Appendix E

Groundwater Model Results

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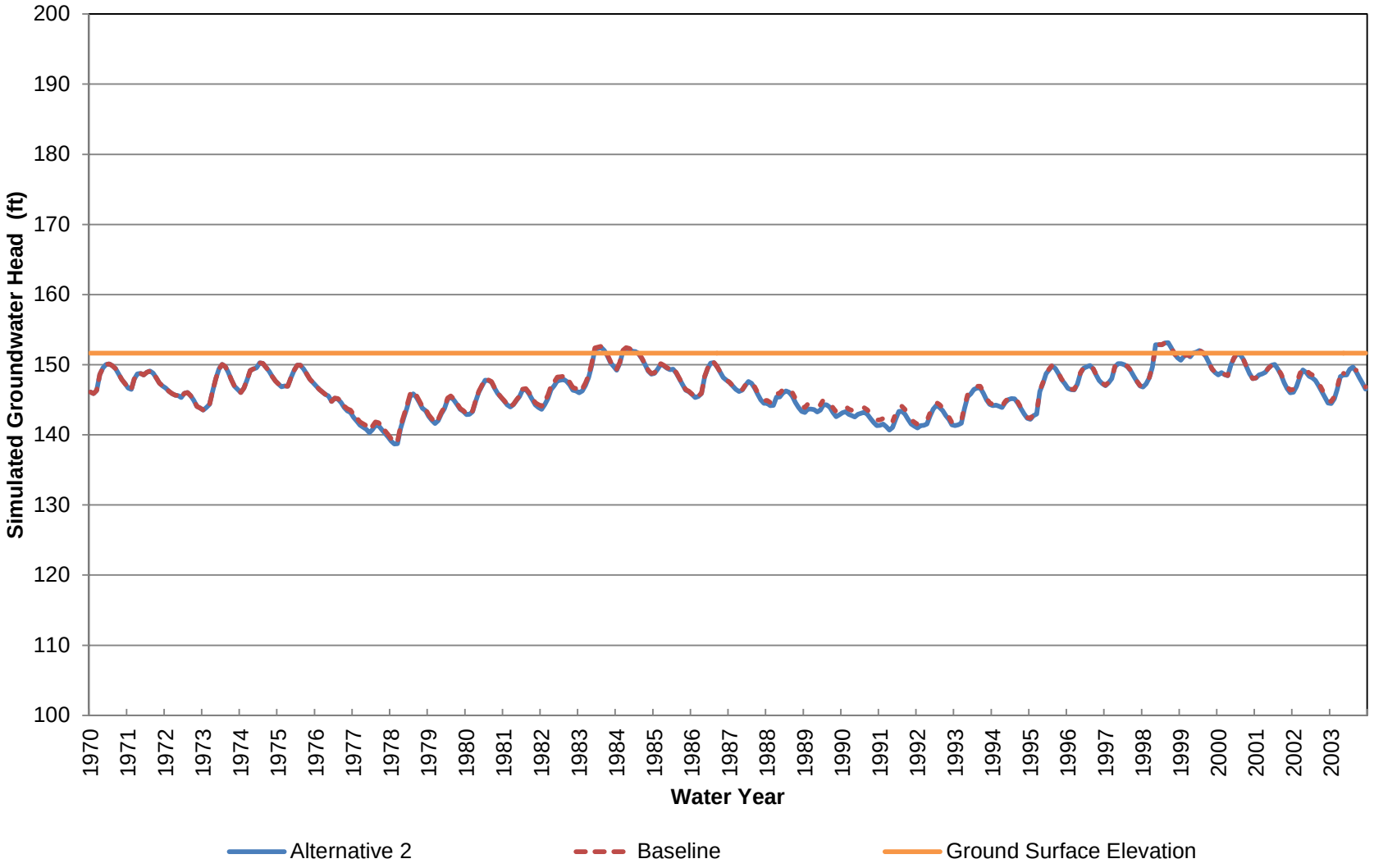
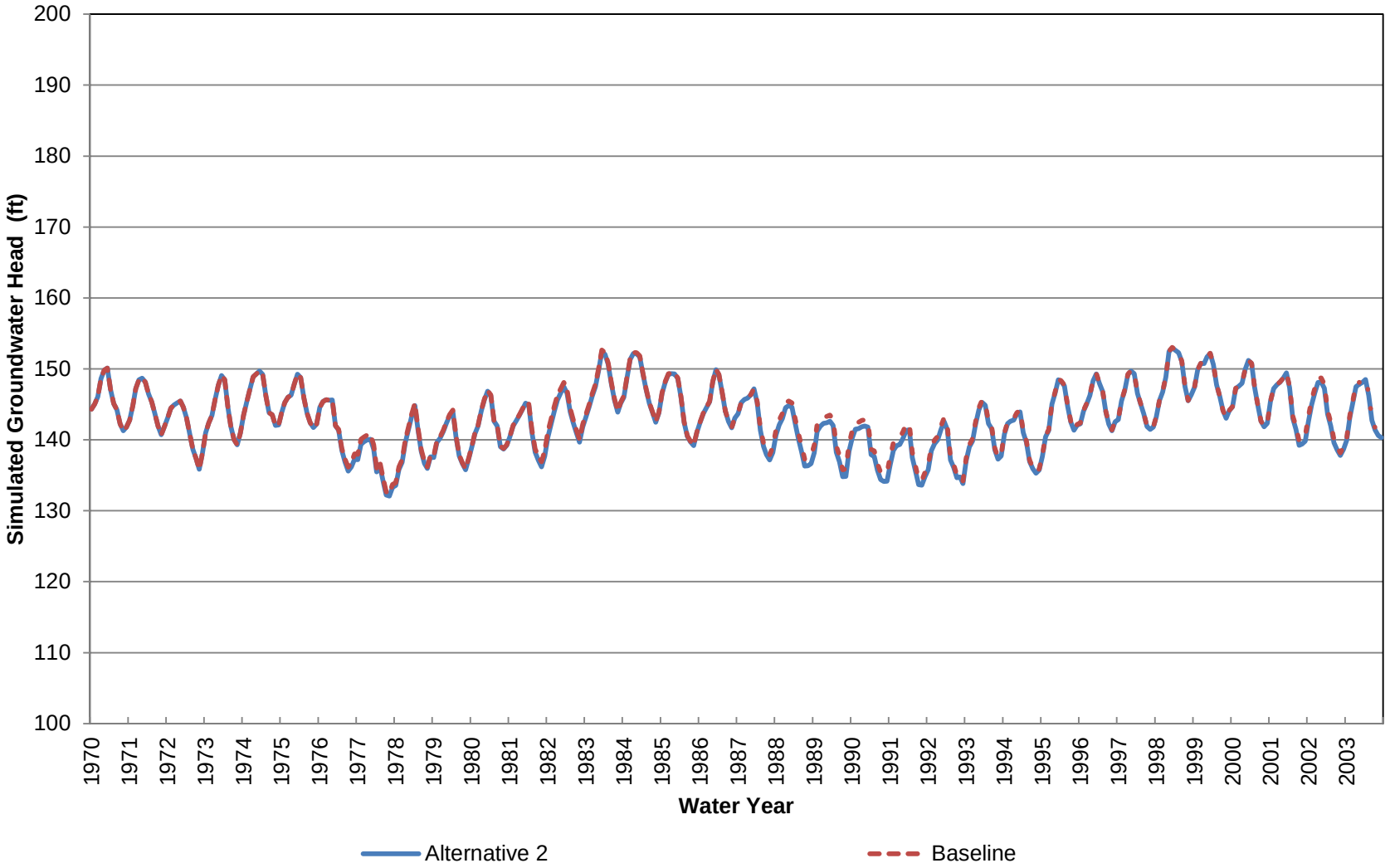
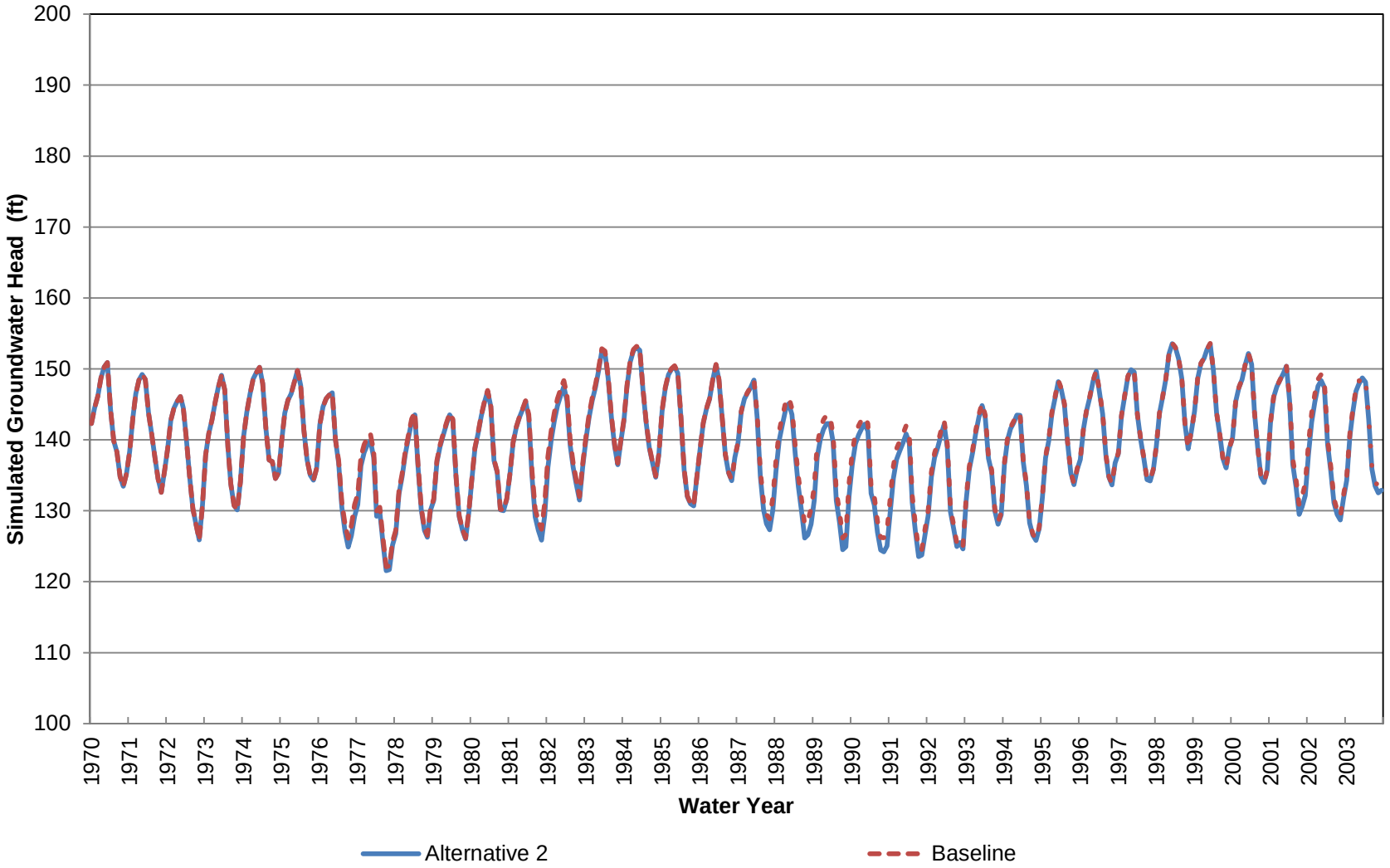
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 1 (Approximately 0-70 ft bgs)



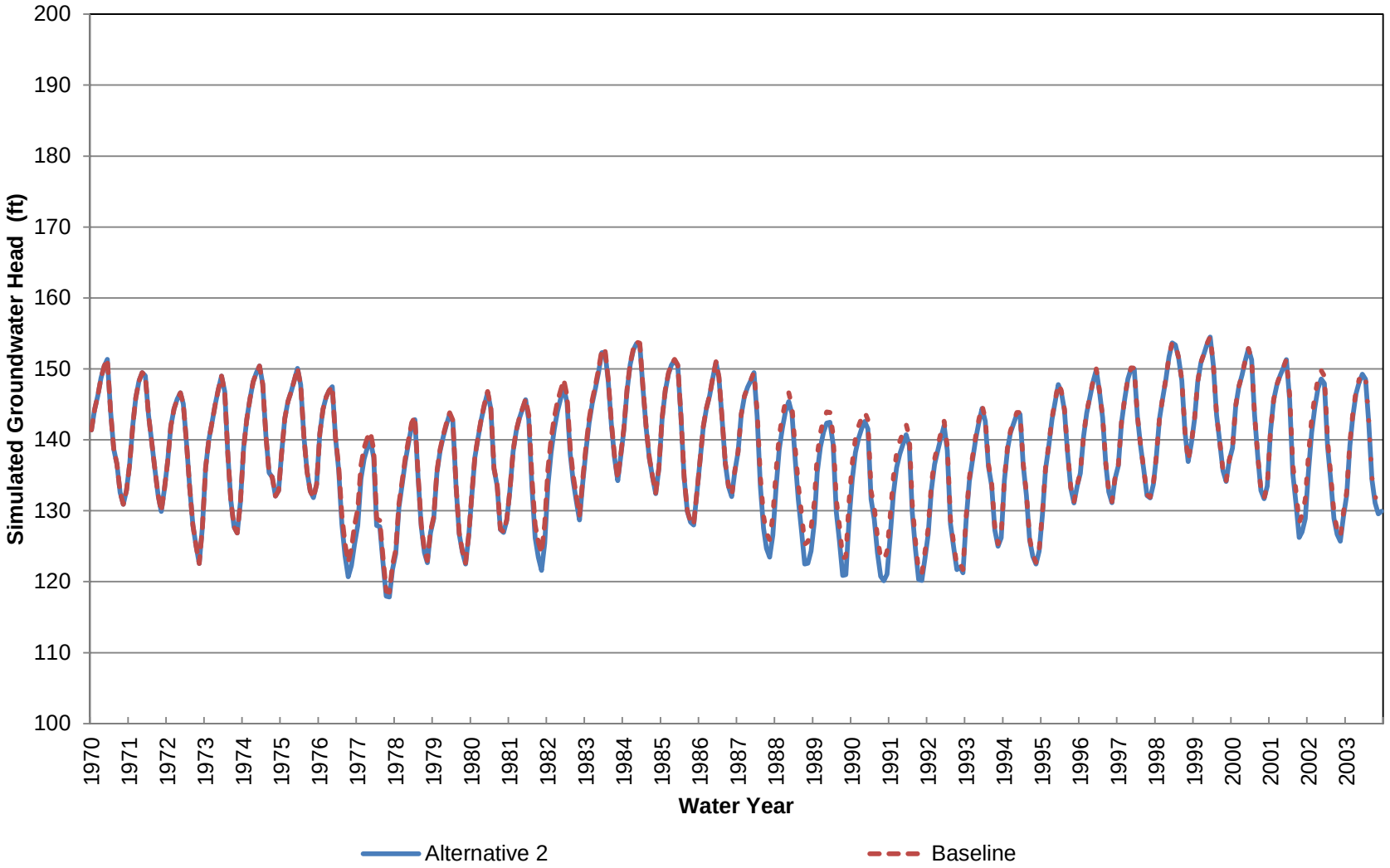
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 1 (Approximately 70-200 ft bgs)



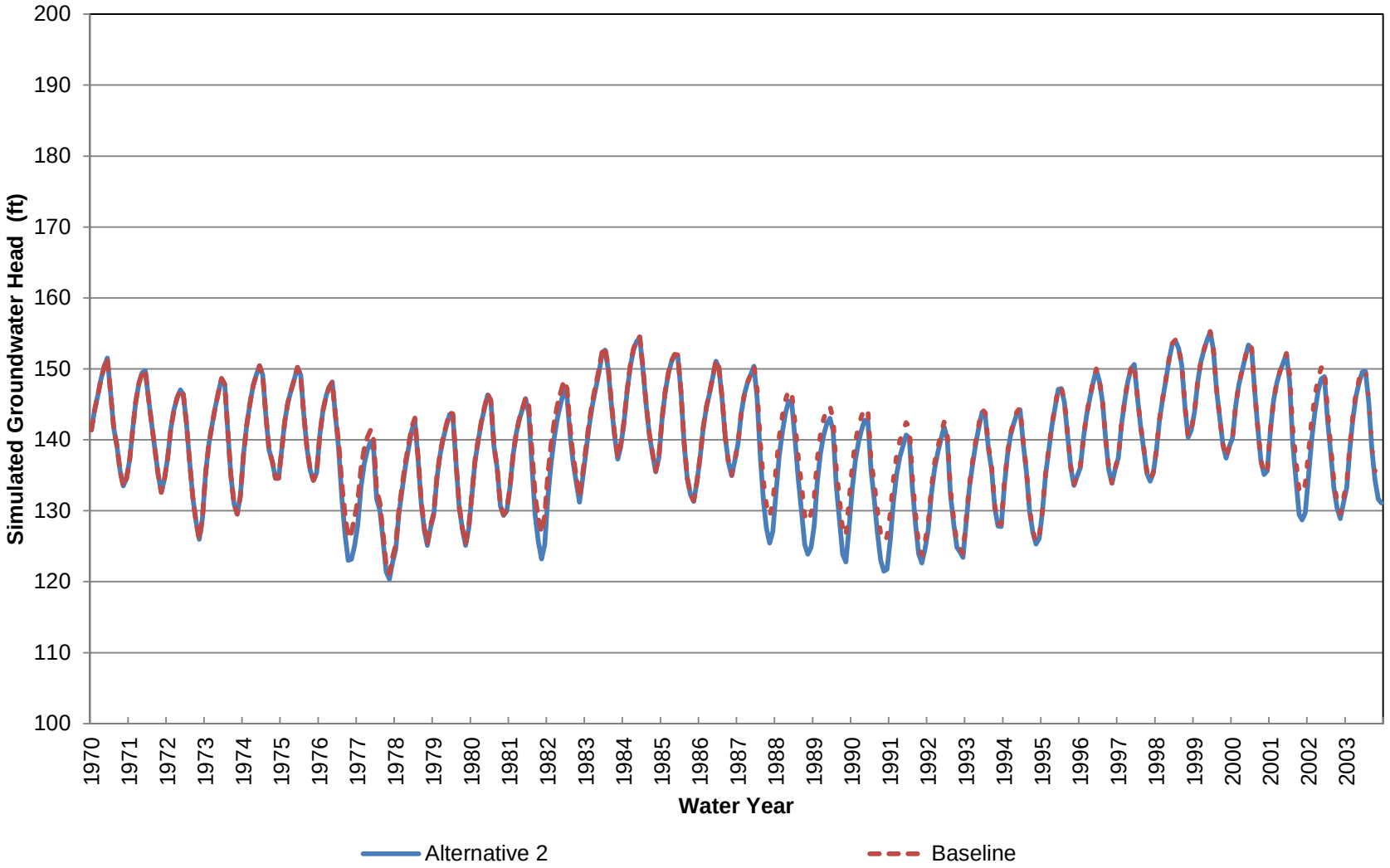
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 1 (Approximately 200-330 ft bgs)



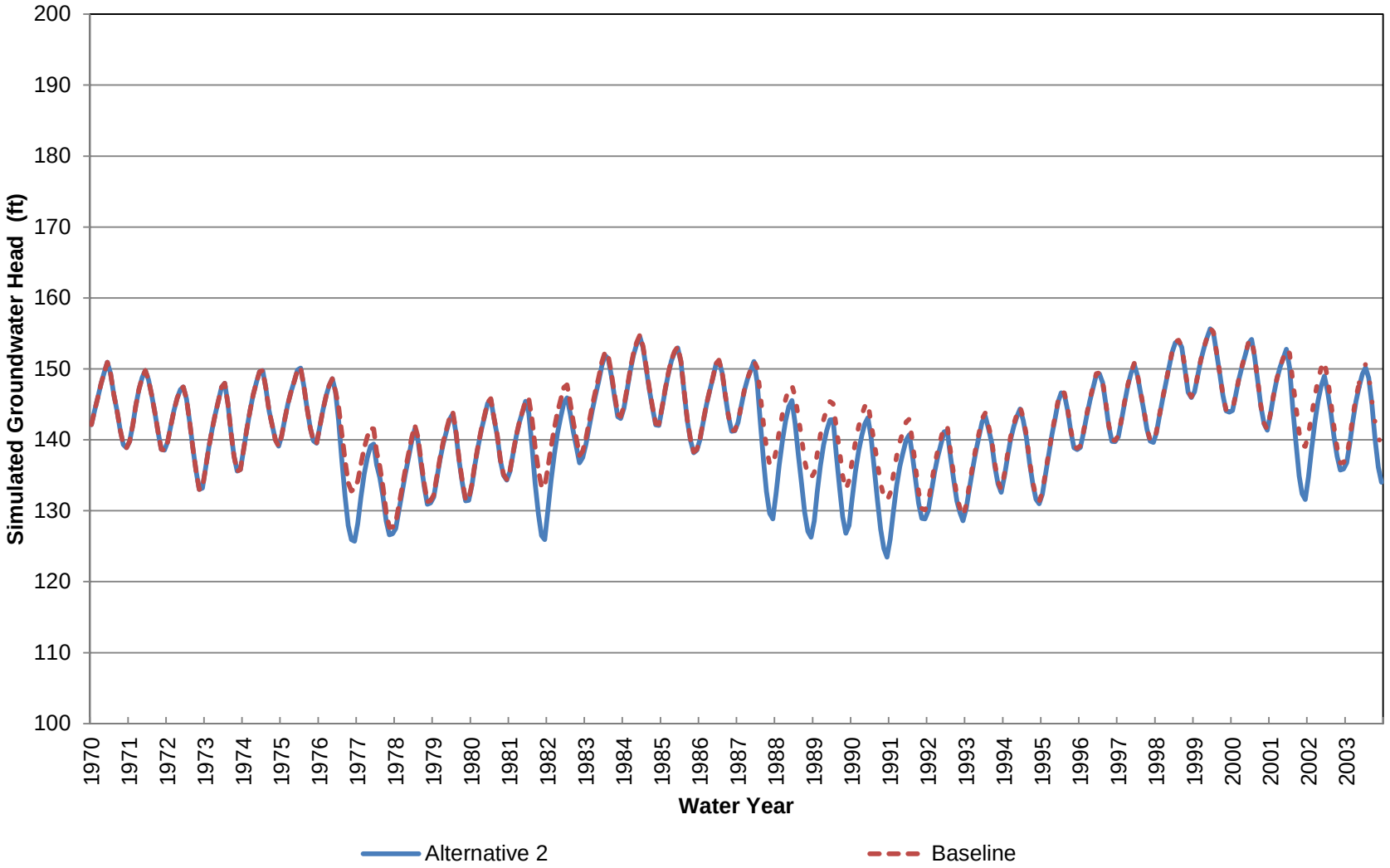
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 1 (Approximately 330-450 ft bgs)



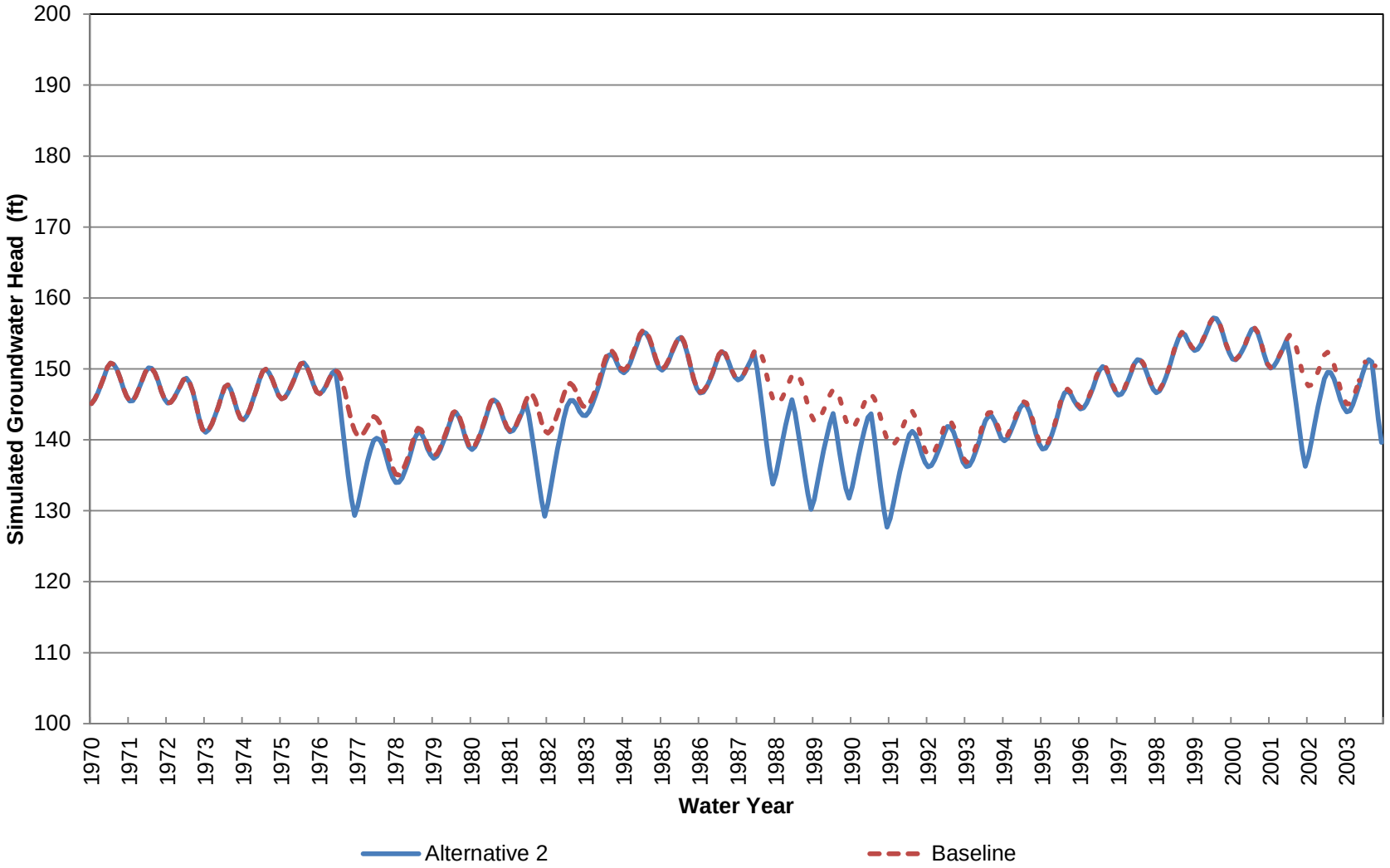
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 1 (Approximately 450-640 ft bgs)



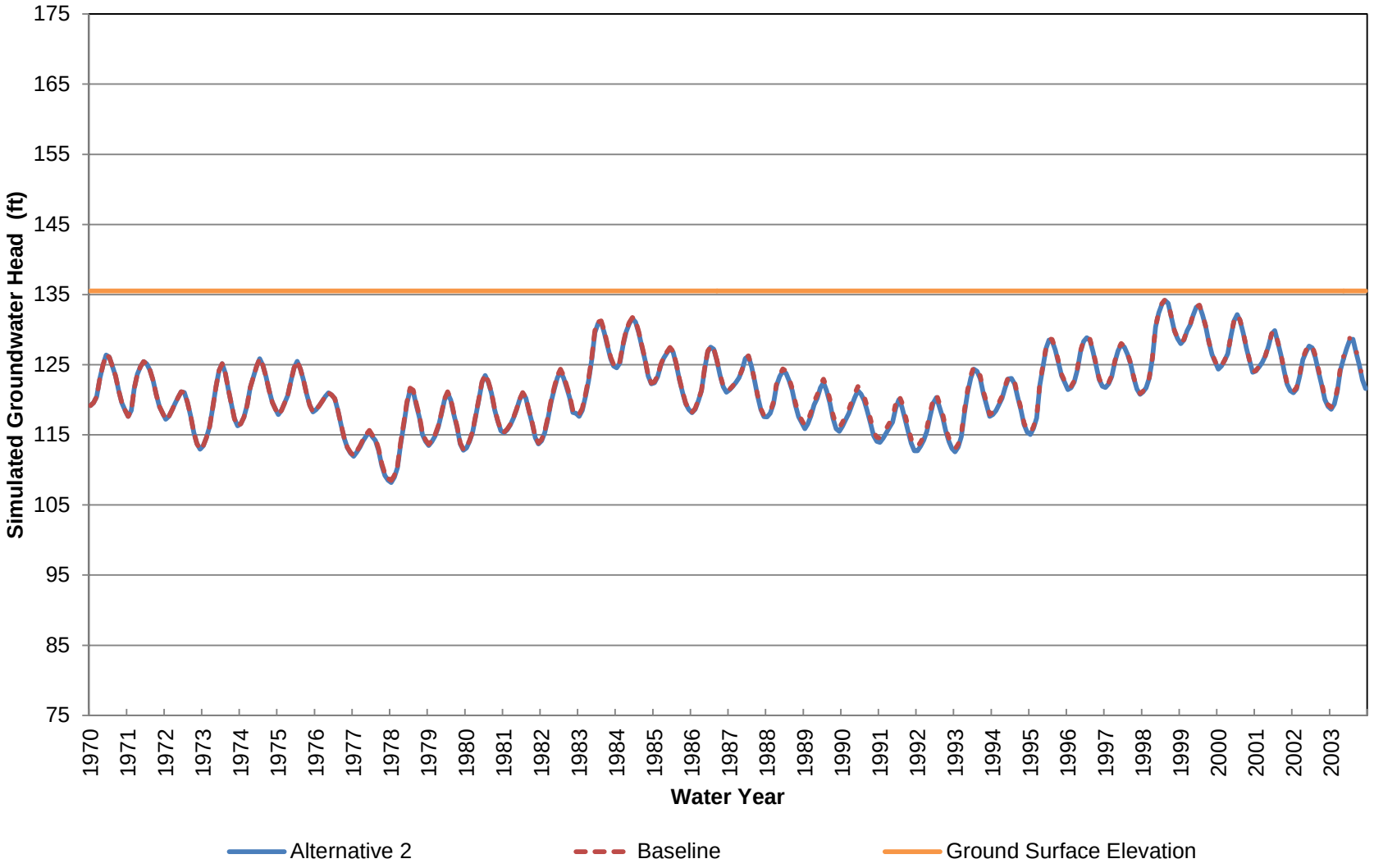
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 1 (Approximately 640-890 ft bgs)



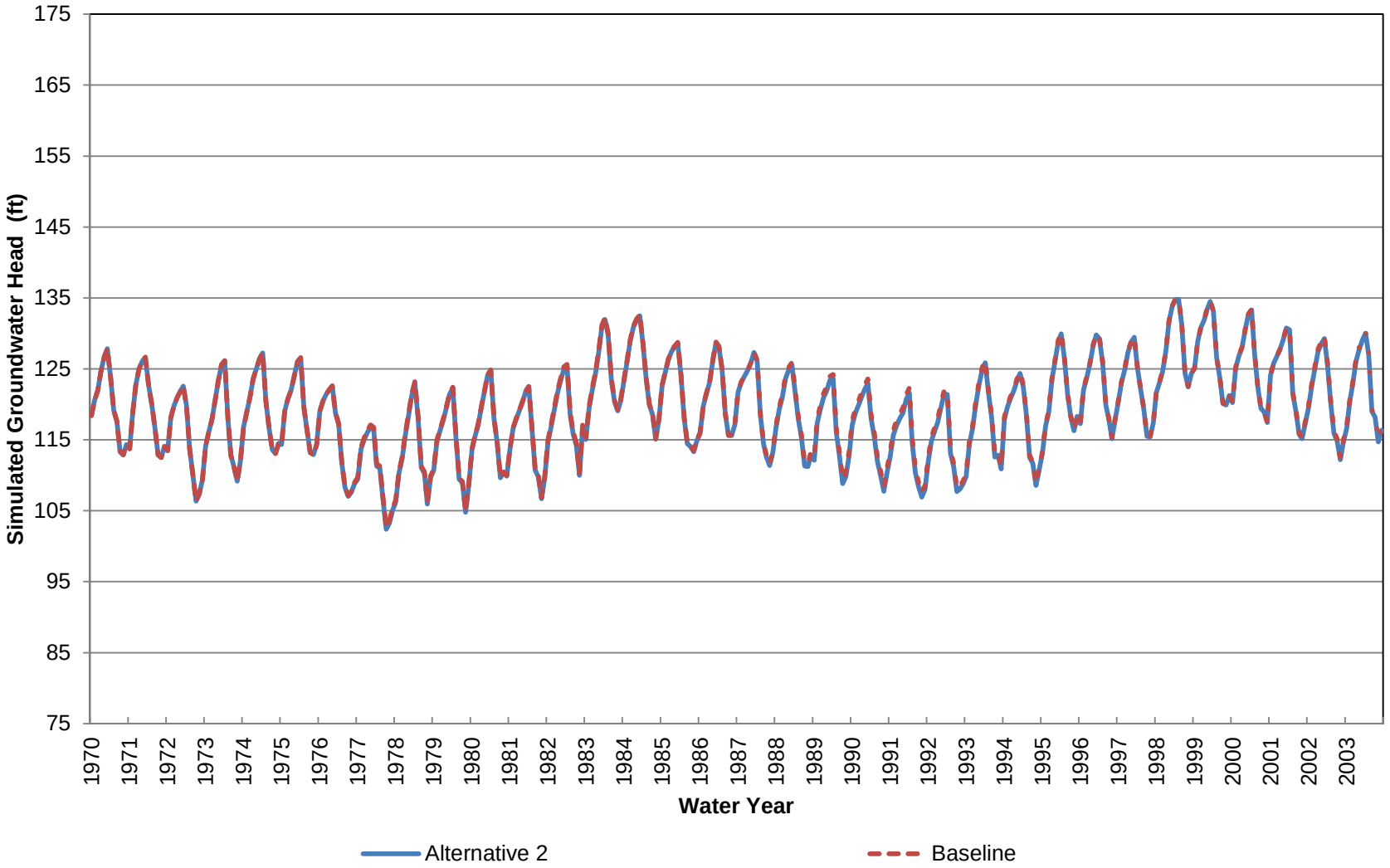
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 1 (Approximately 890-1360 ft bgs)



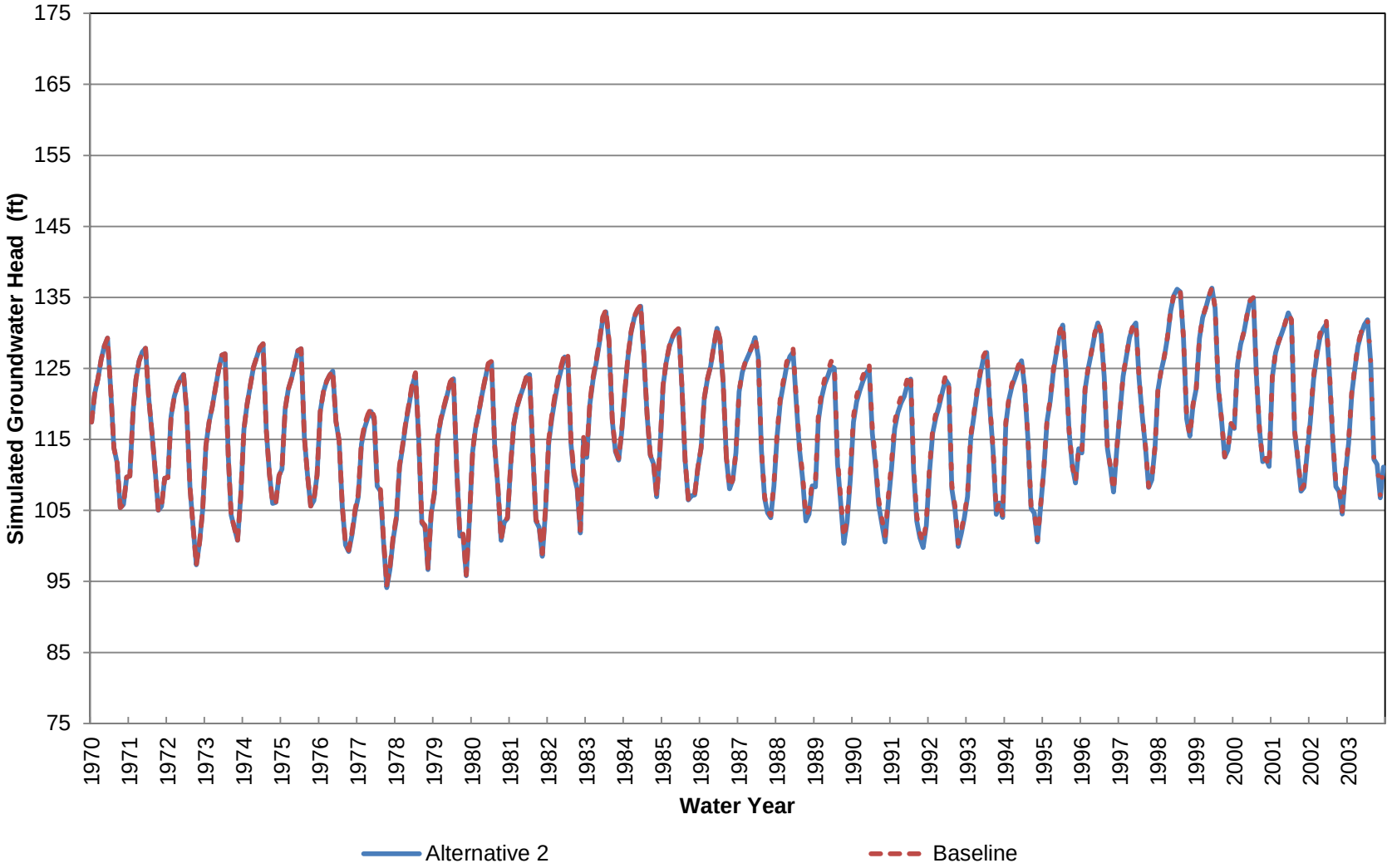
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 2 (Approximately 0-70 ft bgs)



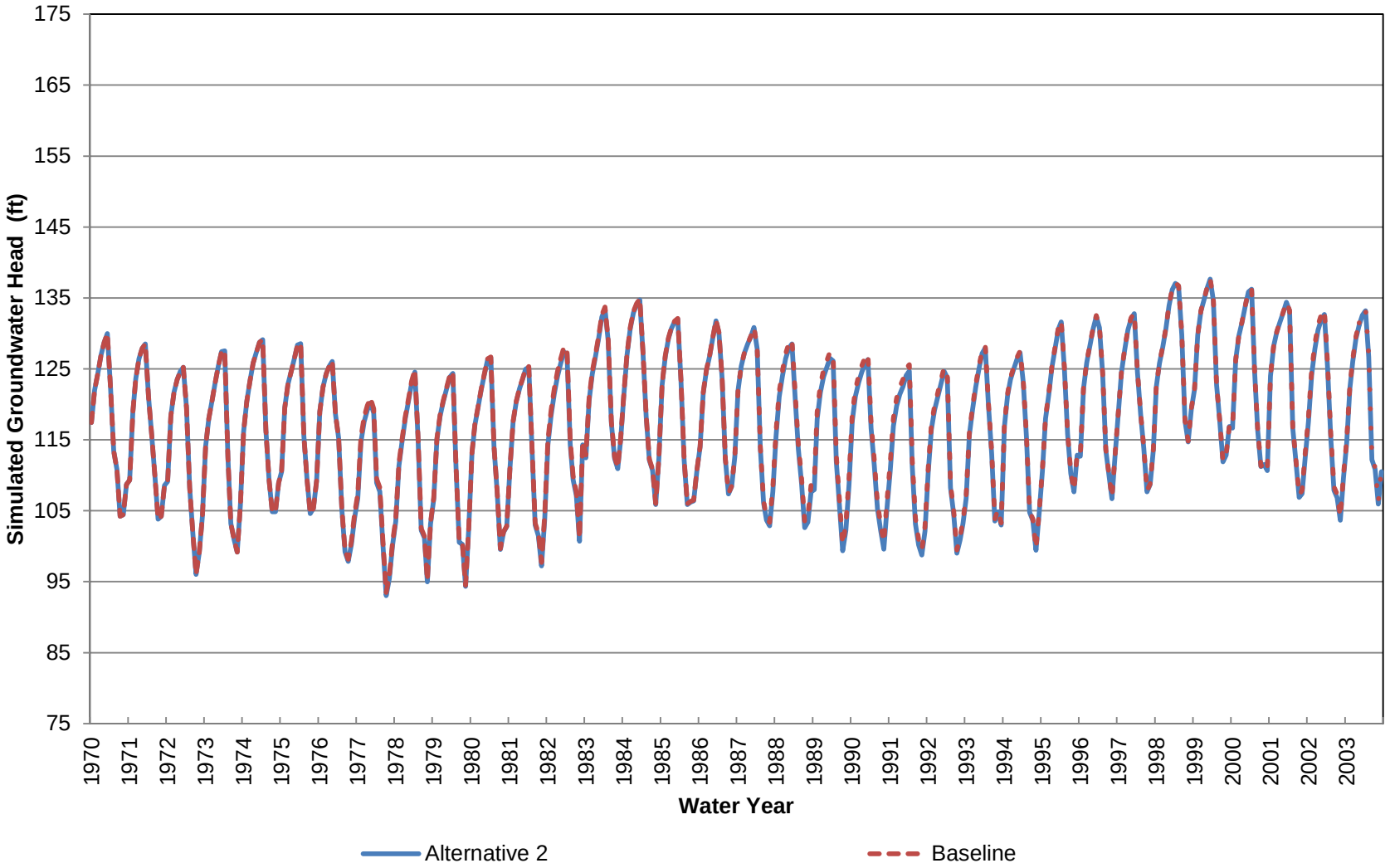
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 2 (Approximately 70-190 ft bgs)



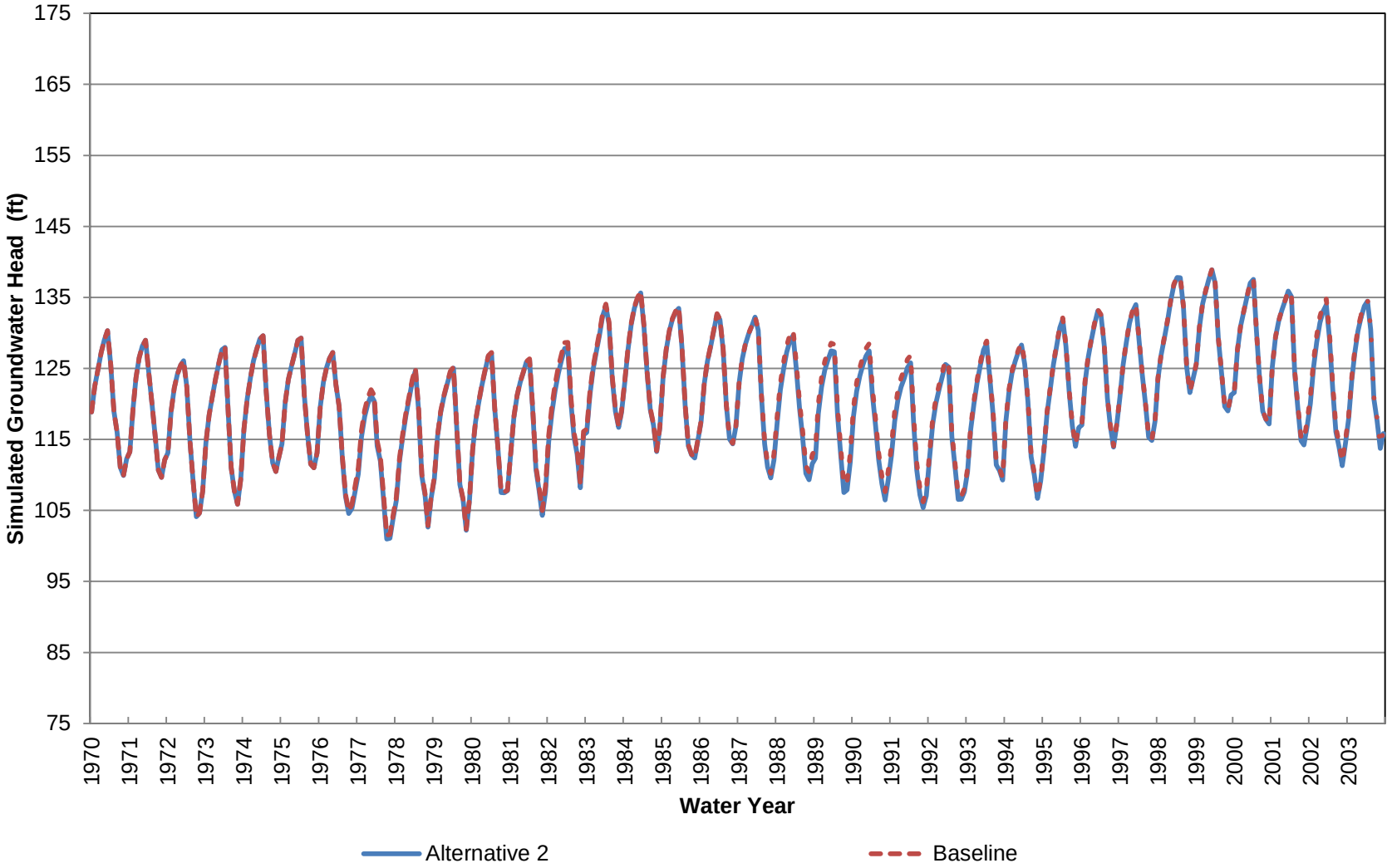
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 2 (Approximately 190-300 ft bgs)



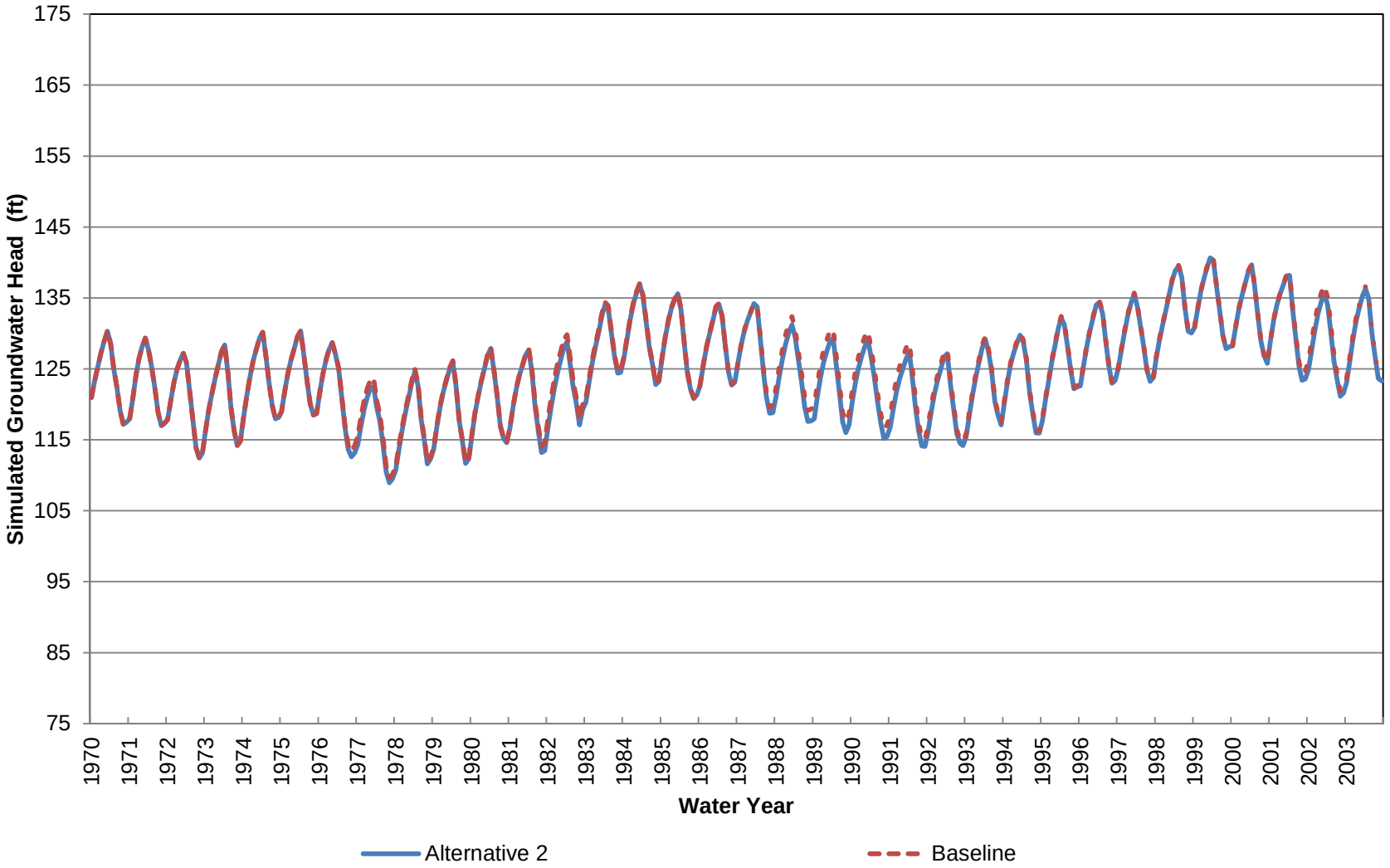
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 2 (Approximately 300-420 ft bgs)



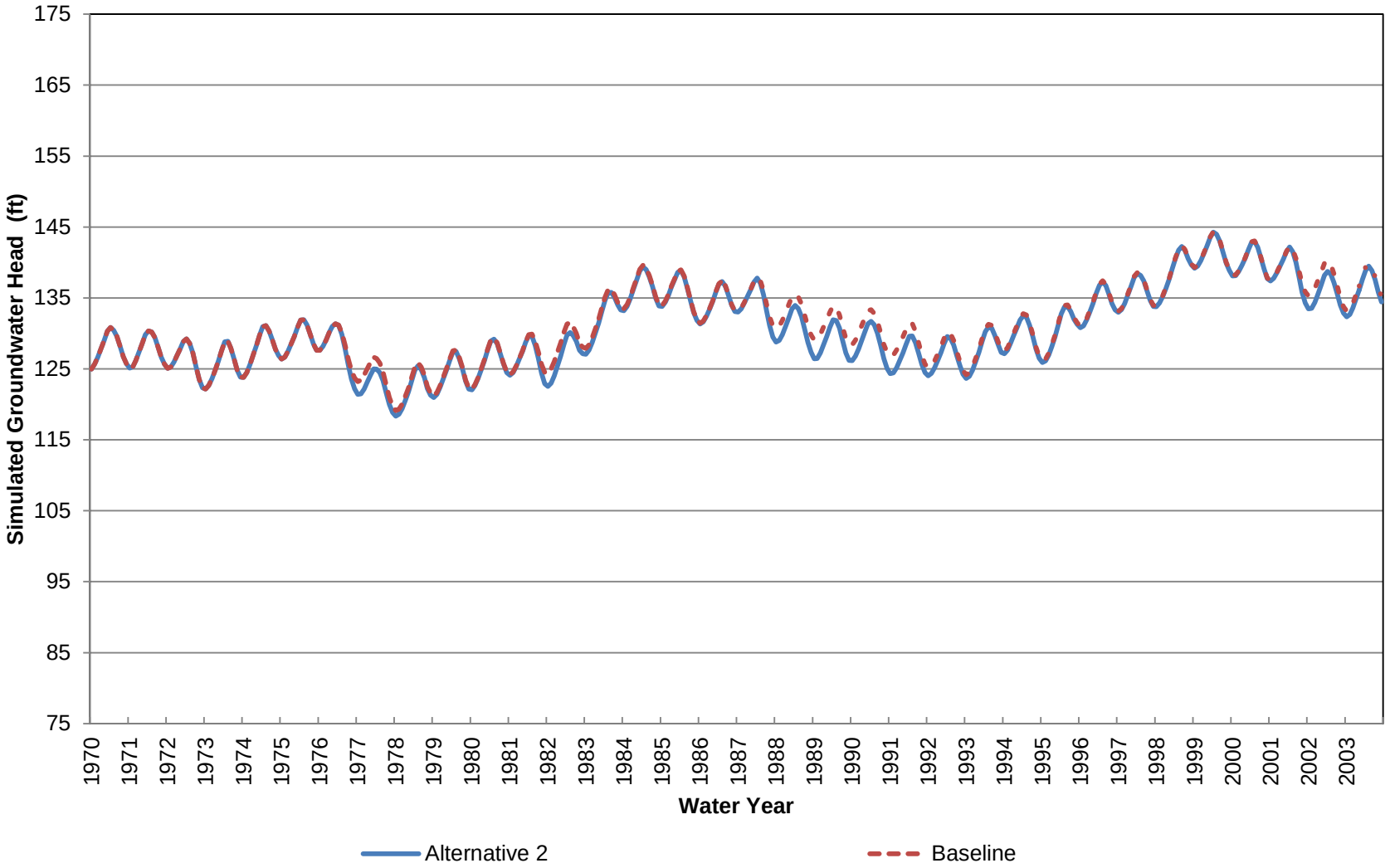
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 2 (Approximately 420-580 ft bgs)



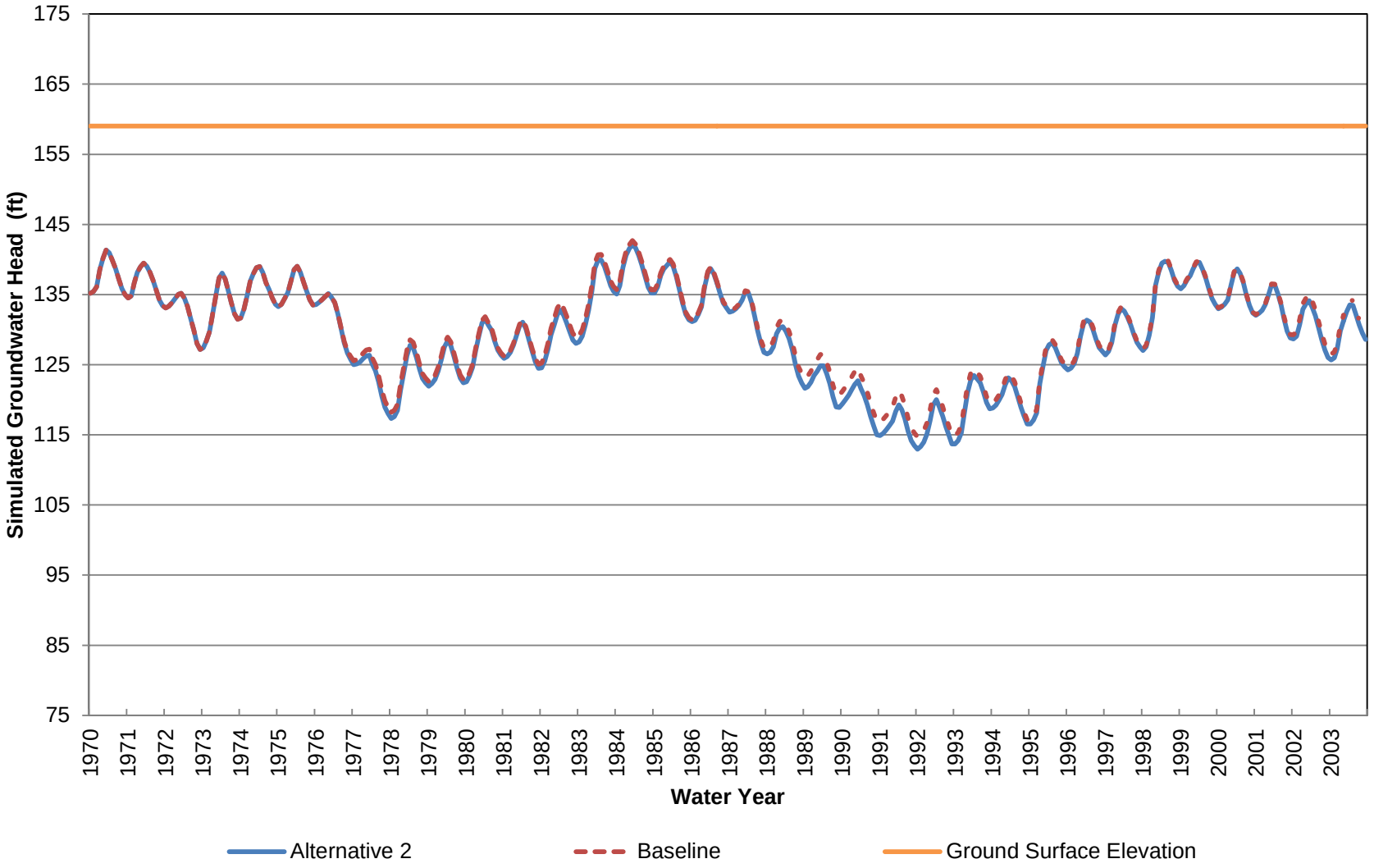
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 2 (Approximately 580-830 ft bgs)



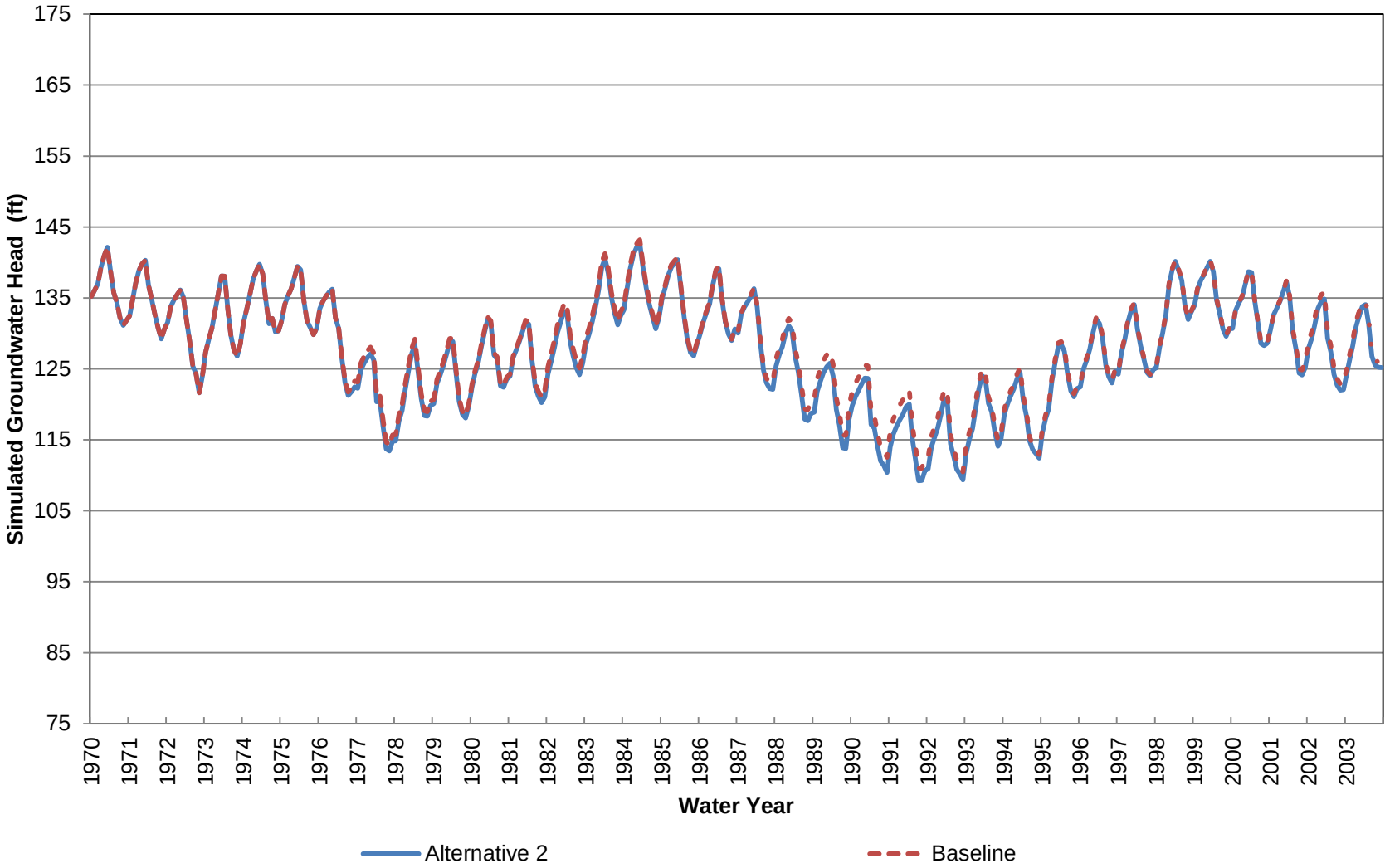
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 2 (Approximately 830-1330 ft bgs)



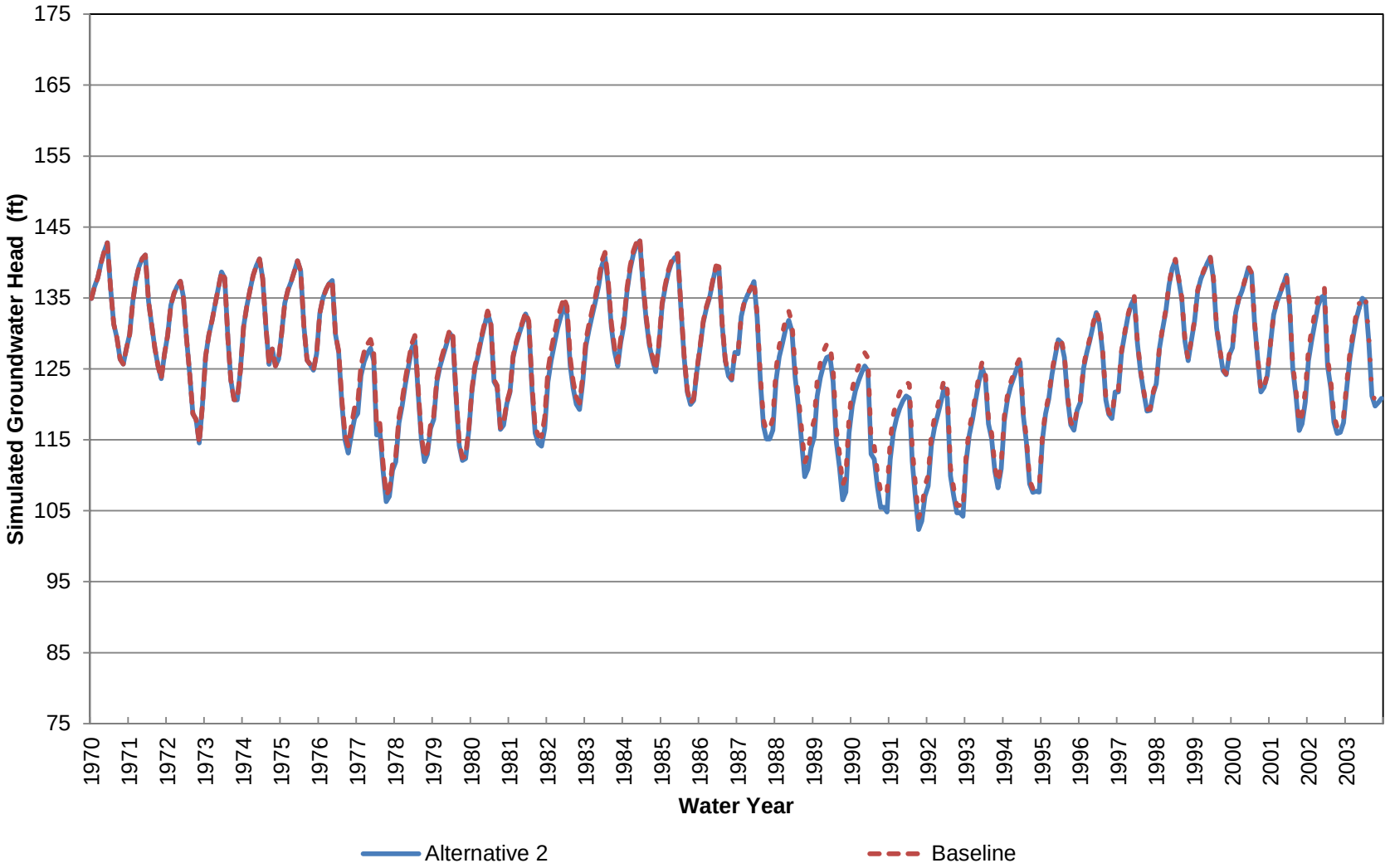
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 3 (Approximately 0-70 ft bgs)



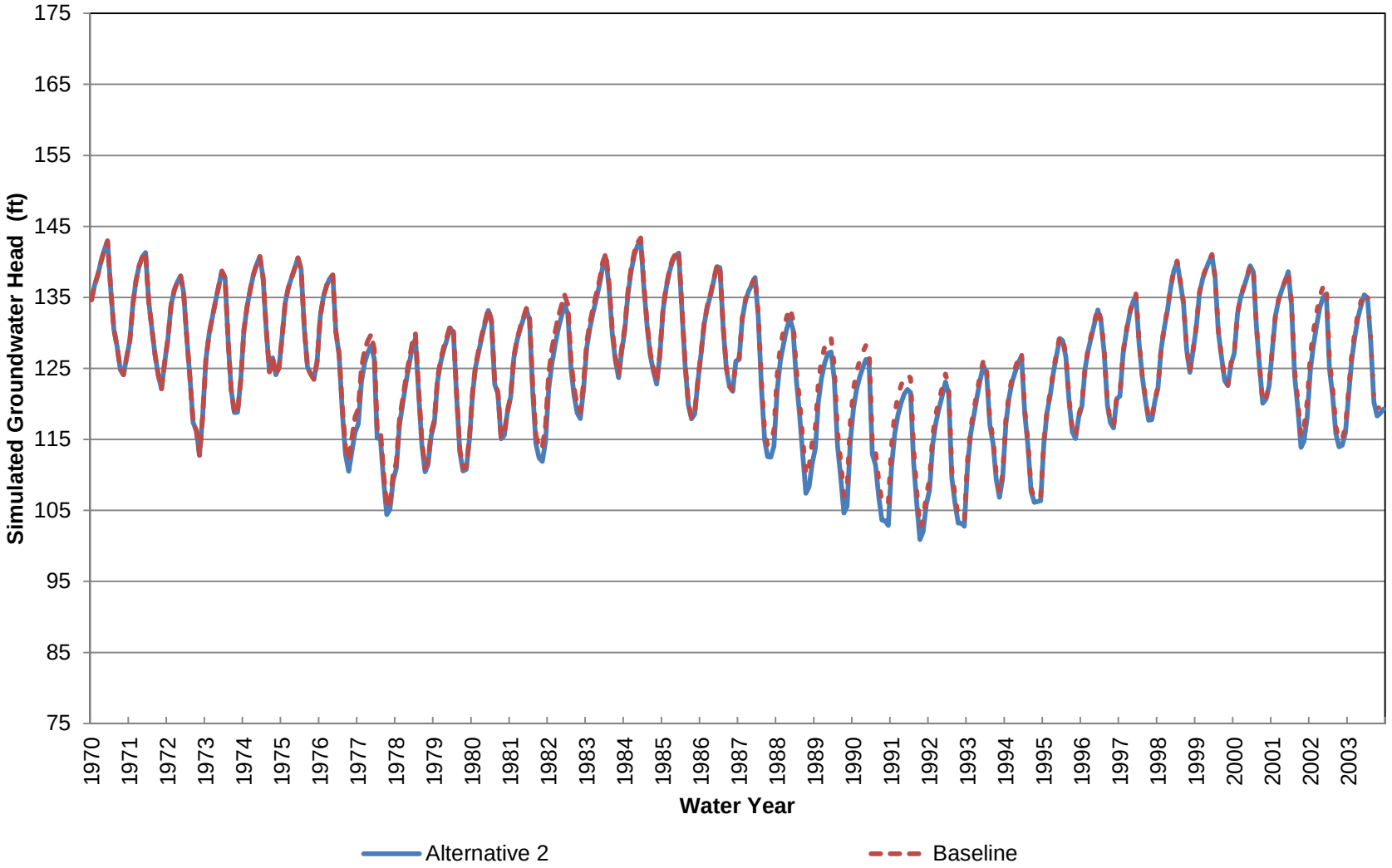
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 3 (Approximately 70-210 ft bgs)



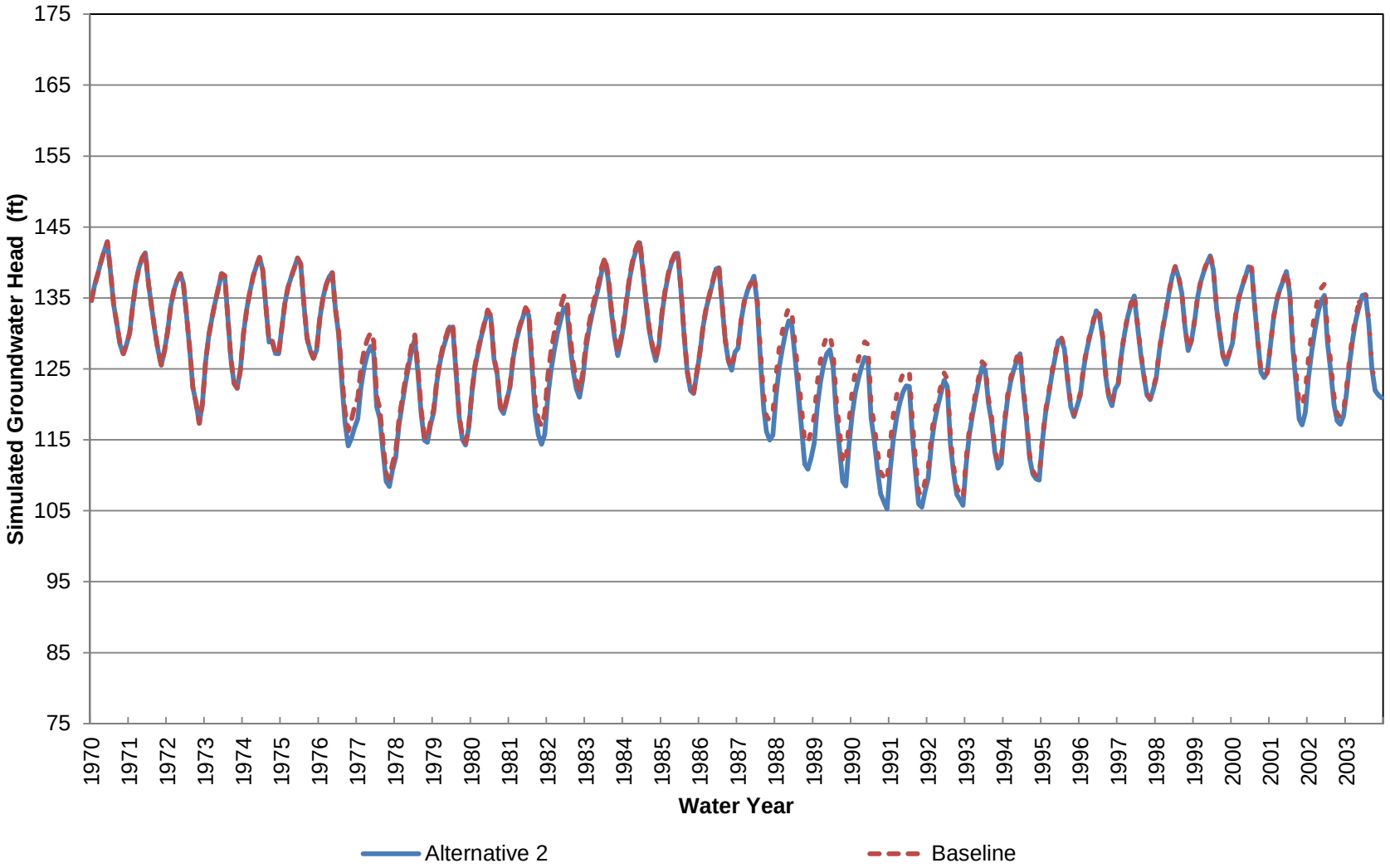
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 3 (Approximately 210-350 ft bgs)



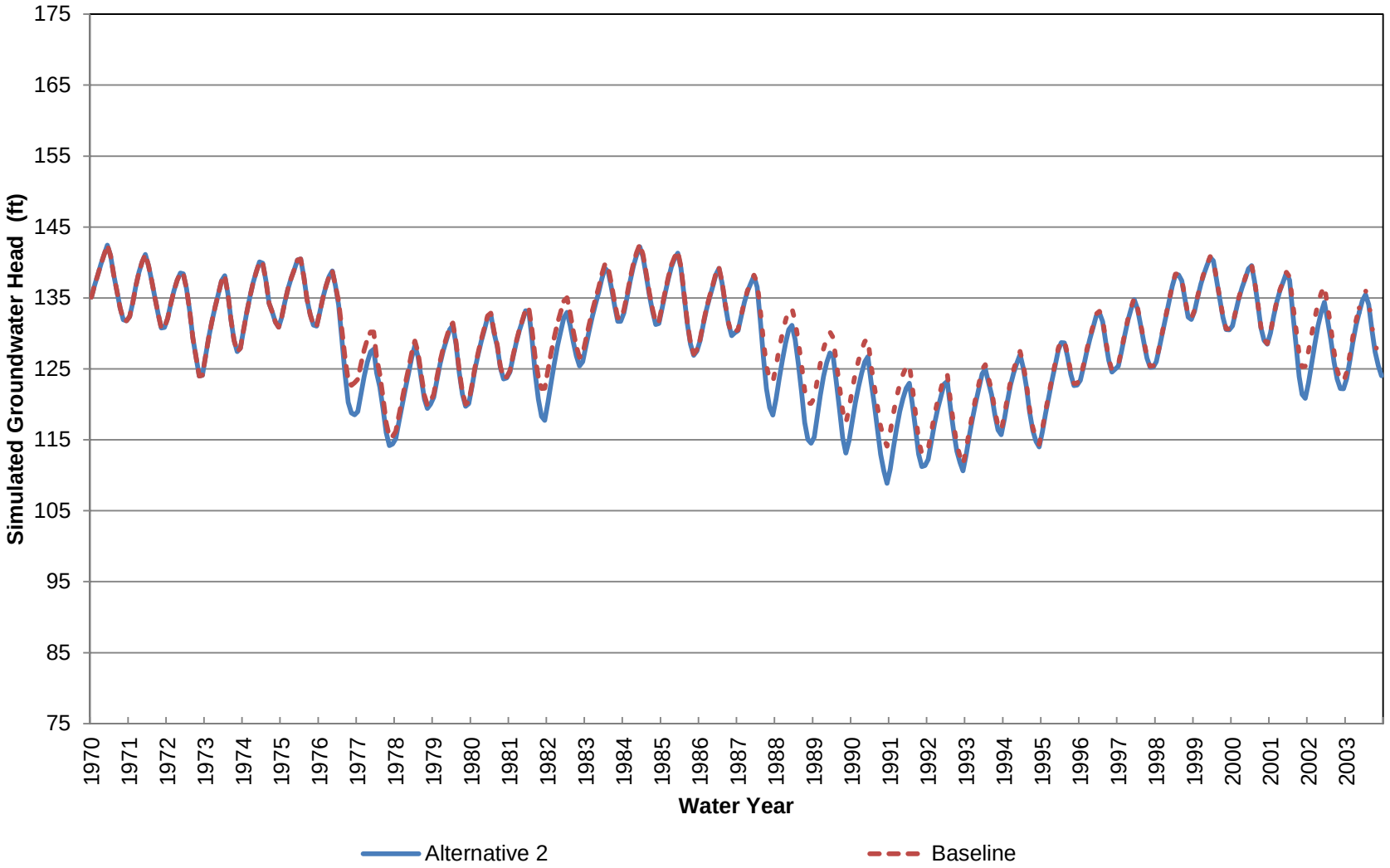
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 3 (Approximately 350-480 ft bgs)



