

S Lesica, Peter
583.123 Demographic
Nildmaf monitoring of
1991 *Arabis fecunda* in
the Pioneer Range,
Beaverhead
National Forest.

DEMOGRAPHIC MONITORING OF ARABIS FECUNDA
IN THE PIONEER RANGE, BEAVERHEAD NATIONAL FOREST, MONTANA

1990 PROGRESS REPORT

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INTRODUCTION

In order to adequately protect populations of an organism, it is necessary to understand its life history and population dynamics (Massey and Whitson 1980, Sutter 1986, Palmer 1987). Sapphire rockcress (Arabis fecunda Rollins) is a rosette-forming perennial in the Mustard Family (Brassicaceae). This recently described species (Rollins 1984) is endemic to highly calcareous, azonal soils in the foothills of the Sapphire Range in Ravalli County and in the Pioneer Range in Beaverhead and Silver Bow counties, Montana (Lesica 1985, Schassberger 1988). Arabis fecunda occurs on eroding slopes with low vascular plant density but often a relatively high cover of cryptogamic soil crust. In Ravalli County, populations of Arabis fecunda are thought to be threatened by livestock grazing and encroachment by an aggressive exotic weed, spotted knapweed (Centaurea maculosa) (Lesica 1985). Arabis fecunda is a candidate for listing as a threatened or endangered species by the U.S. Fish and Wildlife Service (USDI, FWS 1990) and is considered threatened in Montana (Lesica and Shelly 1991).

This paper is a progress report on a long-term demographic monitoring study of A. fecunda populations, established in order to determine important life history attributes and determine trends in overall recruitment and mortality.

METHODS

Study Areas

We conducted our studies at two sites in Ravalli County, Montana: Charley's Gulch and Birch Creek. The Charley's Gulch site is on a steep, eroding, southwest-facing slope along the gulch at an elevation of ca. 5,000 ft. (T6N R19W S29,NW1/4). The Birch Creek site is on a steep, eroding, southeast-facing slope above the creek at an elevation of ca. 4,700 ft. (T7N R19W S16,NW1/4). More complete descriptions of the study sites can be found in Lesica (1985) and Schassberger (1988).

In May, 1987, we established permanent belt transects of 12 adjacent 1-m² plots at both sites following the methods outlined in Lesica (1987). Individual A. fecunda plants were mapped and recorded using the following system:

- S = Seedling (rosette less than 15 mm diameter)
- R - indicates the number of rosettes (> 15 mm diameter) per plant
- I - indicates the total number of inflorescences (stems) per plant
- F - indicates the total number of fruits produced by the plant

Thus, a plant with two rosettes, three stems and a total of nine fruits would be recorded as R1-I3-F9. In cases where plants had not finished blooming, two flowers or flower buds were recorded as one fruit. Since a first year plant can bloom and set fruit (Lesica and Shelly, personal observation), the above system describes size rather than age classes.

We also noted the presence of recently disturbed soil and evidence of livestock trampling. We did not record seedling-size plants at the Birch Creek site in 1987. We collected 25 randomly selected fruits at each site starting in 1989. Each fruit was hand-dissected and the number of seeds in each was recorded. We read the transects on May 19-20, 1987; May 19-20, 1988; May 24-25, 1989 and May 29-30, 1990. In 1987 we recorded data from 12 quadrats at Birch Creek. In 1988 this number was increased to 14.

Population growth rate was calculated by taking the change in number of individuals over one year, and dividing this by the number of individuals present in the plot at the beginning of that year. Negative growth rates reflect a decreasing population size.

RESULTS AND DISCUSSION

A summary of the data from four years of long-term monitoring is presented in Table 1. Fecundity, as measured by percentage of plants fruiting, fruits/plant, fruits/inflorescence and seeds/fruit increased or was stable at Charley's Gulch in 1990 compared to 1989; however, these same parameters were all noticeably lower at Birch Creek. Population growth was positive at Charley's Gulch but negative at Birch Creek.

In 1989 most of Montana received above-normal precipitation in late summer and early autumn, and although snowpack was light in southwestern Montana during the following winter, late spring precipitation was also above average. Since germination of Arabis fecunda seed occurs readily without any cold treatment, the wet period in late summer and early autumn should have resulted in high levels of recruitment and strong seedling growth. Both higher than average levels of autumn and spring precipitation should have resulted in an increase in fecundity. Arabis fecunda populations at Charley's Gulch did experience an increase in both recruitment and fecundity. The negative response at Birch Creek, only five miles distant, is difficult to explain. Negative growth may be the result of mortality due to disturbance of the habitat by livestock or ungulate grazers, but we did not observe recent slumping of the soil as in 1988. Future observations may help explain this dilemma.

Table 1. Population density and fecundity statistics for Arabis fecunda in long-term monitoring transects in the Pioneer Mountains, 1989-1990.

	<u>Year</u>	<u>Vipond Park</u>	<u>Lime Gulch</u>
Density (plants/m ²)	1989	15.8	15.4
	1990	21.6	18.5
# plants fruiting	1989	95	6
	1990	208	158
% plants fruiting	1989	25.1%	1.6%
	1990	41.9%	35.6%
Mean # fruits per fruiting plant	1989	10.8	3.2
	1990	19.1	9.3
Mean # fruits per inflorescence	1989	5.5	1.7
	1990	9.8	3.3
% plants with more than one rosette	1989	20.3%	12.2%
	1990	22.1%	14.0%
% one-rosette plants with fruit	1989	23.8%	0.9%
	1990	39.5	35.1%
% multi-rosette plants with fruit	1989	29.9%	6.7%
	1990	50.0%	38.7%
Population growth	1989	--	--
	1990	36.7%	21.9%
Mean # seeds per fruit (\pm SD, n=25)	1989	34.2 \pm 10.5	31.1 \pm 5.6
	1990	26.0 \pm 10.3	34.3 \pm 7.6

The percentage of plants with more than one rosette has remained constant at both sites for the entire period of our study. The Charley's Gulch population has consistently had 3-4 times as many multi-rosette plants as Birch Creek. We do not know if this difference is a result of a plastic response to environmental differences or genetic differences between the two populations.

To date we have observed the two populations for a period of three years. During this time fecundity and recruitment have fluctuated in both populations. Nonetheless, no definite trends are discernable, and both populations appear to be stable.

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Appendix A. Performance of individual Arabis fecunda plants in permanent monitoring transects in Ravalli County in 1987, 1988 and 1989. Seedlings were not recorded at Birch Creek in 1987. An asterisk (*) indicates a plant lost due to slumping soil. A "b" indicates a plant that has "bolted," produced an inflorescence from the terminal bud.

