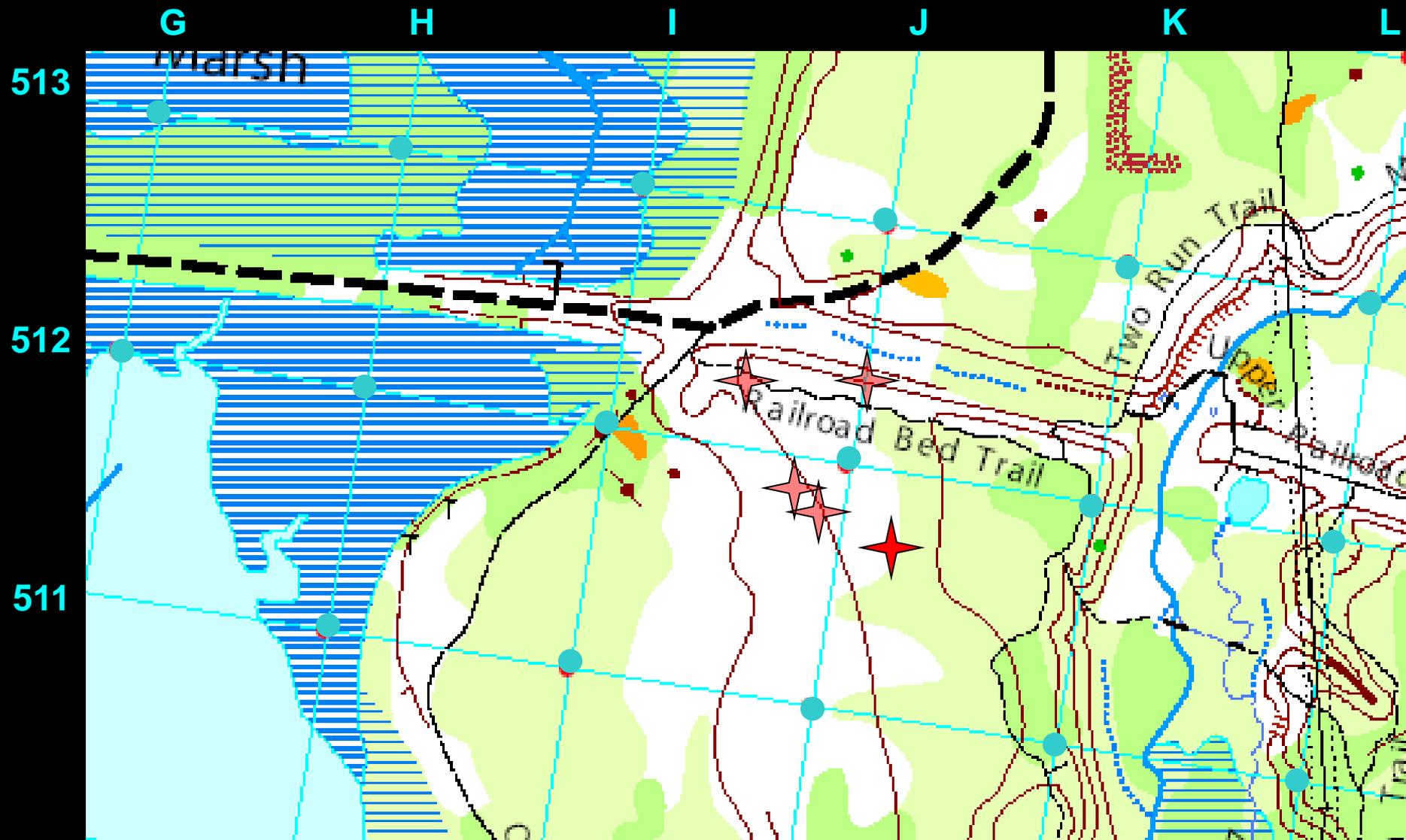
Male #186

June 8th, 2000



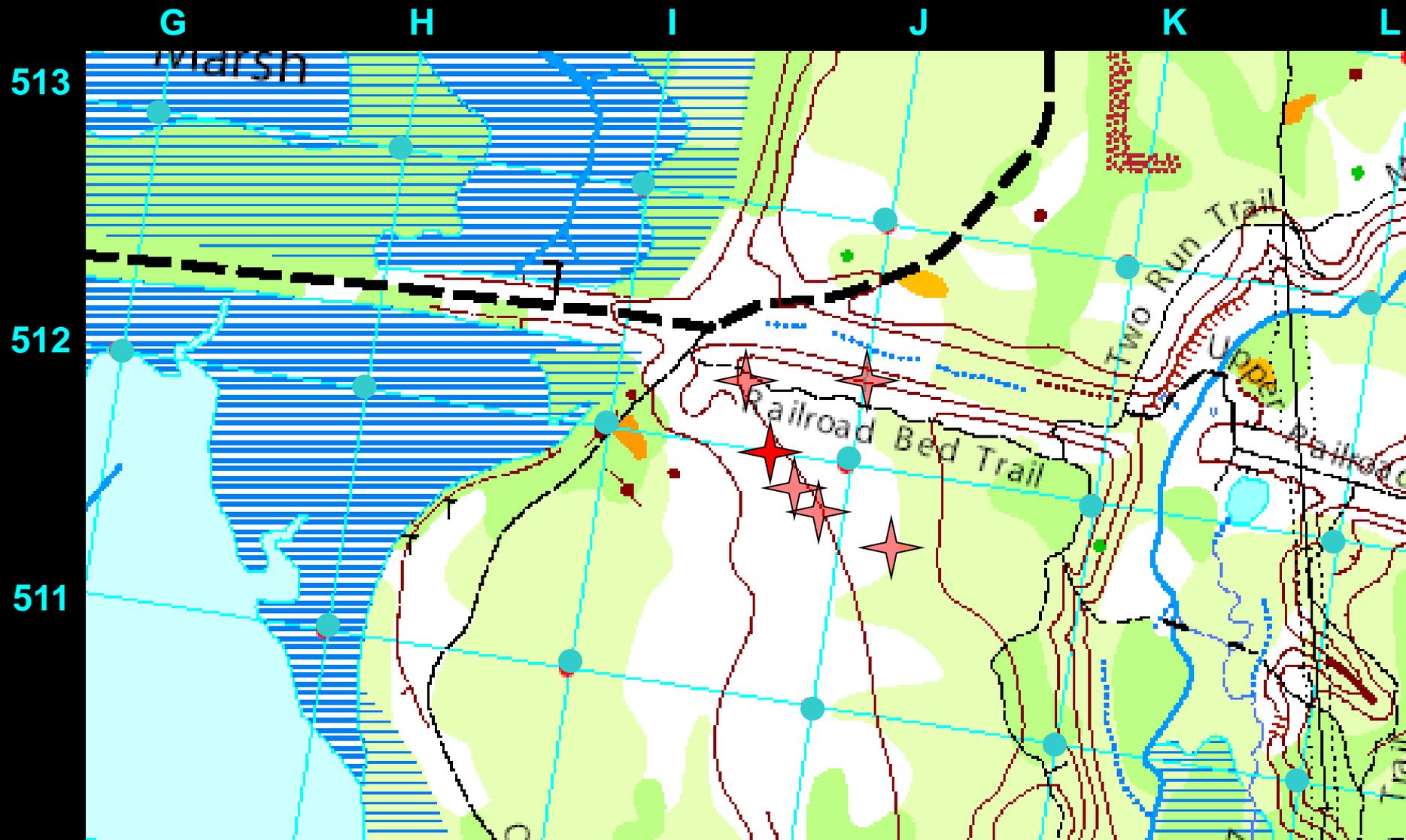
Male #186

June 15th, 2000



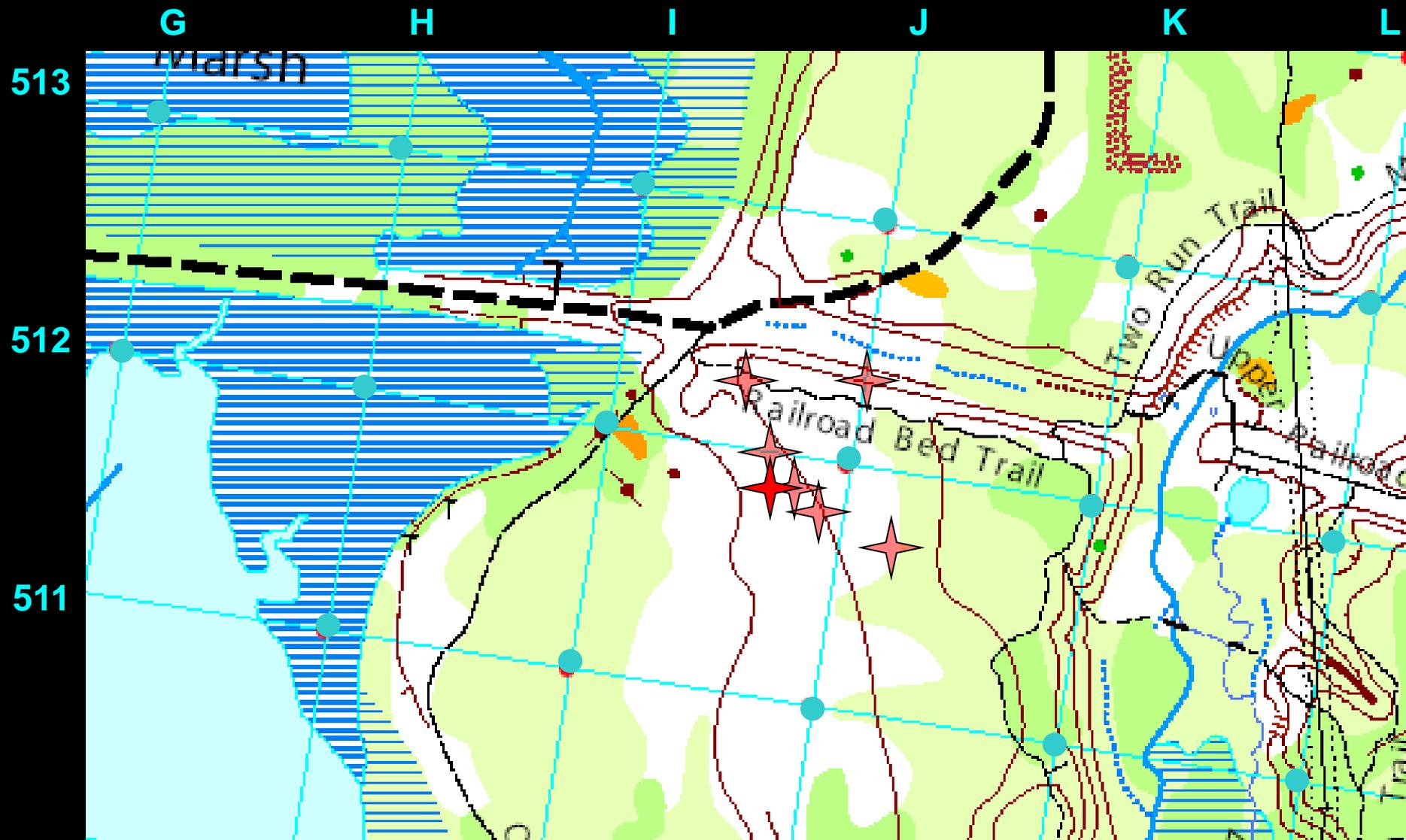
Male #186

July 20th, 2000



Male #186

July 25th, 2000



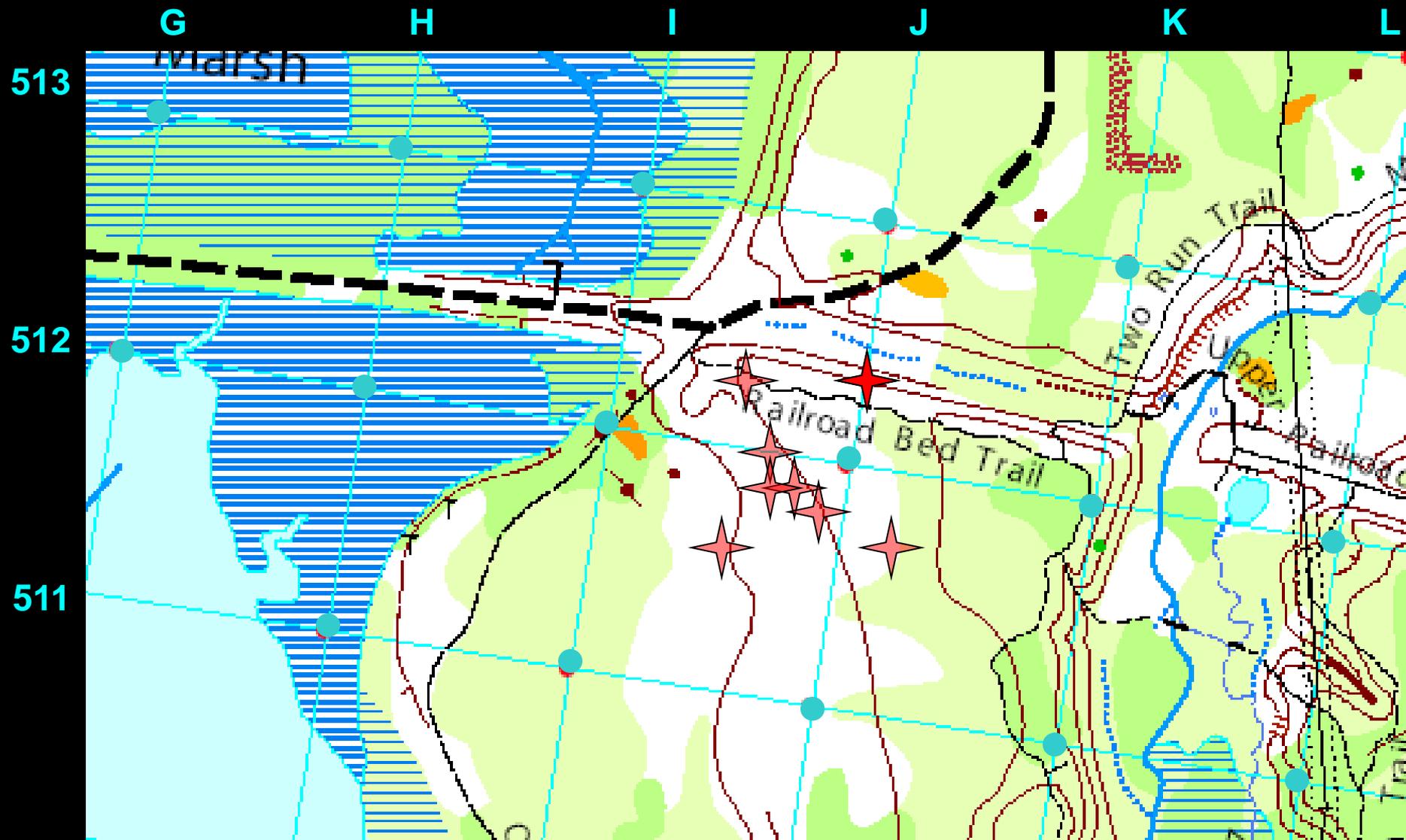
Male #186

August 1st, 2000



Male #186

August 10th, 2000



Male #186

September 22nd, 2000



Male #186

September 23rd, 2000



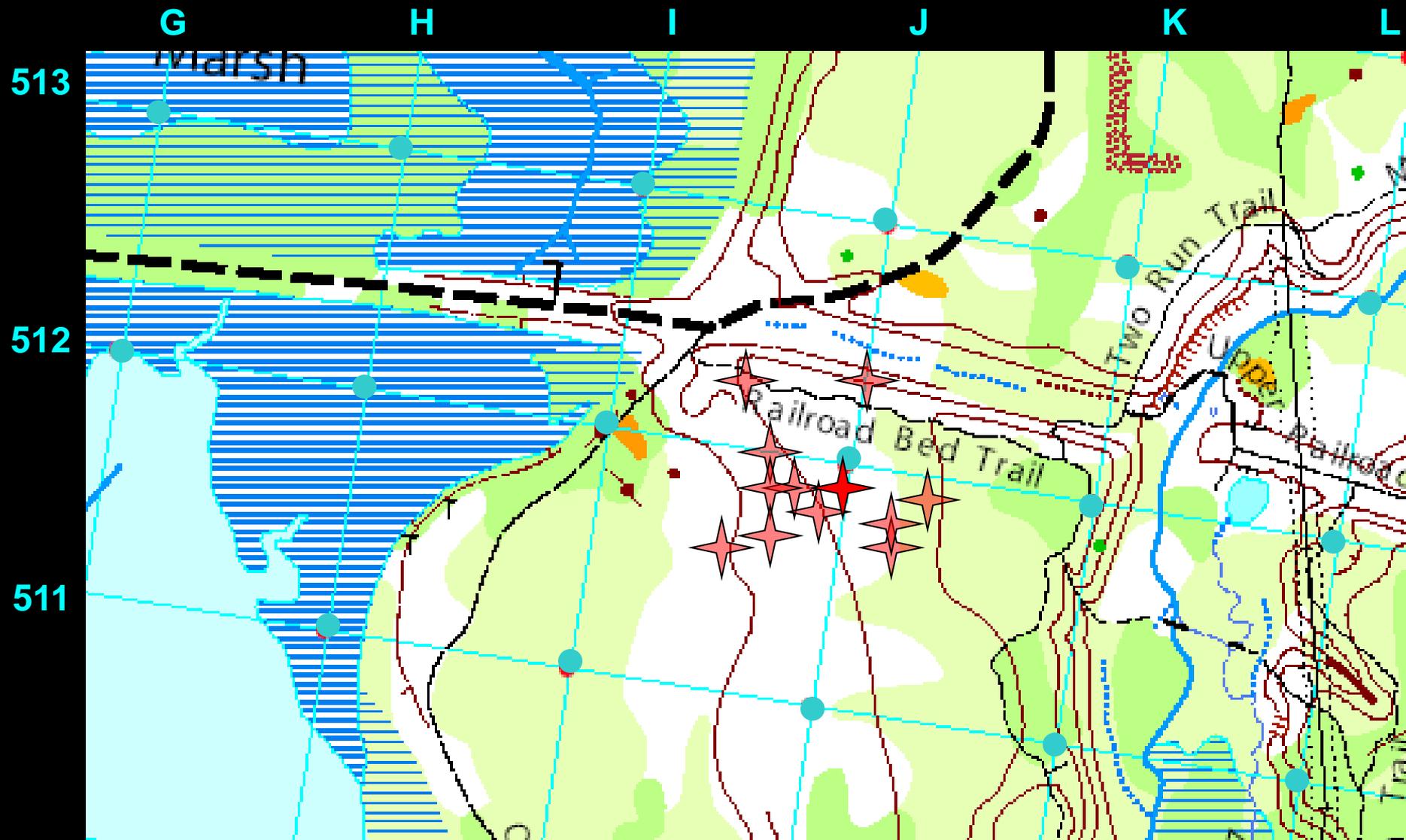
Male #186

June 14th, 2001



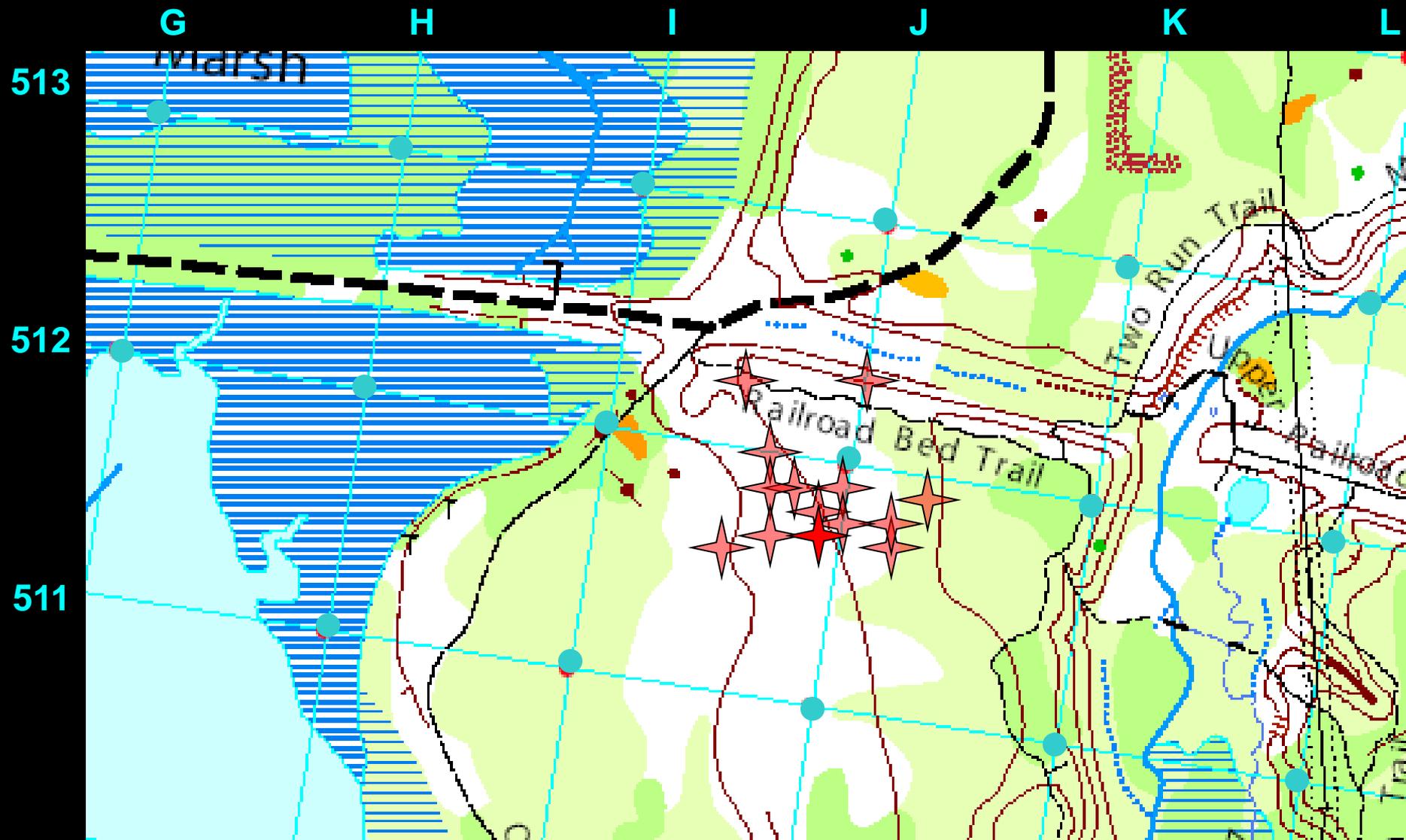
Male #186

June 19th, 2001



Male #186

July 17th, 2001



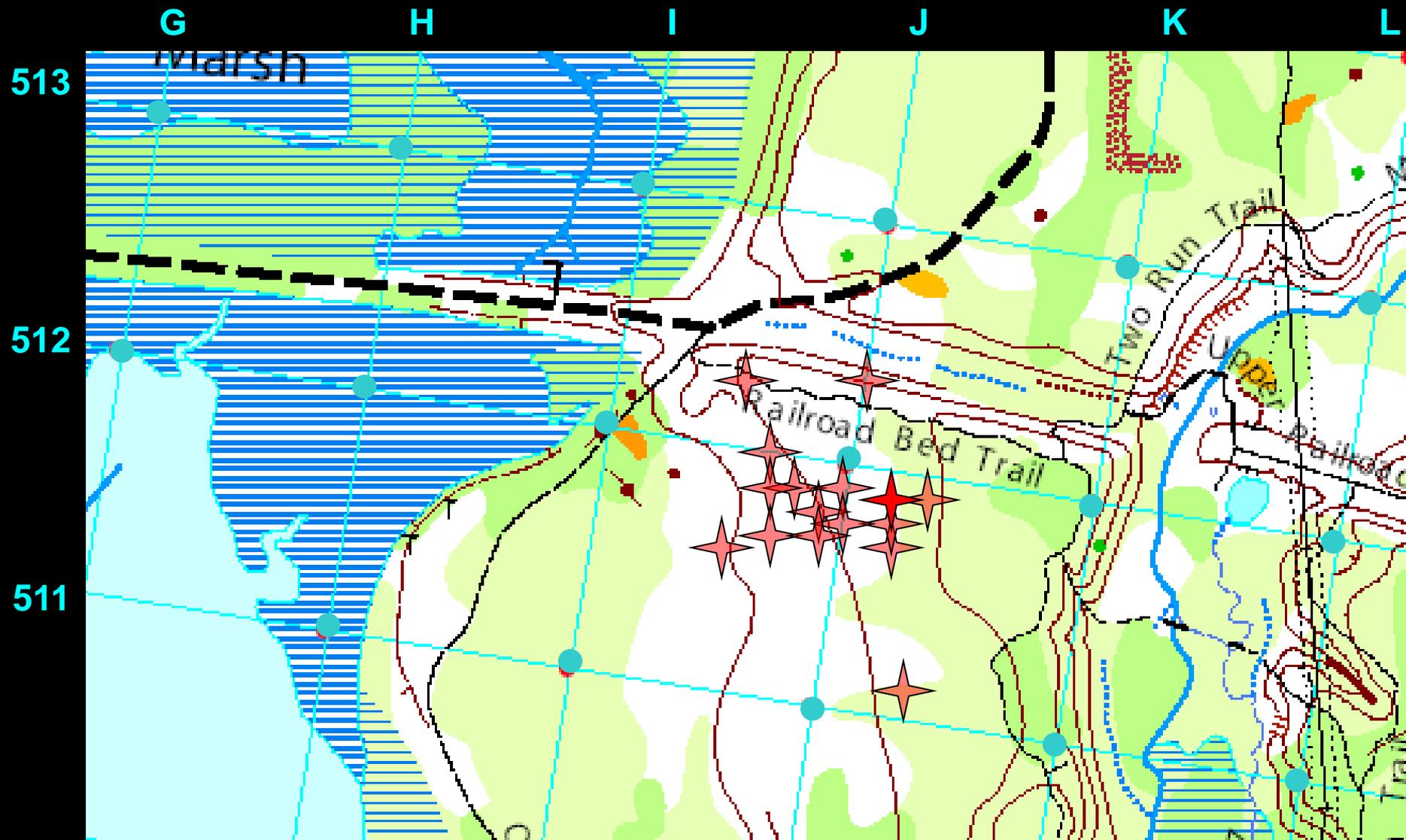
Male #186

August 2nd, 2001



Male #186

October 11th, 2001



Male #186

June 11th, 2002



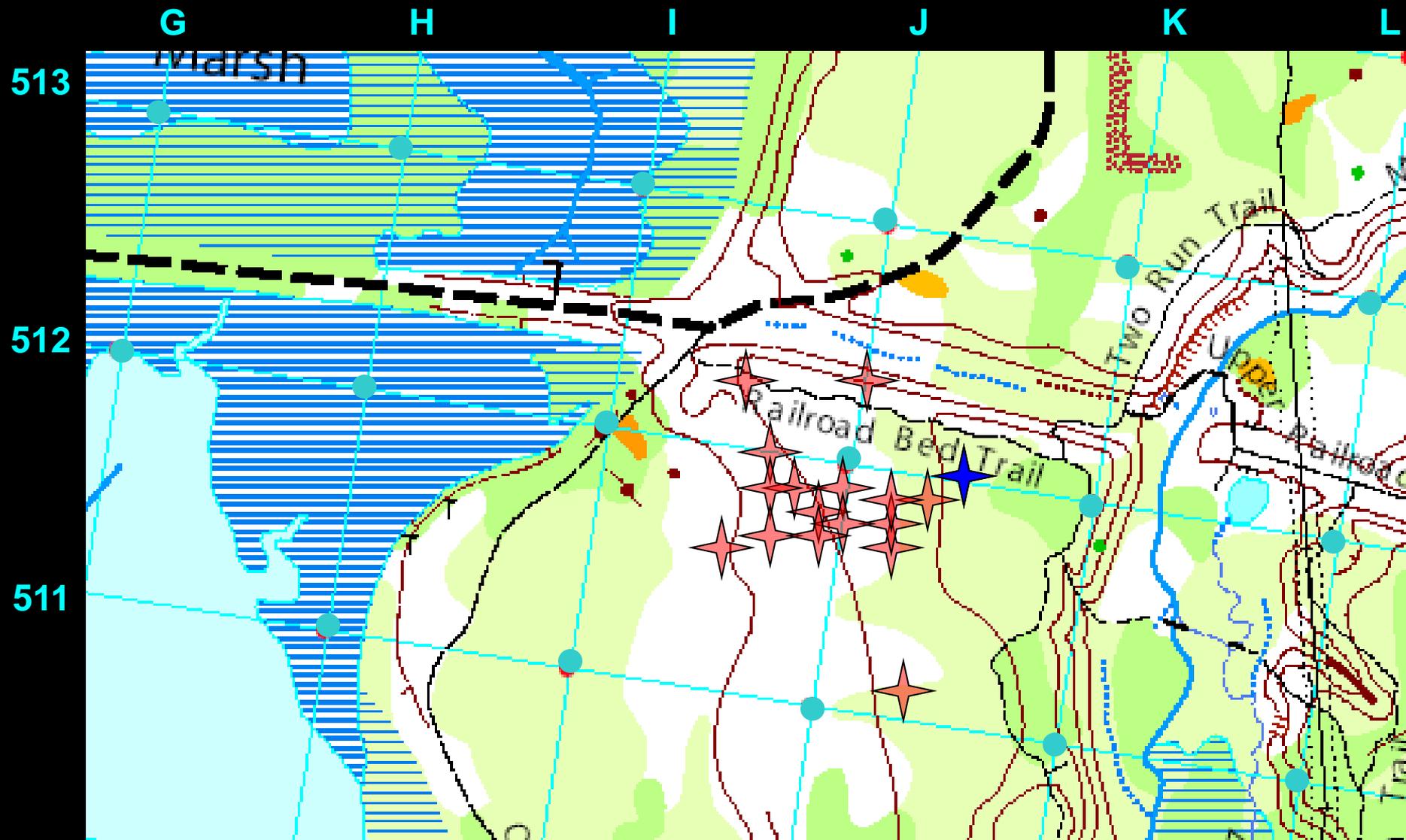
Male #186

May 20th, 2003



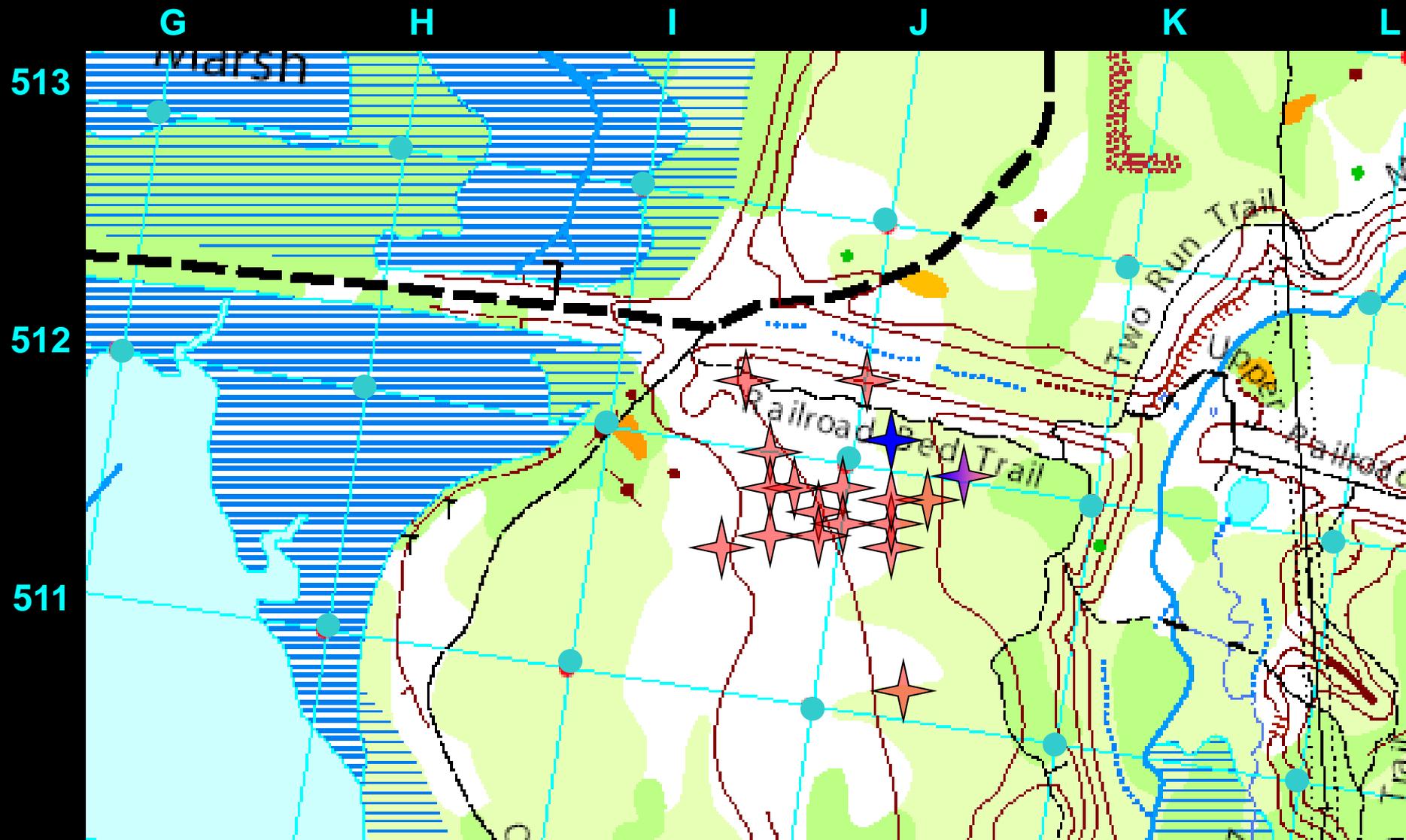
Male #186

May 21st, 2003



Male #186

May 23rd, 2003



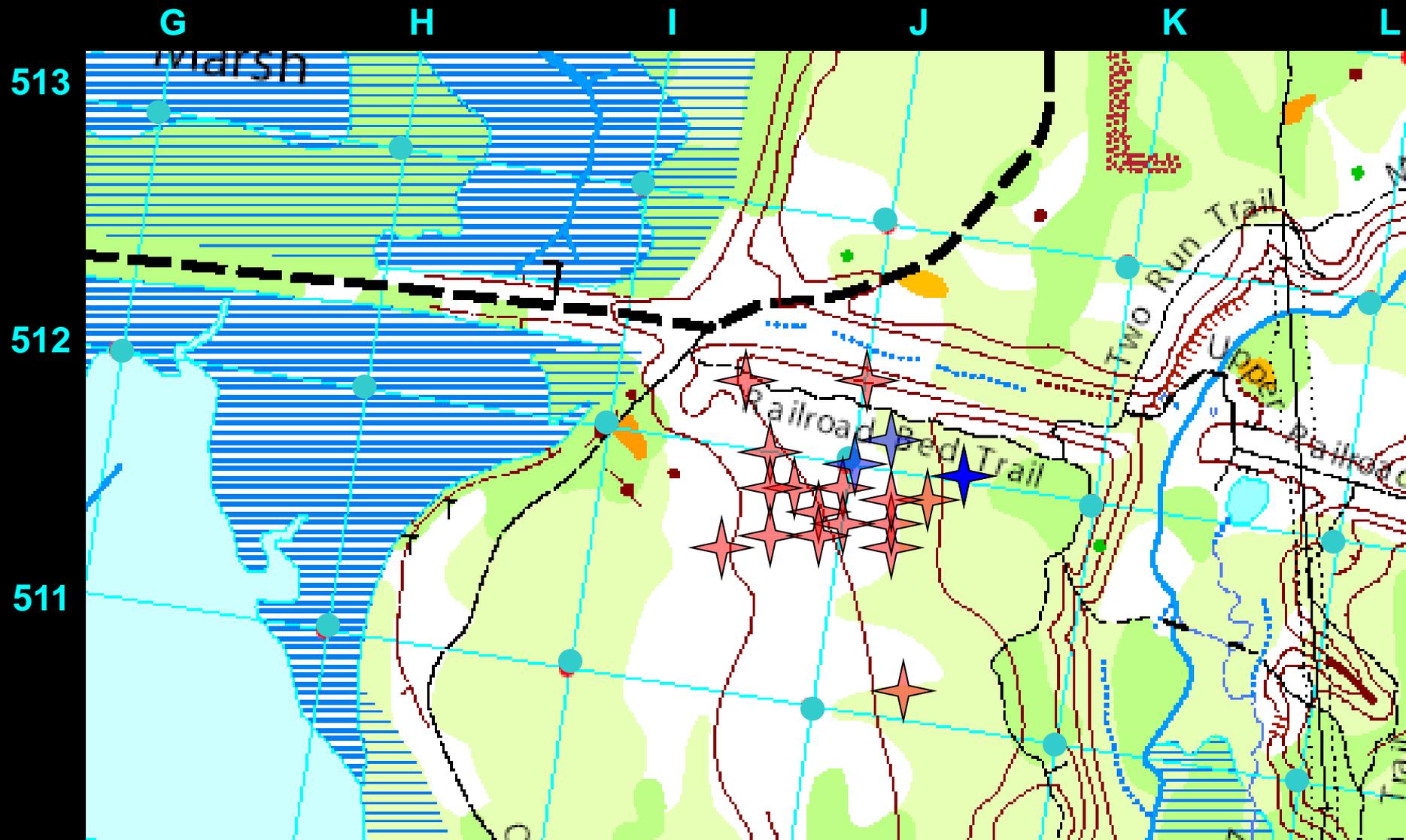
Male #186

May 28th, 2003



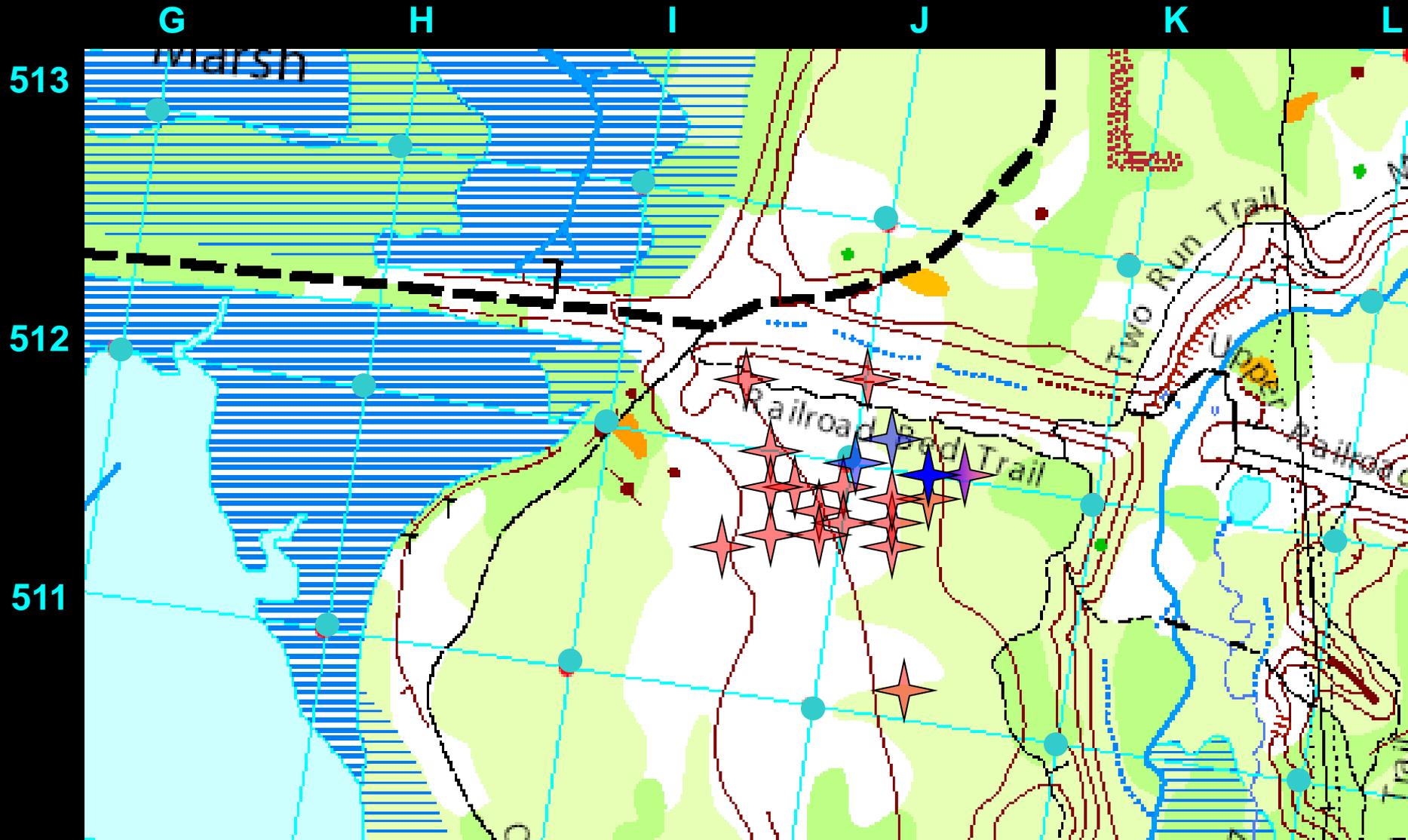