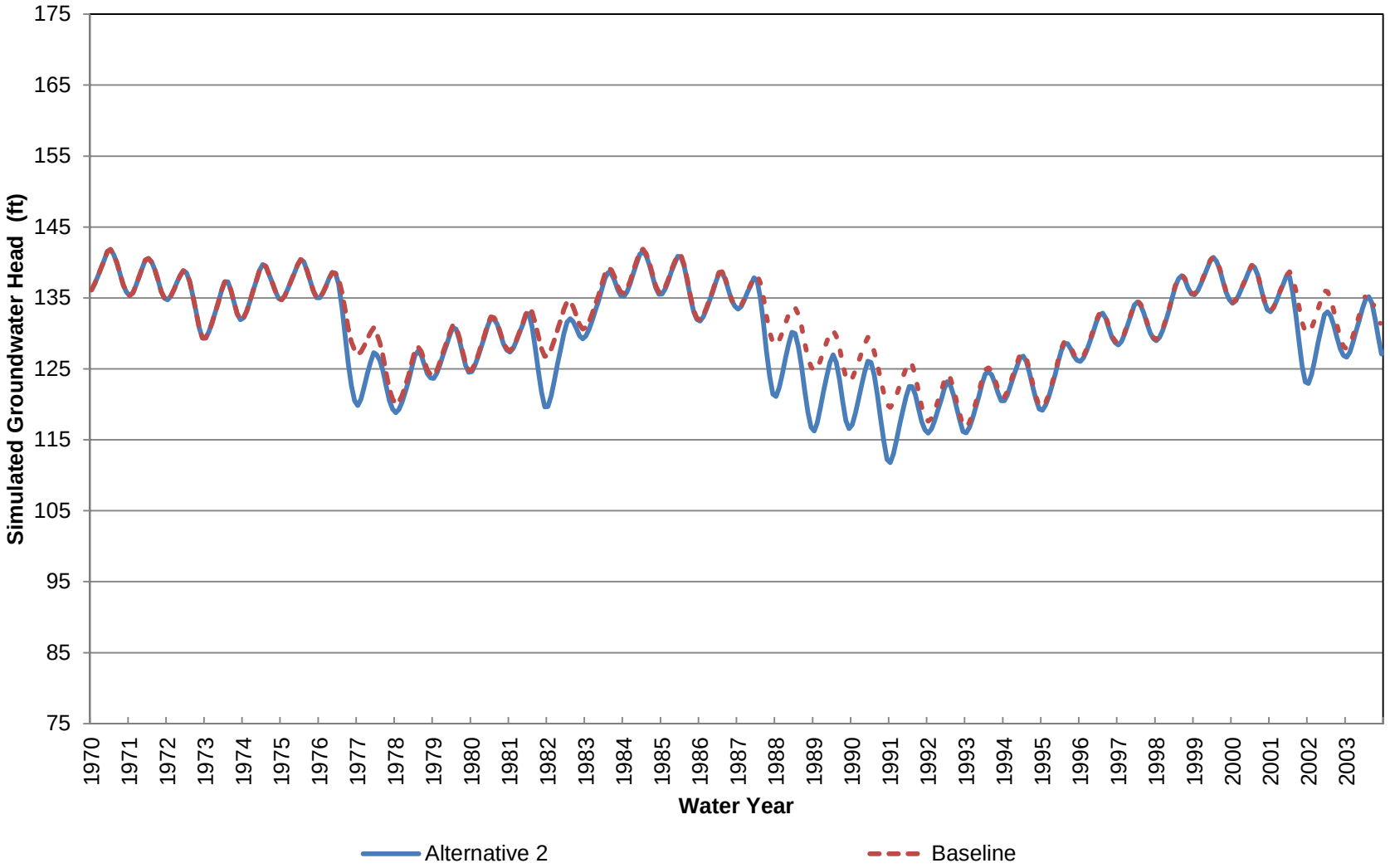
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 3 (Approximately 480-700 ft bgs)



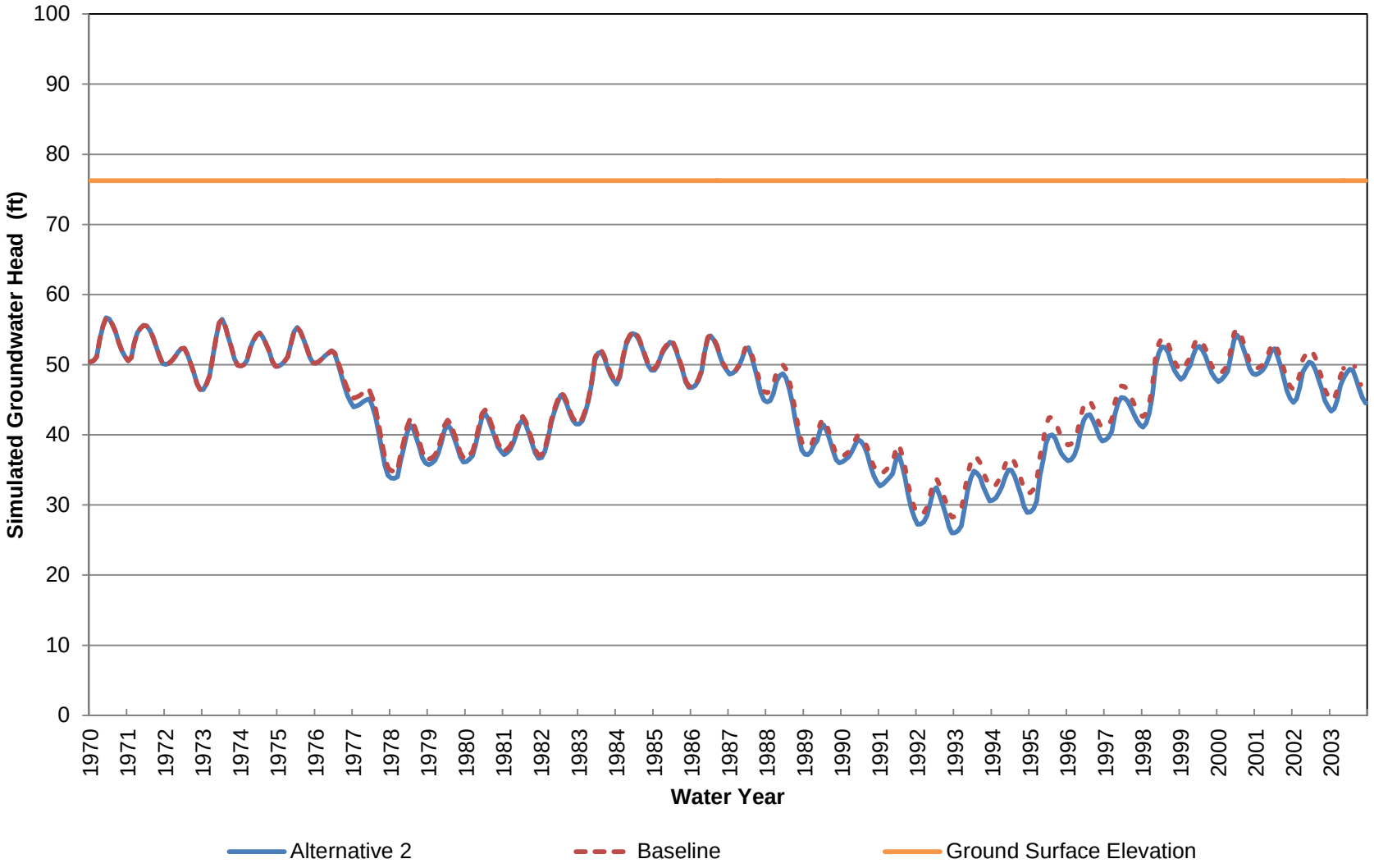
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 3 (Approximately 700-930 ft bgs)



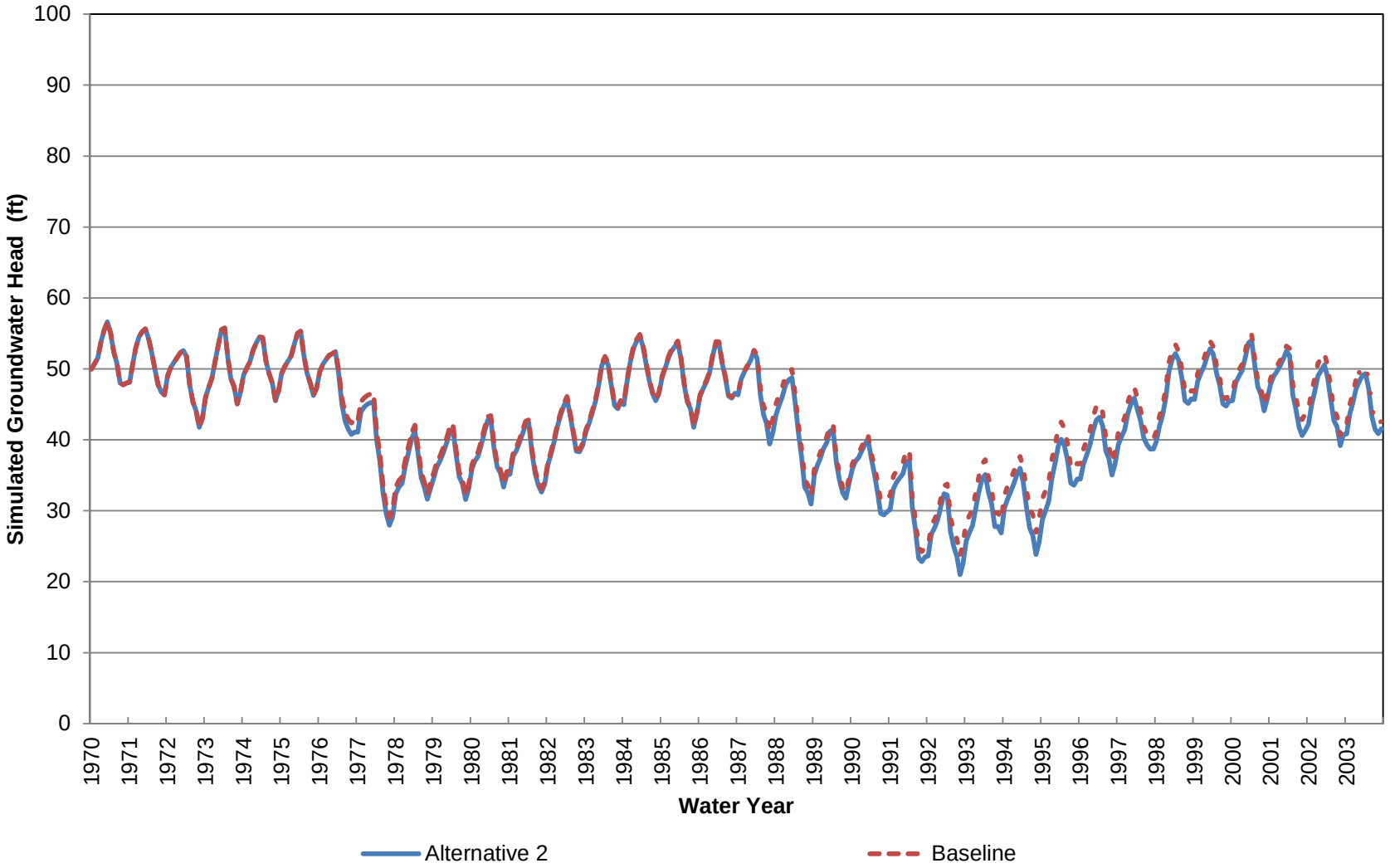
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 3 (Approximately 930-1290 ft bgs)



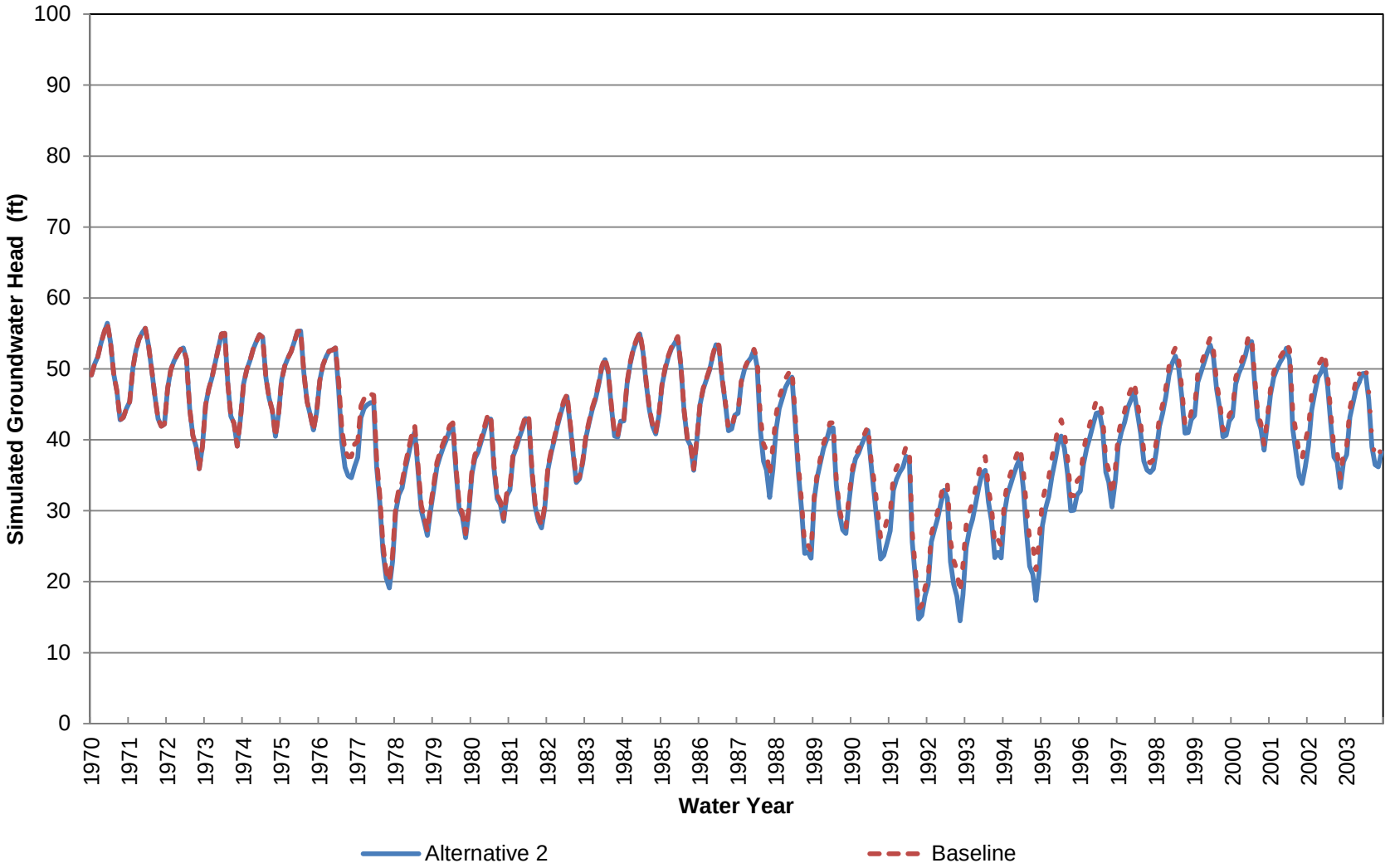
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 4 (Approximately 0-70 ft bgs)



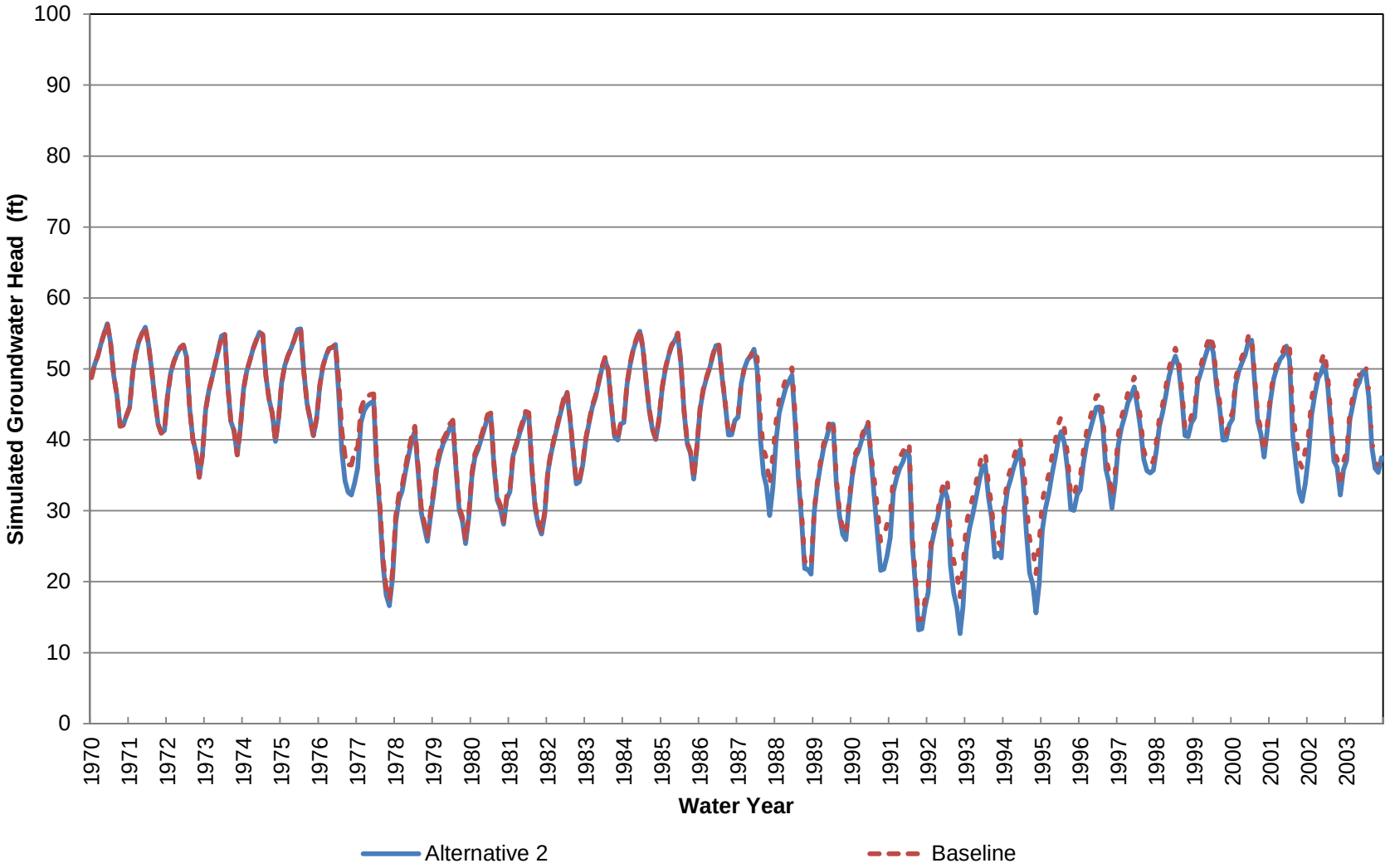
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 4 (Approximately 70-190 ft bgs)



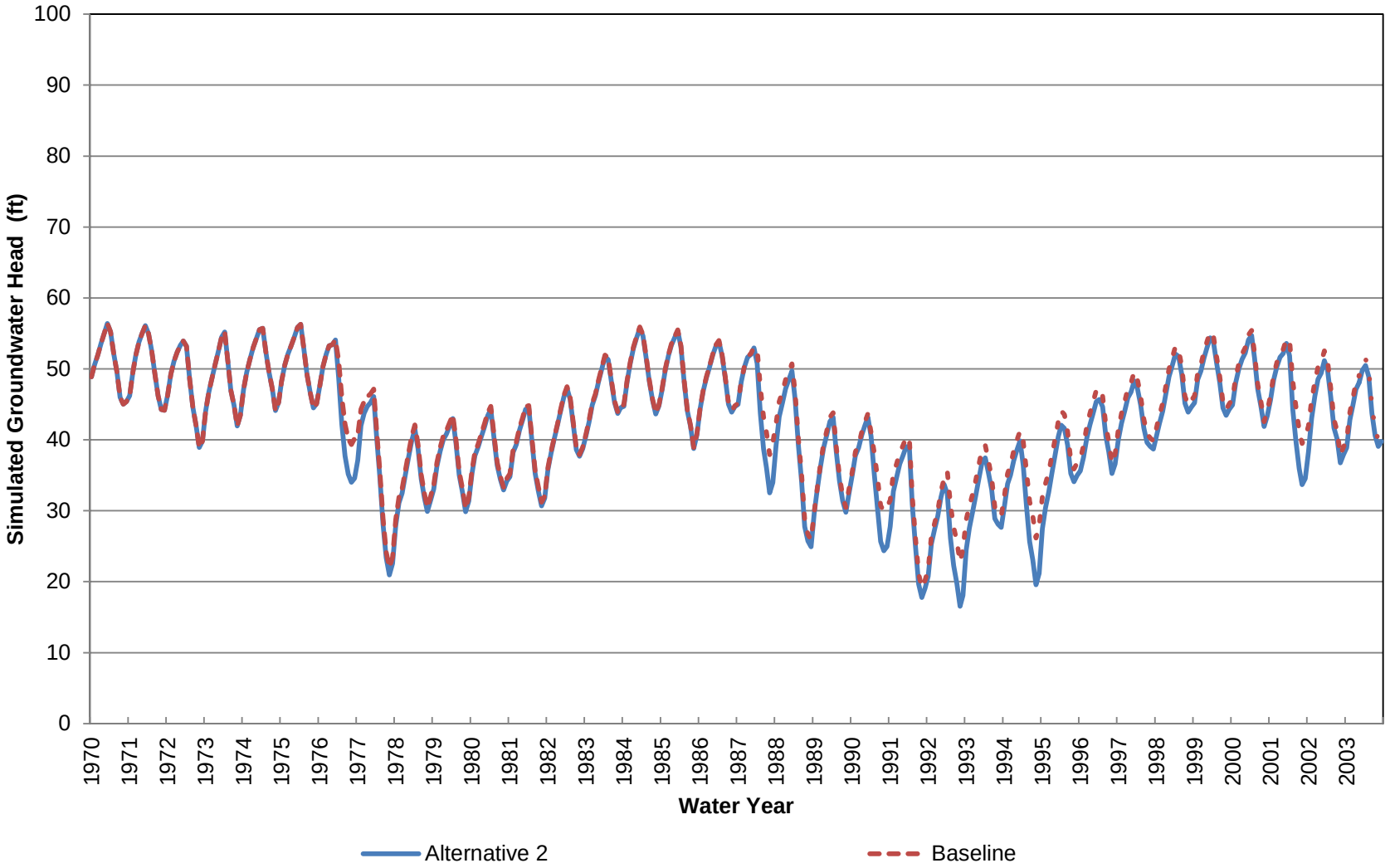
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 4 (Approximately 190-300 ft bgs)



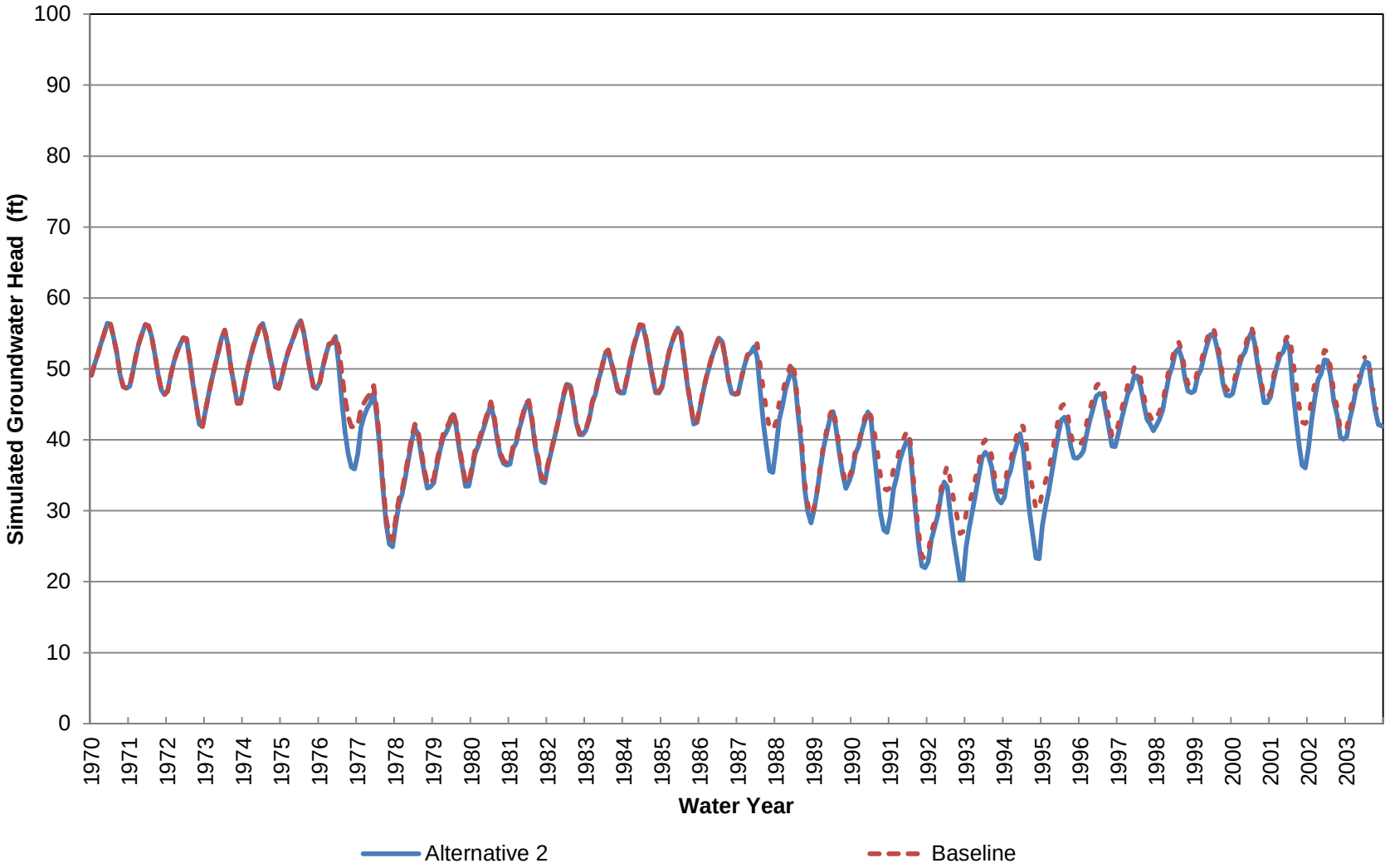
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 4 (Approximately 300-420 ft bgs)



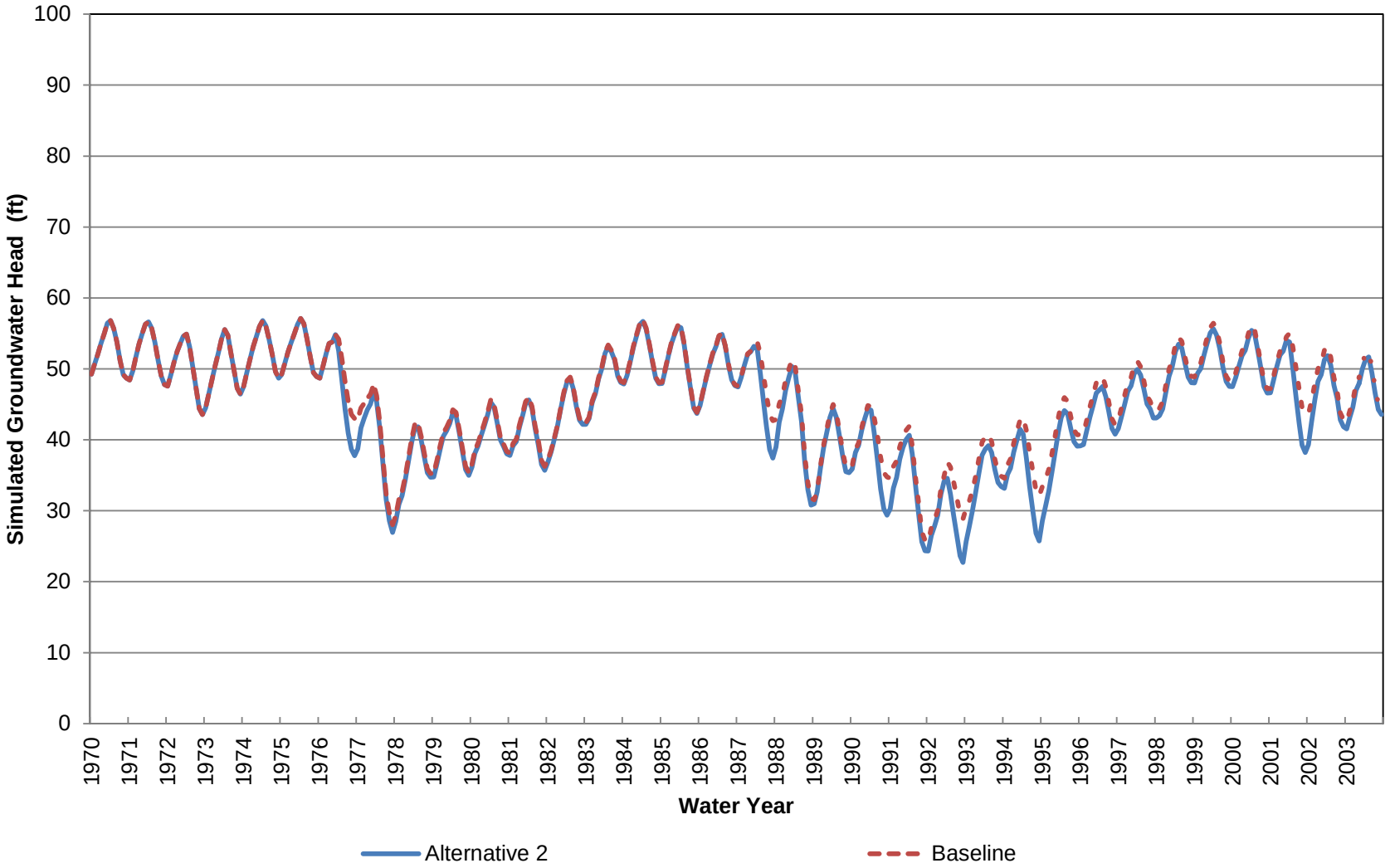
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 4 (Approximately 420-580 ft bgs)



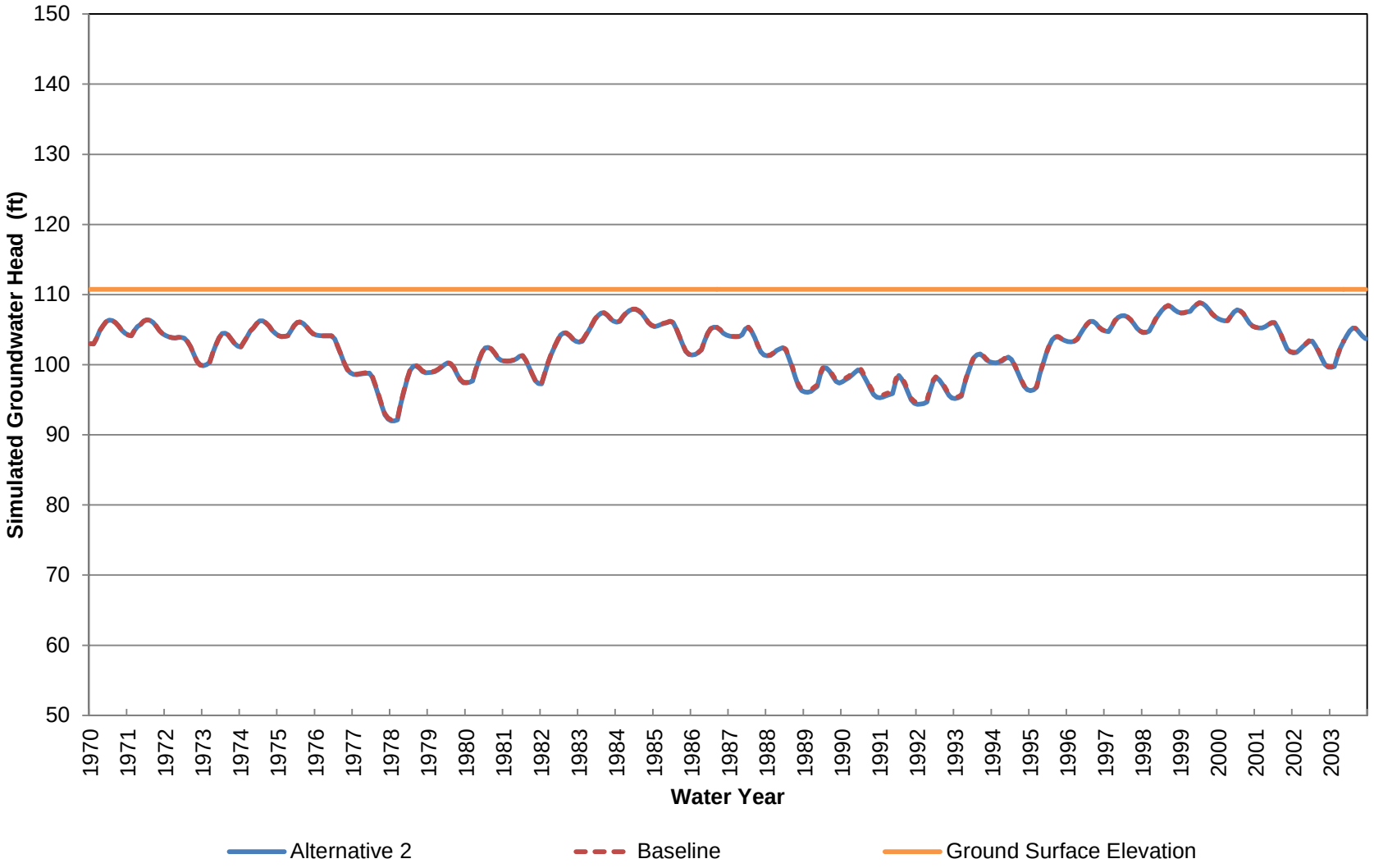
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 4 (Approximately 580-780 ft bgs)



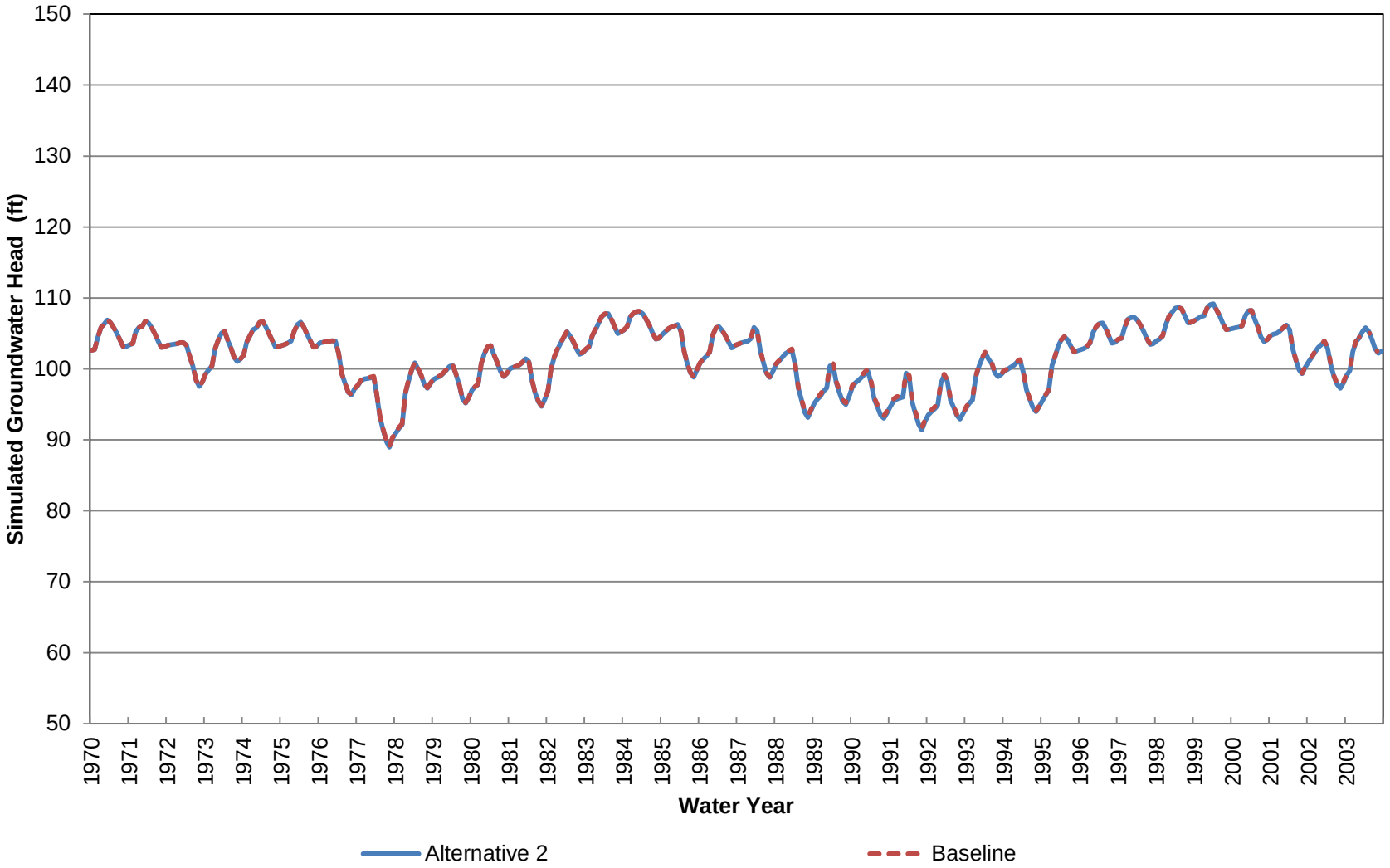
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 4 (Approximately 780-1060 ft bgs)



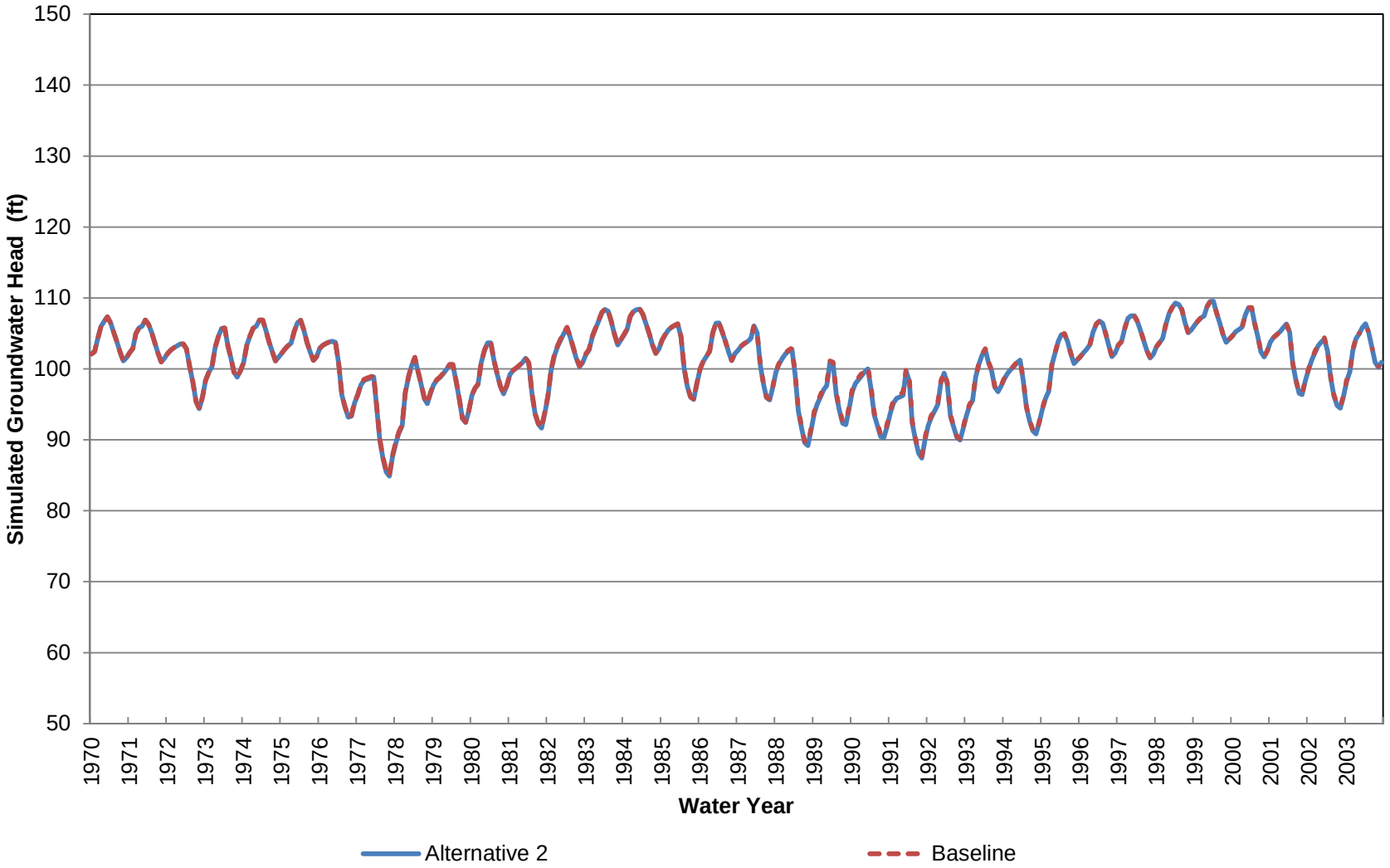
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 5 (Approximately 0-70 ft bgs)



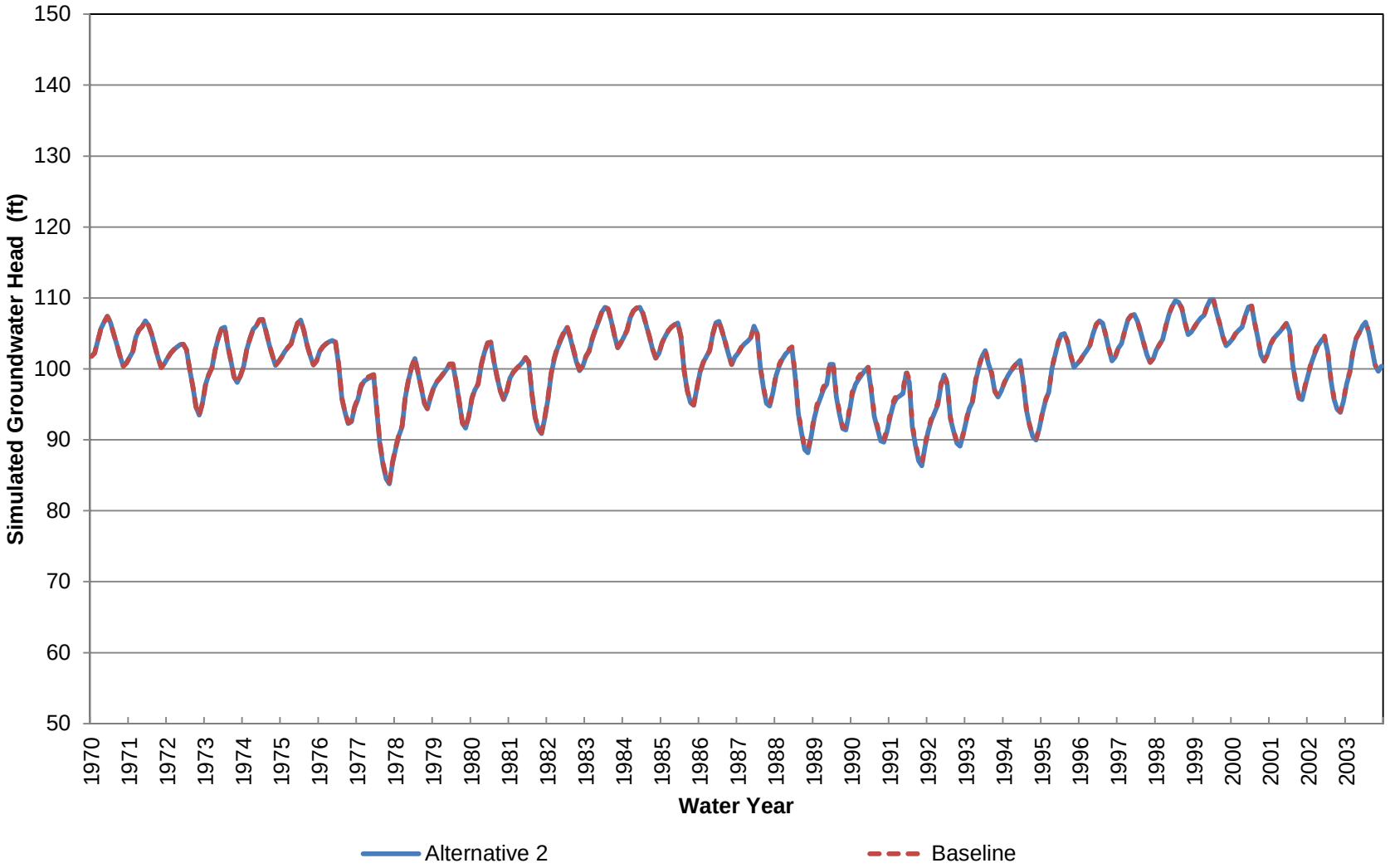
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 5 (Approximately 70-200 ft bgs)



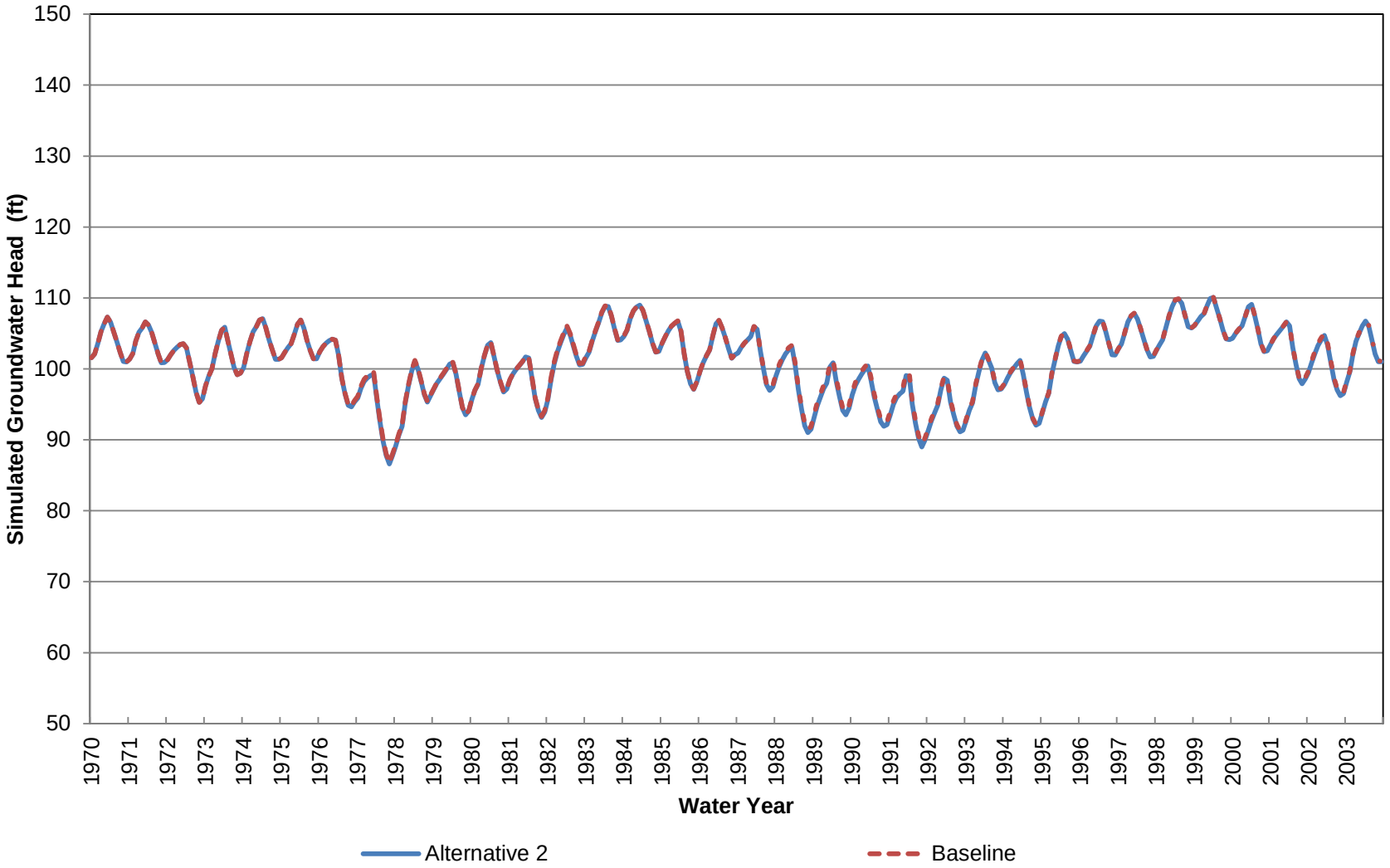
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 5 (Approximately 200-340 ft bgs)



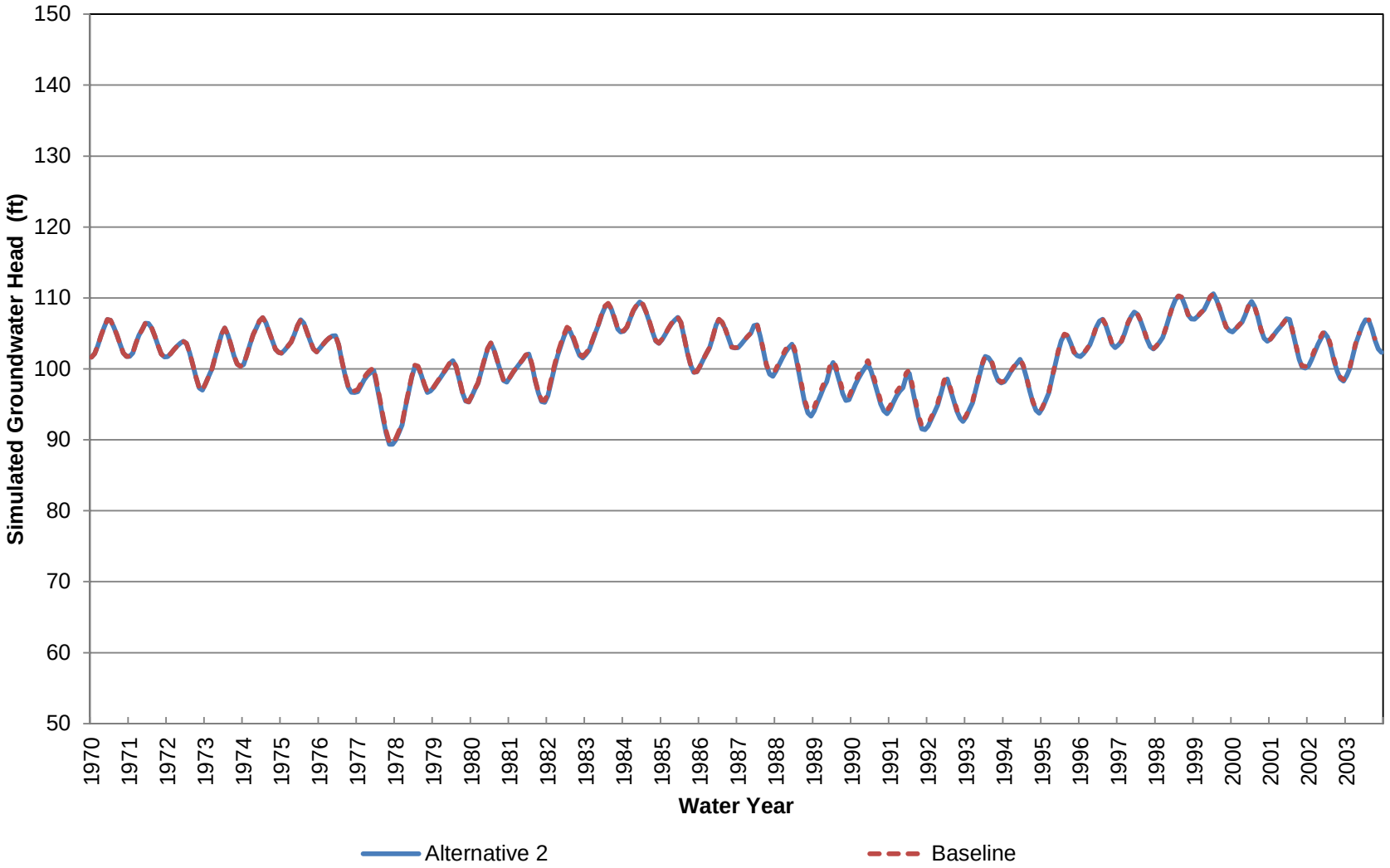
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 5 (Approximately 340-470 ft bgs)



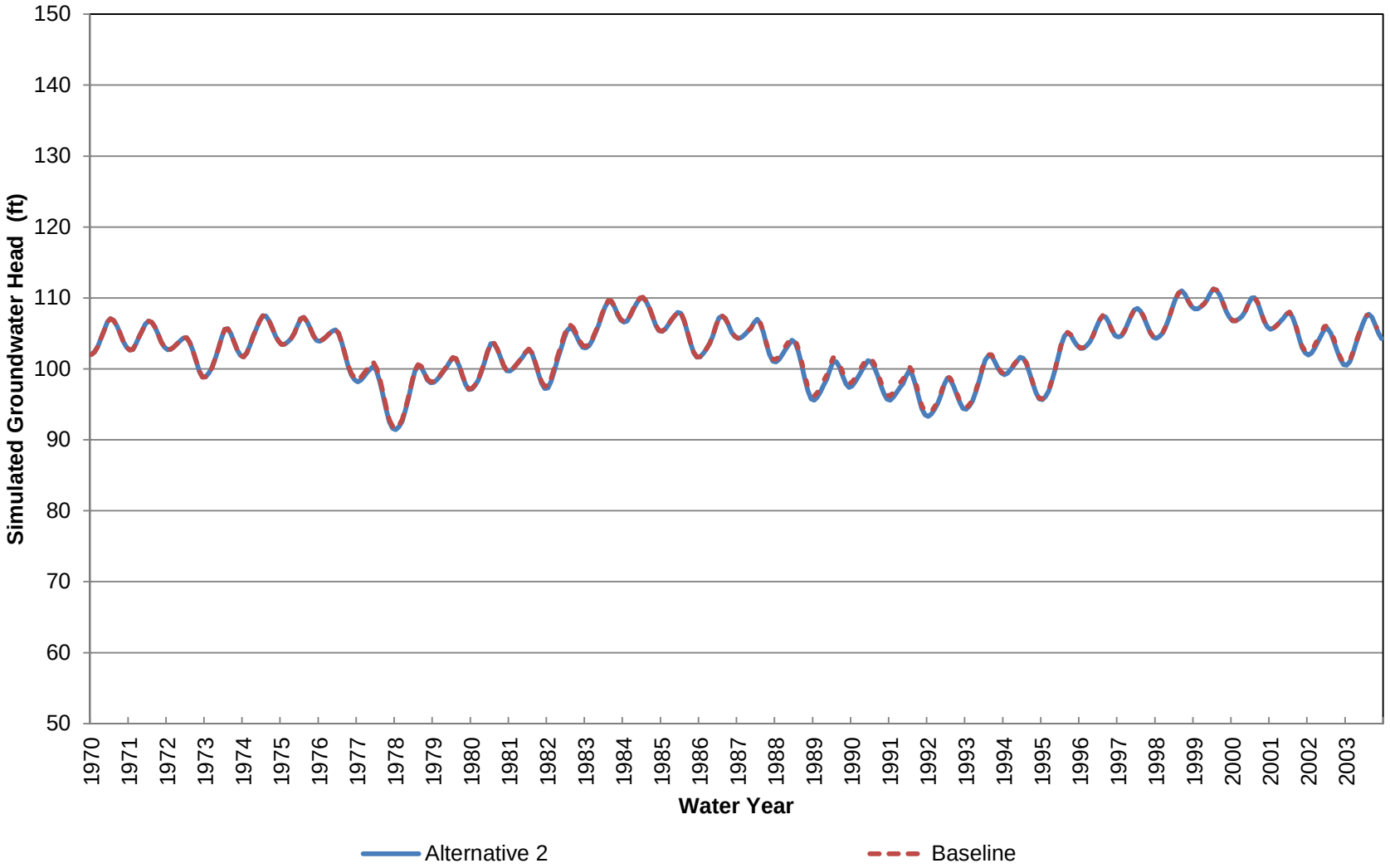
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 5 (Approximately 470-670 ft bgs)



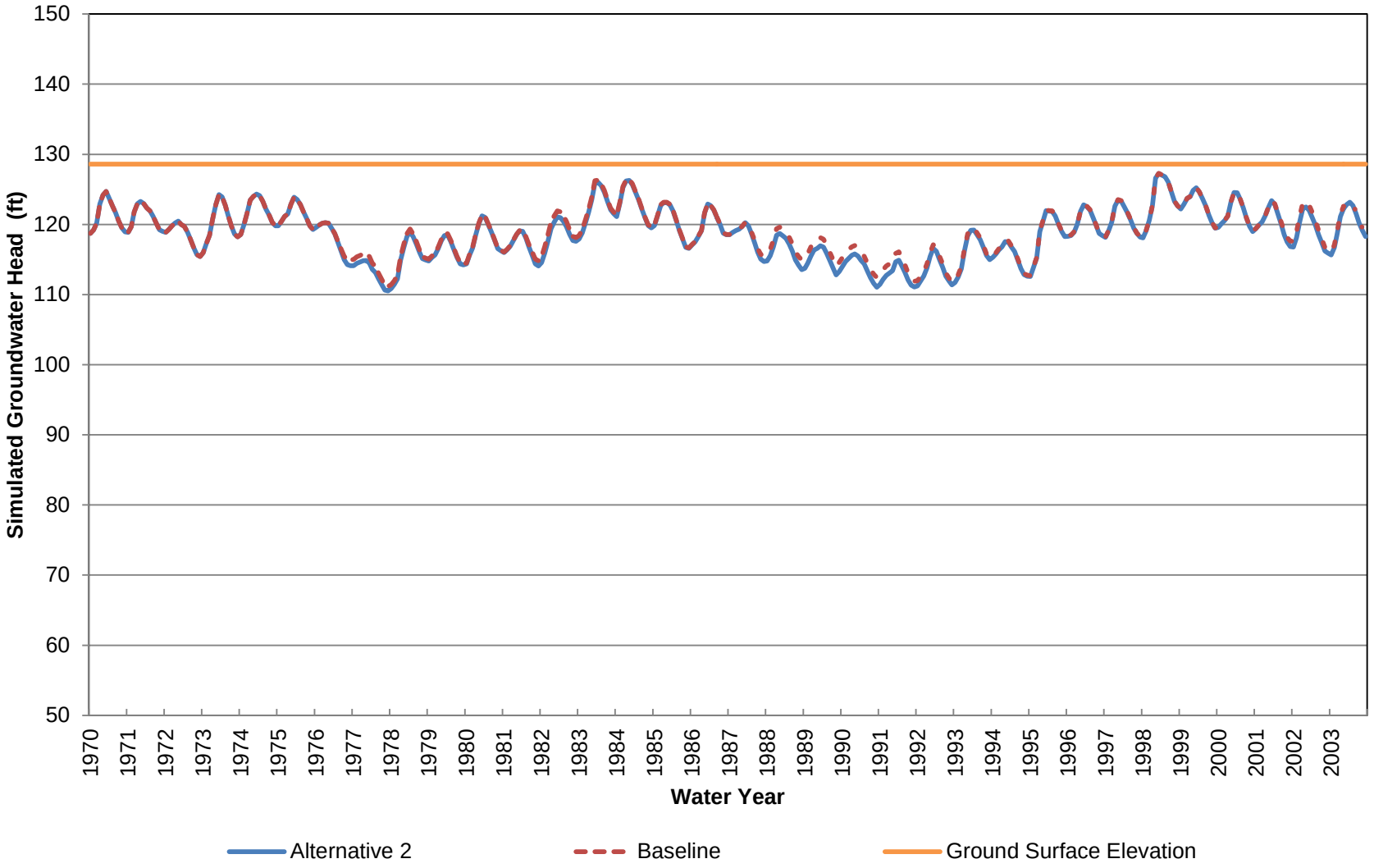
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 5 (Approximately 670-910 ft bgs)



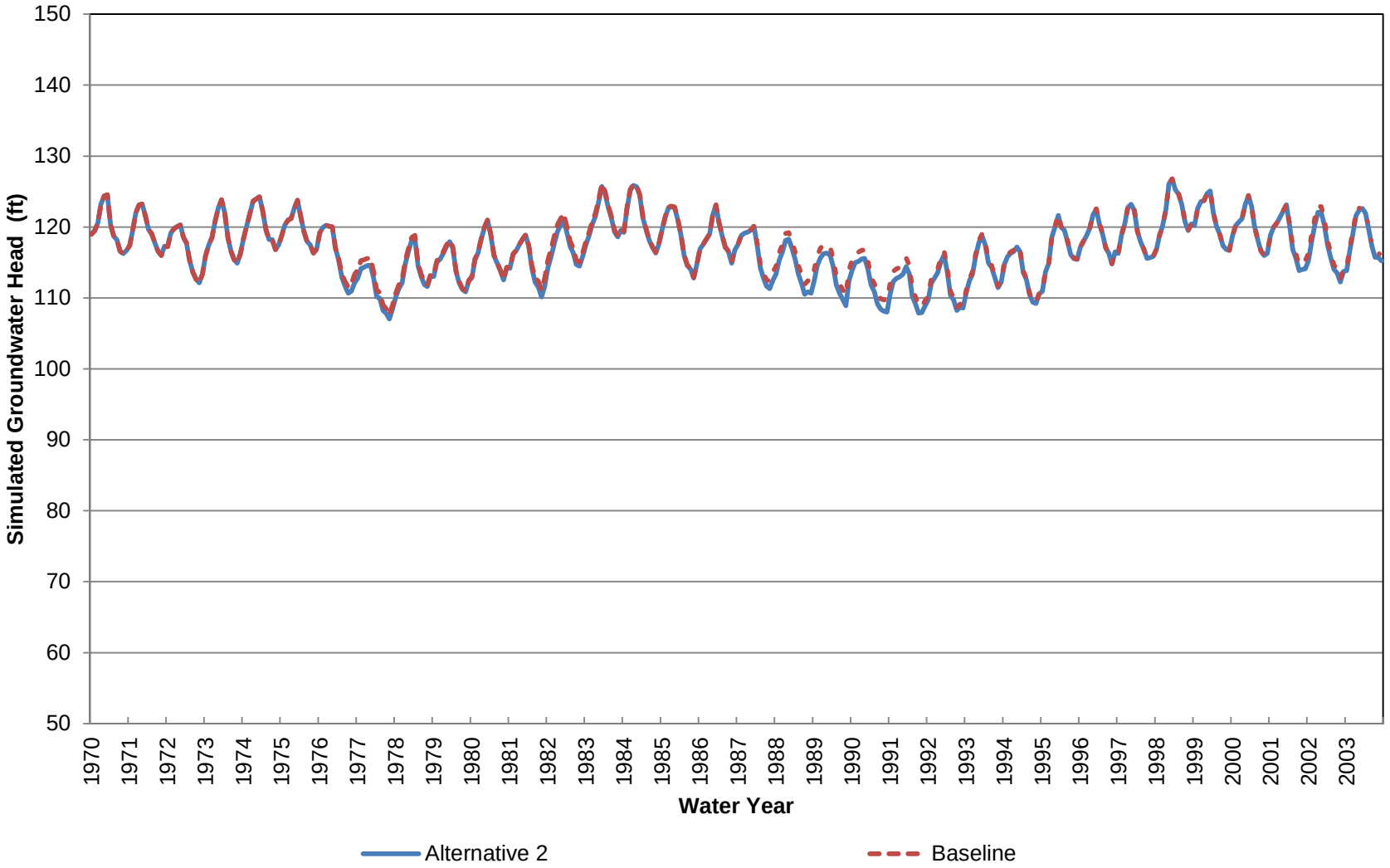
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 5 (Approximately 910-1310 ft bgs)



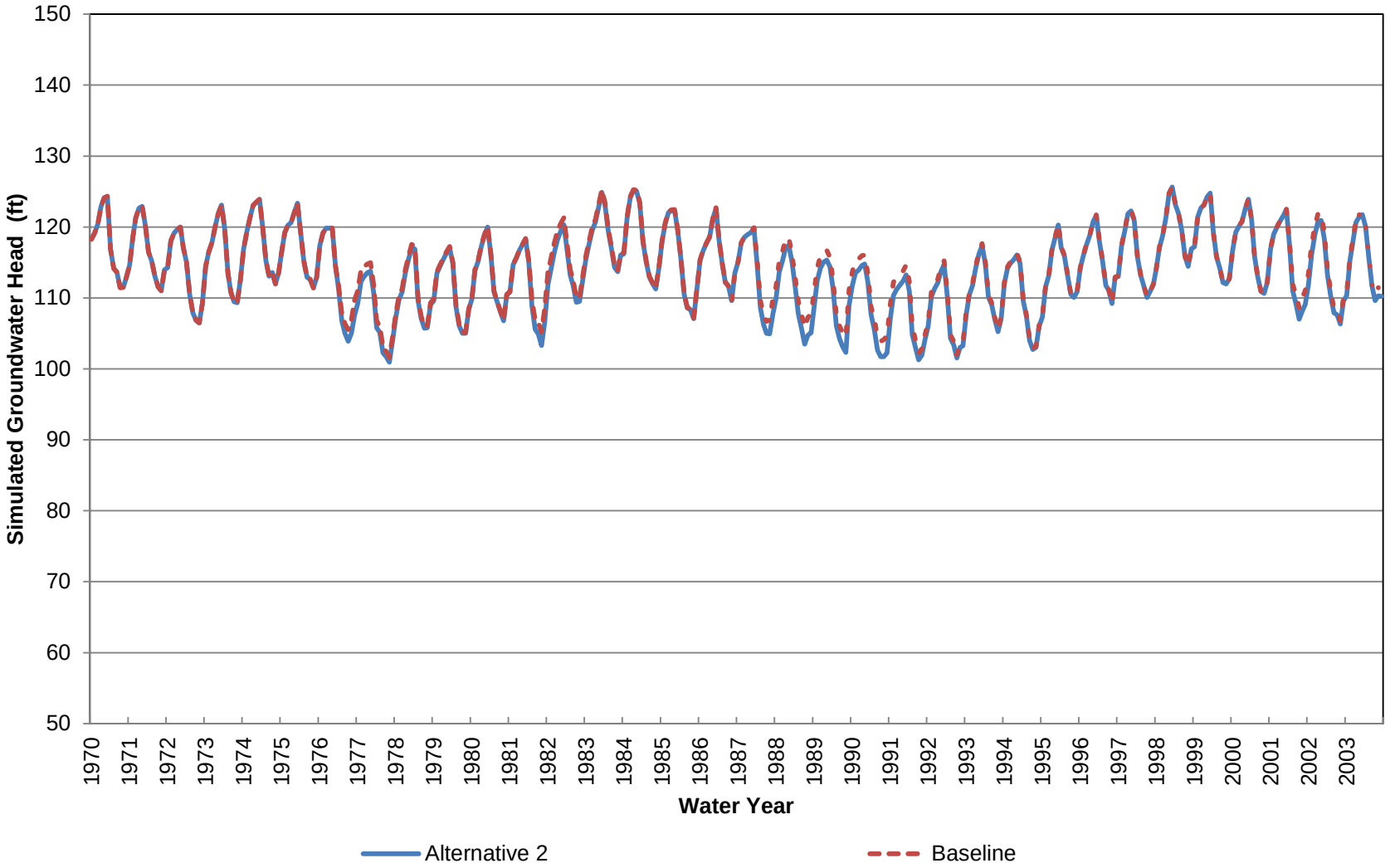
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 6 (Approximately 0-70 ft bgs)



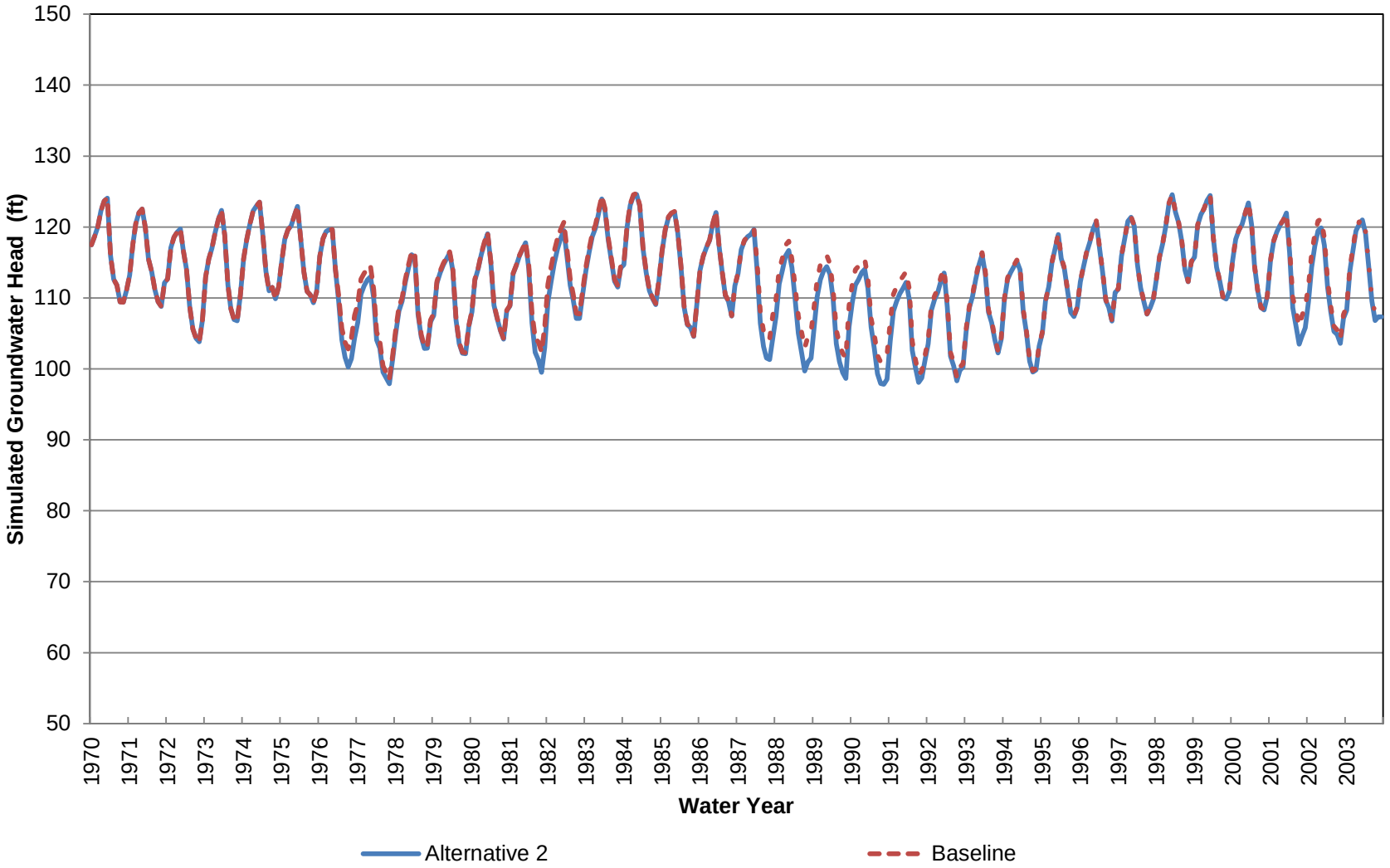
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 6 (Approximately 70-200 ft bgs)



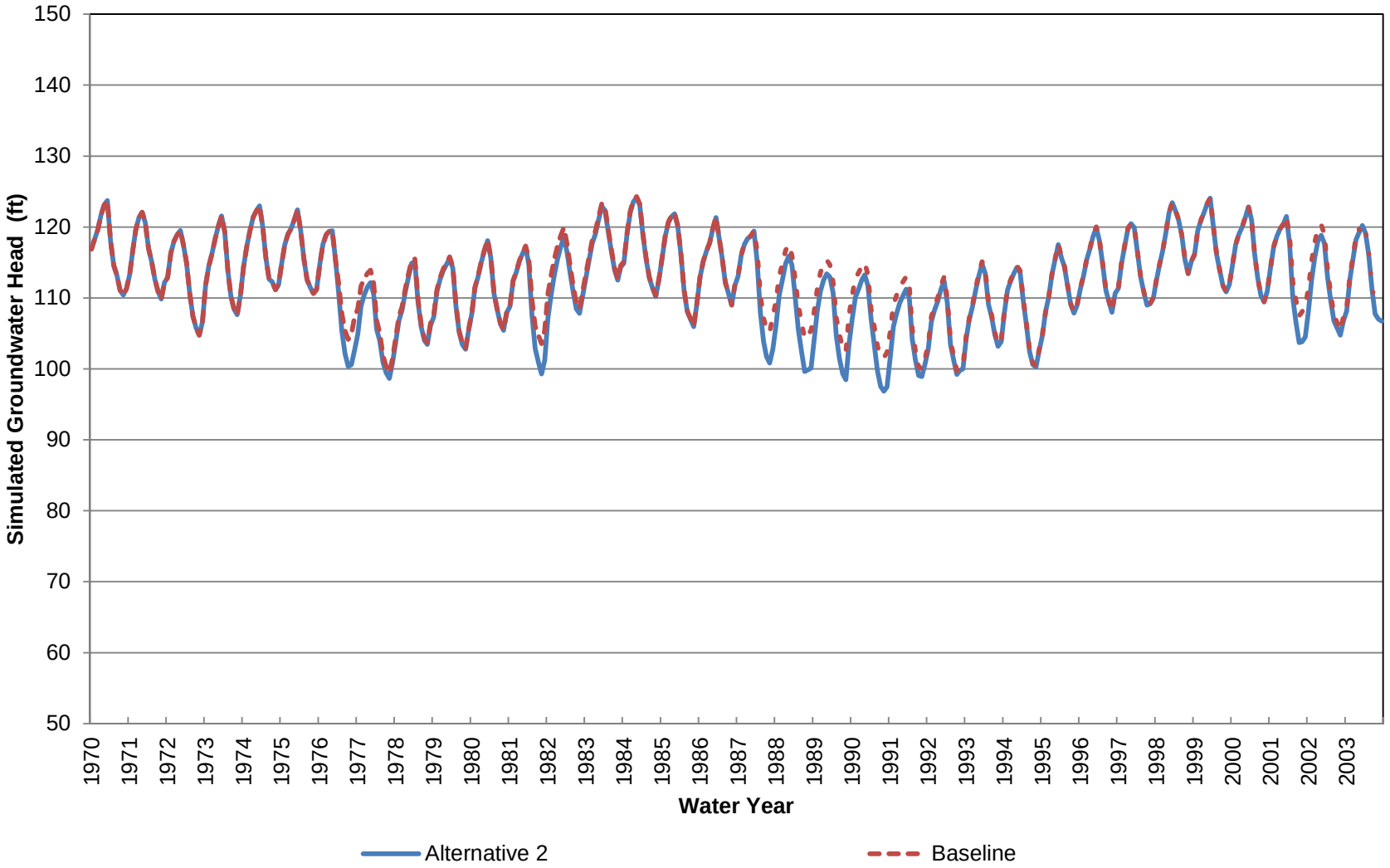
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 6 (Approximately 200-320 ft bgs)