	Charley's Gulch			
	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
1.	S	R1	R1-I3-F10	R1-I5-F19
	R1-I1-F2	R1-I1-F3	R3	R3-I3-F9
	S	R2	R2-I3-F9	R2-I4-F27b
	S	R1	--	--
	R1-I4-F15	R1-I5-F23	--	--
	--	--	S	--
	--	--	--	S
2.	S	R1-I1-F6	R1-I6-F31	--
	--	--	--	R1
3.	NO PLANTS			
4.	R1-I3-F5	R1	R1-I6-F33	R1-I1-F3
	R2-I4-F11	R2-I1-F5	R2-I13-F58	R2-I6-F19
5.	S	--	--	--
	R1-I5-F15	R1-I2-F5	R1	R1-I3-F14
	--	--	--	S
6.	S	--	--	--
b	R1-I1-F4	R1-I1-F5	--	--
c	R1-I5-F13	R1-I2-F12	R1	R1-I4-F15
d	--	R2	--	--
e	--	S	--	--
f	--	S	--	--
g	--	S	--	--
h	S	R1	R1	R1-I1-F4
i	--	--	S	--
j	--	--	S	R1
k	--	--	--	S
l	--	--	--	S
m	--	--	--	S
n	--	--	--	R1
o	--	--	--	S
p	--	--	--	S
q	--	--	--	S
r	--	--	--	S
s	--	--	--	R1
t	--	--	--	R1
u	--	--	--	S

7.	R1-I5-F11	R1-I13-F17	--	R1-I5-F17
b	R1-I1-F2	R2	R2-I4-F9	R2
c	R1-I2-F3	--*	--	--
d	S	S	--	--
e	S	R2	R3-I5-F21	R2-I5-F18
f	R1-I3-F1	R1-I4-F17	R1-I5-F17	R1-I7-F27
g	--	--	R1	R1
h	--	--	R1	R1
i	--	--	R1	R1
j	--	--	--	S
k	--	--	--	S
8.	S	R1	R1-I6-F29	R1
b	S	--	--	--
c	S	--	--	--
d	S	R1	R1-I6-F42	R1-I1-F8
e	S	R1	R1-I2-F12	R1-I4-F1
f	R2-I1-F1	R2	R2	R1
g	S	R1	--	--
h	R1-I3-F2	R1-I1-F2	R1	R1
i	R2	R2	--	--
j	R1-I4-F9	R2	R2-I7-F33	R1-I2-F6
k	S	--	--	--
l	S	--	--	--
m	S	S	--	--
o	R3	R3	R3-I1-F5	R3-I3-F0
p	R4	R3	--	--
q	R1-I1-F2	R1	R1	--
r	R1	R1	R1	R1-I3-F15
s	S	--	--	--
t	--	R1	R1-I2-F3	--
u	--	R1	R1-I4-F3	R1-I3-F9
w	--	R1	--	--
x	--	--	S	--
y	--	--	S	--
z	--	--	S	--
aa	--	--	--	S
bb	--	--	--	R1
9.	S	--	--	--
b	R1-I1-F7	R2	R2-I1-F6	R2-I9-F32
c	R3-I3-F5	R3	R3-I3-F8	R3-I8-F27
d	S	R1	--	--
e	R2-I1-F2	R2	--	--
f	S	--	--	--
g	R2-I2-F6	--	--	--
h	S	R1	R1-I5-F22	R1-I6-F31
i	S	R2	R3	--
j	R2	R2	R2	R2
k	R1	R1	R1	R1
l	R1	R1	R1	R1-I8-F55
m	R3	R3	--	--

n	R2	R2	R2	R2-I3-F18
o	R2-I1-F2	R2	R2	R2-I5-F14
p	R3-I2-F4	R2	R2	R2-I5-F22
q	R2-I2-F4	--	--	--
r	R1-I3-F8	R1	R1-I4-F11	R1-I5-F14
s	R1	R1	R1-I2-F5	R1-I3-F9
t	--	S	--	--
u	--	R2	--	--
v	--	R2	R2	R1S1
w	--	--	R1	--
x	--	--	S	R1
y	--	--	S	R1
z	--	--	--	S
10.	R2	R2	--	--
b	R1-I3-F6	R1	--	--
c	R1	R1-I1-F2	R1-I5-F12	R1-I4-F13
d	R1	R1	R1-I1-F1	R1-I4-F21
e	R2-I2-F5	R2	R2-I2-F8	R2-I3-F9
f	S	--	--	--
g	S	--	--	--
h	R1-I6-F0	--	--	--
i	--	--	--	R1
j	--	--	--	R1-I3-F9
k	--	--	--	S
l	--	--	--	R1
m	--	--	--	S
11.	R3-I4-F8	R3	R3-I1-F4	R3-I11-F43
b	R1-I1-F2	R1	R1	R1S1
c	R1-I1-F1	R1	R1	R1-I4-F5
d	R3	--	--	--
e	R1	R1	R1	R1
f	R1	R1	R1	R1
g	R1	R1	R1	R1
h	R2	R2	R2	R2
i	R3-I3-F5	R3	R3	R3-I6-F7
j	--	--	S	R1
k	--	--	--	S
l	--	--	--	R1
12.	R2-I1-F4	--	--	--
b	R1-I1-F2	R1	R1-I1-F4	R1-I3-F13
c	R1-I1-F2	R1	--	--
d	R2	R2	R1	--
e	--	S	R2	R2
f	--	--	R1	R1
g	--	--	S	R1
h	--	--	S	R1-I2-F6
i	--	--	--	S3
j	--	--	--	S5