Male #186

May 30th, 2003



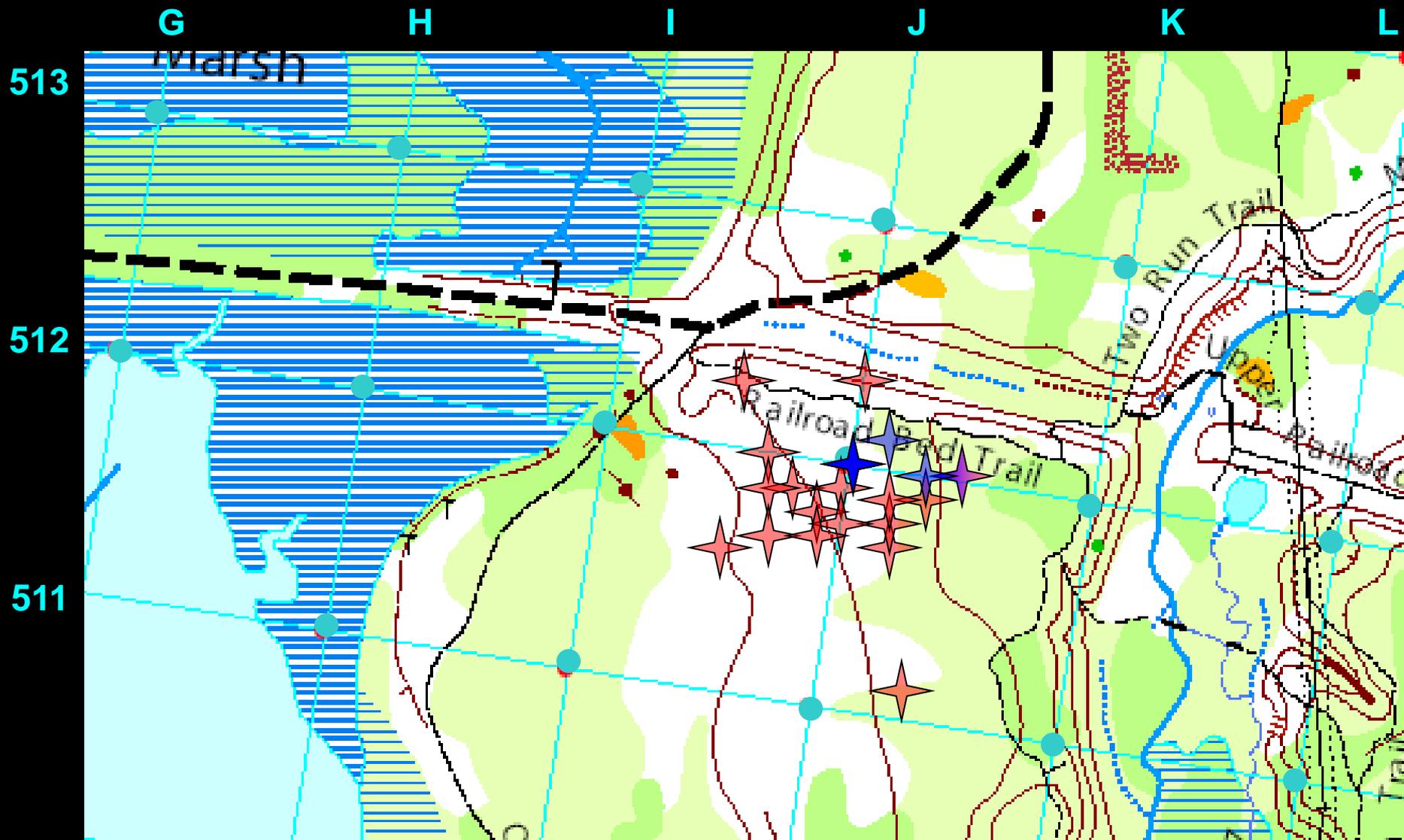
Male #186

June 2nd, 2003



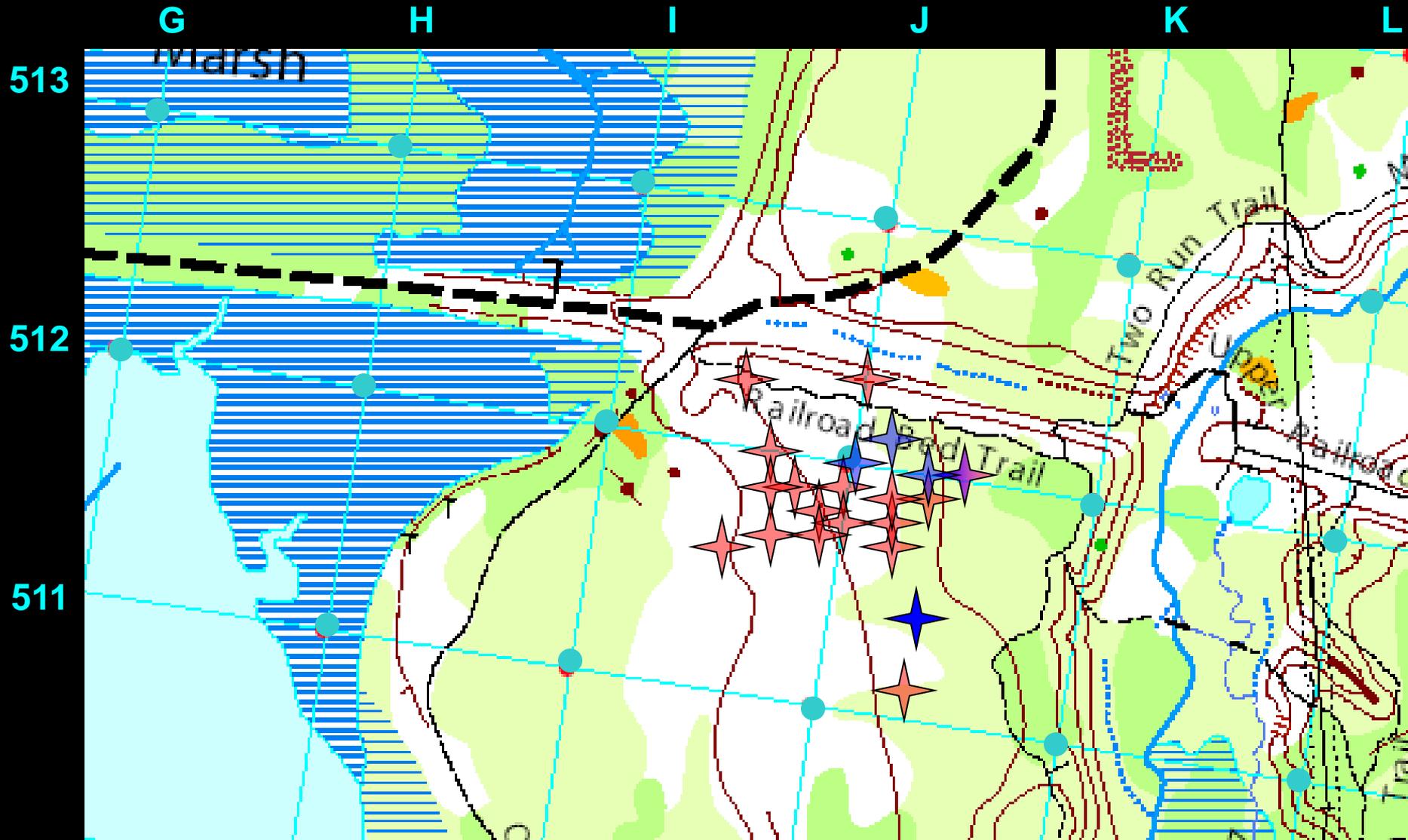
Male #186

June 4th, 2003



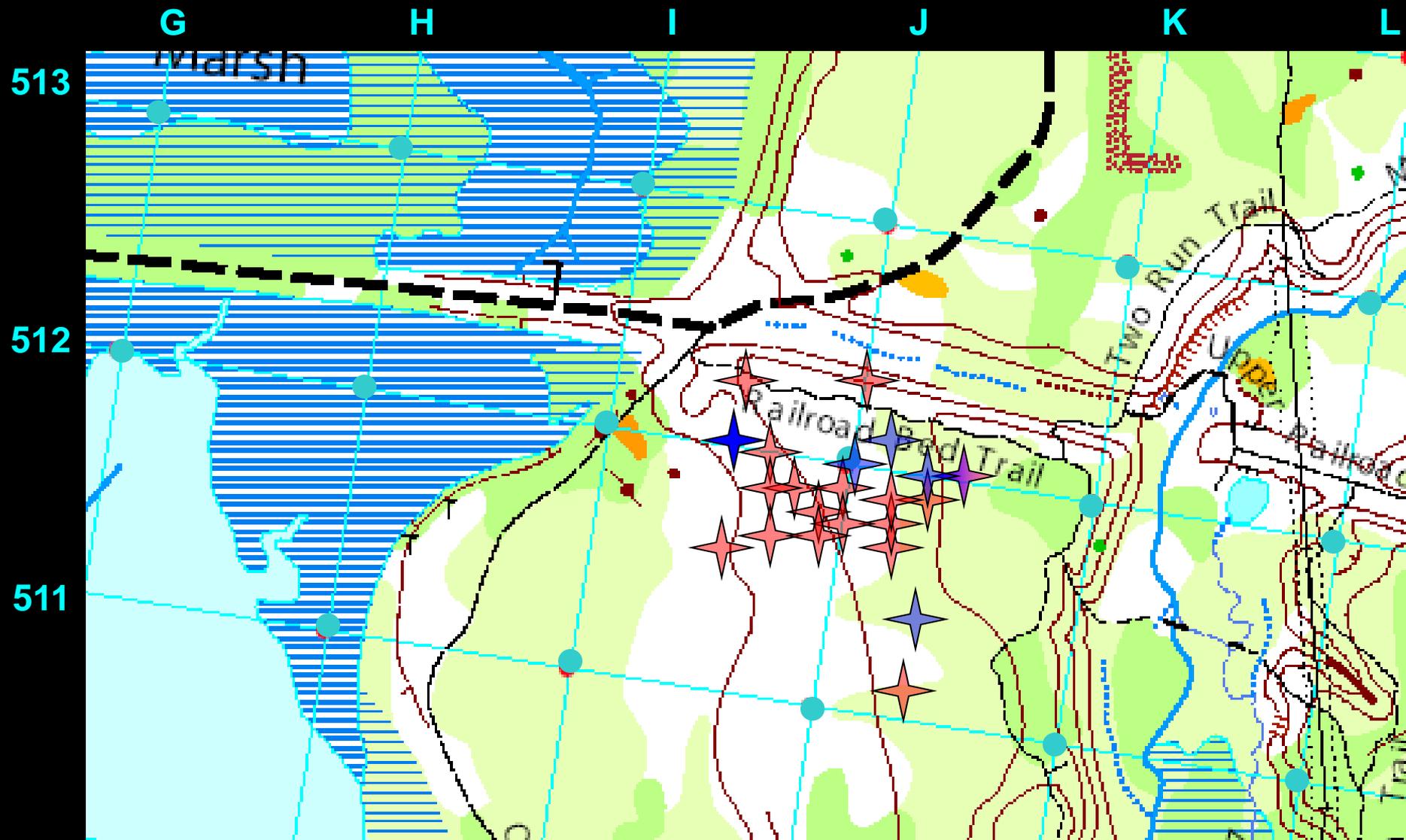
Male #186

June 9th, 2003



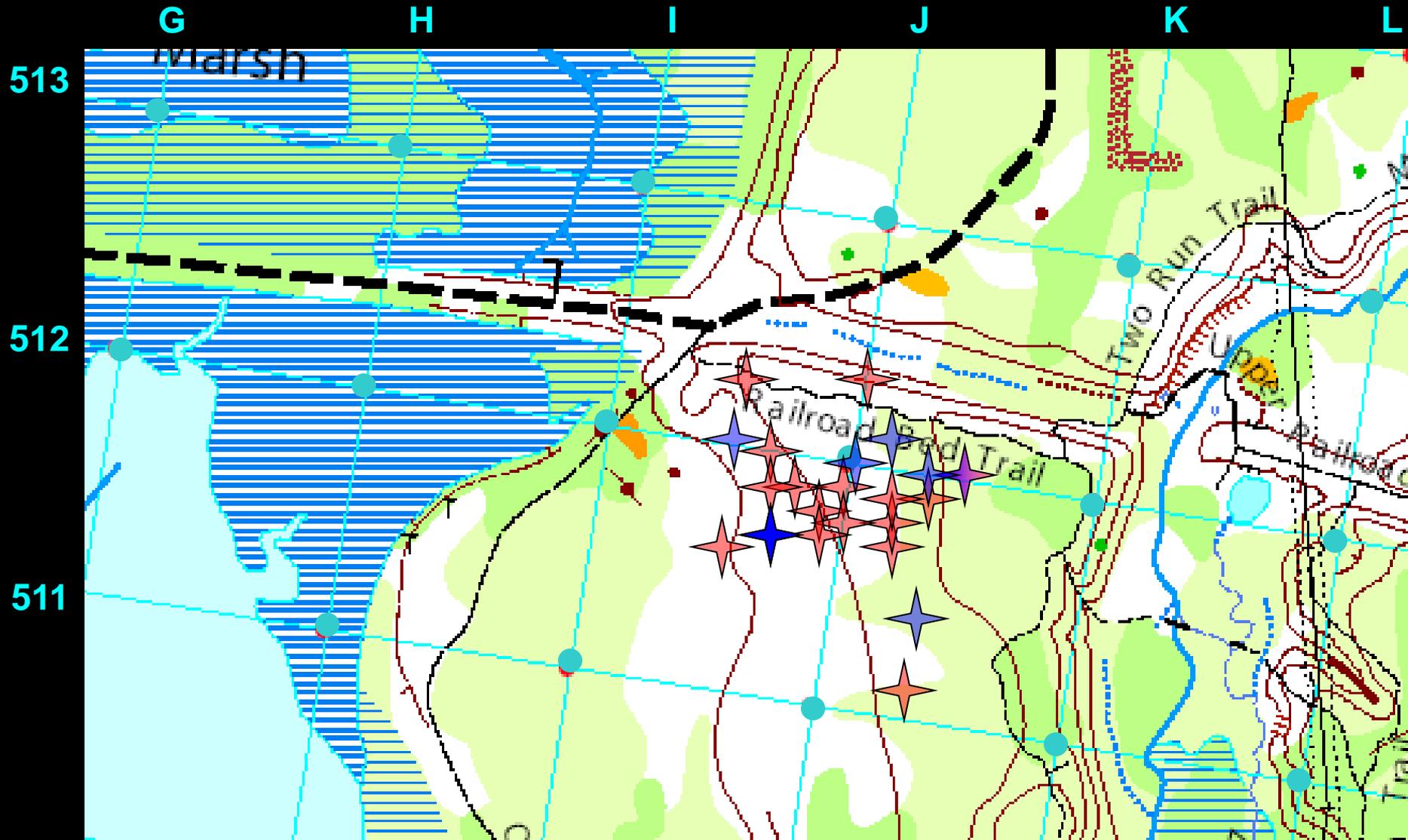
Male #186

June 12th, 2003



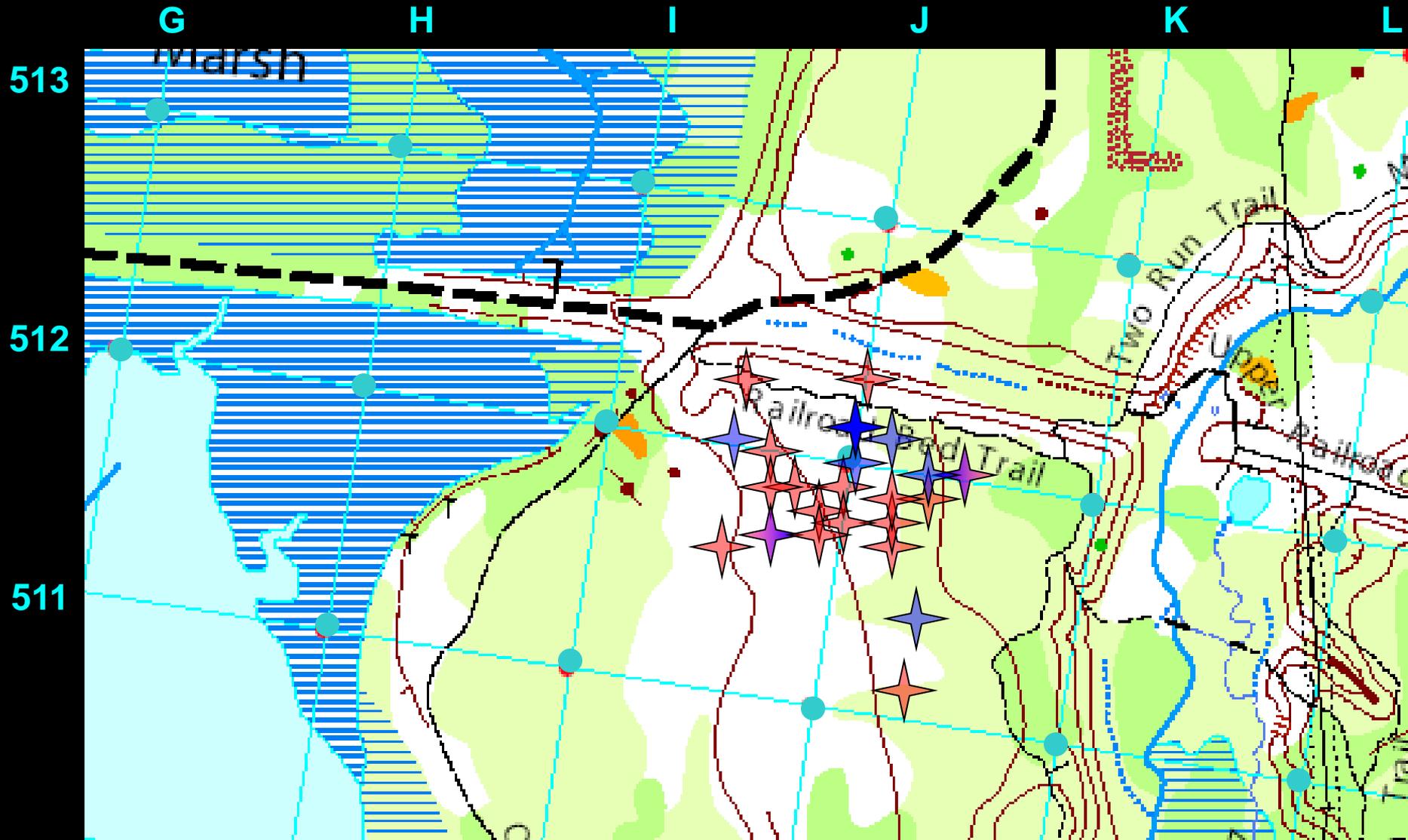
Male #186

June 16th, 2003



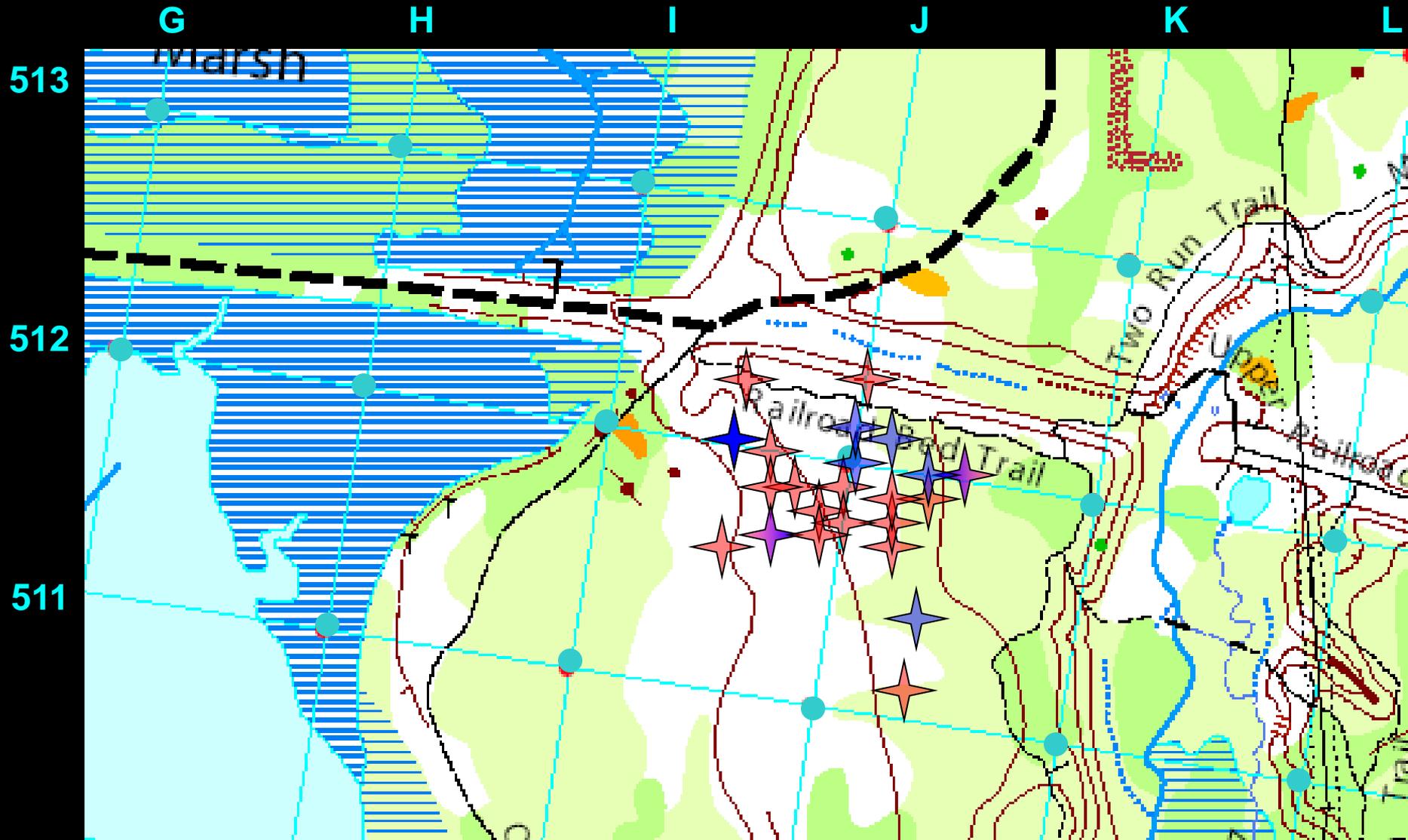
Male #186

June 19th, 2003



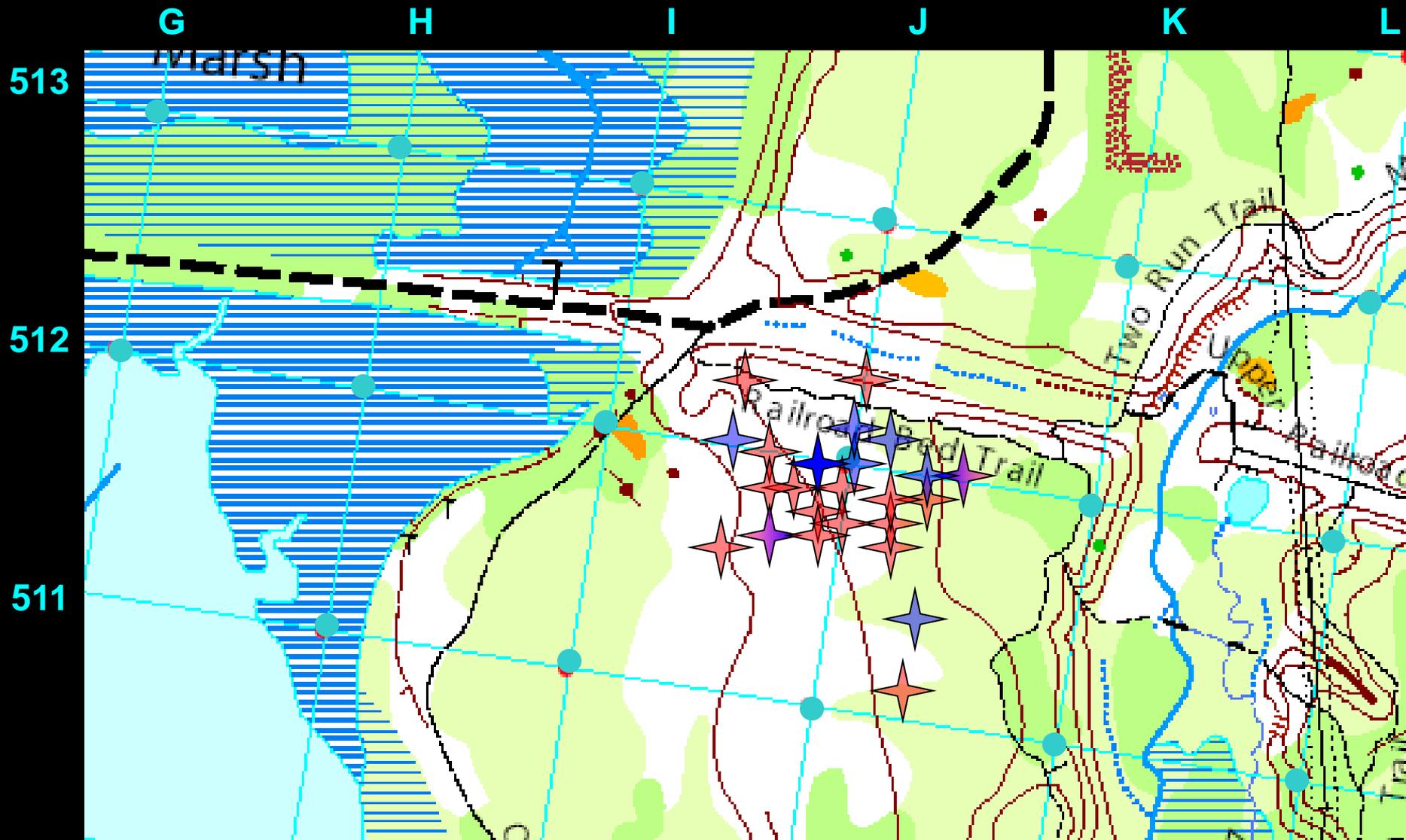
Male #186

June 23rd, 2003



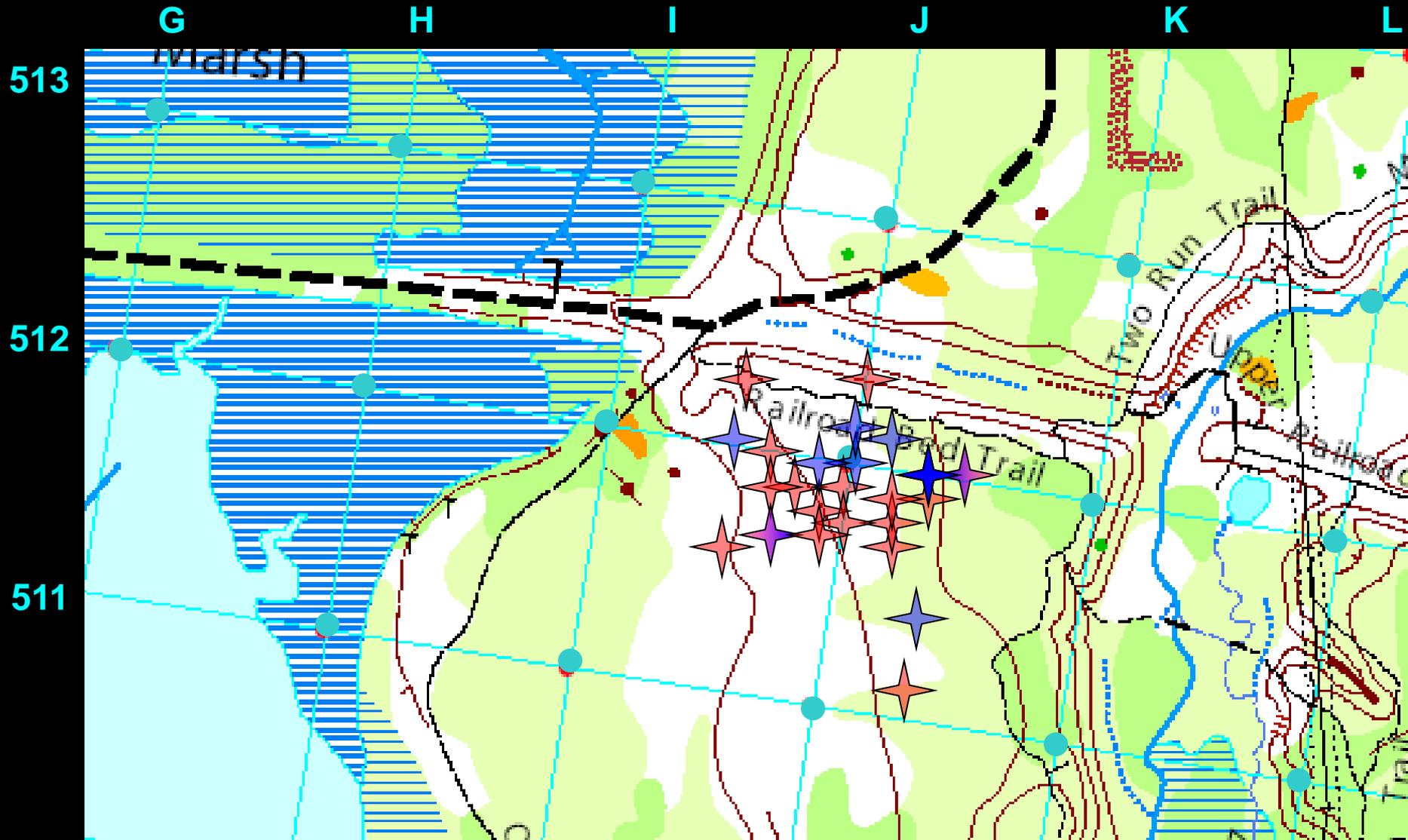
Male #186

June 26th – June 28th, 2003



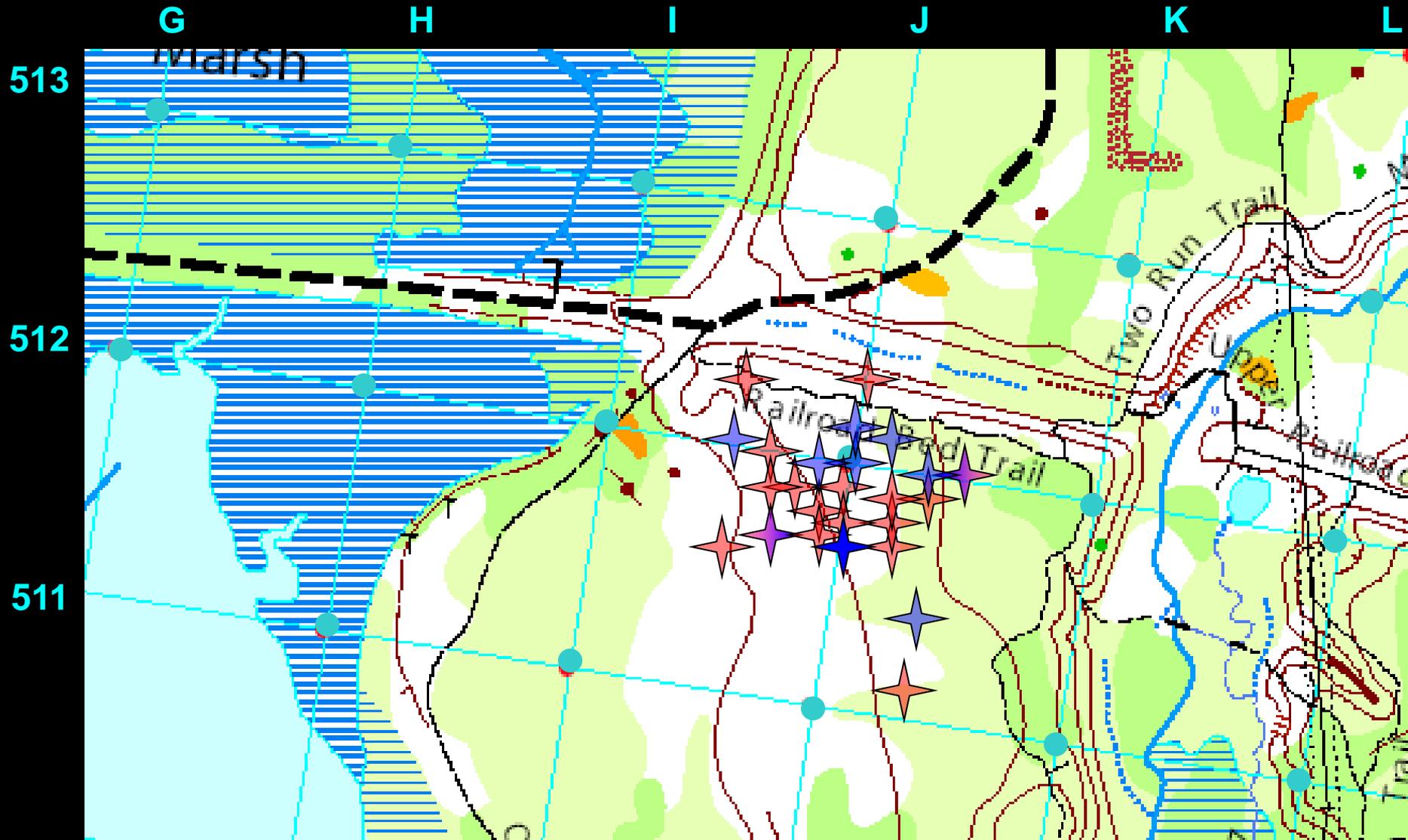
Male #186

July 1st, 2003



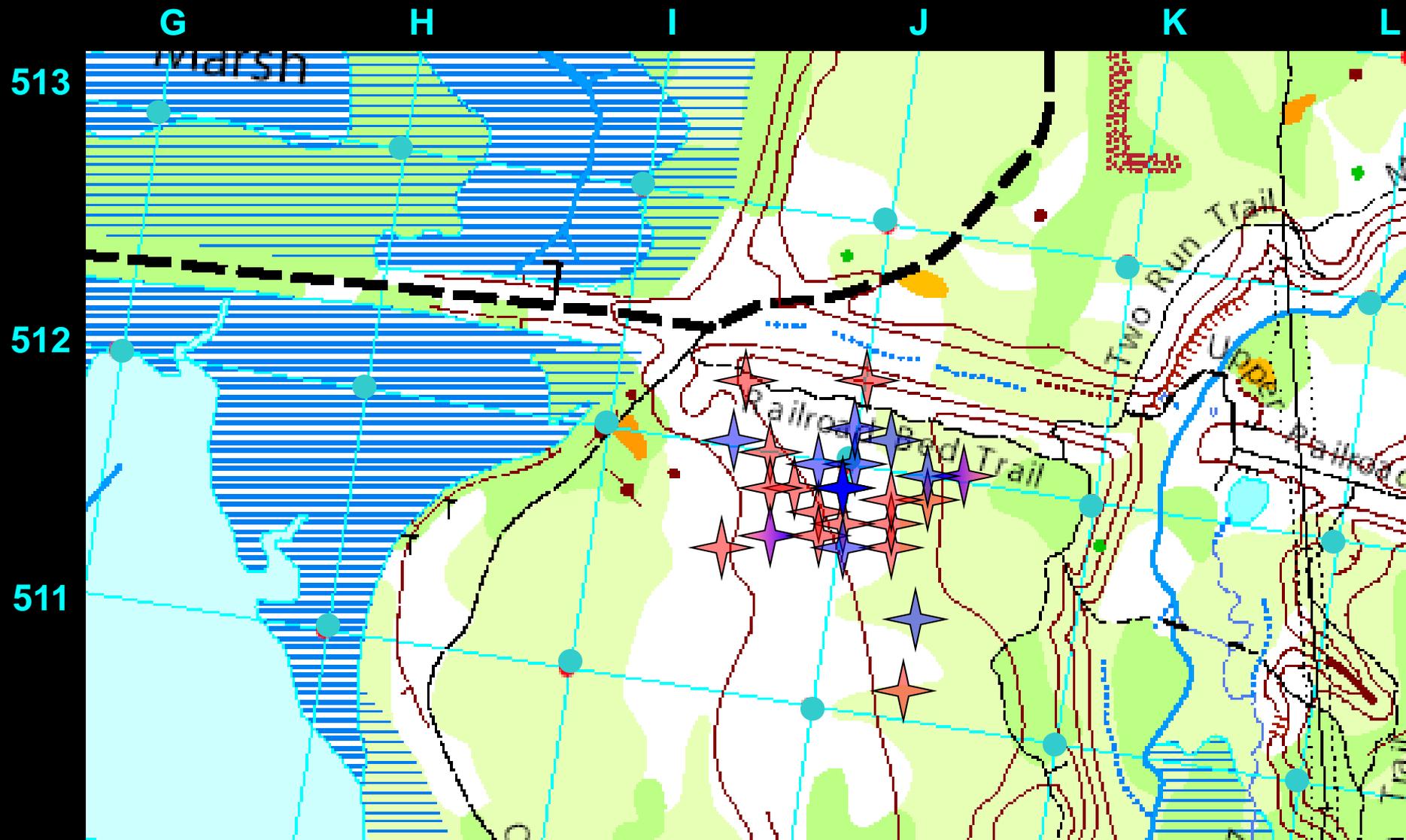
Male #186

July 3rd, 2003



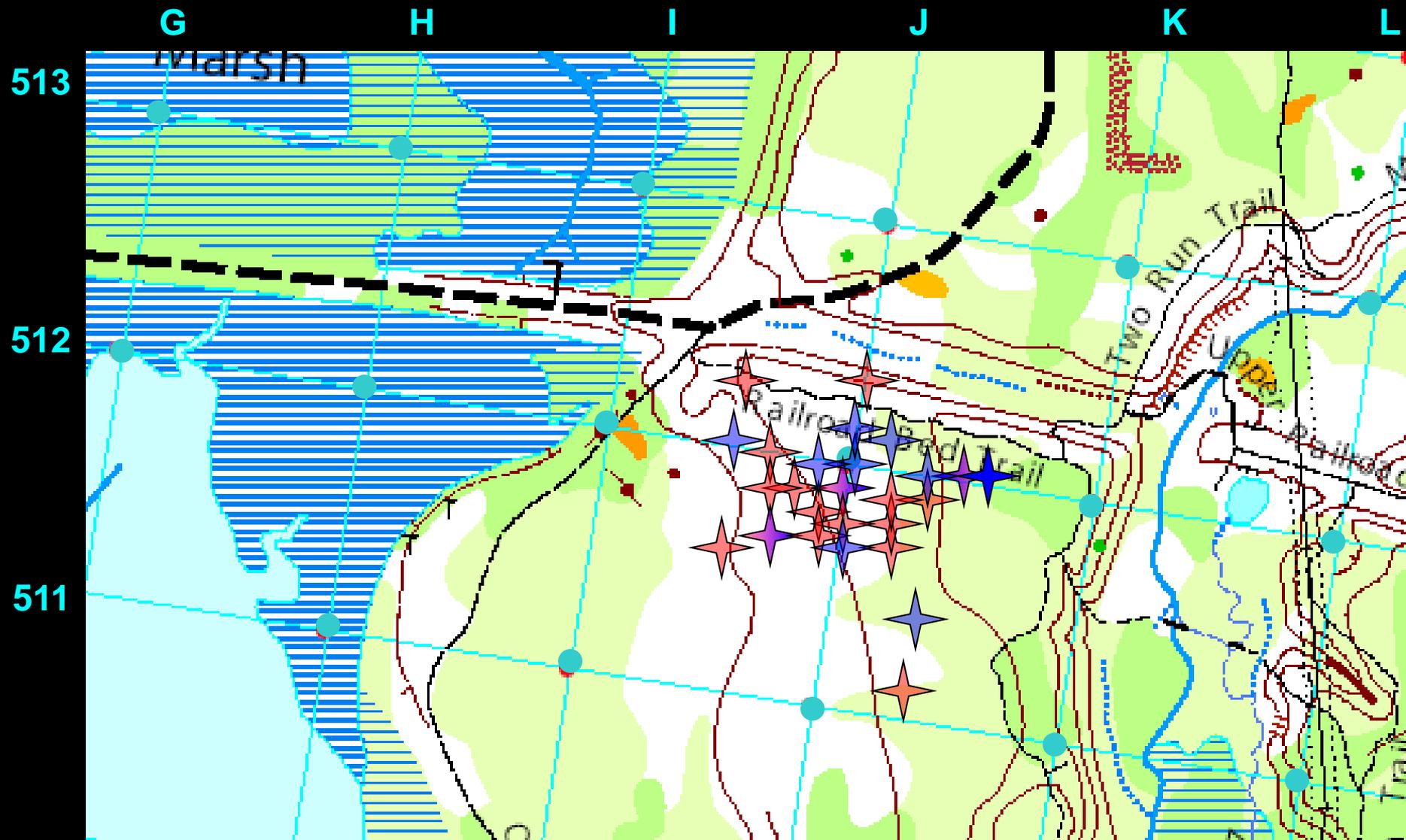
Male #186

July 9th, 2003



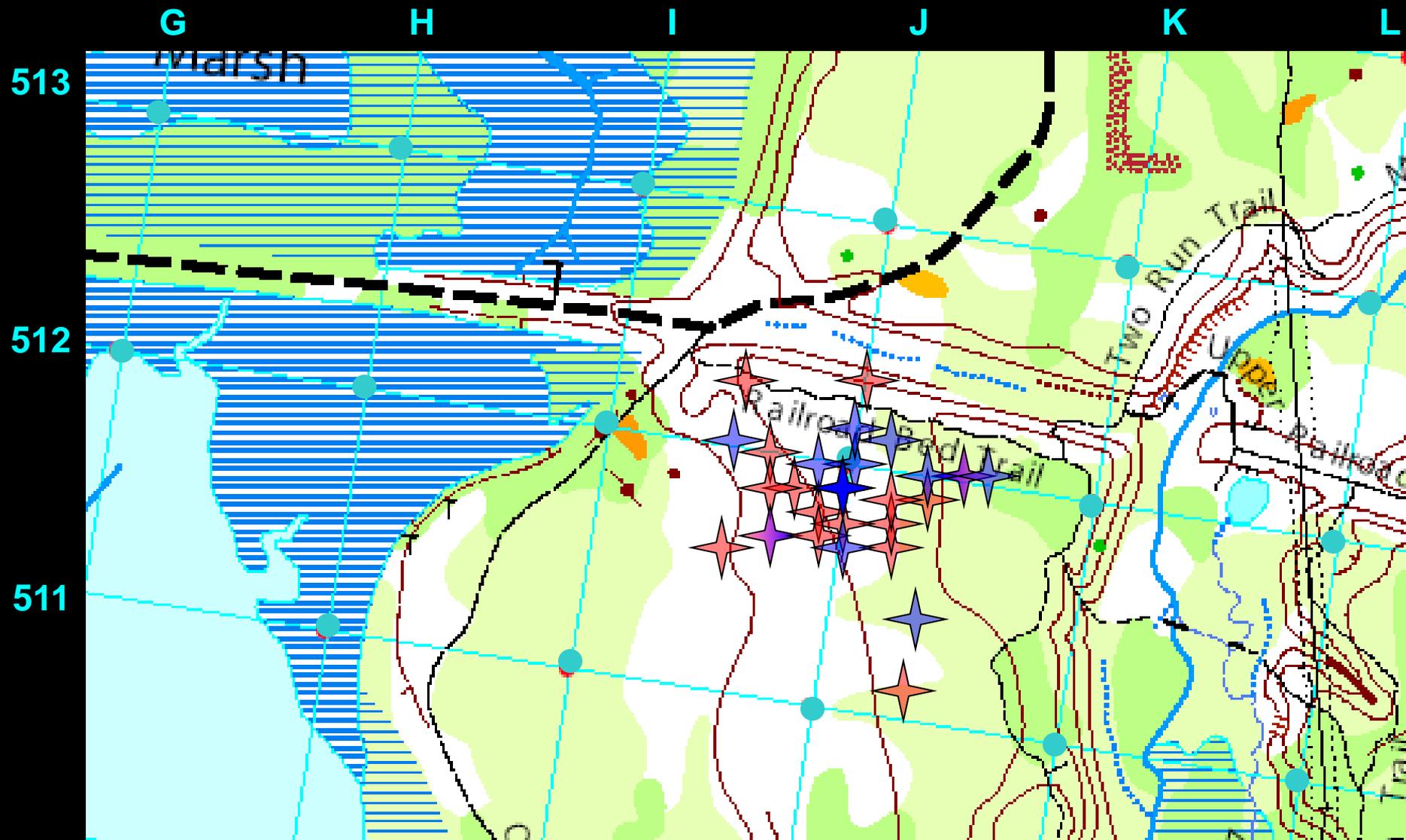
Male #186

July 11th, 2003



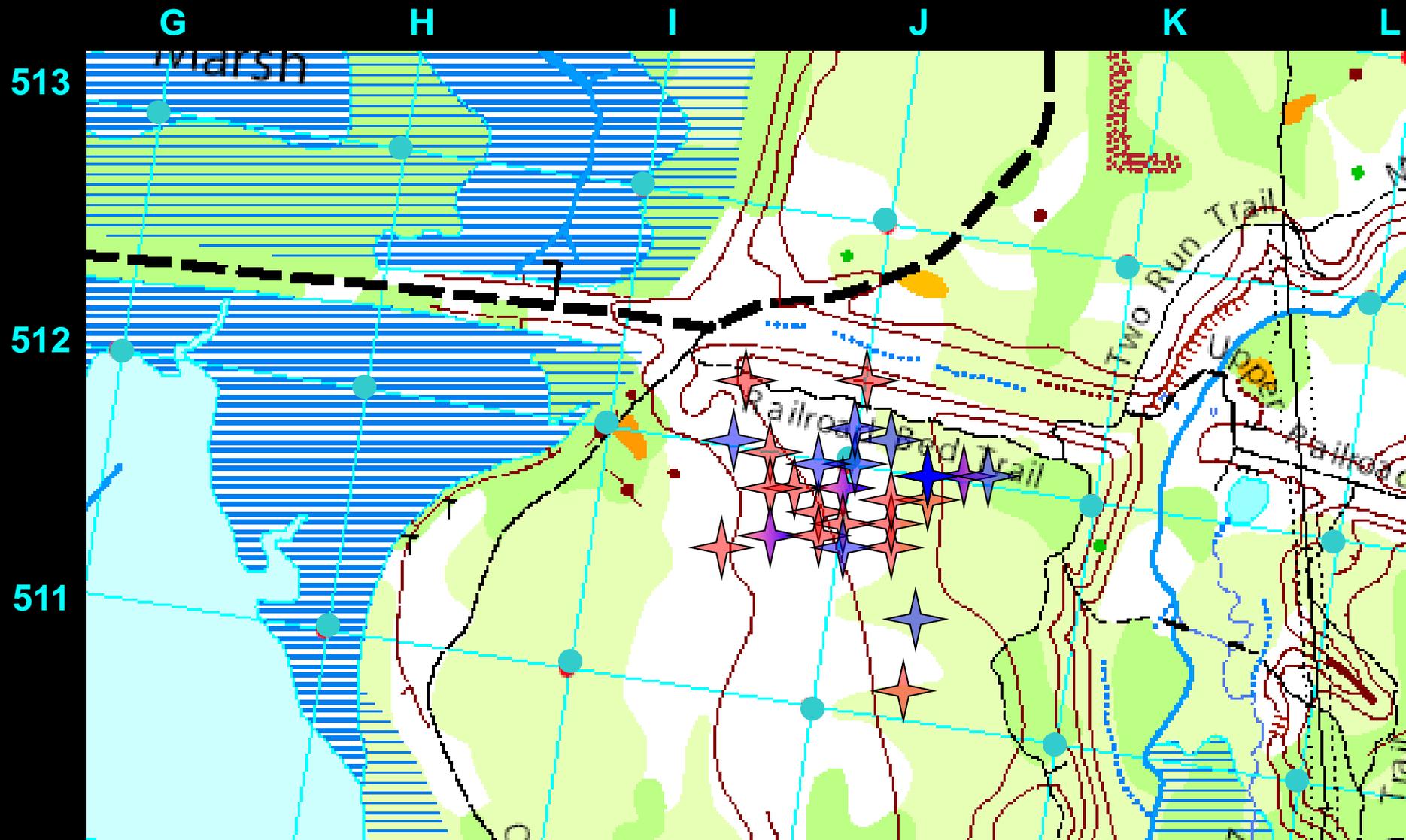
Male #186

July 13th, 2003



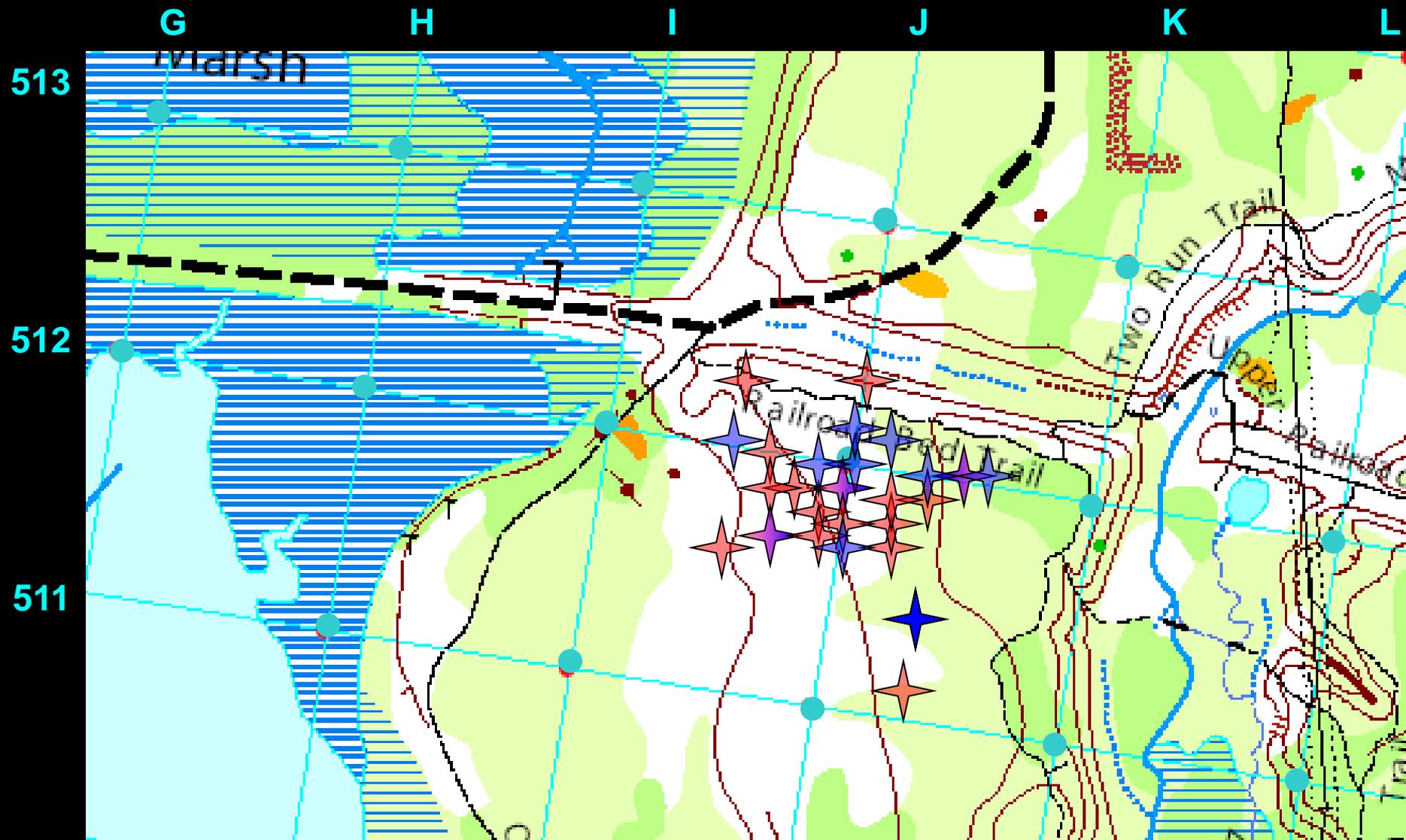
Male #186