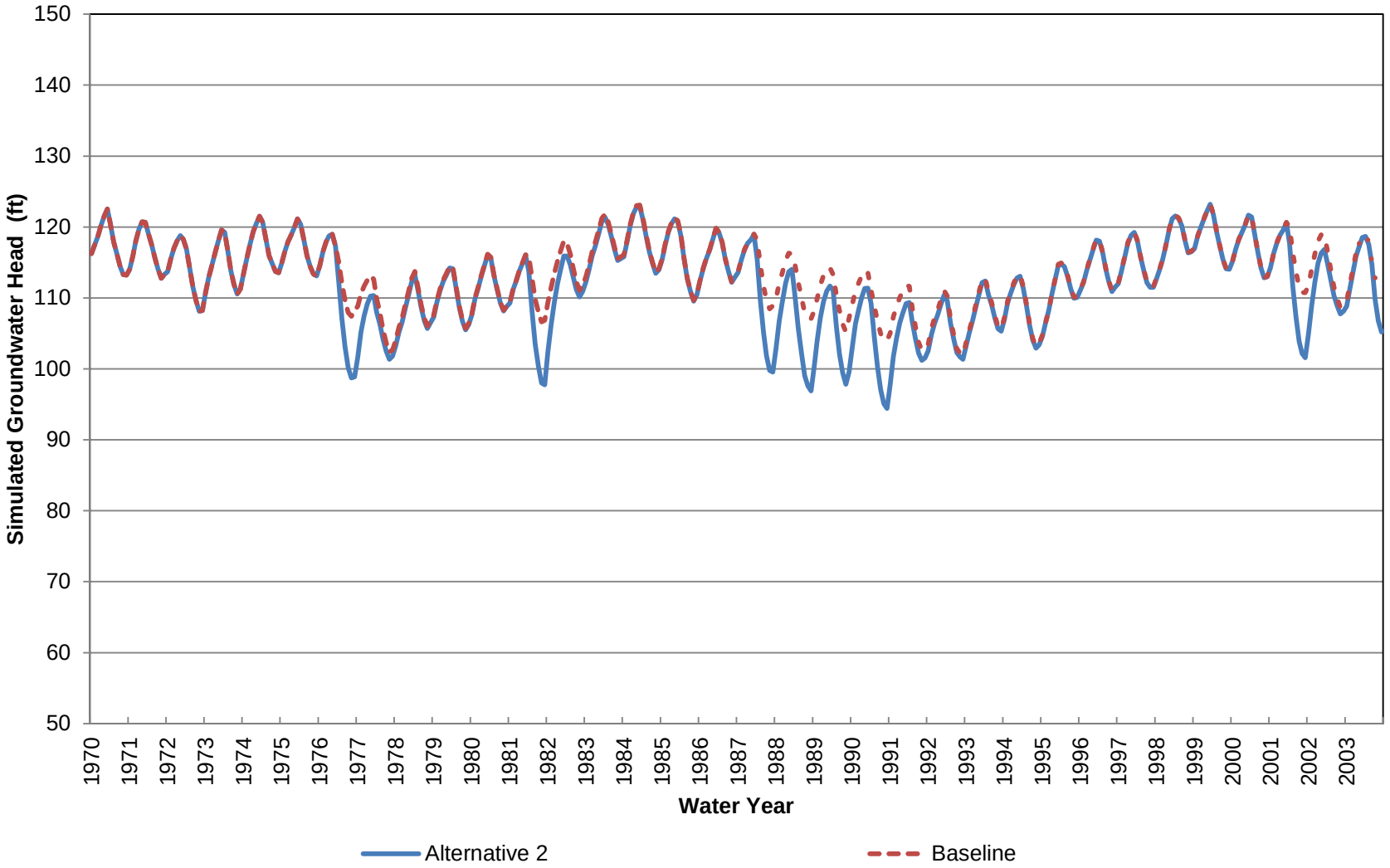
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 6 (Approximately 320-440 ft bgs)



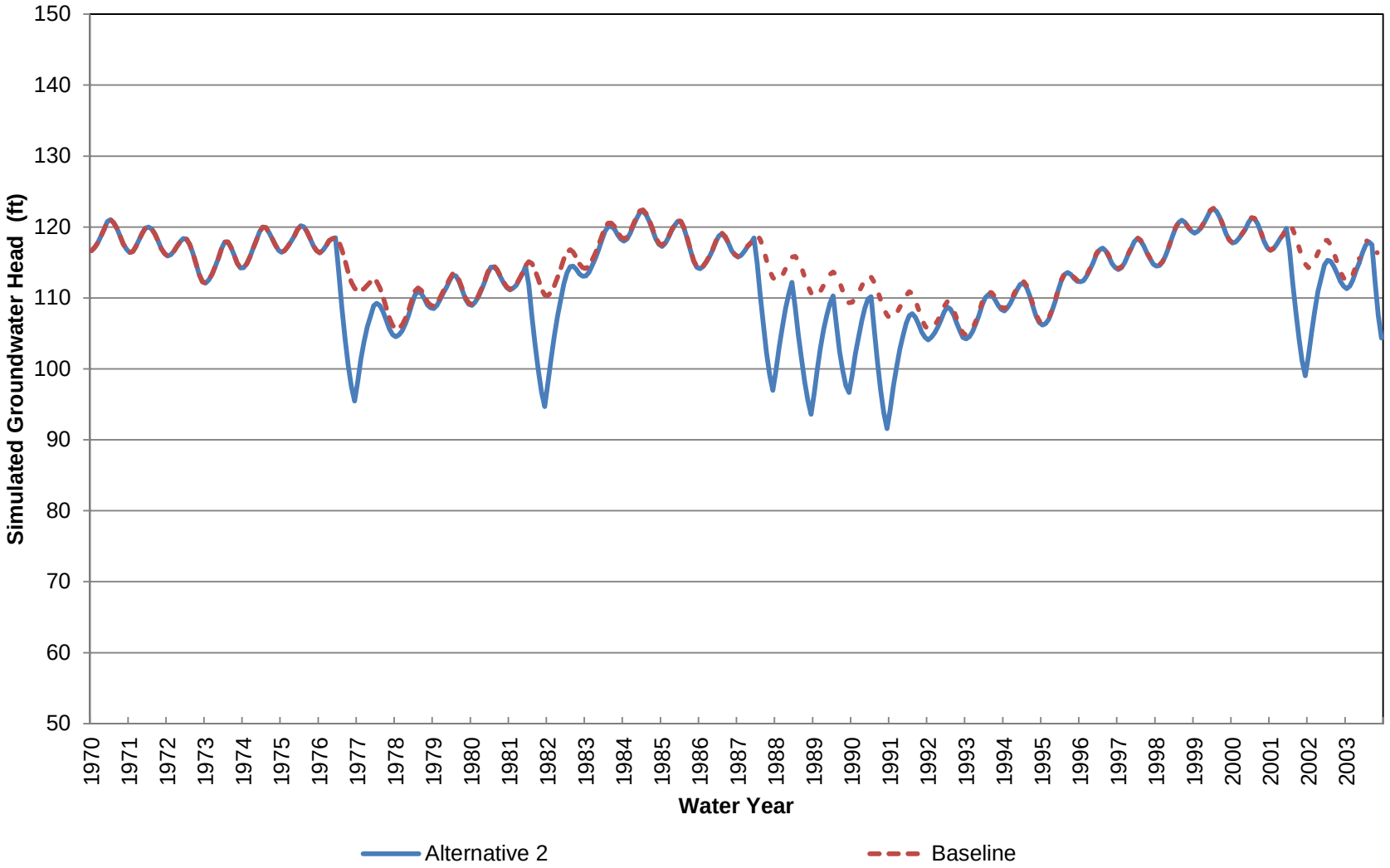
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 6 (Approximately 440-630 ft bgs)



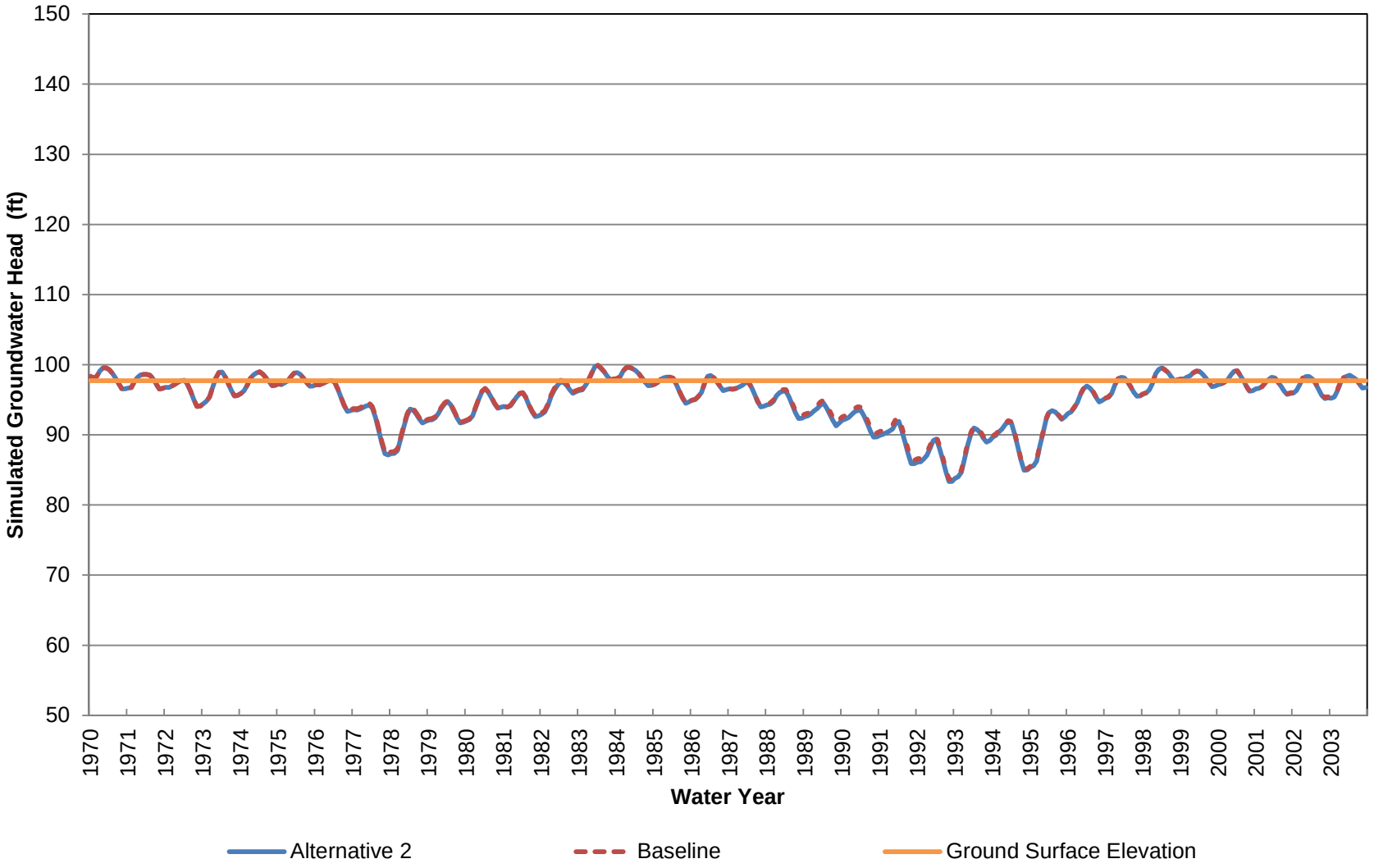
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 6 (Approximately 630-860 ft bgs)



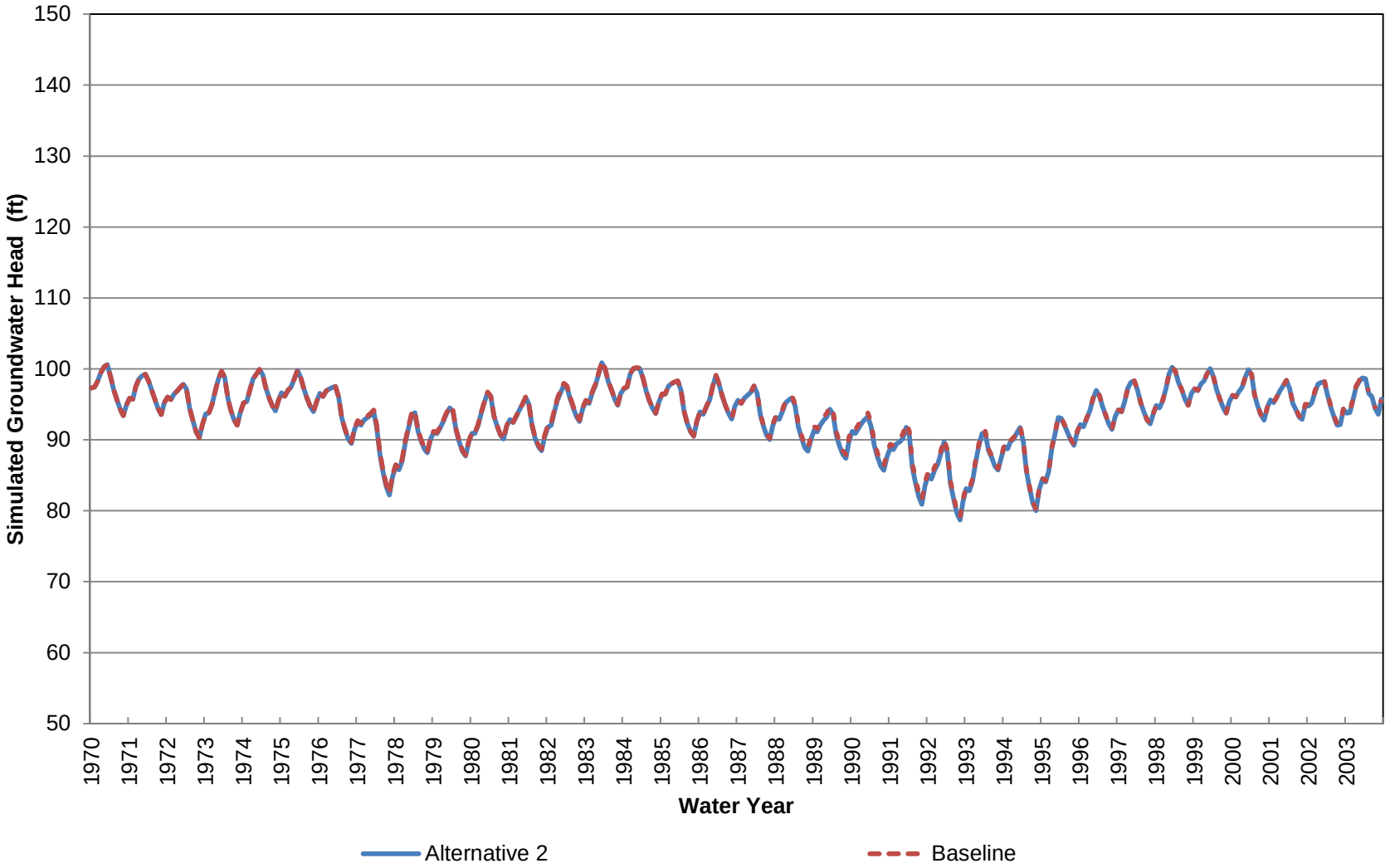
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 6 (Approximately 860-1290 ft bgs)



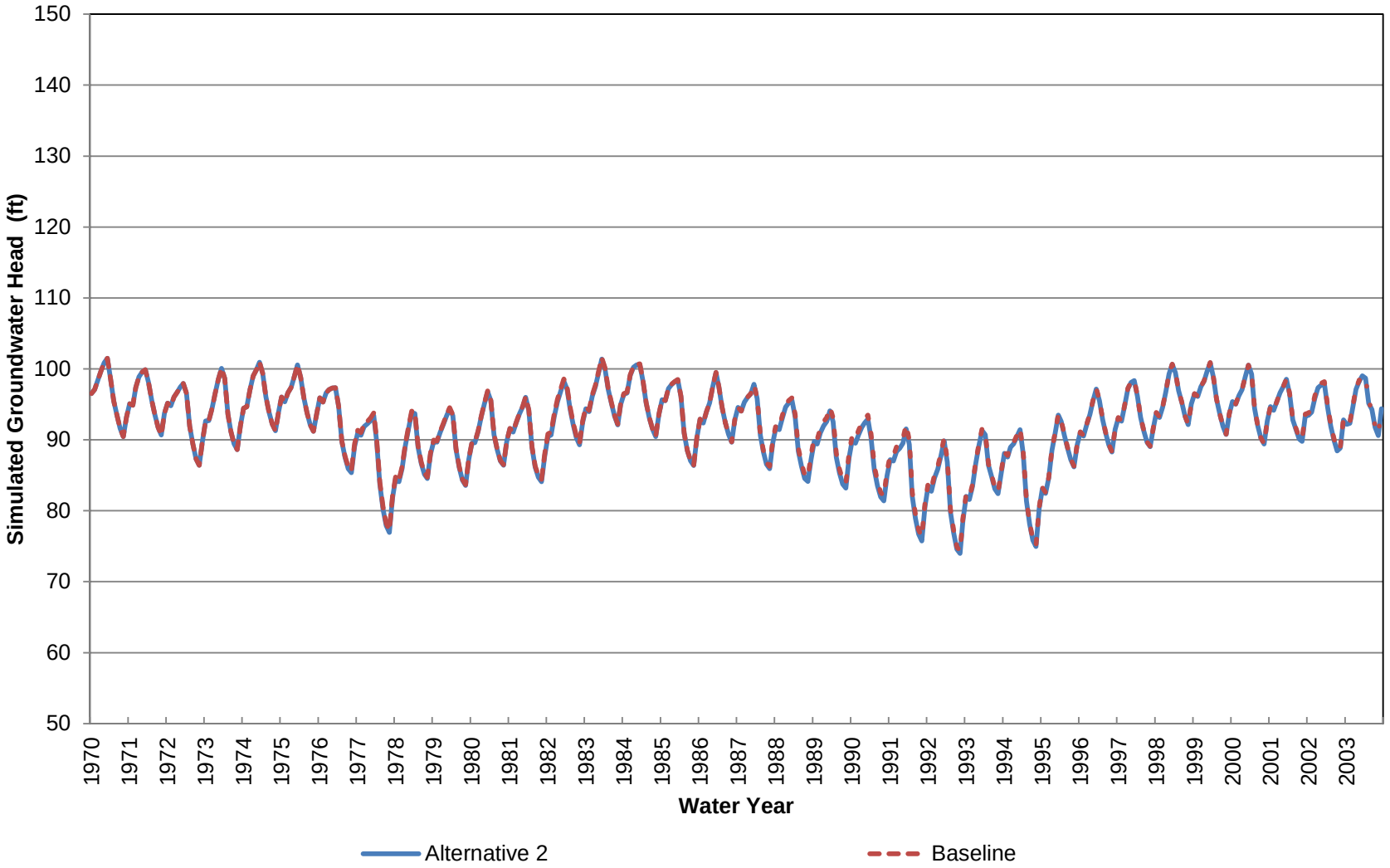
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 7 (Approximately 0-70 ft bgs)



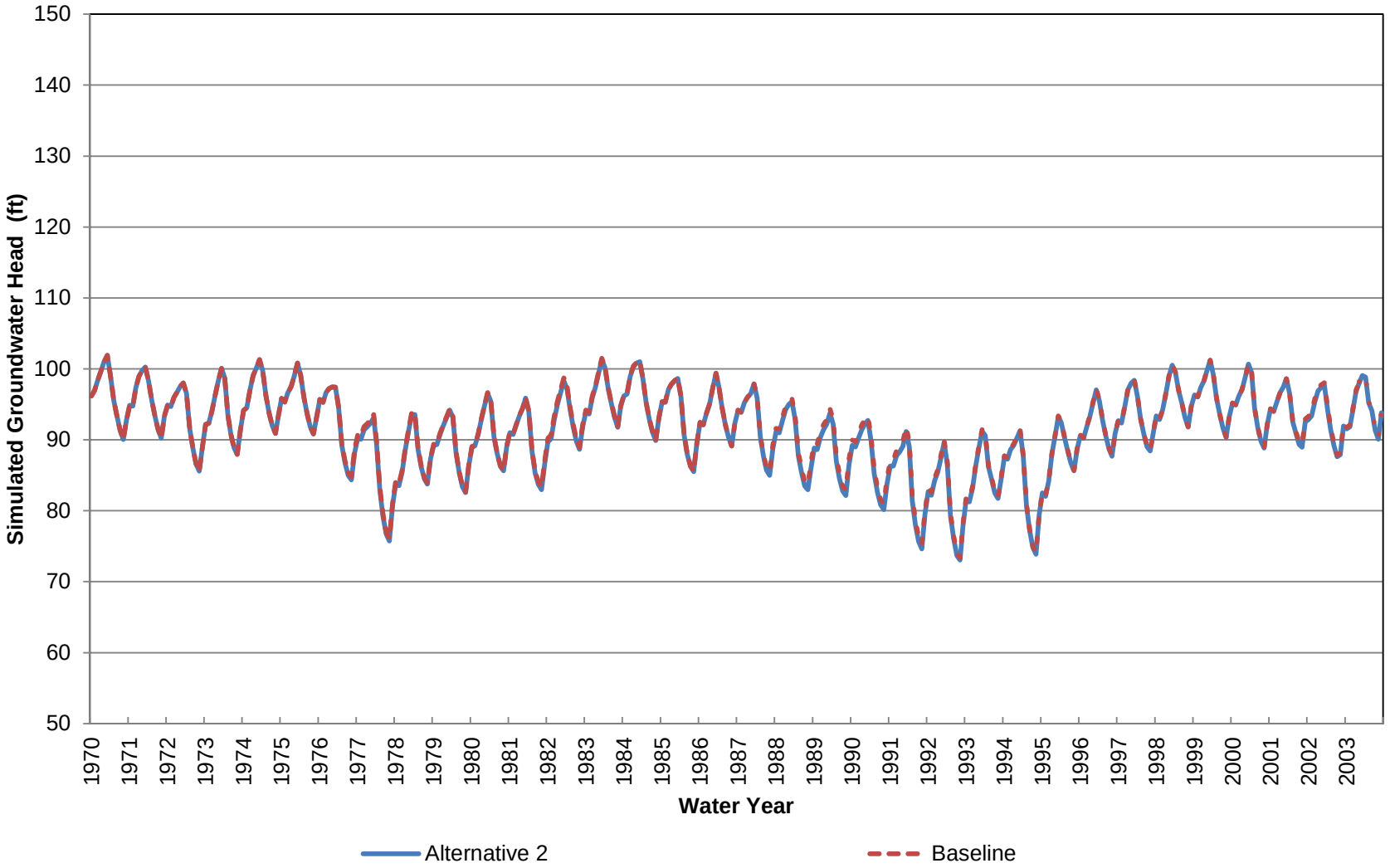
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 7 (Approximately 70-220 ft bgs)



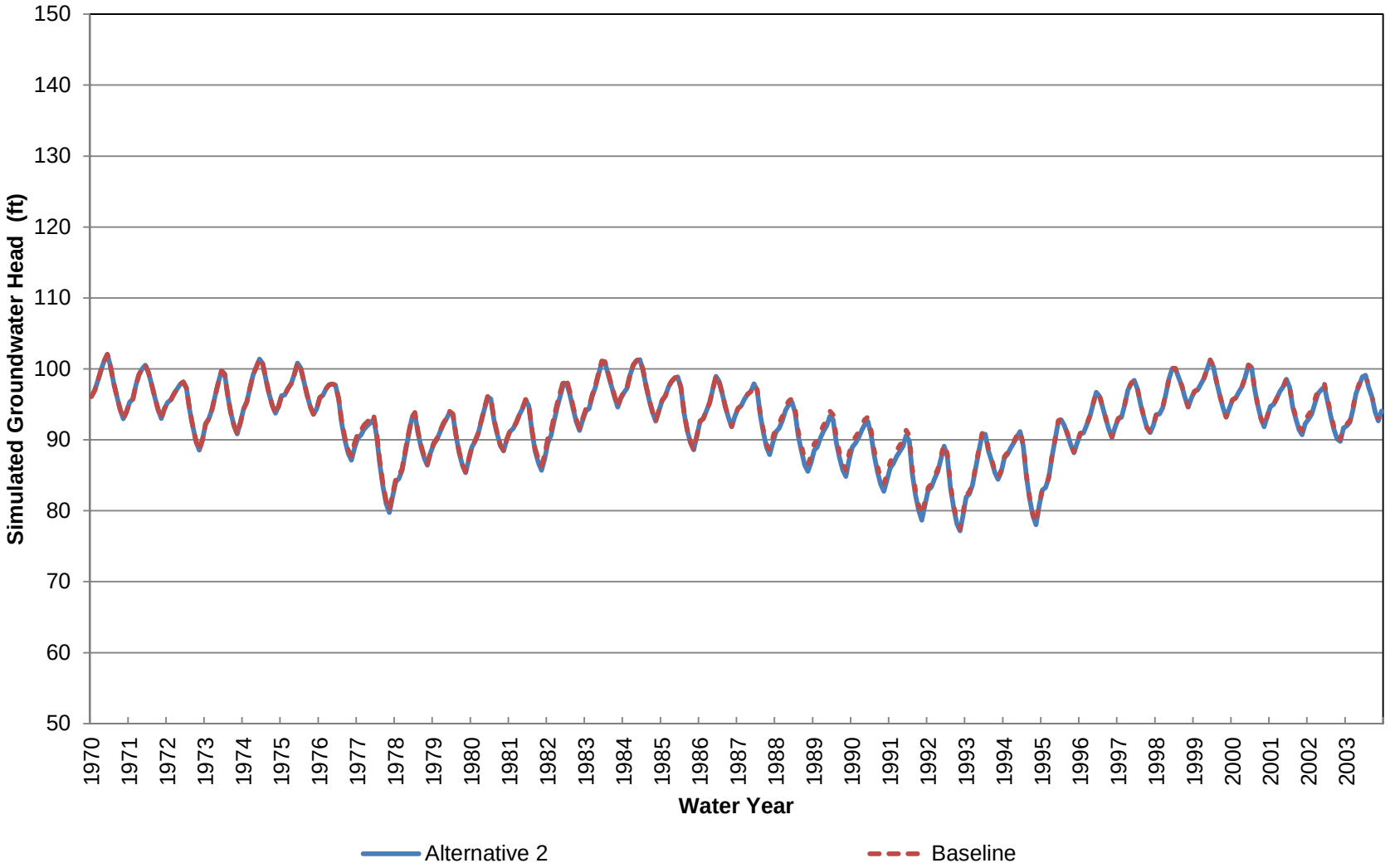
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 7 (Approximately 220-370 ft bgs)



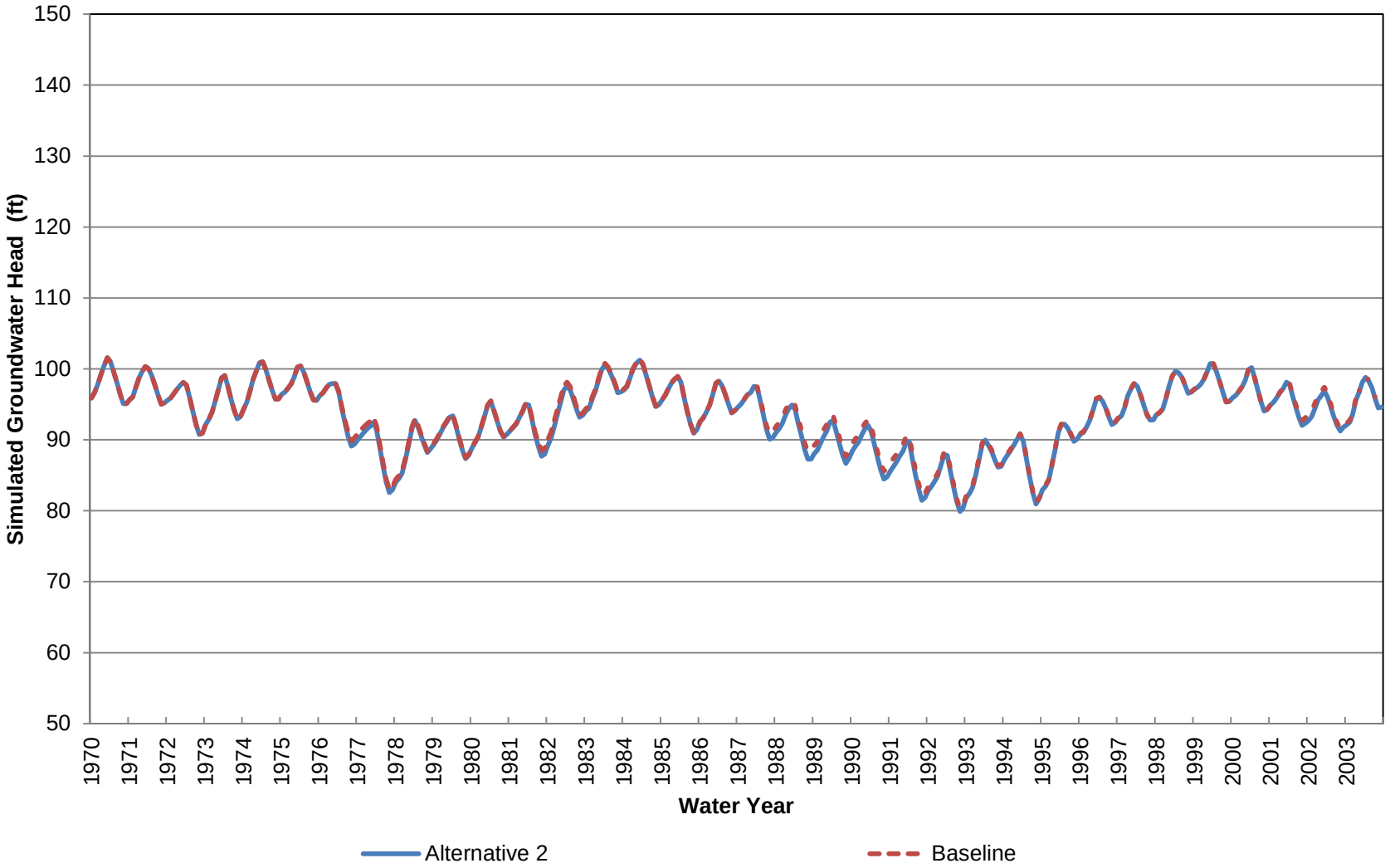
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 7 (Approximately 370-520 ft bgs)



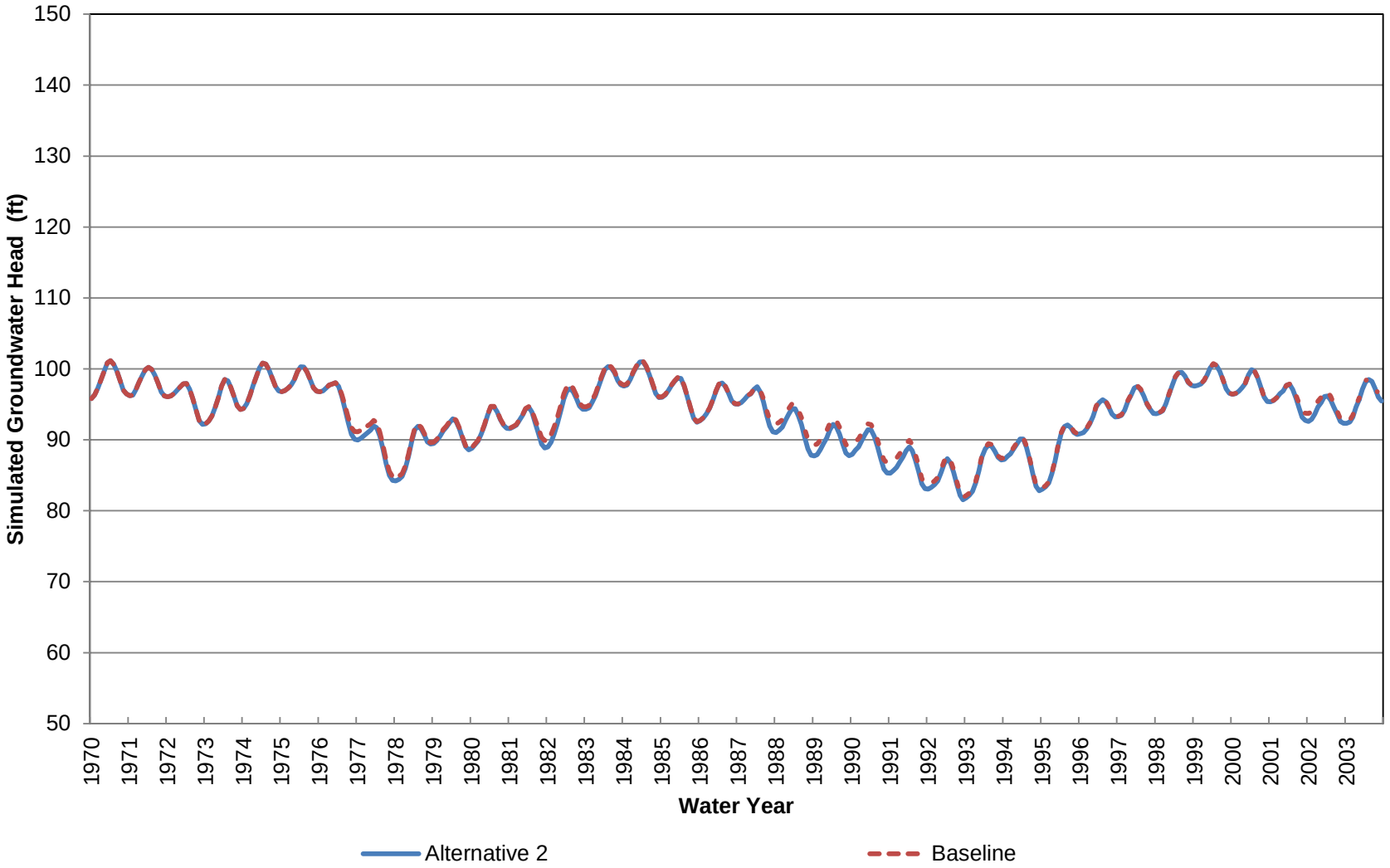
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 7 (Approximately 520-760 ft bgs)



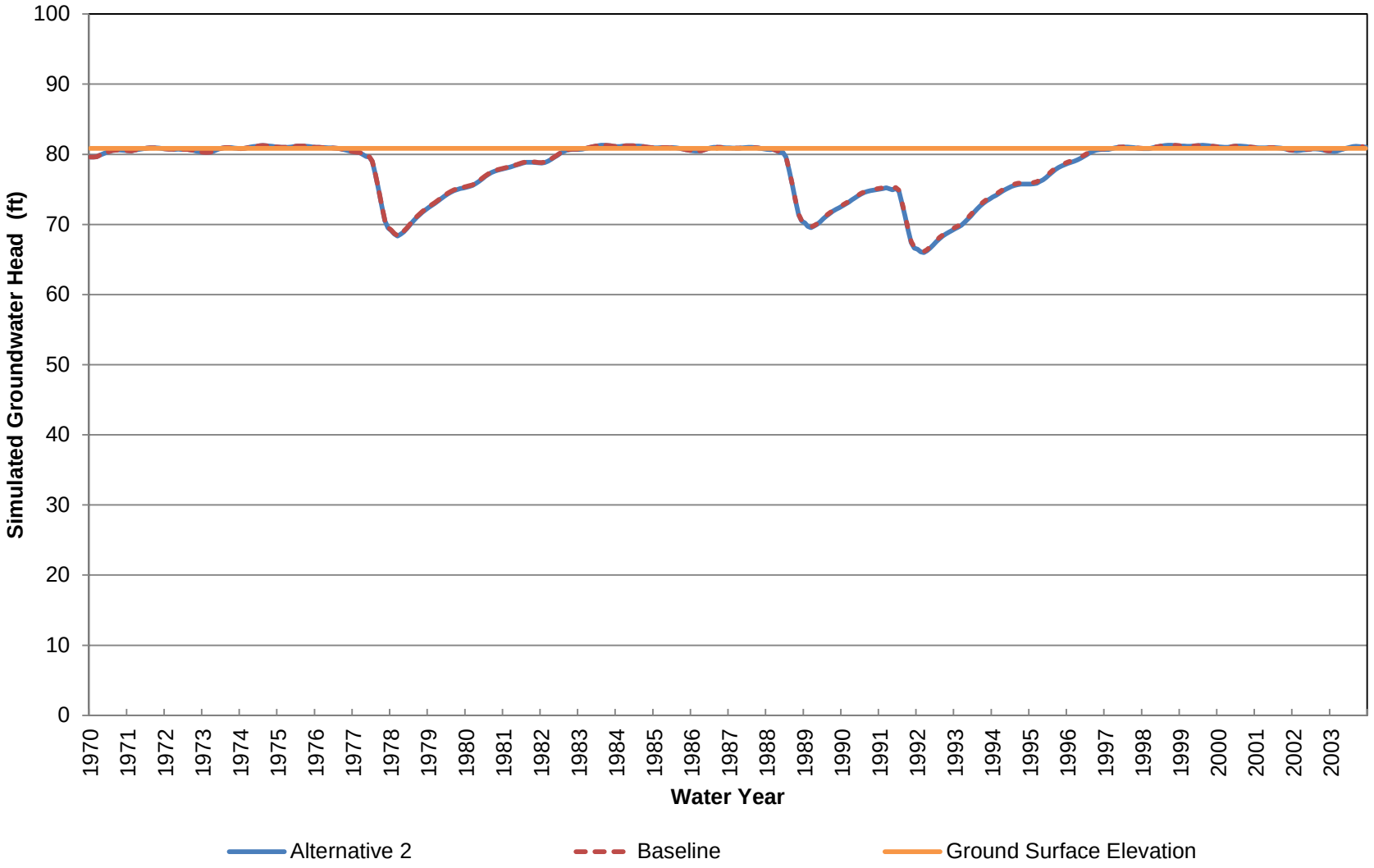
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 7 (Approximately 760-1030 ft bgs)



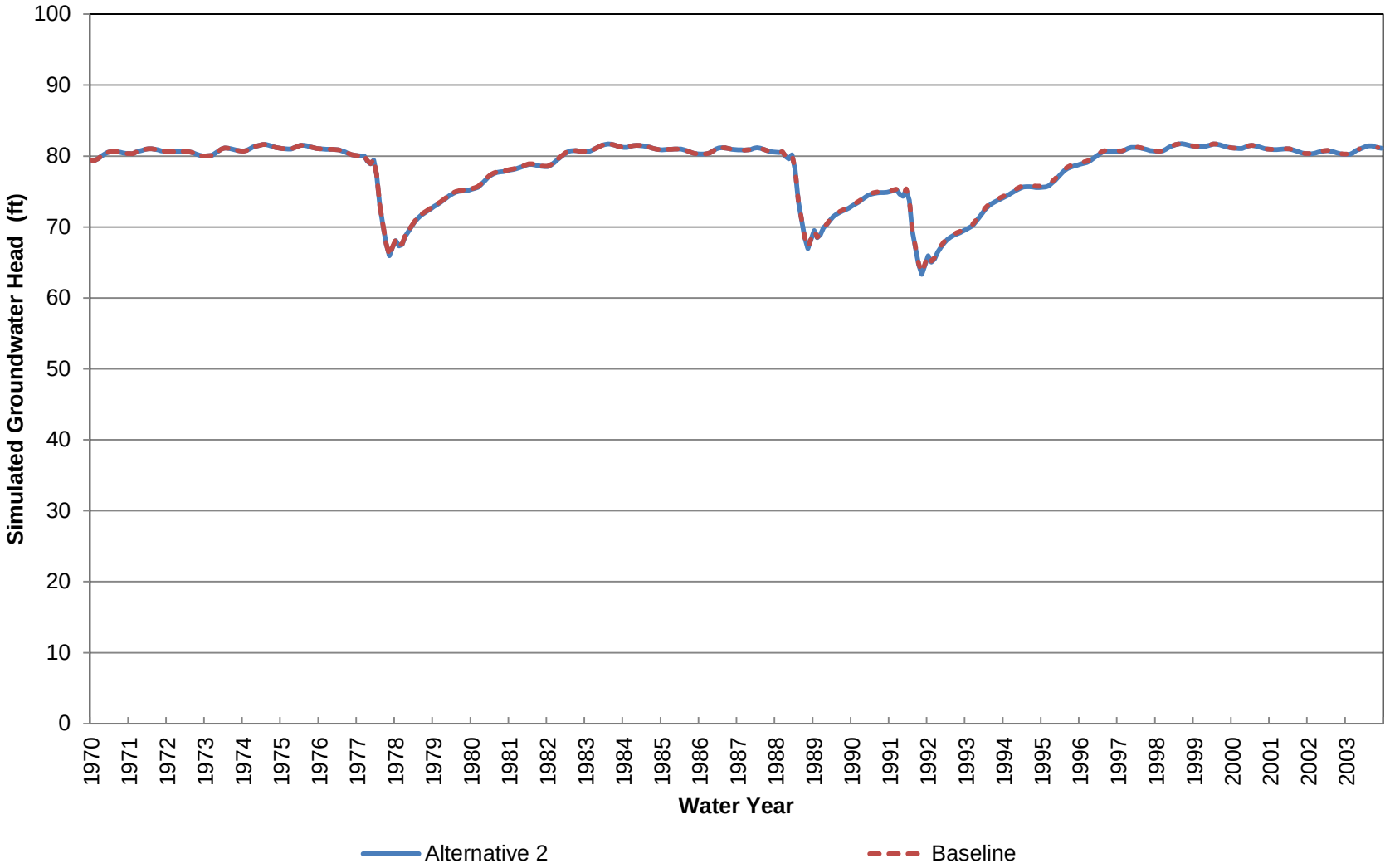
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 7 (Approximately 1030-1520 ft bgs)



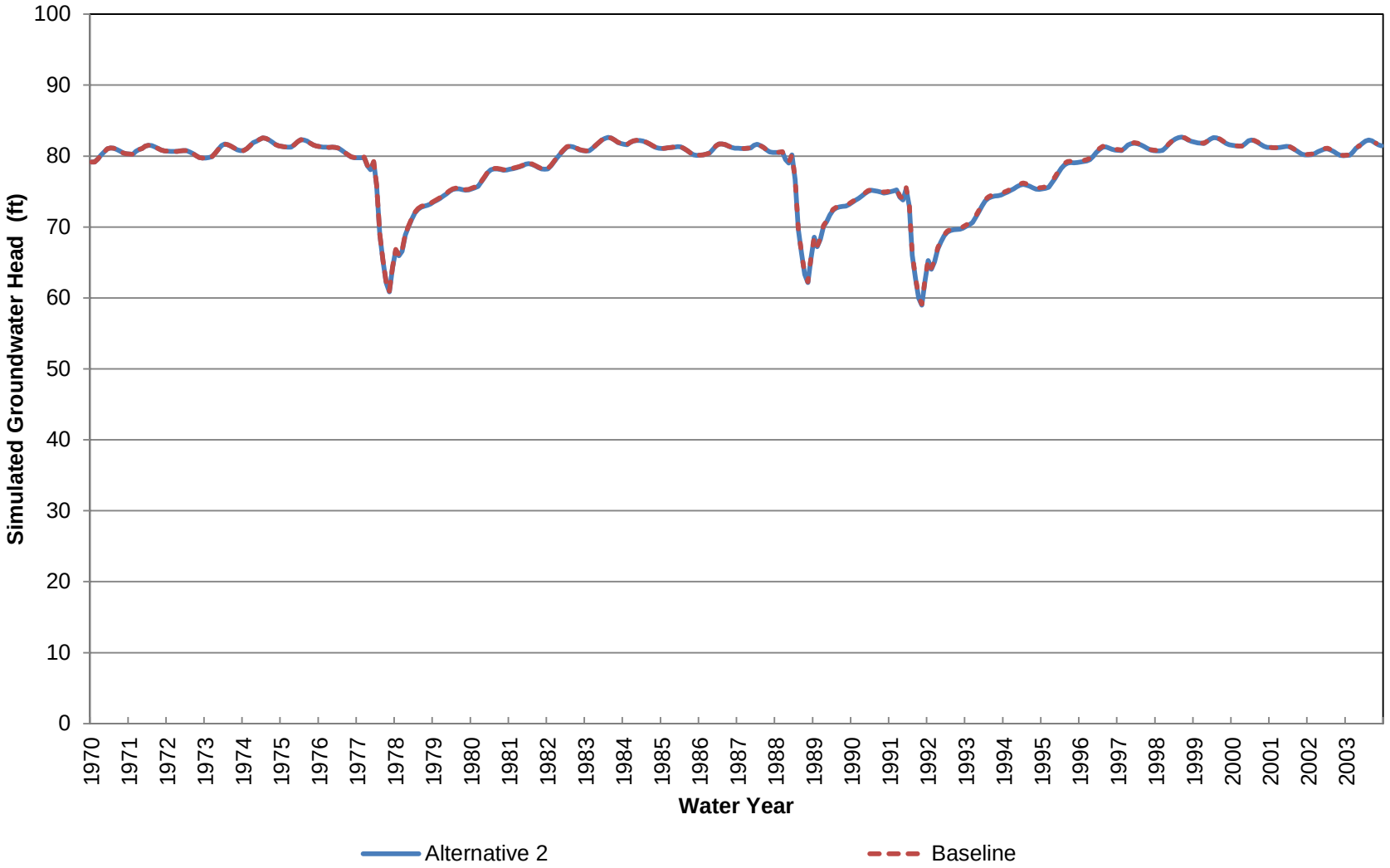
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 8 (Approximately 0-70 ft bgs)



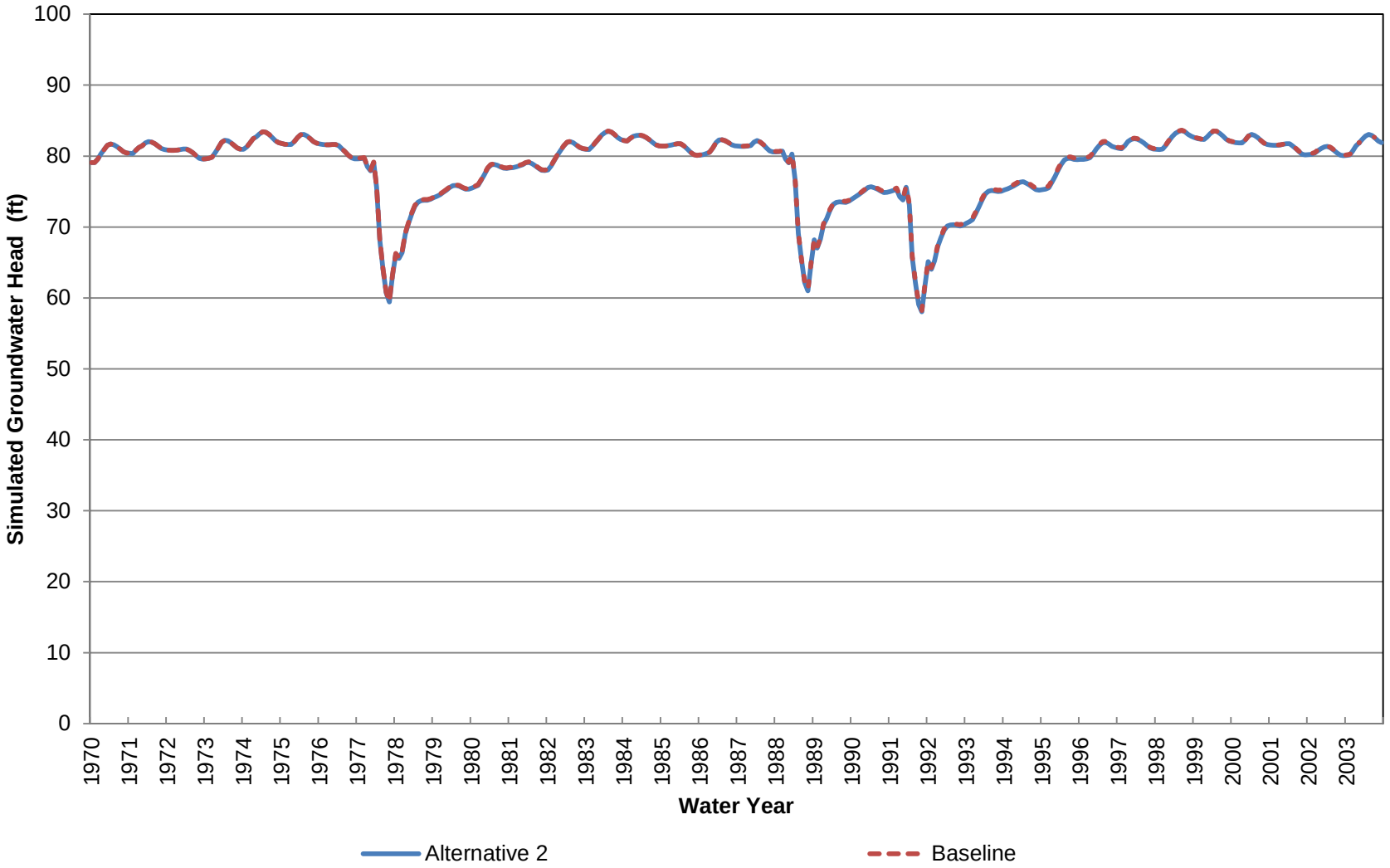
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 8 (Approximately 70-200 ft bgs)



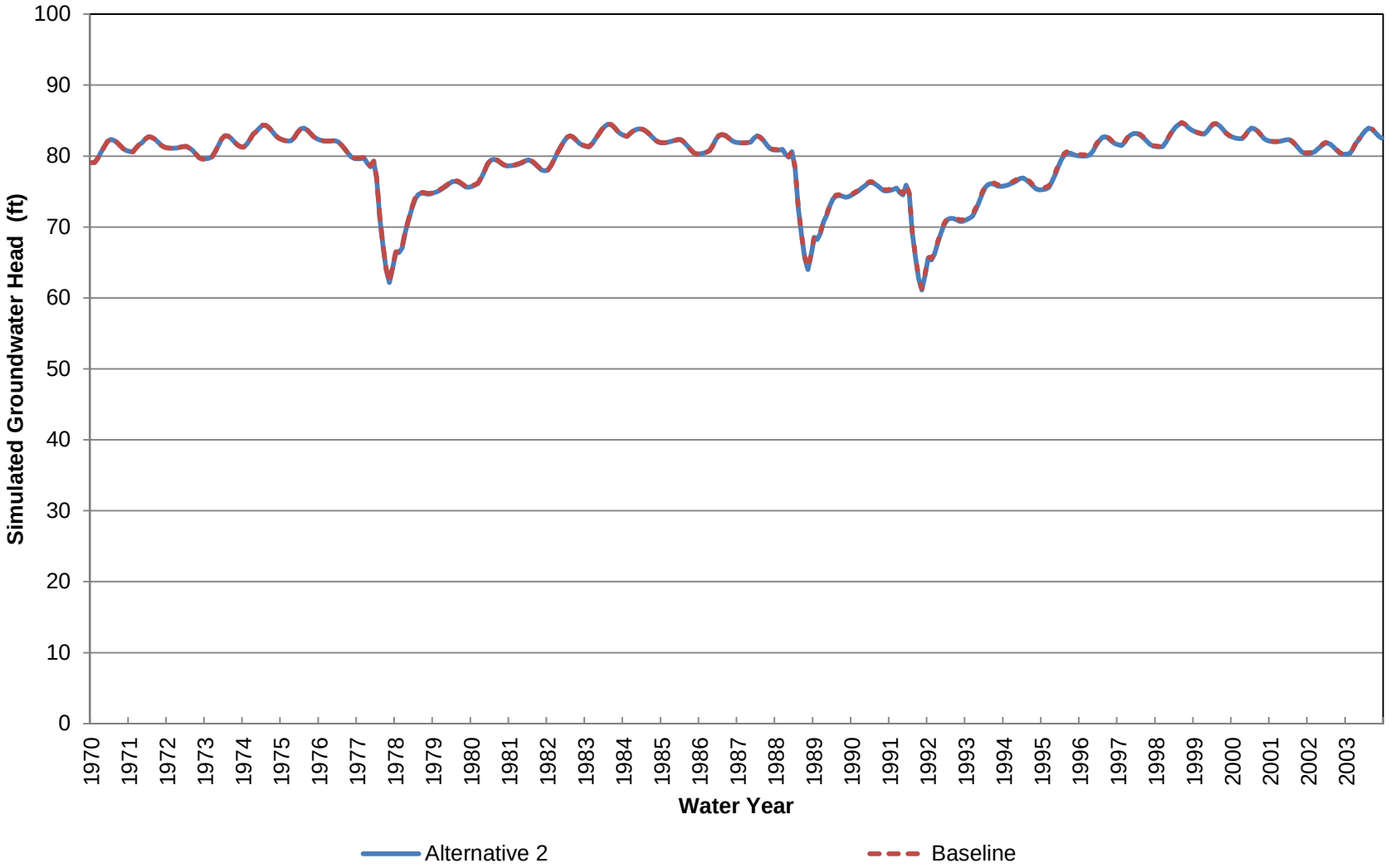
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 8 (Approximately 200-330 ft bgs)



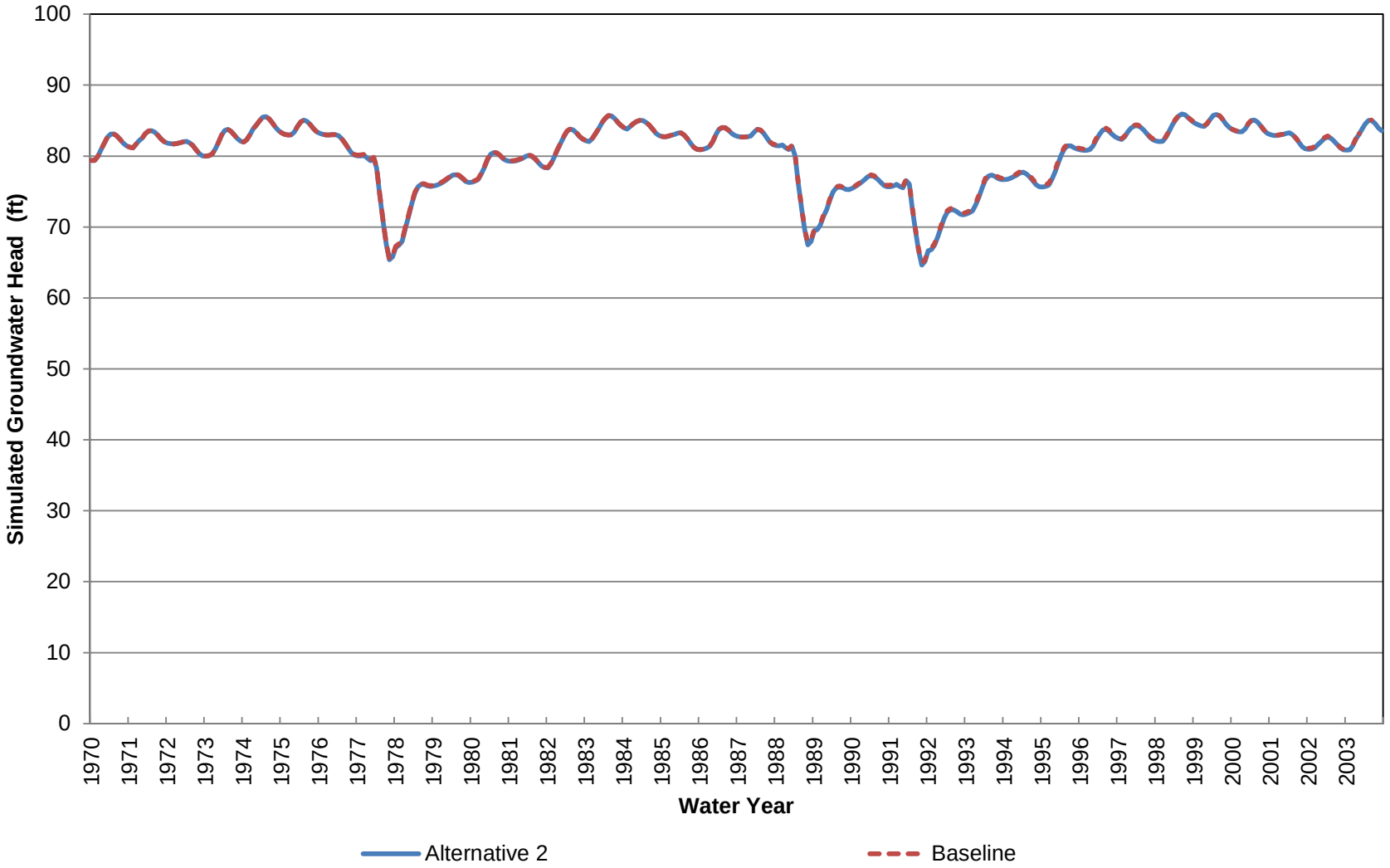
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 8 (Approximately 330-450 ft bgs)



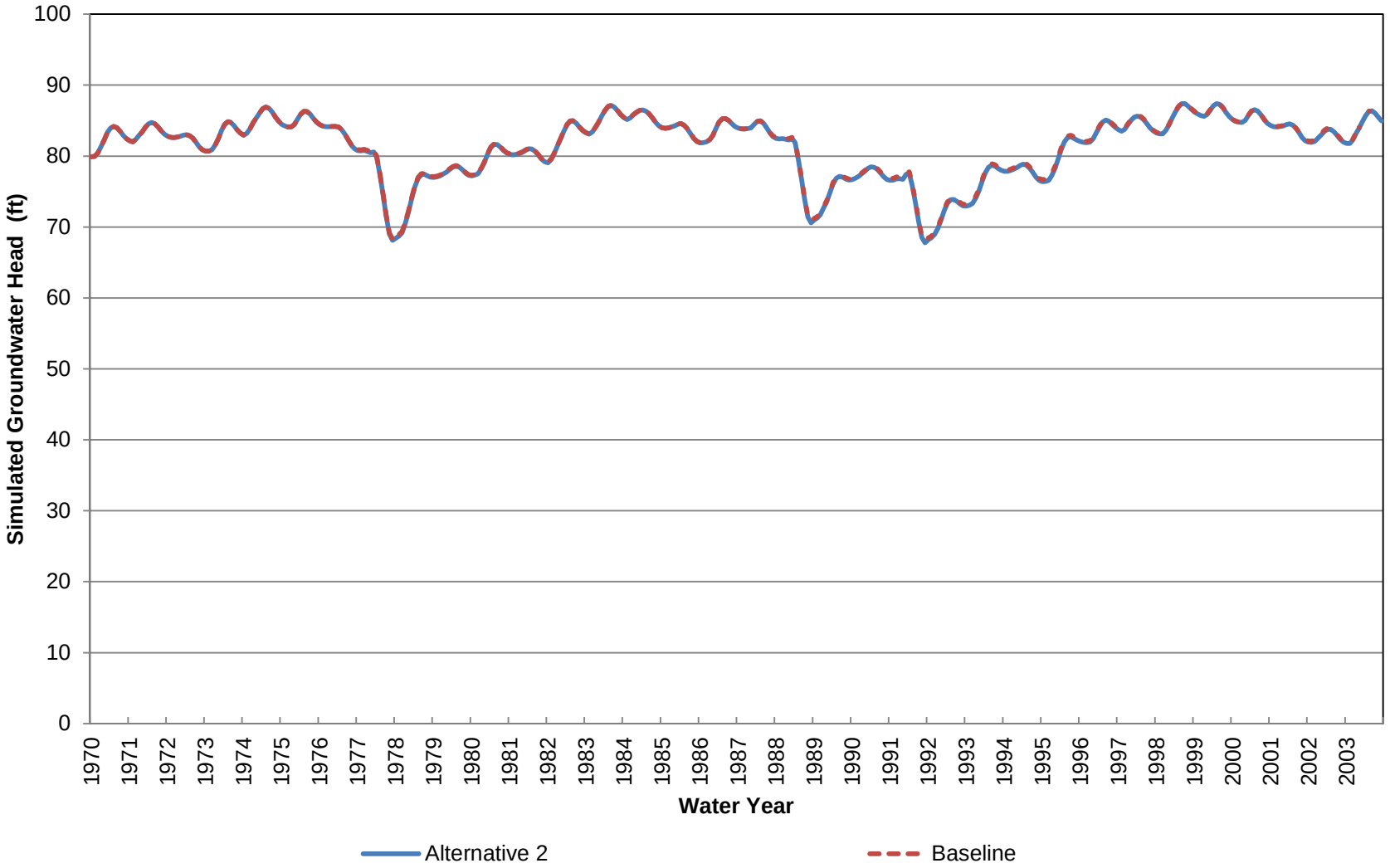
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 8 (Approximately 450-650 ft bgs)



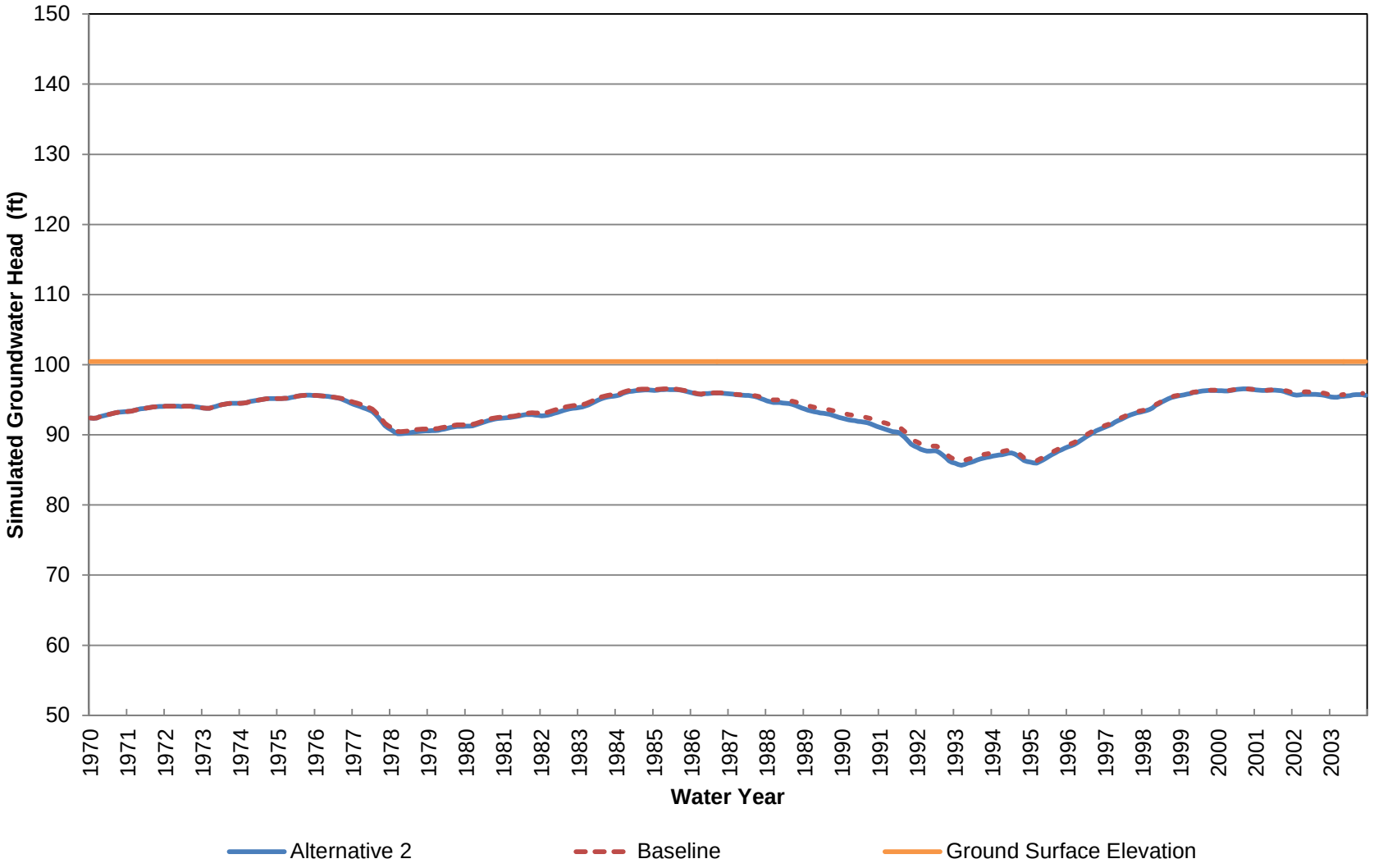
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 8 (Approximately 650-890 ft bgs)



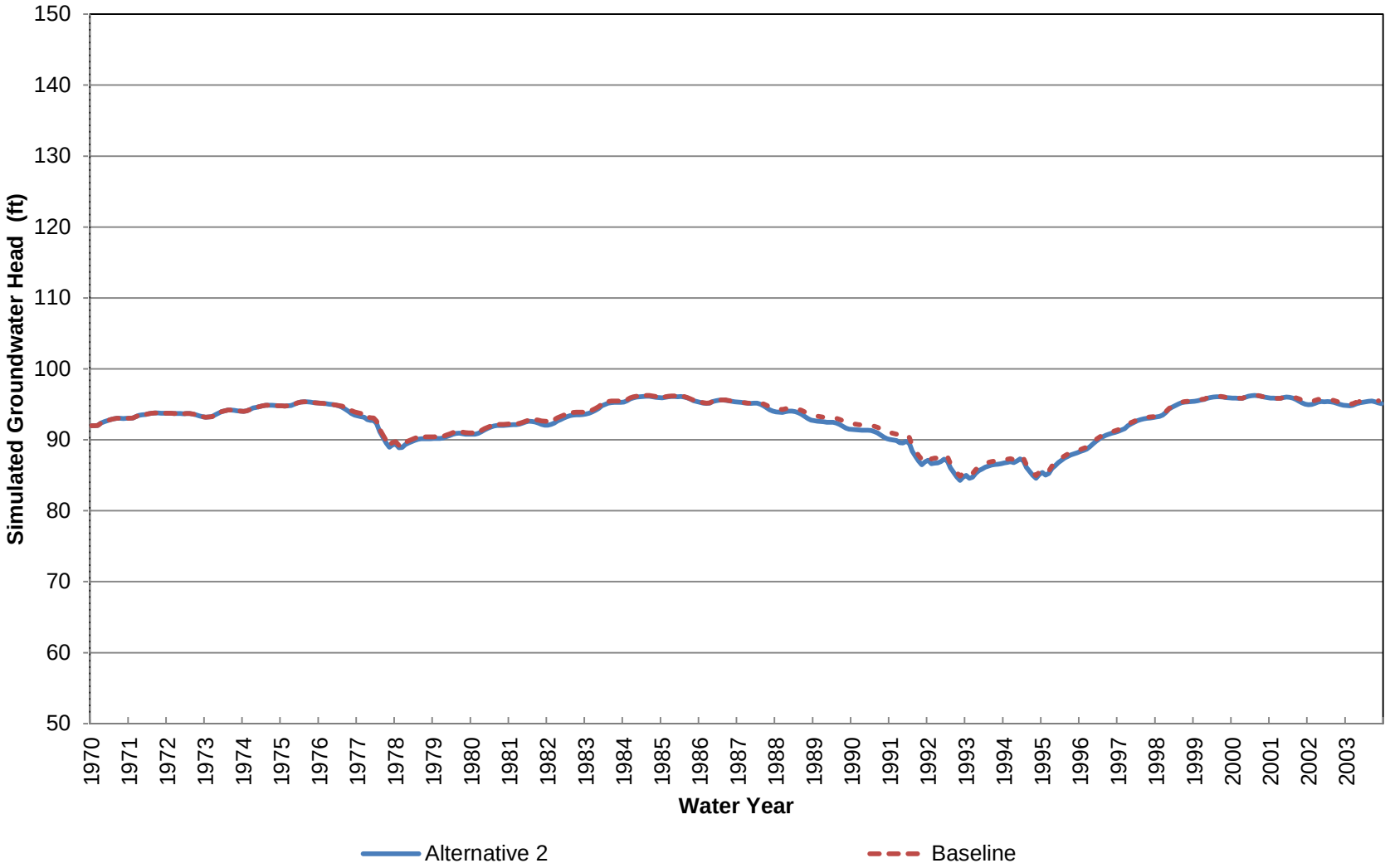
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 8 (Approximately 890-1330 ft bgs)



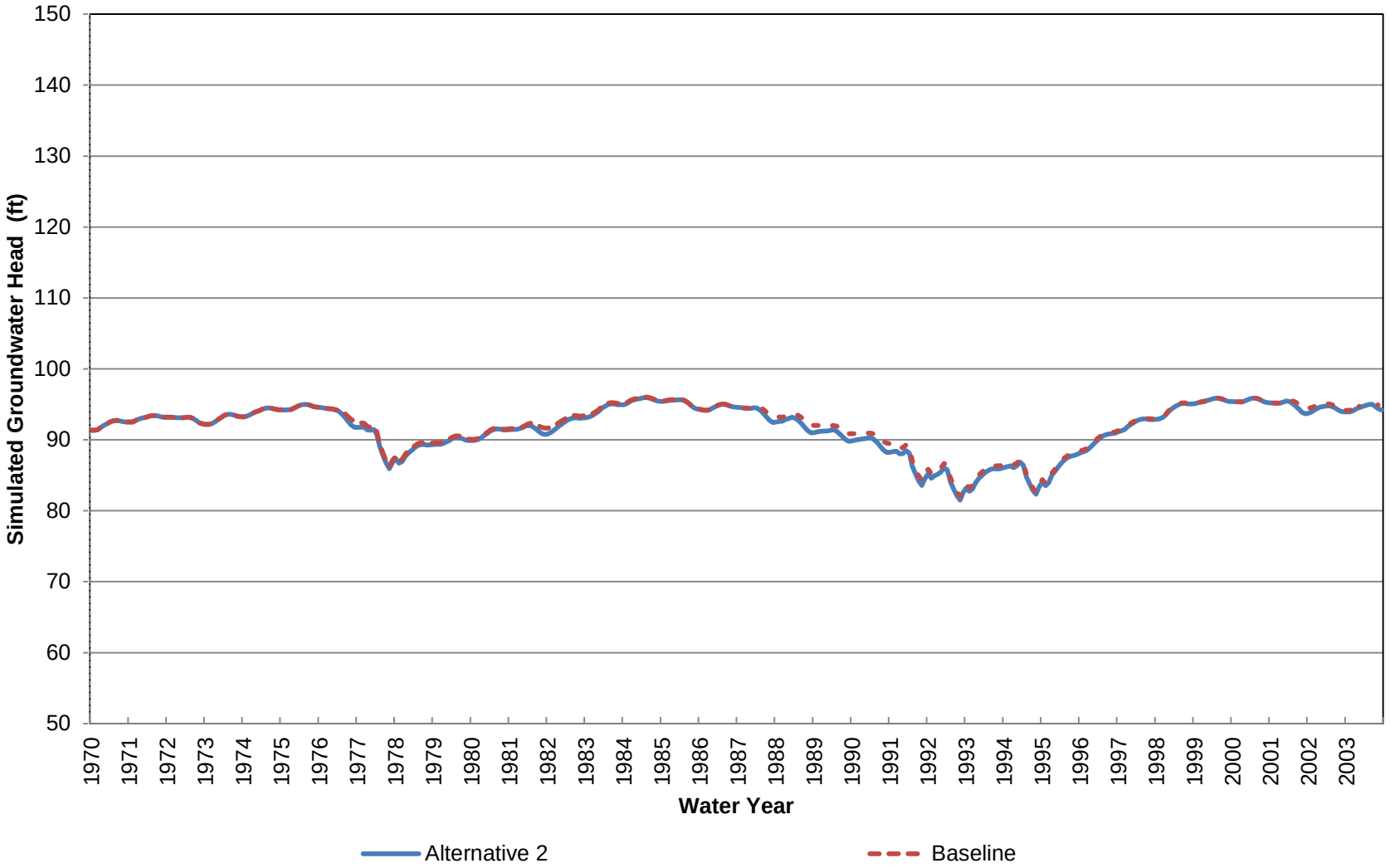
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 9 (Approximately 0-70 ft bgs)



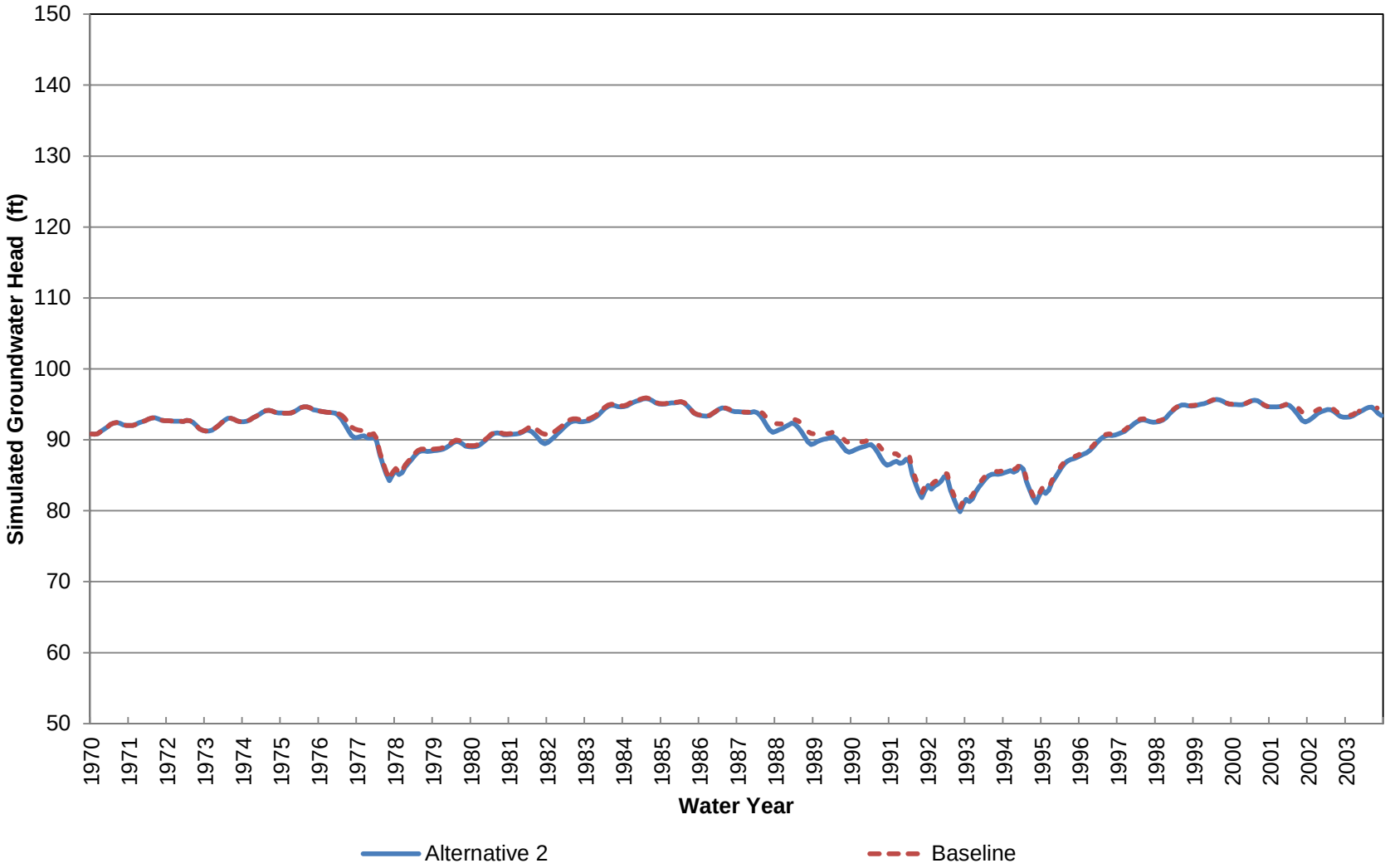
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 9 (Approximately 70-210 ft bgs)



