Horticultural Consultants

HORTSCIENCE INC.

Putah Creek **Riparian Vegetation** Study

August 1991

Prepared for:

Solano County Water Agency
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INTRODUCTION AND BACKGROUND

In the late summer and fall of 1990, HortScience, Inc. assessed plant development and soil moisture status along a a portion of Putah Creek. Seven transects, running north and south across the Creek, were defined.

During that period, soils within the creek bank remained moist, while those on floodplains and along the top of levee dried out. The texture and structure of soils along the creek bank prevented lateral movement of water. We concluded that unless water overflowed the creek bank, soils in floodplain and top of levee areas would remain dry.

By the end of the study period (November), most trees had experienced partial, if not significant defoliation. However, no water stress developed in trees along the transects, either when assessed visually or measured with an infrared thermometer.

Since the observation period during 1990 was late summer, there was no opportunity to examine changes in soil moisture and plant development early in the growing season. Analysis of tree ring data revealed that long-term diameter development of oak trees along the top of levee was more closely related to annual precipitation than early summer water releases from the dam. Thus, plant growth could depend upon soil moisture status at the beginning of the growing season.

OBJECTIVES OF THE 1991 STUDY

This series of observations was undertaken to examine plant development and soil moisture during the early part of the growing season. We assumed that soil moisture was high at the end of winter and early spring (especially given the heavy rainfall of March). In the absence of substantial over-bank flow, trees in the floodplain and top of levee locations must rely on the soil moisture obtained from winter rains.

There were two objectives of this study:

1. Assess soil moisture status across the creek bed through the observation period;
2. Assess plant stress through the observation period.

METHODS

Four of the transects established in 1990 were used in this study: #3, 4, 5, and 7 (Figure 1). Gypsum blocks were installed across each transect as part of the 1990 study. Blocks were placed in creek bank, floodplain and top of levee locations (see APPENDIX, Transect maps). Measurements of soil moisture were collected on a biweekly basis from early April through early July. Visual observations of plant development were made at each soil moisture sampling date.

Heavy spring rains and releases of water prevented use of some blocks. Some were lost entirely due to high water in the creek bank. Others remained underwater for most of the study period. In cases where blocks were damaged or lost, new blocks were installed. Thus, while 20 blocks were installed, only 14 provided consistent data.

RESULTS -- SOIL MOISTURE

As seen in 1990, there were large differences in soil moisture status within individual transects (Table 1, Figure 2). Through the study period, soils directly adjacent to the creek bank remained moist, while soil moisture in top of levee locations decreased (Figure 2).

Soils began to dry in the top of levee approximately 7 weeks (end of May) after installation of gypsum blocks. The pattern of drying continued until the observations were terminated, in early July 2. By this point, soils in the top of levee area were very dry (below the ability of the gypsum block to measure soil moisture accurately). The only exception to this pattern was found in Transect #4 (block 5), where soils began to dry later in the study.

Also as in 1991, there did not appear to be any large differences among transects in soil moisture for the top of levee and creekbank locations (Table 1). All transects had similar patterns of soil moisture retention or loss.

This was not the case for the floodplain location, where there was variation in soil moisture patterns across the four transects. Depending upon the transect, soil moisture in the floodplain locations followed the general pattern of either creek bank or top of levee. In Transect #4, soils were dry, like those in the top of levee. In Transect #3, a pattern of soil drying had begun by early July. In the other transects, soils in the floodplains had moisture readings like those of the creek bank locations, i.e., soils remained wet through the experimental period.

RESULTS -- PLANT DEVELOPMENT

At the time the 1991 study began, new shoots of most trees were just beginning to emerge and elongate. Cottonwood and willow were in full flower.

No significant changes in plant growth occurred during the 3-month period of observation. Development appeared to proceed normally. Even in early July, there was no evidence of any water stress at any transect or location within transect.