July 15th, 2003



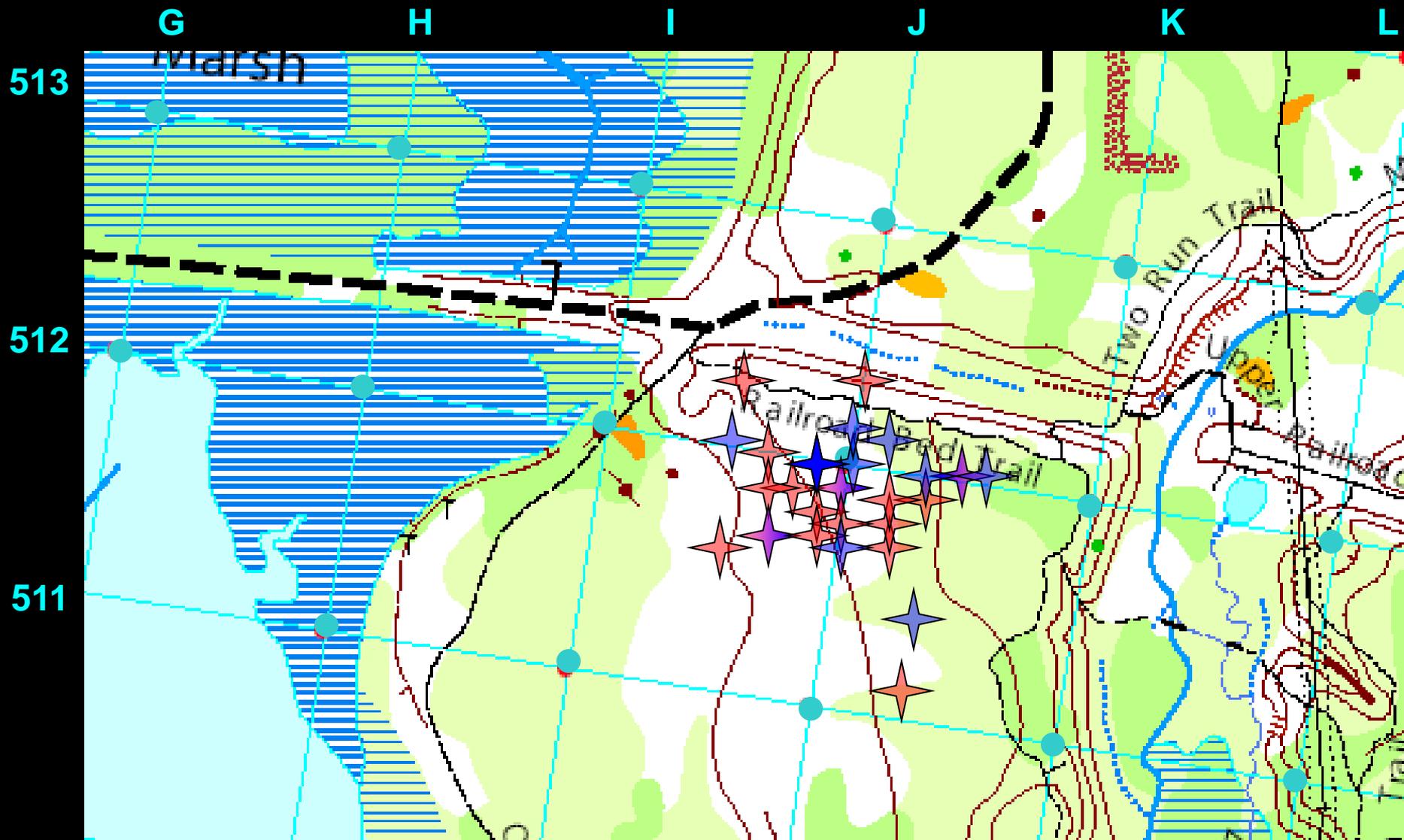
Male #186

July 17th, 2003



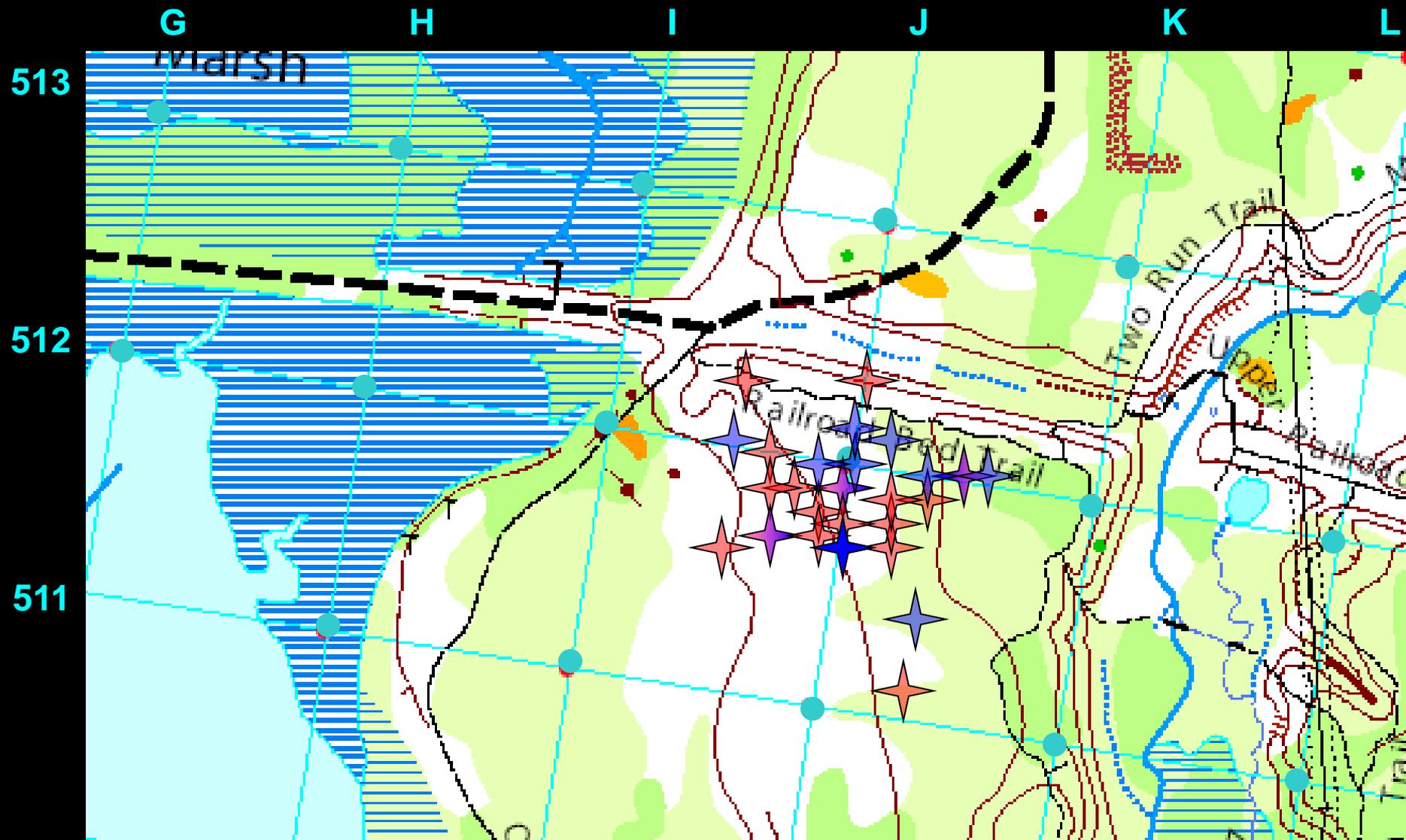
Male #186

July 21st, 2003



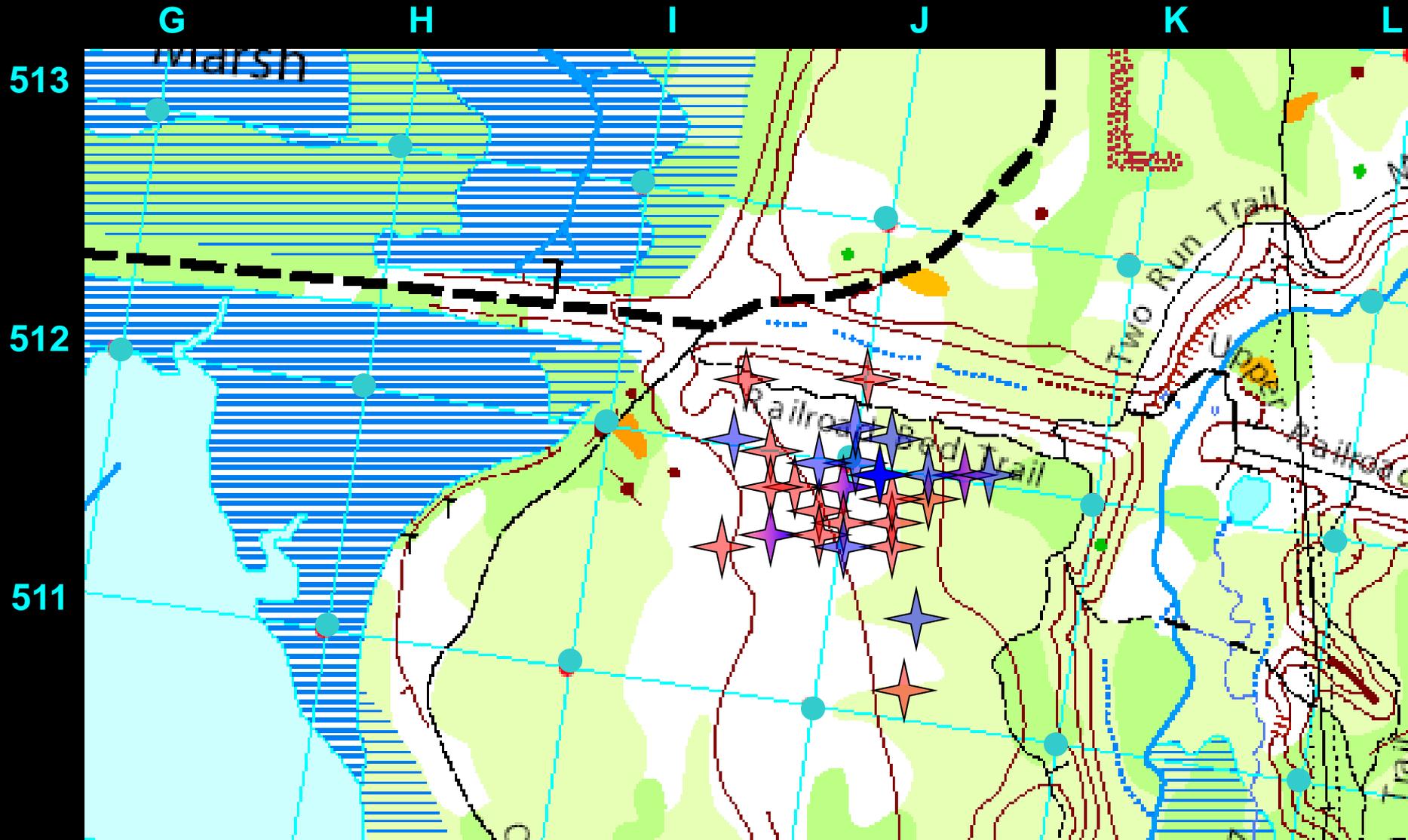
Male #186

July 30th, 2003



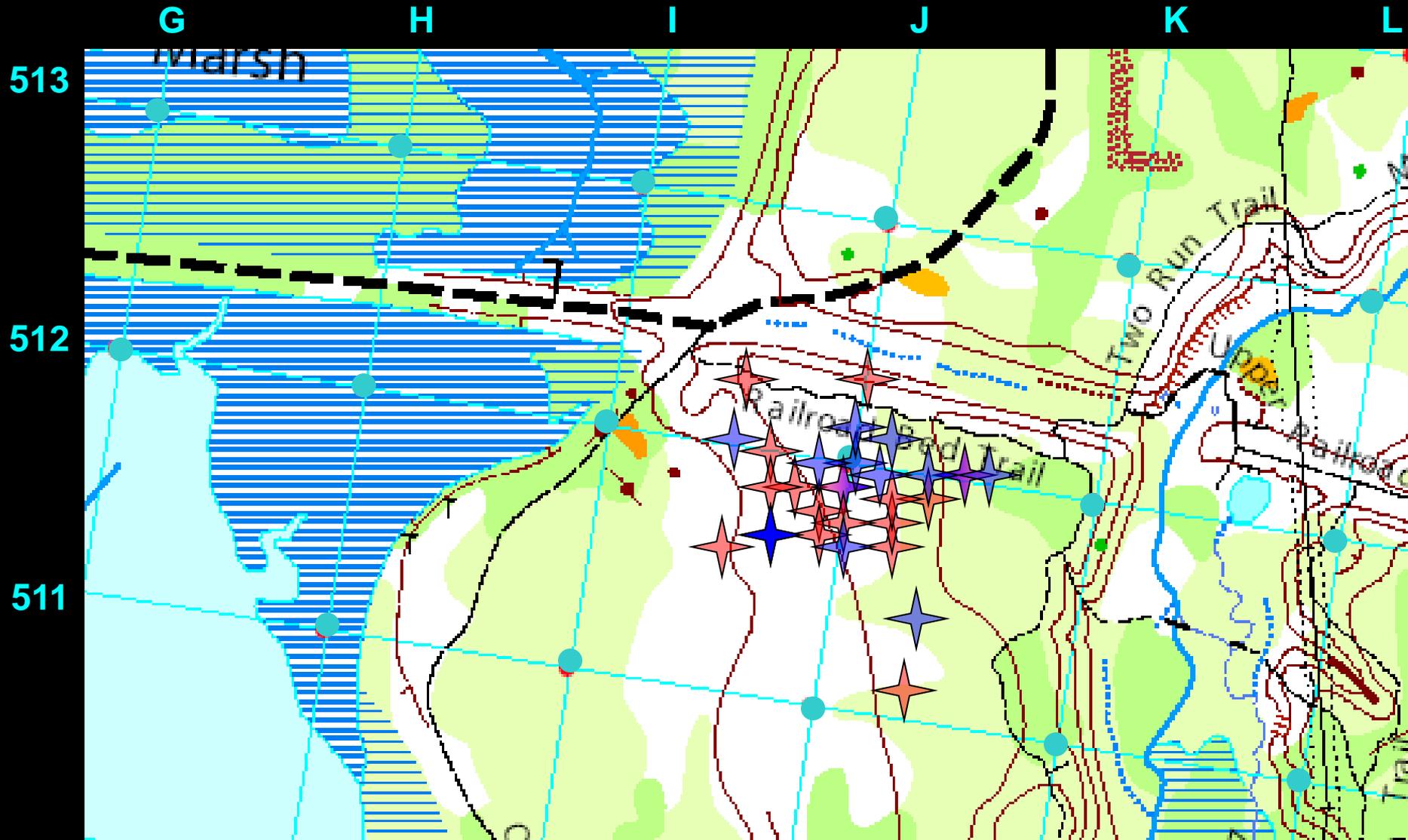
Male #186

August 1st, 2003



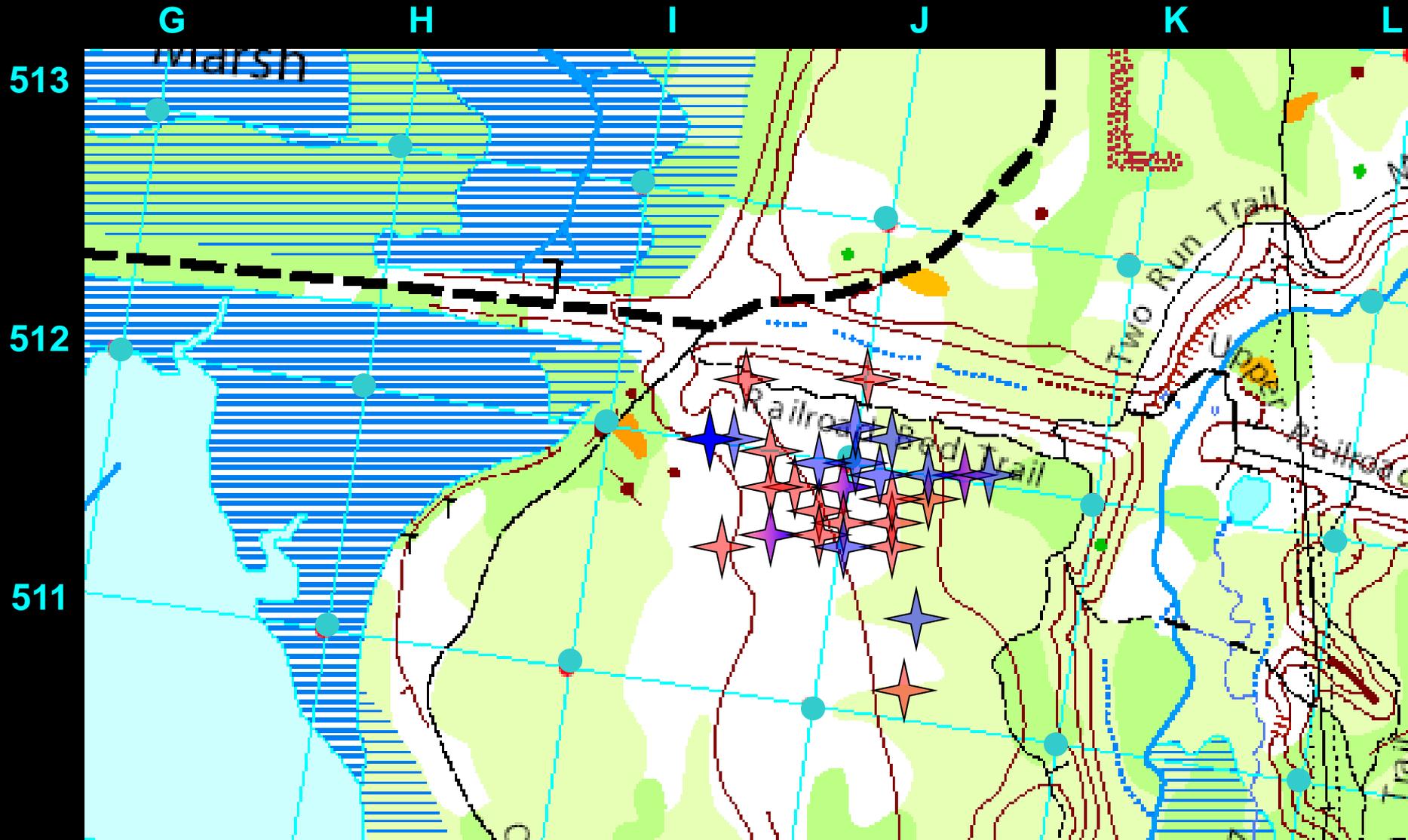
Male #186

August 12th, 2003



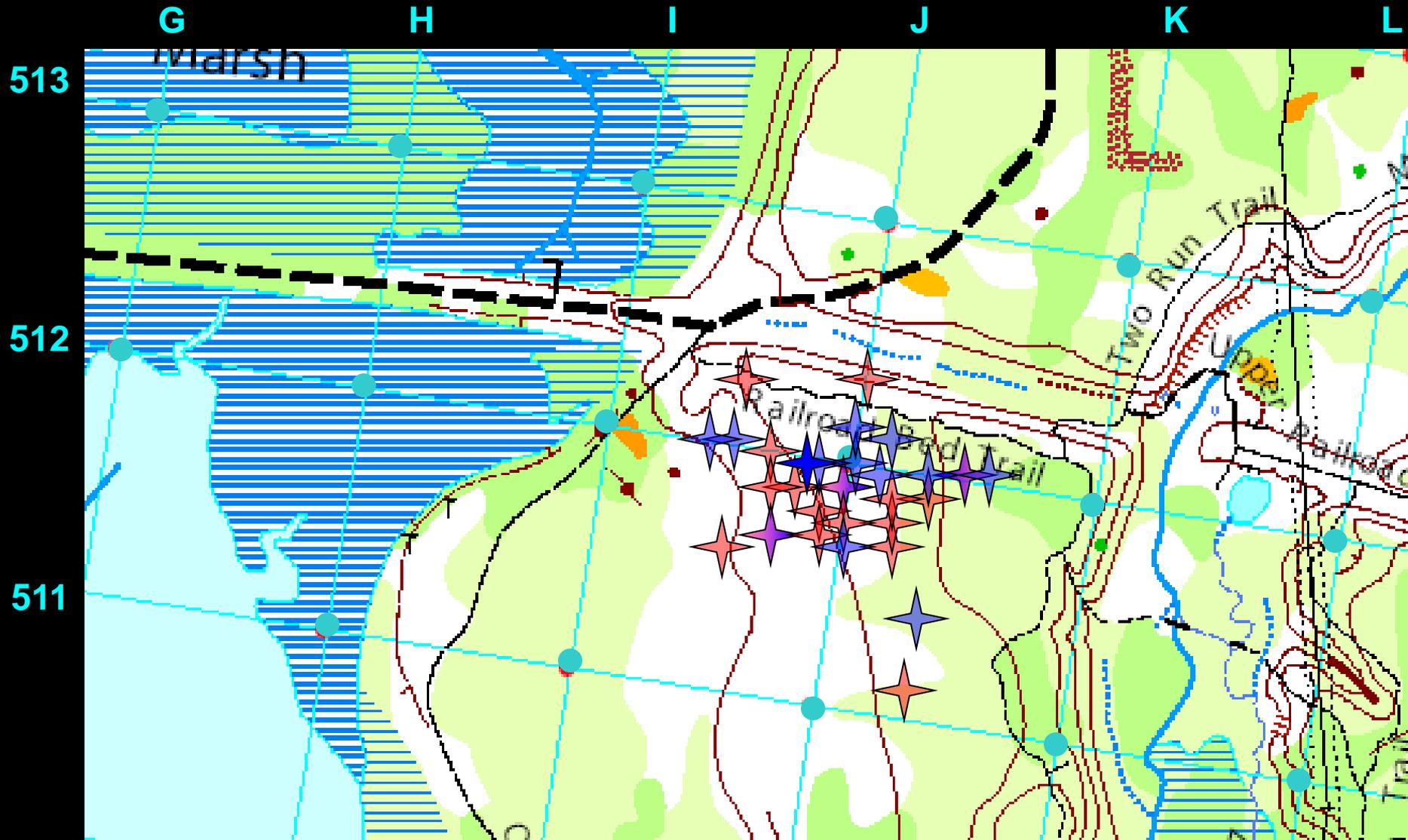
Male #186

August 19th, 2003



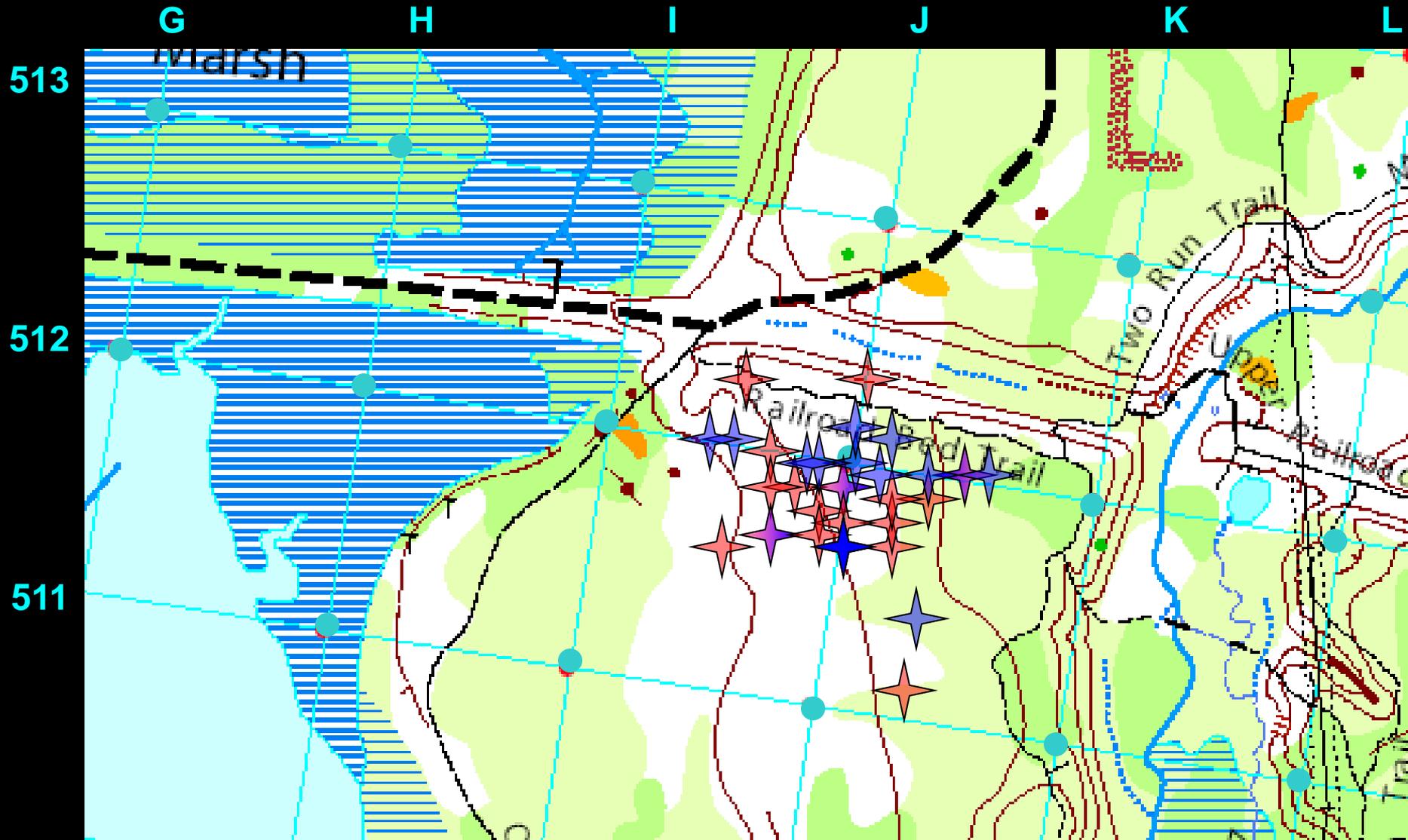
Male #186

August 20th, 2003



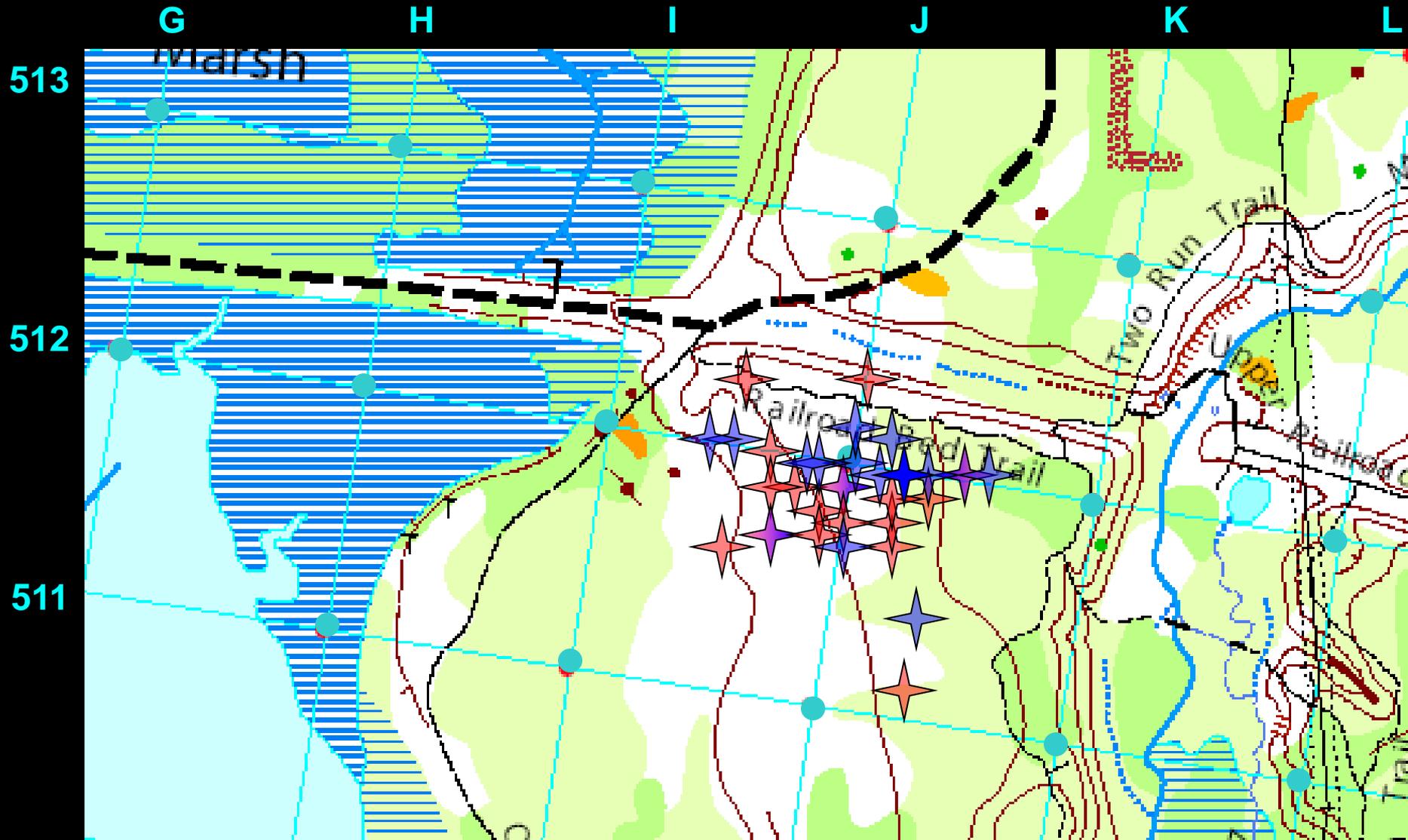
Male #186

August 28th, 2003



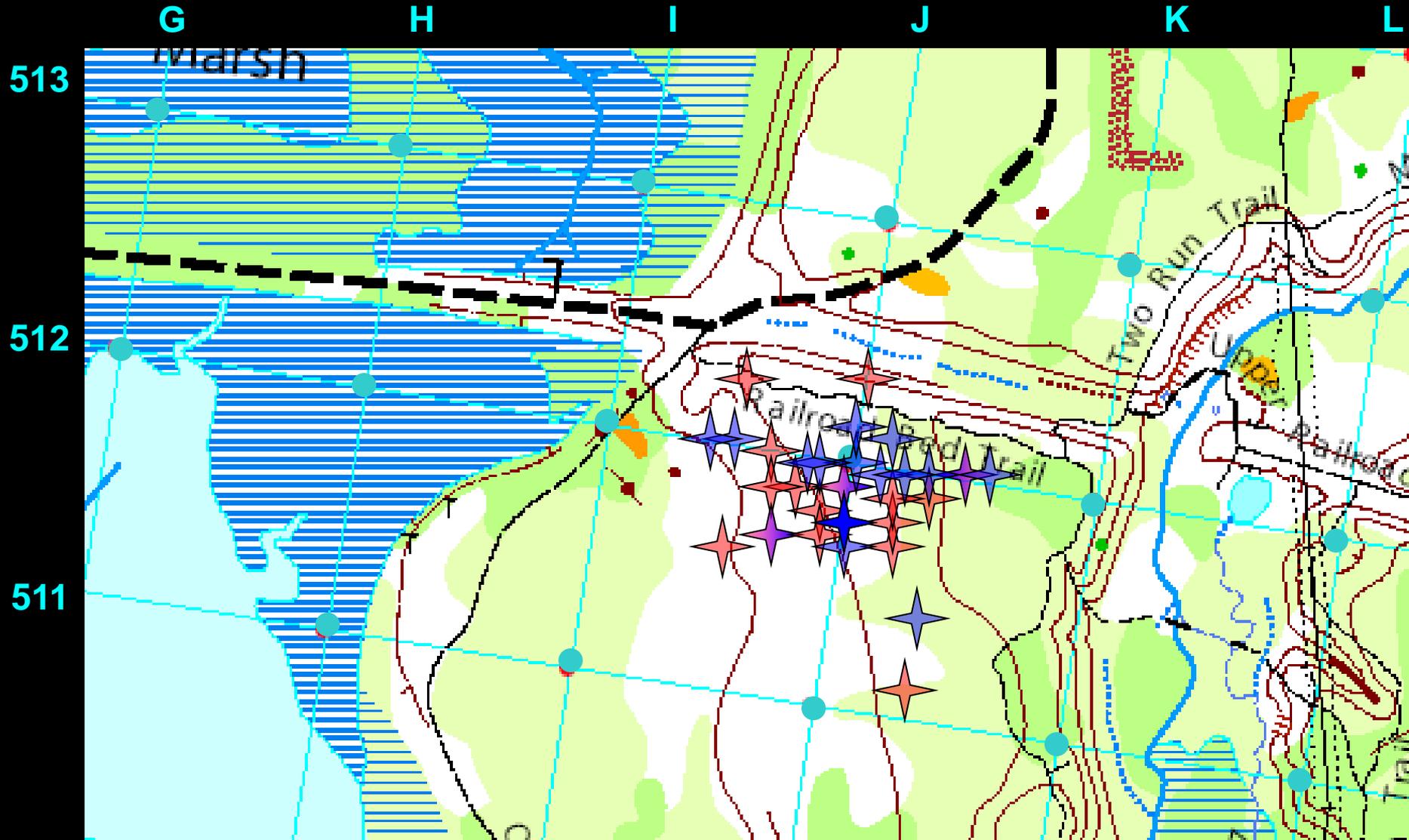
Male #186

September 5th, 2003



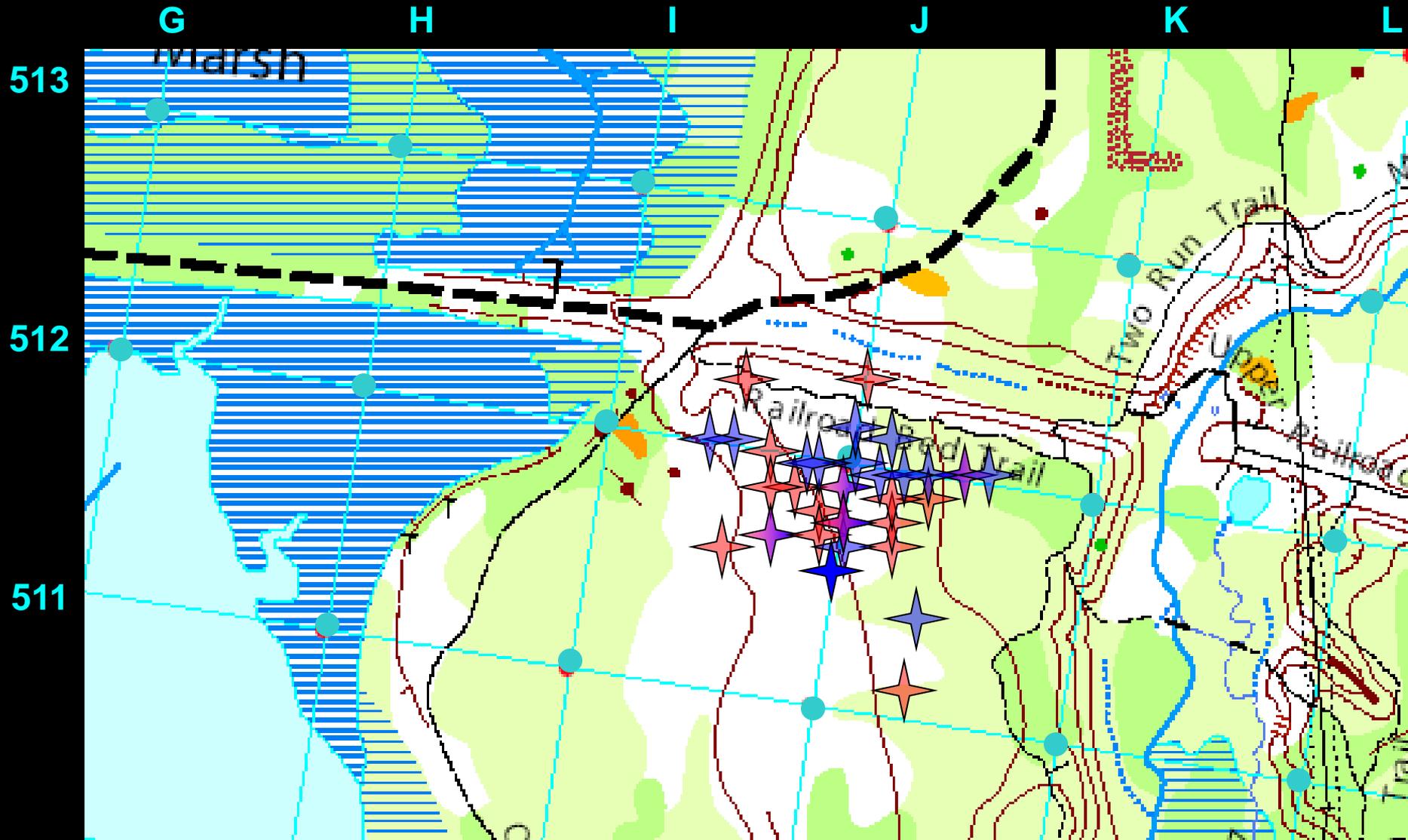
Male #186

September 11th, 2003



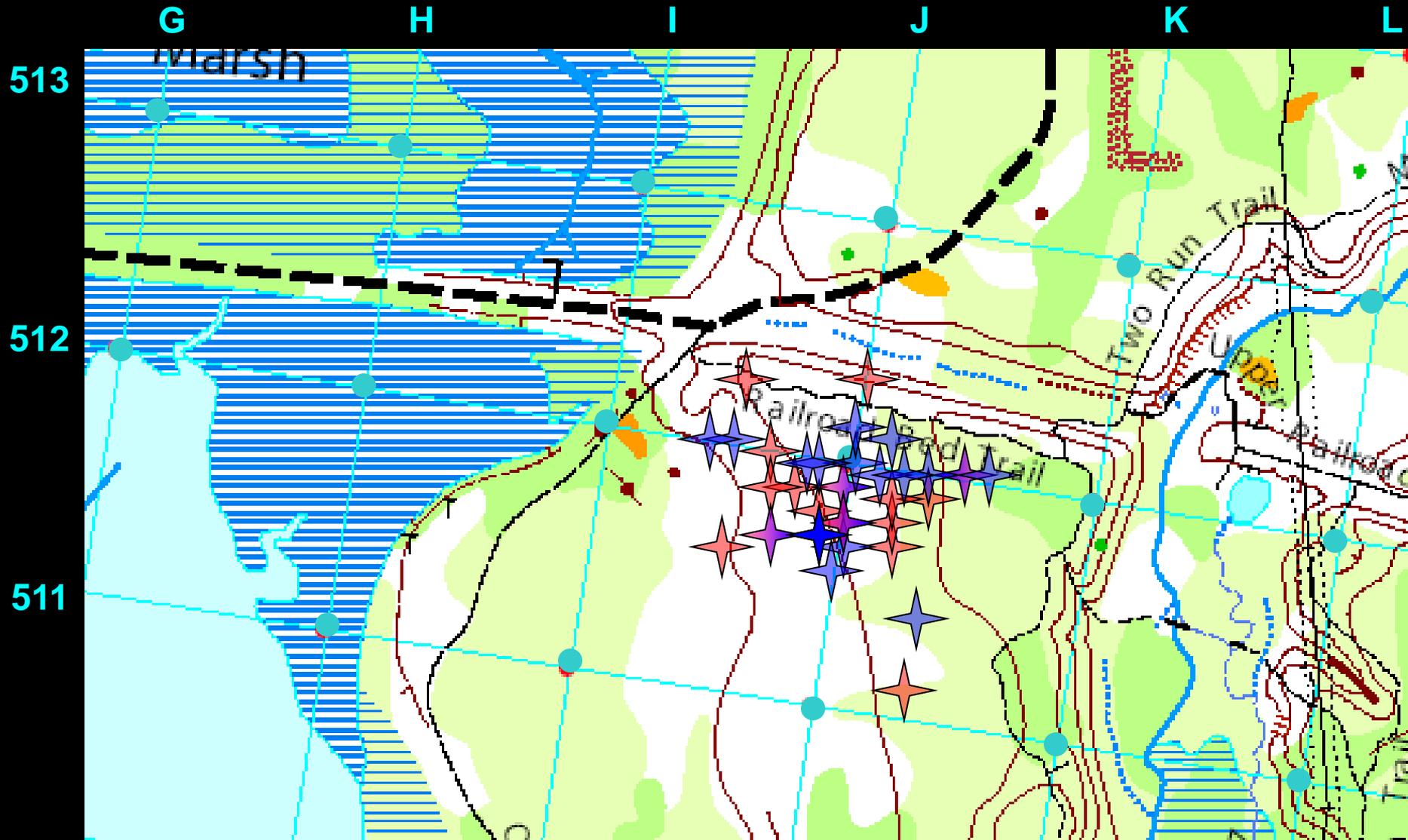
Male #186

September 16th, 2003



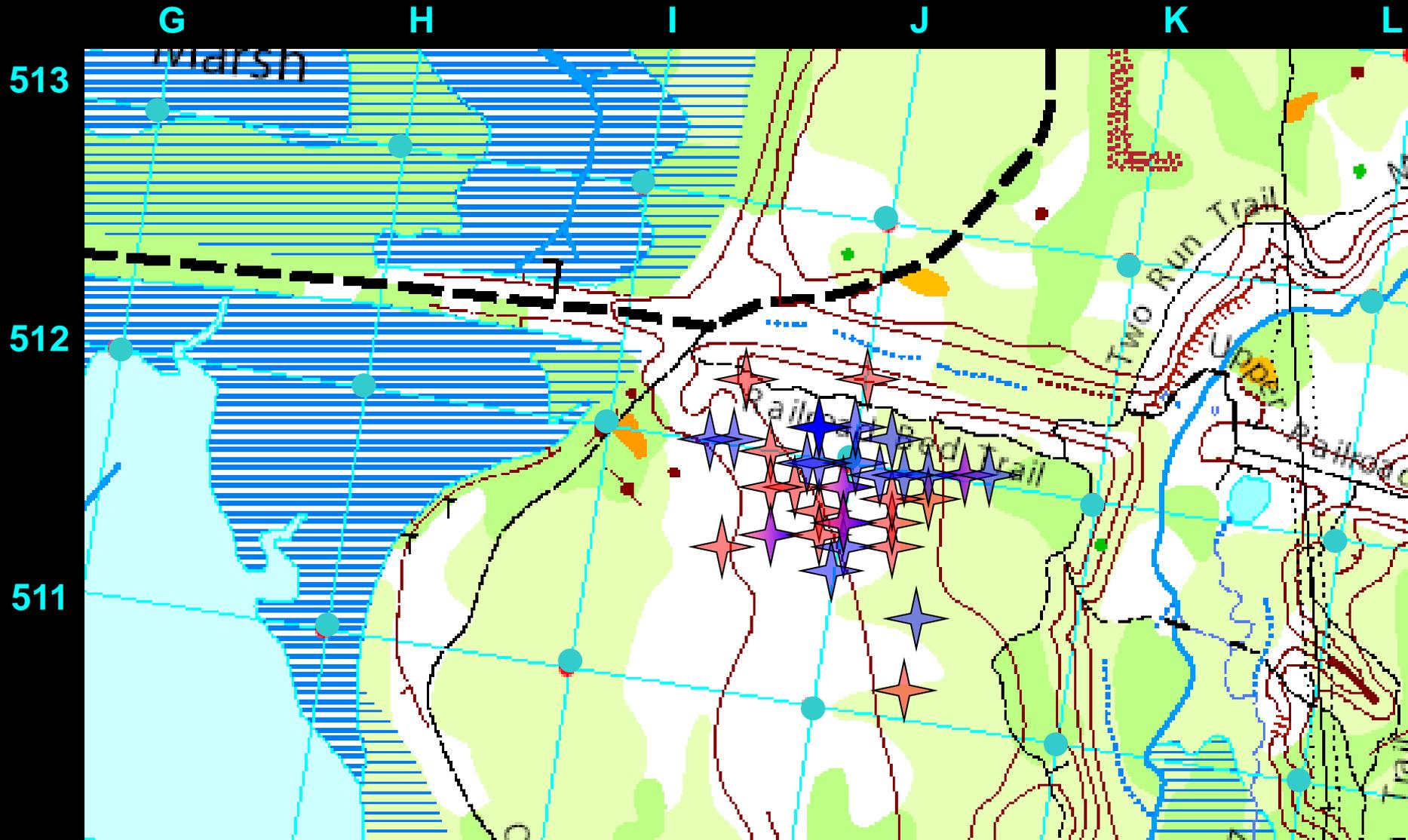
Male #186

September 30th – October 1st, 2003



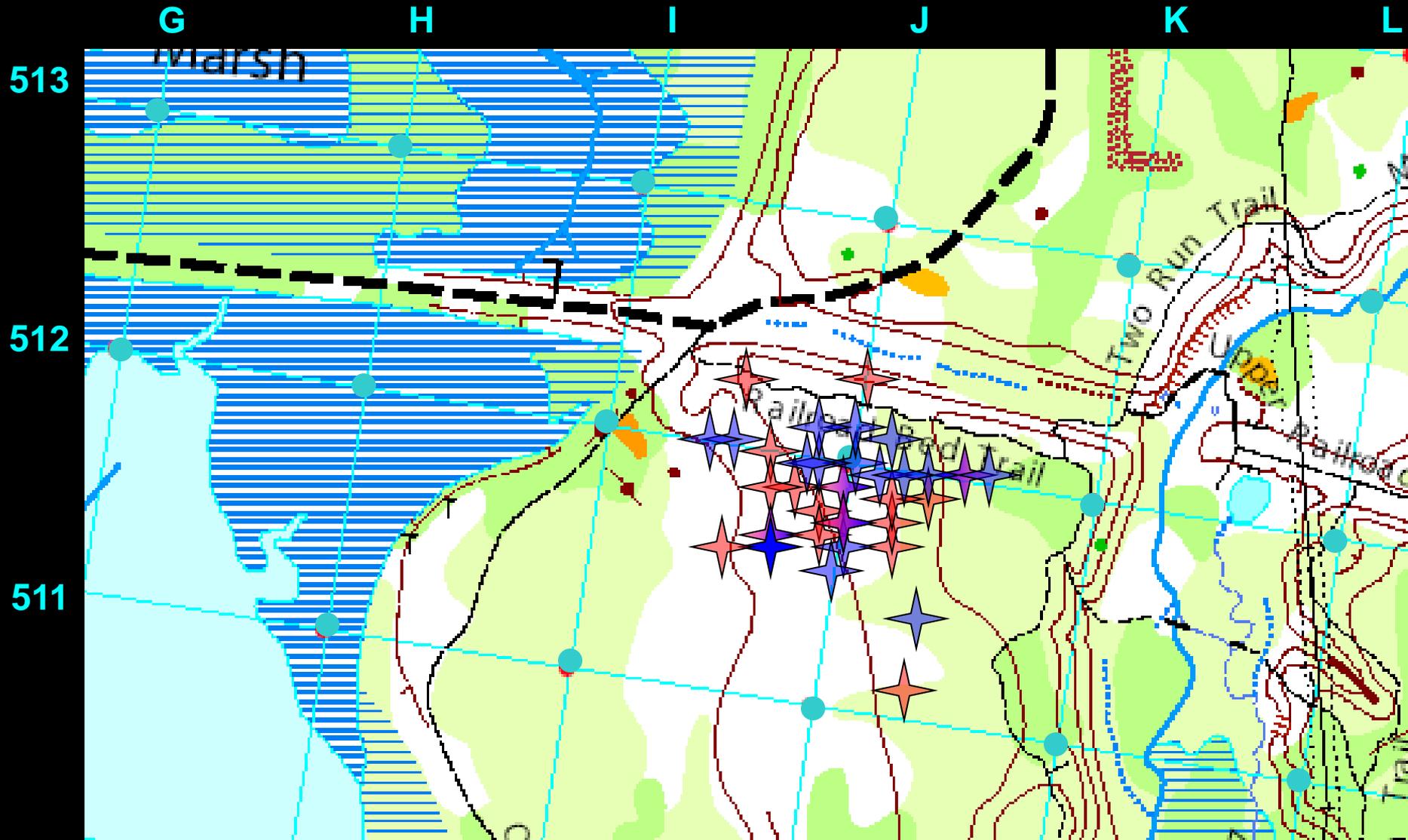
Male #186

October 4th, 2003