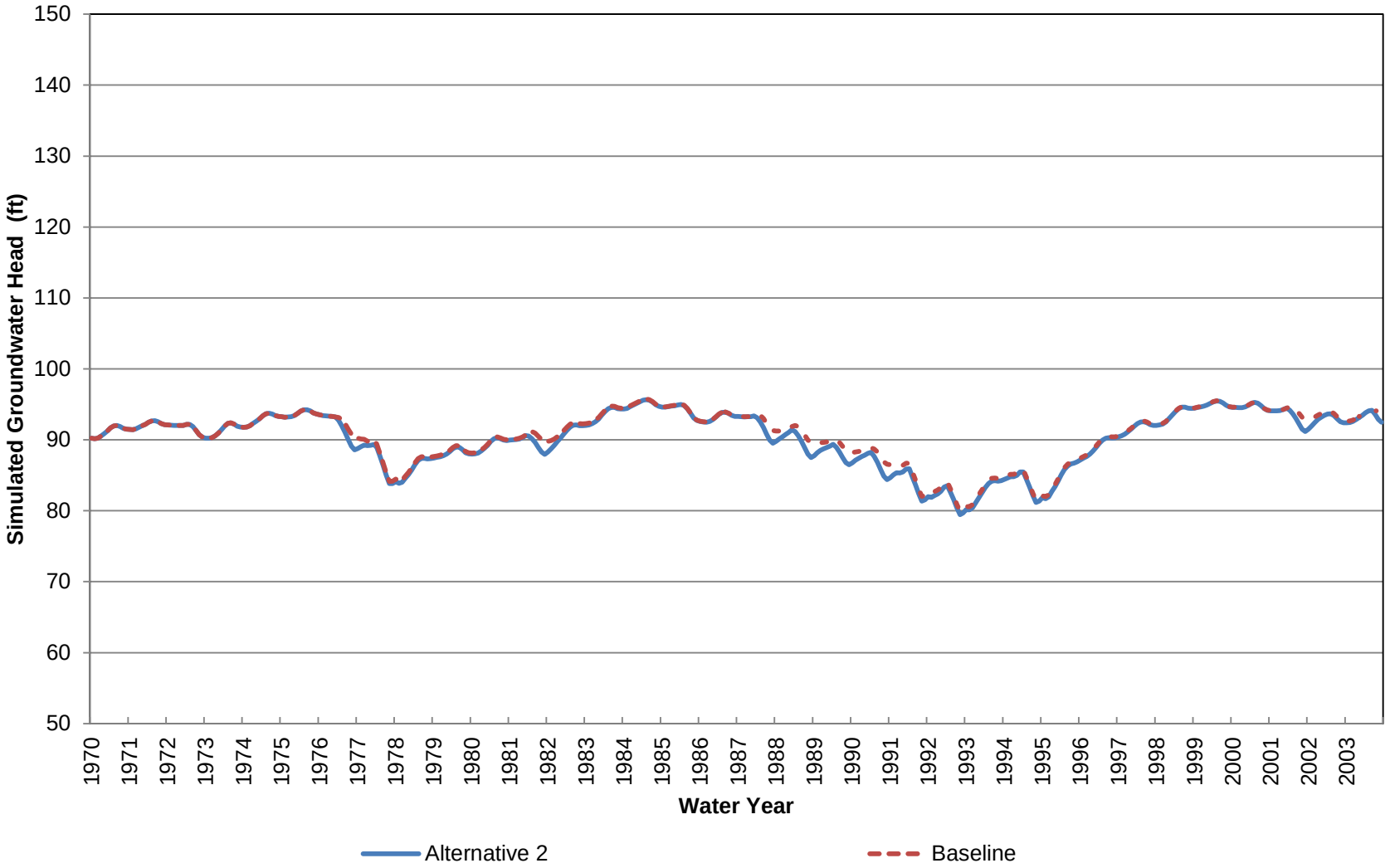
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 9 (Approximately 210-340 ft bgs)



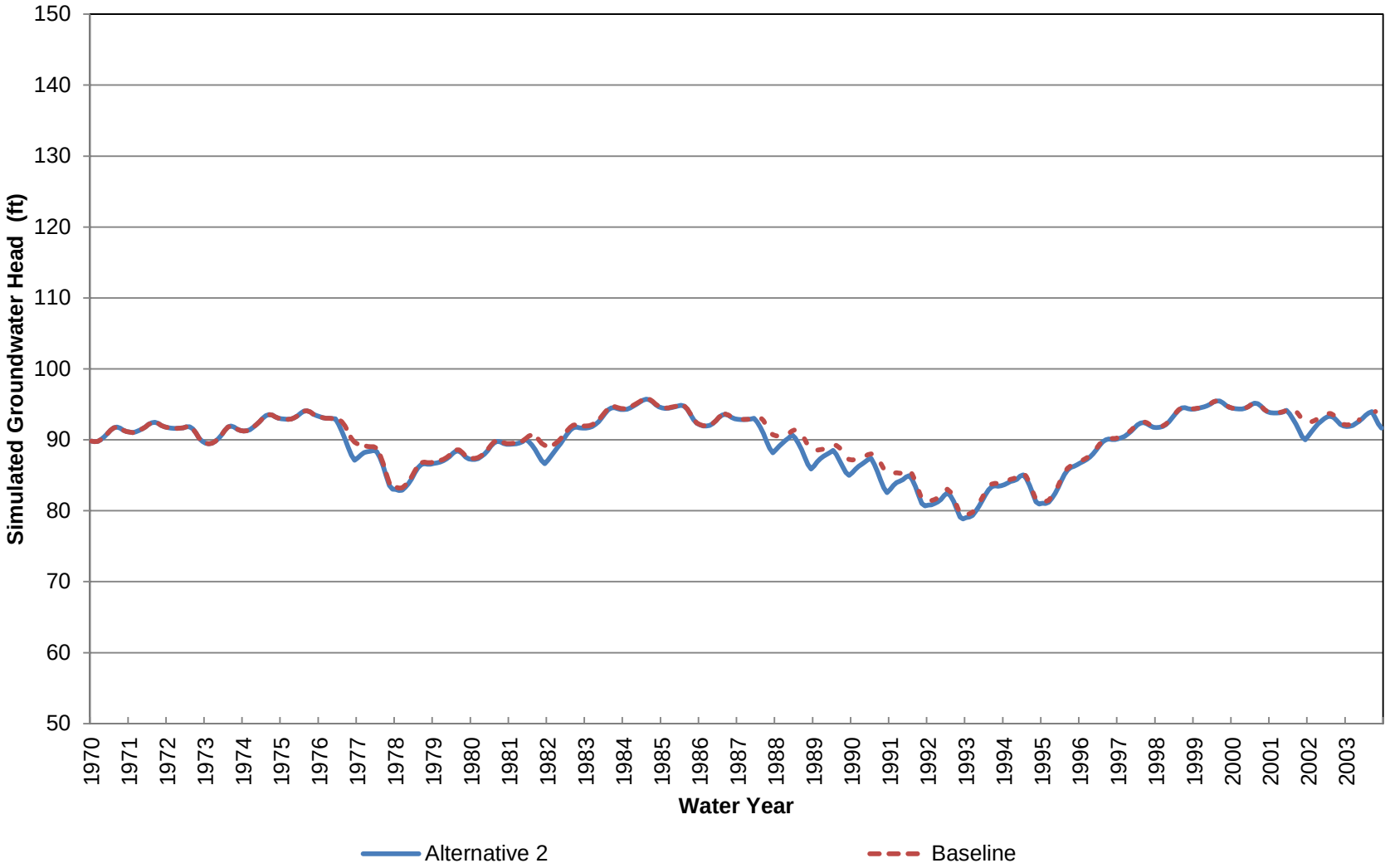
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 9 (Approximately 340-480 ft bgs)



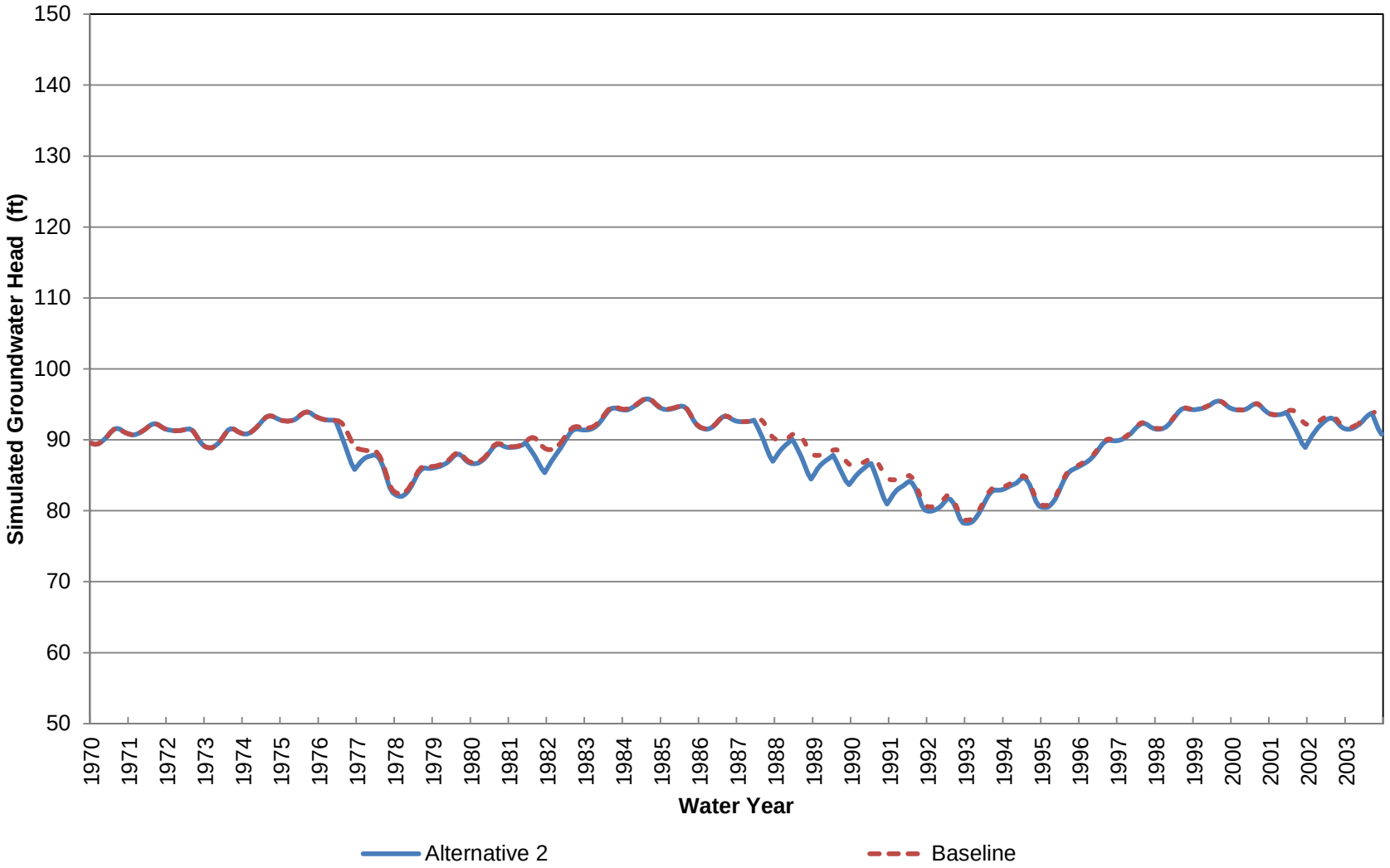
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 9 (Approximately 480-690 ft bgs)



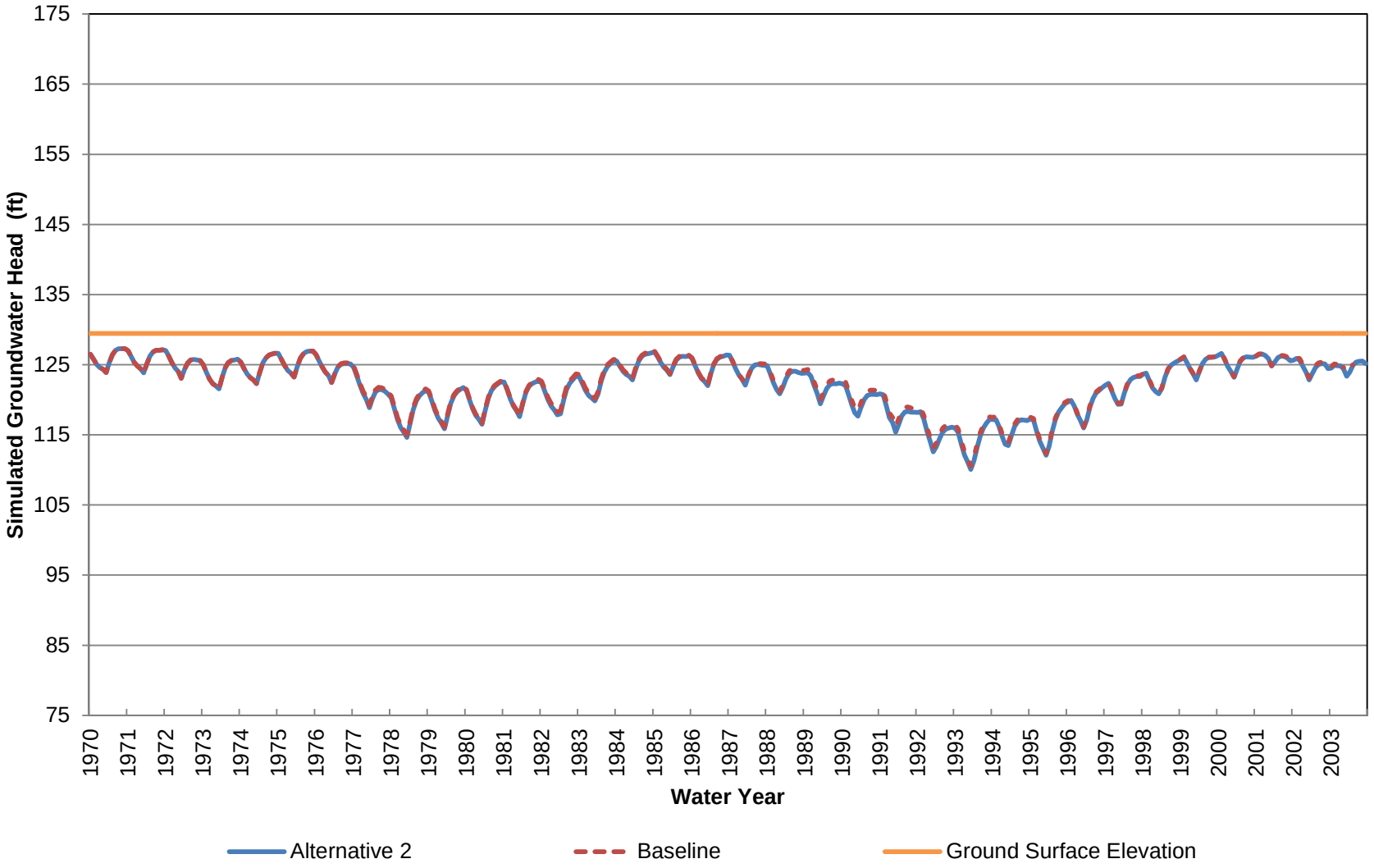
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 9 (Approximately 690-910 ft bgs)



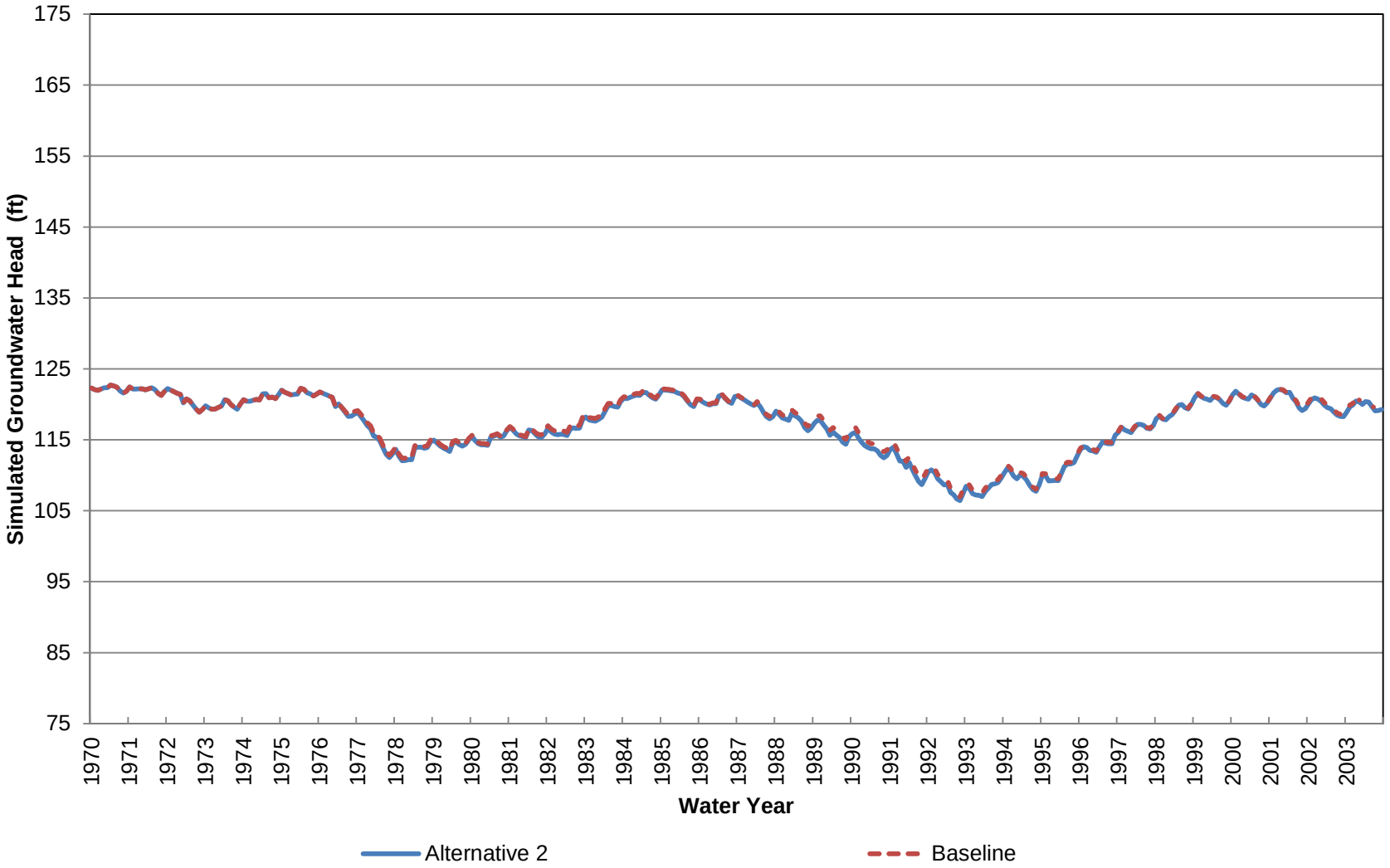
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 9 (Approximately 910-1250 ft bgs)



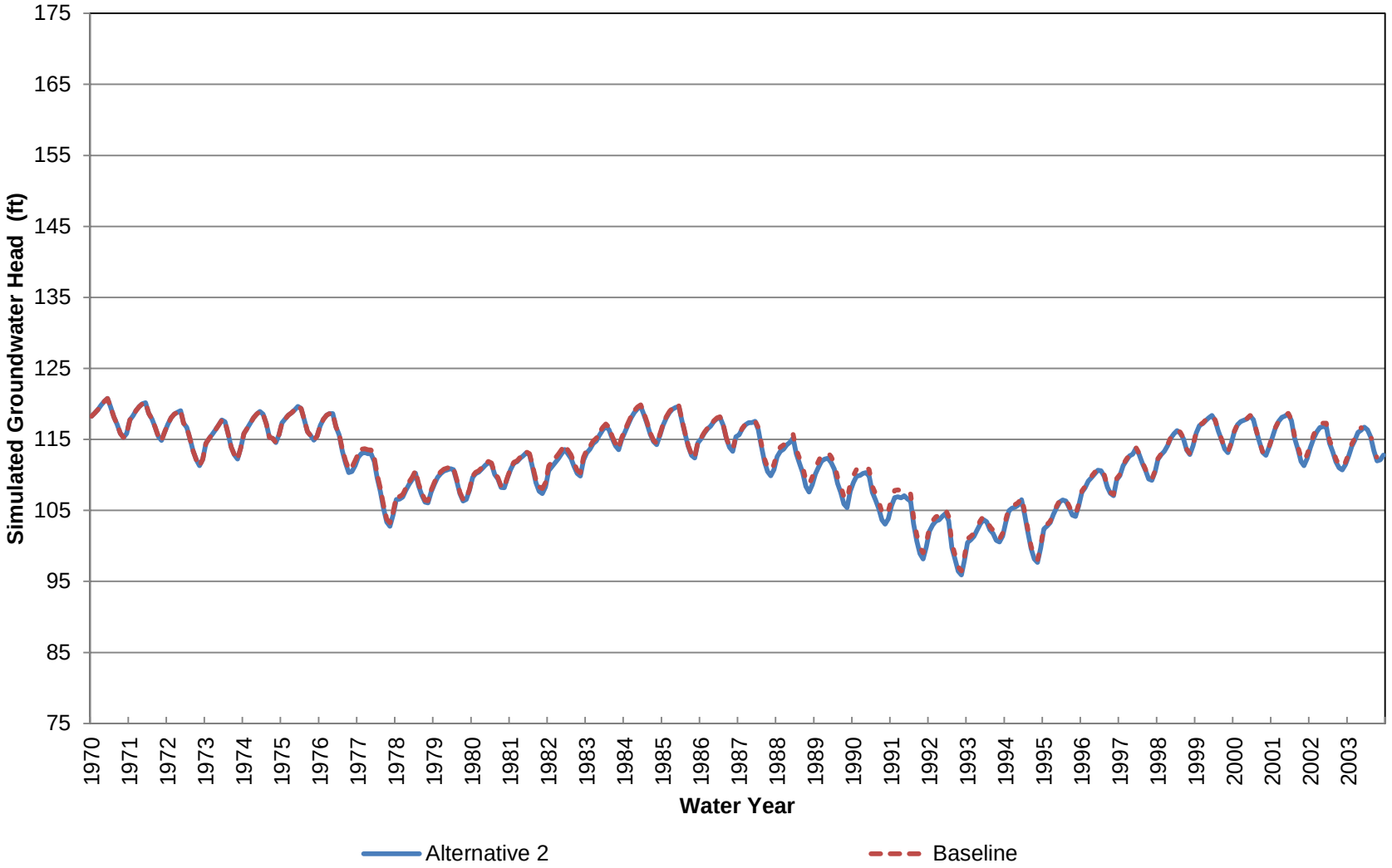
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 10 (Approximately 0-70 ft bgs)



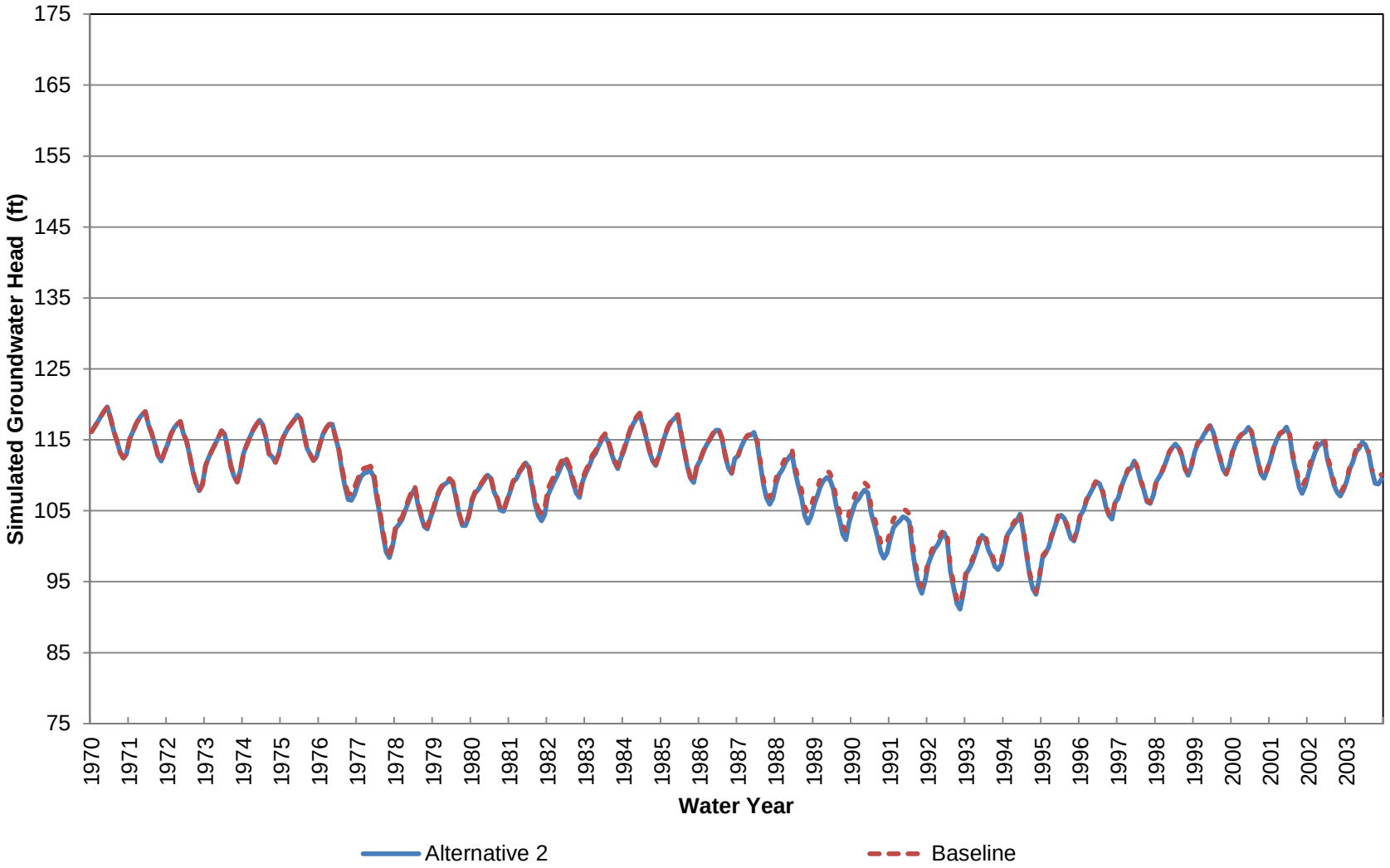
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 10 (Approximately 70-240 ft bgs)



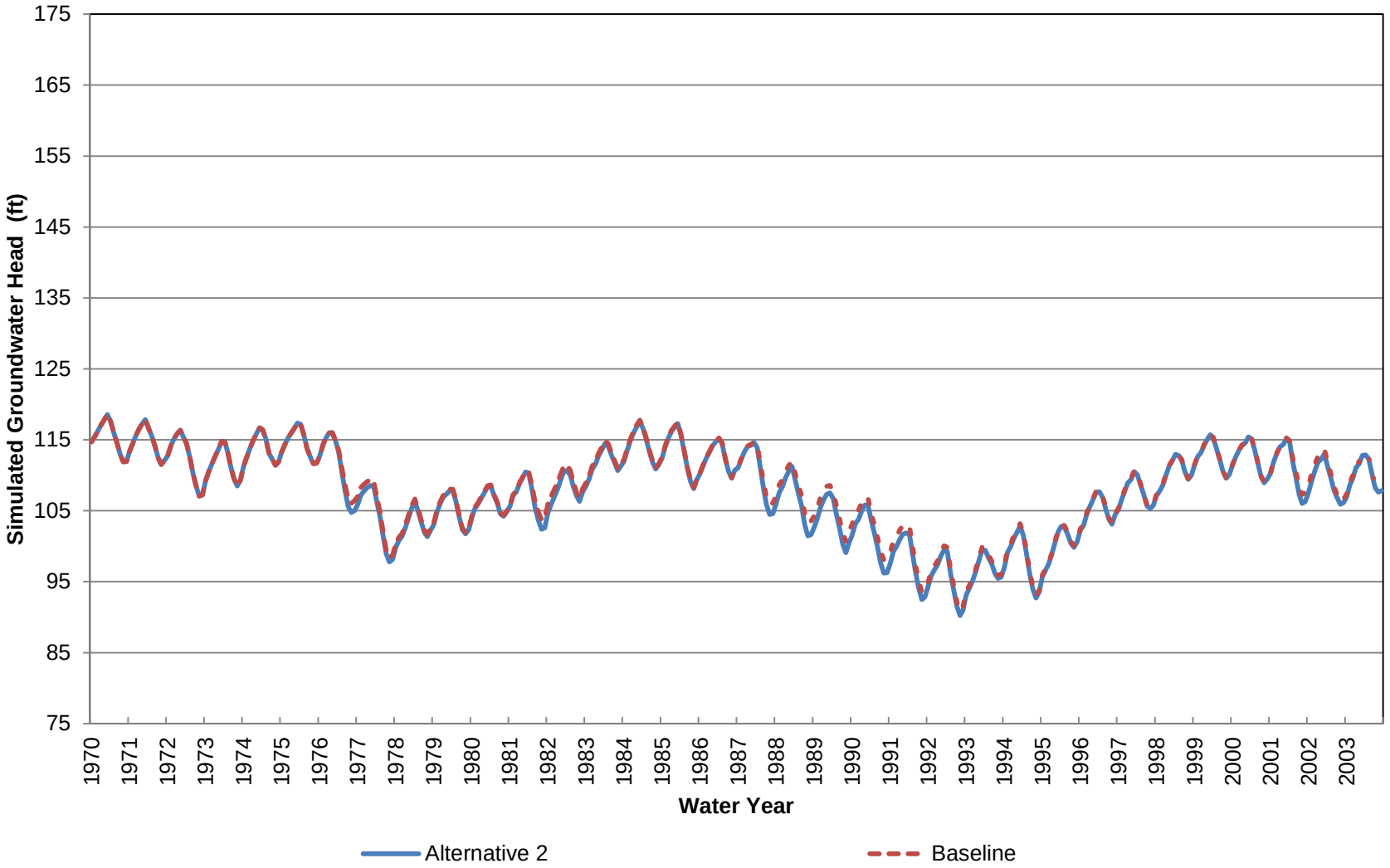
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 10 (Approximately 240-420 ft bgs)



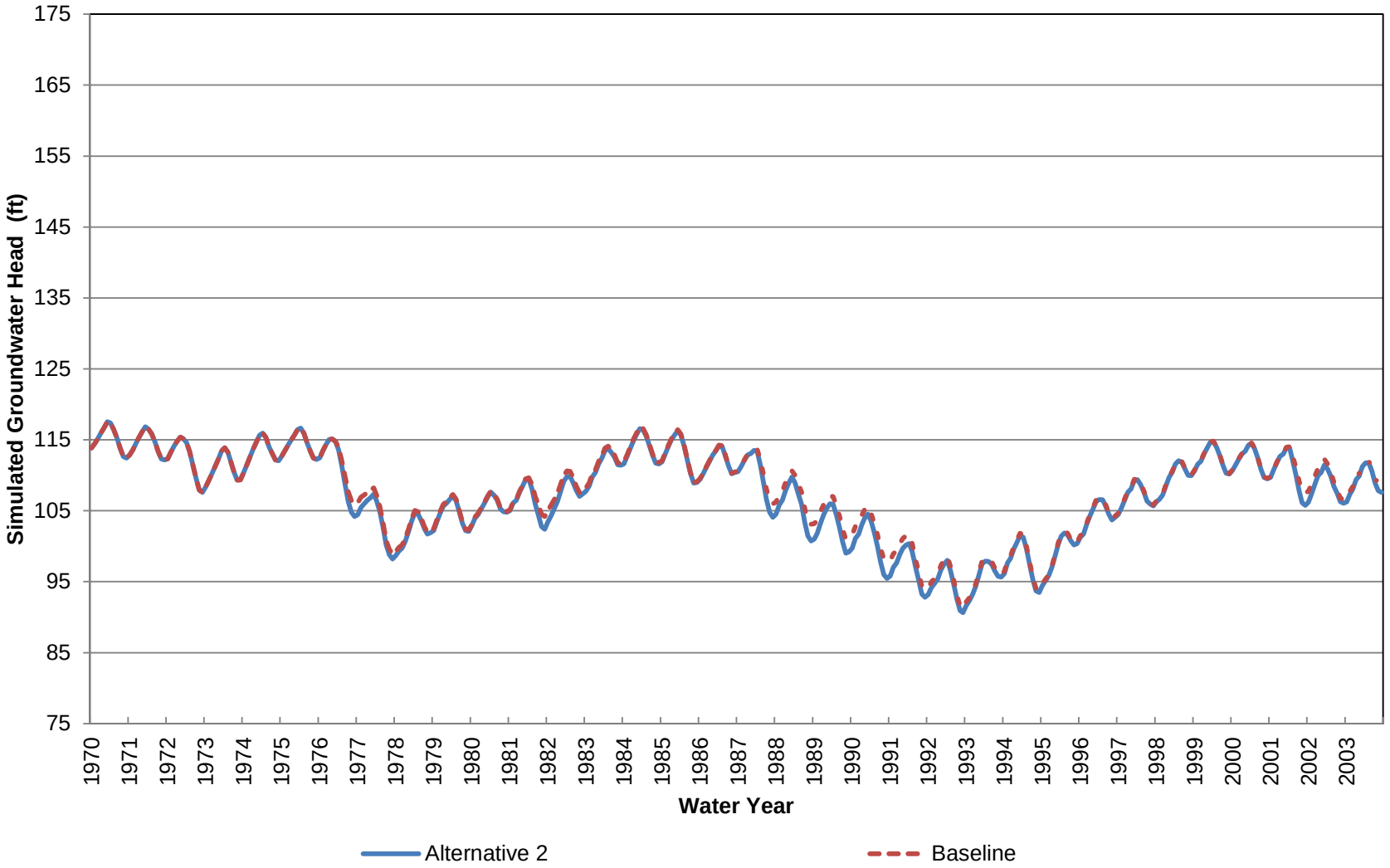
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 10 (Approximately 420-590 ft bgs)



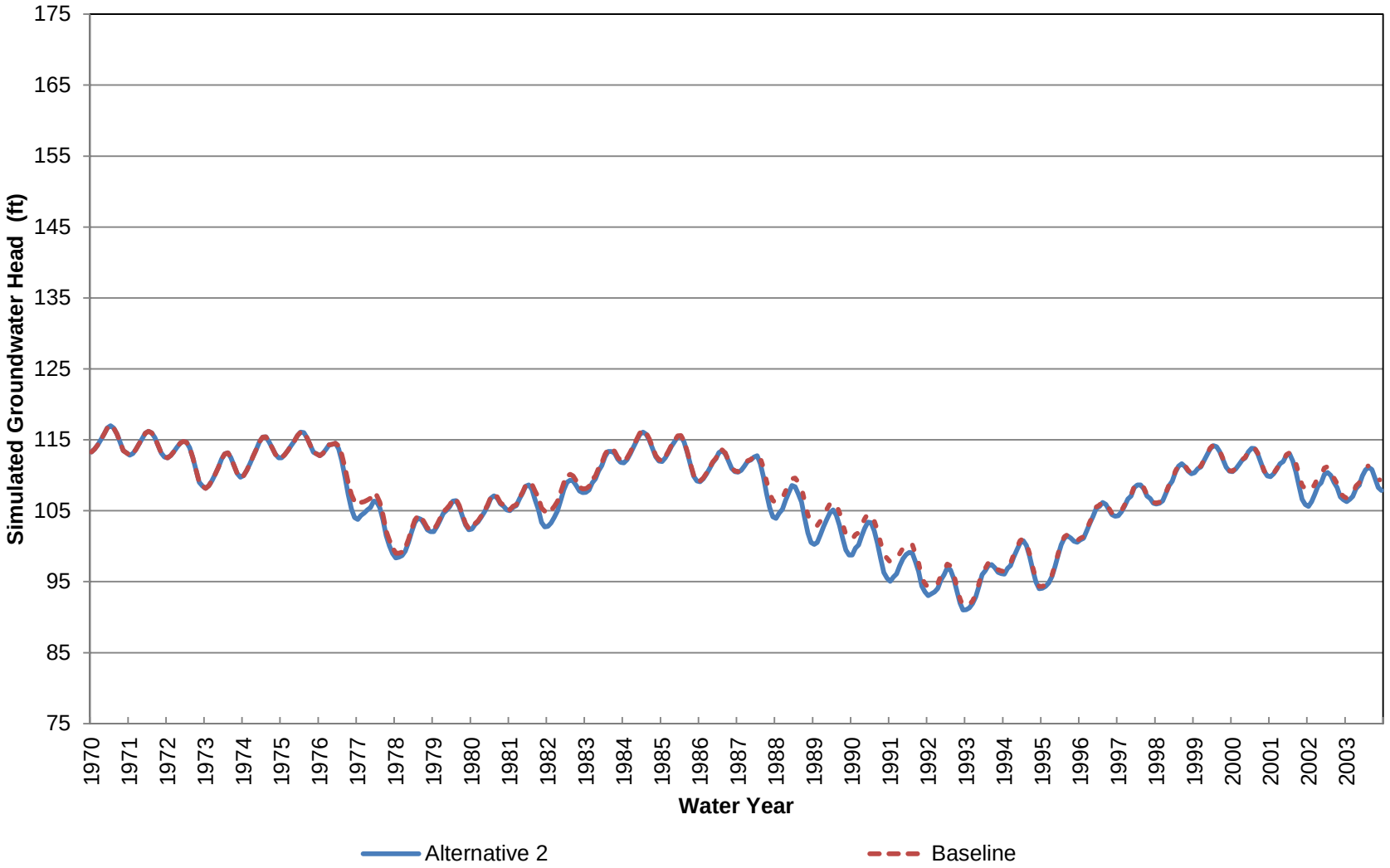
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 10 (Approximately 590-870 ft bgs)



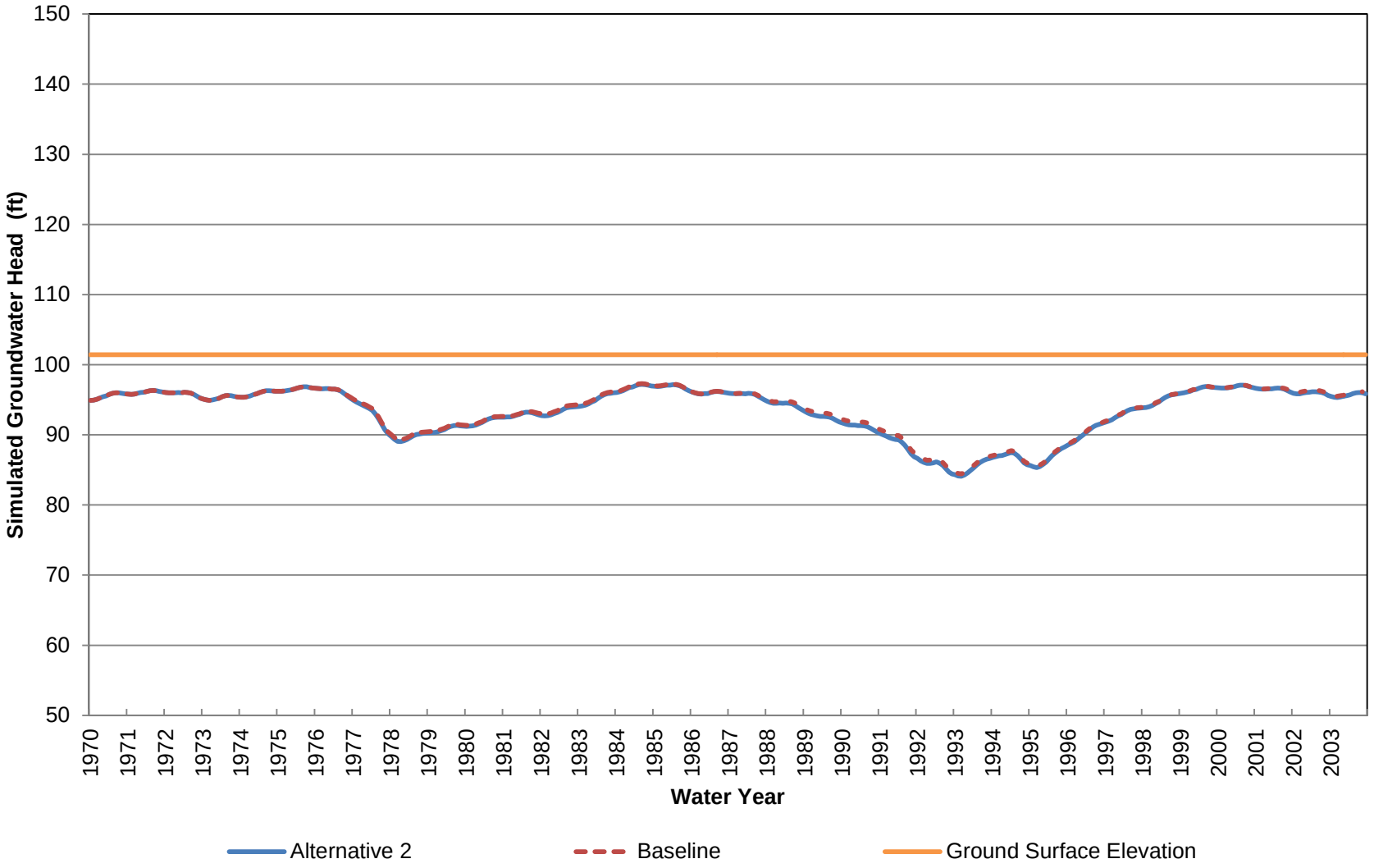
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 10 (Approximately 870-1160 ft bgs)



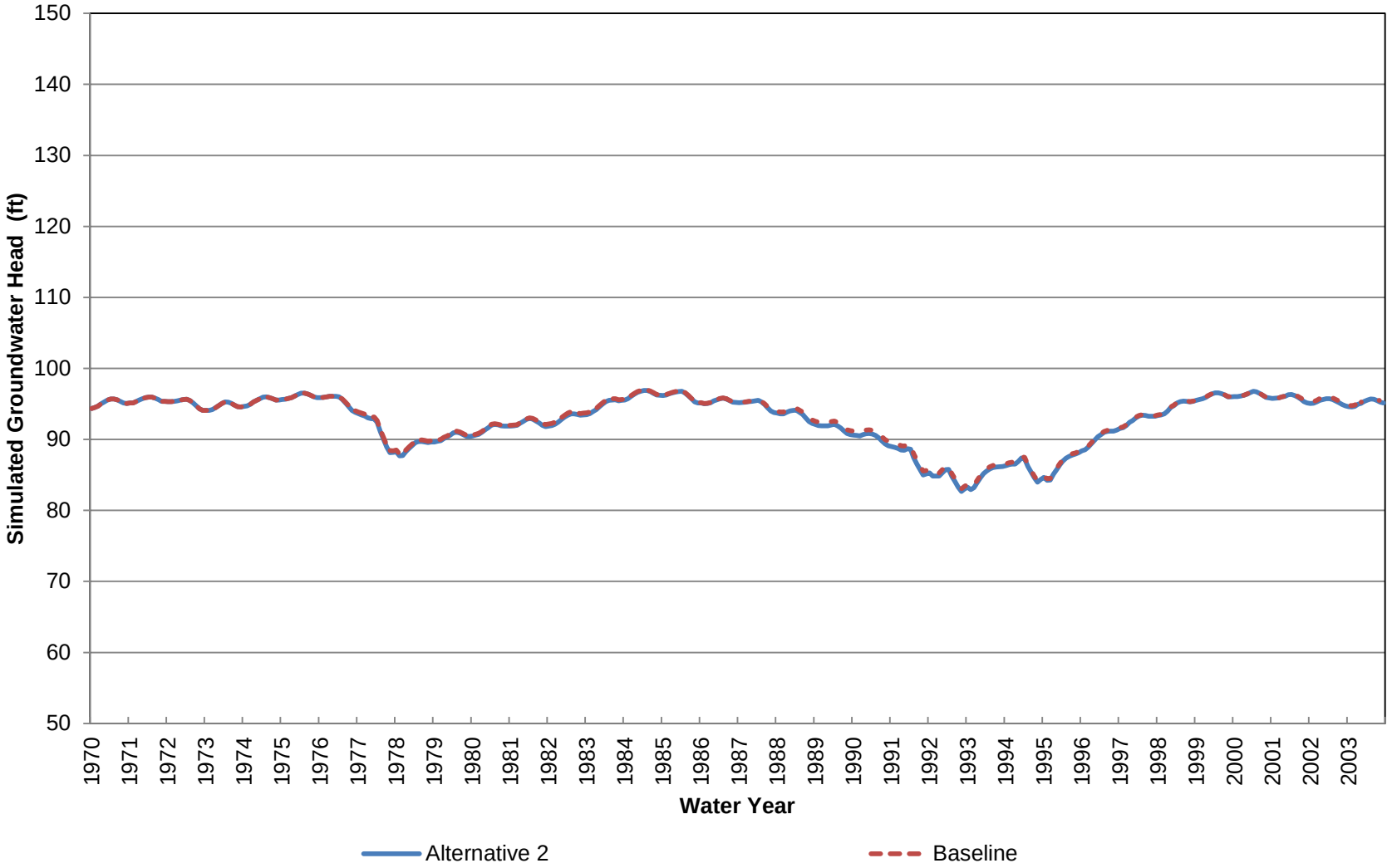
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 10 (Approximately 1160-1590 ft bgs)



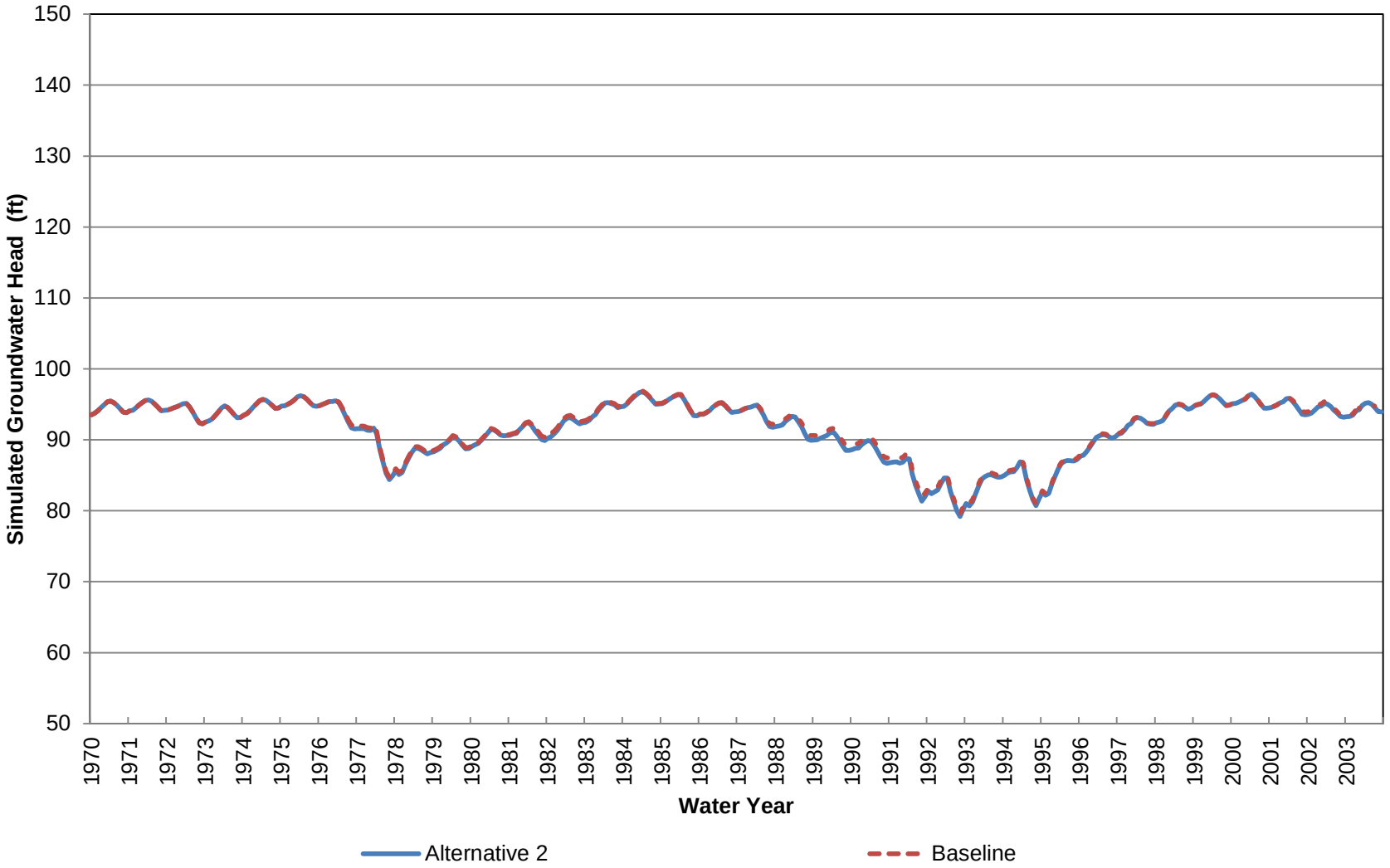
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 11 (Approximately 0-70 ft bgs)



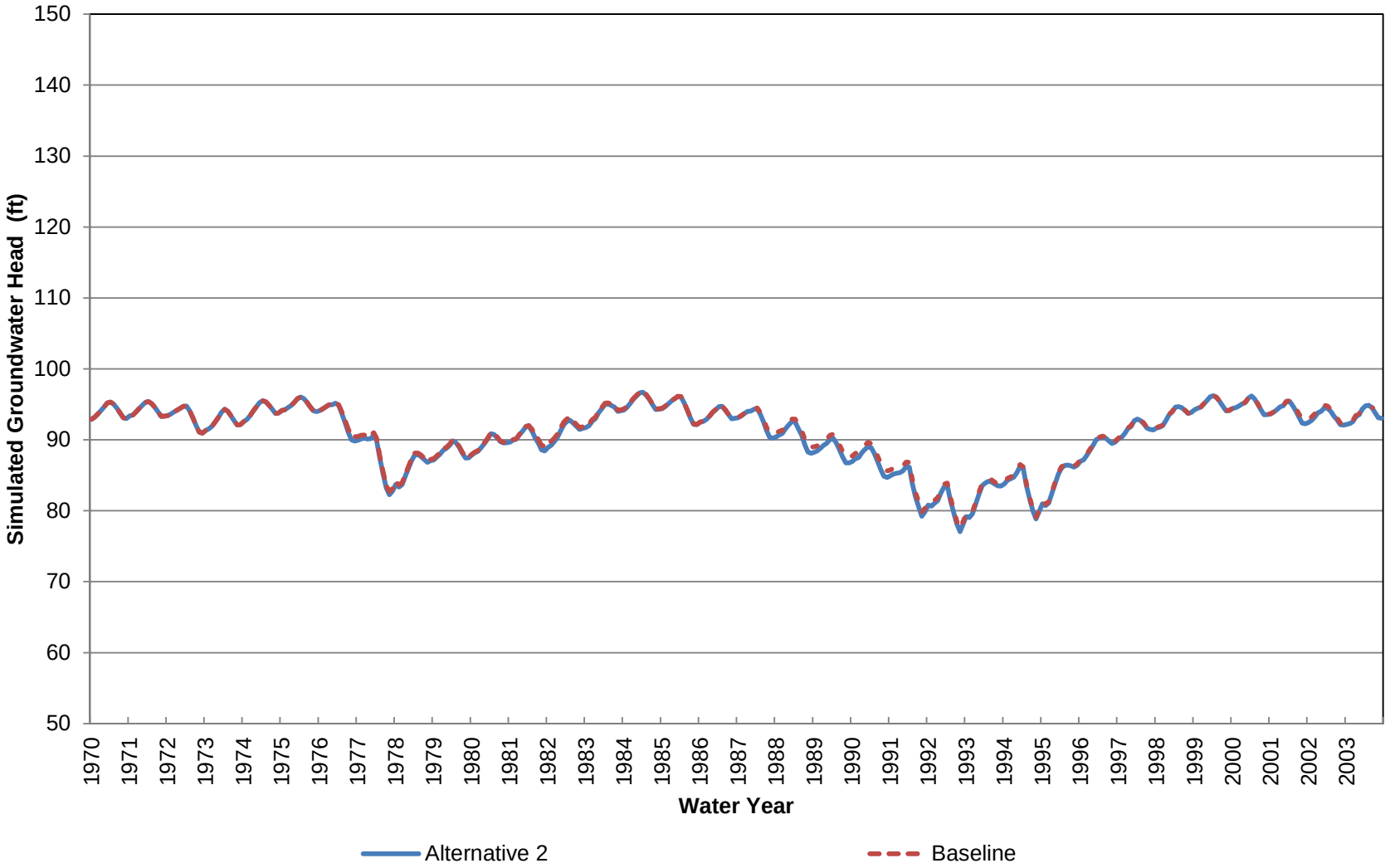
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 11 (Approximately 70-260 ft bgs)



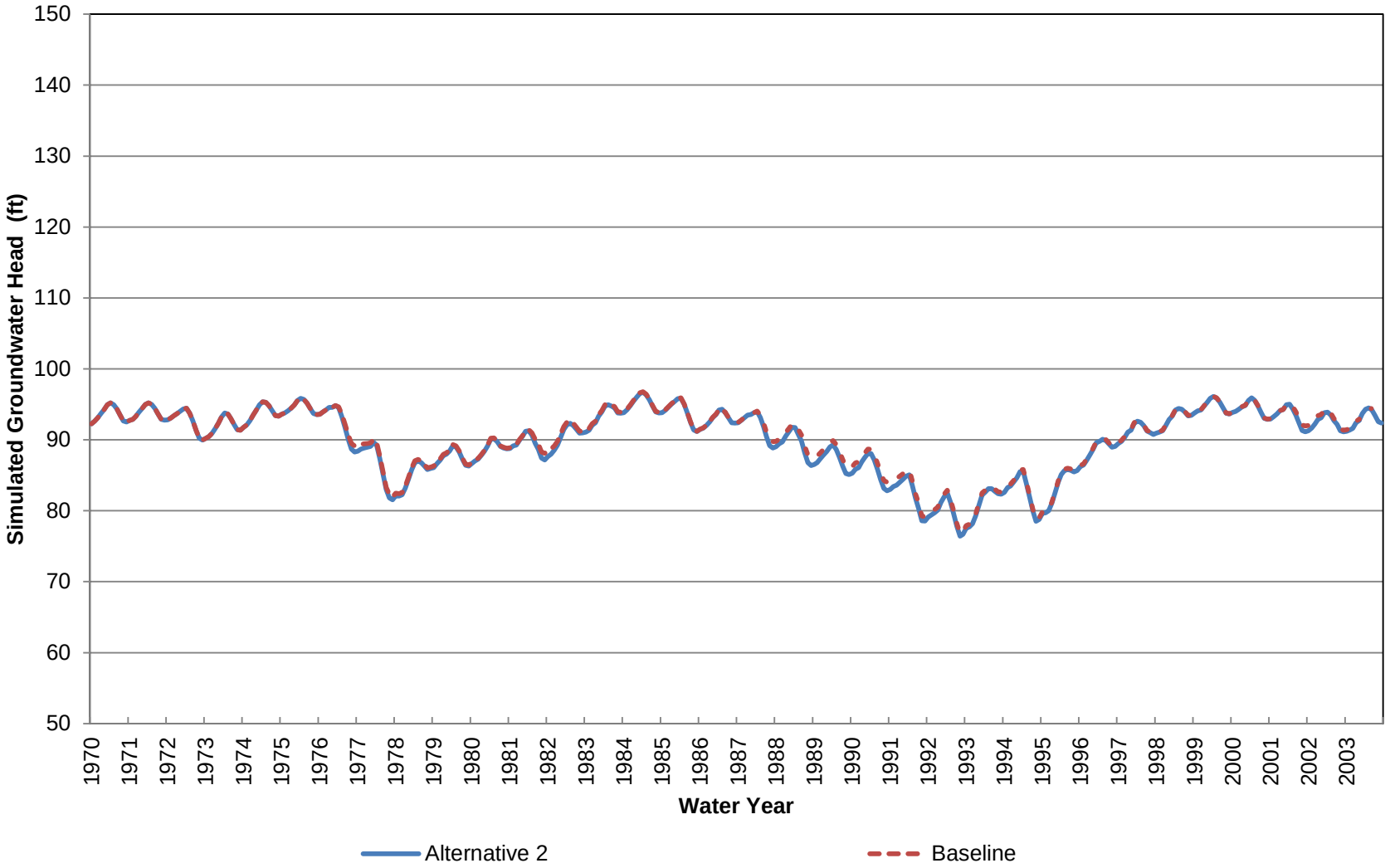
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 11 (Approximately 260-450 ft bgs)



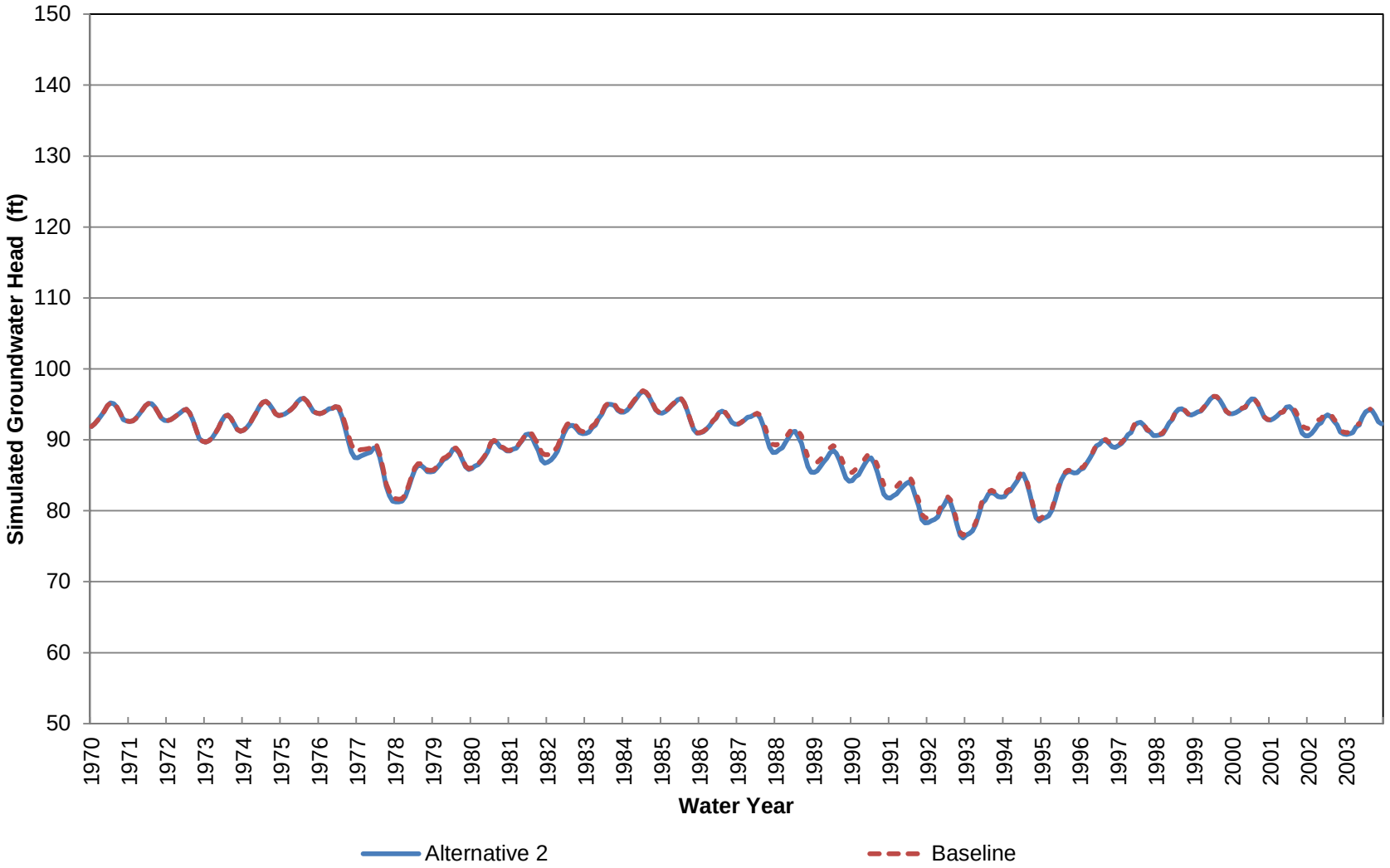
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 11 (Approximately 450-640 ft bgs)



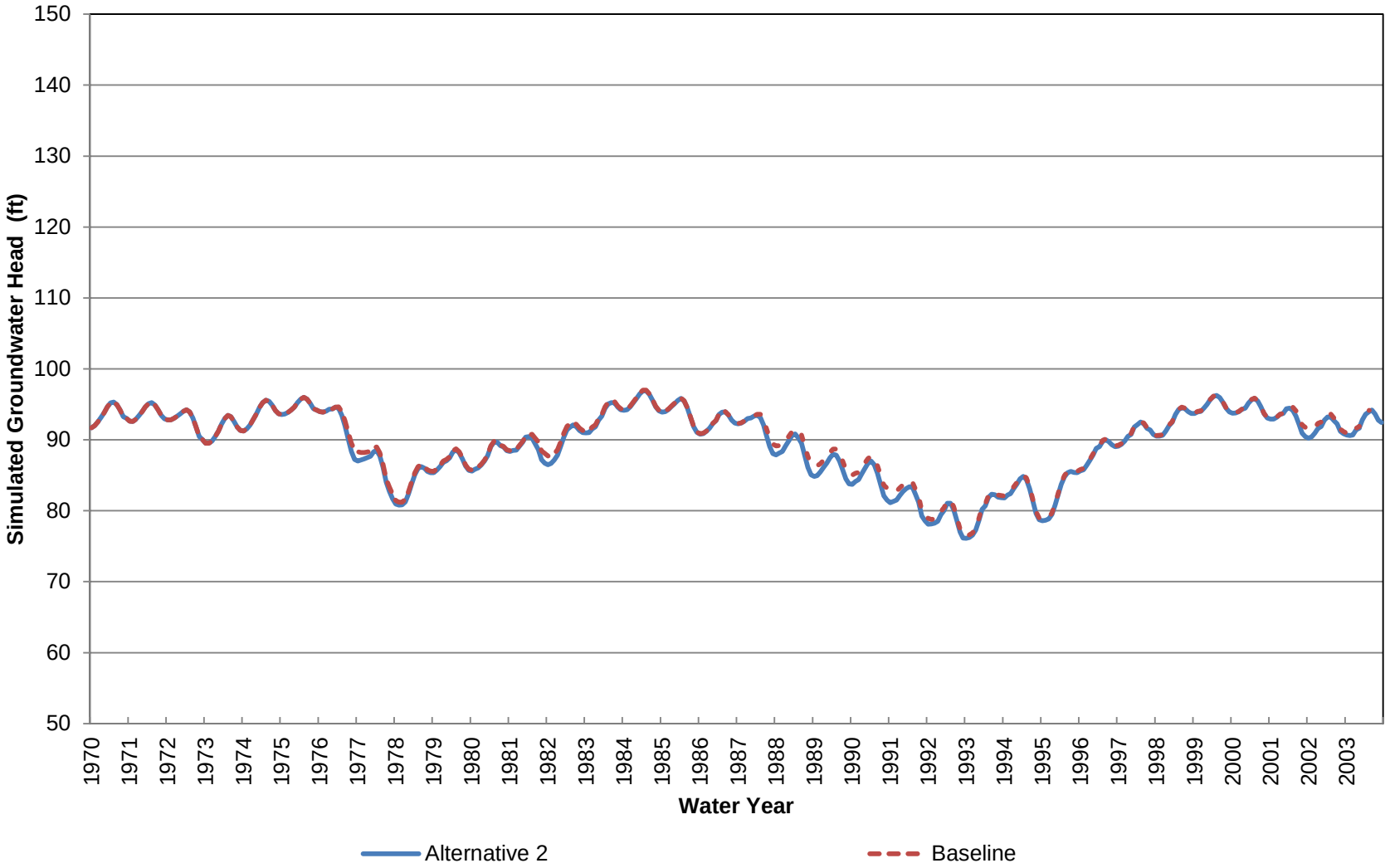
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 11 (Approximately 640-950 ft bgs)



Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 11 (Approximately 950-1260 ft bgs)

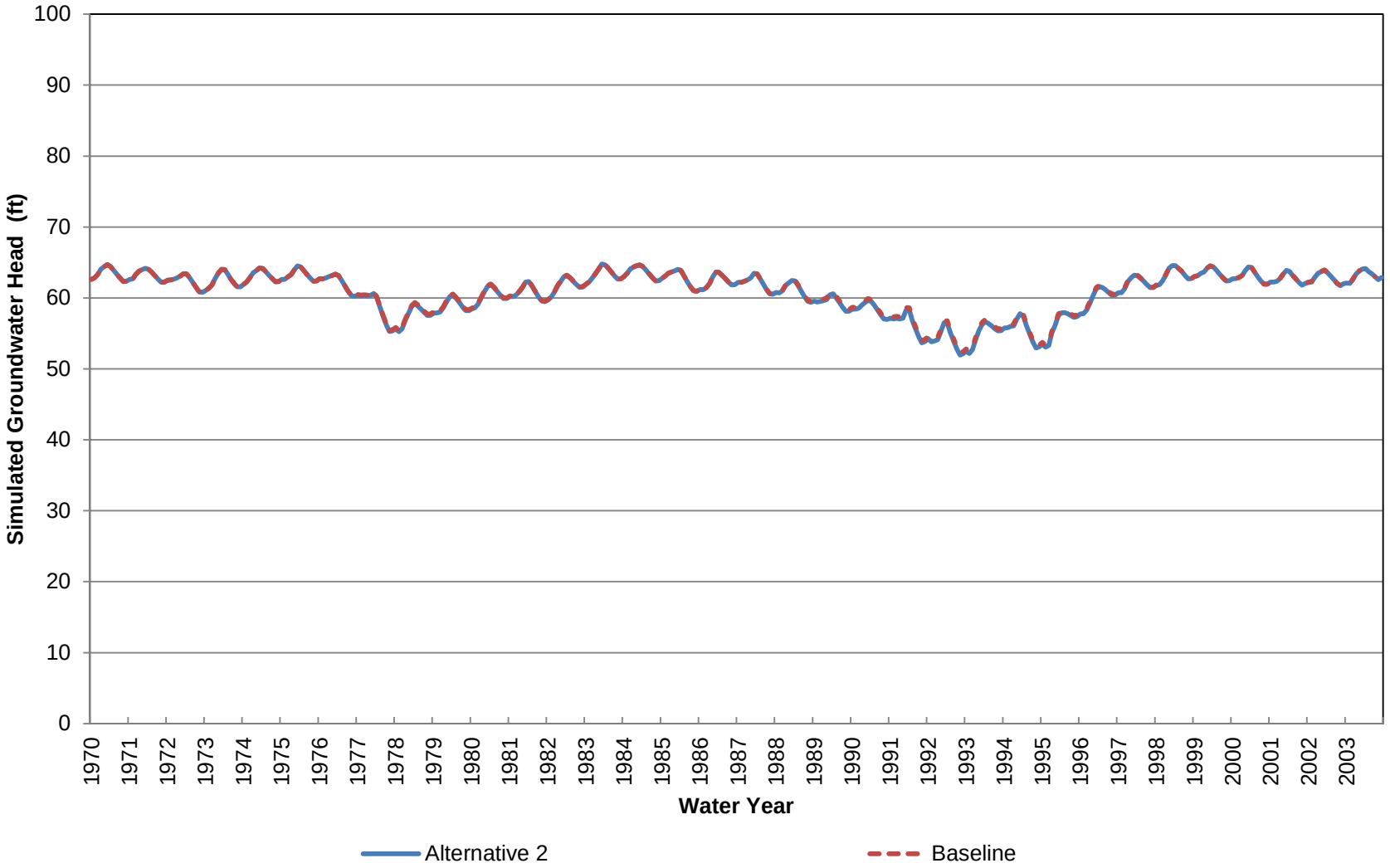


Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 11 (Approximately 1260-1740 ft bgs)

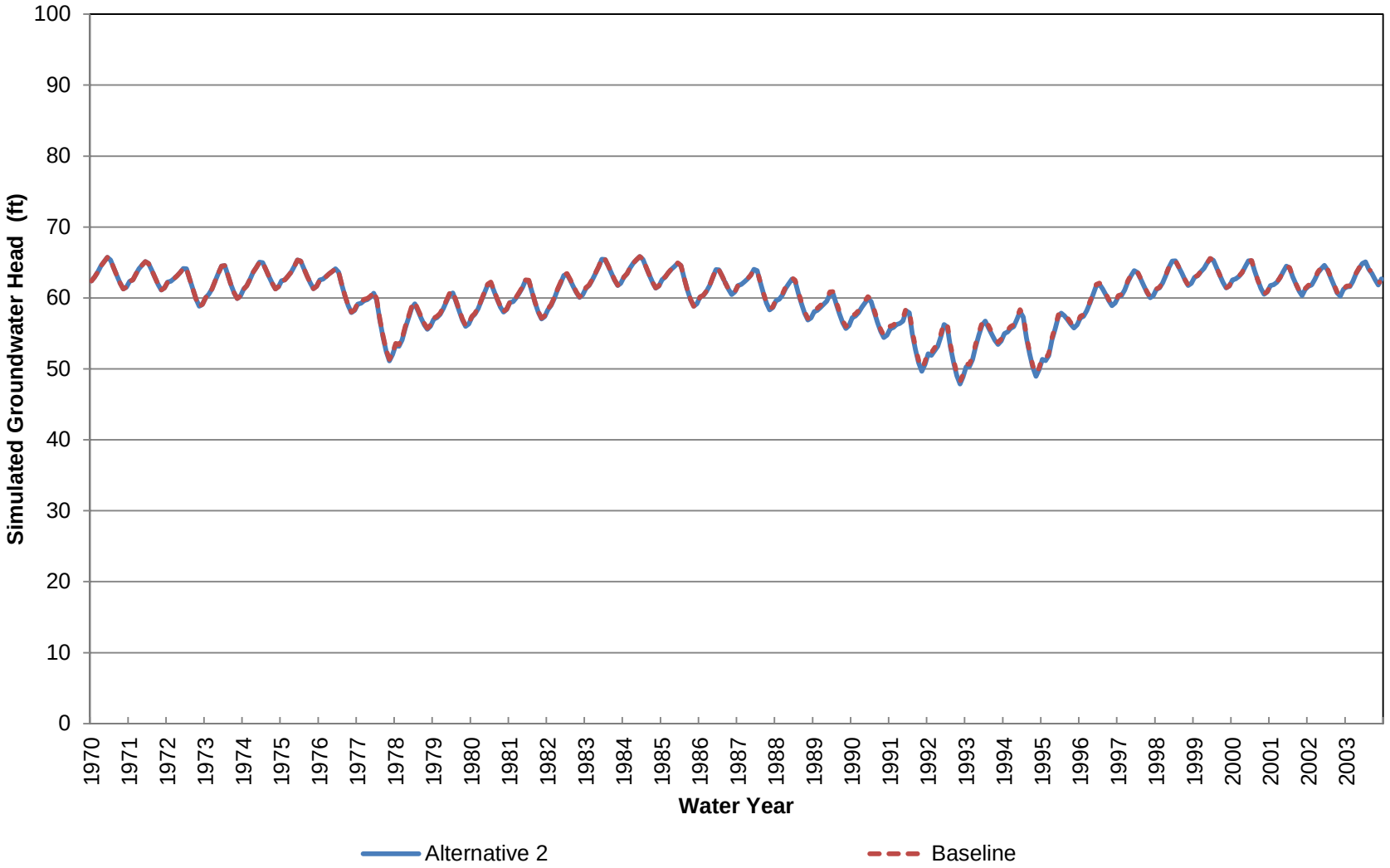


Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 12 (Approximately 0-70 ft bgs)

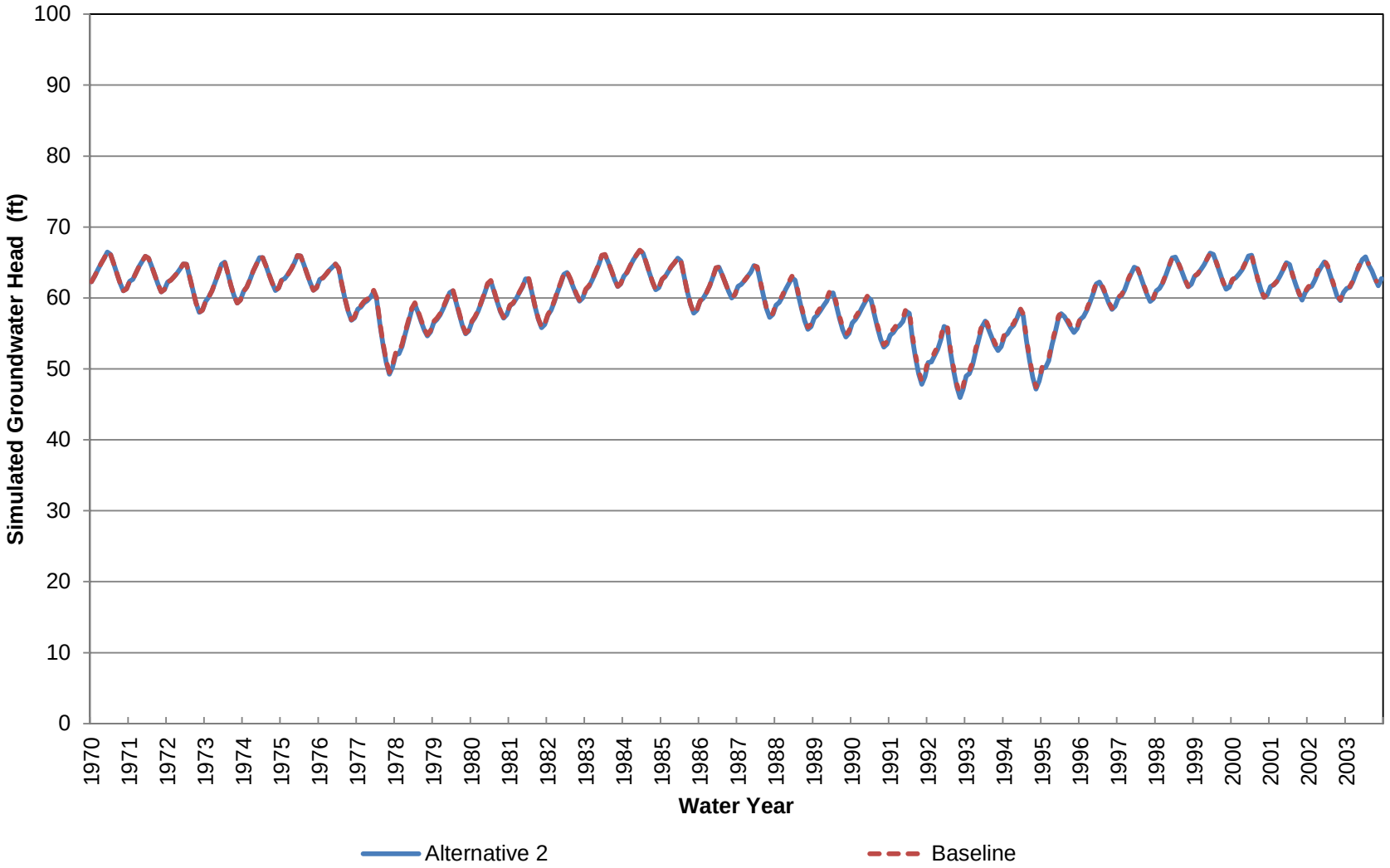
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 12 (Approximately 70-260 ft bgs)



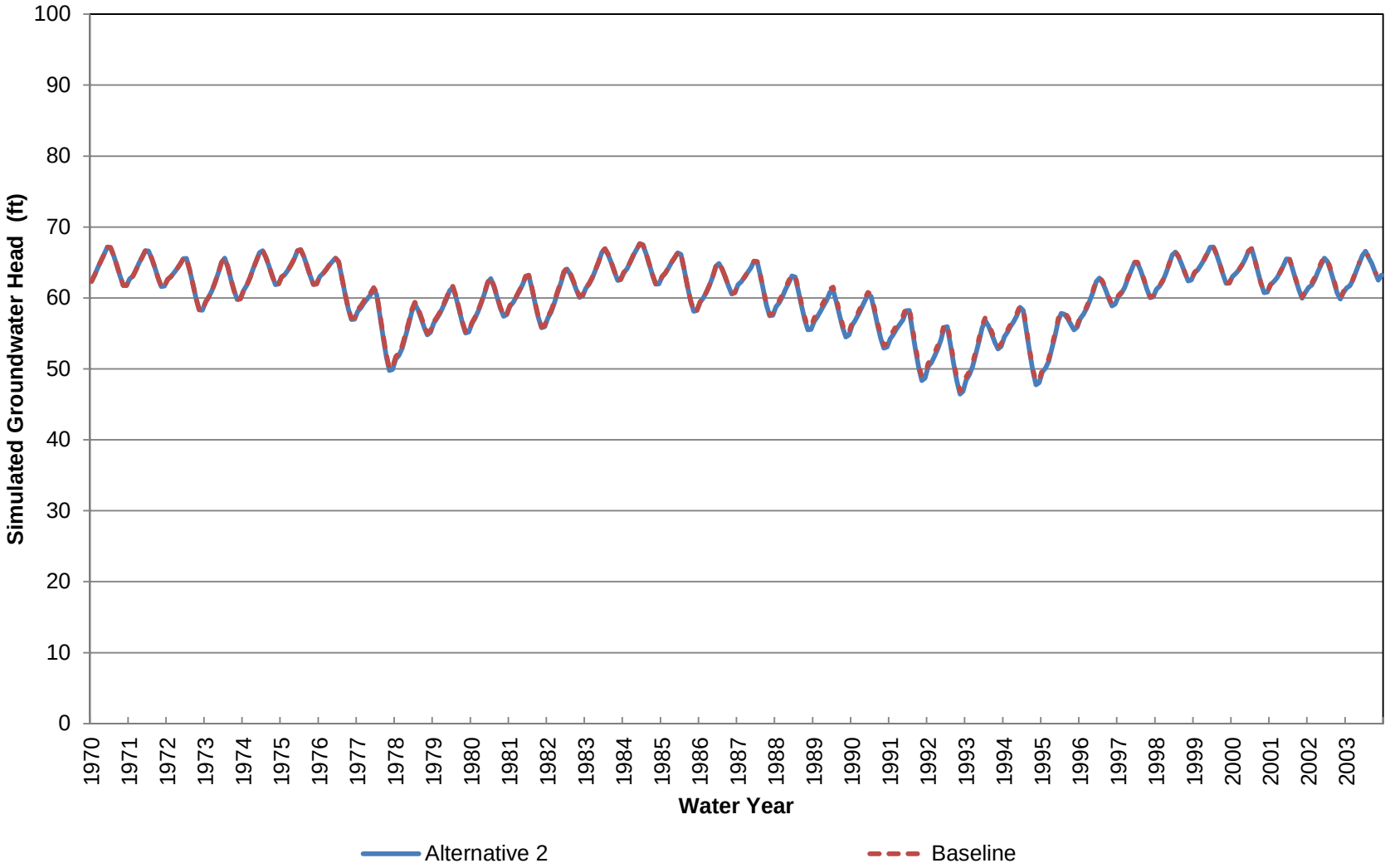
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 12 (Approximately 260-440 ft bgs)