DISCUSSION

Observations of soil moisture in 1991 were similar to those seen in 1990 for the top of levee and creek bank locations; the former were dry while the latter remained moist (compare Figure 2 with APPENDIX, 1990 Soil moisture). This result confirms our belief that water flow in the channel during the growing season is not a significant contributor to soil moisture along the top of levee location.

Soils in the floodplain were not uniformly dry. Soil moisture was variable, depending upon the specific transect. We observed significant over-bank flow this year, which must have contributed to the high soil moisture in some floodplain locations. Both the intensity of water flow and creek morphology within individual transects will determine the extent of over-bank flow from channel to floodplain. For example, gypsum block #2 (transect #5) was located within a secondary channel. In addition, at least one sampling location (gypsum block #12, transect #7) received agricultural run-off.

However, in the absence of over-bank flow (or other surface recharge), we believe that soils in floodplain locations will dry out by the end of summer, in a pattern similar to that seen in 1990. There is no evidence that lateral flow of water occurs from active channel to floodplain in the transects examined. Unfortunately, we cannot predict when this drying will occur, primarily because the periods of observation in 1990 and 1991 did not overlap: in 1990 sampling began in late August, 1991 in concluded in early July.

We conclude that trees growing along the top of levee undergo a yearly drying of the soil. Tree species that grow successfully in this location have a high tolerance to low soil moisture. There were no indications of water stress. Trees were fully foliated and there was no evidence of wilting.

Table 1. Gypsum block readings.

LOCATION	TRANSECT	BLOCK	April 2	April 10	April 22	May 7	May 23	June 5	June 18	July 2	
Top of levee	EAST PEDRICK 3	17	97.2	97.9	97.7	96.4	82.6	40.1	5.6	-0.8	dry sandy loam
	EAST 505 4	5 40	--	--	97.3	98.3	96.8	92.8	78.9	59.0	Fine sandy loam
	WEST 505 5	1	97.4	98.0	97.9	98.2	24.4	-9.4	-9.5	-10.2	SANDY
	RAILROAD WEIR 7	8 50	97.4	--	97.9	--	--	-10.1	-10.4	-9.5	sandy loam
	7	13	--	--	97.8	98.3	89.0	35.7	9.6	1.3	SANDY loam
	Average		**97.3**	**98.0**	**97.7**	**97.8**	**73.2**	**29.8**	**14.8**	**8.0**	
Floodplain	3	16	--	97.7	98.0	98.3	98.3	96.5	83.8	55.4	sandy loam
	4	6 30-40	lost	nb	97.9	20.5	-21.1	-21.0	-4.5	-4.1	sandy, gravel
	5	2 IN CHAN	uw	98.4	98.0	nb	--	96.5	94.0	94.3	moist clayey
	7	9	lost	nb	97.9	98.7	98.9	98.7	99.0	99.1	sandy loam
	7	12 30	96.9	97.6	97.6	--	97.8	97.7	42.2	98.9	SANDY loam
	Average		**96.9**	**97.9**	**97.9**	**72.5**	**68.5**	**73.7**	**62.9**	**68.7**	
Creek bank	3	14 25	uw	nb	98.0	98.3	nb	--	99.2	99.2	sandy matrix
	3	15 IN CREEK	97.1	uw	uw	uw	uw	uw	uw	--	sand loam/clay loam
	4	7 4'	97.7	97.6	uw	uw	uw	95.8	99.0	99.1	Fine sandy clay
	5	3	--	98.7	98.0	--	nb	--	--	--	gleyed sands + cl
	5	4 5'	--	98.6	--	nb	--	--	--	--	coarse sand
	7	10 2-4'	uw	uw	uw	--	--	--	--	--	gravel + clay/gleyed
	7	11	uw	uw	uw	uw	nb	98.9	99.2	99.7	coarse sandy soil/gley
	7	20	--	--	--	nb	--	98.9	99.2	84.9	
	Average		**97.4**	**98.3**	**98.0**	**98.3**	**98.1**	**97.9**	**99.3**	**95.9**	