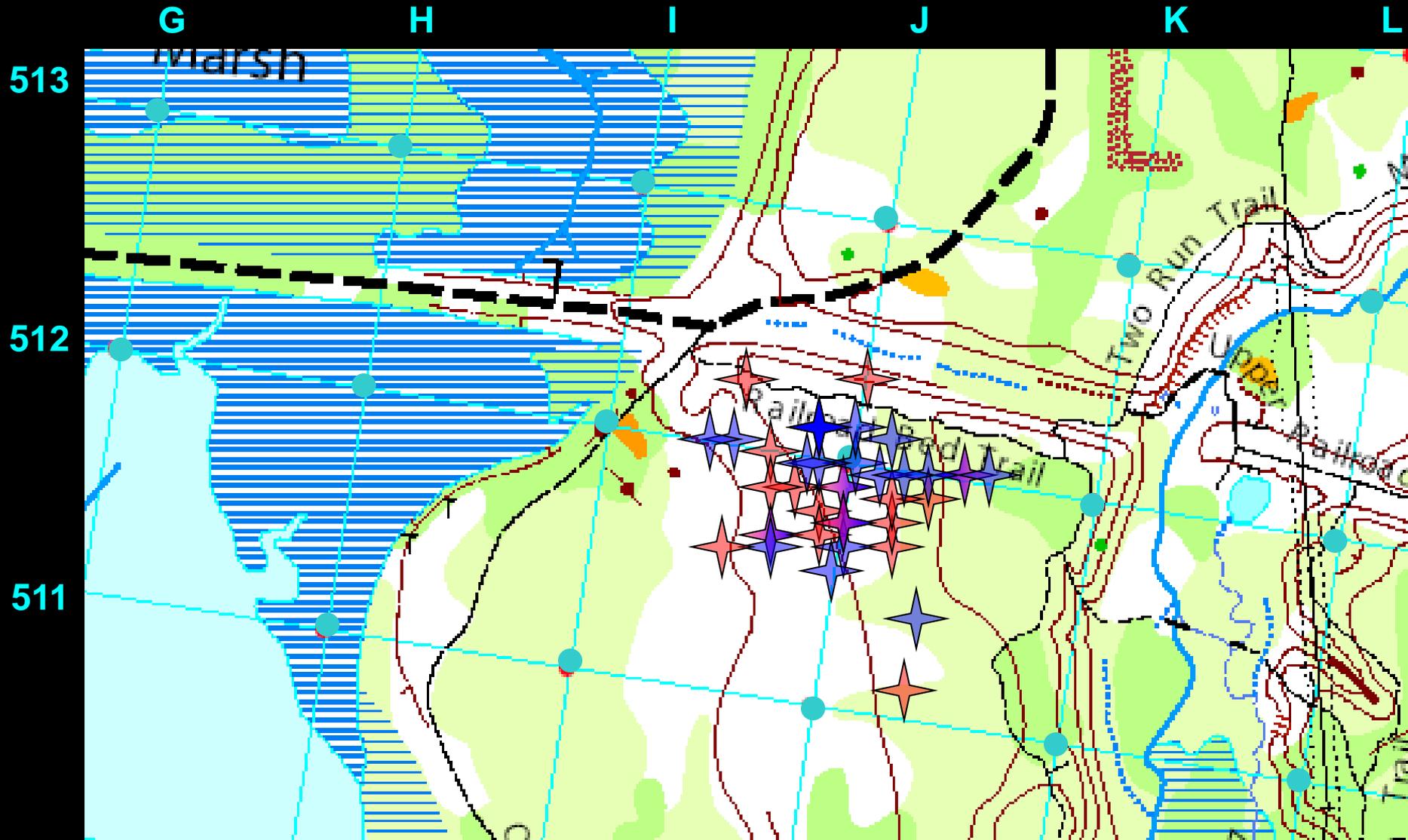
Male #186

October 7th, 2003



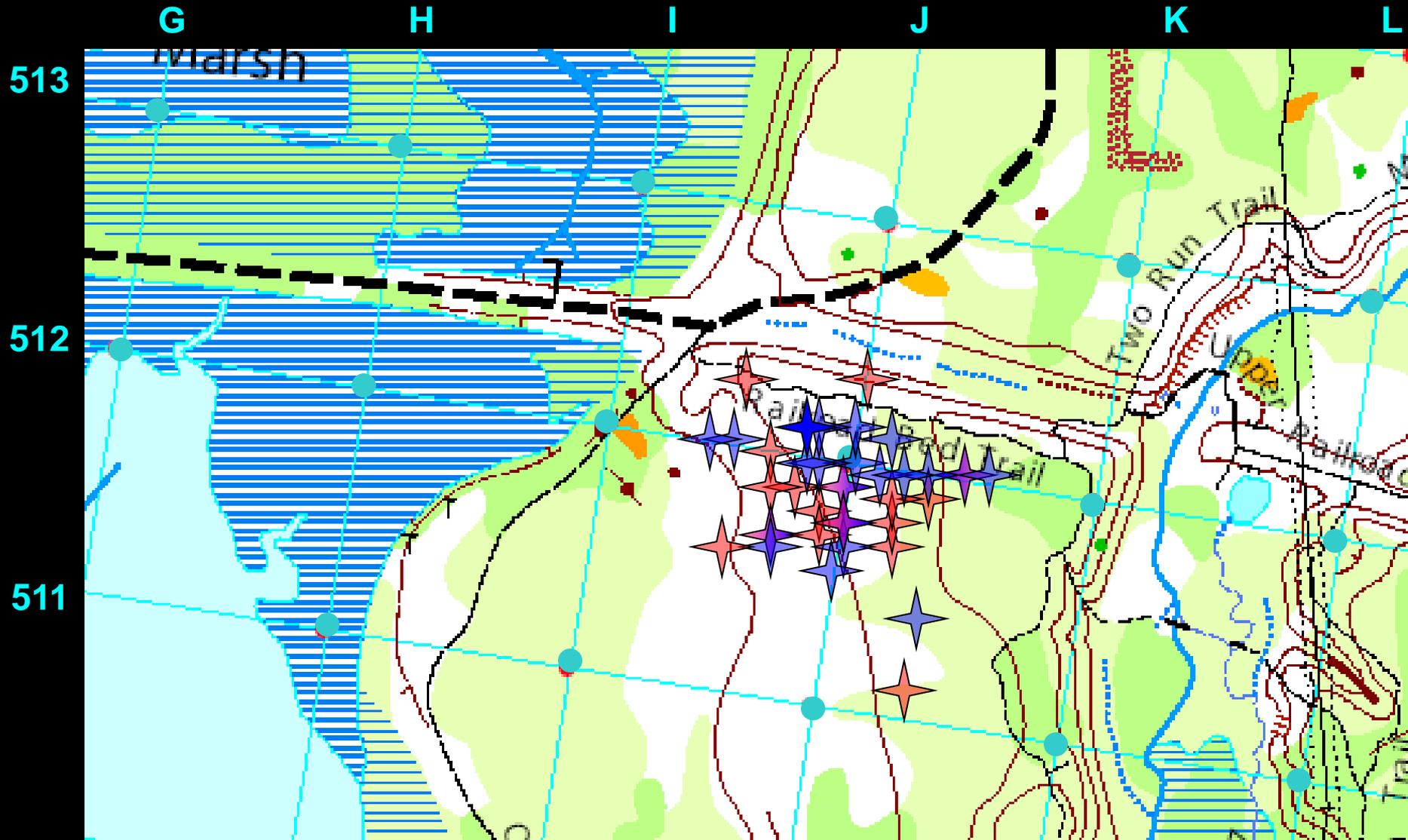
Male #186

October 15th – October 21st, 2003



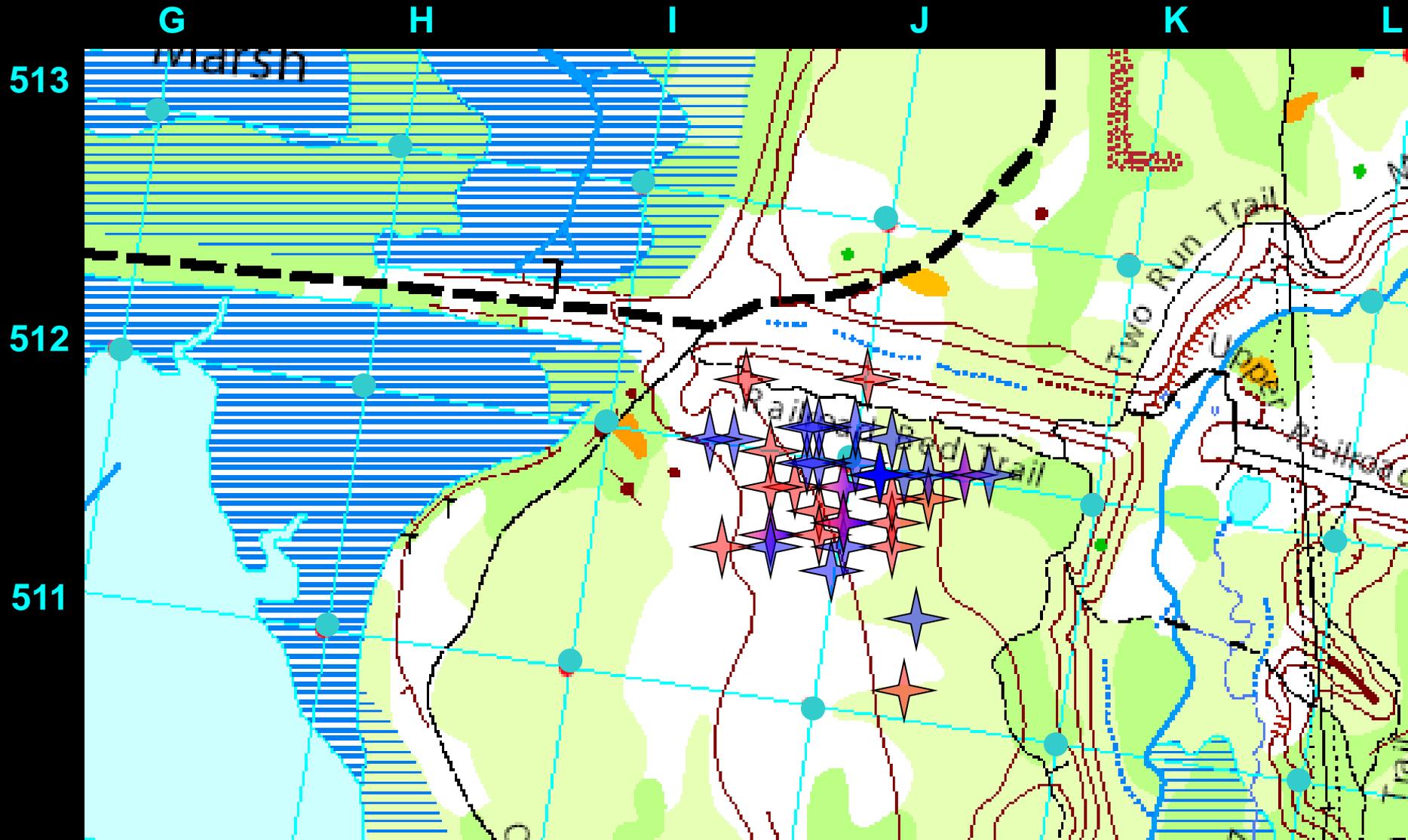
Male #186

October 22nd, 2003



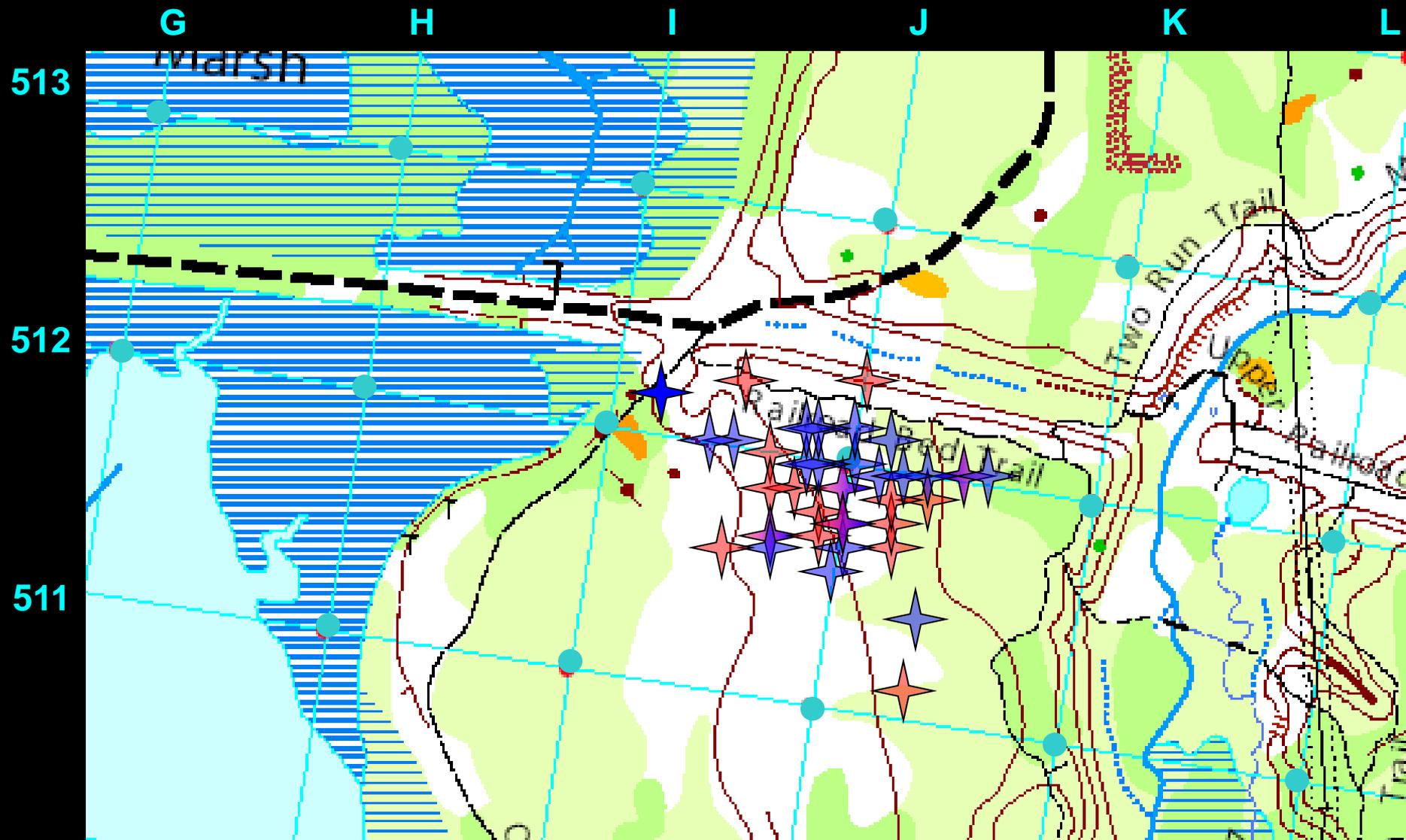
Male #186

November 8th, 2003 – April 7th, 2004



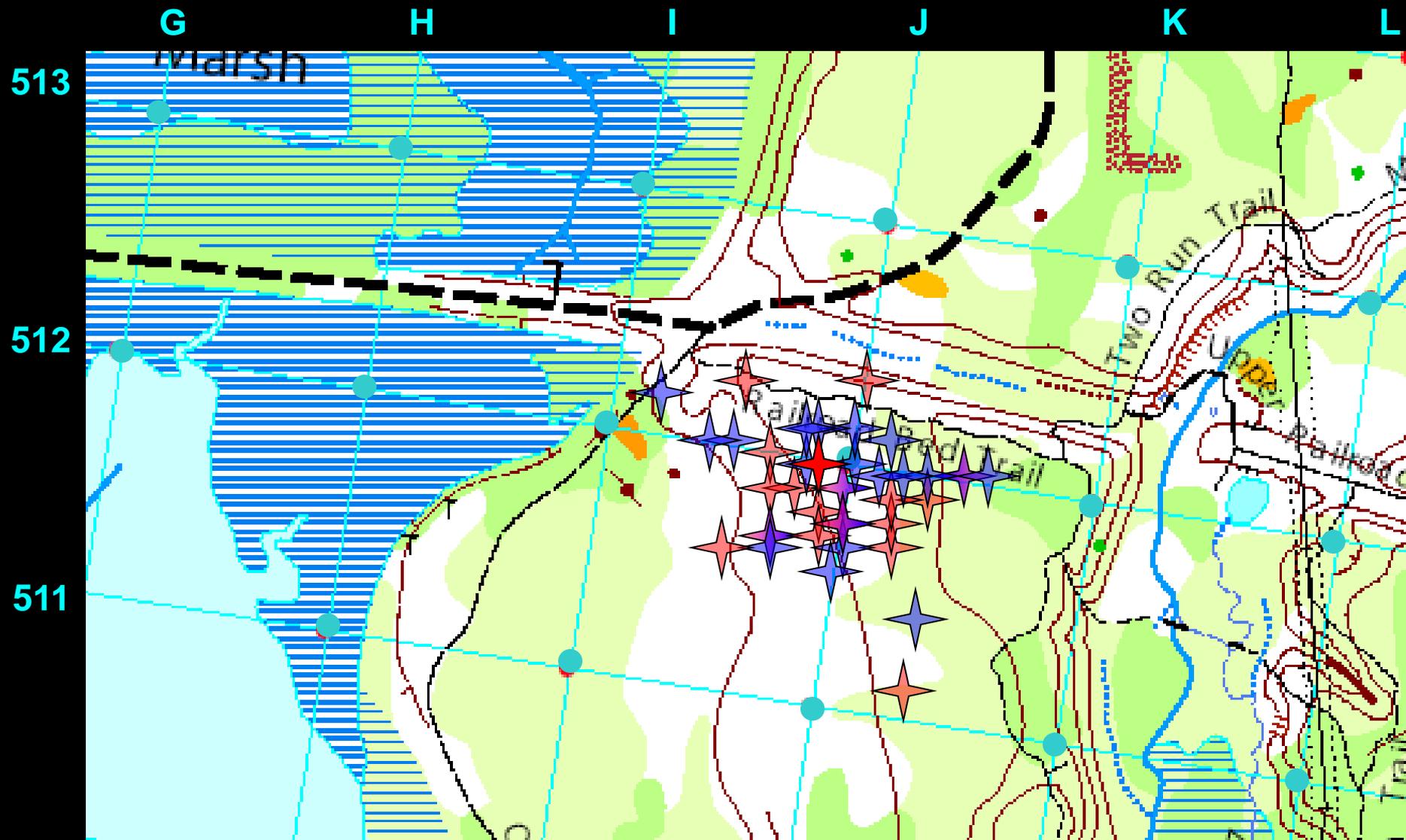
Male #186

April 26th, 2004



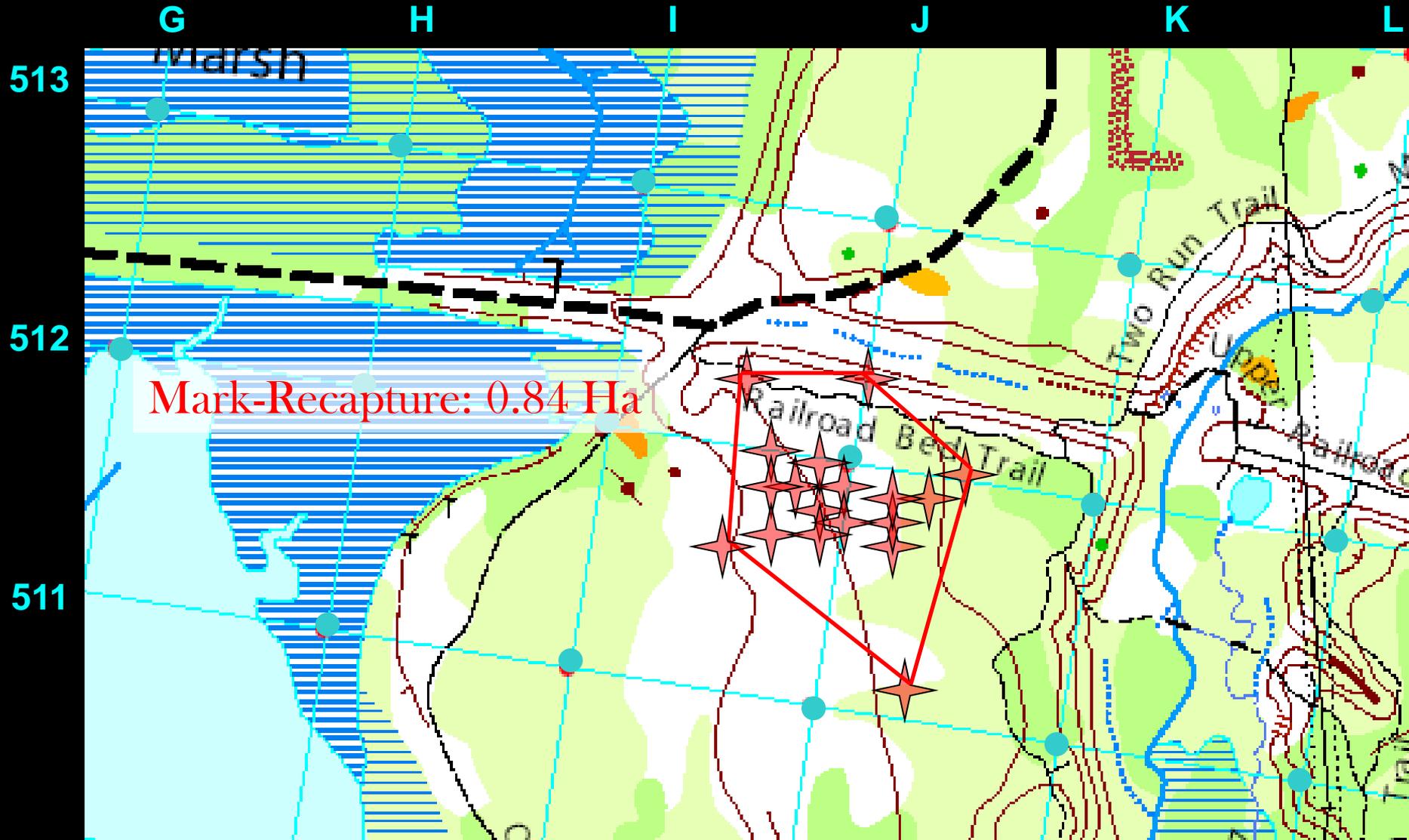
Male #186

May 14th, 2004



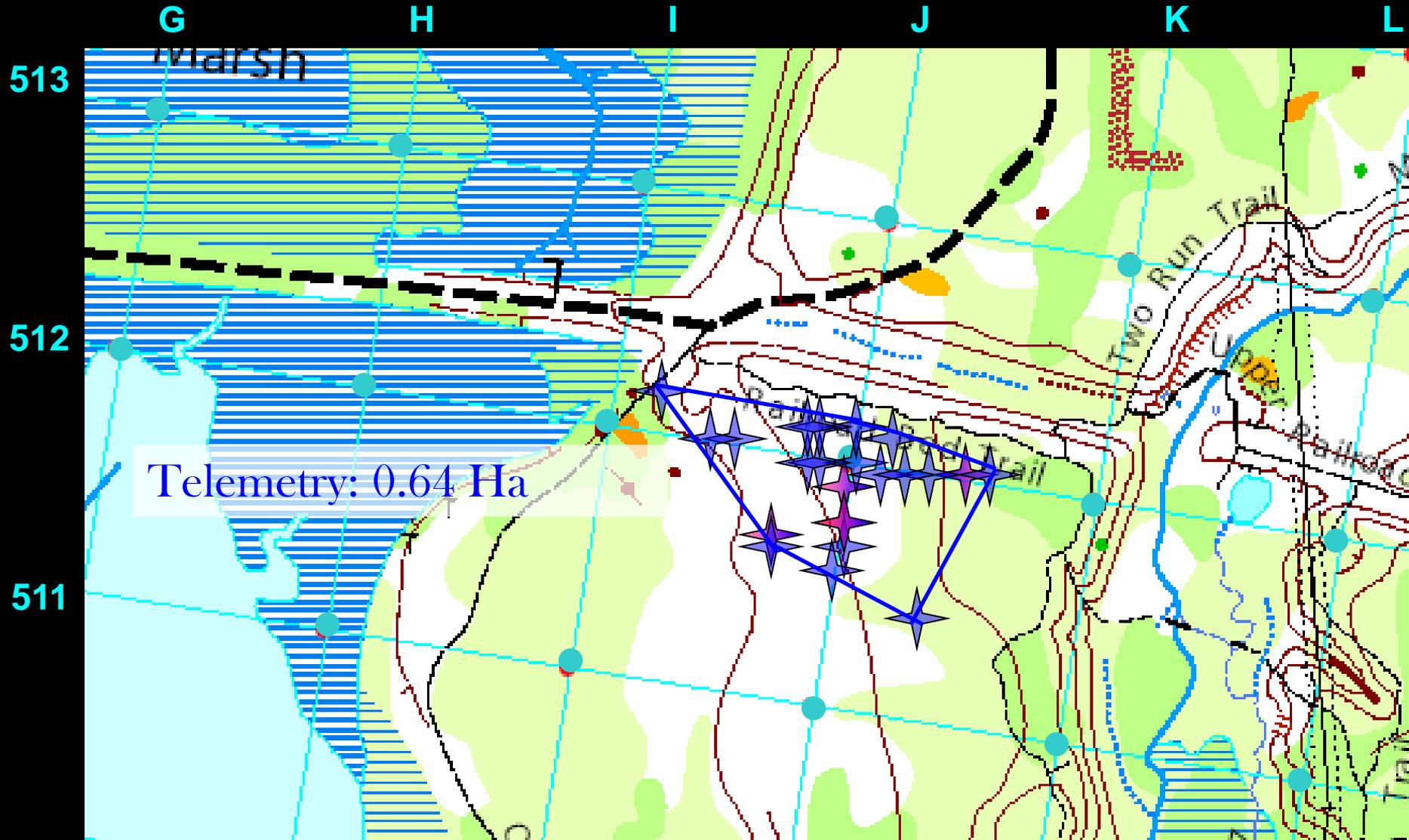
Male #186

Home range based on random sightings from June 1998 – May 2004



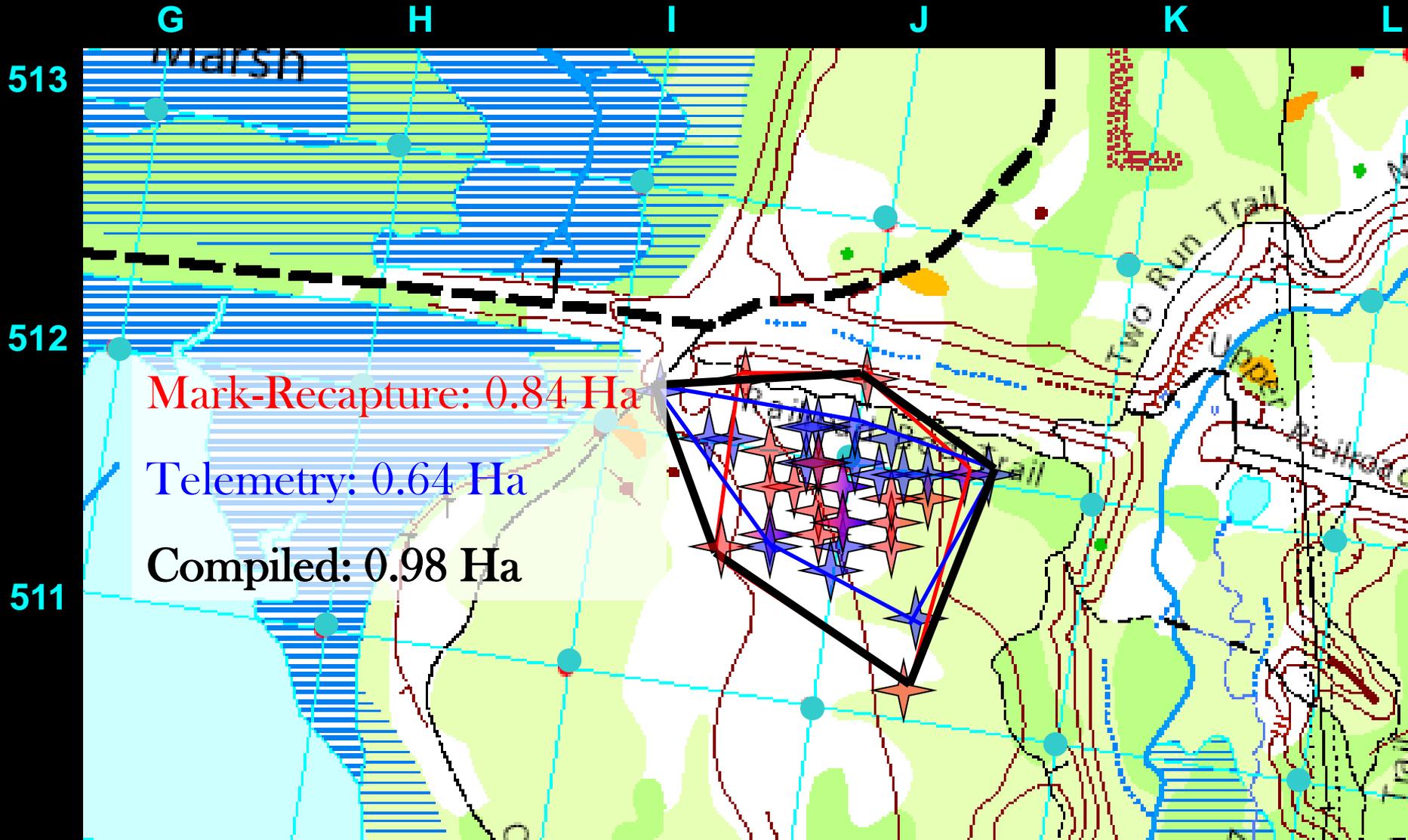
Male #186

Home range based on Telemetry sightings from May 2003 – April 2004



Male #186

Home Range based on Random & Telemetry sightings from June 1998 – May 2004



Materials and Methods



Calculating Home Range Size

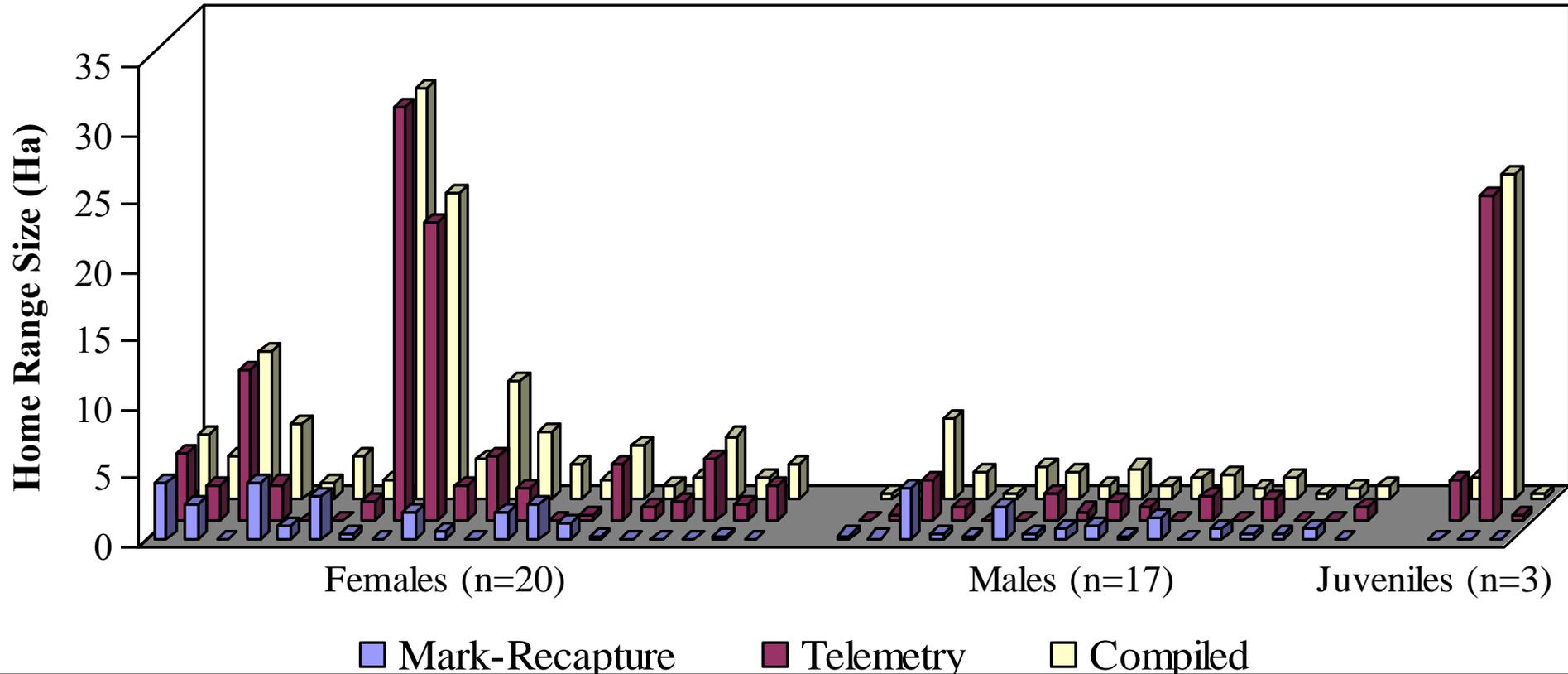
1 Ha

Random

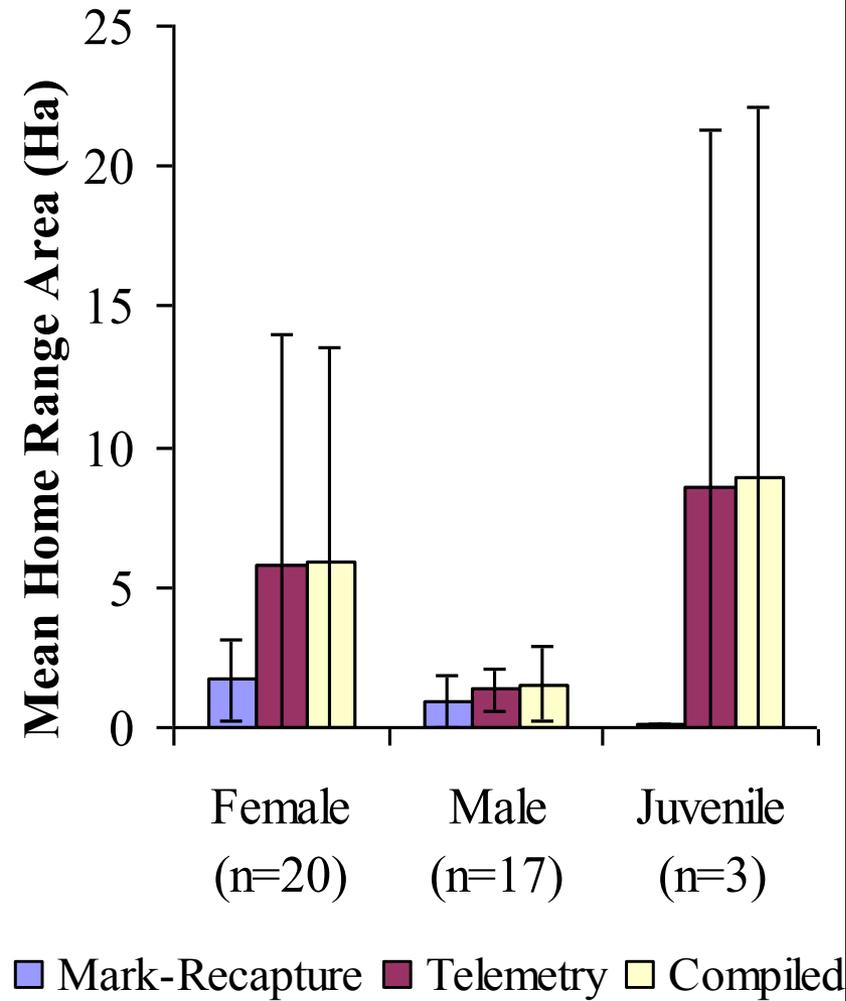
Telemetry

Compiled
Home Range

Results