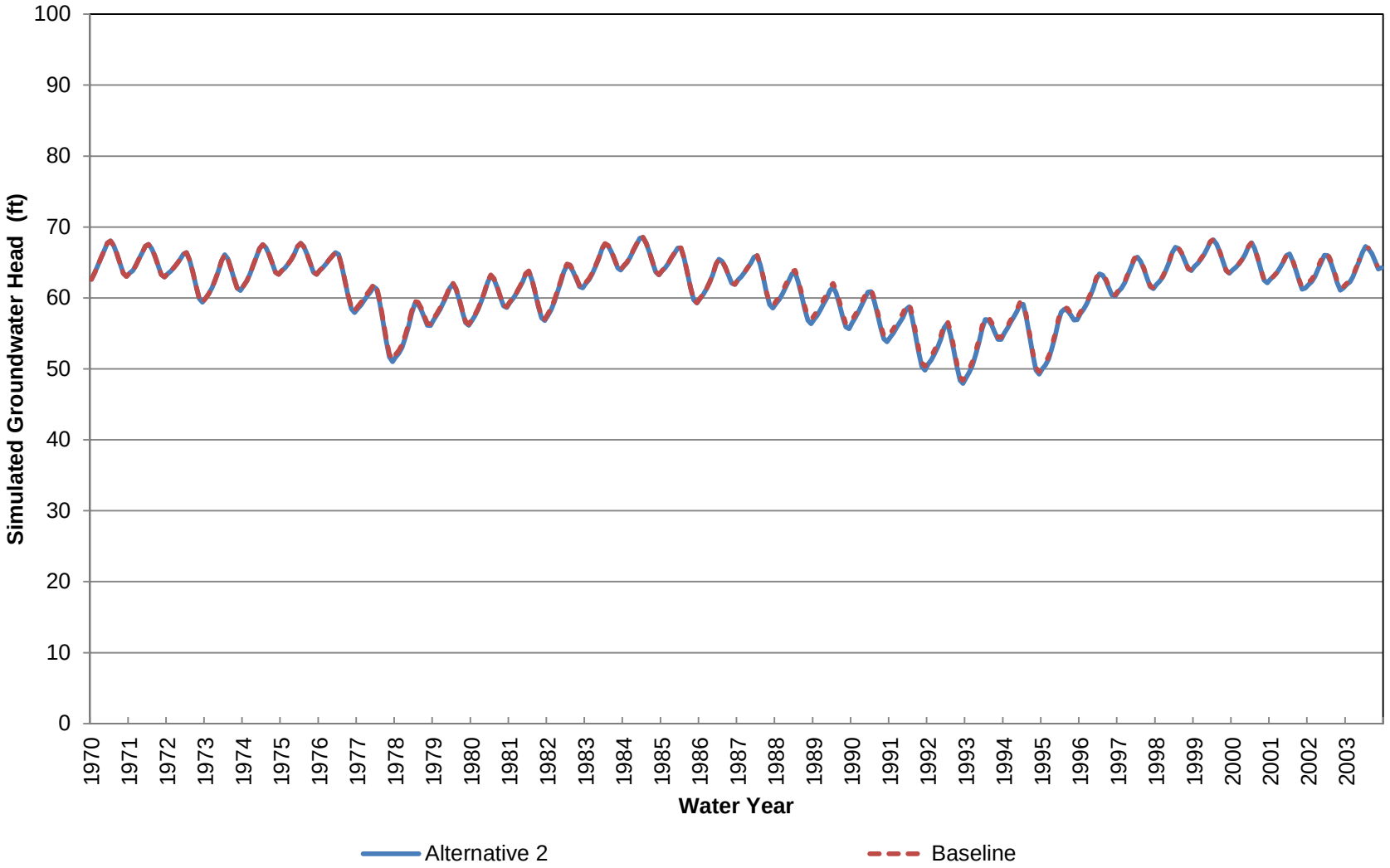
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 12 (Approximately 440-630 ft bgs)



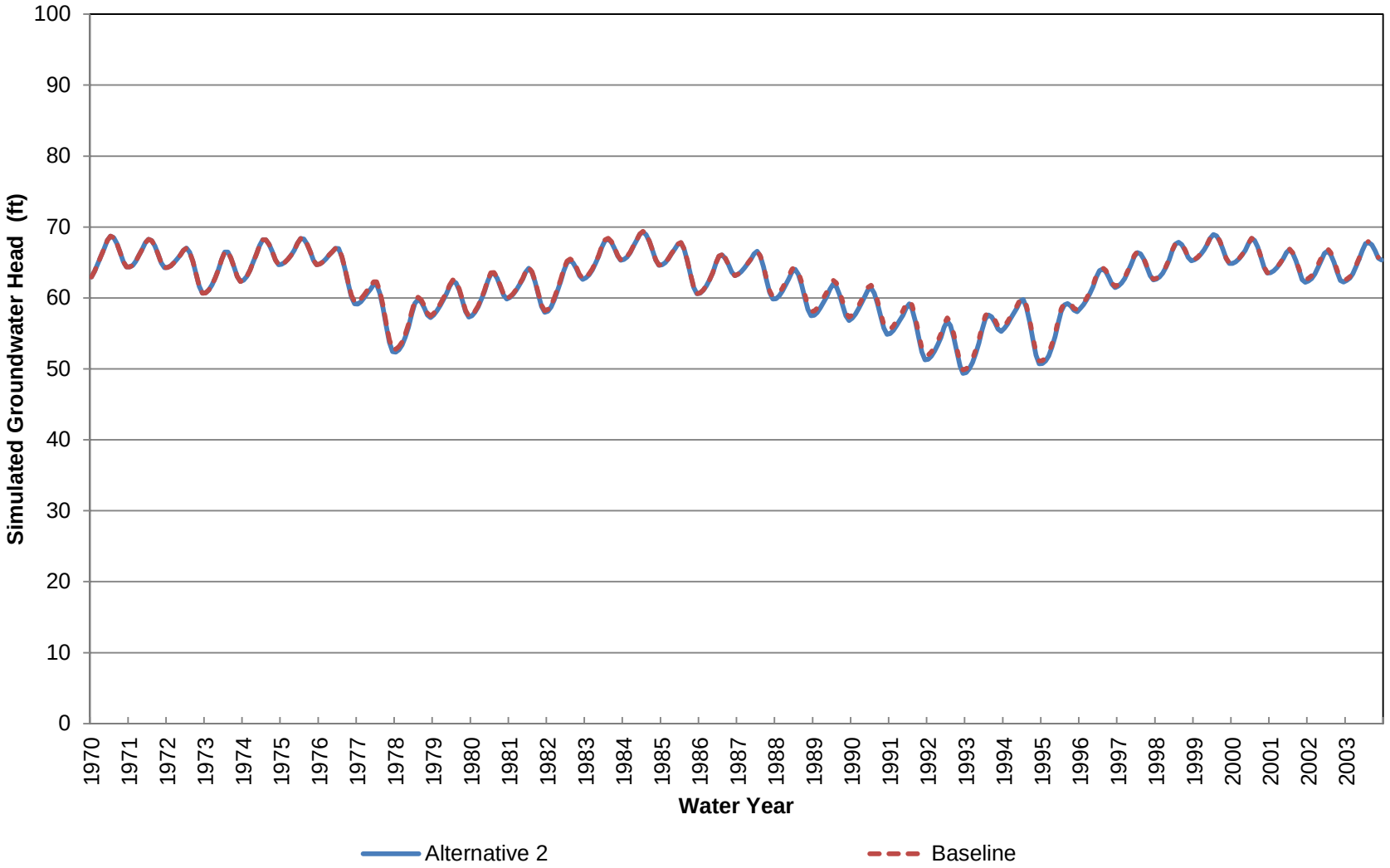
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 12 (Approximately 630-930 ft bgs)



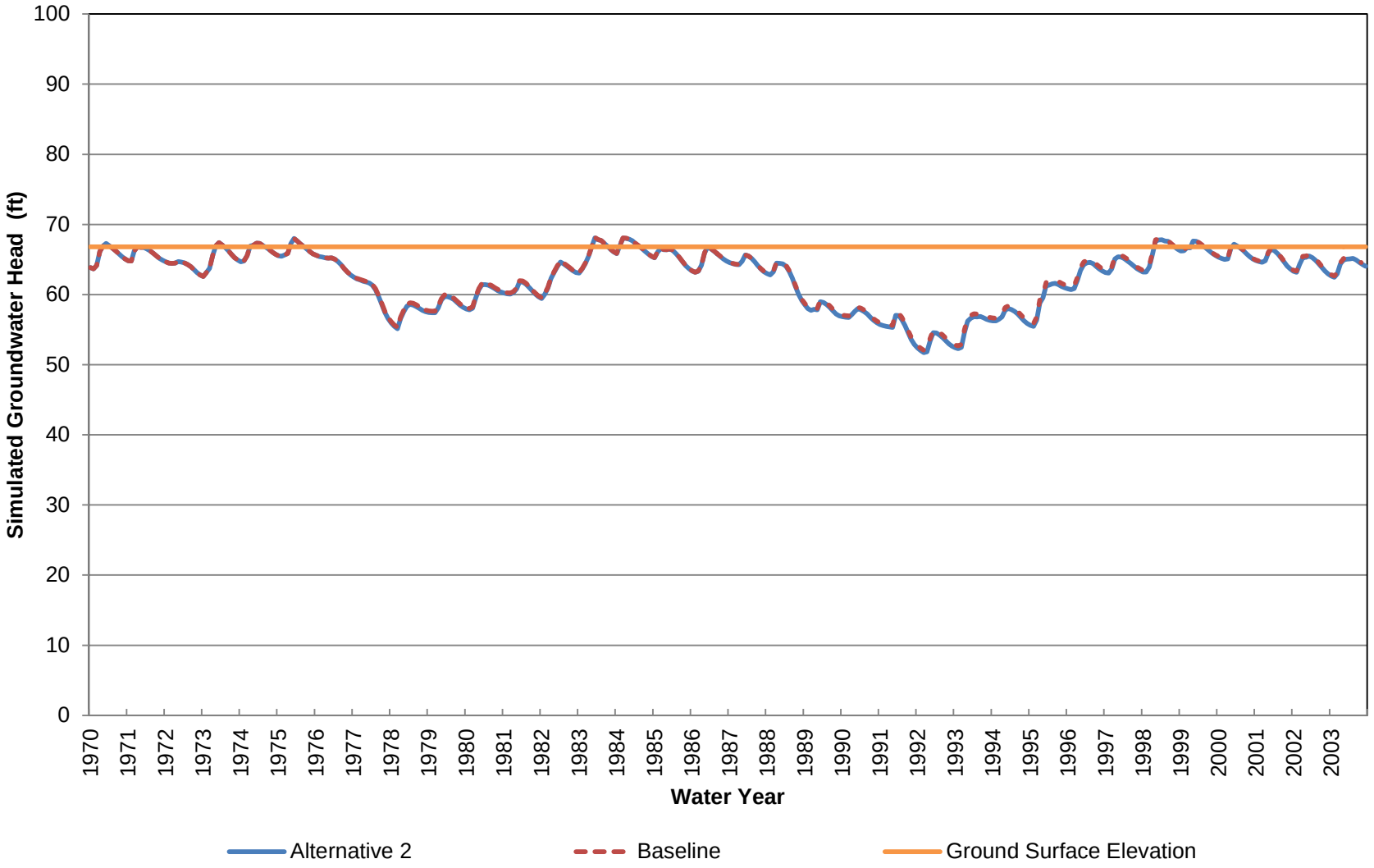
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 12 (Approximately 930-1240 ft bgs)



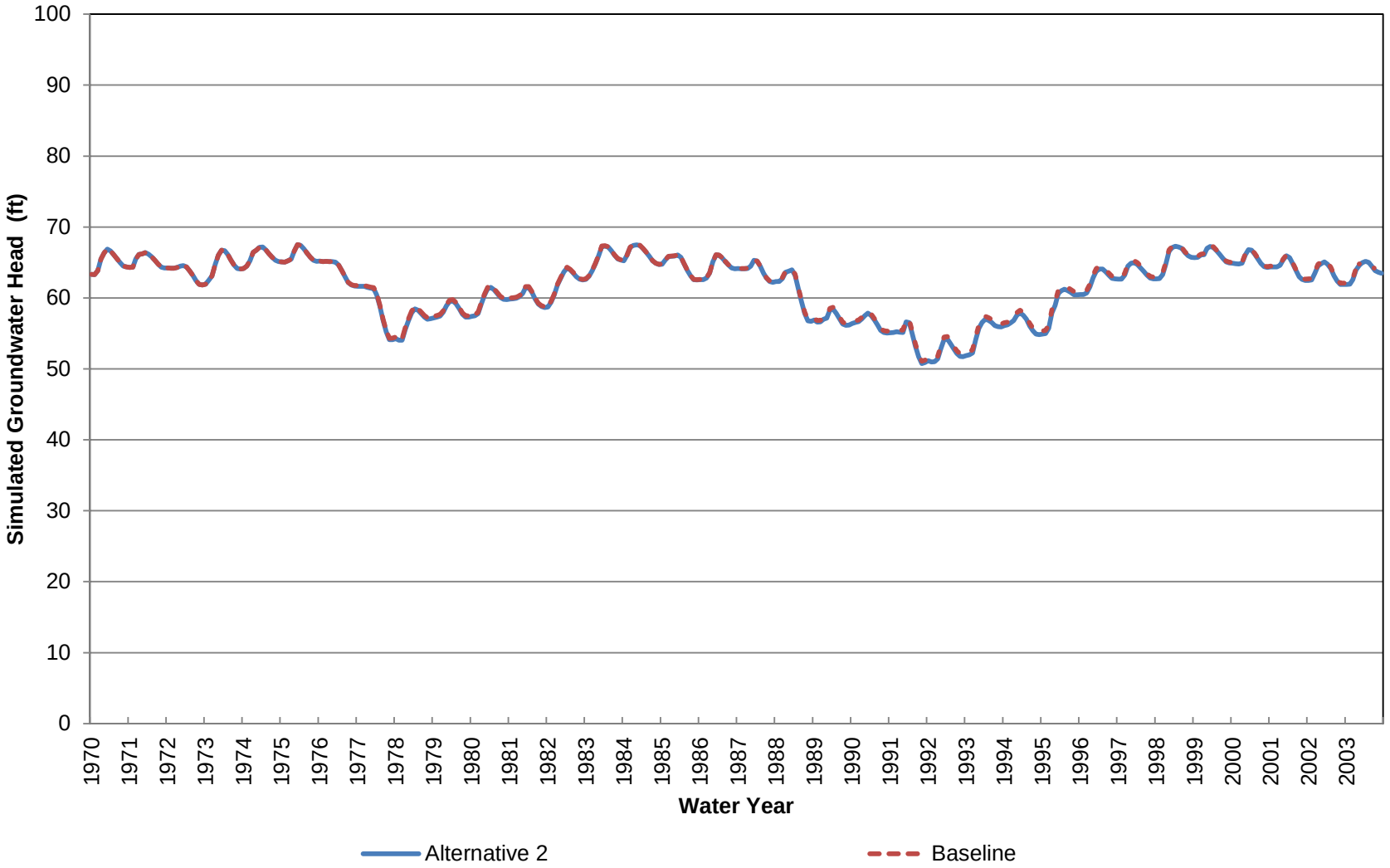
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 12 (Approximately 1240-1700 ft bgs)



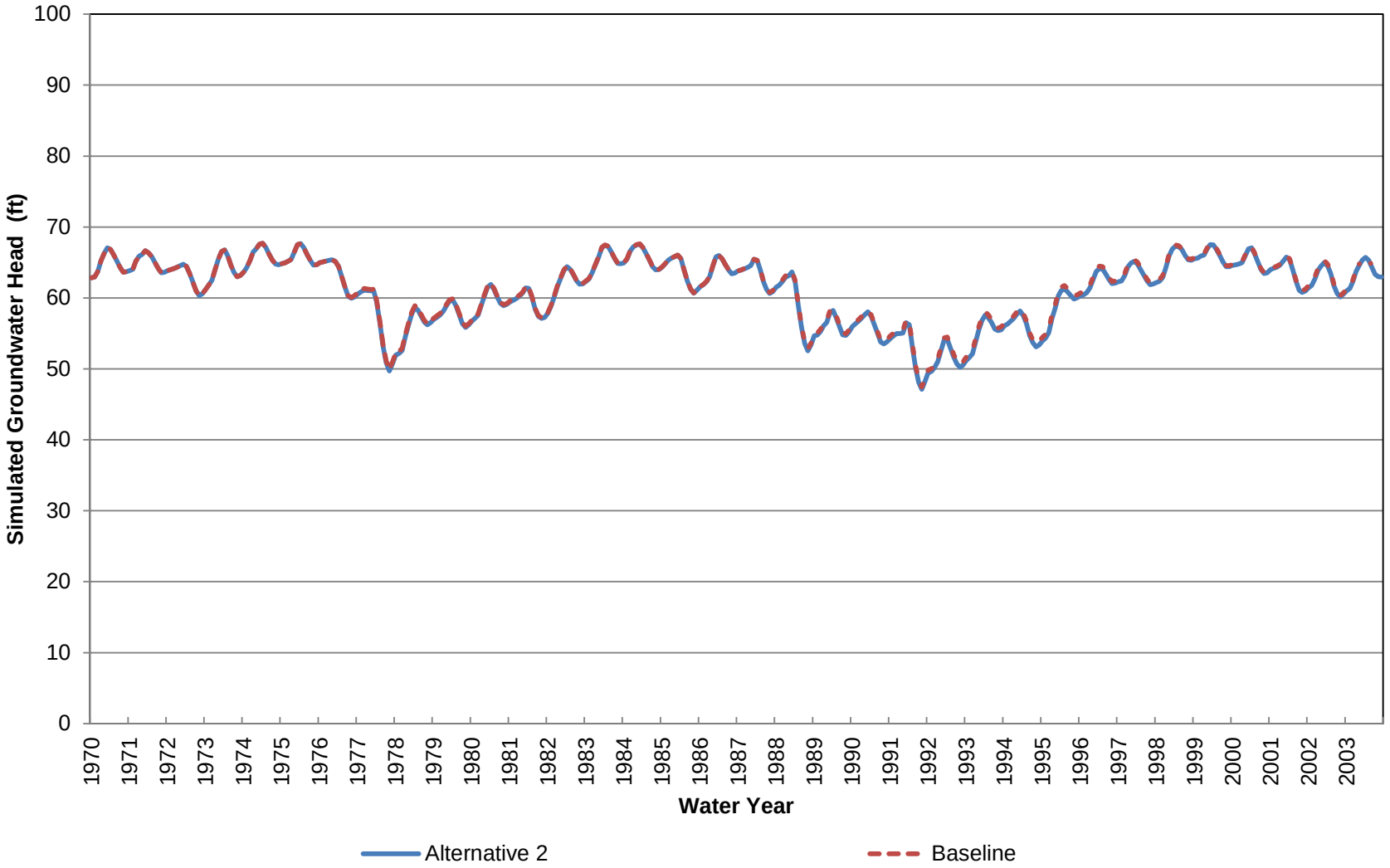
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 13 (Approximately 0-70 ft bgs)



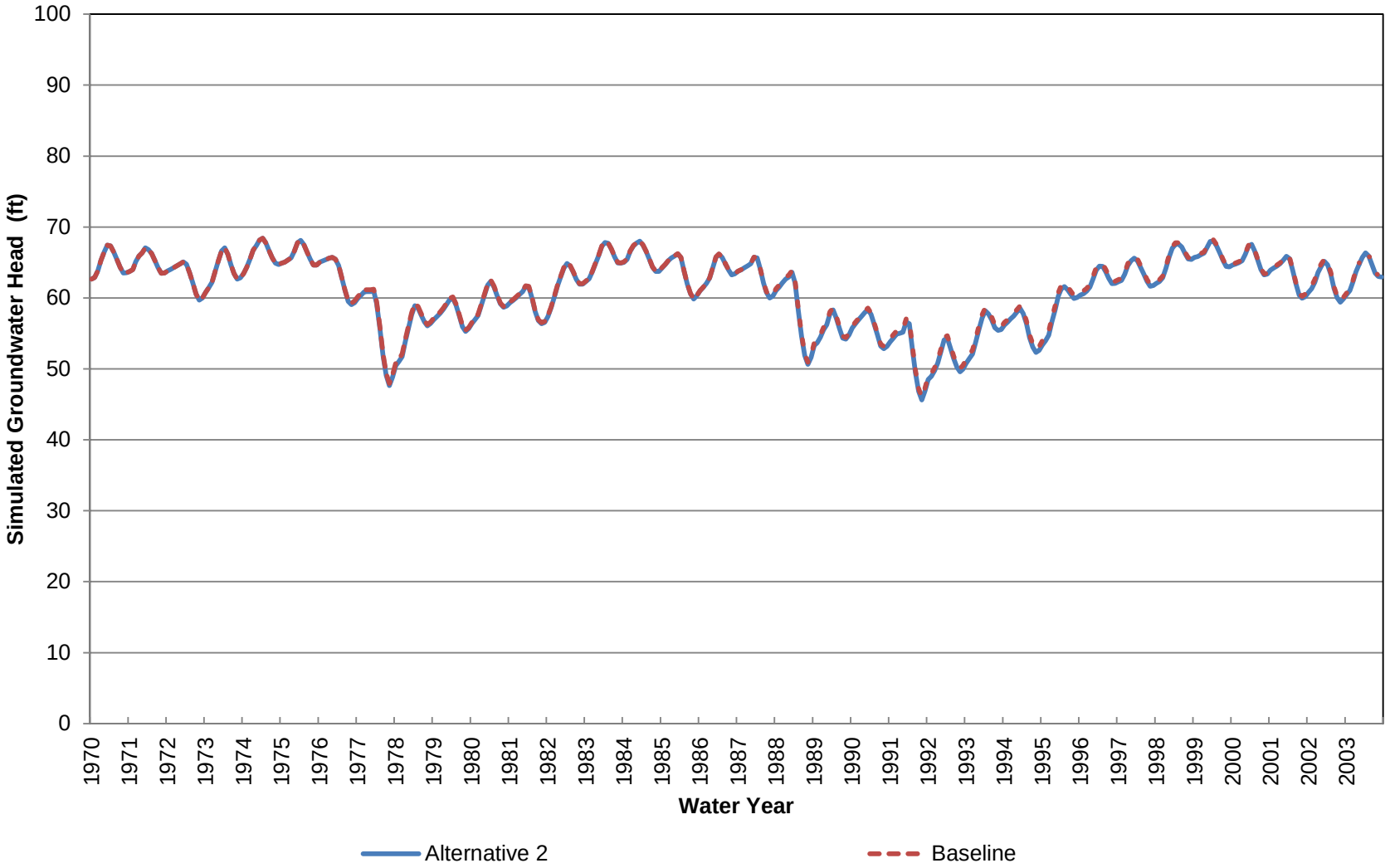
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 13 (Approximately 70-210 ft bgs)



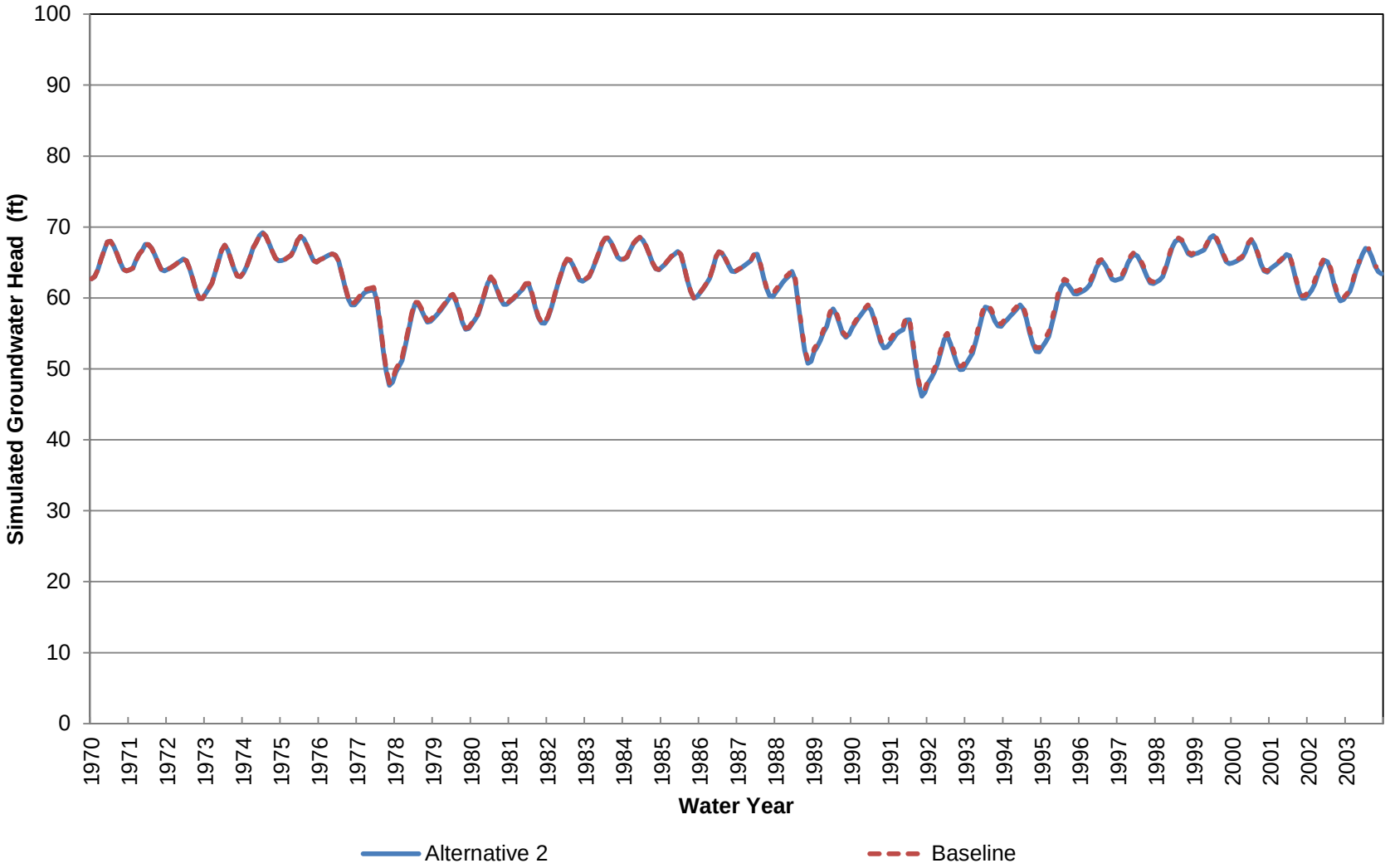
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 13 (Approximately 210-350 ft bgs)



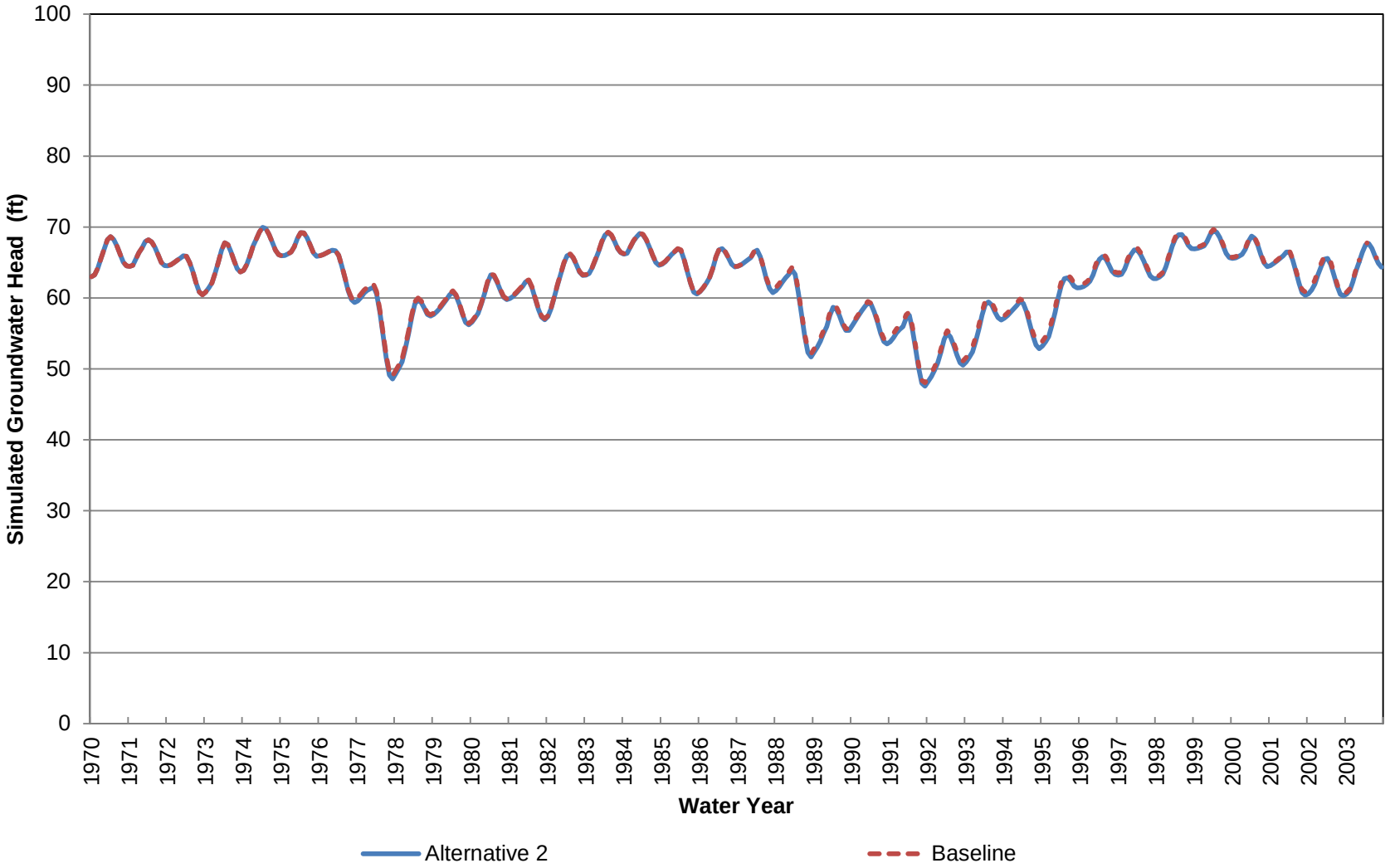
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 13 (Approximately 350-490 ft bgs)



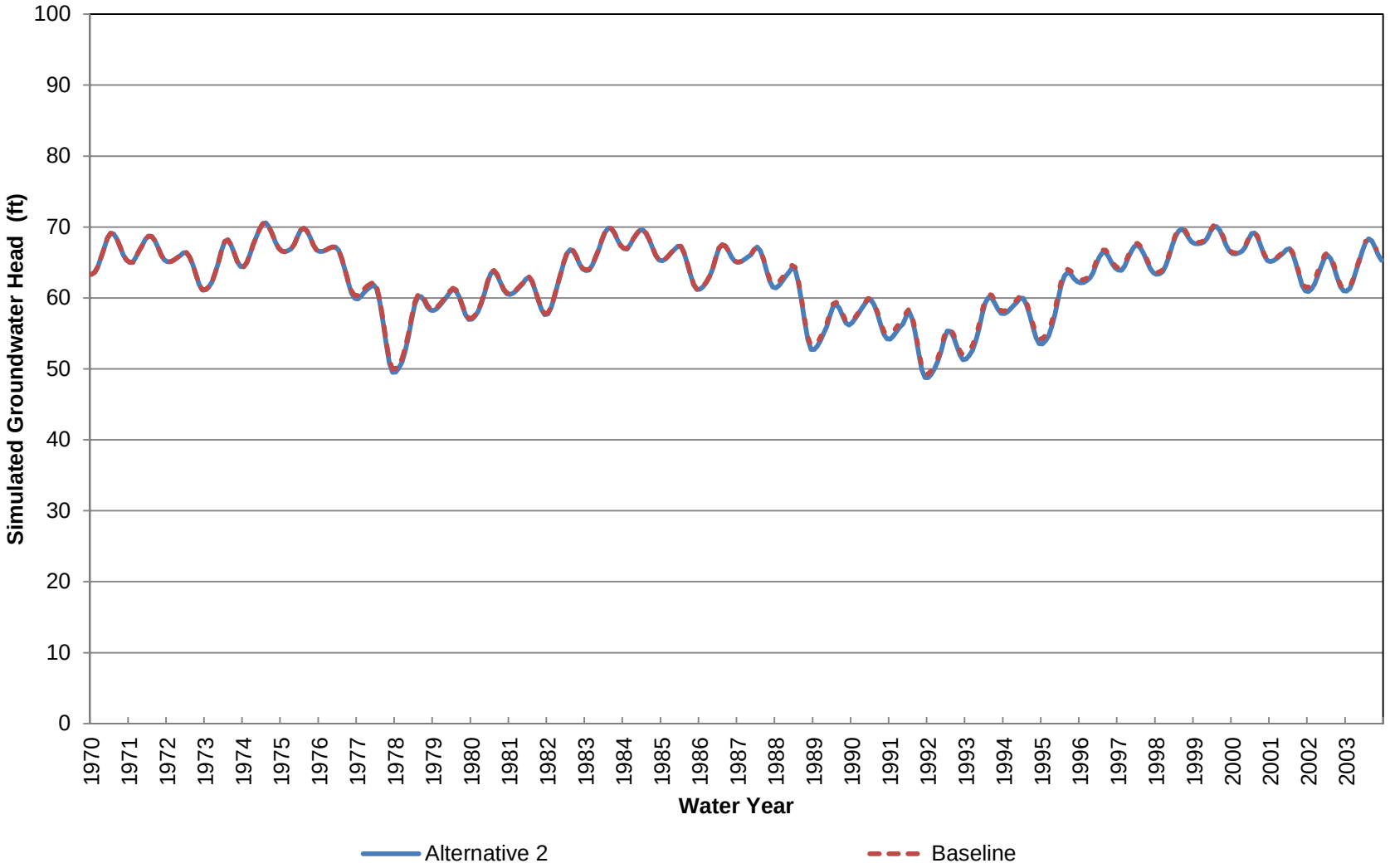
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 13 (Approximately 490-700 ft bgs)



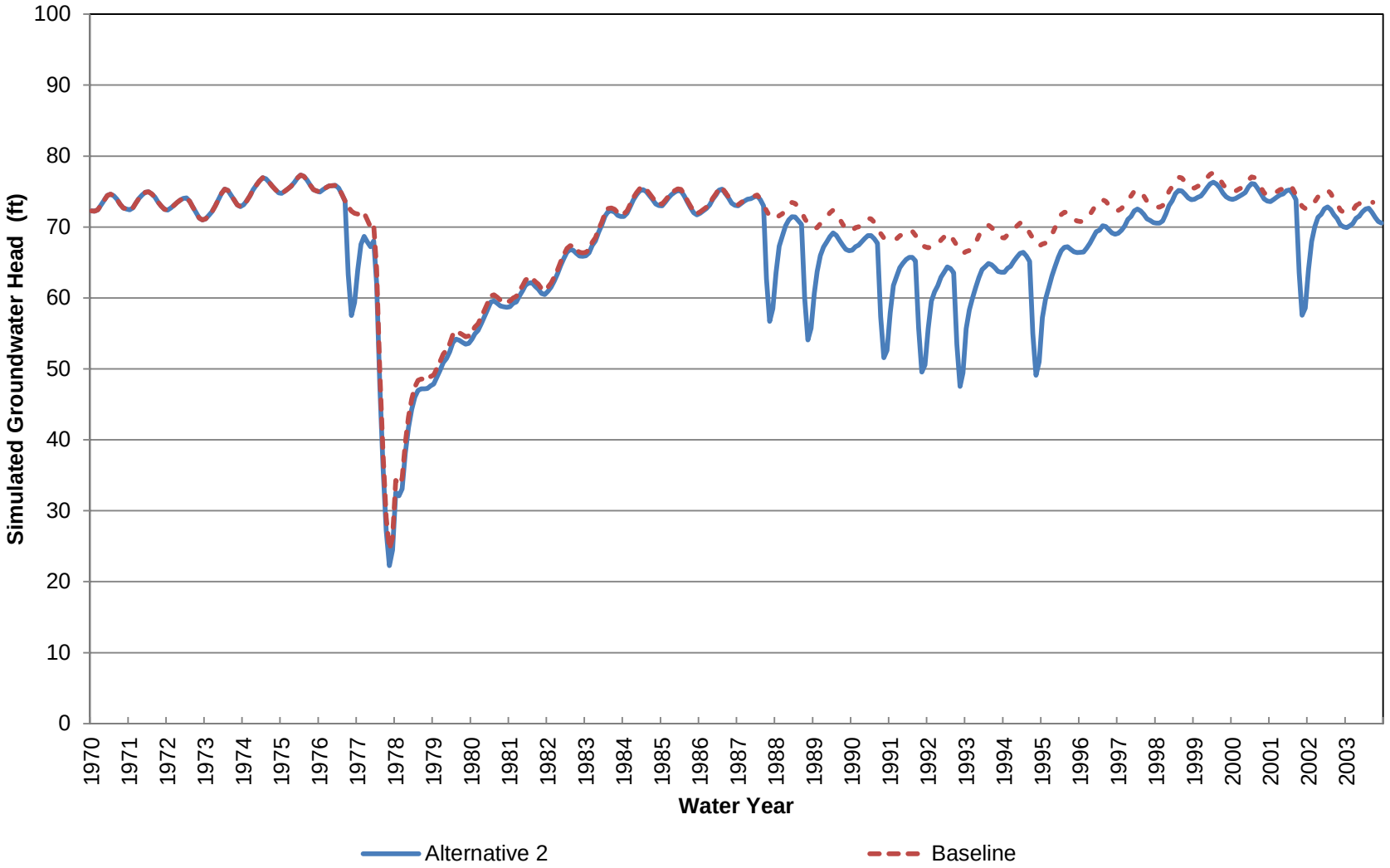
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 13 (Approximately 700-930 ft bgs)



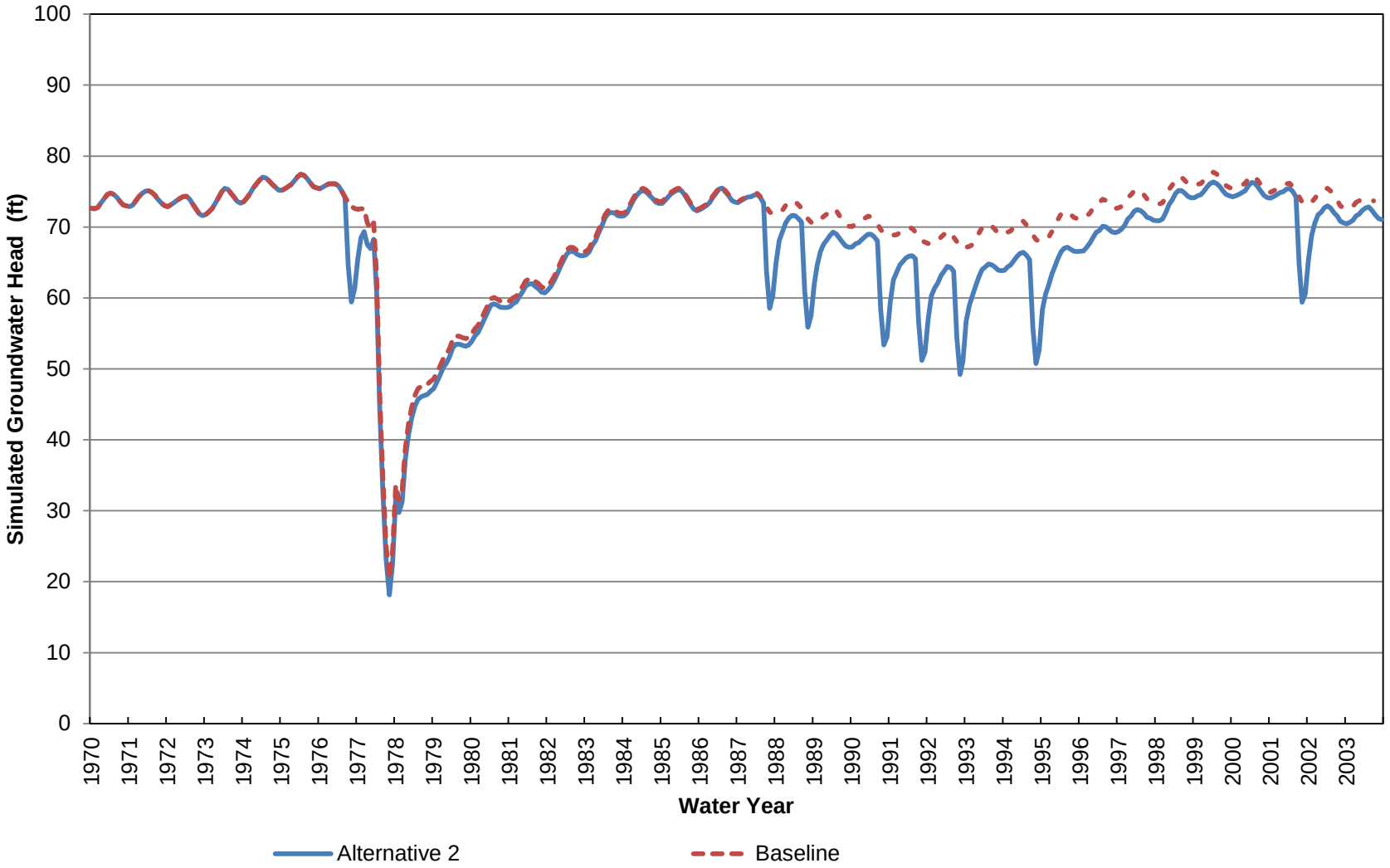
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 13 (Approximately 930-1280 ft bgs)



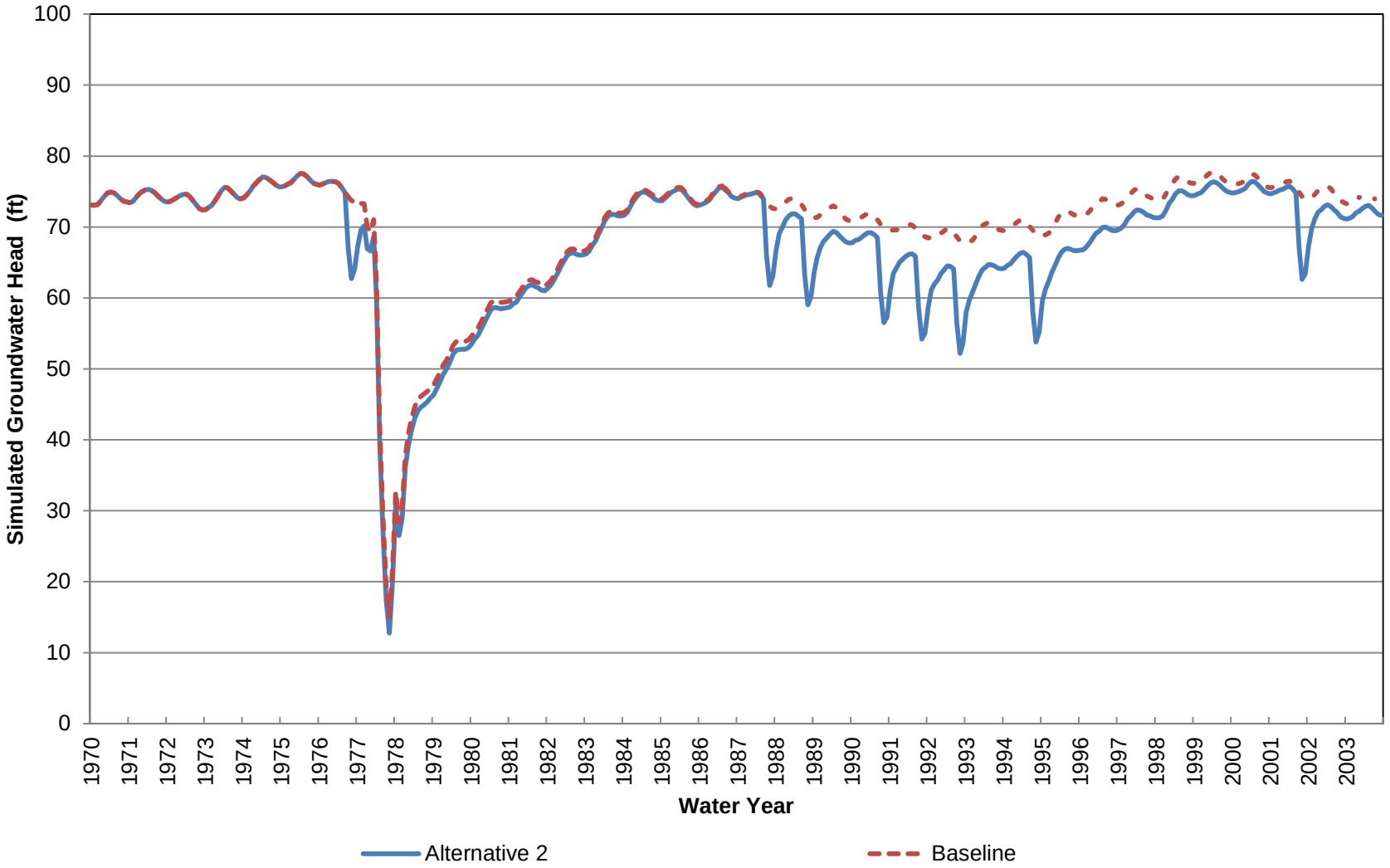
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 14 (Approximately 420-570 ft bgs)



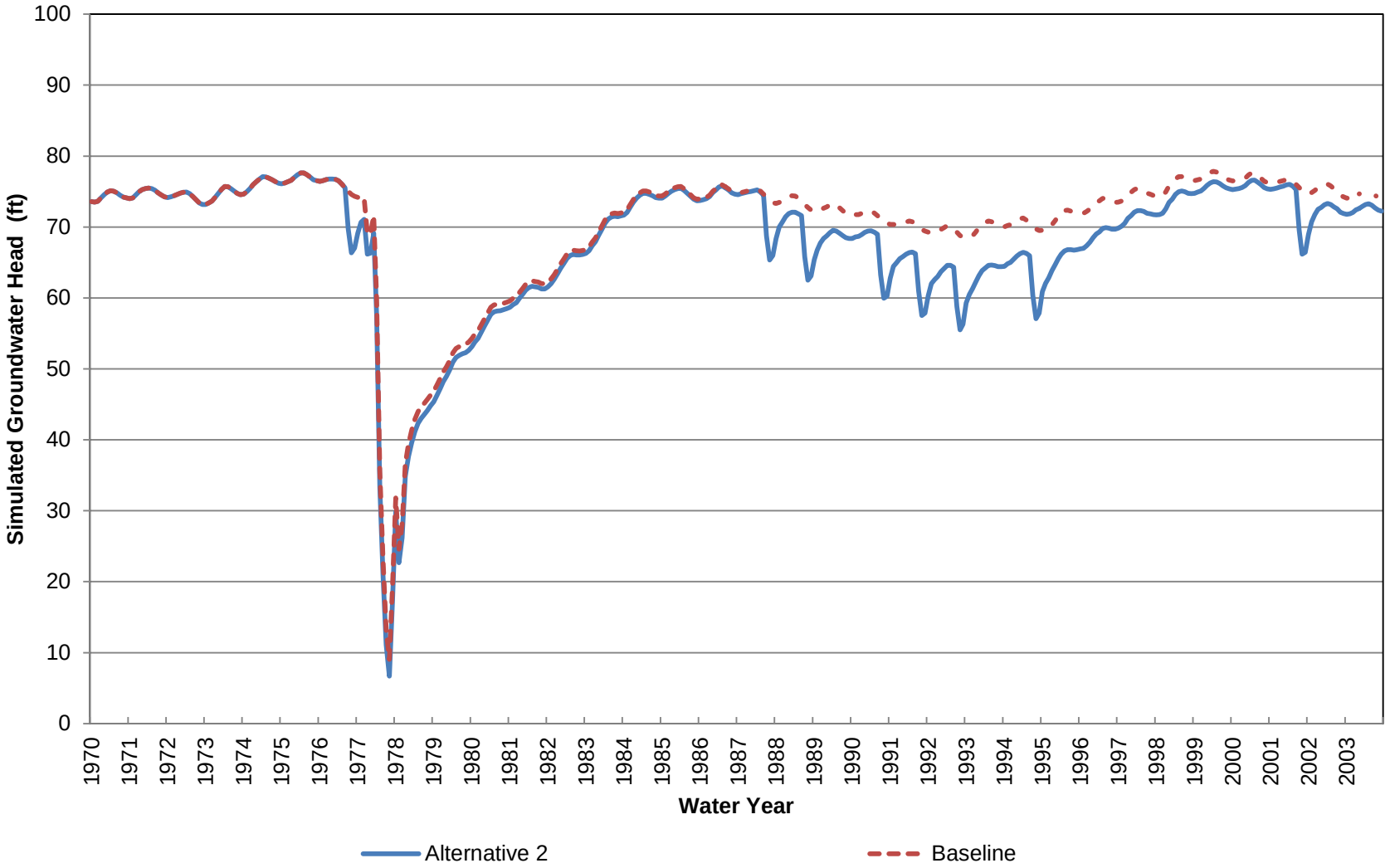
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 14 (Approximately 310-420 ft bgs)



Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 14 (Approximately 230-310 ft bgs)

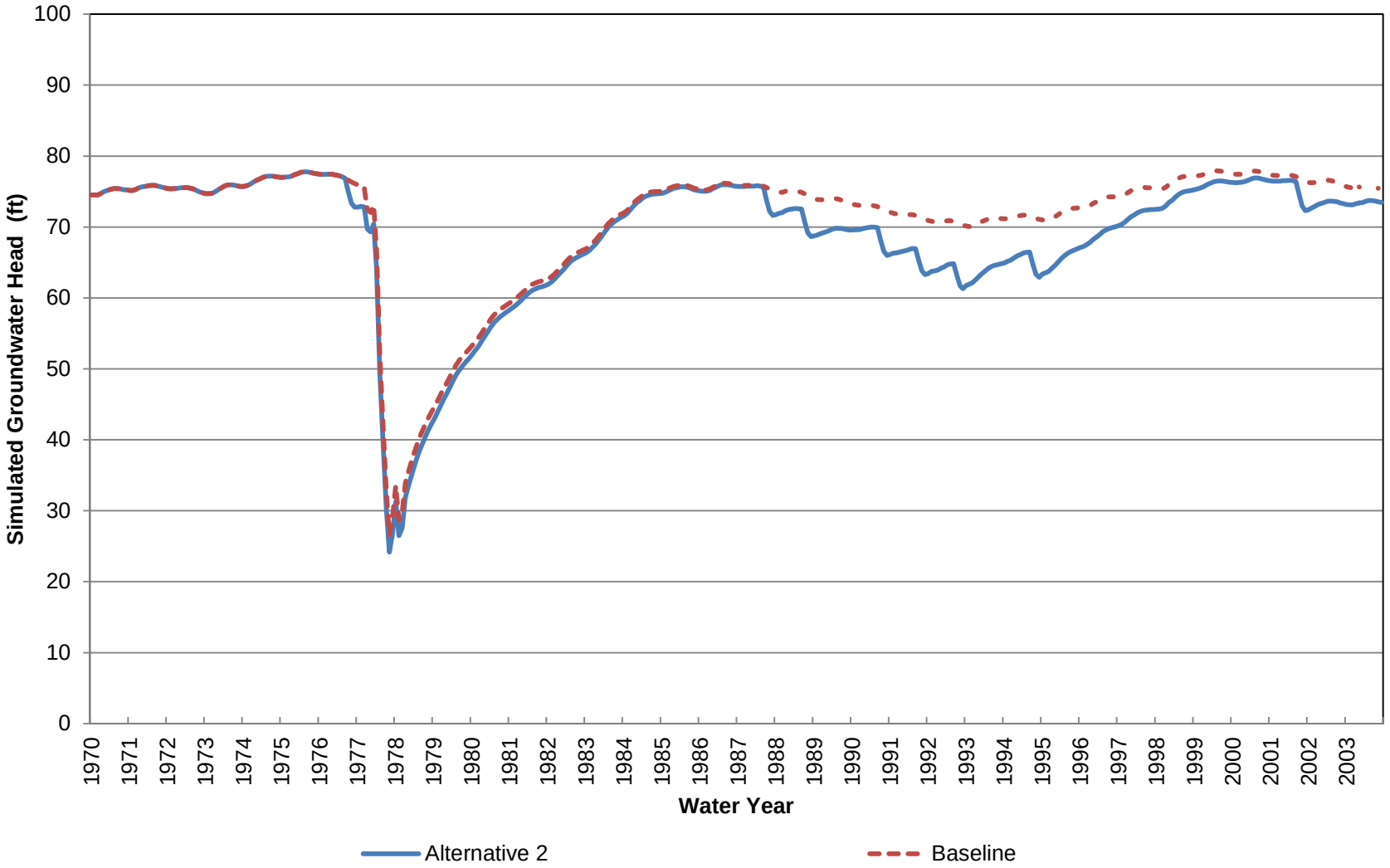


Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 14 (Approximately 170-230 ft bgs)

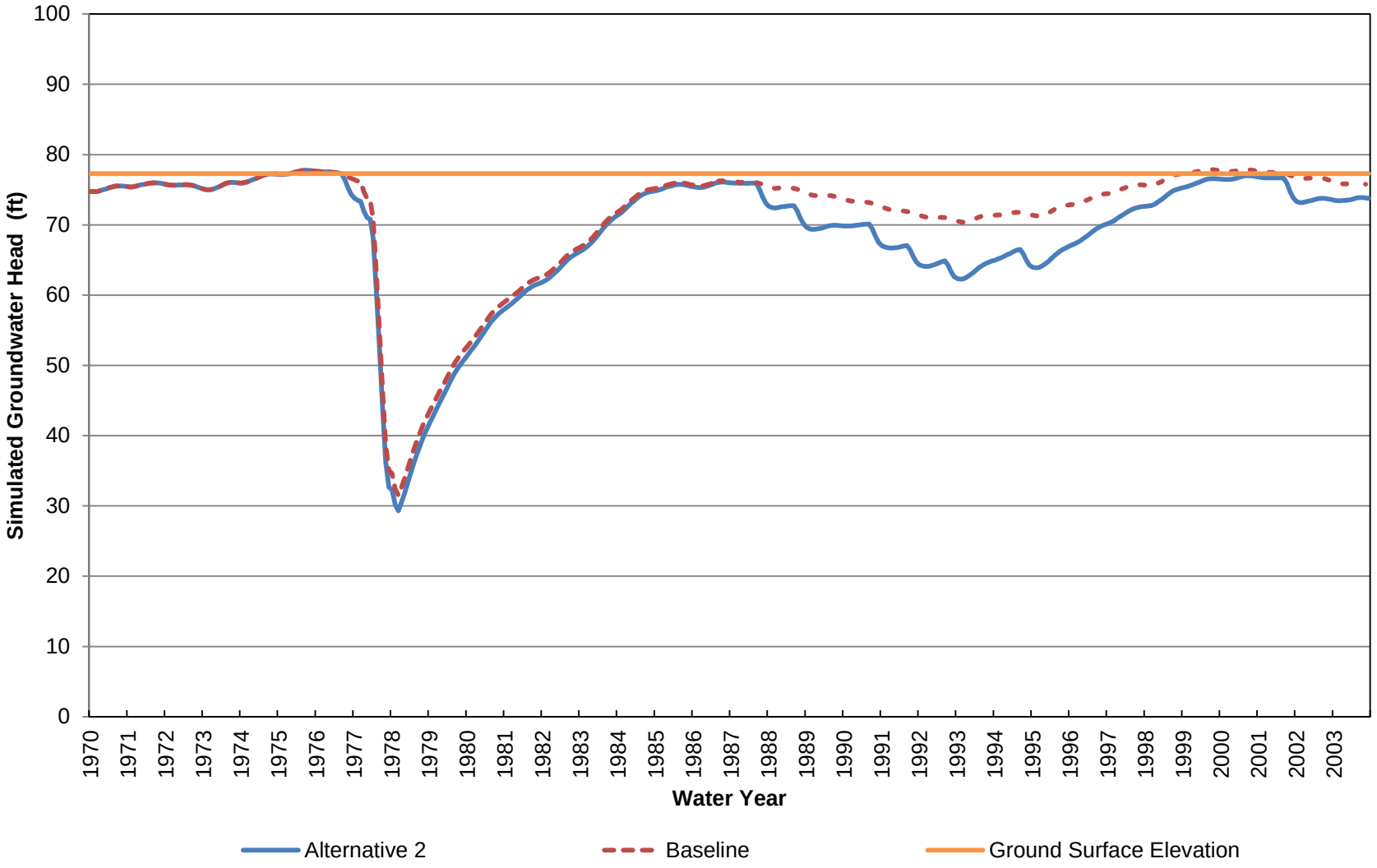


Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 14 (Approximately 110-170 ft bgs)

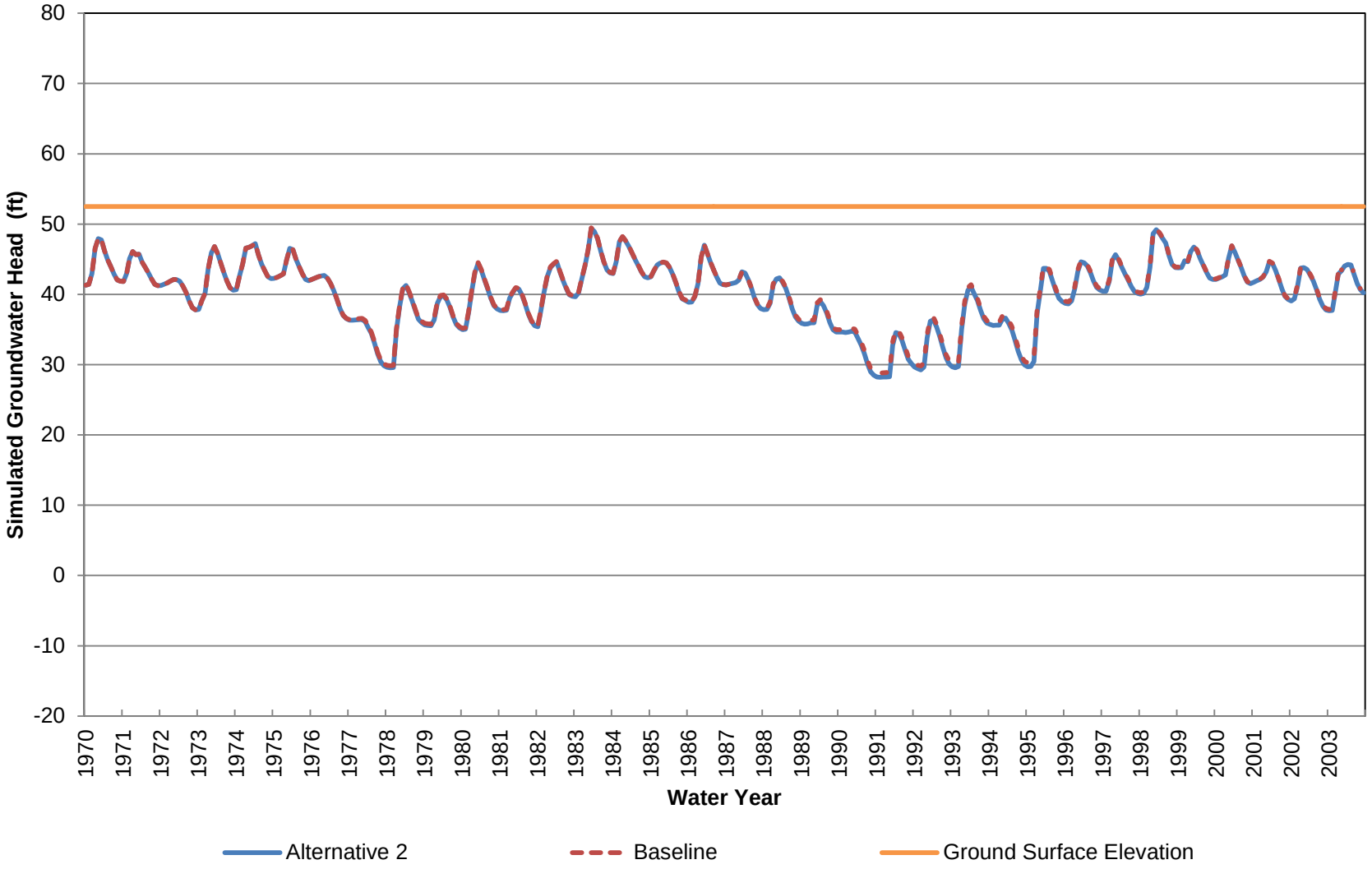
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 14 (Approximately 40-110 ft bgs)



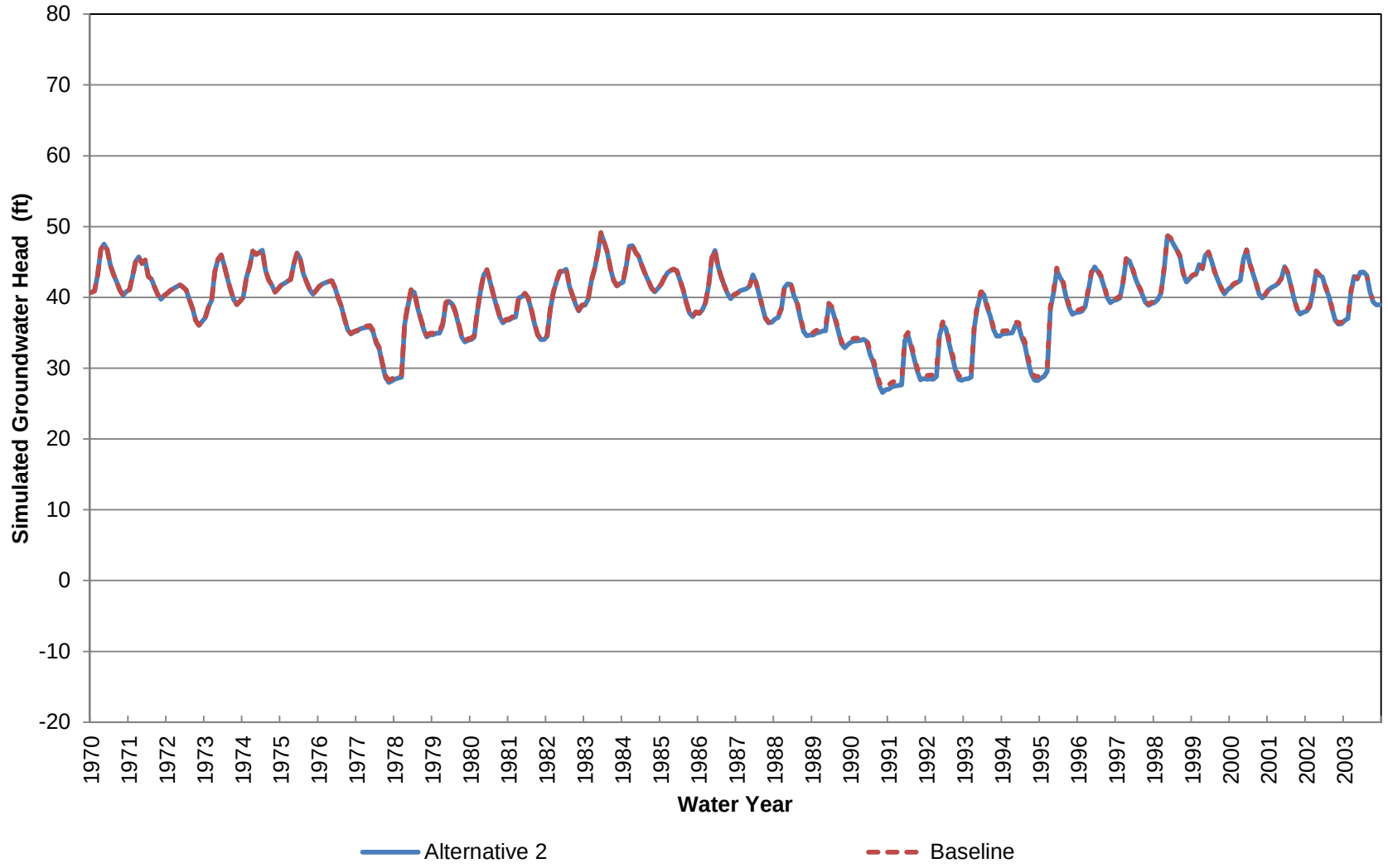
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 14 (Approximately 0-40 ft bgs)



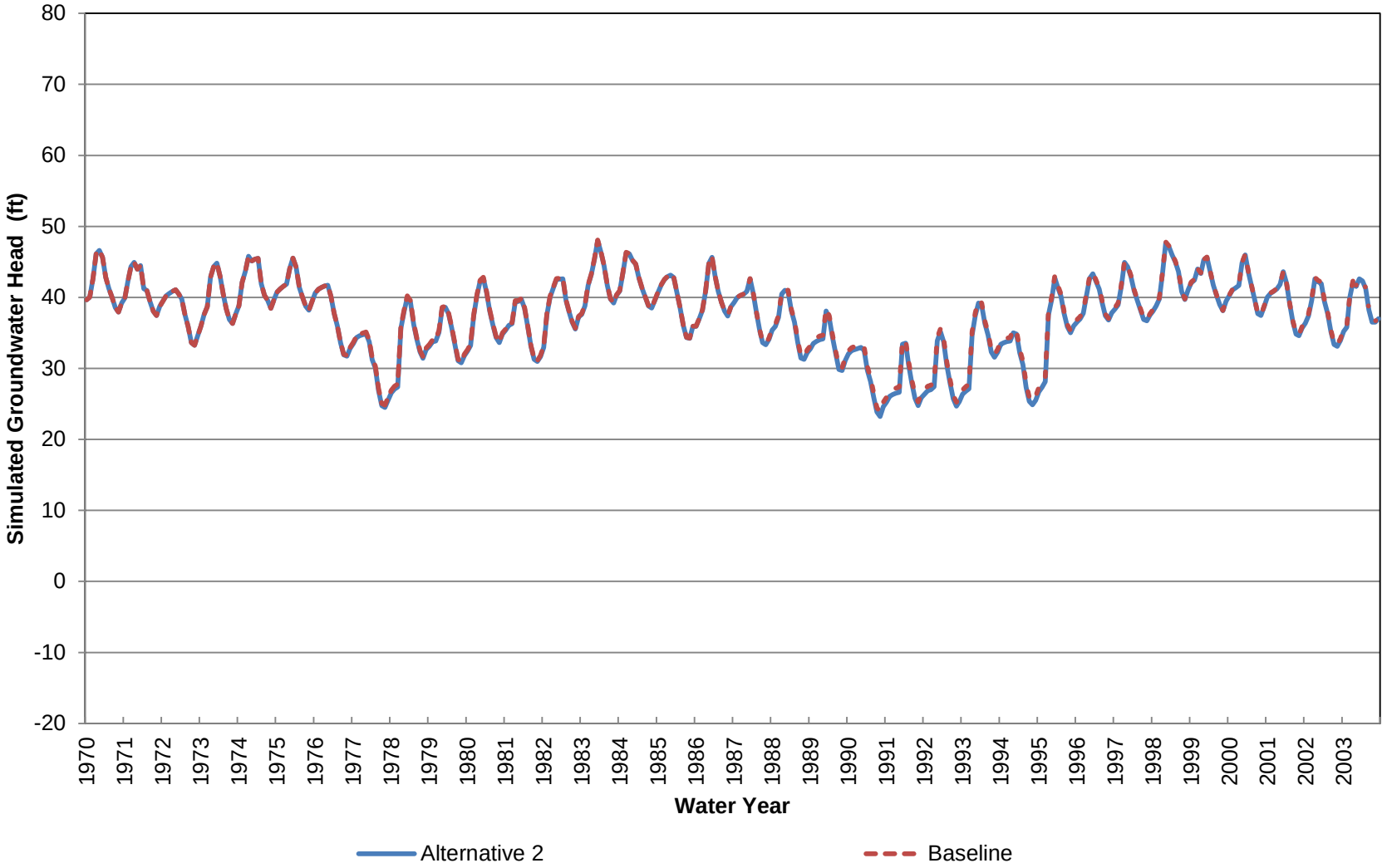
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 15 (Approximately 0-30 ft bgs)



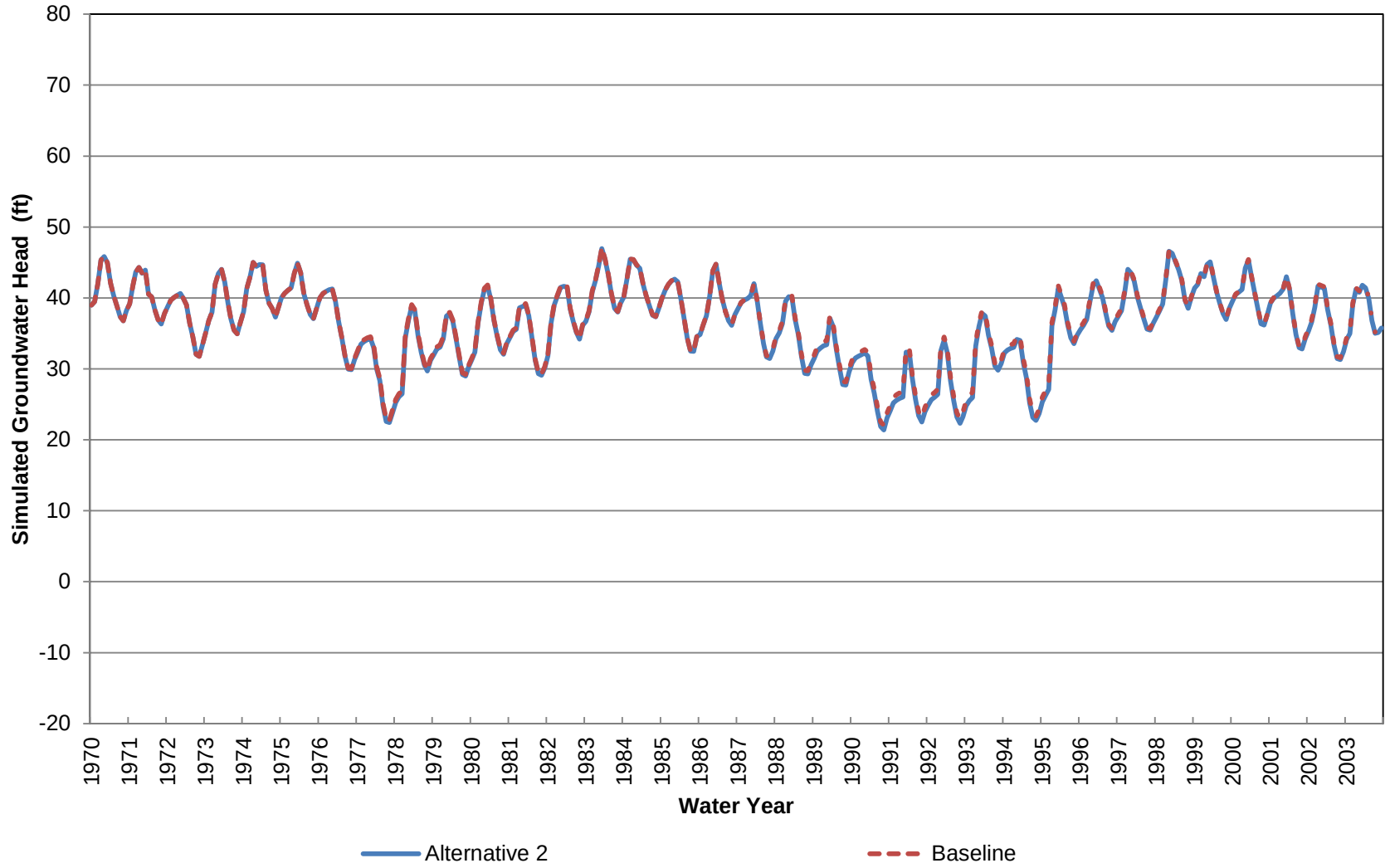
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 15 (Approximately 30-70 ft bgs)



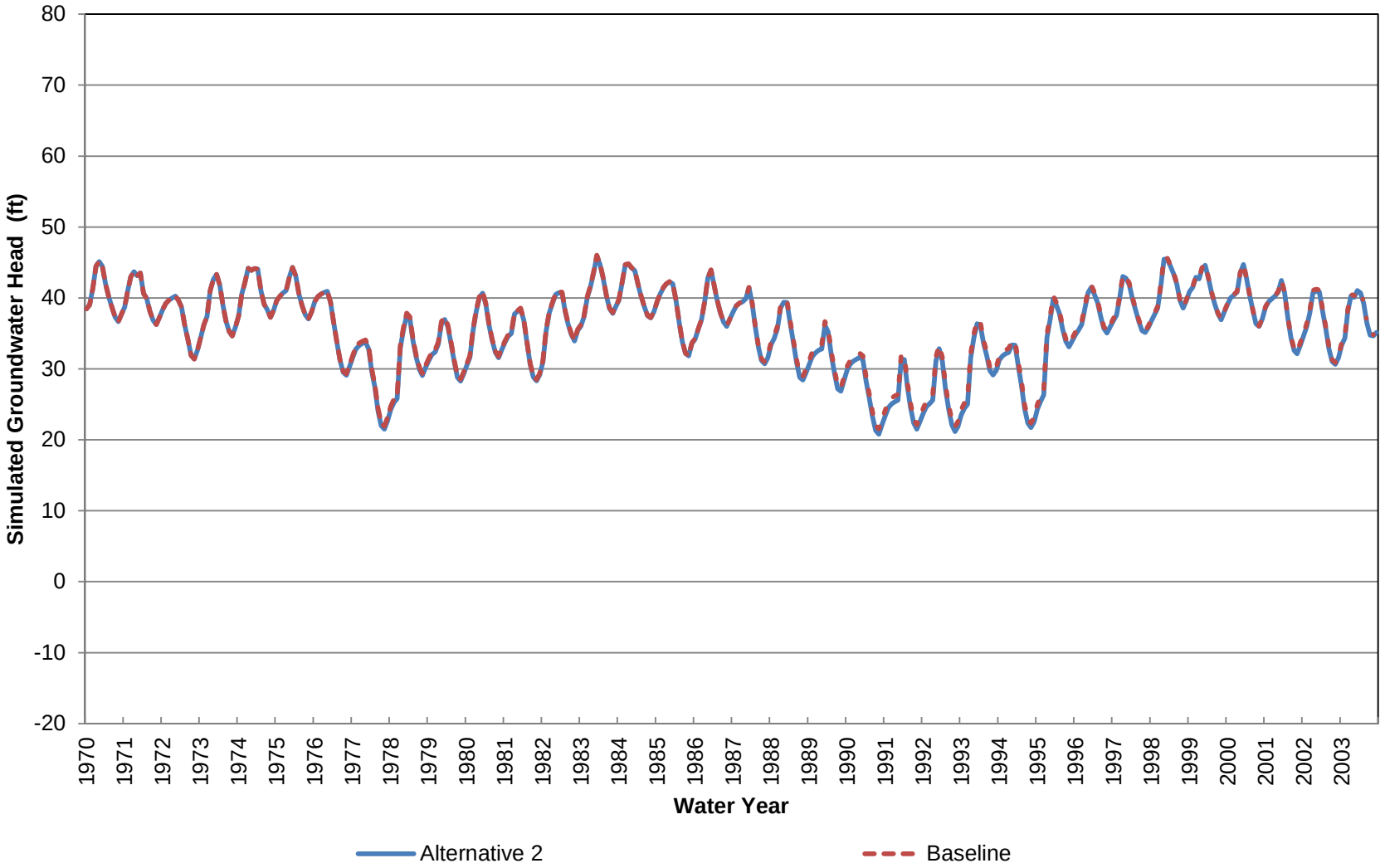
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 15 (Approximately 70-110 ft bgs)