uw = block underwater
nb = new block installed

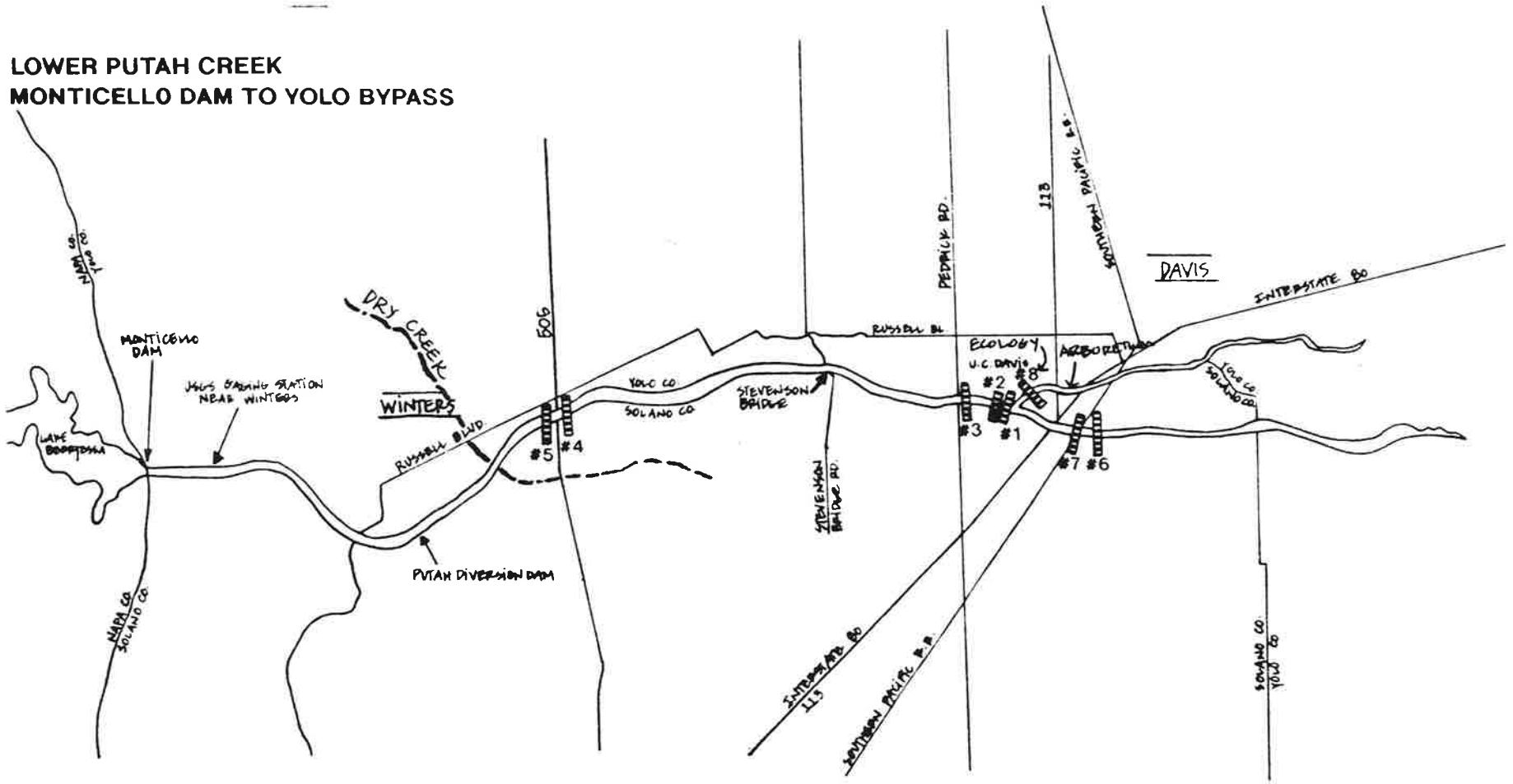

Fig. 1 **TRANSECT LOCATIONS MAP**

Putah Creek
Riparian Vegetation
Study

1991

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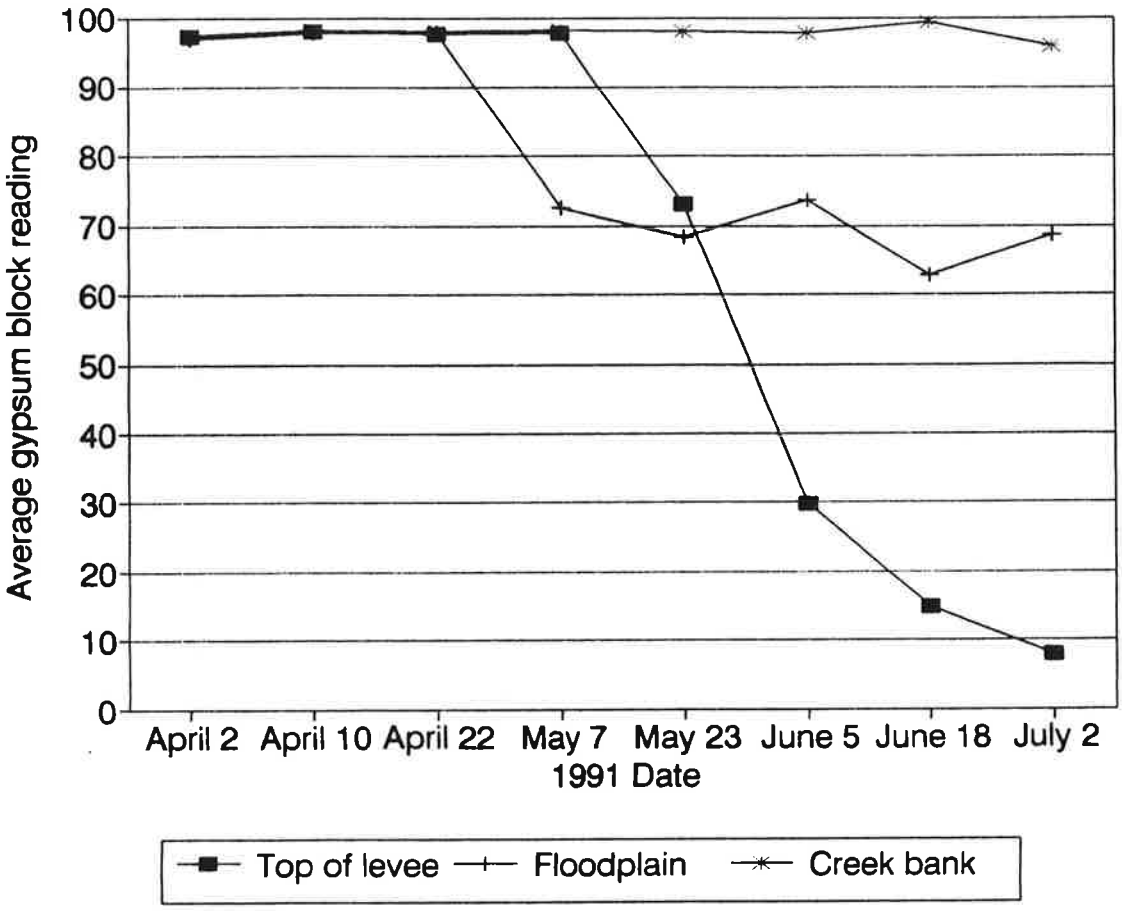
Figure 2. Soil moisture patterns along Putah Creek for the period April - July 1991. Data are average readings from gypsum blocks installed at four sites along the Creek. The number of observations for each average ranges from 1 to 5 (see Table 1)