Comparison of home range size using mark-recapture and telemetry sightings, as well as the compiled sightings data.

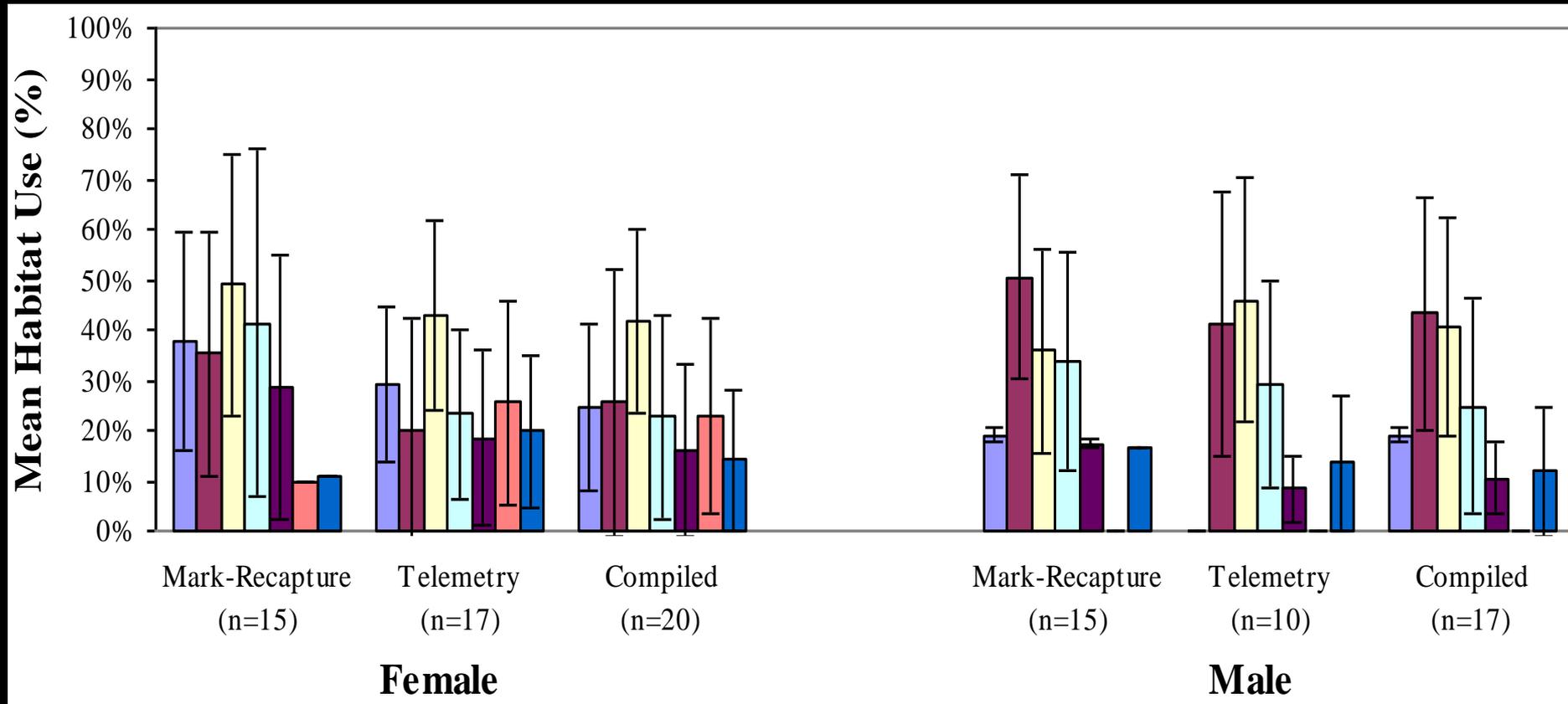


Technique Comparison using T-tests

	Factors being compared	df	T-Stat	p
Female vs. Male	Mark-Recapture	25	1.706	0.100
	Telemetry	16	2.234	0.040*
	Compiled	20	2.589	0.018*
Females	M.-R. vs. Telemetry	17	-2.036	0.058
	M.-R. vs. Compiled	21	-2.465	0.022*
	Telemetry vs. Compiled	33	-0.063	0.950
Males	M.-R. vs. Telemetry	23	-1.217	0.236
	M.-R. vs. Compiled	29	-1.412	0.169
	Telemetry vs. Compiled	25	-0.411	0.685

** indicates a significant difference*

Habitat comparison between measurement techniques



Upland

Meadow

Non-Tidal Wetland

Flood Plain

Tidal Wetland

Tidal Wetland / Marsh

Open Forest

Phragmites

Dense Forest

Scrub-Shrub

Comparison of *T. carolina* home ranges using different measuring and computation methods

Location	Collection Method	Computation Method*	Area (Ha)		n	Reference
			Mean	Range		
MD	M-R	MCP	♀1.70; ♂0.93	♀4.22; ♂3.55	♀15; ♂15	<i>This study</i>