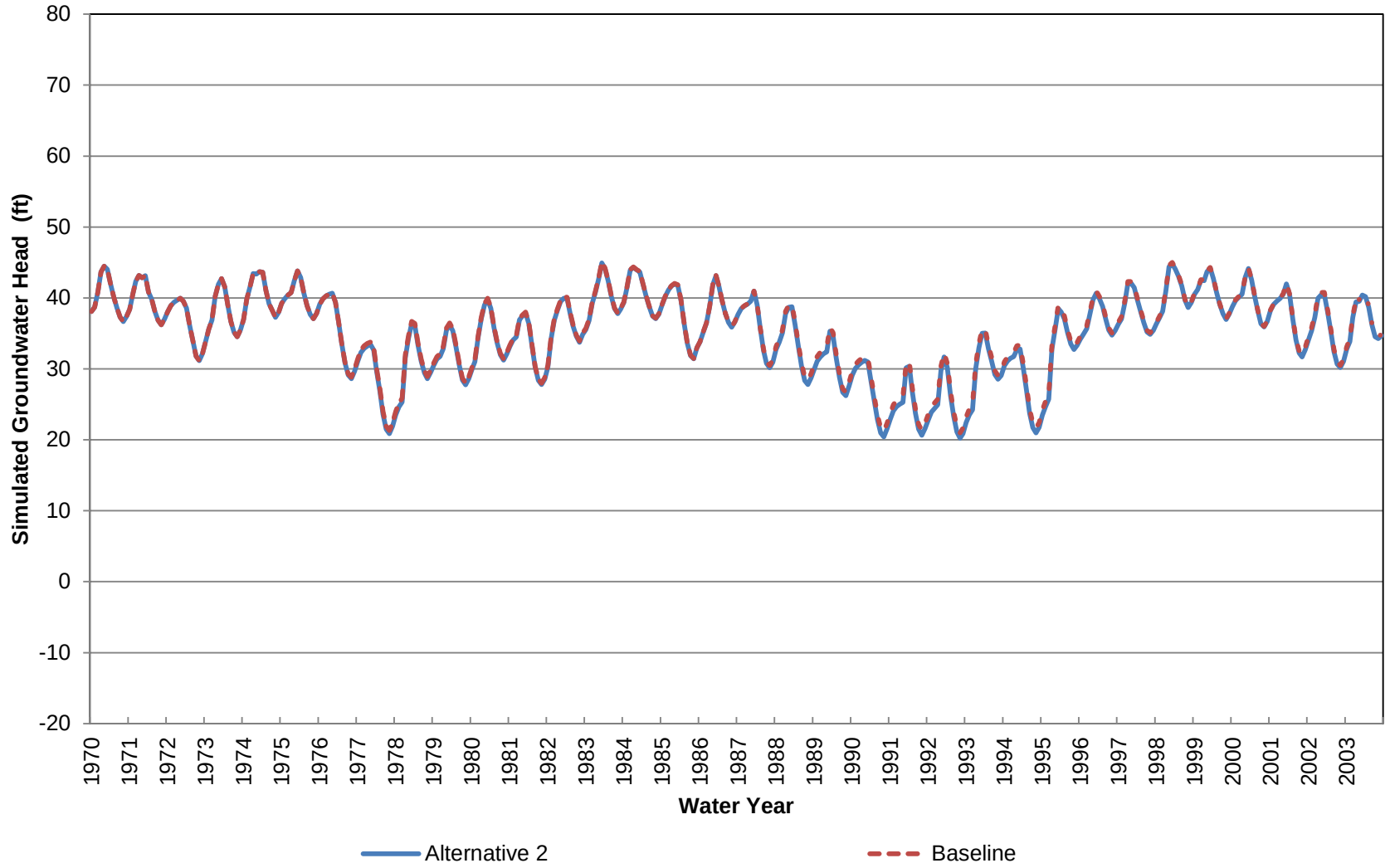
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 15 (Approximately 110-150 ft bgs)



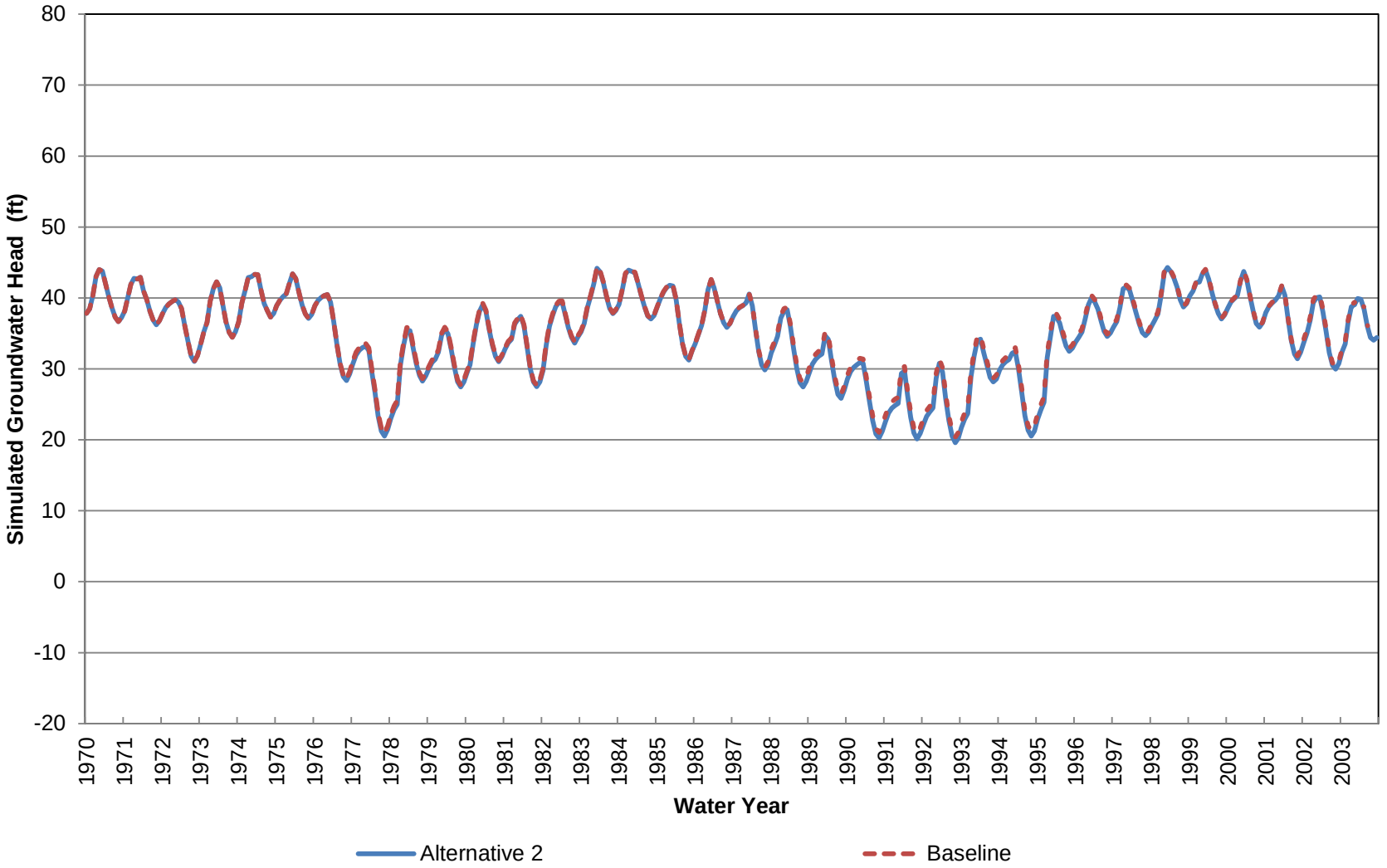
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 15 (Approximately 150-200 ft bgs)



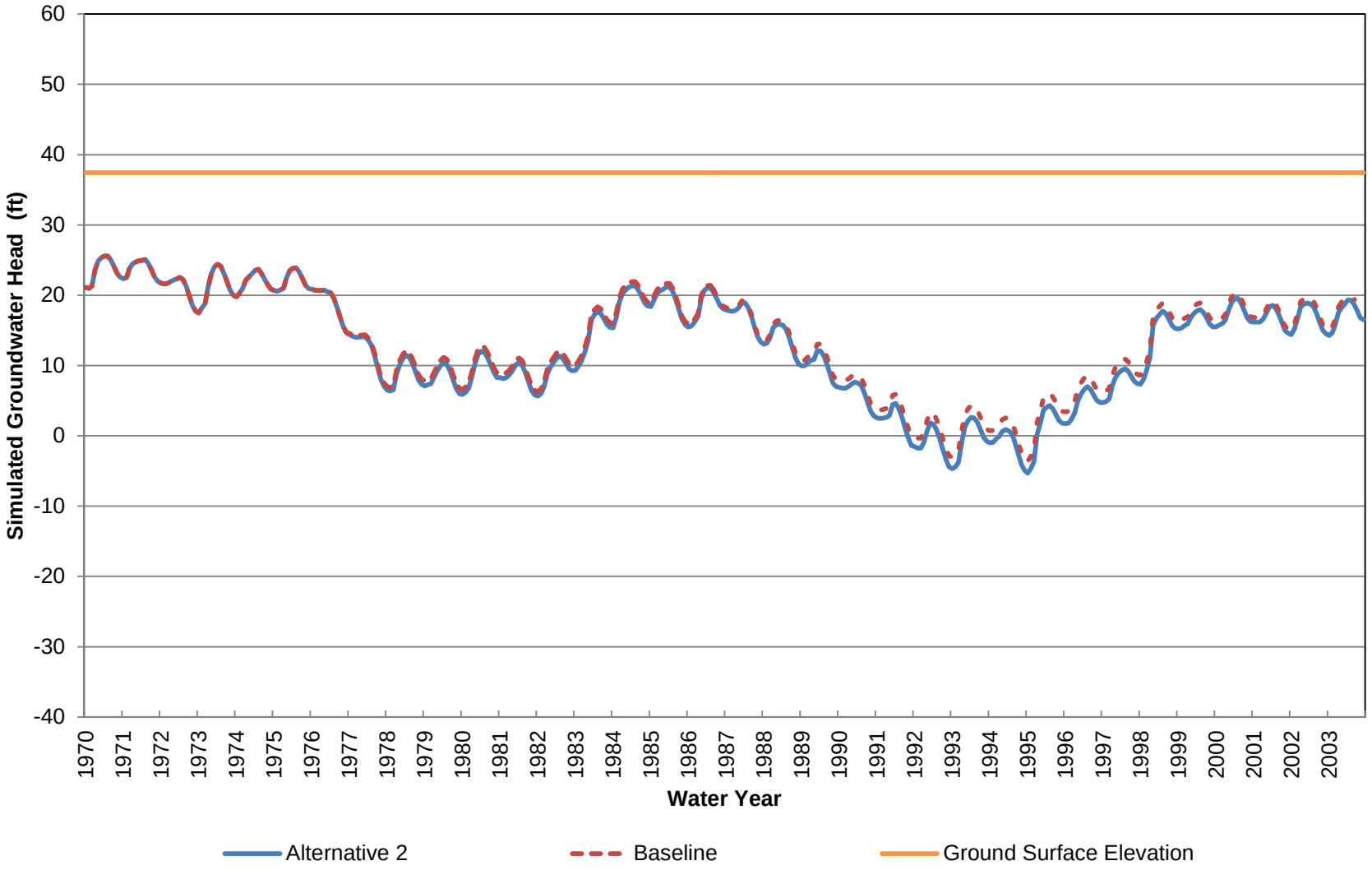
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 15 (Approximately 200-270 ft bgs)



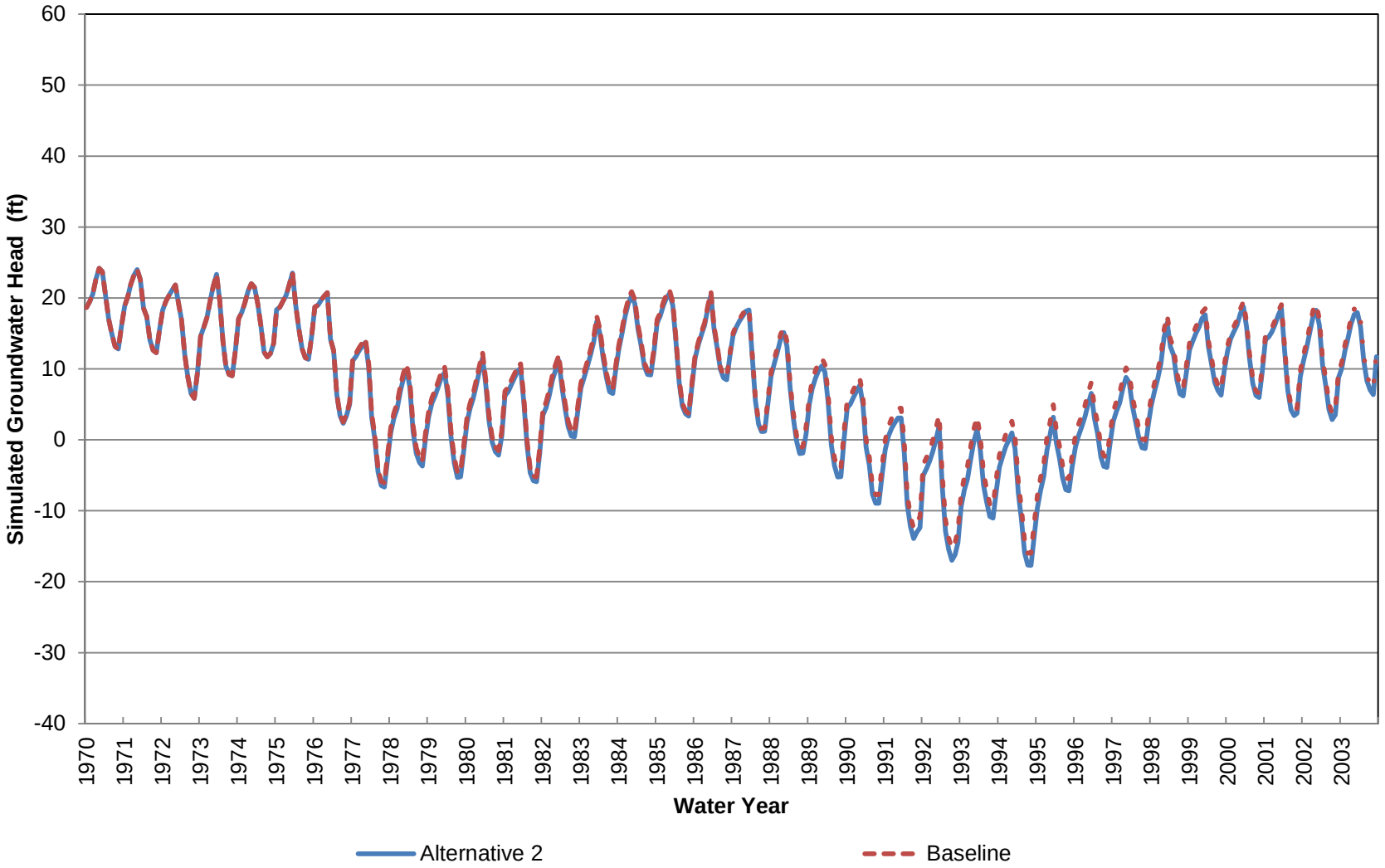
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 15 (Approximately 270-360 ft bgs)



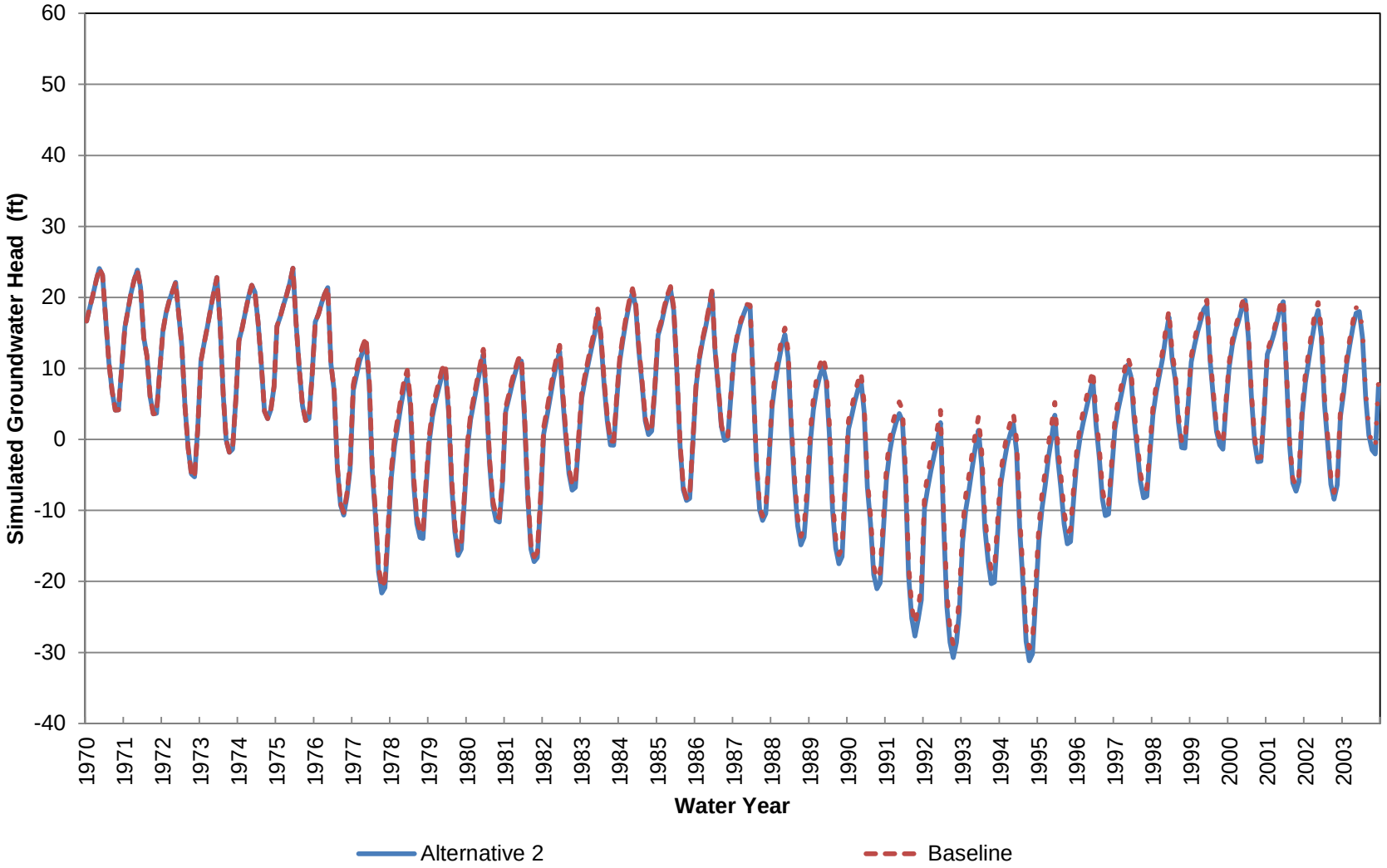
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 16 (Approximately 0-70 ft bgs)



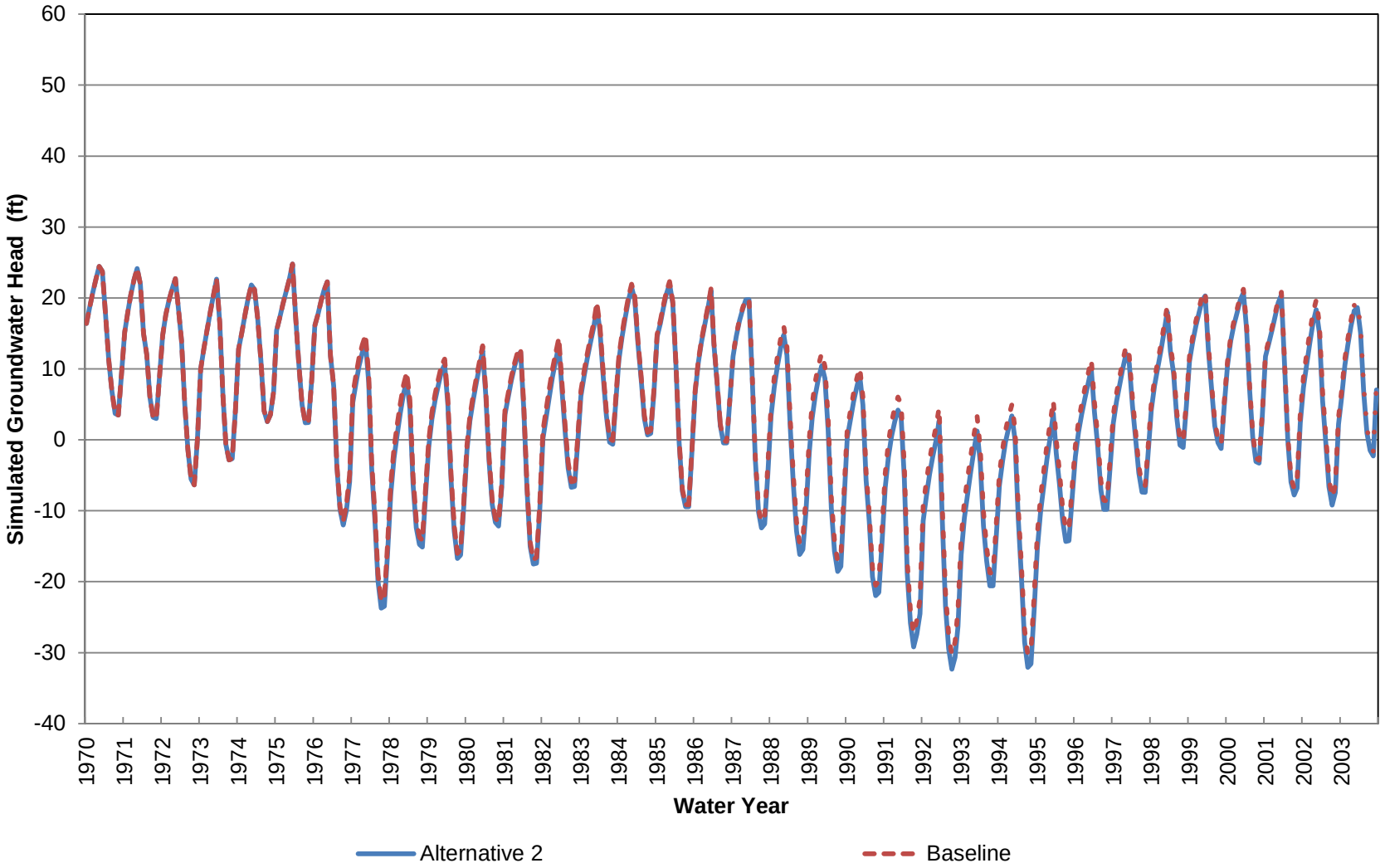
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 16 (Approximately 70-220 ft bgs)



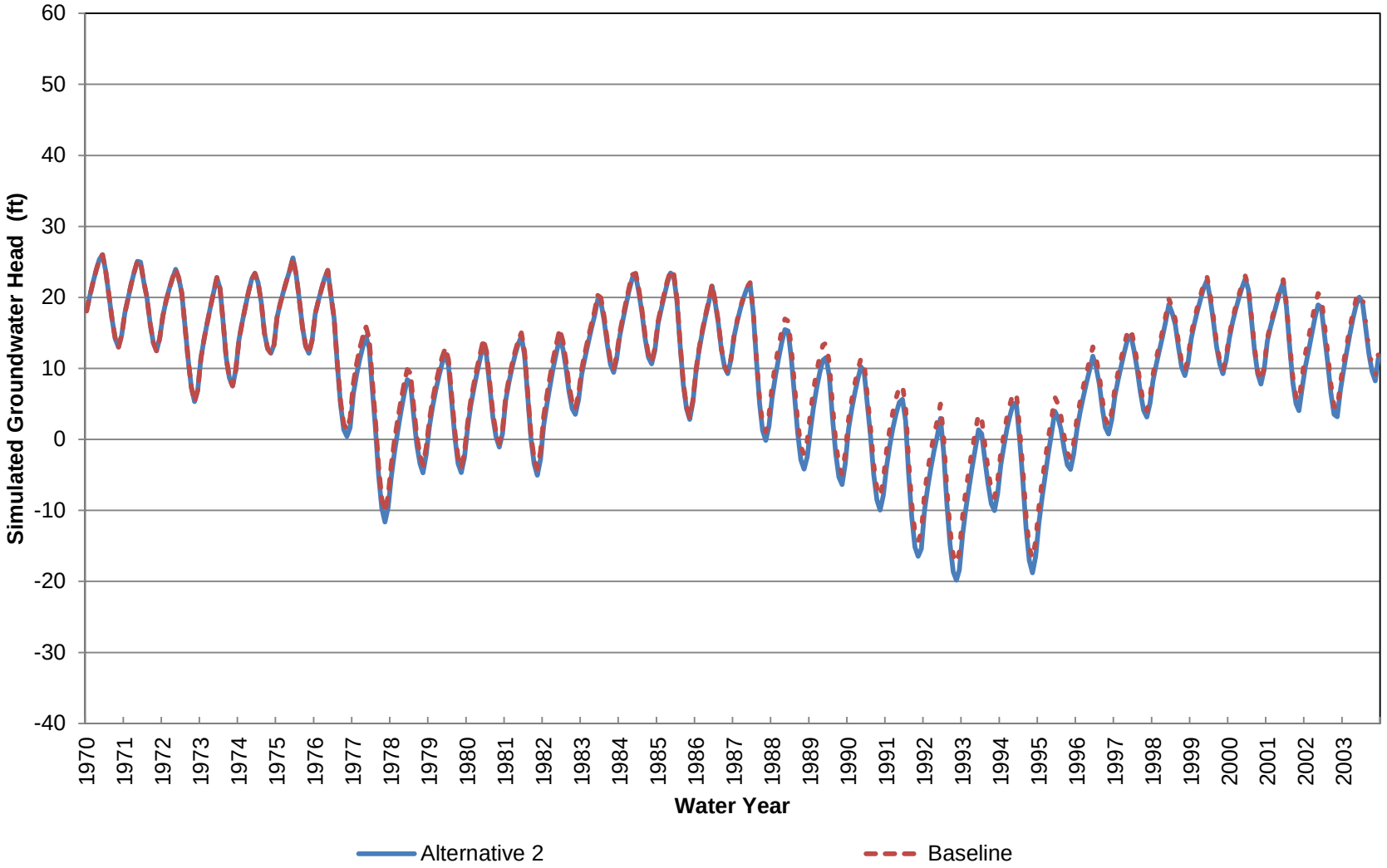
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 16 (Approximately 220-370 ft bgs)



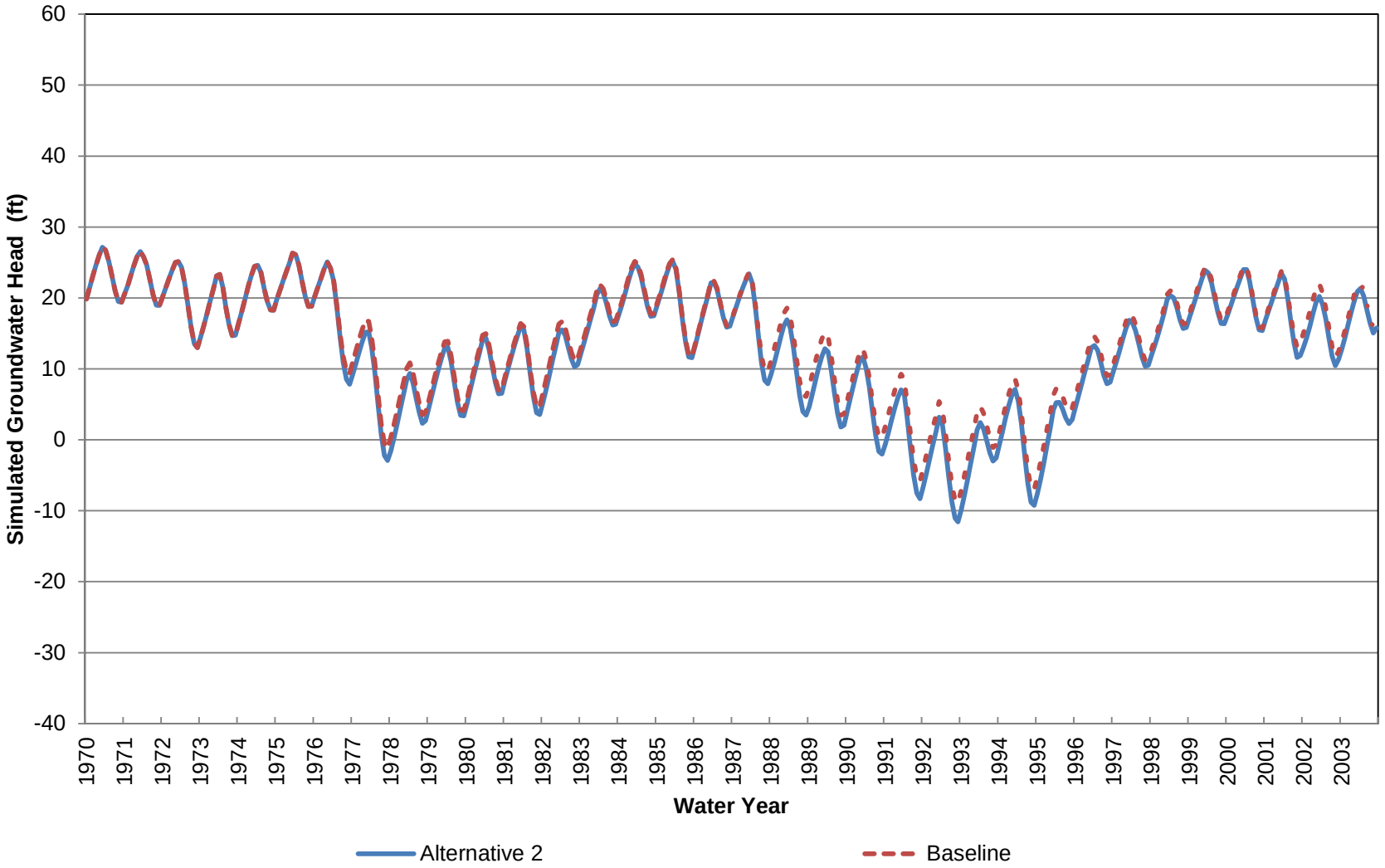
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 16 (Approximately 370-530 ft bgs)



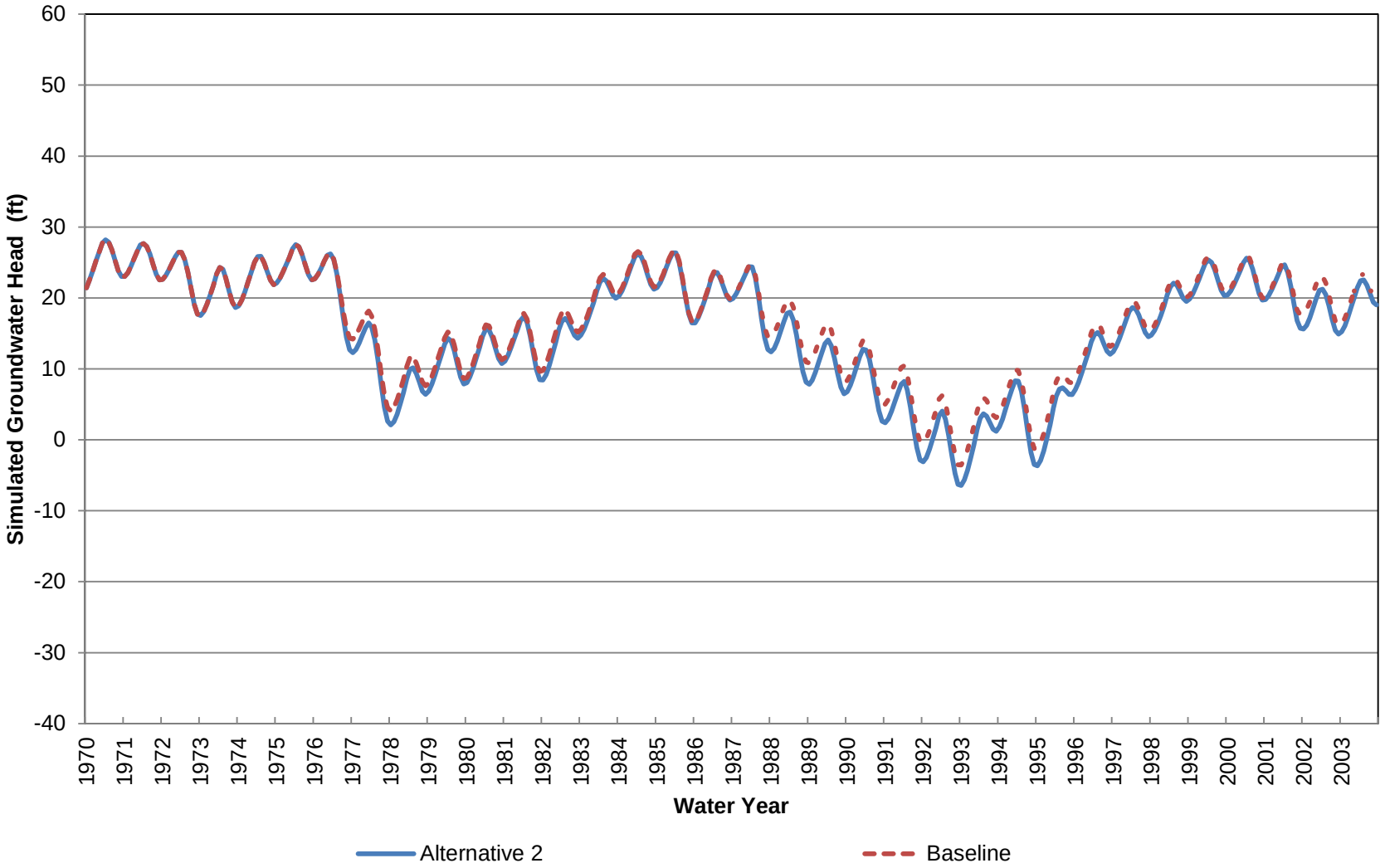
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 16 (Approximately 530-760 ft bgs)



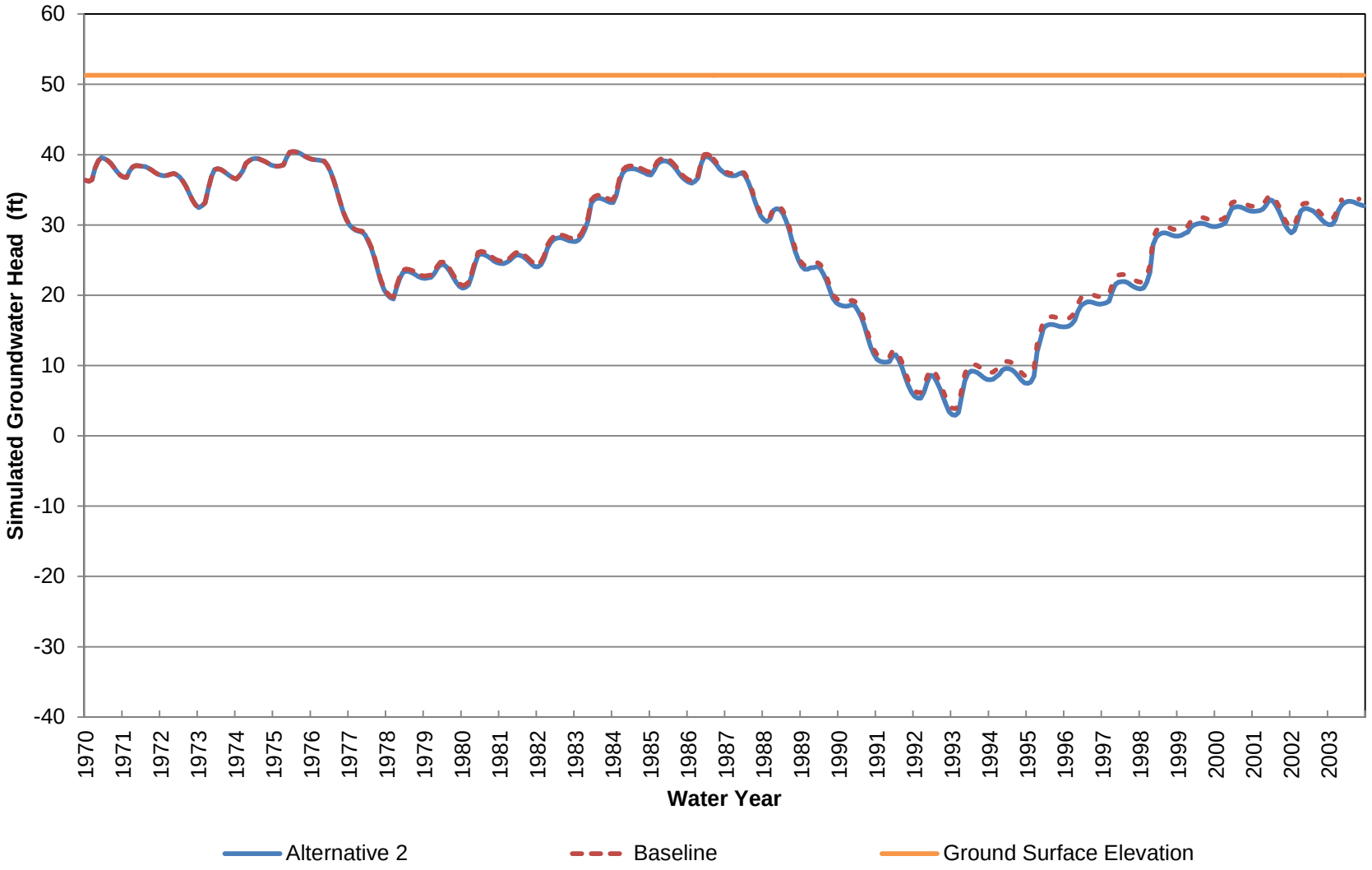
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 16 (Approximately 760-1020 ft bgs)



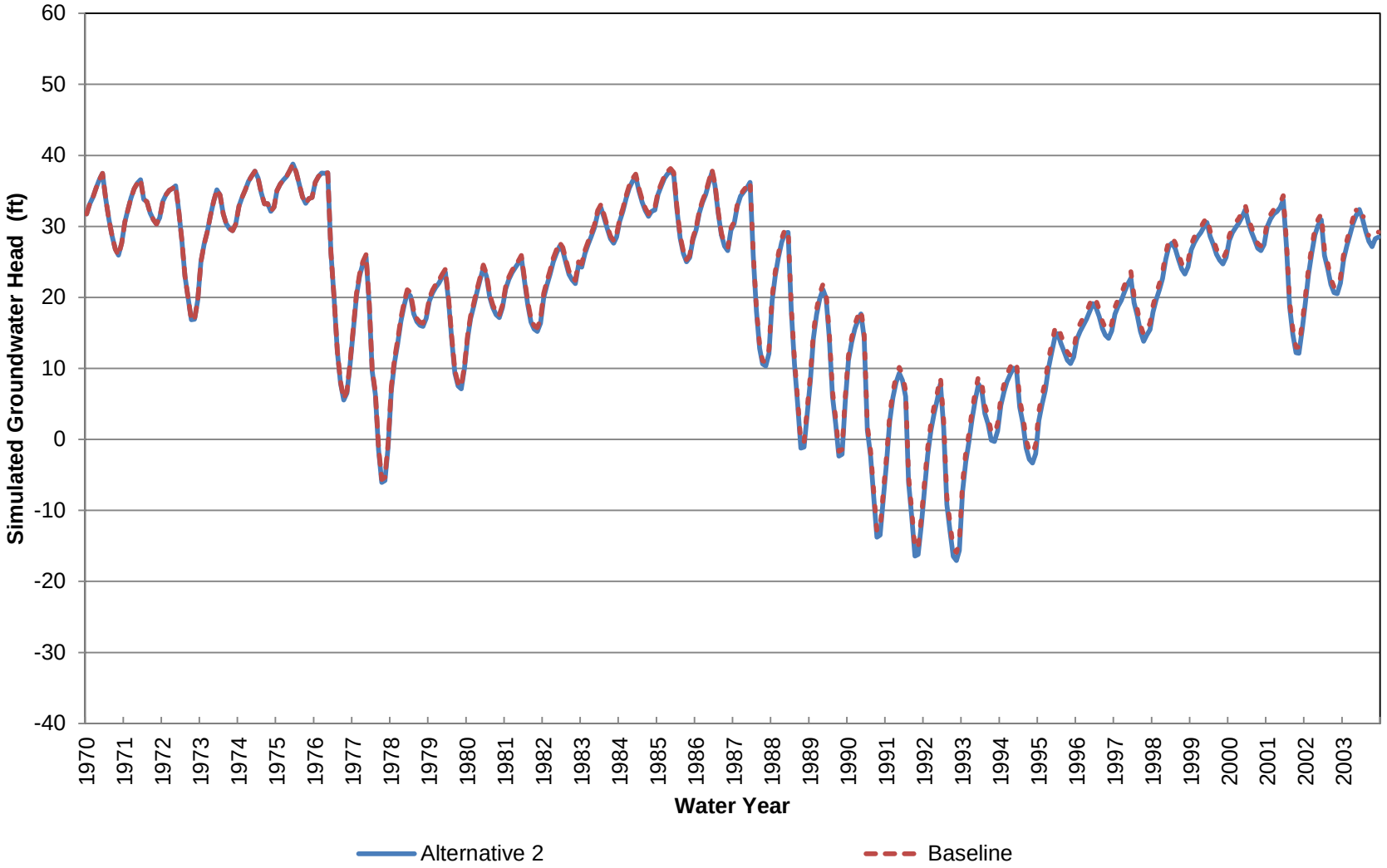
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 16 (Approximately 1020-1390 ft bgs)



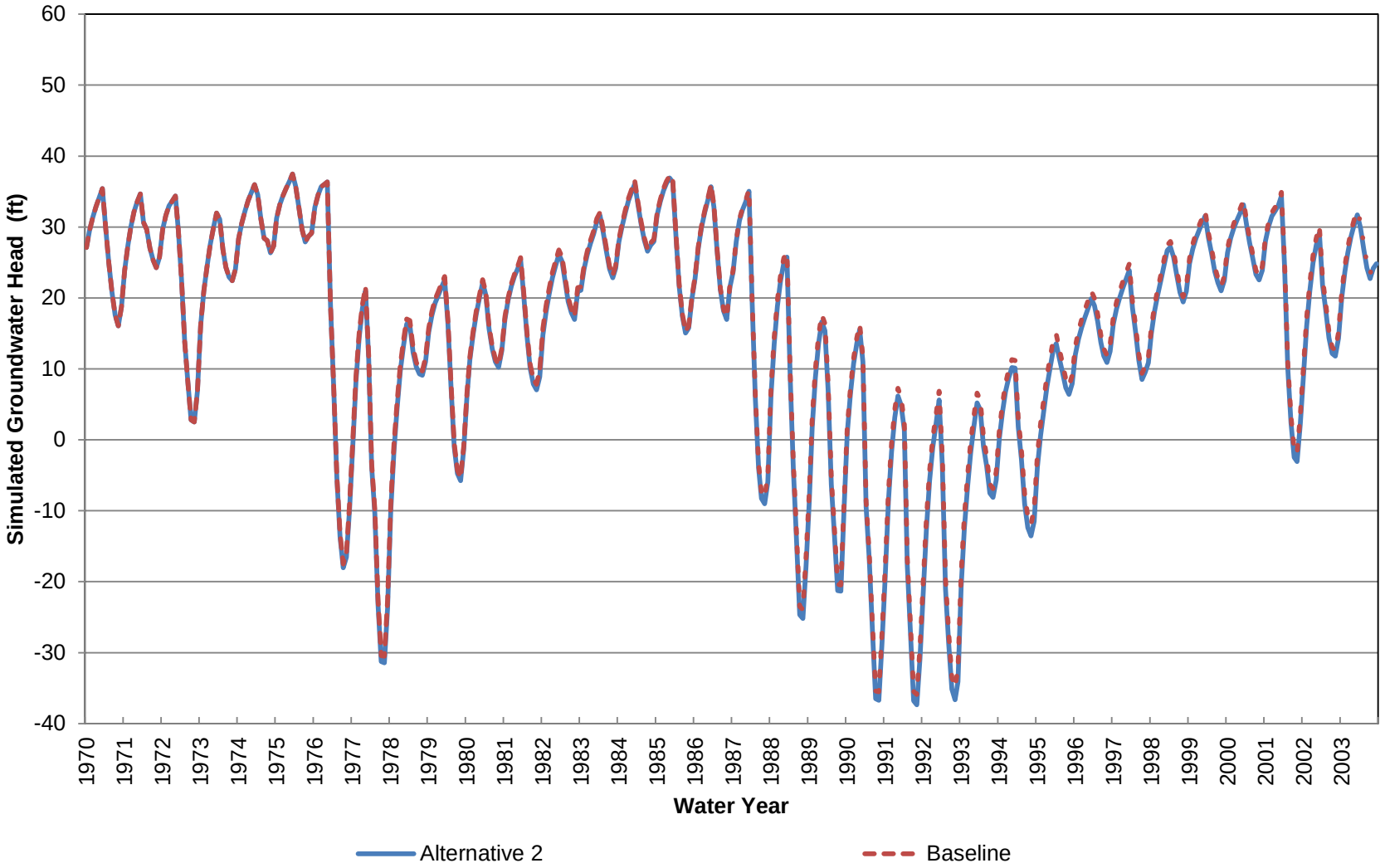
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 17 (Approximately 0-70 ft bgs)



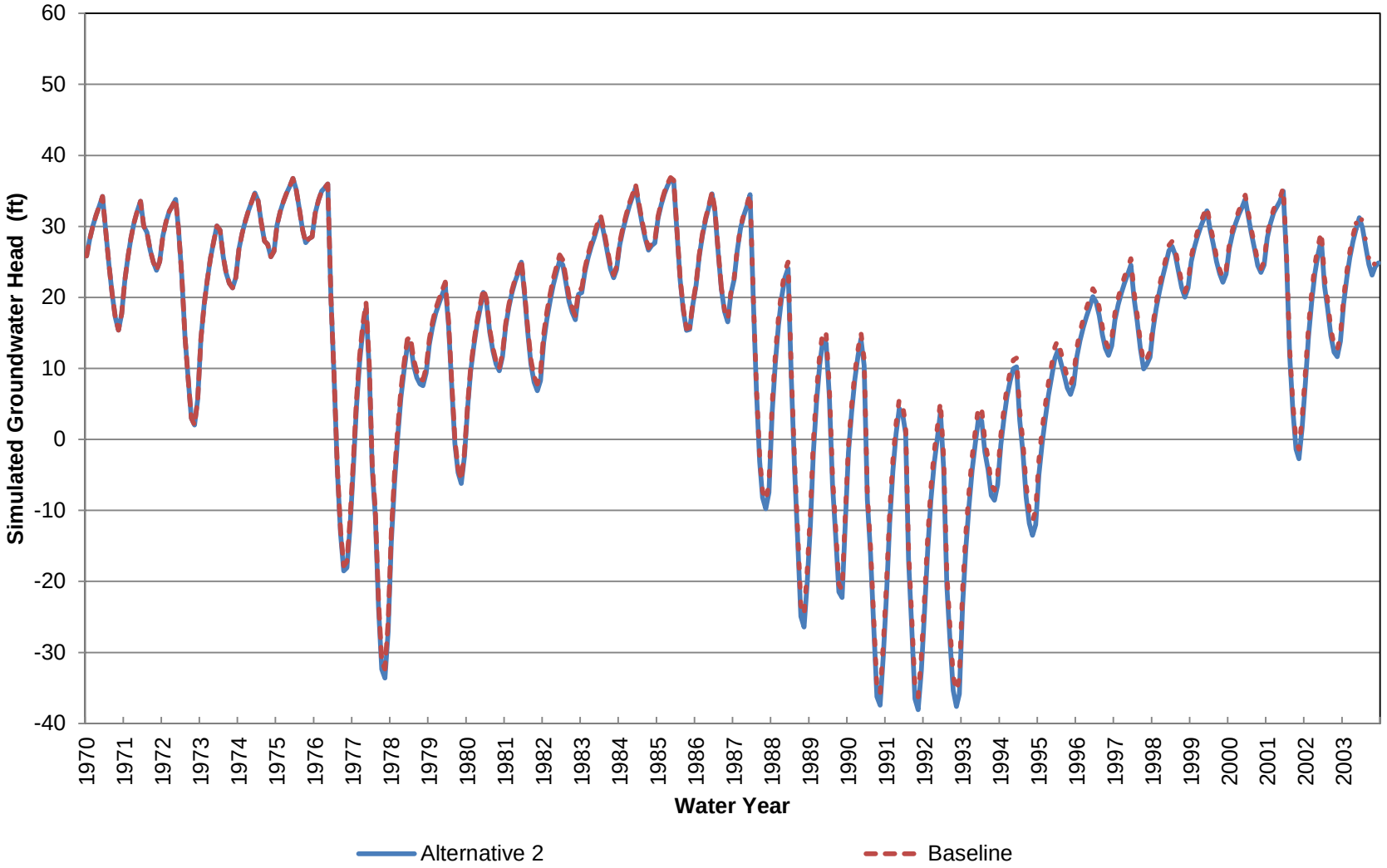
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 17 (Approximately 70-250 ft bgs)



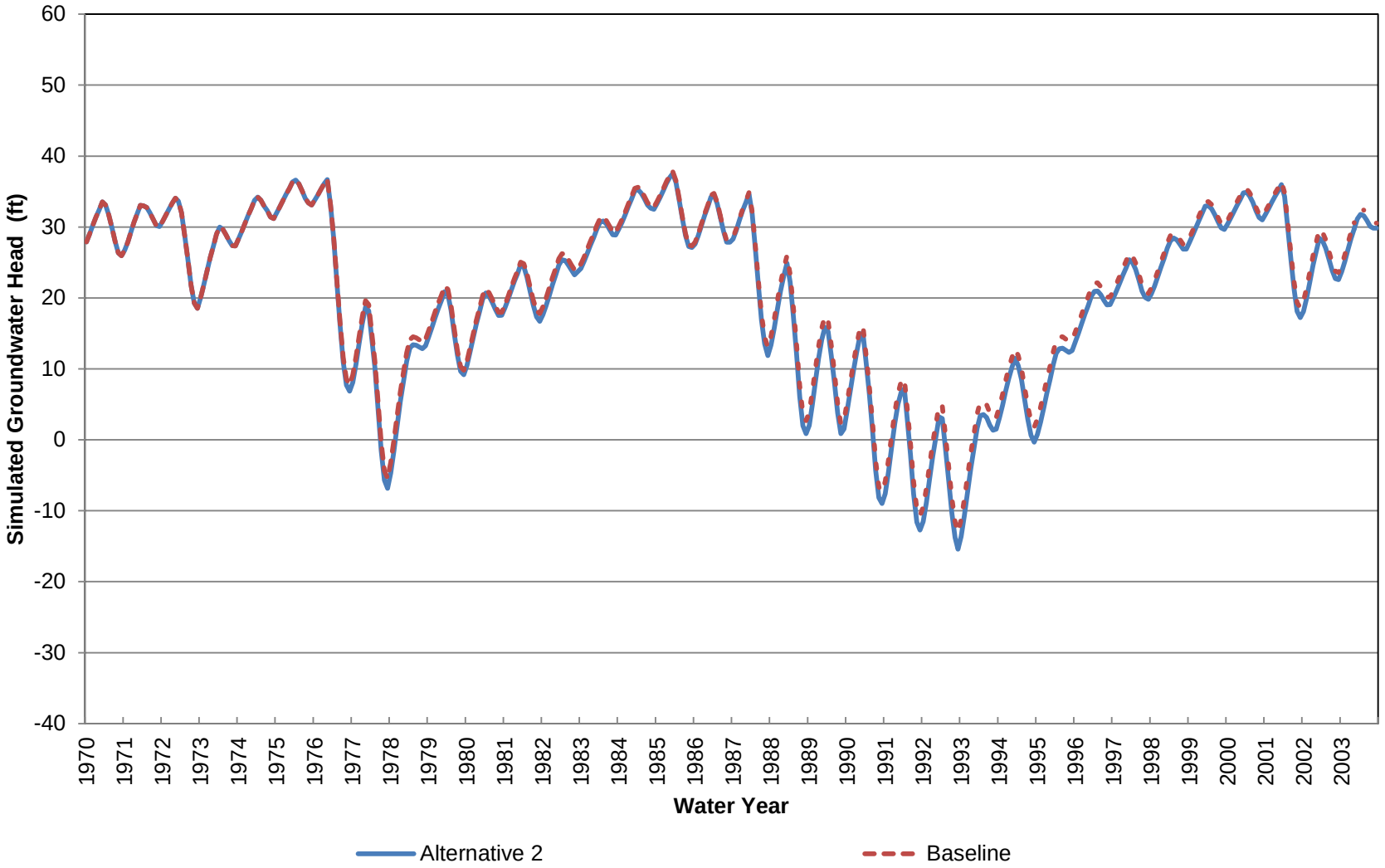
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 17 (Approximately 250-440 ft bgs)



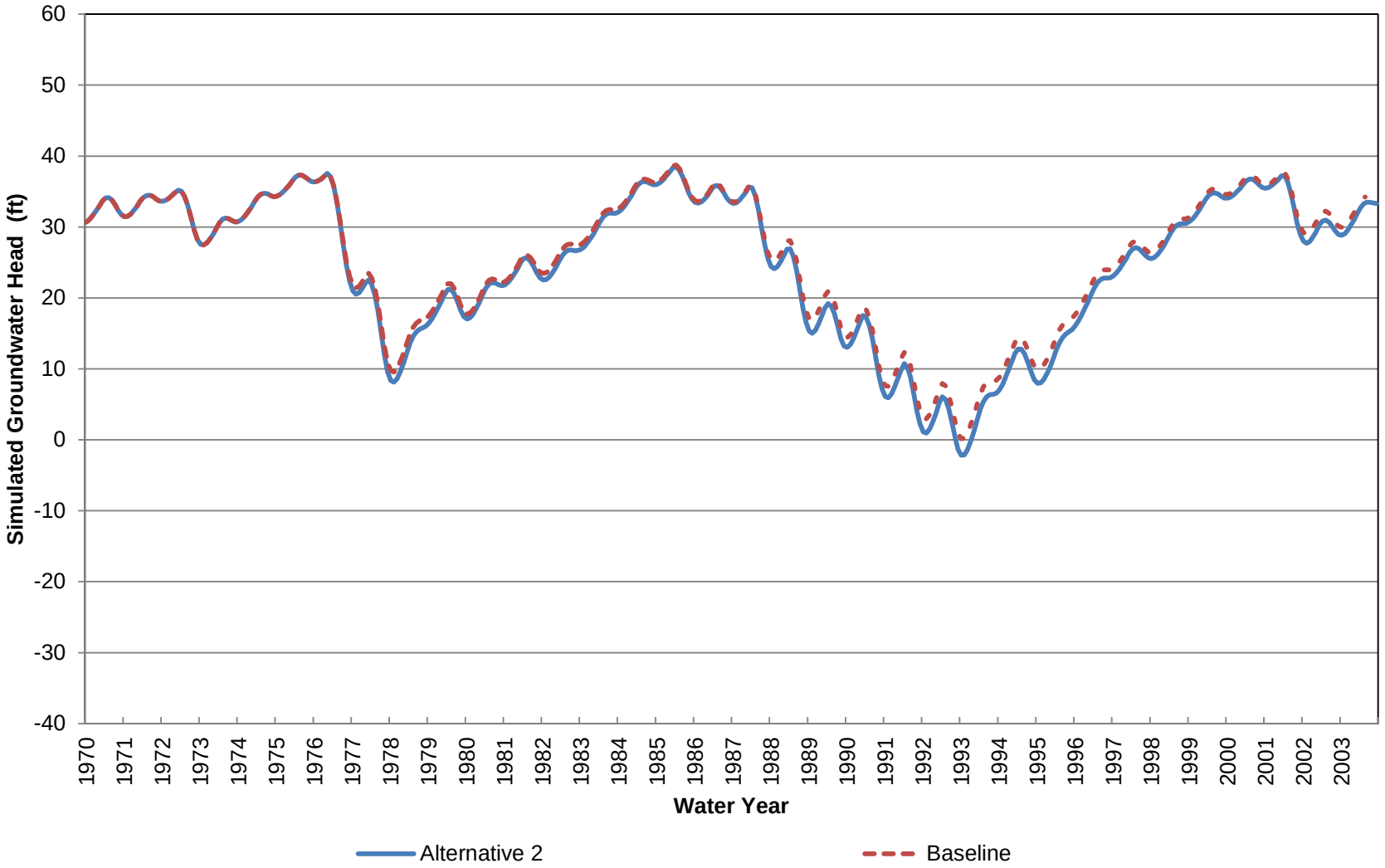
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 17 (Approximately 440-620 ft bgs)



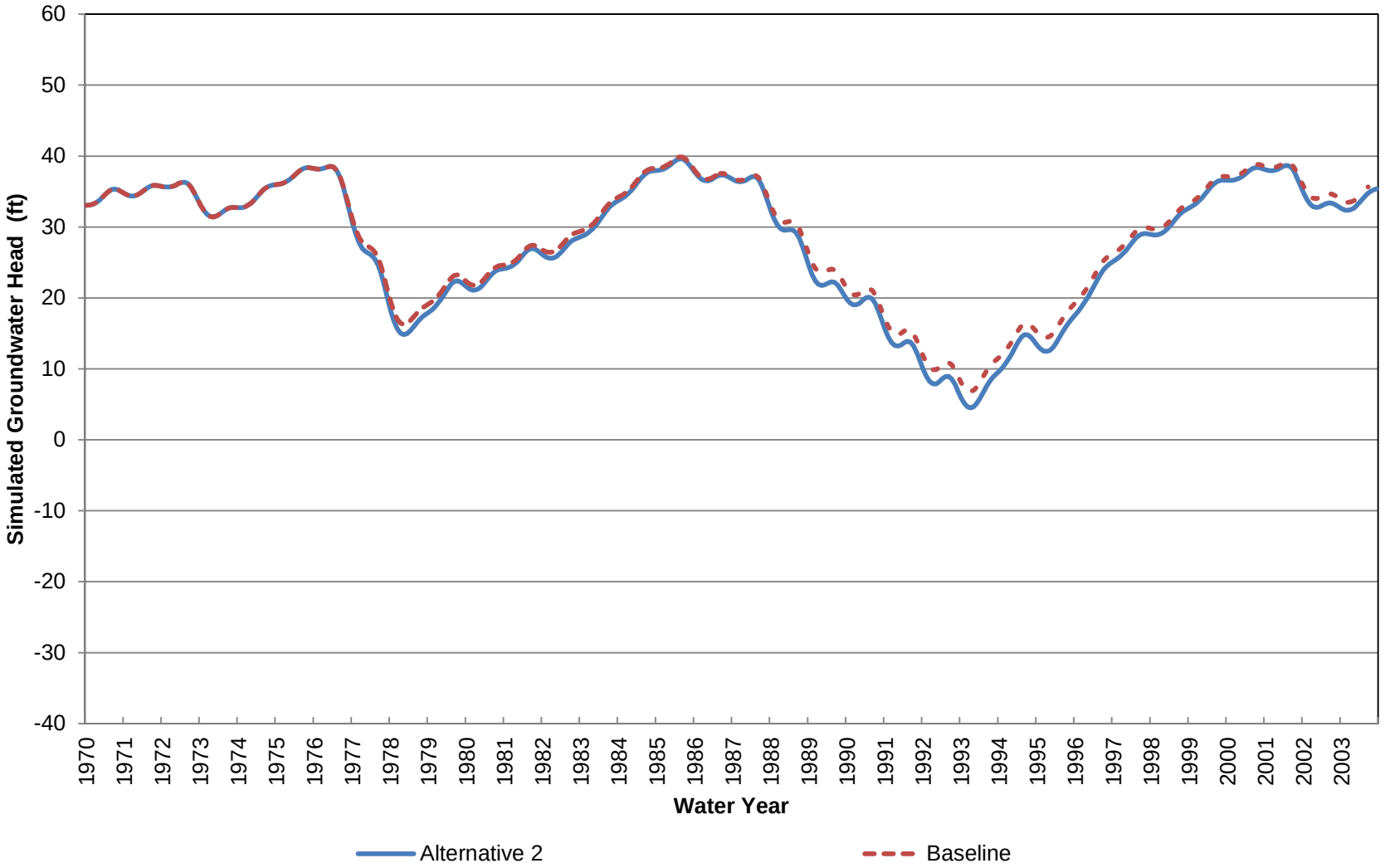
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 17 (Approximately 620-920 ft bgs)



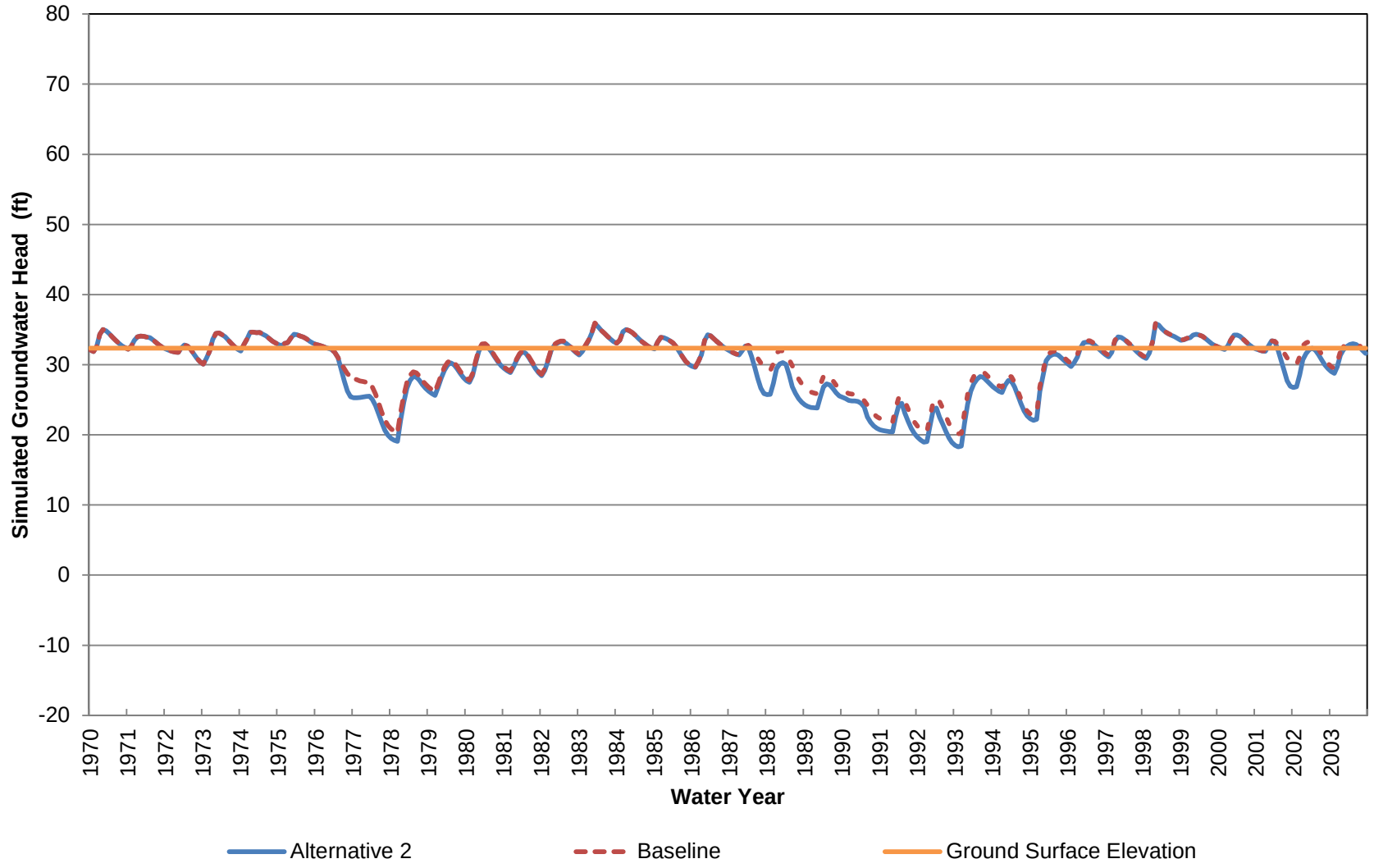
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 17 (Approximately 920-1220 ft bgs)



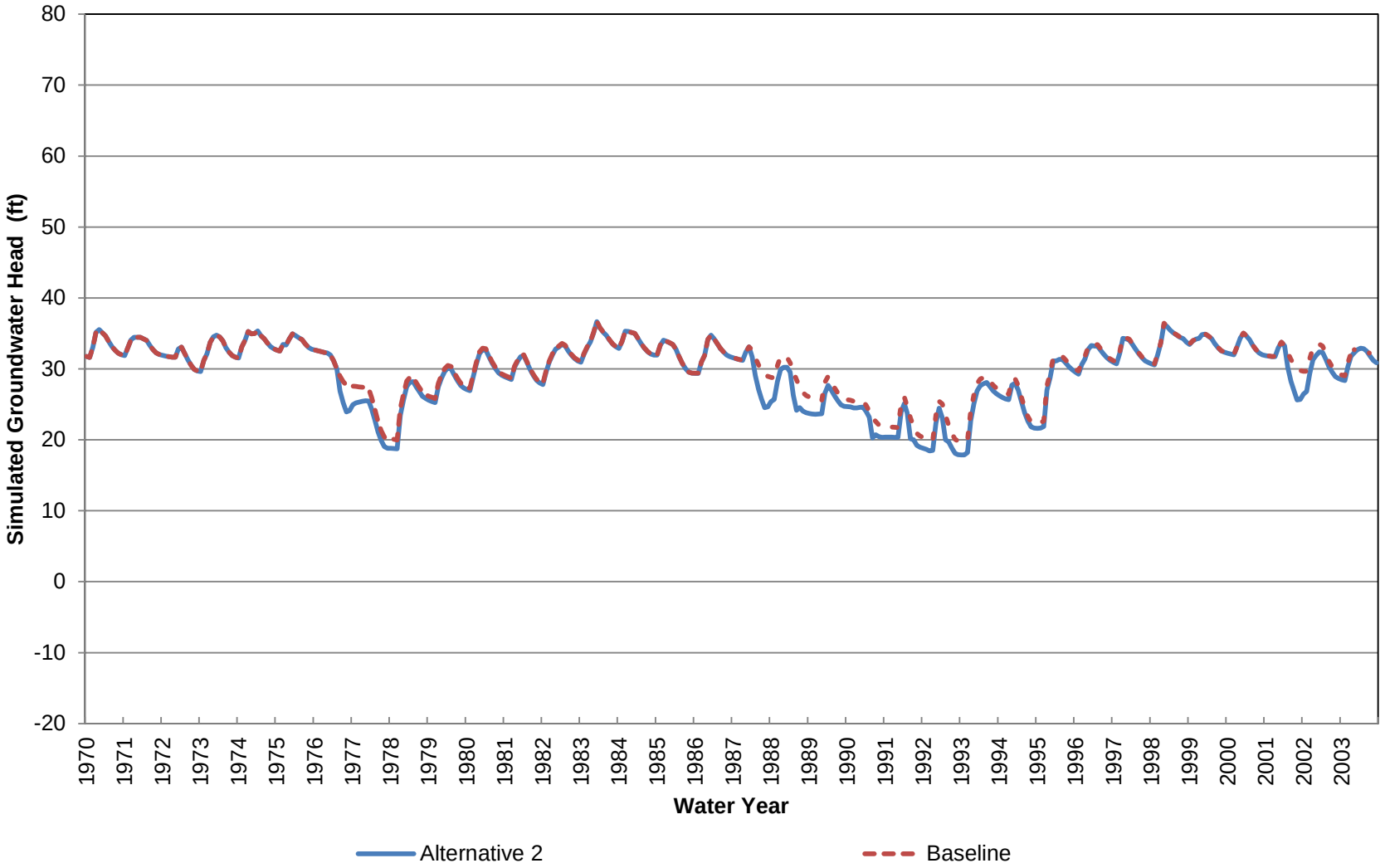
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 17 (Approximately 1220-1680 ft bgs)



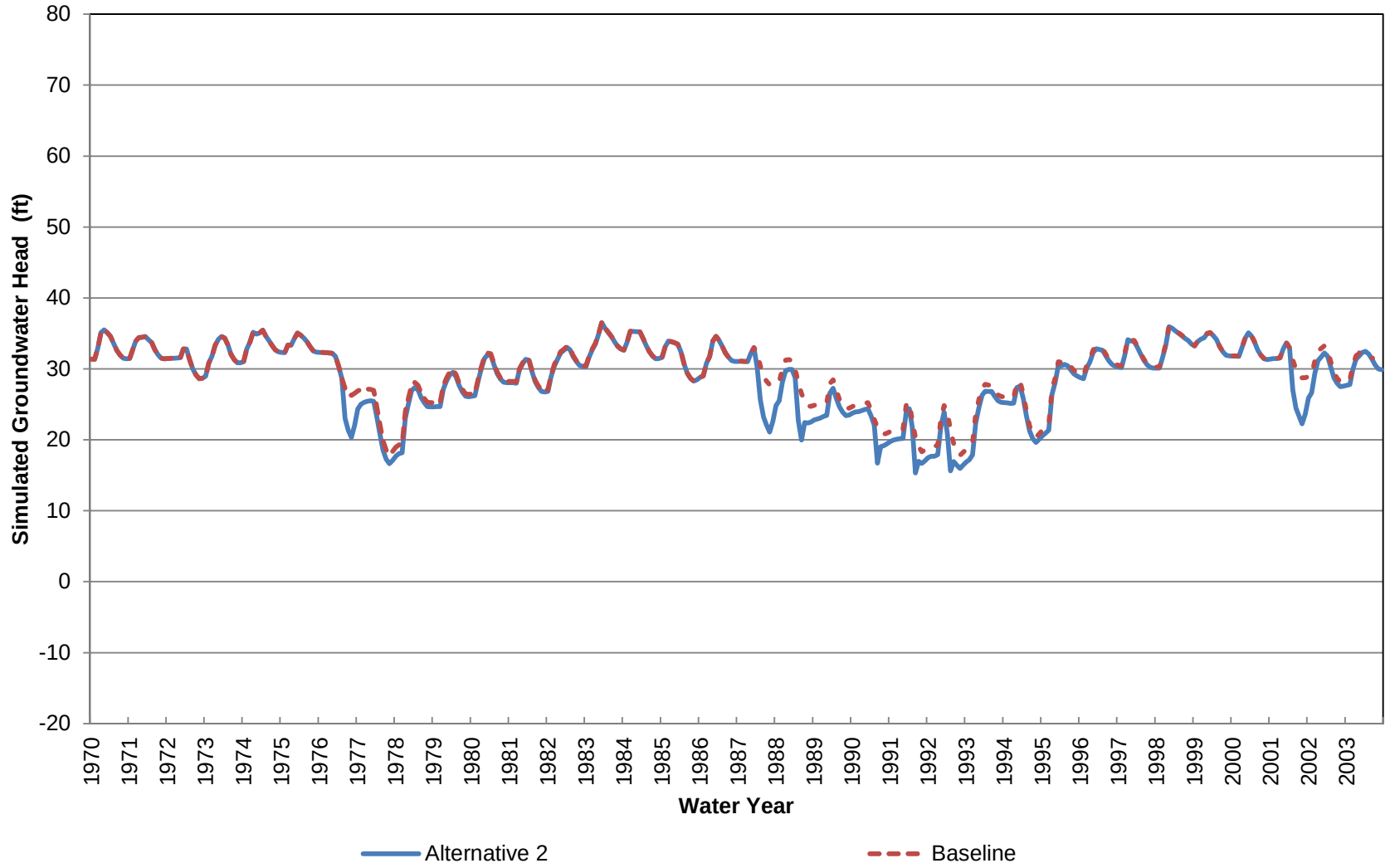
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 18 (Approximately 0-60 ft bgs)



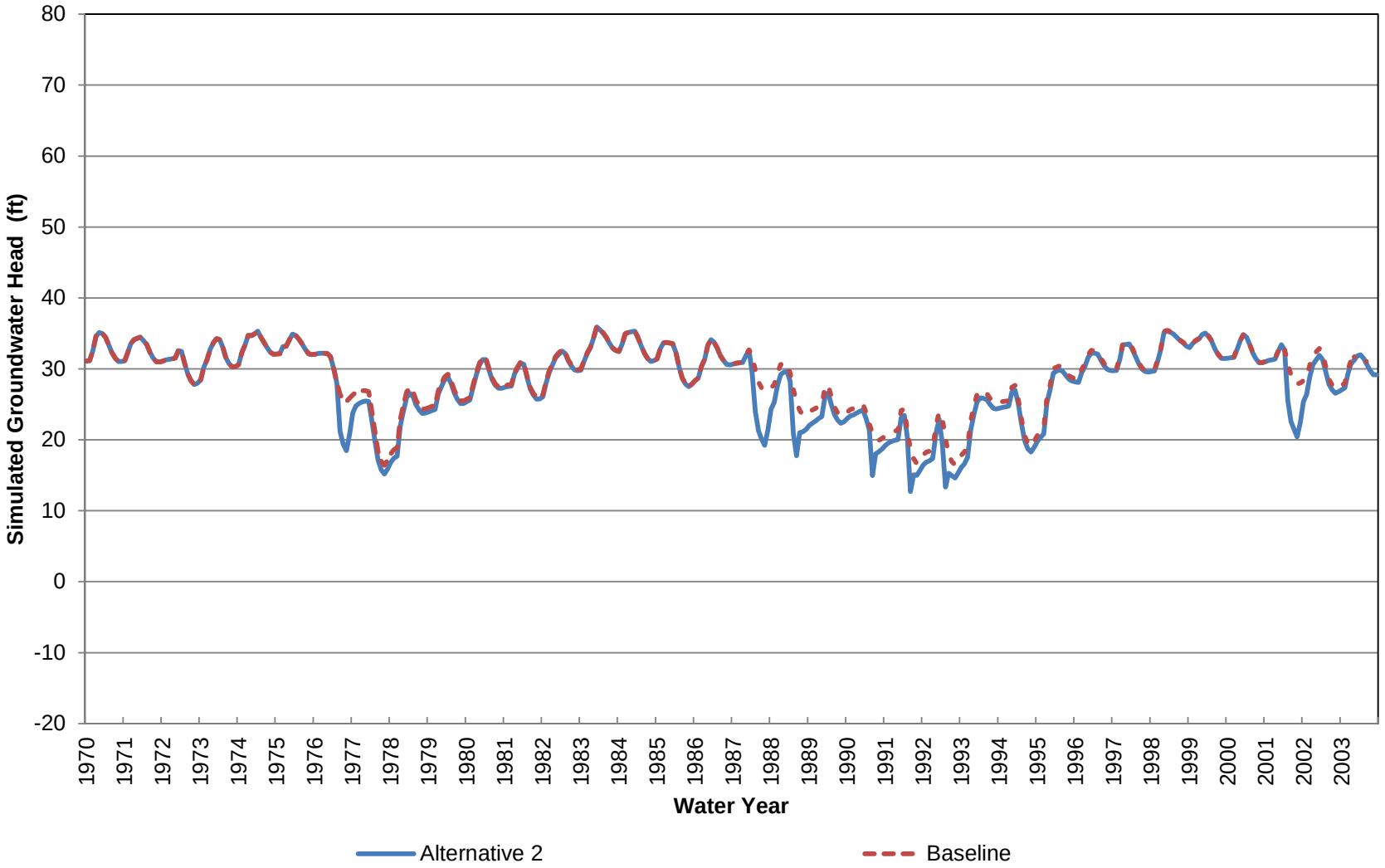
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 18 (Approximately 60-150 ft bgs)