Birch Creek

<u>Plot #</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
1.	R1	R1	R1-I1-F7	R1
b	R1	R1	R1	R1
c	R3	R4	--	--
d	R2-I3-F6	R2	R2-I1-F5	--
2.	R1	---*	--	--
b	R1	---*	--	--
c	R1	---*	--	--
d	R1	---*	--	--
e	R1	R1	R1-I8-F56	--
f	R1	--	--	--
g	R1-I1-F3	--	--	--
h	R1	R1	R1	--
i	R1	R1	R1-I7-F36	--
j	R1	R1	R1	R1
k	R1-I2-F3	---*	--	--
l	--	--	R1-I1-F5	--
m	--	--	--	R1
n	--	--	--	R1-I3-F6
3.	R1-I1-F1	---*	--	--
b	R1-I2-F4	---*	--	--
c	R1	---*	--	--
4.	R1	R1	R1	R1
b	R1	R1	R1	R1-I2-F0
c	--	R2	--	--
d	--	R1	--	--
e	--	R1	--	--
5.	R1	--	--	--
b	R1	R1	R1	R1
c	R1	R1	R1	--
d	R1	--	--	--
e	R1	R1	R1	R1
f	R2-I1-F6	R1	--	--
g	R1	R1	R1	R1
h	--	--	R1	R1
i	--	--	--	R1
6.	R1	--	--	--
b	R1	R1	R1	R1
c	R1-I1-F3	R1	R1	R1
d	R1-I2-F6	R1-I3-F9	R1-I2-F3	R1
e	R2-I2-F5	--	--	--
f	R1	--	--	--
g	R1	R1-I2-F12	R1-I1-F5	R1-I2-F6
h	R1	R1	R1	R1S1

i	--	R2	R1	R1
j	--	R1	R3-I1-F3	R4-I3-F9
k	--	R1	R1	--
l	--	R1	R1-I4-F18	R1
7.	R1-I1-F1	R1	R1-I3-F13	R1-I1-F2
b	R1	--	--	--
c	R1-I2-F2	R1	R1-I5-F39	R1-I1-F5
d	R1	--	--	--
e	--	--	R2	--
f	--	--	R1-I2-F12	--
g	--	--	S	R1
8.	R1-I1-F3	R3	R3-I3-F17	R3-I1-F5
b	R1	R1	R1	R1-I1-F6
c	R1-I2-F4	R1	R1-I1-F3	--
d	R1	R1	--	--
e	R1	R1	--	--
9.	R2-I2-F5	---*	--	--
b	R1-I3-F6	---*	--	--
c	R1-I1-F5	---*	--	--
d	R1	---*	--	--
e	R2-I1-F2	---*	--	--
10.	--	S	S	R1
b	--	S	--	--
c	--	--	--	R1
d	--	--	--	R1
e	--	--	--	R1
11.	R1	R1	--	--
b	R1	--	--	--
c	R1	--	--	--
d	R1	R1	R1-I2-F10	R1-I1-F0
e	R1	R1-I1-F3	R1-I5-F38	R1
f	--	R1	R1-I2-F10	R1
g	--	R1	R1	R1-I1-F2
h	--	R1	R1	R1
i	--	--	R1-I1-F8	R1
j	--	--	R1	R1-I3-F19
l	--	--	--	R1
12.	R1-I3-F7	R1	R1-I4-F21	R1
b	R1	R1	R1-I1-F5	R1-I2-F1
c	R1	--	--	--
d	R1	--	--	--
e	R1-I1-F1	--	--	--
f	R1	R1	R1	S
g	R1-I2-F3	R1	R1-I6-F22	--
h	R1	--	--	--
i	R1	R1	R1-I2-F10	R1

j	--	R1	R1-I5-F28	R1-I1-F2
k	--	R1	R1-I3-F11	R2
l	--	S	R1	S
m	--	S	S	S
n	--	S	S	S
o	--	R1	R1	R1-I1-F2
p	--	R1	R1	R1
q	--	--	R1	R1
r	--	--	R1	S
s	--	--	R1	R1
t	--	--	S	S
13.	NOT	R1	R1-I3-F7	R1-I1-F5b
b	RECORDED	R1	R1-I1-F5	R1-I2-F1b
c		R1-I1-F5	R1-I11-F78	--
d		R1	R1-I6-F35	--
e		R1	R2	R2
f		R1-I5-F22	R1-I3-F65 ^b	--
g		--	--	R1
h		--	--	R1
i		--	--	R1
14.	NOT	R1-I5-F34	R1-I4-F35	--
b	RECORDED	R1	R1	--
c		R1	R1	R1-I5-F4
d		R1	R1-I2-F83 ^b	--
e		R1-I2-F13	--	--
f		--	R2-I2-F12	R1
g		--	R1	--
h		--	R1	R1
i		--	--	R1
j		--	--	S
k		--	--	S

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Table 1. Population density and fecundity data for Arabis fecunda in long-term monitoring transects, 1987-1990.

		<u>Birch Creek</u>	<u>Charley's Gulch</u>
Density (plants/m ²)	1987	4.8	6.5
	1988	4.6	6.0
	1989	4.9	5.5
	1990	4.6	7.0
Population growth	1988	-0.14	-0.08
	1989	0.05	-0.08
	1990	-0.07	0.18
% plants fruiting	1987	35%	42%
	1988	11%	15%
	1989	47%	36%
	1990	27%	42%
# fruits per fruiting plant	1987	3.8	5.1
	1988	14.0	8.8
	1989	22.0	15.8
	1990	4.4	16.0
# fruits per inflorescence	1987	2.2	2.1
	1988	5.2	3.0
	1989	6.8	3.9
	1990	2.4	3.7
% plants with more than one rosette	1987	9%	27%
	1988	8%	38%
	1989	9%	30%
	1990	8%	25%
% one-rosette plants with fruit	1987	29%	37%
	1988	12%	22%
	1989	45%	35%
	1990	25%	34%
% multi-rosette plants with fruit	1987	83%	57%
	1988	0%	4%
	1989	67%	40%
	1990	40%	62%
Mean # seeds per fruit (\pm SD, n=25)	1989	38.6 \pm 5.6	32.3 \pm 4.7
	1990	30.4 \pm 5.6	31.2 \pm 5.2

INTRODUCTION

In order to adequately protect populations of an organism, it is necessary to understand its life history and population dynamics (Massey and Whitson 1980, Sutter 1986, Palmer 1987).

Sapphire rockcress (Arabis fecunda Rollins) is a rosette-forming perennial in the Mustard Family (Brassicaceae). This recently described species (Rollins 1984) is endemic to highly calcareous, azonal soils in the foothills of the Sapphire Range in Ravalli County and in the Pioneer Range in Beaverhead and Silver Bow counties, Montana (Lesica 1985, Schassberger 1988). Arabis fecunda generally occurs on steep, often eroding slopes with low vascular plant density. In Ravalli County, populations of A. fecunda are thought to be threatened by livestock grazing and encroachment by an aggressive exotic weed, spotted knapweed (Centaurea maculosa) (Lesica 1985, Schassberger 1988). In Silver Bow and Beaverhead counties, populations may be threatened by mining activity and livestock grazing. Arabis fecunda is a candidate for listing as a threatened or endangered species by the U.S. Fish and Wildlife Service (USDI, FWS 1990) and is considered threatened in Montana (Lesica and Shelly 1991).