	Telemetry		♀5.76; ♂1.35	♀29.75; ♂2.43	♀17; ♂10	
	Combined		♀5.92; ♂1.50	♀29.10; ♂5.62	♀20; ♂17	
MD	M-R	BNE	♀1.13; ♂1.20		♀52; ♂51	Stickel (1989)
MD	Trailing	CP	0.20	0.48	11	Hallgren-Scaffidi (1986)
VA	Telemetry	MA	1.25	1.80	6	Bayless (1984)
		O-U	2.47	3.30		
MO	M-R	--	♀5.1; ♂5.2	10.00	♀16; ♂21	Schwartz et al. (1984)
TN	Telemetry	CP	0.38	0.30	4	Davis (1981)
NY	Telemetry	BNE	6.95	17.80	23	Madden (1975)
		MP	2.12			
		CP	4.05			
MO	Mark-recapture	--	♀1.45; ♂1.53	3.50	♀64; ♂79	Schwartz ² (1974)

*Computation Method Key: Bivariate Normal Ellipse (BNE); Minimum Polygon (MP); Convex Polygon (CP); Minimum Convex Polygon (MCP); Minimum Area (MA); Ornstein-Uhlenbeck (O-U) (adapted from Dodd 2001).

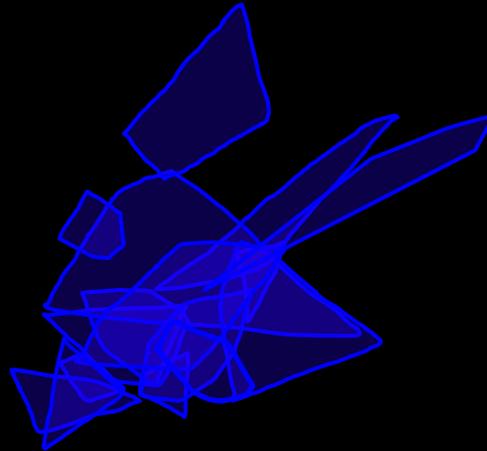
Total Home Range Comparison



Female

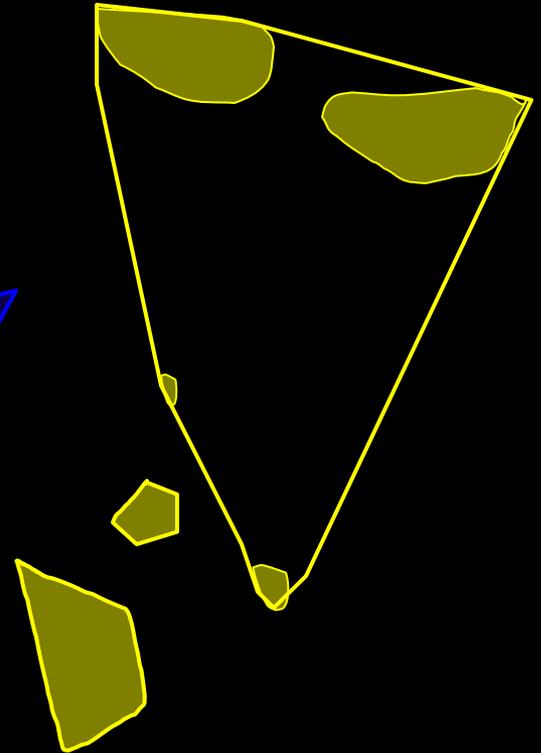
n = 20

■ 1 Ha



Male

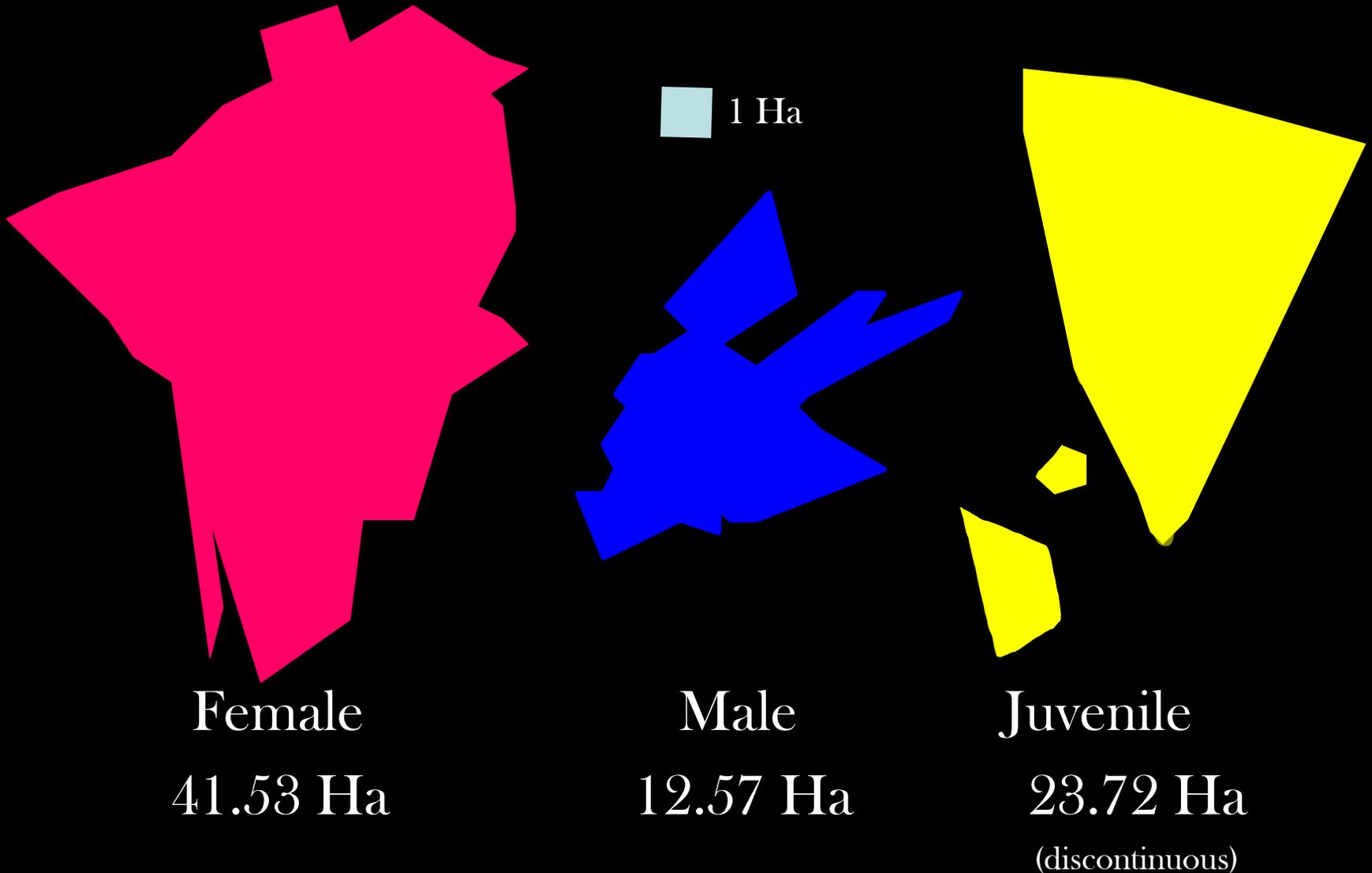
n = 17



Juvenile

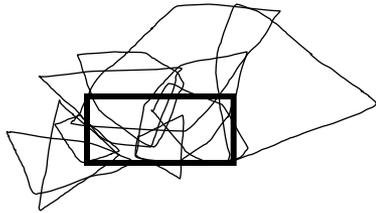
n = 3

Total Home Range Comparison