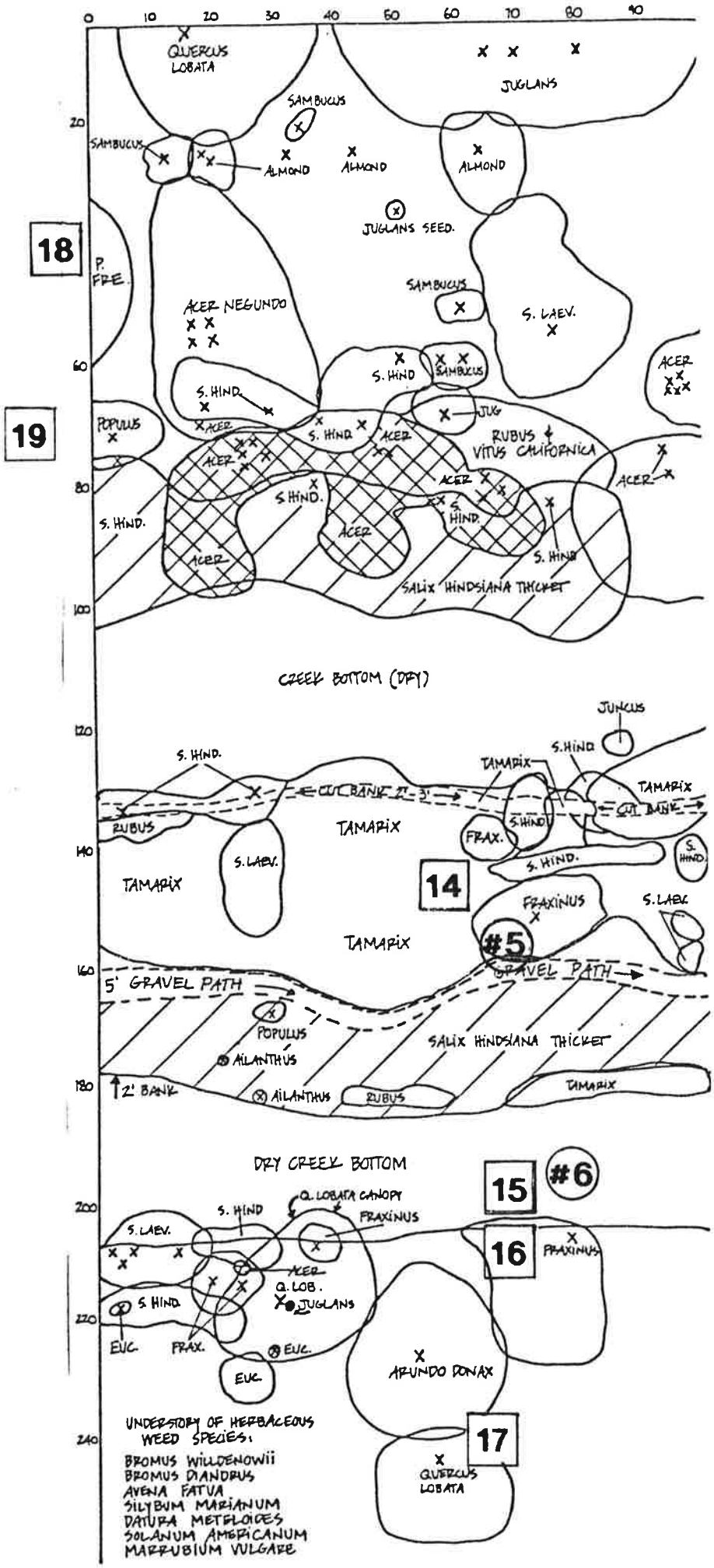
APPENDIX

Sample Location Maps

1990 Soil Moisture

Putah Creek Riparian Vegetation Study

1991



SAMPLE LOCATION MAP

Transect #3