Here we report the results of the first two years of a long-term demographic monitoring study at two sites in the Pioneer Range on Beaverhead National Forest.

STUDY SITES

Lime Gulch

Location: Five miles west of Interstate Highway 15 on the north side of Birch Creek Road, approximately 1/4 mile up Lime Gulch from the road; T5S R10W Sec14; approximately 6,200 ft elevation.

Vipond Park

Location: Approximately 12.5 miles west of Melrose on the Canyon Creek Road, at the corner of the road overlooking the kilns; T2S R10W Sec 8; 7,200 ft elevation.

Further information on the study sites and location of the transects can be found in Lesica (1989).

METHODS

In 1989 we established two permanent belt transects of 12 adjacent m² plots at each site following the methods outlined in Lesica (1987). Lime Gulch transects were read on June 15, 1989 and June 15, 1990. Vipond Park transects were read on June 16, 1989 and June 29, 1990. Individual A. fecunda plants were mapped and recorded using the following system:

S = Seedling (rosette less than 15 mm diameter)

R - indicates the number of rosettes (> 15 mm diameter) per plant

I - indicates the total number of inflorescences (stems) per plant

F - indicates the total number of fruits produced by the plant

Thus, a plant with two rosettes, three stems and a total of nine fruits would be recorded as R1-I3-F9. In cases where plants had not finished blooming, two flowers or flower buds were recorded as one fruit. Since a first year plant can bloom and set fruit (Lesica and Shelly, personal observation), the above system describes size rather than age classes.

At each site we collected 25 randomly-chosen fruits. We dissected each fruit and recorded the number of viable-appearing seeds in each.

Population growth rate was calculated by dividing the increase in individuals over the previous year divided by the number of individuals present in the plot the previous year. Negative growth rates reflect a decreasing population size.

Many of the plants at Vipond Park were still flowering when we read the transects in 1989, thus we read these transects in late June in 1990.

In 1990 the No. 10 quadrat of the Vipond Park East transect was so crowded that interpretation was impossible, thus this quadrat was dropped from the analyses.

RESULTS AND DISCUSSION

A summary of the data collected in 1989 and 1990 is presented in Table 1. At both sites plant density increased substantially, and this increase is reflected in the high positive growth rates. The percentage of plants producing fruit and the mean number of fruits per fruiting plant were also substantially higher at both sites. This change was particularly dramatic at the Lime Gulch

site where fecundity was very low in 1989. Nonetheless, fecundity, as measured by both of these statistics, was higher at the Vipond Park site, and population growth was also higher at this site. The percentage of plants with more than one rosette remained constant at both sites. The mean number of seeds per fruit was constant at Lime Gulch but decreased at Vipond Park.

In 1989 most of Montana received above-normal precipitation in late summer and early autumn, and although snowpack was light in southwestern Montana during the following winter, late spring precipitation was also above average. Previous to this period, southwestern Montana had experienced two years of serious drought conditions. Since germination of Arabis fecunda seed occurs readily without any cold treatment (Lesica, unpublished data), the wet period in late summer and early autumn probably resulted in high levels of recruitment and strong seedling growth. Both higher than average levels of autumn and spring precipitation may have contributed to the dramatic increase in fecundity.

Generally Arabis fecunda plants do not produce fruit during their first year; however, in 1990, 21% (49 of 237) of the newly recorded plants at Vipond Park and 11% (11 of 151) of the newly recorded plants at Lime Gulch produced fruit. We believe that this phenomenon is a result of the combination of a wet fall followed by a wet spring.

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Appendix A. Performance of individual *Arabis fecunda* plants in permanent monitoring transects. See Methods for description of codes. Individuals are identified by letters within each plot. A "b" indicates plants that have "bolted," produced a large, multi-branched inflorescence from the terminal bud.

Vipond Park West

Plot

	<u>1989</u>	<u>1990</u>
1.	R2-I3-F12	R1
b	R3	R2-I1-F11
c	R2	R2
d	R1-I2-F7	R1-I2-F10
e	R1	--
f	R1-I4-F29	R1-I1-F43b
g	R1	--
h	S	--
i	R1	R1-I1-F5
j	S	--
k	R1	R2-I5-F29
l	S	R1
m	R1	--
n	R1-I1-F25	R1-I1-F14
o	R1-I3-F15	R1-I1-F44b
p	R1-I3-F9	R1-I1-F3
q	R6-I5-F29	--
r	R1	S
s	R1	S
t	R1	R1
u	--	R1
v	--	S
w	--	S
x	--	S3
y	--	R1
z	--	R3
aa	--	S3
bb	--	R2-I2-F8
cc	--	R1
dd	--	S1
ee	--	R2
ff	--	R1
gg	--	R1
hh	--	S
2.	R2	R2-I2-F16b
b	R1	--
c	R1	R1-I1-F1
d	R2	R2-I1-F11b
e	R3	--

f	R1	--
g	R1	R1-I1-F19
h	R1	--
i	R1	--
j	R1-I1-F18	--
k	R3	--
l	R1-I1-F22	--
m	R1-I1-F20	--
n	R1-I2-F17	--
o	R1	--
p	R1	R1
q	R2-I1-F13	R2-I2-F40b
r	R2-I4-F21	R1-I1-F0
s	R1-I5-F33	--
t	R1	R1
u	R1	R1
v	R1	R1
w	R1-I1-F16	--
x	R1	R1-I1-F23b
y	R3-I1-F5	--
z	R2	R2-I4-F?b
aa	R1	R1-I3-F12
bb	R1	R1-I1-F25b
cc	R1	R1-I1-F2
dd	R1	--
ee	R1	R1-I1-F25b
ff	R1	R1-I1-F32b
gg	R1	--
hh	R1	R2-I2-F26b
ii	R1	--
jj	R1	--
kk	R1	--
mm	--	R1-I1-F21b
nn	--	R1-I1-F2
oo	--	S2
pp	--	R1
qq	--	S
rr	--	R1
ss	--	R2
tt	--	R1
uu	--	R1
vv	--	R1-I1-F16
ww	--	R1-I1-F10
xx	--	R1
yy	--	R1
zz	--	S
aaa	--	R2
bbb	--	R1-I1-F2
ccc	--	R1
ddd	--	R1-I1-F2
3.	S	--