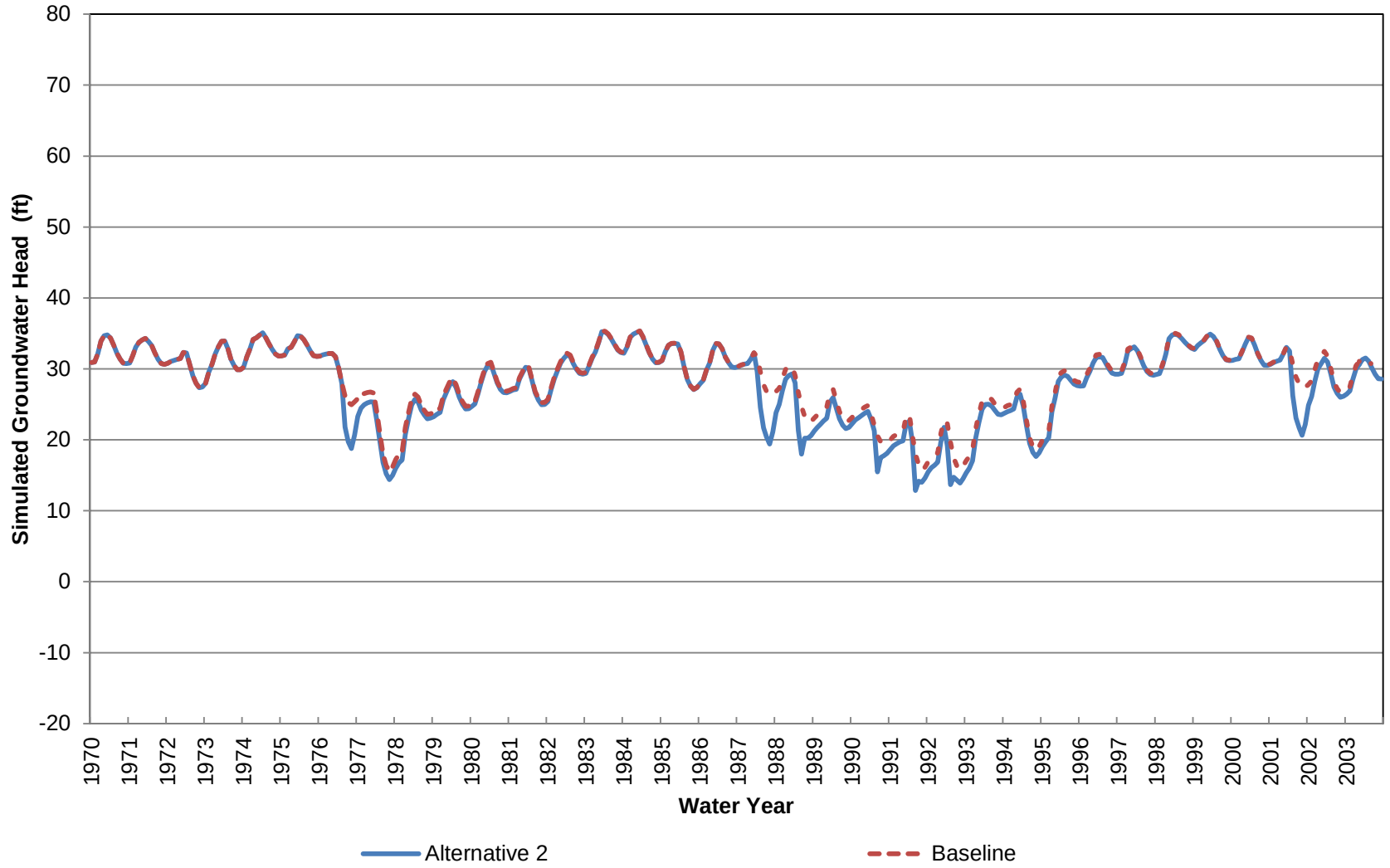
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 18 (Approximately 150-240 ft bgs)



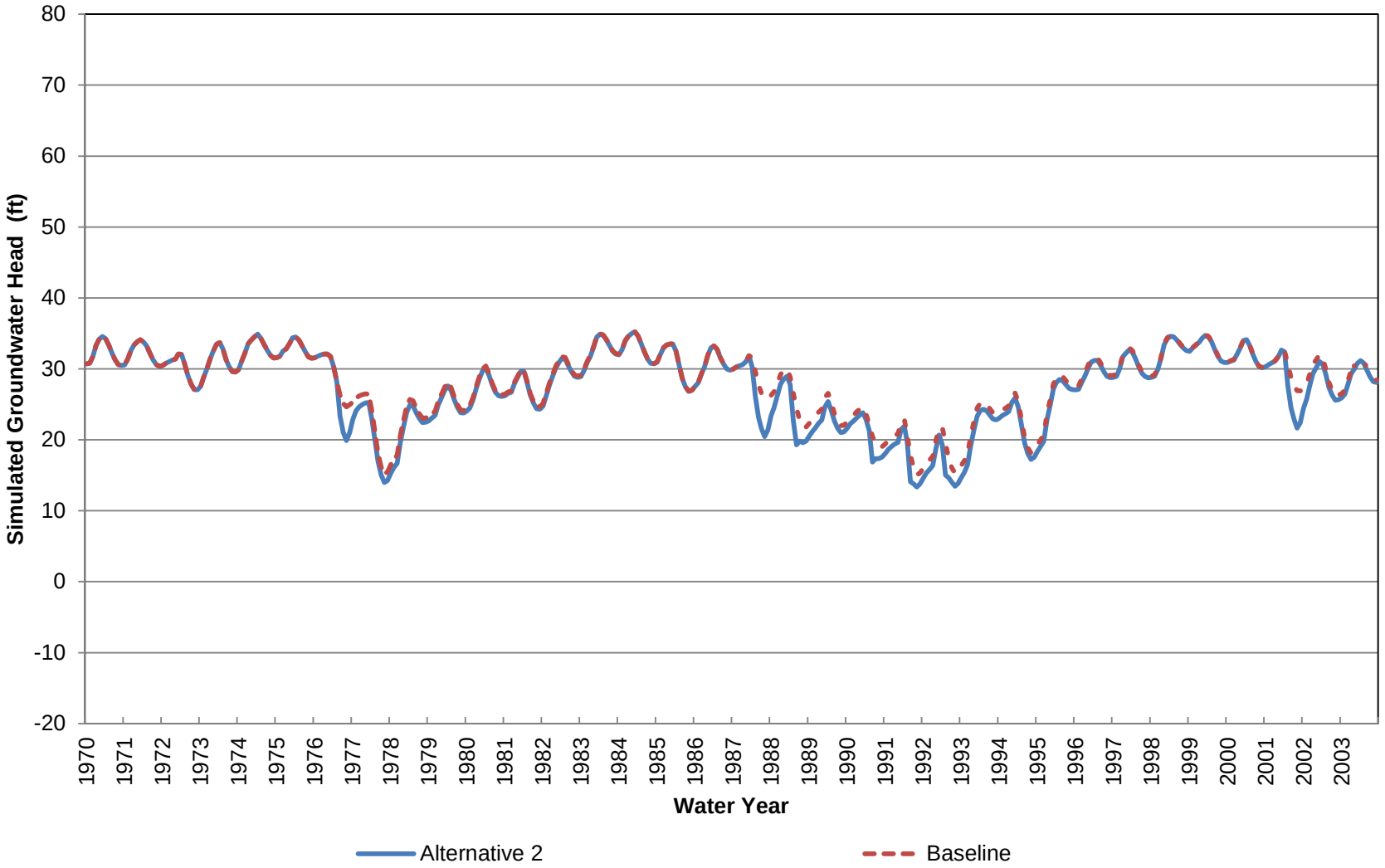
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 18 (Approximately 240-330 ft bgs)



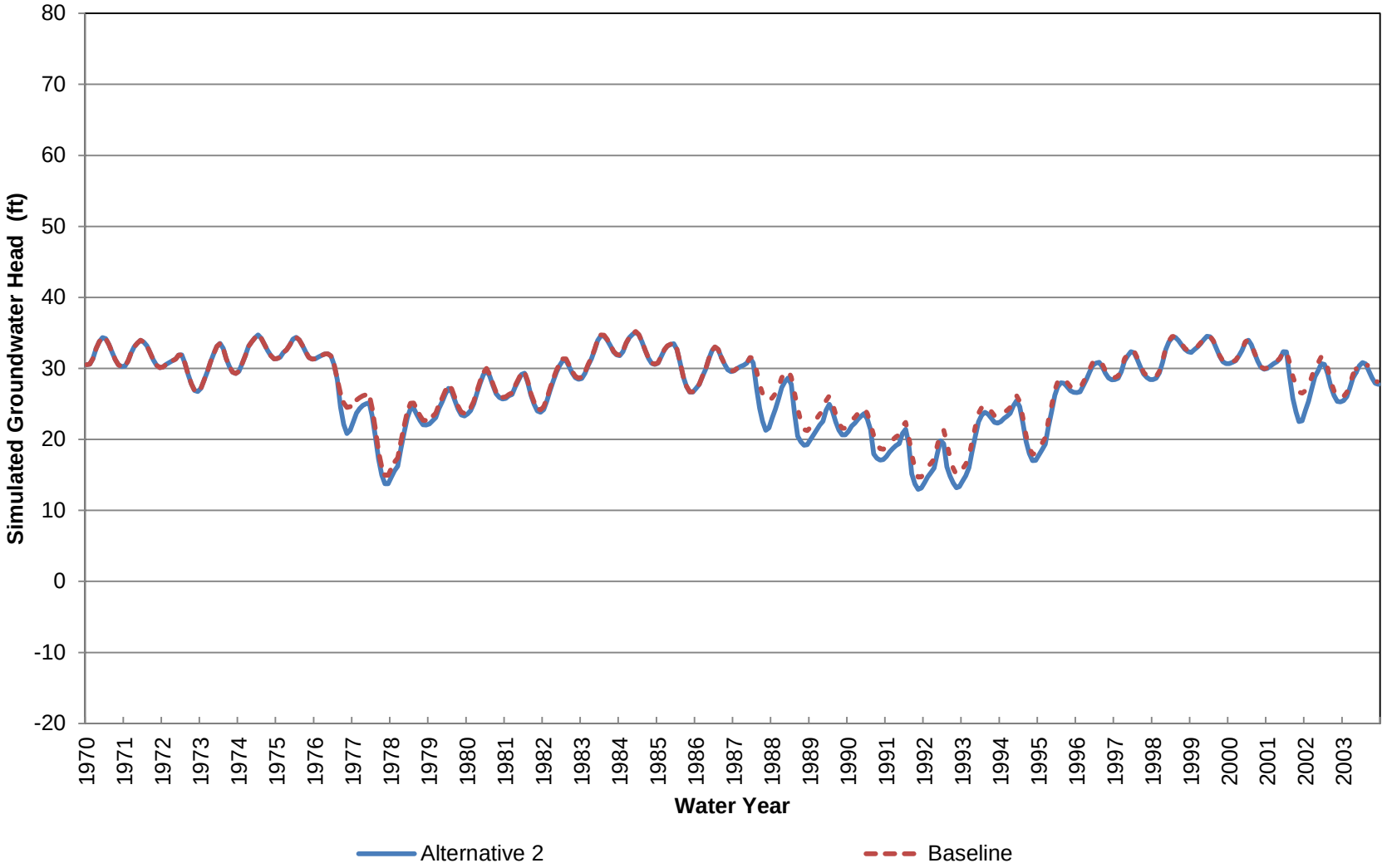
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 18 (Approximately 330-450 ft bgs)



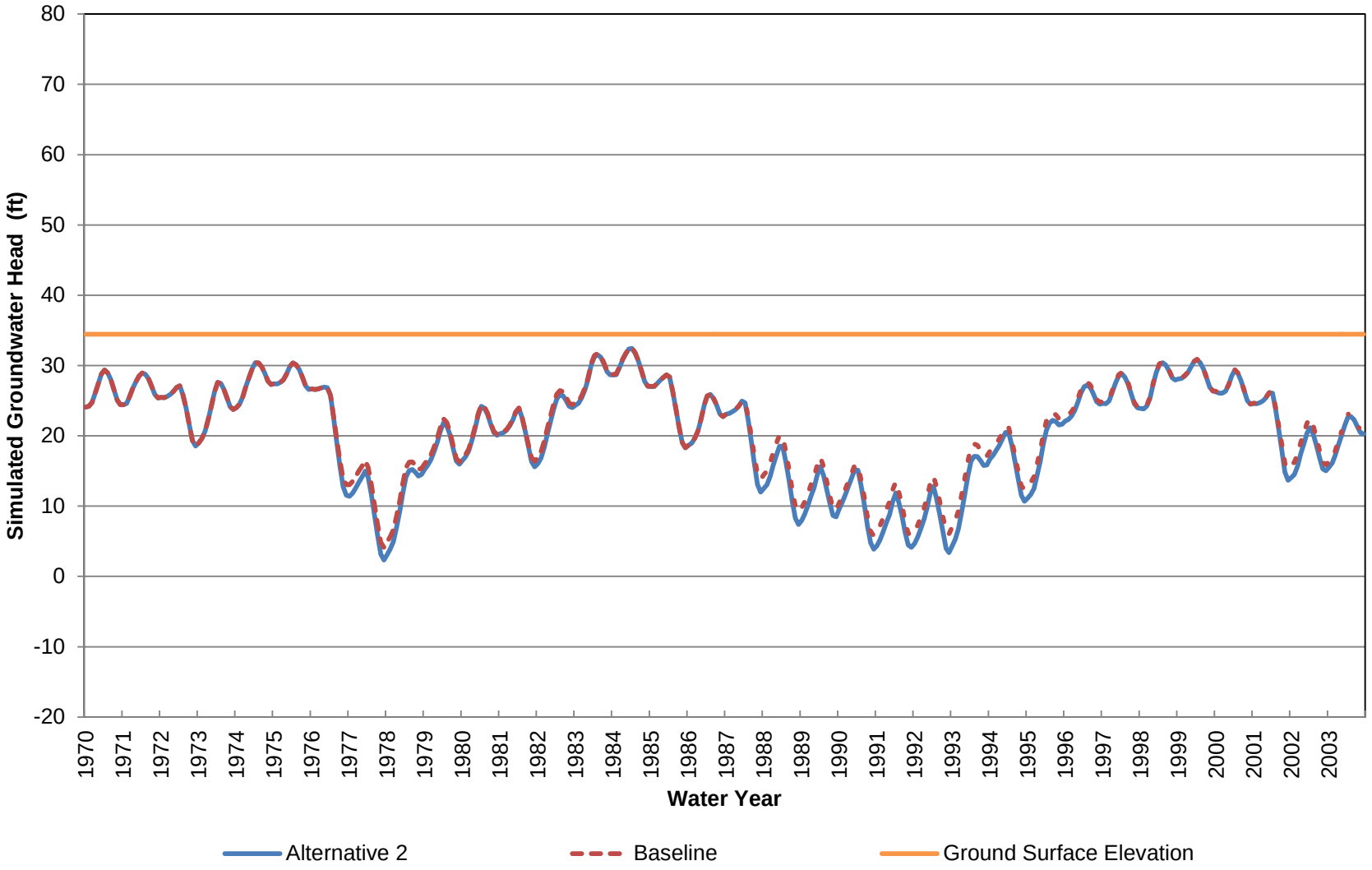
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 18 (Approximately 450-600 ft bgs)



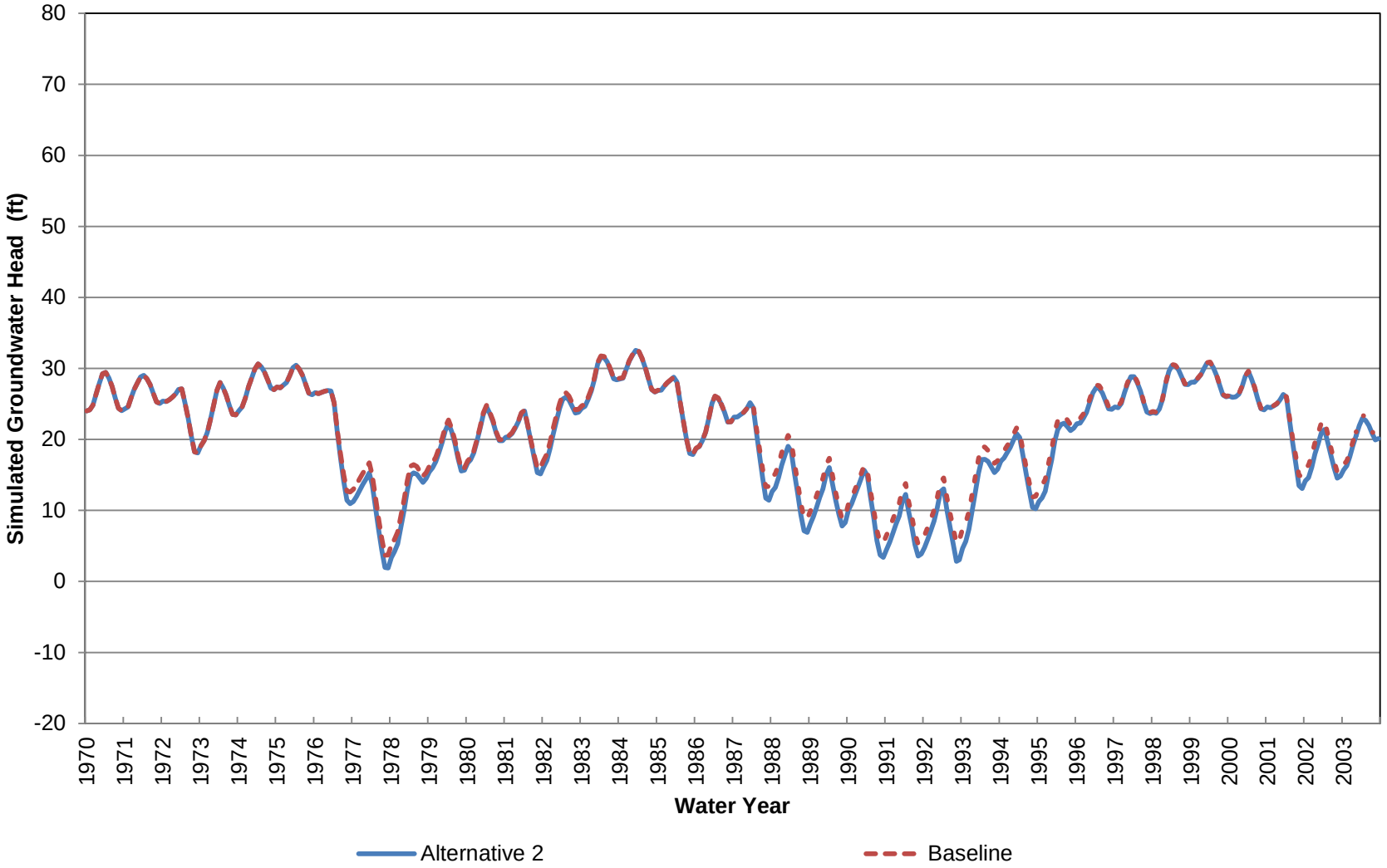
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 18 (Approximately 600-820 ft bgs)



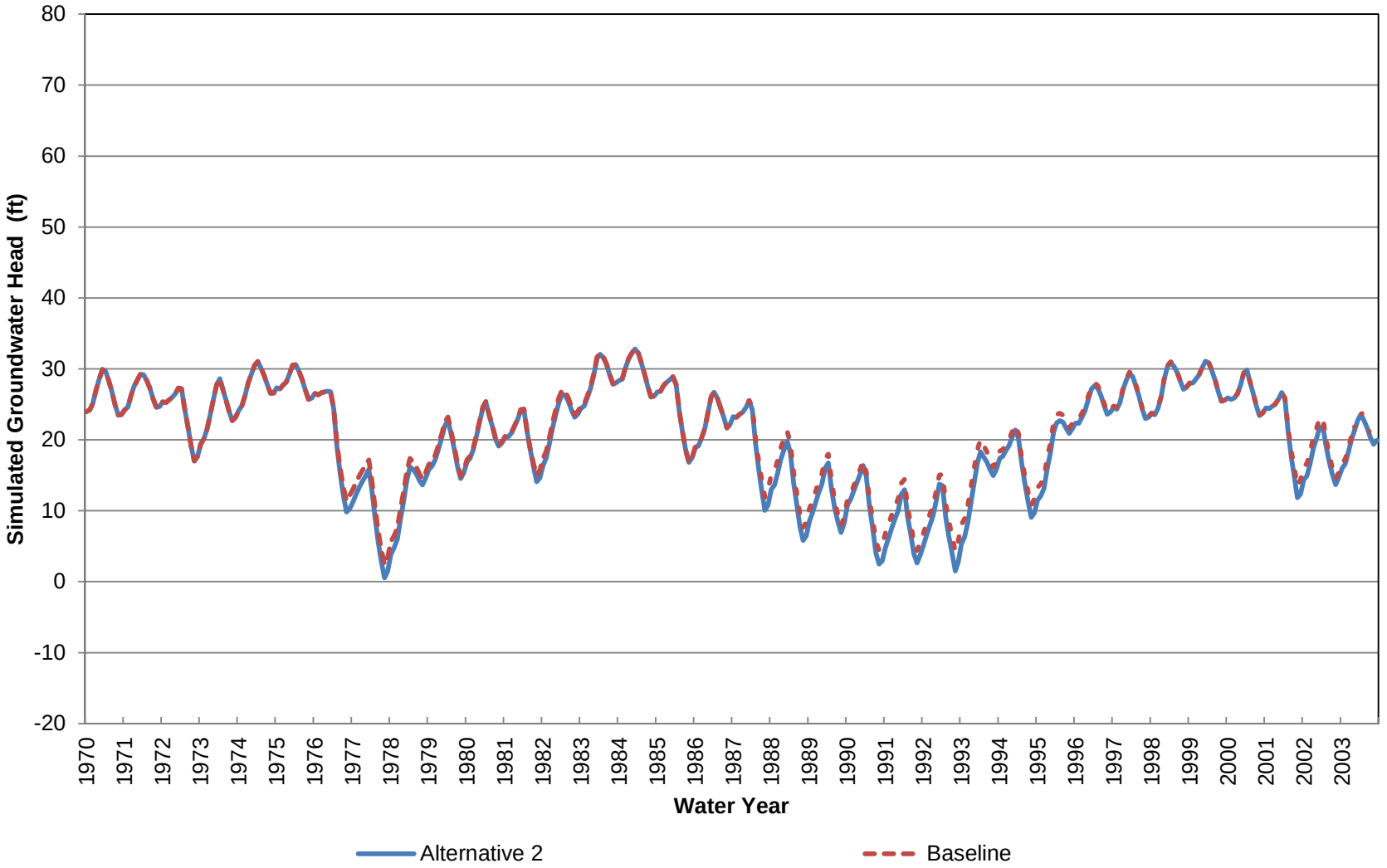
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 19 (Approximately 0-30 ft bgs)



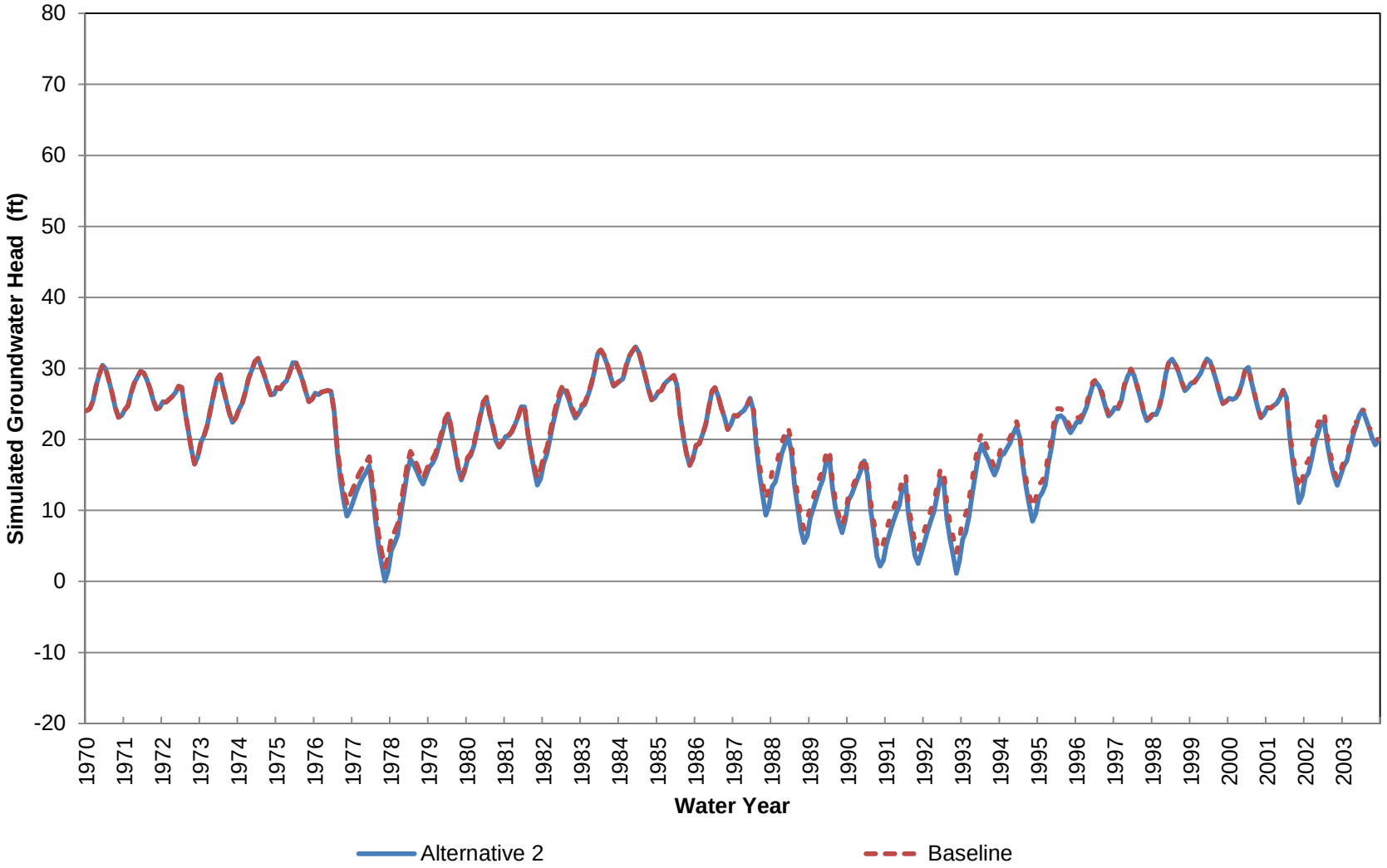
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 19 (Approximately 30-70 ft bgs)



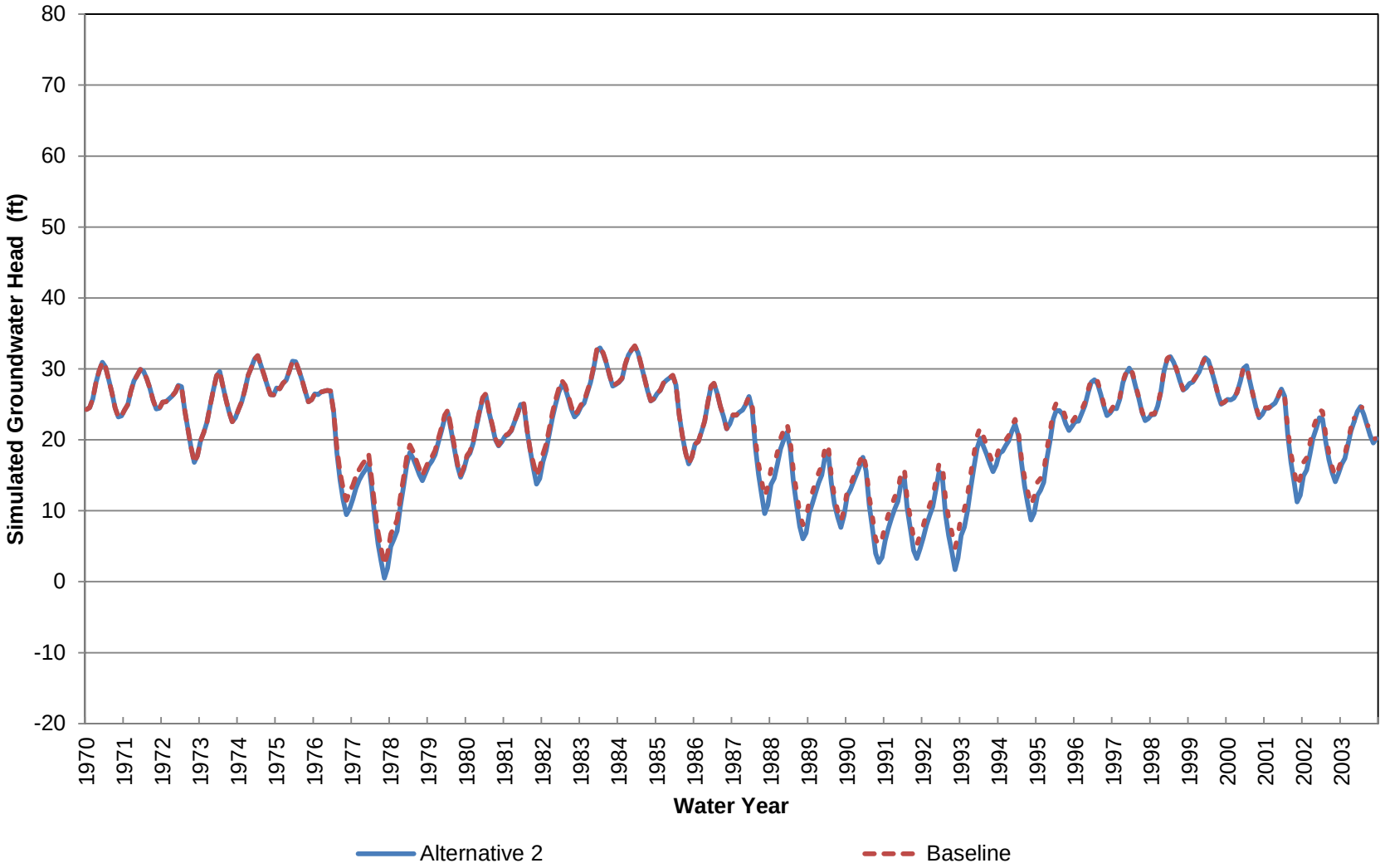
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 19 (Approximately 70-120 ft bgs)

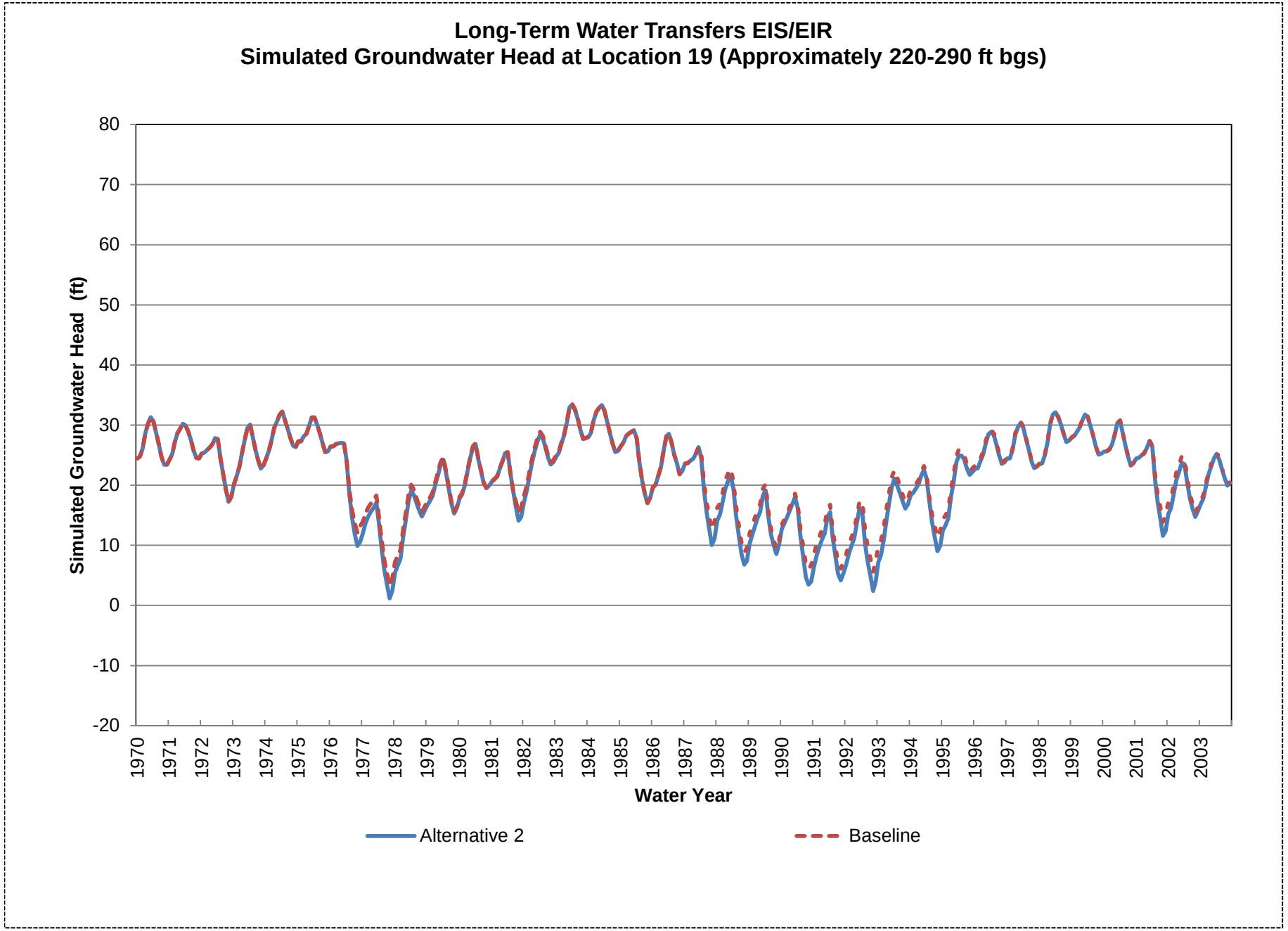


Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 19 (Approximately 120-160 ft bgs)

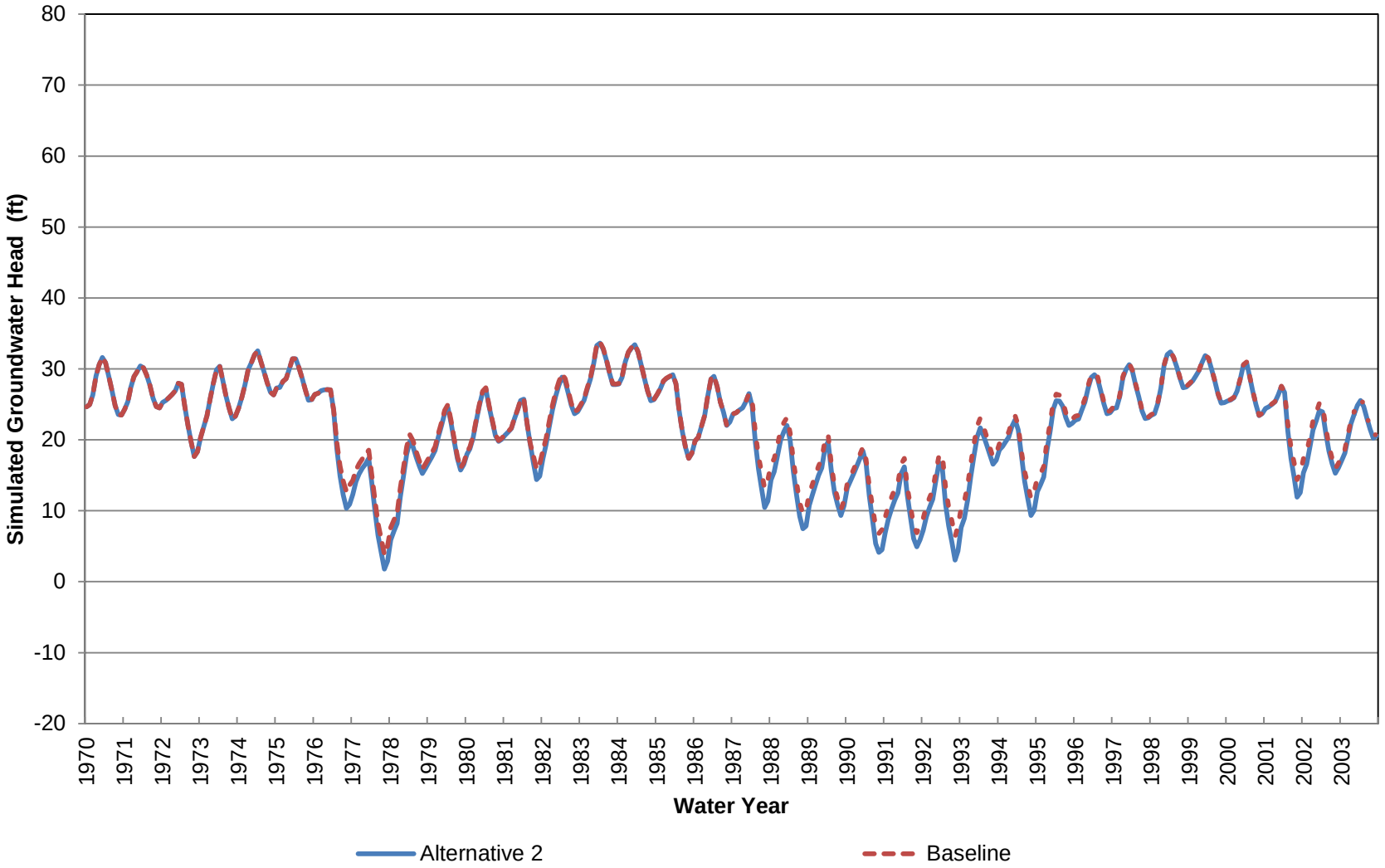


Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 19 (Approximately 160-220 ft bgs)

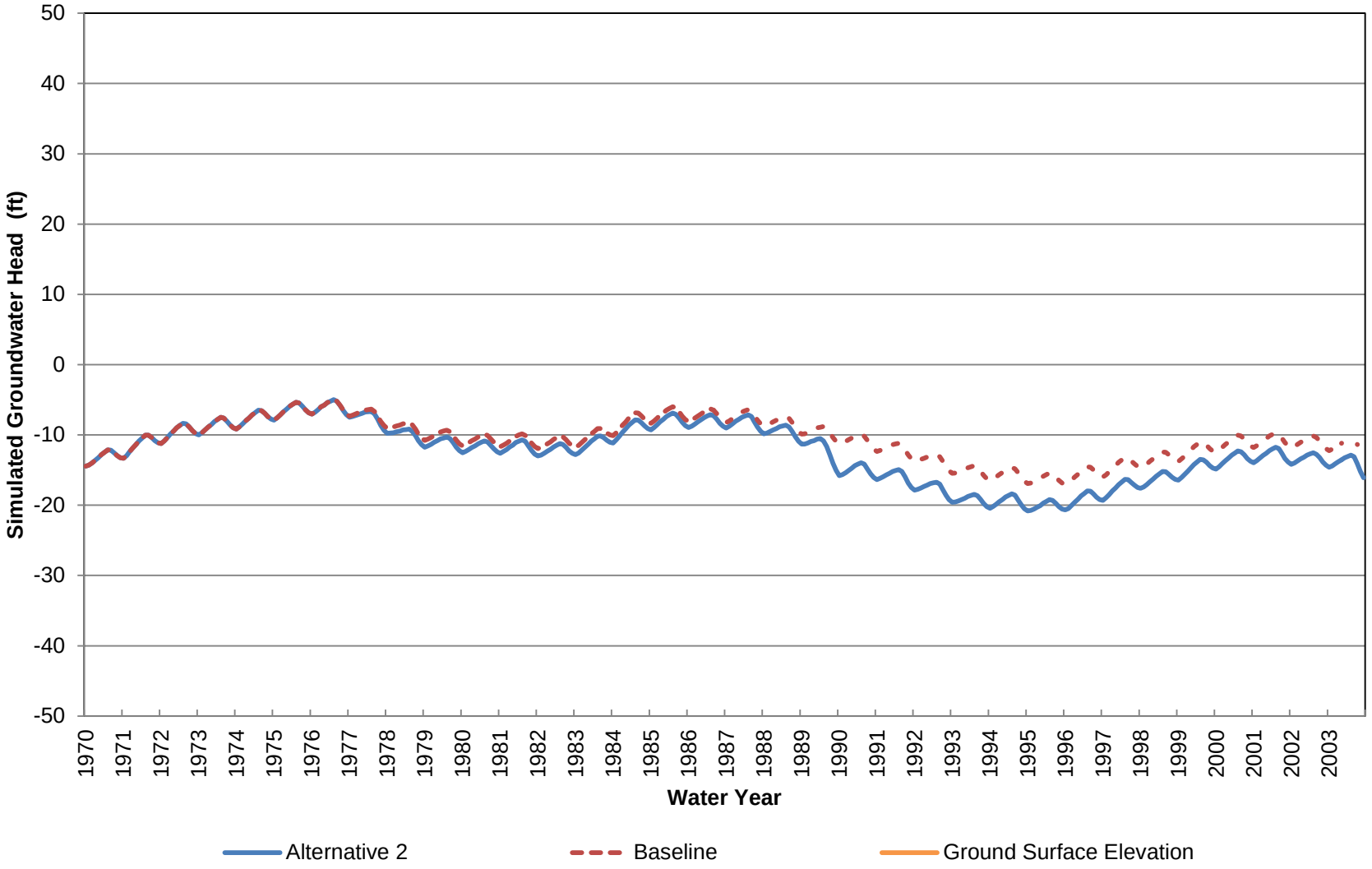



Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 19 (Approximately 220-290 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

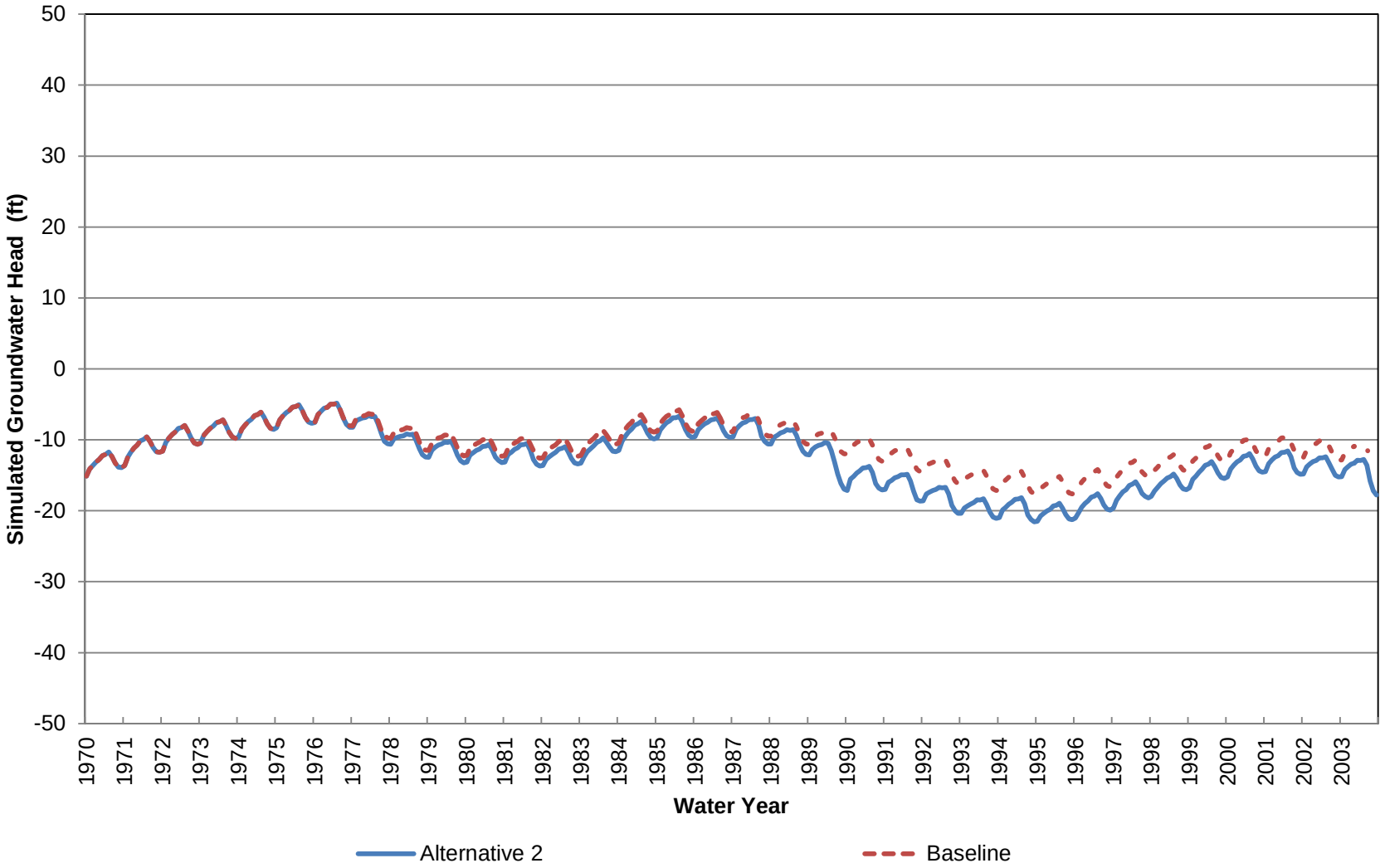
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 19 (Approximately 290-400 ft bgs)



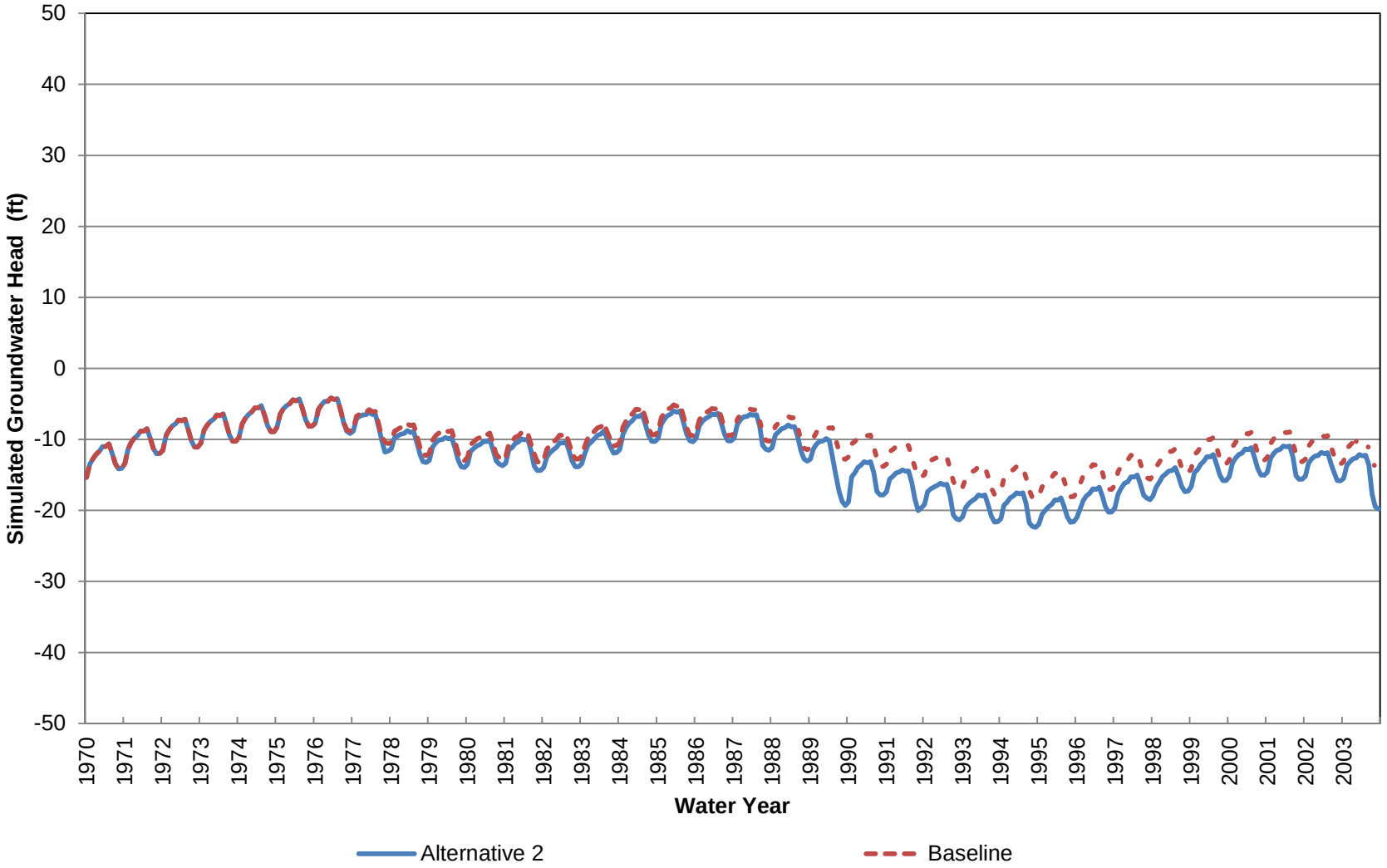
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 20 (Approximately 0-70 ft bgs)



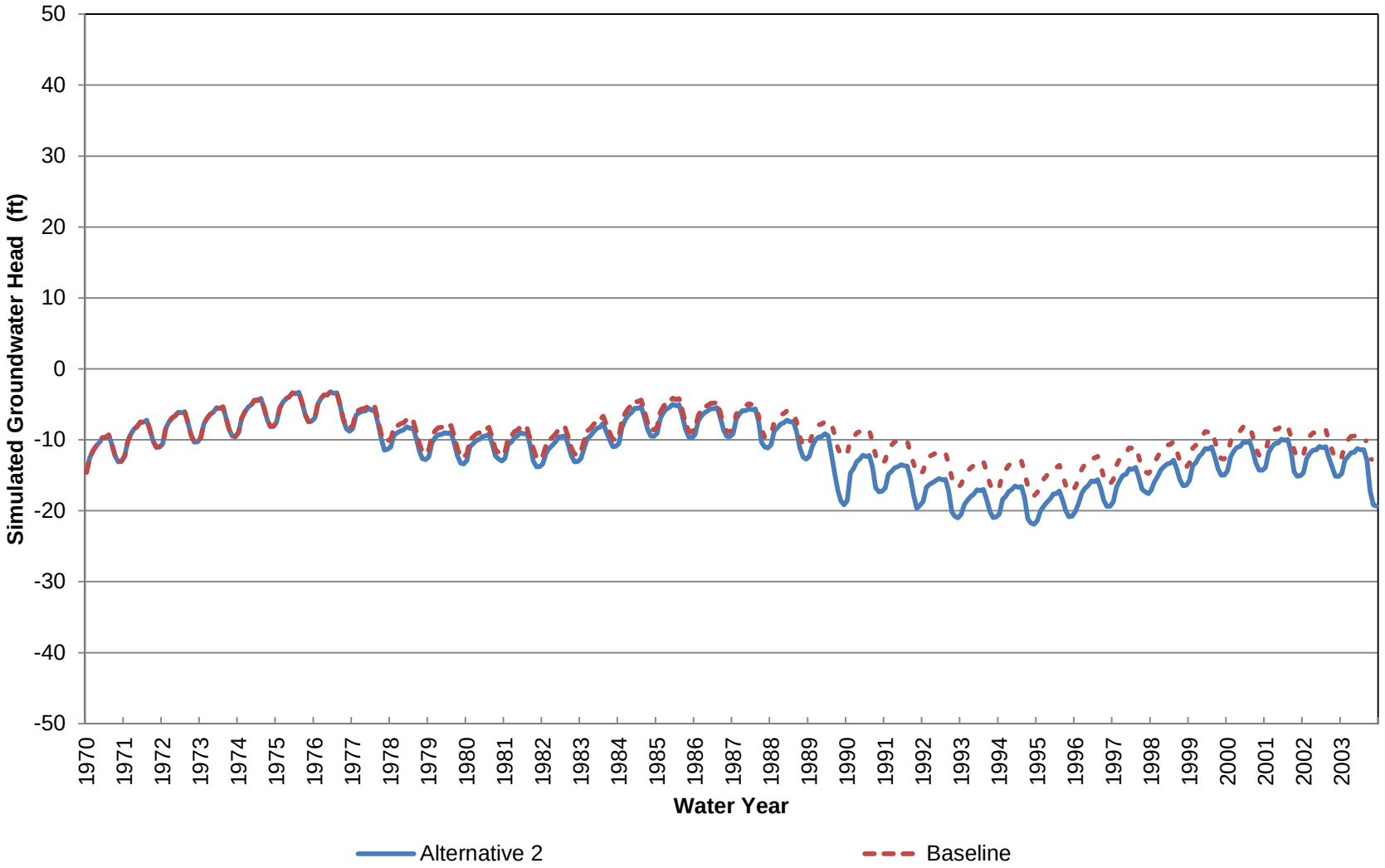
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 20 (Approximately 70-230 ft bgs)



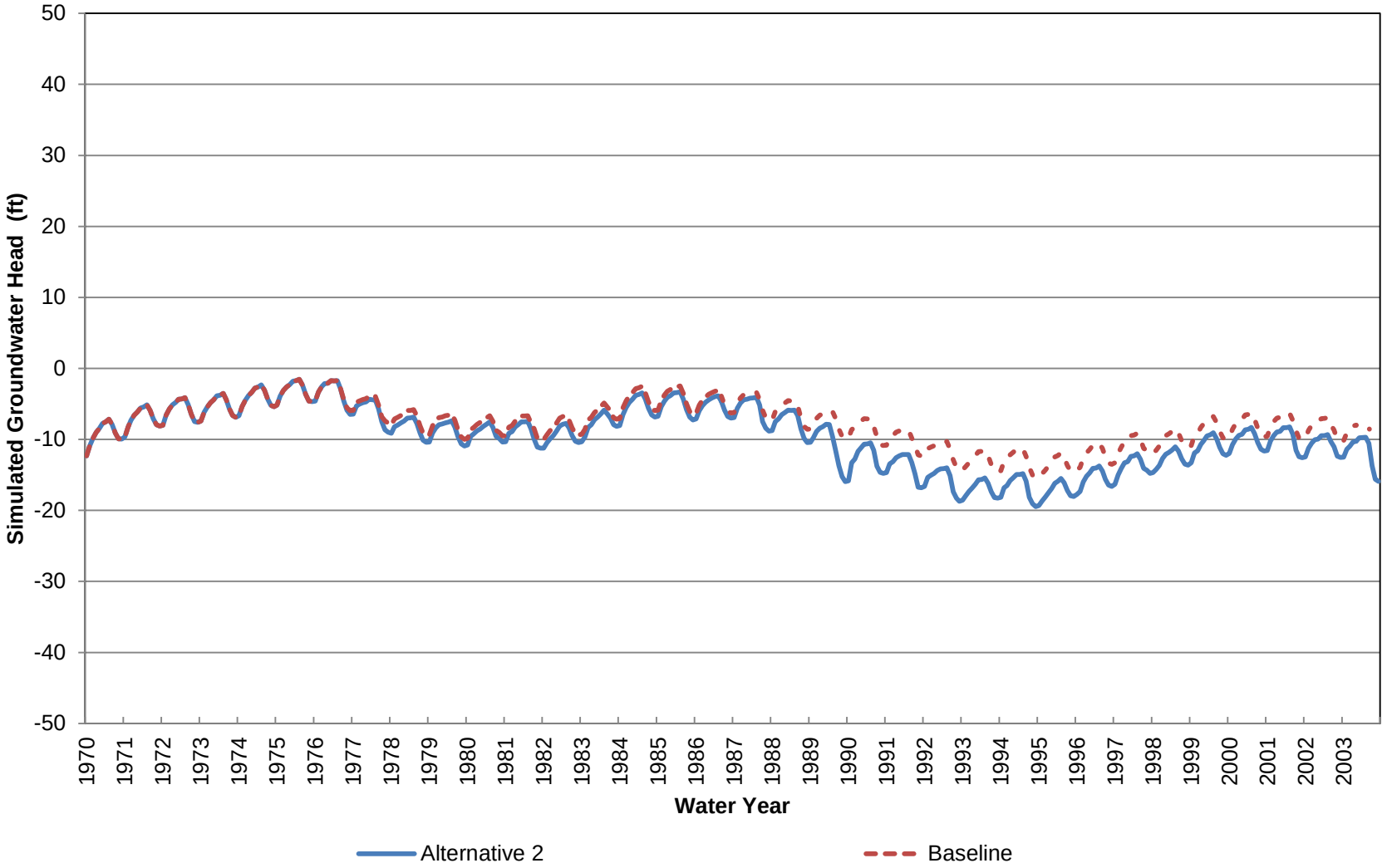
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 20 (Approximately 230-380 ft bgs)



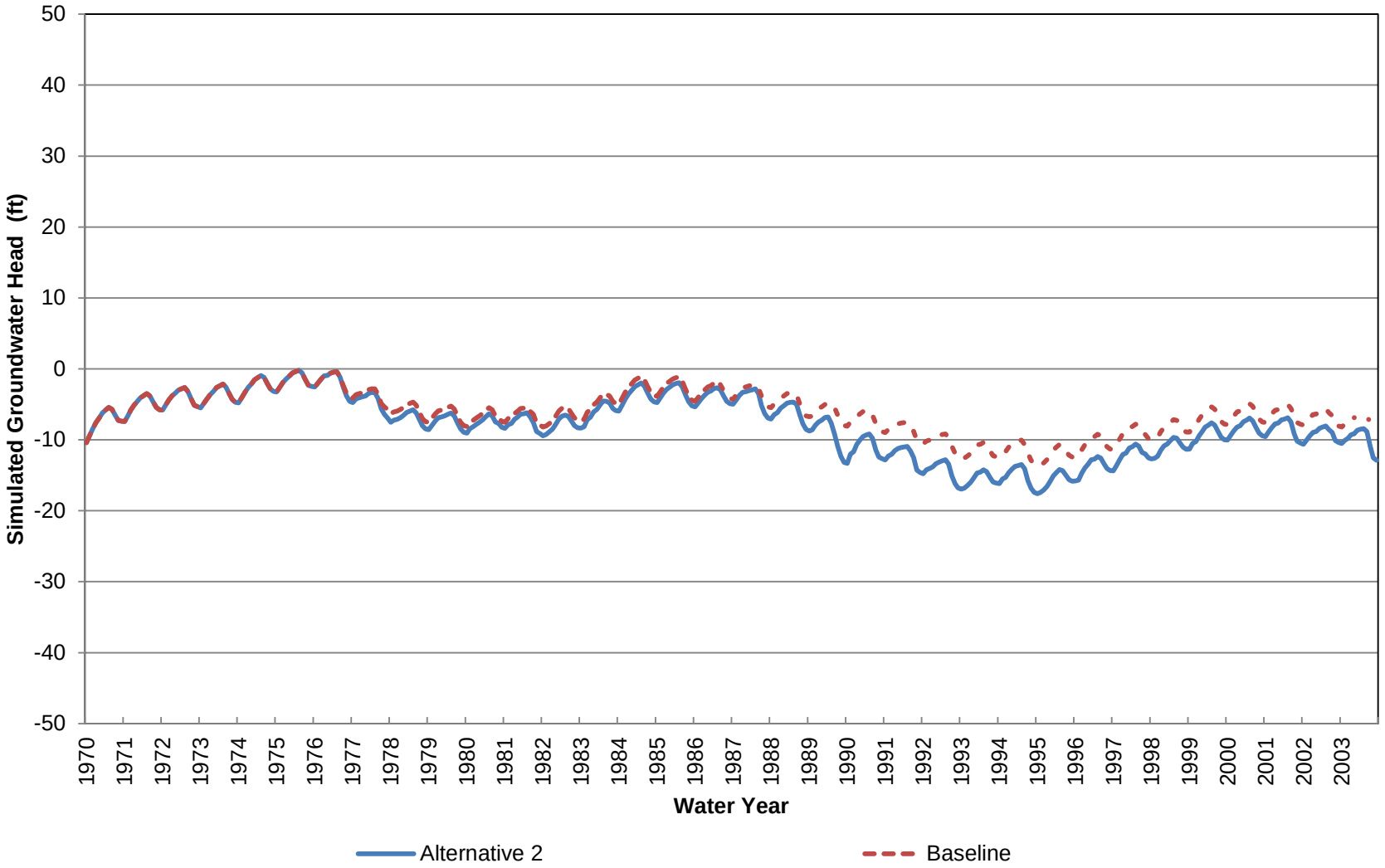
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 20 (Approximately 380-530 ft bgs)



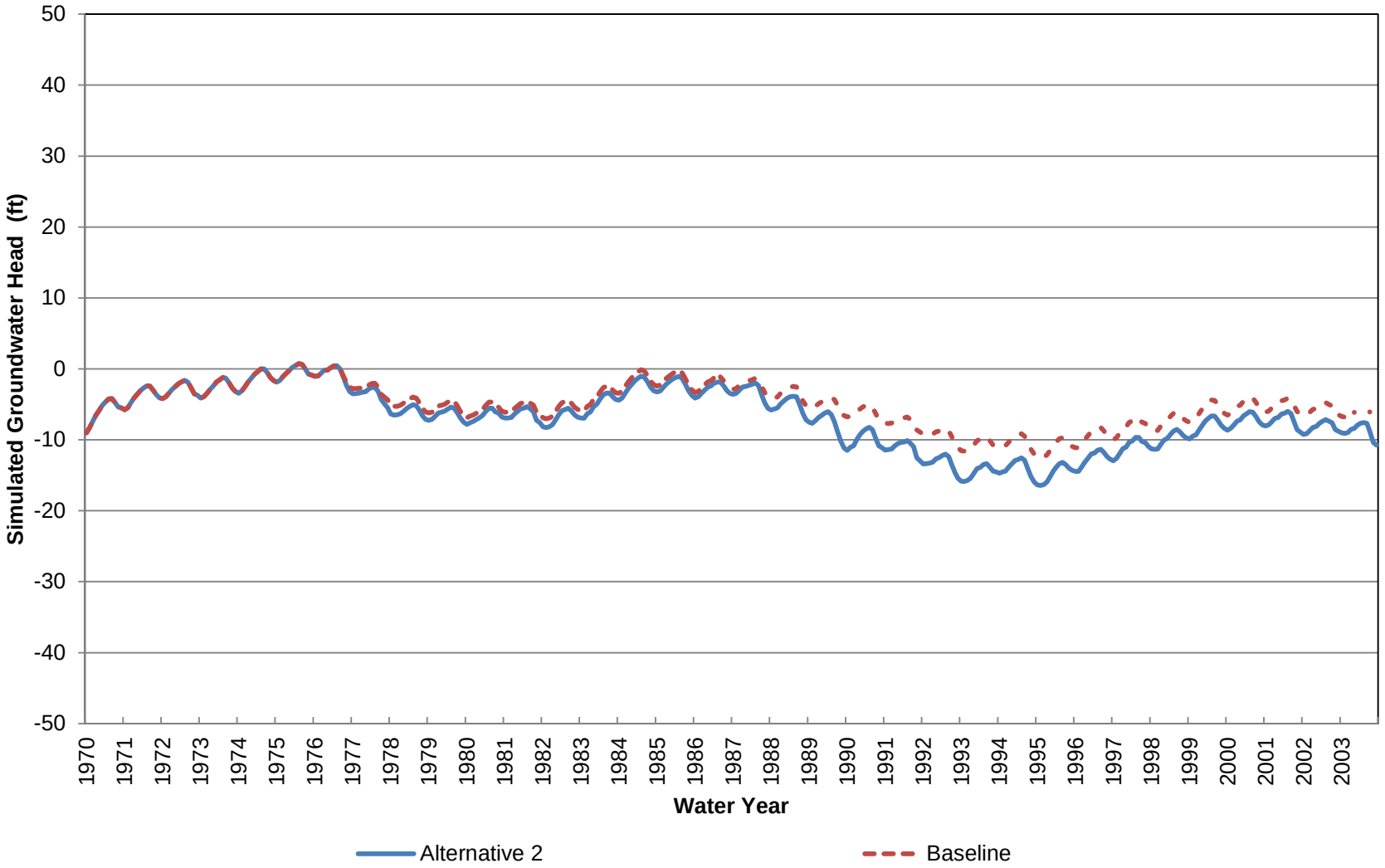
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 20 (Approximately 530-780 ft bgs)



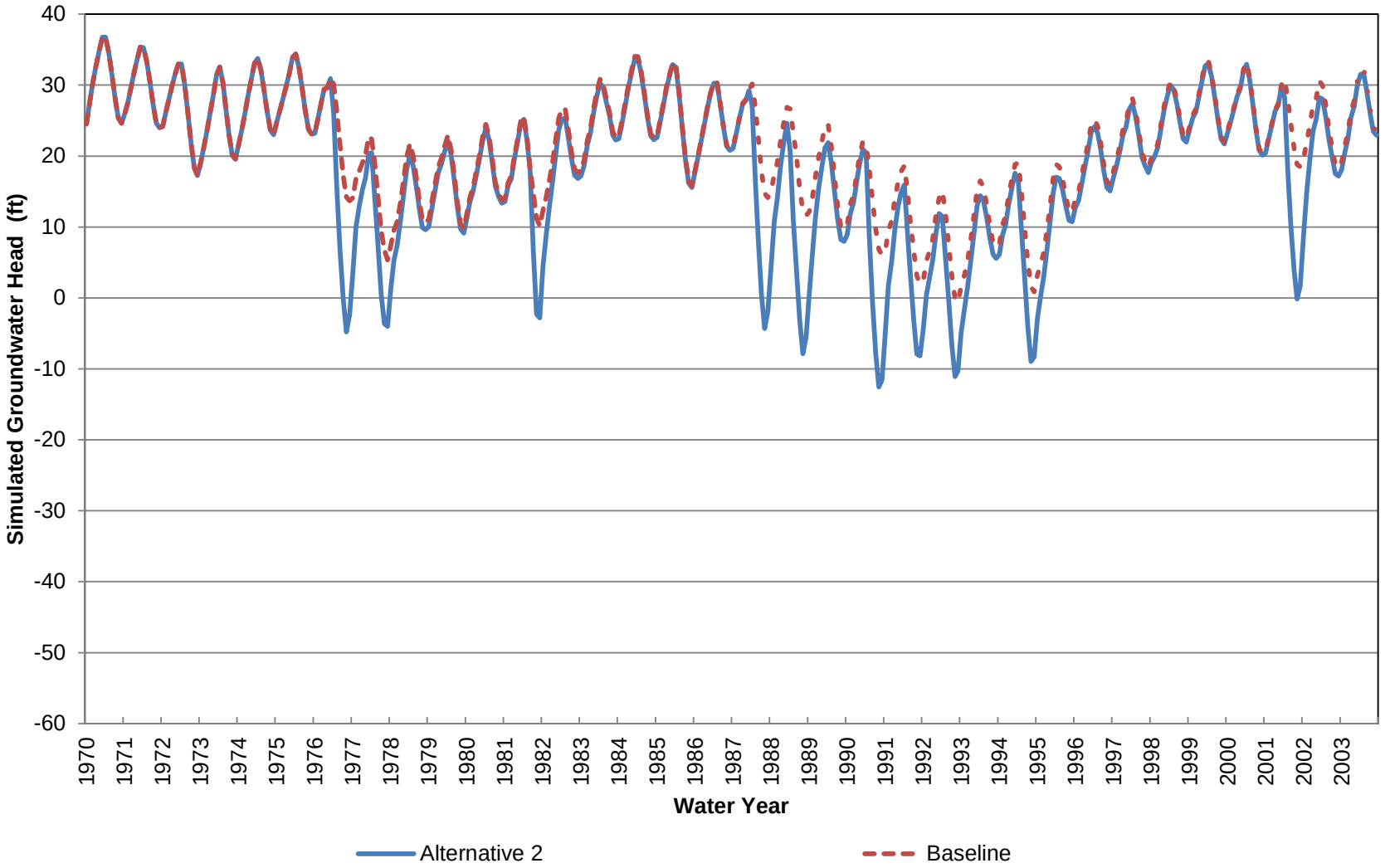
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 20 (Approximately 780-1030 ft bgs)



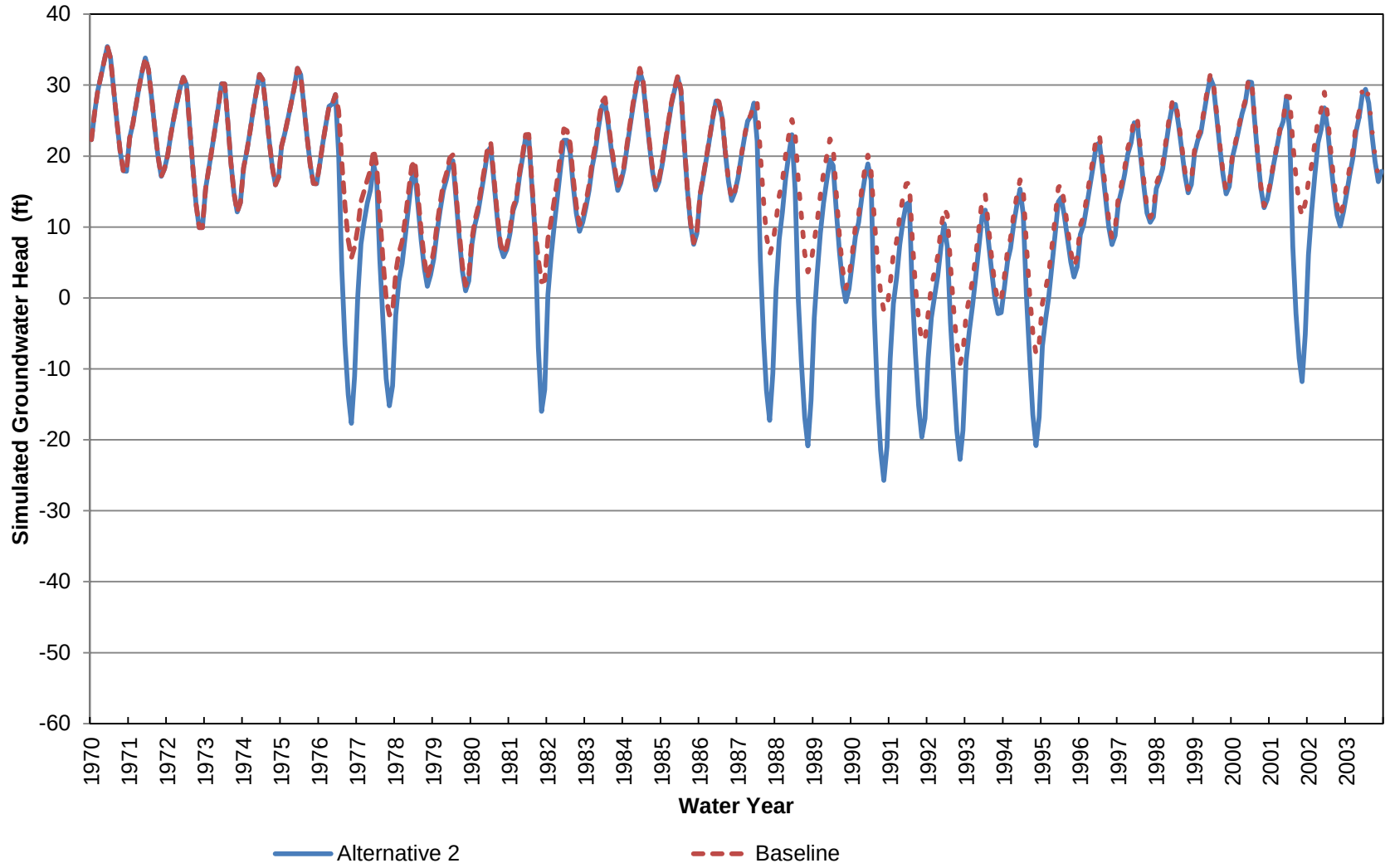
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 20 (Approximately 1030-1420 ft bgs)



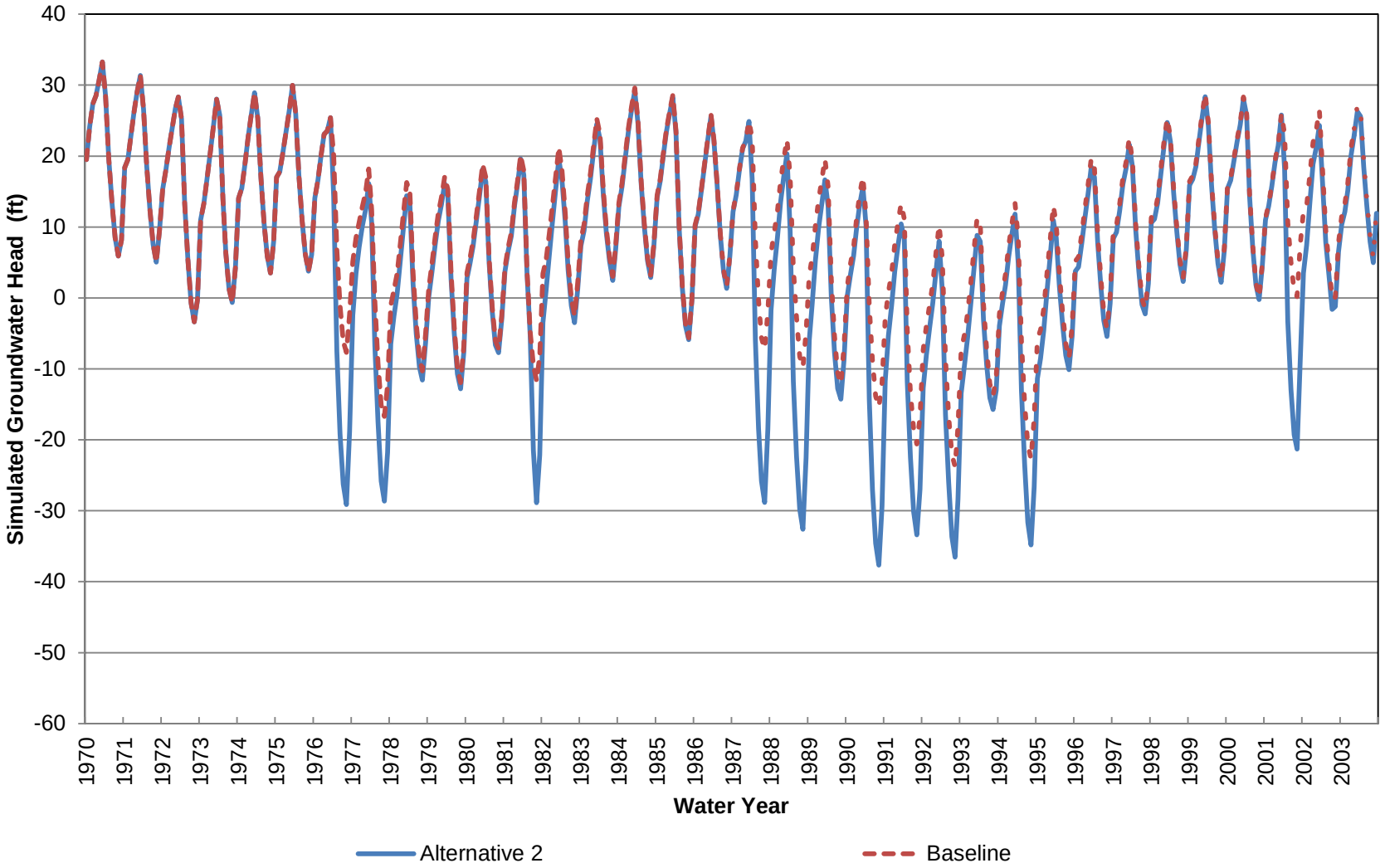
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 21 (Approximately 910-1250 ft bgs)