Location:
East of Pedrick Road

LEGEND

- Gypsum Block
- Soil Profile Pits

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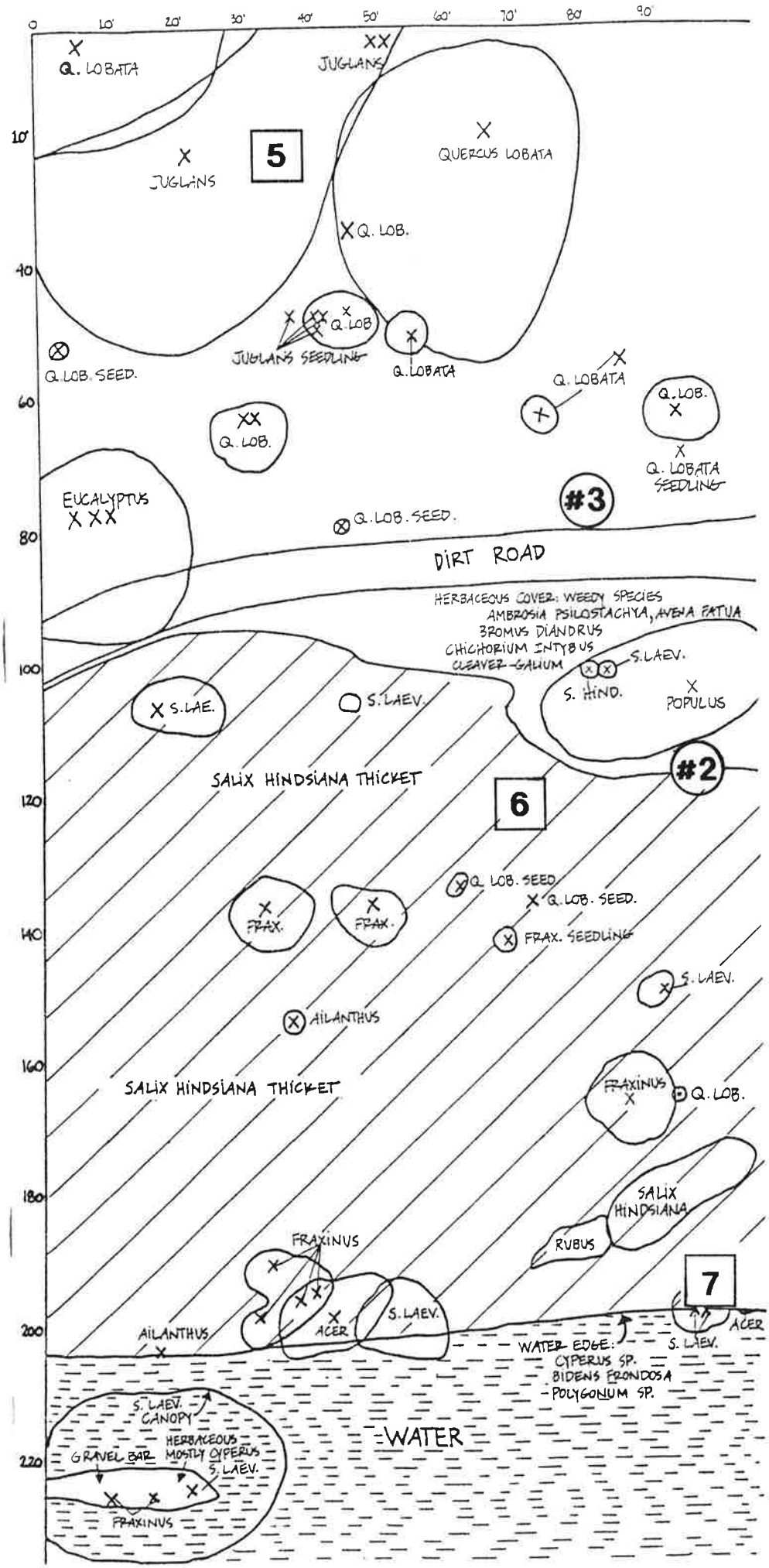