b	R1	R1-I1-F4
c	R1	R1-I1-F16b
d	R1	S3
e	R1	R1-I1-F19b
f	R1-I3-F9	R1-I1-F22b
g	R1-I2-F17	R1-I5-F26
h	R1	--
i	R2	R2-I2-F36b
j	--	R2S3
k	--	R1
l	--	S
m	--	S
n	--	R1-I2-F13
o	--	R1-I4-F22
p	--	S
q	--	R1-I5-F26
r	--	R1
s	--	R1-I1-F2
t	--	S
u	--	S
4.	R2-I2-F9	R2-I2-F49b
b	R1	R1-I1-F5
c	R1	--
d	R1-I2-F13	--
e	R1	R1
f	R1-I3-F18	R2-I1-F24b
g	R1	R1
h	R1	--
i	R2	R2-I2-F2
j	R1-I3-F6	R2-I2-F6
k	R1	--
l	R1	R1
m	R2	S2
n	R1	R1
o	R1	S
p	R1	--
q	R1	R1
r	R1	R1
s	R2-I1-F5	R2-I1-F3b
t	R1-I1-F3	R1-I1-F27b
u	R4	--
v	R1	--
w	R1	--
x	R1	R1-I2-F10
y	R1	R2-I1-15b
z	R1	R1
aa	R1	R1
bb	--	S
cc	--	S
dd	--	R2
ee	--	R1

ff	--	R1
gg	--	R1
hh	--	R1-I2-F12
ii	--	R1S2-I3-F14
5.	R2	R5
b	S	S4
c	R1	R1
d	R1	S
e	S	--
f	S	--
g	R1	R1-I1-F2
h	S	--
i	R8	--
j	R4	R3-I4-F23
k	R1	--
l	--	R1-I1-F43b
m	--	S2-I2-F6
n	--	R1
6.	R1	R1-I1-F53b
b	R1	R1
c	R1-I2-F11	R1-I2-F19
d	S7	--
e	S5	S4
f	S	--
g	S2	--
h	R1	R2-I1-F28b
i	S	R1-I1-F9b
j	S8	R5-I1-F8
k	R1	R1-I3-F10
l	R1	R1-I1-F28b
m	R1	R1
n	R1	R1
o	S	S
p	R1	R1-I1-F49b
q	R1	--
r	R1	R1-I4-F17
s	S5	R3-I1-F4b
t	--	S
u	--	R2
v	--	R1
w	--	R2
x	--	S
y	--	R2-I1-F11b
z	--	S3
aa	--	S
7.	R5	--
b	R1	R1-I5-F18
c	R1-I3-F11	--
d	R1-I3-F11	R1-I6-F40

e	R1	R1
f	R2-I1-F2	R2-I1-F0
g	R1	R1
h	R1	R1-I1-F34b
i	R1	R1-I2-F11
j	R1	R1
k	R1	--
l	S	R1
m	R1-I1-F8	R1
n	R1-I2-F8	R1-I1-F4
o	R1	R1
p	S	S3
q	S	R1
r	R1	--
s	R1	R1-I1-F2
t	--	R1-I1-F1
u	--	R1-I1-F22b
v	--	R1-I6-F23b
w	--	R1S1
x	--	R1
y	--	R2-I3-F27b
z	--	S
8.	S	R1
b	R3	R2-I1-F5
c	S	S
d	R2	R2-I1-F23b
e	R2	R2-I1-F1
f	R1	--
g	R1-I1-F7	--
h	R1	R1-I2-F2
i	R1-I1-F6	R1
j	R1-I1-F5	R1-I1-F23b
k	--	R2
l	--	R1
m	--	R1
9.	R1-I2-F7	--
b	S	R1
c	R1-I4-F26	--
d	R1	R1-I2-F6
e	R1	R1-I1-F23b
f	R1-I2-F11	R1-I1-F30b
g	R1	R1
h	R1	--
i	R1-I1-F3	R1-I1-F2
j	R1	--
k	R2	R2
l	R2	--
m	R1-I1-F4	--
n	R1	R1
o	--	R1-I2-F8

p	--	R1
q	--	S
r	--	S
s	--	R1
t	--	S2
u	--	R1
v	--	R1
w	--	R1-I5-F16
x	--	R1
y	--	R2
z	--	S
aa	--	R1-I1-F53b
10.	R1	R1
b	R3-I1-F9	--
c	R3	R2-I3-F5
d	R3-I1-F1	R2-I5-F11b
e	R2	R2
f	R1	S
g	R1	R1-I1-F27b
h	R1	R1-I1-F4
i	R3	R2
j	--	S2
k	--	S
l	--	S
m	--	S
11.	R1	R1S1
b	R1	R1-I3-F8
c	S3	R1S2
d	R2-I3-F13	--
e	R1	R1-I1-F3
f	R1	R1-I1-F15b
g	S	R1-I1-F10
h	--	R1-I1-F32b
i	--	R1S2
j	--	R1
k	--	R1-I1-F23b
l	--	S2-I2-F9b
12.	S	R1-I1-F3
b	R3	--
c	R1	R1-I4-F22
d	R1-I1-F4	R1-I2-F2
e	R1	R1-I1-F2
f	R1	R1
g	S	R1
h	S	--
i	S2	--
j	S	R1
k	S	S
l	R1	R1-I1-F27b

m	R1	R1
n	R1	R1-I1-F5
o	R1	R1-I1-F52b
p	R1	R1-I1-F19b
q	R1-I3-F11	R1-I1-F46b
r	R4-I1-F3	R3-I1-F24b
s	R1	R1-I1-F37b
t	R1	R1-I1-F50b
u	R1	R1-I1-F3
v	--	R1