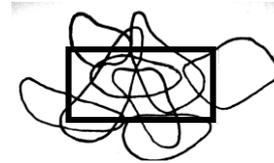


Jug Bay vs. Patuxent Research Center

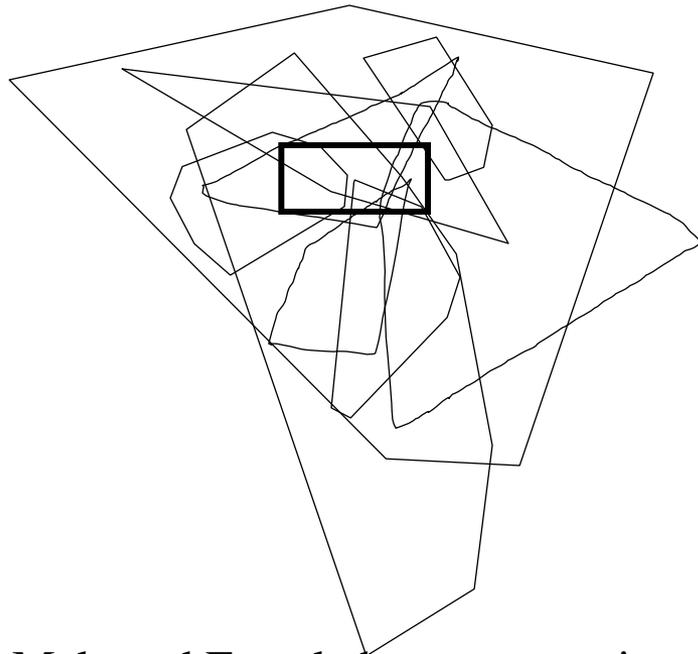
Males



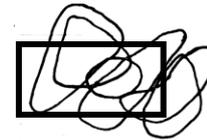
Males



Females



Females



Male and Female home ranges in a 5 acre (2.025 Ha) plot vs the plotted areas of male and female *T. c. carolina* in the same size plot from Stickel's 1950 study.

Discussion

Home Range

- Overall, the home ranges were much larger than those reported elsewhere, while having the third largest sample size.
- The difference in home range size may be due to how each study defined home range, or how strong the mean areas were for the past studies.
- Findings contradict the inverse relationship between population size and home range size found in past studies. Instead Jug Bay's high density-high home range size relationship is more likely explained by Madden's (1975) theory that high turtle densities in specific areas reflect the criticalness of that specific habitat.

Discussion

Habitat Preference

- There was no significant preference among the seven habitat types.
- More abundant in upland habitats but not to a significant degree
- Females occupy a much larger and more diverse area of the Sanctuary, than the males
- Females overall were seen using more habitats than males, which is most likely because of they require the meadow and wetlands in their nesting preparations

Conclusion

The most important findings of my study were that females' home range was significantly larger than that of males. This has important conservational implications, because larger, more diverse areas need to be protected in order to insure population health. Researchers should be cautious when lumping male and female home ranges because this may obscure interesting and important differences between the sexes.

Acknowledgements

I wish to thank...

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- Jug Bay Wetlands Sanctuary for their logistical support

And the

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