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SAMPLE LOCATION MAP

Transect #4

Location:
East of Interstate 505

LEGEND

Gypsum Block

Soil Profile Pits

#4 Soil Profile Pit #4 located to the east of Transect #4

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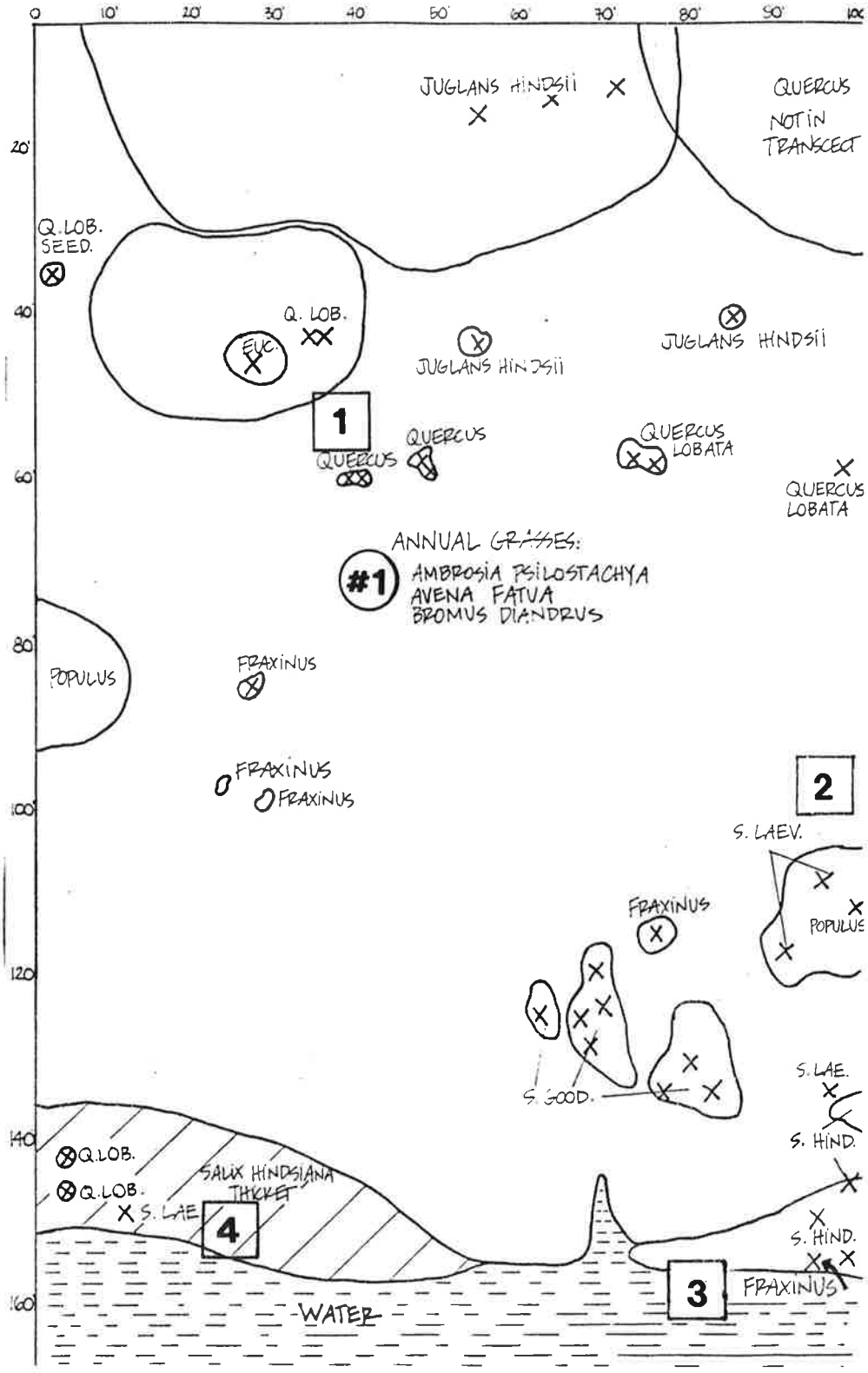