Vipond Park East

<u>Plot</u>	<u>1989</u>	<u>1990</u>
1.	R1	R1
b	S	R1-I1-F4
c	R1-I2-F5	R1-I1-F45b
d	R2	R2-I2-F54b
e	R3	--
f	R2	R1S1
g	R2	--
h	R1-I2-F8	--
i	R1	R1-I1-F50b
j	S	R1
k	S	R1
l	--	S2
m	--	R1-I1-F19b
n	--	S
o	--	R1
p	--	S
q	--	R1
r	--	R1-I2-F15
s	--	R1
t	--	R1
u	--	R1
v	--	R1-I1-F20b
w	--	R1
x	--	S2
y	--	R1-I3-F12
z	--	R1
aa	--	R1
2.	R1	R1-I1-F21b
b	R1	R2
c	S	--
d	R1	R1-I1-F2
e	S	R1
f	R3-I3-F20	R3-I1-F3
g	R1	R1-I1-F2

h	R2-I2-F4	R2-I2-F40b
i	--	S1-I1-F4
j	--	R1
k	--	R1
l	--	S
m	--	S
n	--	R1-I1-F9b
o	--	S
p	--	R1
q	--	R1
r	--	R1
s	--	S
t	--	R1
u	--	R1
v	--	S
w	--	R1
x	--	R1-I5-F25
Y	--	R1
z	--	S
aa	--	R1
bb	--	S
cc	--	S
3.	R1-I1-F3	--
b	R1	--
c	R1-I1-F3	R1-I1-F32b
d	R1-I3-F13	R1-I1-F14b
e	R1	--
f	S	R1-I1-F38b
g	R1-I1-F5	R1-I1-F29b
h	R1-I4-F16	--
i	R1-I1-F3	S
j	R1-I2-F9	S
k	S2	R2-I4-F29b
l	R1	R1-I1-F9b
m	R1	R1-I6-F33
n	R1	R1-I1-F10b
o	R1-I2-F4	R1-I1-F24b
p	--	S
q	--	R1-I1-F19b
r	--	R1-I1-F27b
s	--	S
4.	R1	R1
b	R4	R3-I3-F18b
c	R3-I1-F1	R4-I4-F21b
d	R1	R1
e	R1	--
f	R1-I1-F2	--
g	--	R3
h	--	S
i	--	S

j	--	S2
k	--	S
l	--	R1-I2-F2
m	--	S
n	--	R1
5.	R1	R1
b	R1	R1-I4-F18
c	R1	--
d	R1	R1
e	S	R1
f	S	--
g	S	R1
h	R2	R2-I1-F5
i	S	S
j	S	--
k	S	R1
l	S	--
m	S	R1-I1-F8b
n	R1-I1-F25	--
o	R1	R1
p	R1-I4-F9	R1-I1-F21b
q	--	S
r	--	R1
s	--	S3
t	--	S
u	--	R1-I2-F11
v	--	R1
w	--	S
6.	R2	R1-I1-F6
b	S	S
c	R2	R2
d	R1	R1-I1-F8b
e	R2	R2-I5-F31b
f	R1	R2
g	R1	--
h	R4-I1-F1	S
i	R1-I4-F19	R1-I1-F26b
j	R2	R1-I4-F74b
k	R1	R1
l	R1	--
m	R1	R1
n	R2-I3-F15	R2-I6-F21b
o	R1-I1-F13	R1S3
p	--	R1
q	--	R1
r	--	R1
s	--	R1-I7-F43
7.	R1-I1-F4	R2-I2-F17b
b	R1-I1-F9	R1-I1-F42b

c	R1	R1-I2-F2
d	R1-I3-F14	R3-I4-F28
e	R1	--
f	S4	R5
g	S	--
h	R1	R1-I1-F4
i	R3	R4-I2-F4
j	S2	R2
k	R1-I2-F8	R1-I1-F19b
l	R1	R1
m	R1	R1-I1-F3
n	R1	R1-I1-F3
o	R1	R1-I1-F16b
p	--	R1
q	--	R1
r	--	S
s	--	R1
8.	R2-I2-F14	--
b	S	--
c	R1	R1S1
d	S	--
e	R1	R1-I2-F3
f	S	--
g	S	--
h	R1-I1-F2	R1
i	R1	R1-I1-F3
j	R1-I1-F3	R1-I4-F15
k	R1-I3-F14	R1-I1-F37b
l	R1	R1-I1-F16b
m	R2-I1-F4	R1-I1-F10b
n	R1	--
o	R2	R2
p	S	--
q	R1	R1-I1-F2
r	R1	R1-I4-F16
s	R1	--
t	R1	--
u	R1	--
v	R1	--
w	R1-I4-F15	R1-I1-F43b
x	S	--
y	R3-I5-F11	--
z	R1	R1
aa	S	S
bb	S	S
cc	S	S
dd	S	S
ee	R1	R1-I7-F41
ff	R2-I4-F28	S
gg	S	R1-I2-F19b
hh	R1	R1-I1-F31b

ii	R3-I3-F9	R1-I1-F31b
jj	R1	R1-I4-F21b
kk	S	--
ll	S	--
mm	S	S1-I1-F17b
nn	--	S
oo	--	R1
pp	--	S
qq	--	R1
rr	--	S
tt	--	S
uu	--	S
vv	--	S
ww	--	S
xx	--	R1
yy	--	R1
zz	--	S3
aaa	--	R1
bbb	--	R1
ccc	--	S4
ddd	--	S
eee	--	R1-I7-F41
fff	--	S
ggg	--	R1
hhh	--	R1-I1-F5
9.	S	R1
b	S	--
c	R1	R1-I2-F10
d	R2	R2-I2-F6
e	R2	R1-I6-F39
f	R1	R1-I2-F4
g	R1	R1
h	R1-I1-F22	R2S1
i	R1-I5-F11	R1-I1-F17b
j	R1-I2-F7	R2-I2-F22b
k	R2	R2-I2-F55b
l	R1-I3-F10	R1-I1-F46b
m	R1	R1
n	R1-I1-F10	--
o	R1-I1-F2	--
p	R2-I1-F8	S2-I2-F17b
q	S	S2-I1-F24b
r	S	R1
s	R1	S2-I1-F19b
t	R1	R1-I1-F40b
u	R1	R1-I1-F27b
v	R1	R1-I1-F15b
w	R1-I1-F25	R1-I1-F41b
x	R1-I1-F6	R1-I1-F52b
y	--	S
z	--	S

aa	--	S
bb	--	R1-I1-F29b
cc	--	S
dd	--	R2
ee	--	S
ff	--	S
gg	--	R1
hh	--	S3
ii	--	S
jj	--	S2
kk	--	R1
ll	--	R1-I9-F44b
mm	--	R1
nn	--	R1
oo	--	R1
pp	--	S
qq	--	R1
rr	--	R1
ss	--	R2-I2-F8

10.	S	
b	R1	
c	R1	
d	R2-I1-F6	
e	R1	
f	R1-I1-F23	
g	R2	
h	R3	
i	R1	
j	R1	
k	R1	
l	R1	
m	R1-I1-F12	
n	R3-I2-F7	
o	R1	
p	R1-I3-F4	
q	R2-I1-F3	
r	R1-I1-F5	
s	R1	
t	R1-I1-F26	

NOT
TRANSLATED

11.	S2	S1
b	R1	R1
c	S3	S2
d	R1	--
e	R1-I1-F35	R1-I4-F14
f	R1-I3-F12	--
g	R1	R1-I1-F4
h	--	R1
i	--	S
j	--	S
k	--	S

l	--	S
m	--	R2-I4-F14
n	--	S
o	--	S
p	--	S
q	--	S
r	--	S
s	--	S
t	--	R1
u	--	R1
v	--	R10
w	--	S2
x	--	R3-I3-F6
y	--	R1
z	--	R1
aa	--	R1
bb	--	R1
cc	--	S
dd	--	S
ee	--	R2
ff	--	R4-I6-F8
12.	R1	R2
b	R1	--
c	--	S2
d	--	R1
e	--	R3-I1-F7b
f	--	R3-I1-F5
g	--	R4-I1-F7b
h	--	S3
i	--	R1
j	--	S5
k	--	S
l	--	S
m	--	R1S3

Lime Gulch North

1.	R1	R1-I1-F3
b	S	R1
c	R1	R1
d	S	R1
e	R1	R1
f	R1	R1
g	S	R1
h	--	S
i	--	R1
j	--	R1
k	--	S
2.	R1	R1
b	S	R1
c	S	S
d	S	R1
e	R1	R1
f	S	R1
g	R1	R1-I3-F10
h	S	R1
i	R1	R1-I2-F9
j	R1	R1
k	R1	--
l	R2	R2
m	R1	R1-I1-F1
n	R1	R1
o	S	S
p	R1	R1
q	S	R1
r	R1	--
s	R1	R2-I3-F9
t	R1	R1
u	S	R1
v	--	S
w	--	R1
x	--	S
y	--	S2
z	--	R1
aa	--	R1
bb	--	R1
cc	--	S
dd	--	S
3.	S	R1
b	R1	--
c	R2	R2
d	R4	R4
e	S	S
f	R1	R1
g	R2	S

h	R1	R1-I2-F4
i	R1	R1-I6-F24
j	S	--
k	R1	--
l	R1	R1-I4-F15
m	R3	R3-I2-F14b
n	--	R1
o	--	S
p	--	R1
q	--	S
r	--	S
4.	R1	R1-I3-F4
b	R2	R2-I2-F10
c	R1	R1-I3-F5
d	R4	R1-I4-F17
e	R1	R2-I2-F4
f	R1	R1-I2-F26b
g	R1	R1
h	--	R1
i	--	R1
j	--	R1
k	--	R1
l	--	S
m	--	S
5.	R1	R1
b	S	R1
c	S	R2
d	R1	R1
e	R1	R1
f	S	S
g	S	S
h	R1	--
i	R1	R1-I1-F4
j	R1	R1
k	--	R1
l	--	S
m	--	S
6.	R2	R2
b	R1	R1
c	R1	R1-I3-F12
d	R1	R2-I1-F15b
e	R1-I2-F1	--
f	S	--
g	S	--
h	R1	S
i	R1	R1-I3-F8
j	R1	R1
k	R1-I2-F5	R5-I5-F20b
l	R1	R1-I7-F21

m	R1	R2
n	--	R1-I3-F7
7.	R1	R1
b	R1-I2-F6	R1-I5-F20
c	R1	R1-I7-F62b
d	R1	--
e	R1	R1-I2-F4
f	S	--
g	R1	R1-I4-F15
h	R1	R1-I2-F10
i	R1	R1-I1-F3
j	S	S
k	S	R1
l	R1	R1
m	R1	R1
n	R4	R4-I3-F18b
o	R1	R1
p	S	R1
q	S	R1
r	--	R1
s	--	R2
t	--	S
u	--	R1-I2-F7
v	--	R1
w	--	R1
8.	R1	R1-I1-F17b
b	R1	R1-I3-F3b
c	R1	R1-I3-F15
d	S	R1
e	R1	R1-I5-F22b
f	R1	R1-I7-F16b
g	R1	R2
h	R1	--
i	R1	S
j	R1	S
k	R1	R1-I1-F6b
l	S	S
m	S	R1
n	S	S
o	R1	R1
p	S	S
q	R1	R1
r	R1	R1
s	R1	--
t	R1	R4-I1-F5
u	R1	R1-I2-F10
v	R1	R1-I2-F8
w	S	R1
x	S	S
y	R1	R1-I5-F38b

z	--	R1
aa	--	R3
bb	--	S2
cc	--	S
9.	R1	R1
b	R2	R1-I2-F18b
c	R1	R4
d	R1	S3-I1-F1
e	R1	R1-I1-F2
f	R1	R1-I4-F8
g	R1	R1-I4-F14b
h	R1	R1-I1-F3
i	R1	R1
j	R1	R1
k	R1	R1
l	S	S
m	R1	--
n	R1	R1
o	R1	R1
p	R1	R1-I4-F13
q	R1	R1-I3-F14
r	R1	R1-I6-F36
s	S	R1
t	S	--
u	R1	R1
v	R1	R1-I1-F47b
w	R1	R1
x	S	R1
y	R1	--
z	R1	R1
aa	R1	--
bb	R1	R1-I1-F6
cc	S	--
dd	--	R1
ee	--	S
ff	--	S
gg	--	R1
hh	--	S
ii	--	R1
jj	--	R1
kk	--	R1
10.	R1	R1
b	R1	R1
c	R1	R1S1
d	R1	R1-I4-F4
e	R1	--
f	R2	--
g	S	R1
h	R1	R1-I2-F9
i	S	R1

j	R1	R1
k	--	S
l	--	S
11.	R1	R1-I1-F1
b	R1	R1-I3-F12
c	R1	R1-I2-F5
d	S	R1-I1-F5b
e	R1	R1-I1-F2
f	R1	--
g	R1	R1
h	R1	R1-I1-F2
i	R1	R1-I2-F2
j	R1	R1
12.	R1	R1-I5-F8
b	R1	R1-I1-F1
c	R1	R1-I3-F6
d	R3	R3-I2-F10b
e	S	R1
f	R1	R1
g	R1	R1-I7-F24
h	R1	R1-I2-F6
i	S	R1
j	R1	R1-I3-F7
k	R1	R1
l	--	R1
m	--	R1-I3-F11