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SAMPLE LOCATION MAP

Transect #5

Location:
West of Interstate 505

LEGEND

Gypsum Block

Soil Profile Pits

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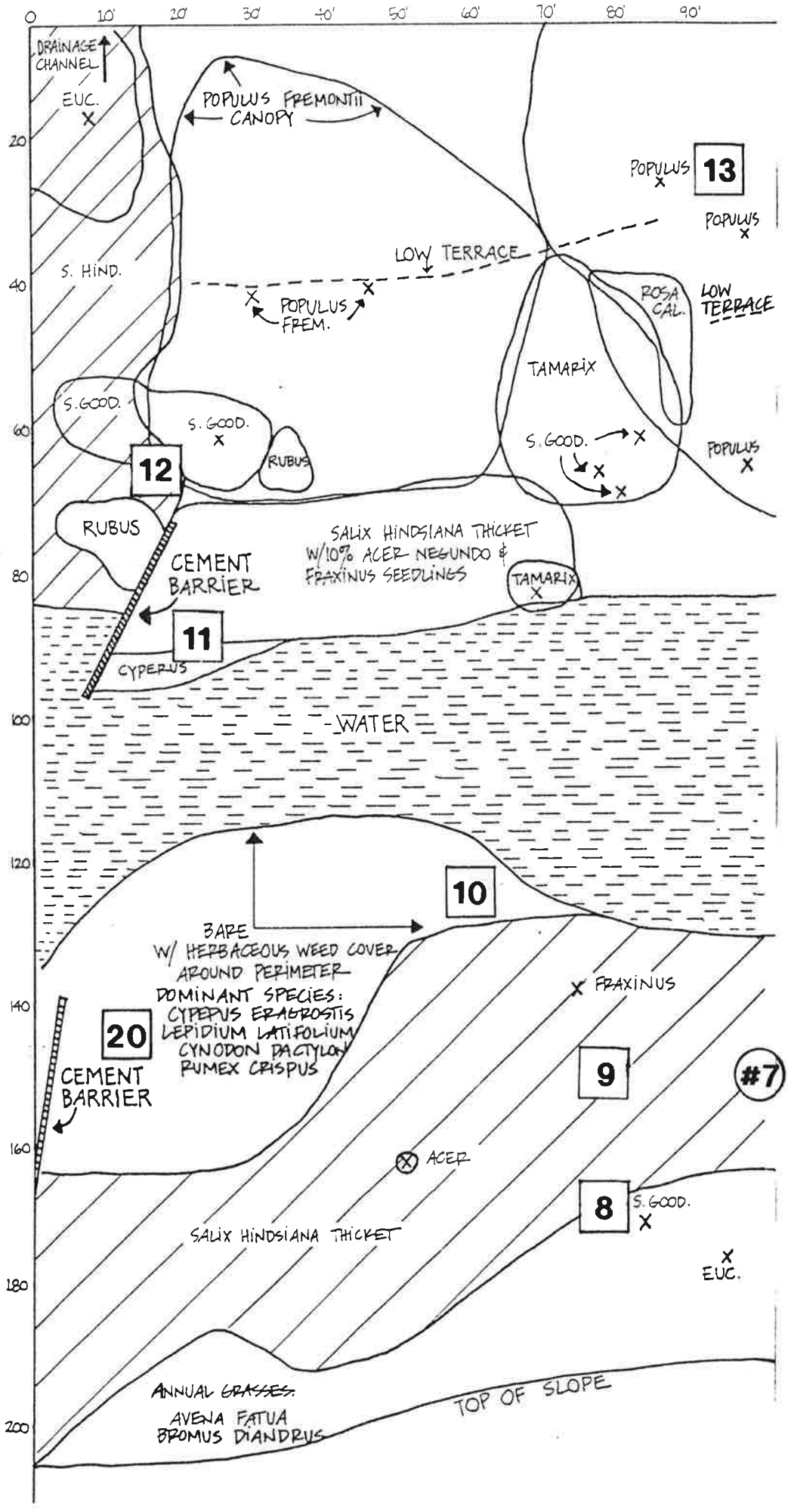

SAMPLE LOCATION MAP

Transect #7

Location:
Railroad Overpass

LEGEND

- Gypsum Block
- Soil Profile Pits

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Soil moisture patterns along Putah Creek, for the period September - November 1990.