Lime Gulch South

1.	R1	R1
b	S	R1
c	S	R1-I3-F14
d	S	R1
e	R1	R1-I1-F5
f	--	S
g	--	R1
h	--	S
i	--	S
j	--	S
k	--	R4
l	--	R1
m	--	R1
n	--	R1
o	--	S
2.	R2	R1
b	R1	R1S1-I1-F5
c	R1	R3
d	R1	R1-I3-F10
e	R1	R1

f	S	R1
g	S	R1
h	S	R1
i	S	R1
j	R1	R1-I2-F4
k	R1	R1
l	S	S
m	--	R1
n	--	R1
o	--	R1
p	--	S
q	--	R1
r	--	S
s	--	R1-I1-F3
t	--	S
u	--	R1
3.	R1	R1
b	S	--
c	R1	R1
d	R1	R1-I3-F14
e	R1	--
f	R1	R1-I2-F5
g	R3	--
h	R1	--
i	S	R2
j	R1	--
k	R6	R5-I1-F5
l	R1	--
m	R1	R1-I1-F0
n	R1	R1-I3-F8
o	S	R1
p	R1	R1-I5-F12
q	S	--
r	S	R1
s	R2	R2-I1-F0
t	R1	R1-I1-F3
u	--	S
v	--	S
w	--	S
x	--	R1-I4-F7
y	--	S
z	--	R1
aa	--	R1
bb	--	R1
4.	R1	R1-I2-F2
b	R1	--
c	R4	--
d	R4	R3-I2-F8
e	R1	--
f	R1	--

g	R1	R1-I6-F8
h	S	R1
i	R1	R1-I1-F1
j	S	R1
k	R1	R1-I3-F9
l	S	S
m	R1	R1
n	R1	R1-I2-F8b
o	--	R1
p	--	S
q	--	S
5.	R1	--
b	R1	R1-I1-F18b
c	R1	R1-I1-F4
d	R1	--
e	R1	R1-I1-F1
f	R3	R2
g	R1	--
h	R3	R6-I1-F1
i	S	--
j	R1	R1-I1-F2
k	S	R1
l	S	R1
m	S	R1
n	R2-I1-F0	R2-I1-F6
o	R1	--
p	R1	S
q	R1	R1-I3-F10
r	S	S2
s	S	--
t	S	--
u	S	--
v	R1	R1
w	R2	--
x	R1	R1
y	R6	--
z	R1	R1-I5-F14
aa	R2	S2
bb	S	S
cc	R4	--
dd	R3	--
cc	--	R1-I3-F9
dd	--	S
ee	--	R1-I1-F0
ff	--	S
gg	--	S
hh	--	R5
ii	--	R1
jj	--	R1
kk	--	R1
ll	--	S

mm	--	S
nn	--	S
oo	--	S
pp	--	S
qq	--	S
rr	--	R1
ss	--	R1
tt	--	R1-I2-F16
uu	--	S
vv	--	R1-I2-F6
ww	--	S
xx	--	R1
yy	--	S
6.	R2	R1-I2-F13b
b	S	R1
c	S	R1-I3-F5
d	S2	S2
f	S	--
g	R1	R1
h	R1	R1-I2-F17b
i	S	R1
j	R1	R1-I1-F1
k	R1	R1-I2-F7
l	S	R1
m	R1	R1-I1-F1
n	R3	R3
o	R1	R1
p	S	R1
q	R1	--
r	R1	R1-I4-F8
s	R1	--
t	R2	R2-I2-F1
u	R1	R2-I4-F0
v	R1	--
w	--	S
x	--	R1
y	--	S
z	--	R1-I9-F24
aa	--	R1
bb	--	S
cc	--	R1-I1-F4
dd	--	R1
ee	--	S
ff	--	R1
gg	--	R4-I4-F1
7.	R1	R1
b	R1	R1
c	R1	R1-I3-F3
d	S	--
e	R1	R1S2

f	R5	R1-I3-F25b
g	--	R1
h	--	R1-I1-F1
i	--	R1-I3-F1
j	--	R3-I1-F2
8.	R1	R2
b	R1	R1-I2-F3
c	R1	R1-I2-F5
d	R1	R2-I2-F6
e	R1	R2S3
f	S	--
g	R1	R1
h	R1	R4
i	R1	R1-I1-F4
j	R1	R2
k	R1	R2S1
l	--	S
m	--	S
n	--	R1
o	--	S7(?)
p	--	R1
9.	R1	R1
b	R1	R1
c	S	--
d	R1	R1-I1-F2
e	R2-I3-F4	--
f	R1	R4
g	R1	R4
h	R1	R1-I5-F17b
i	S	--
j	R1	R1-I3-F13
k	S	--
l	R4	R3
m	R1	R2S3
n	R1	R1-I6-F14
o	R2	R2-I3-F2
p	R1	S
q	R1	R1-I1-F0
r	R2	R2-I9-F19
s	--	R1
t	--	S
u	--	R1-I1-F2
v	--	R1
w	--	S
x	--	R2
y	--	R1-I1-F6
10.	R1	R1-I1-F13b
b	R1	R1-I1-F8b
c	R2	--

d	R1	R3-I2-F4
e	R1	R1-I2-F5
f	R1	R1-I8-F29
g	S	--
h	R1	R1-I3-F4
i	R1	R1-I1-F5
j	R1	R1-I3-F2
k	R1	--
l	R1	R1S1
m	R1	R1-I4-F14
n	S	R1
o	R2	S2
p	R2	R1S1
q	R1	--
r	R1	R1-I4-F8
s	R2	R2
t	R1	R1-I1-F5
u	S	S
v	R3	R1S1
w	S	R1
x	R1	--
y	R3	R1S3
z	R1	--
aa	R1	--
bb	R1	R1-I3-F8
cc	R1	S5
dd	R1	R1
ee	--	R1
ff	--	S
gg	--	S
hh	--	R3
ii	--	S3
jj	--	R1
11.	R1	R1-I4-F8
b	R1	--
c	R5	--
d	R1	--
e	R1	R1-I2-F17b
f	R1	R1-I3-F12
g	R1	--
h	R1	R1-I2-F31b
i	R1	R1
j	R2	R3-I7-F20
k	R1	--
l	R6	--
m	R3	--
n	S	R1
o	R1	R1-I1-F14b
p	R1	--
q	S	S
r	S	R1

s	R1	--
t	--	R1
u	--	S
v	--	S
w	--	R1
x	--	R1
y	--	S
z	--	R1-I2-F2
aa	--	R1
bb	--	R1-I1-F2
12.	R1	R1-I3-F1
b	R1	R1-I5-F16
c	R1	R1-I1-F0
d	R1	R1-I5-F1
e	R2-I1-F3	R1-I2-F2
f	S	R1
g	--	R1
h	--	R1-I1-F6
i	--	R1
j	--	R1-I1-F2

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