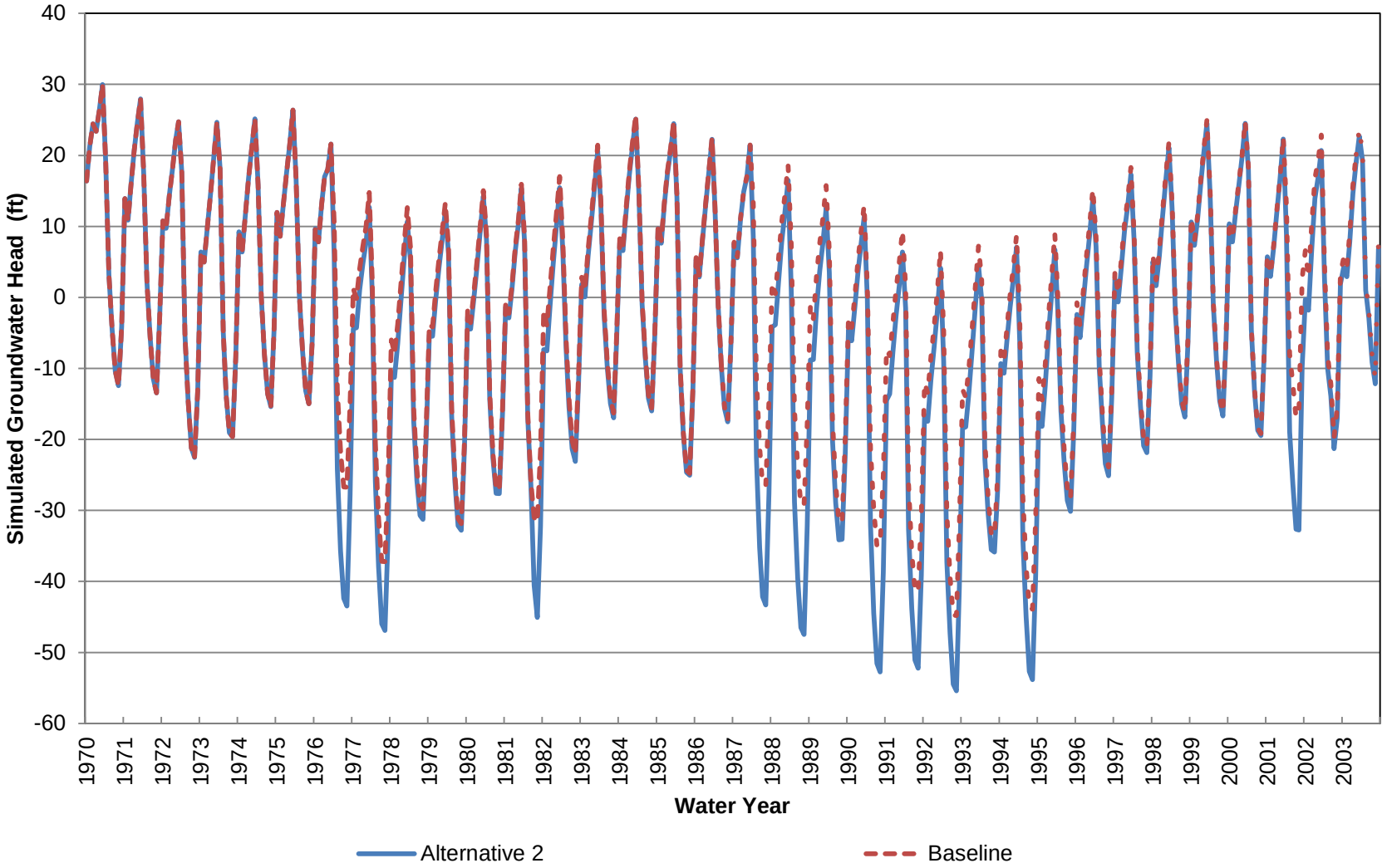
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 21 (Approximately 690-910 ft bgs)



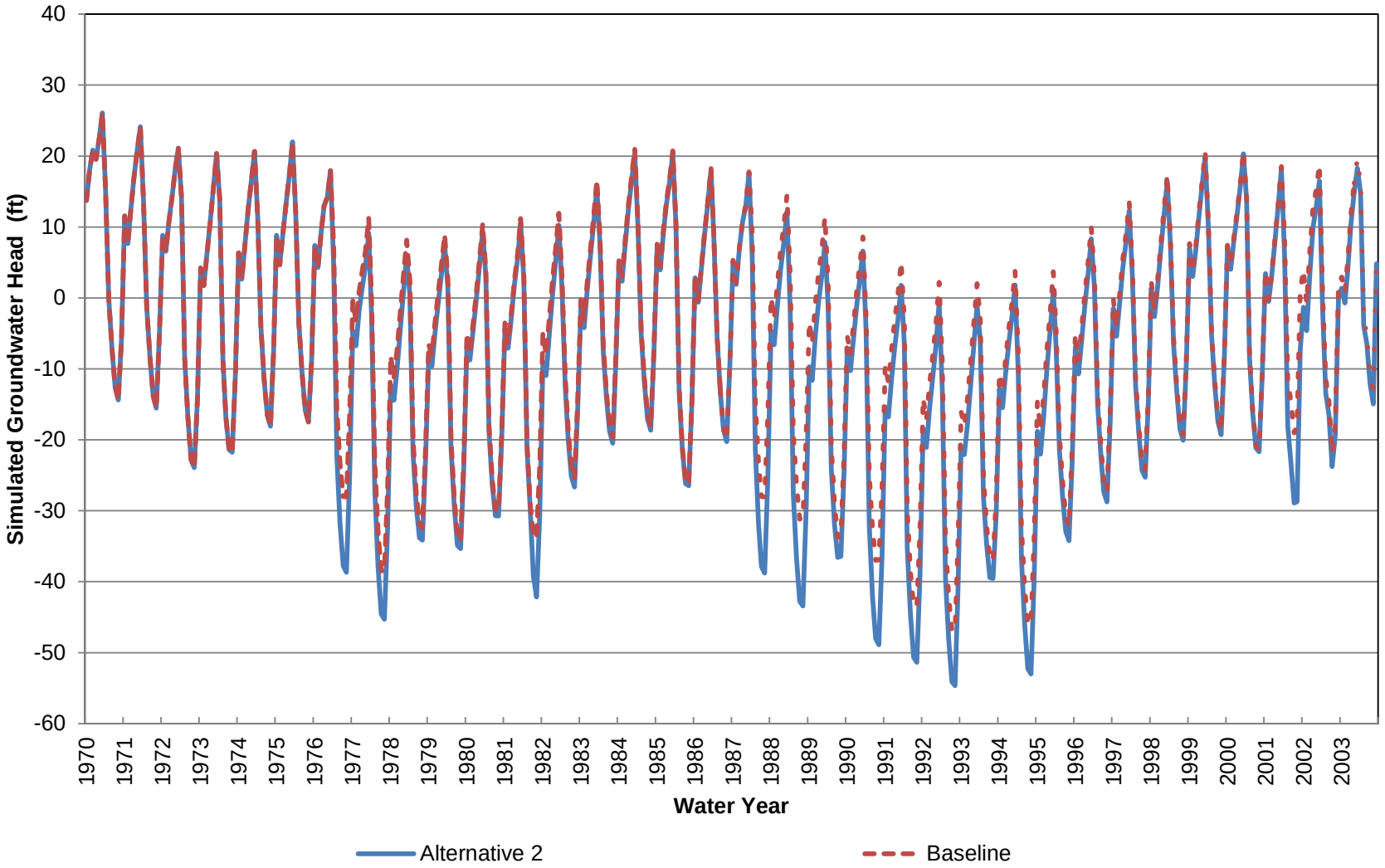
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 21 (Approximately 480-690 ft bgs)



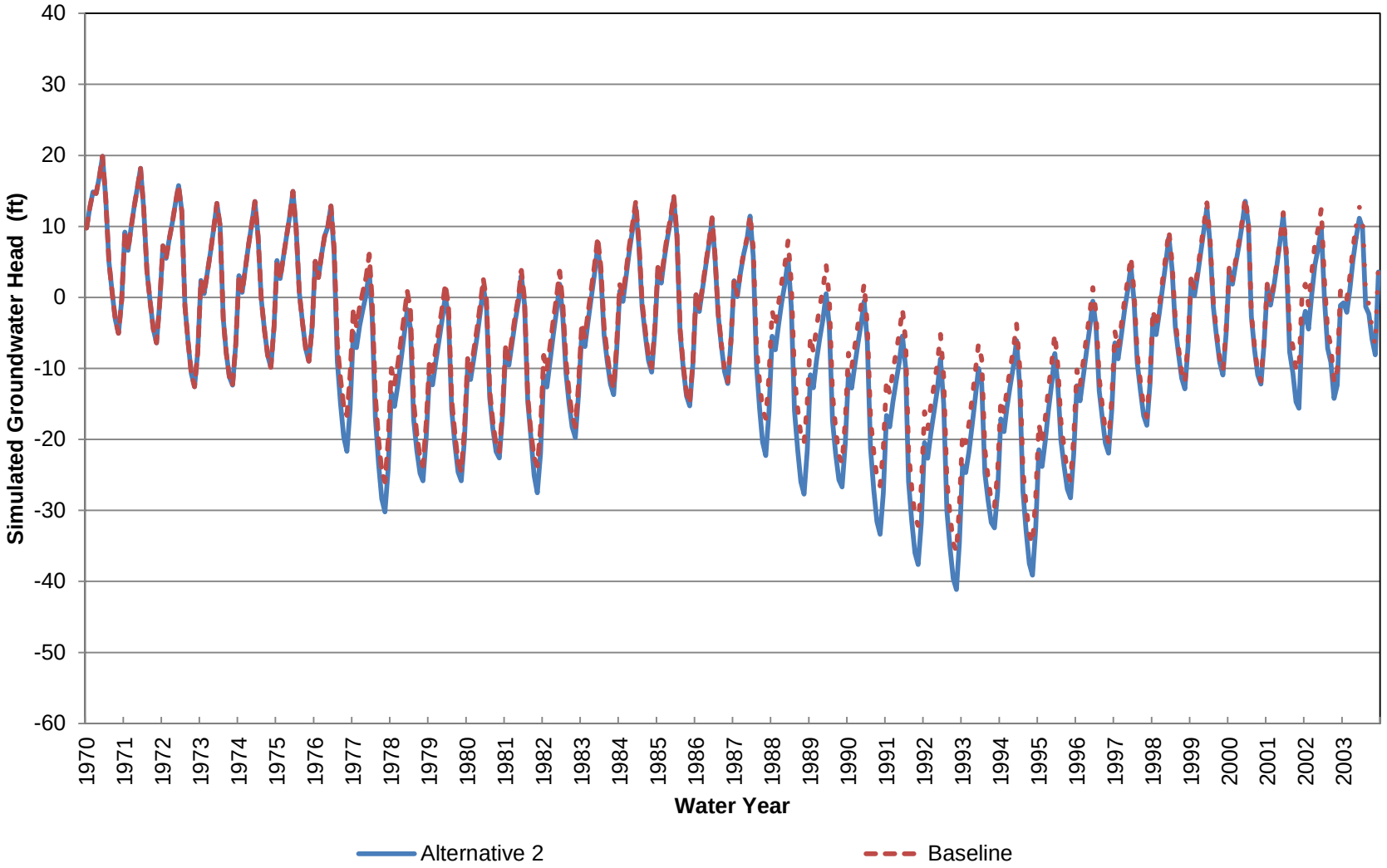
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 21 (Approximately 340-480 ft bgs)



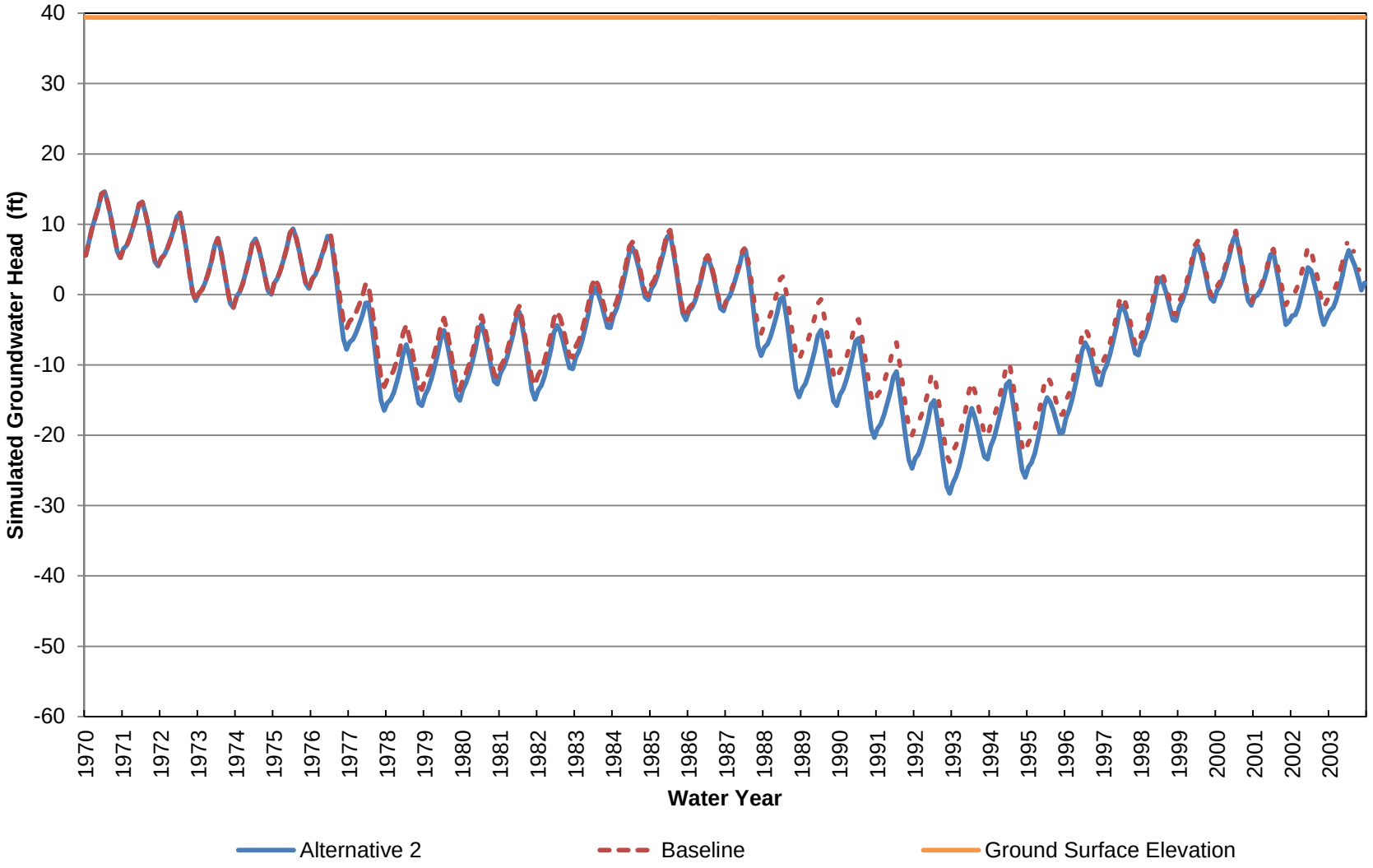
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 21 (Approximately 210-340 ft bgs)



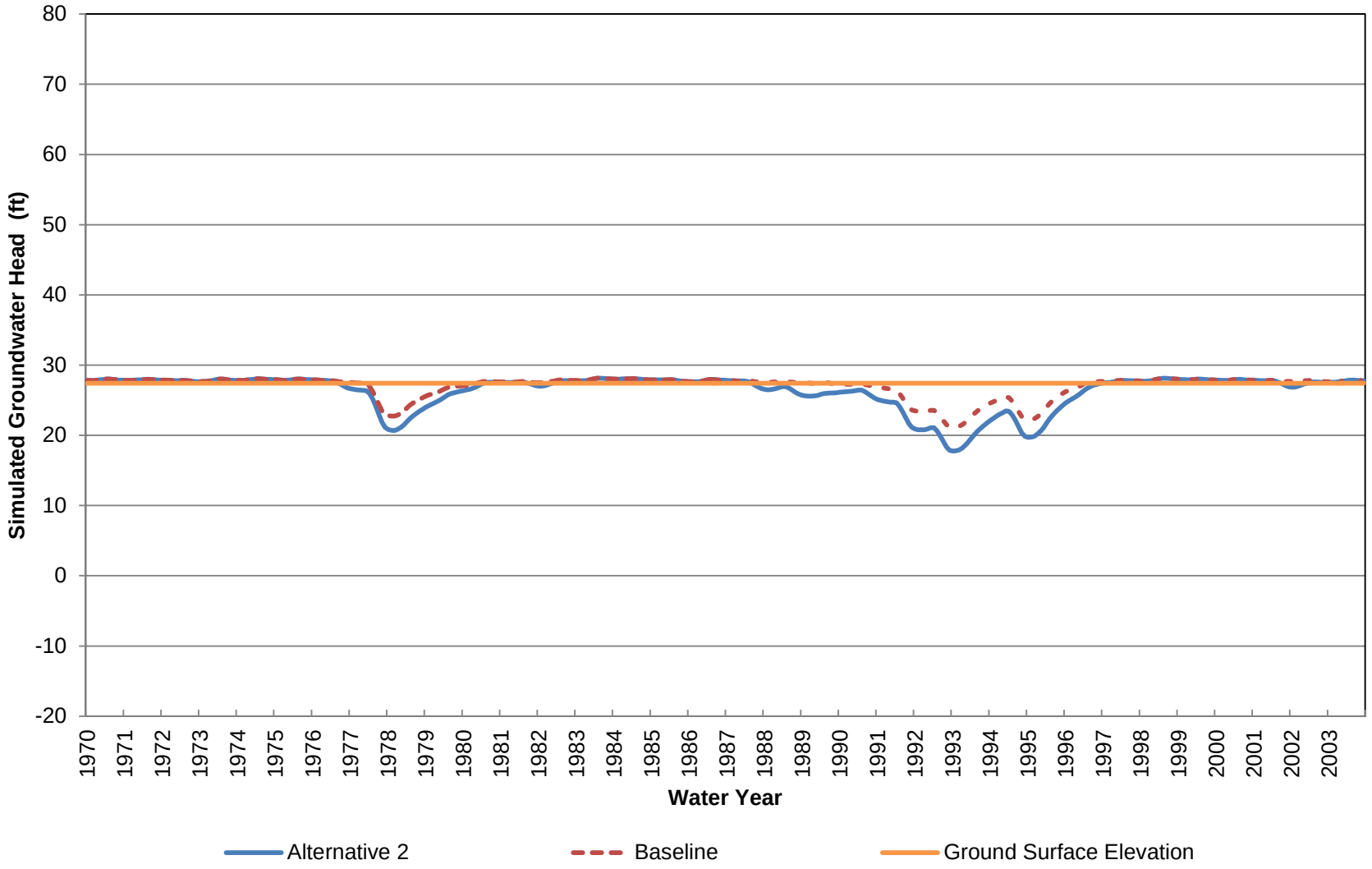
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 21 (Approximately 70-210 ft bgs)



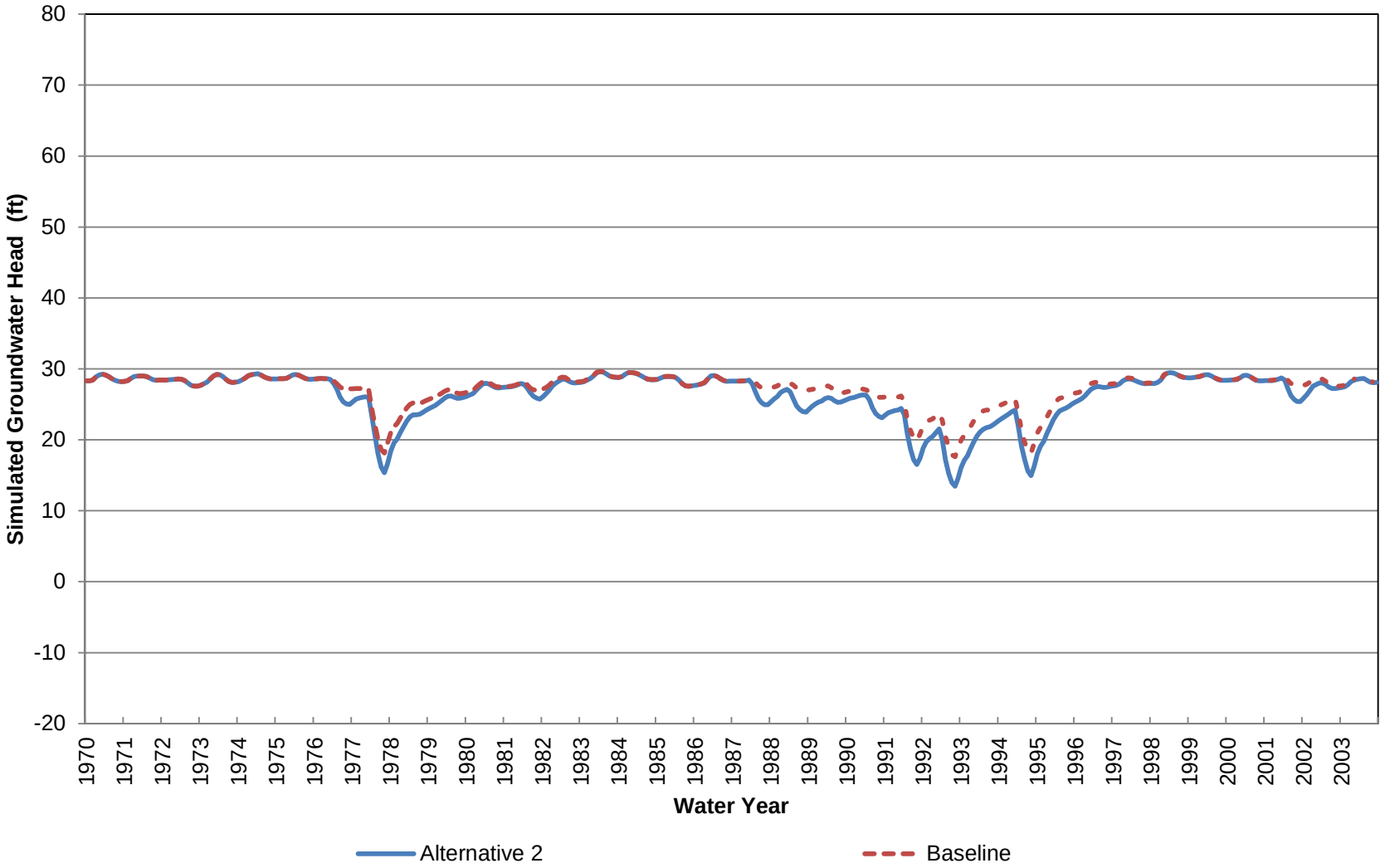
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 21 (Approximately 0-70 ft bgs)



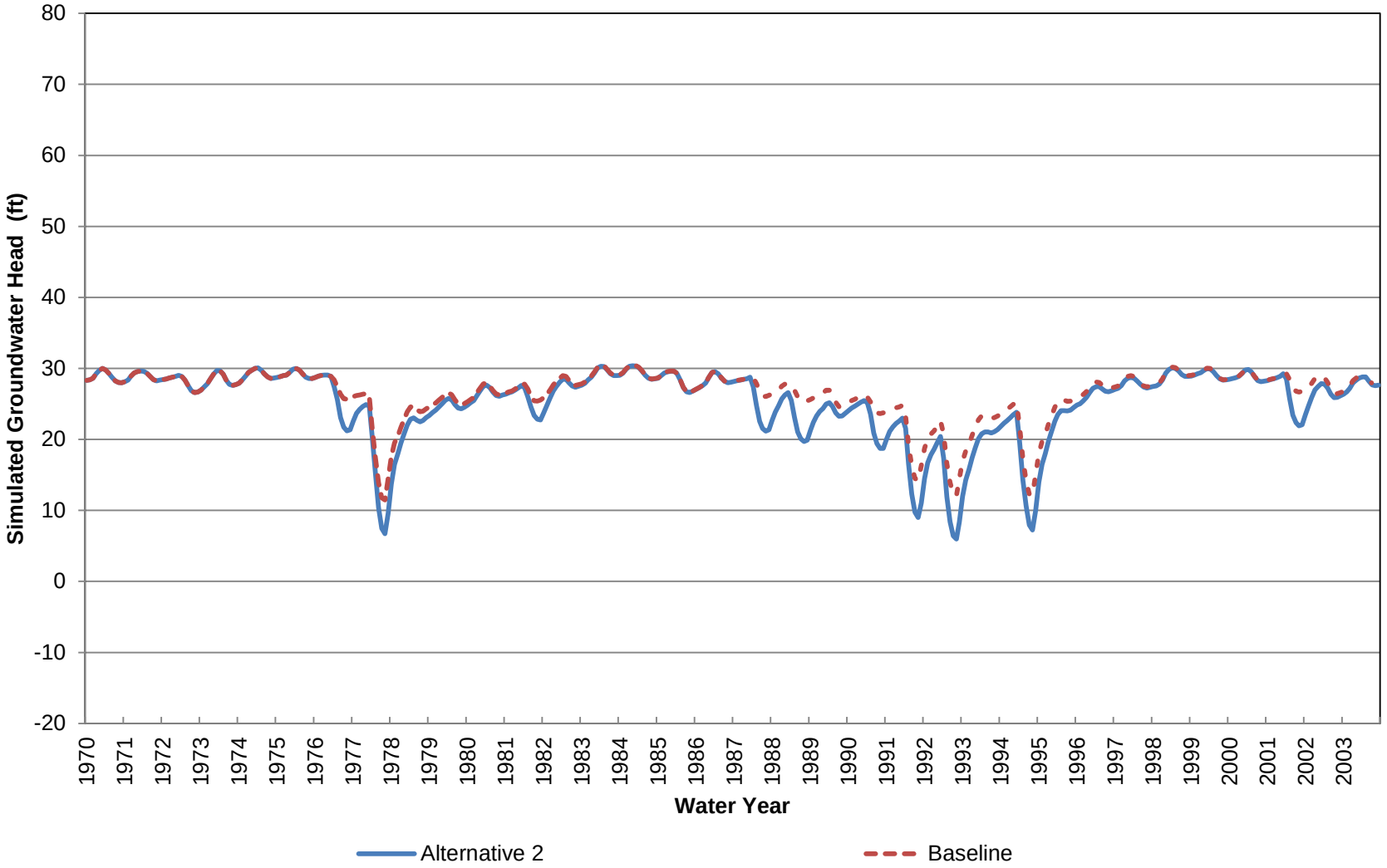
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 22 (Approximately 0-70 ft bgs)



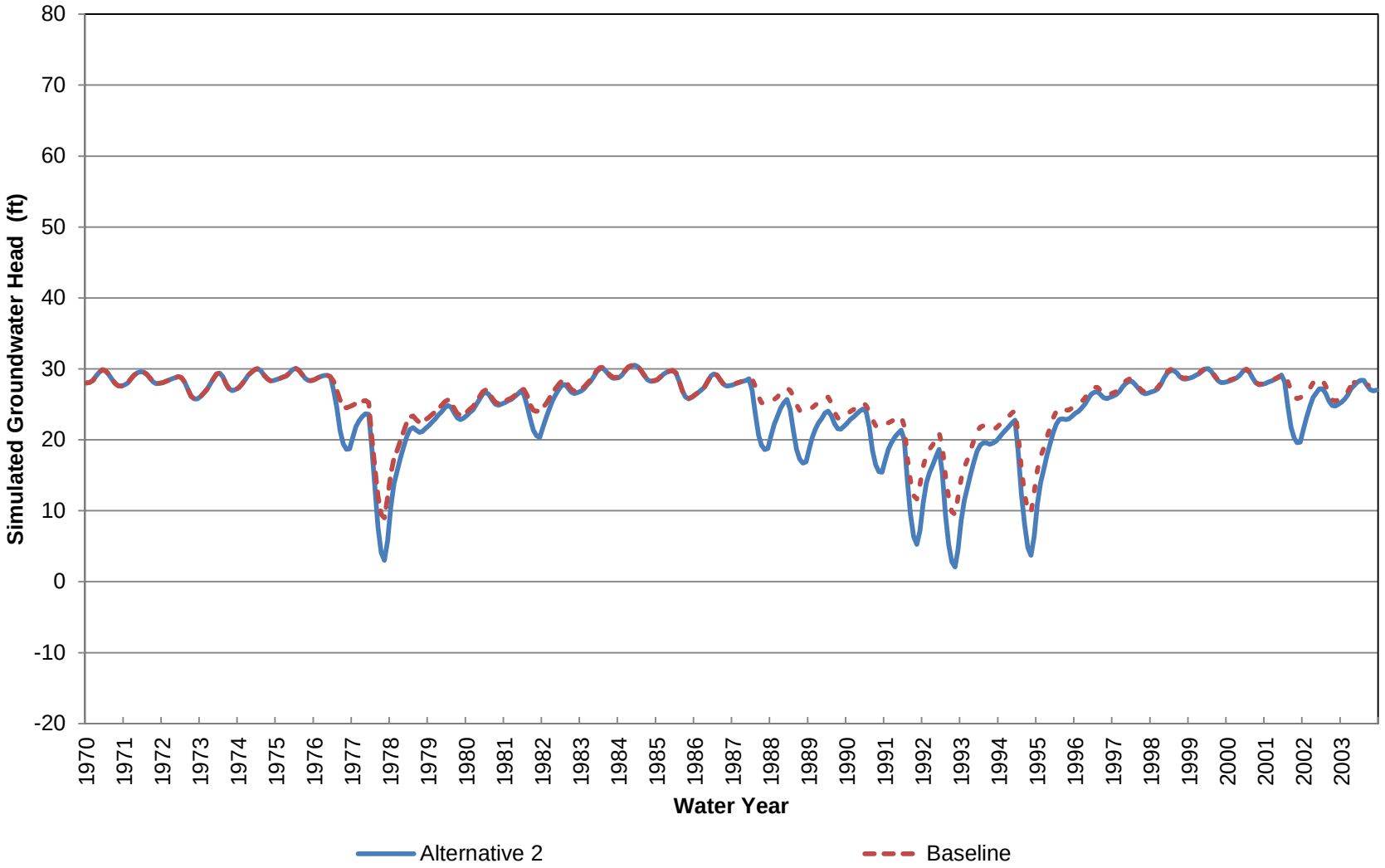
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 22 (Approximately 70-230 ft bgs)



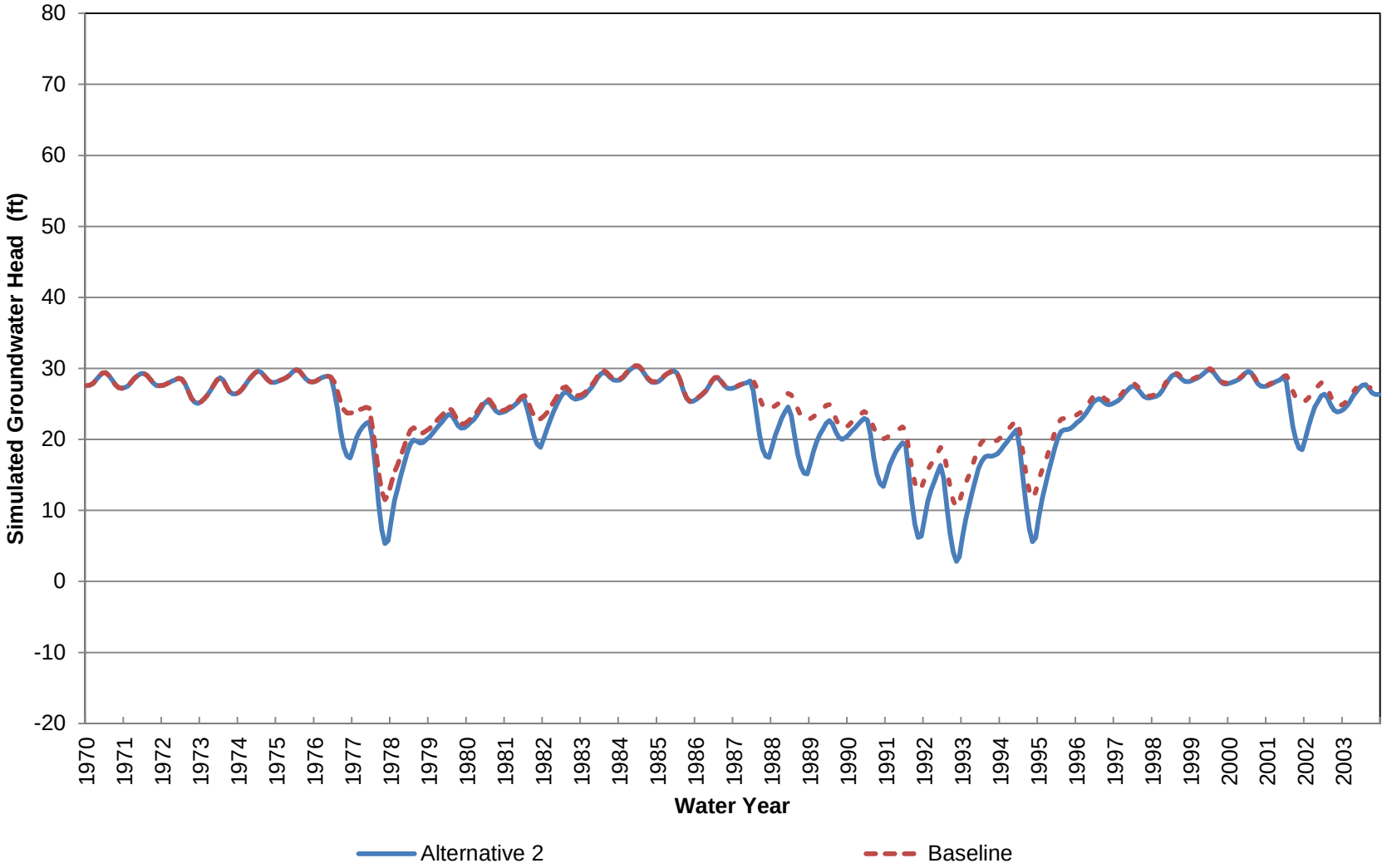
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 22 (Approximately 230-390 ft bgs)



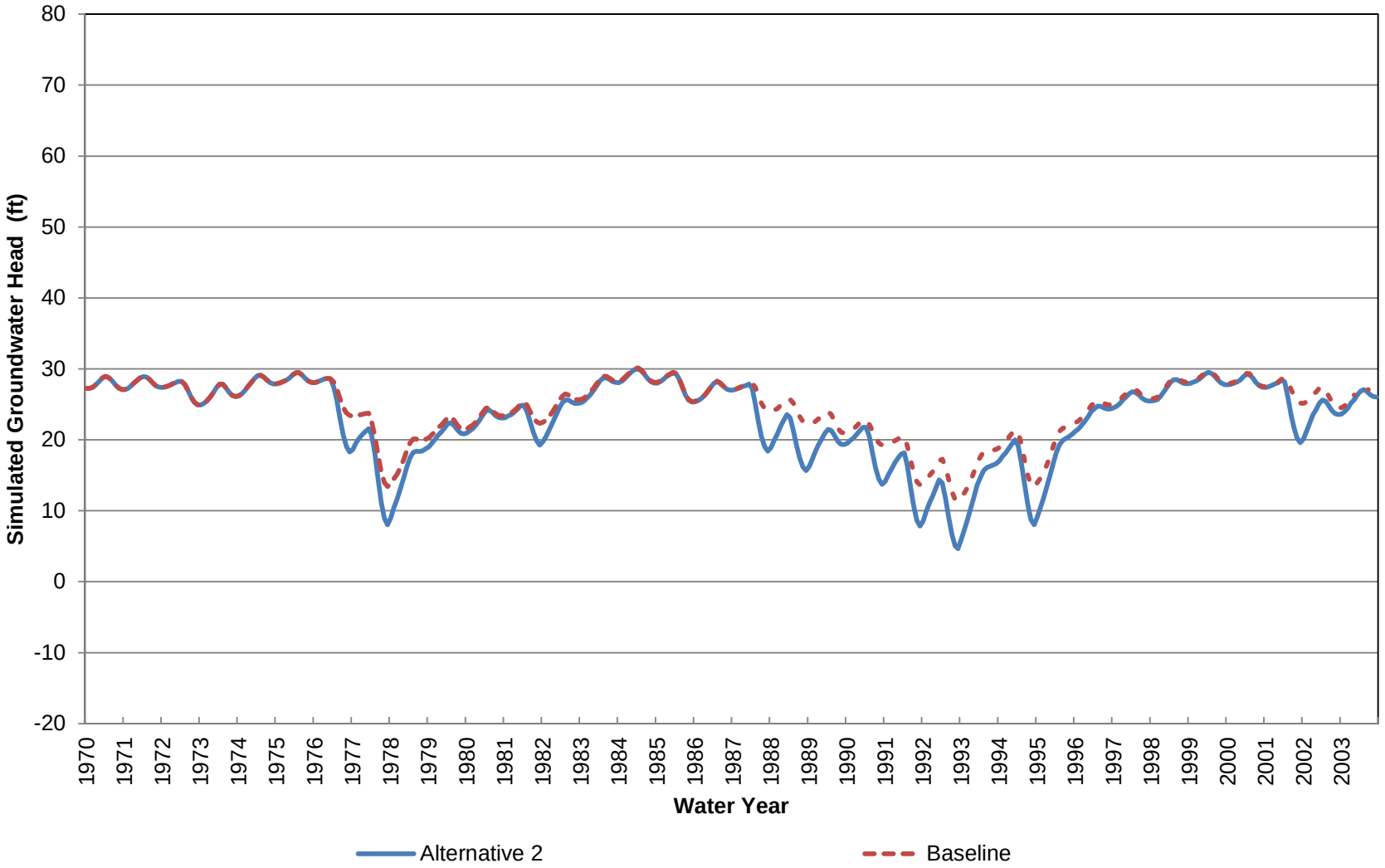
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 22 (Approximately 390-550 ft bgs)



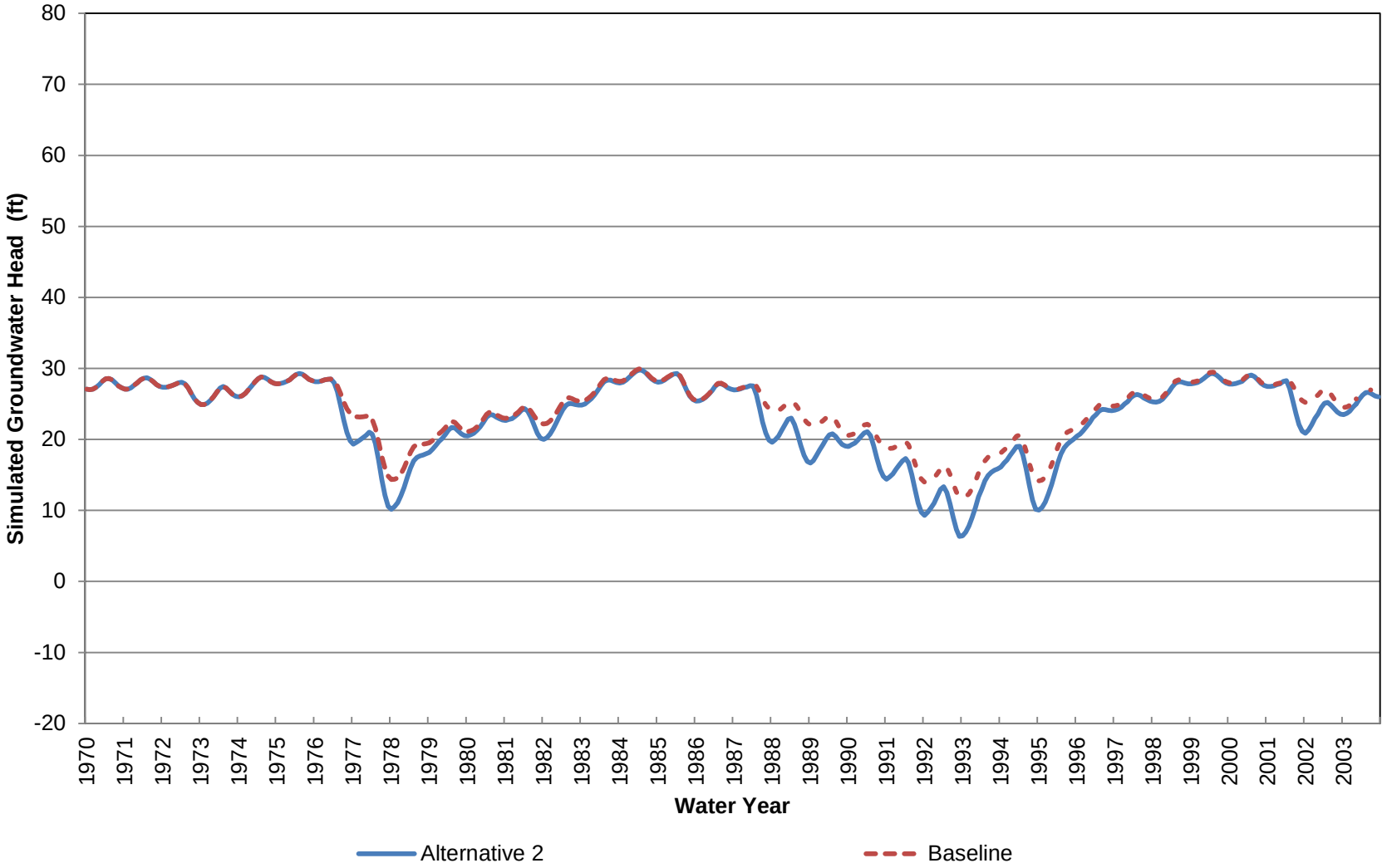
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 22 (Approximately 550-810 ft bgs)



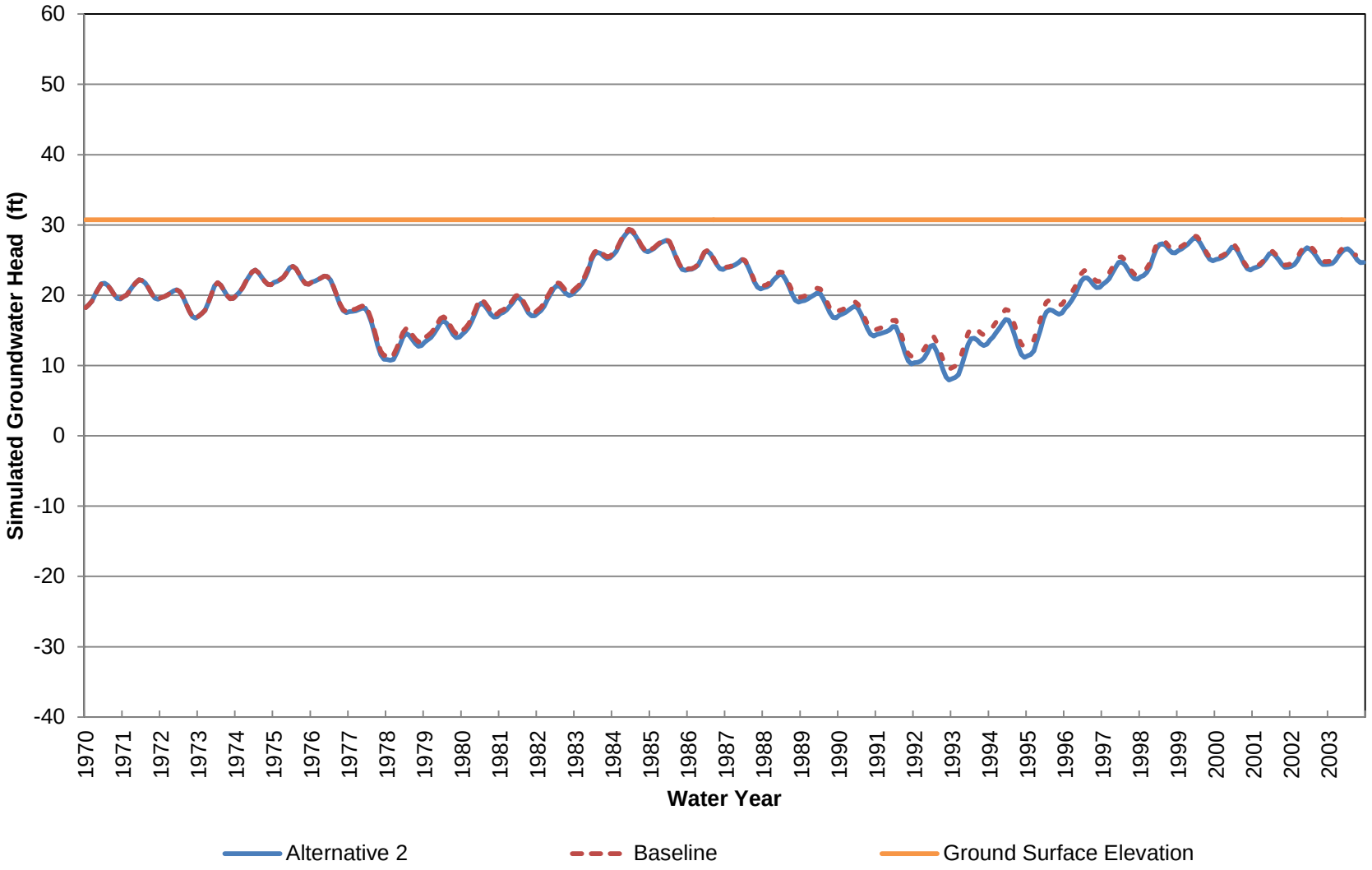
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 22 (Approximately 810-1080 ft bgs)



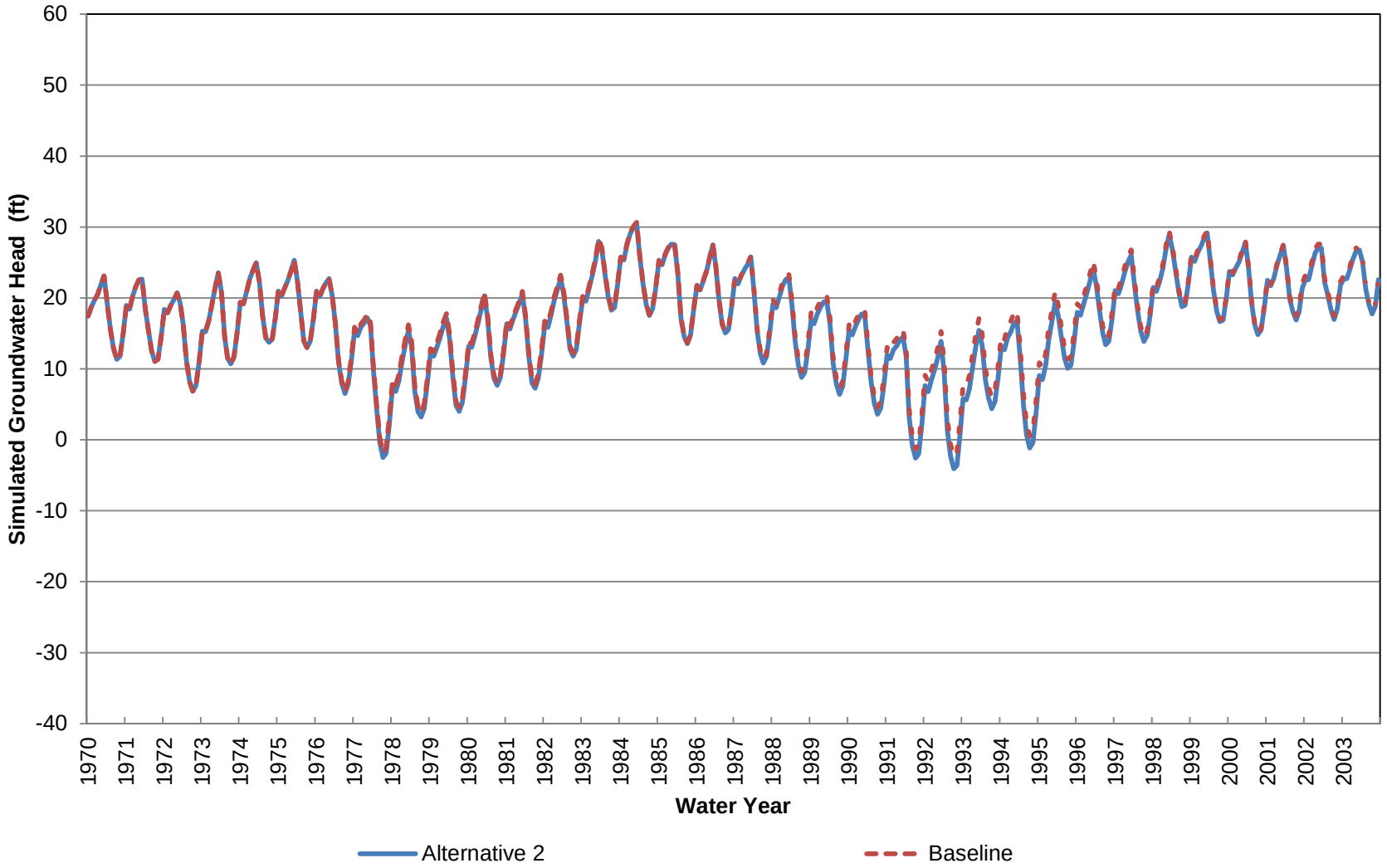
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 22 (Approximately 1080-1480 ft bgs)



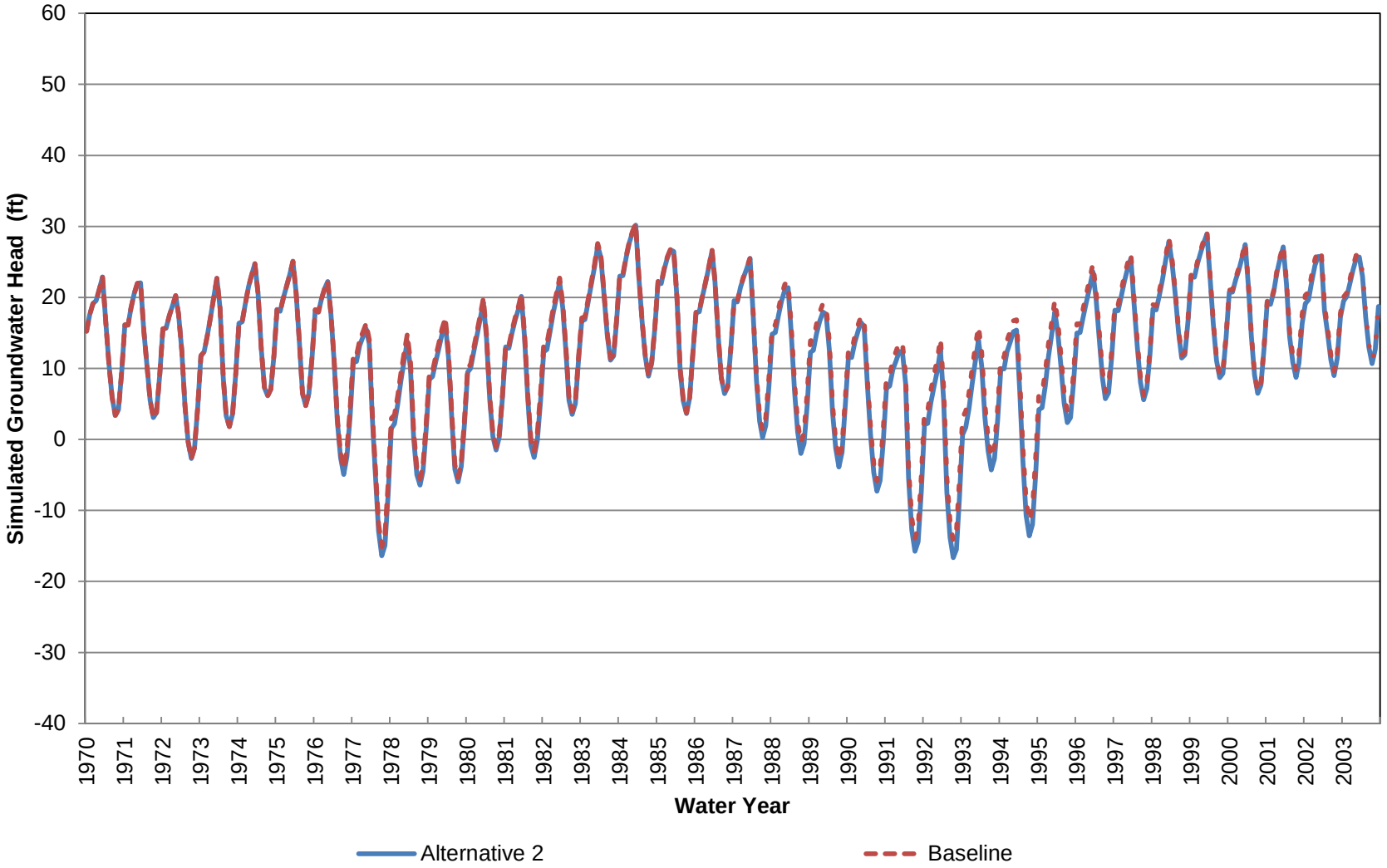
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 23 (Approximately 0-70 ft bgs)



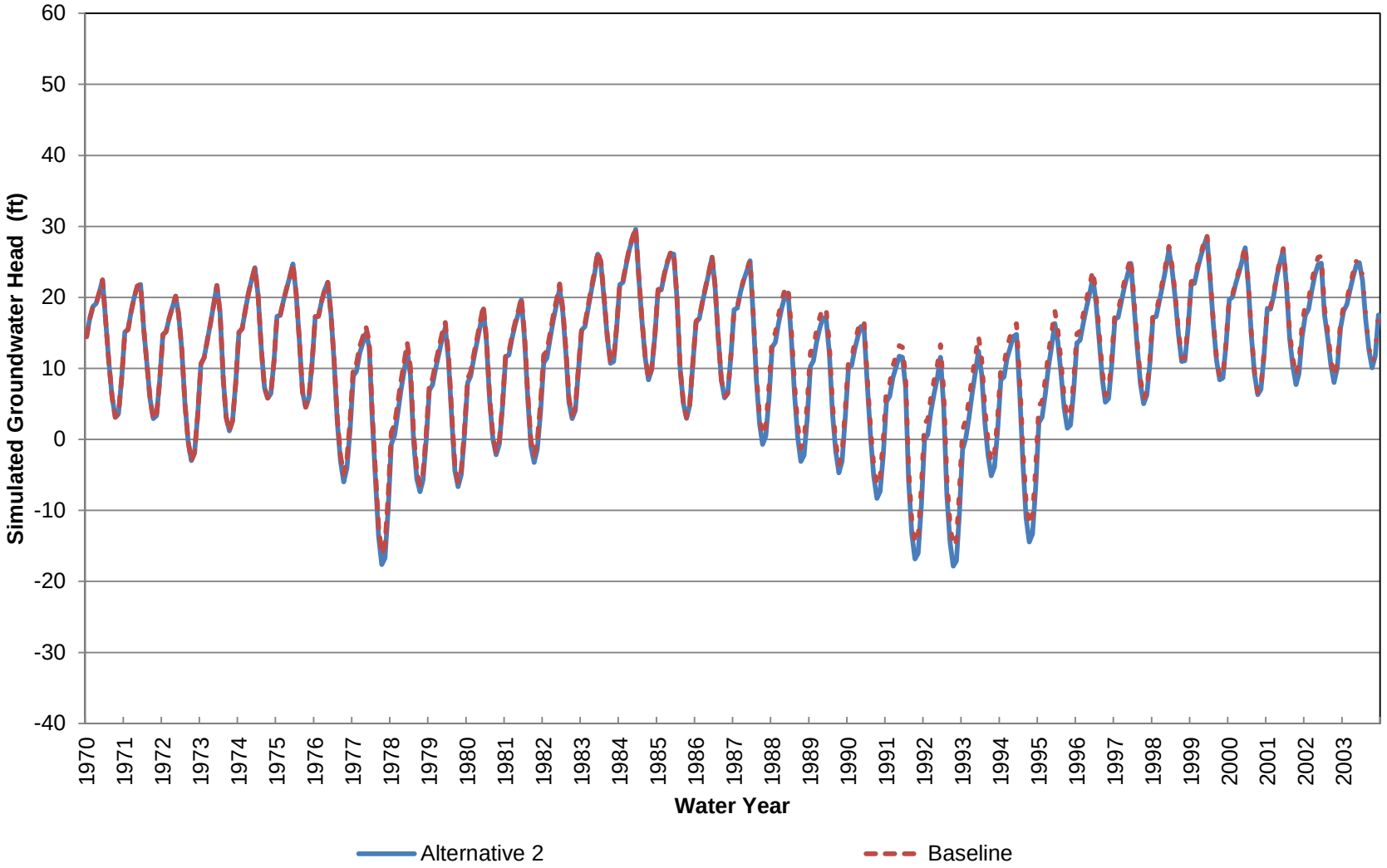
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 23 (Approximately 70-290 ft bgs)



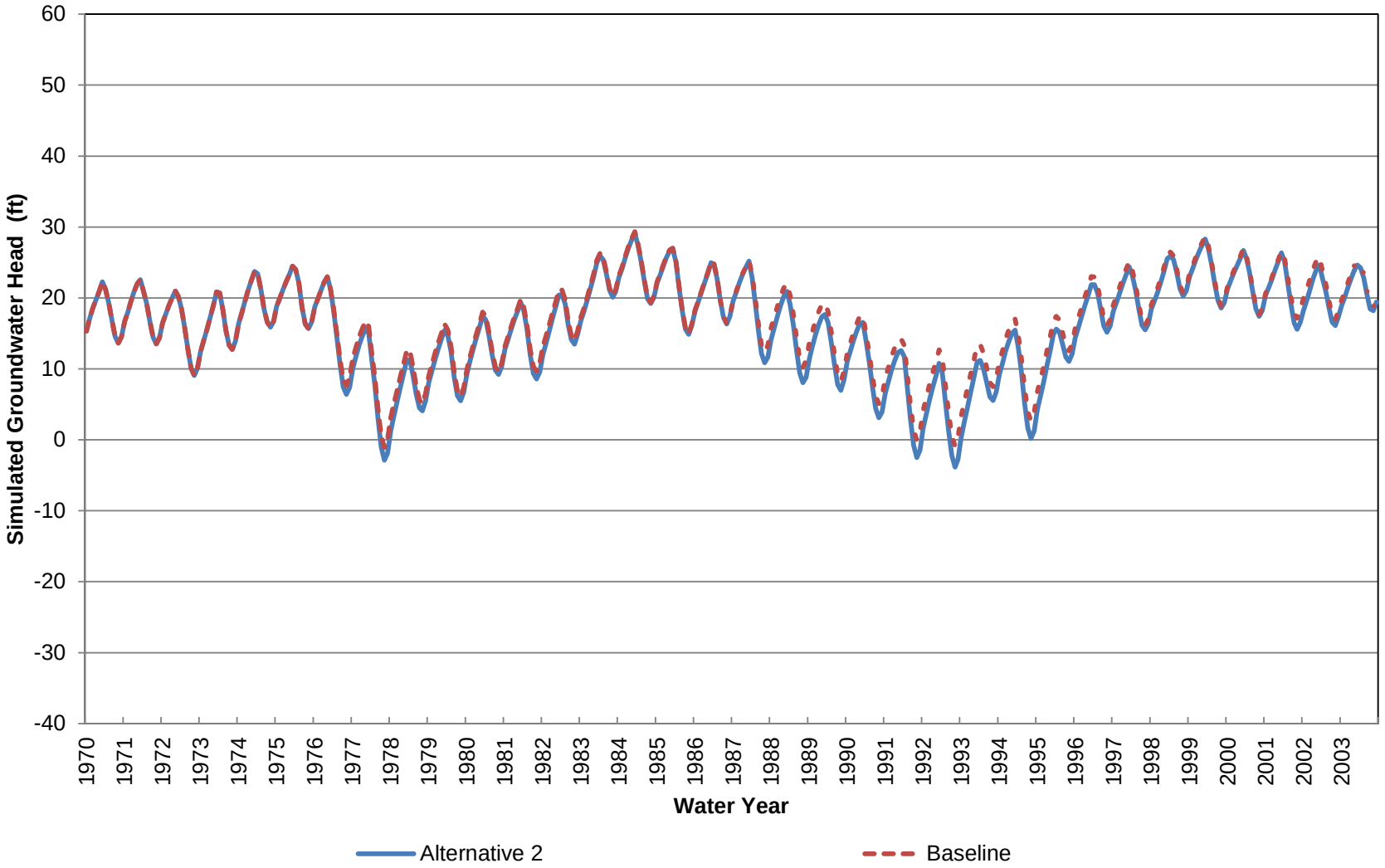
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 23 (Approximately 290-520 ft bgs)



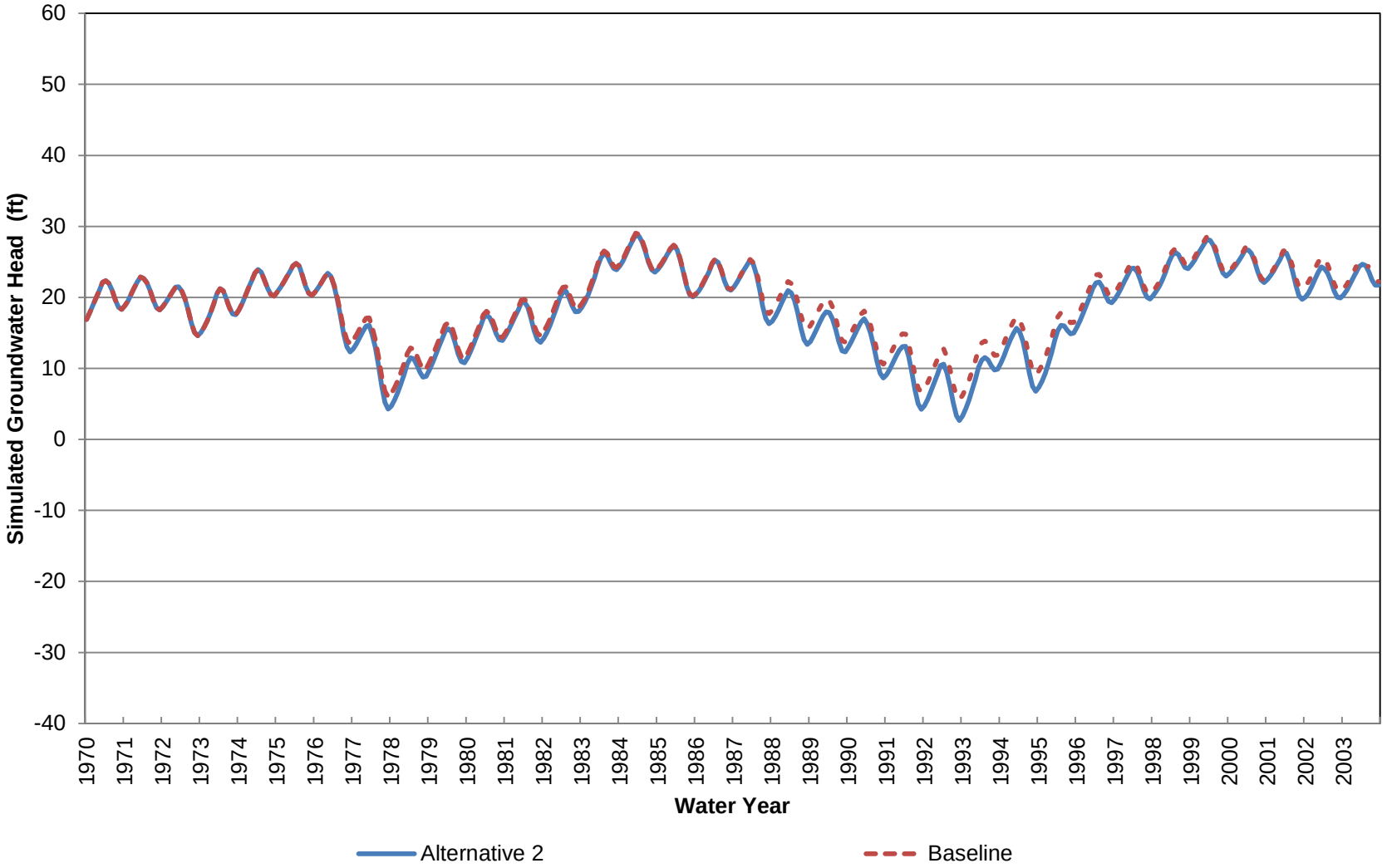
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 23 (Approximately 520-740 ft bgs)



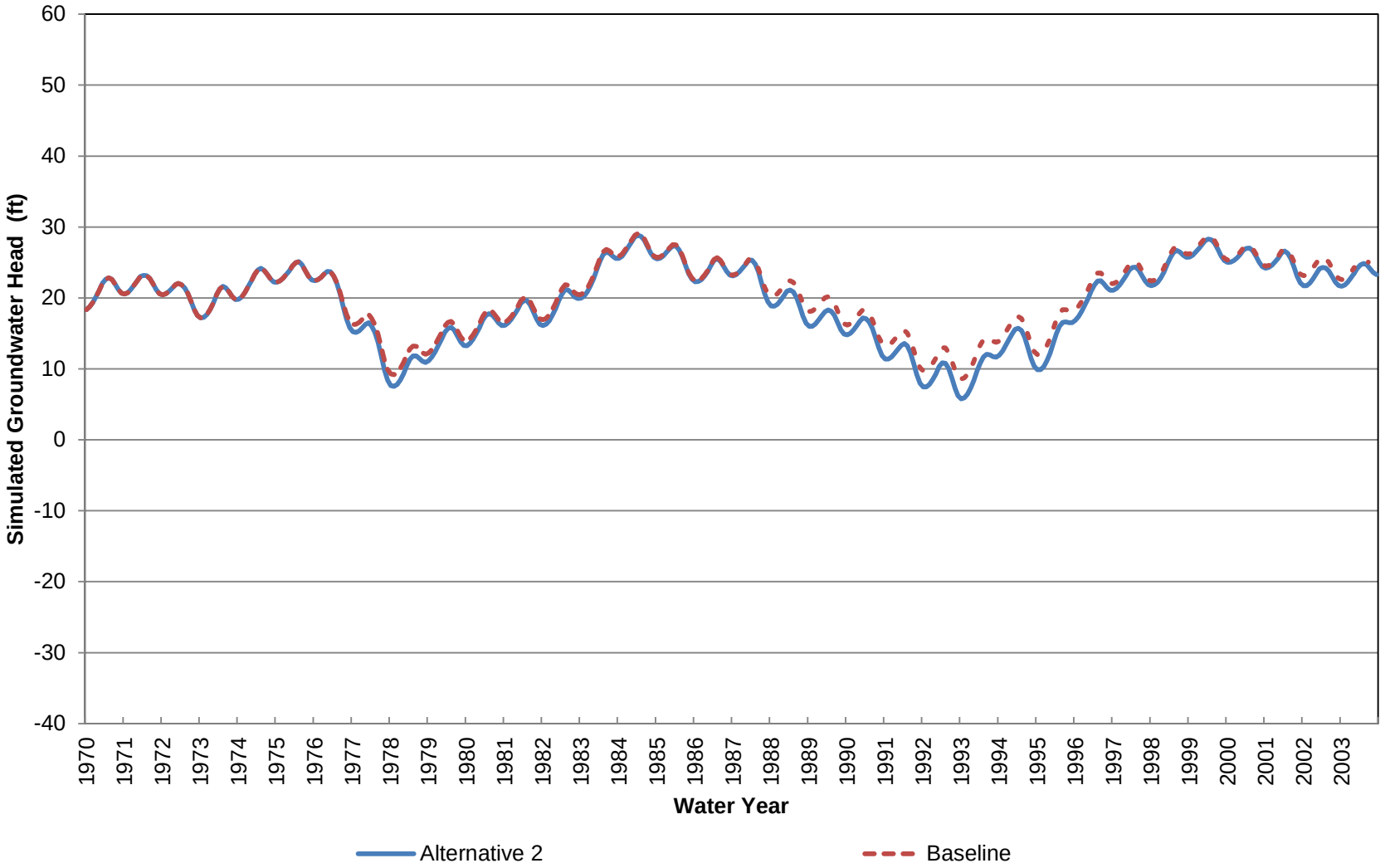
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 23 (Approximately 740-1120 ft bgs)



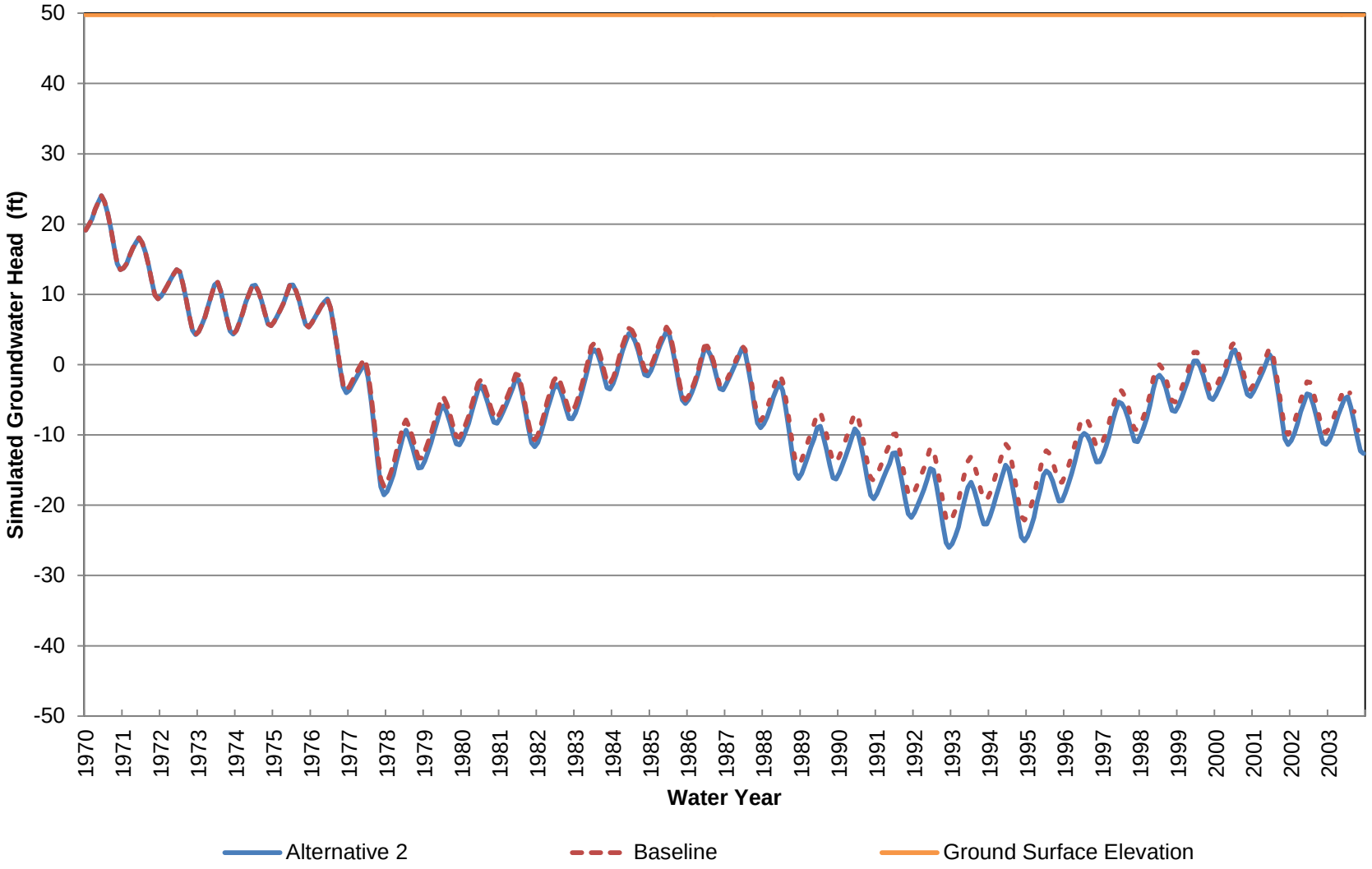
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 23 (Approximately 1120-1500 ft bgs)



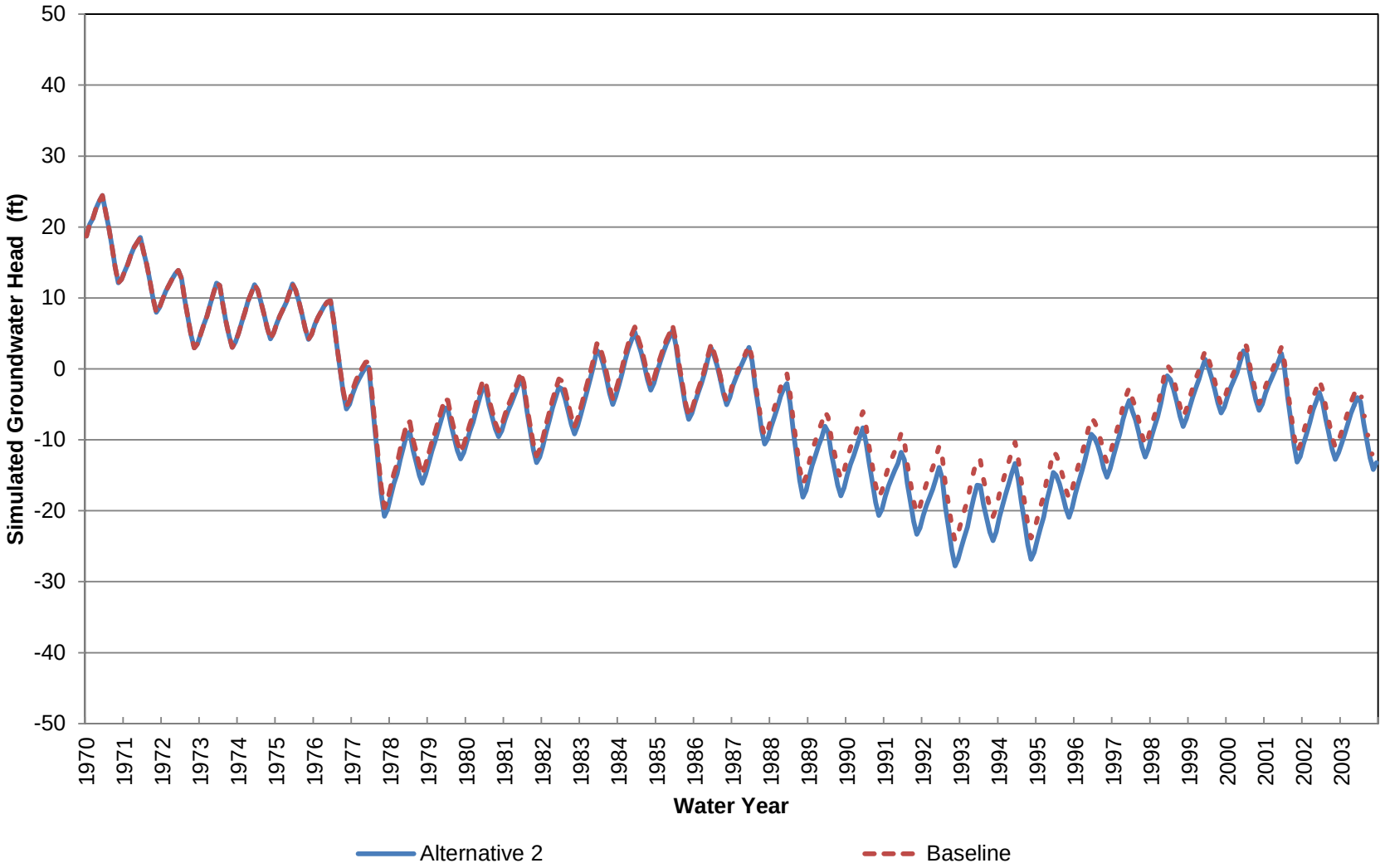
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 23 (Approximately 1500-2050 ft bgs)



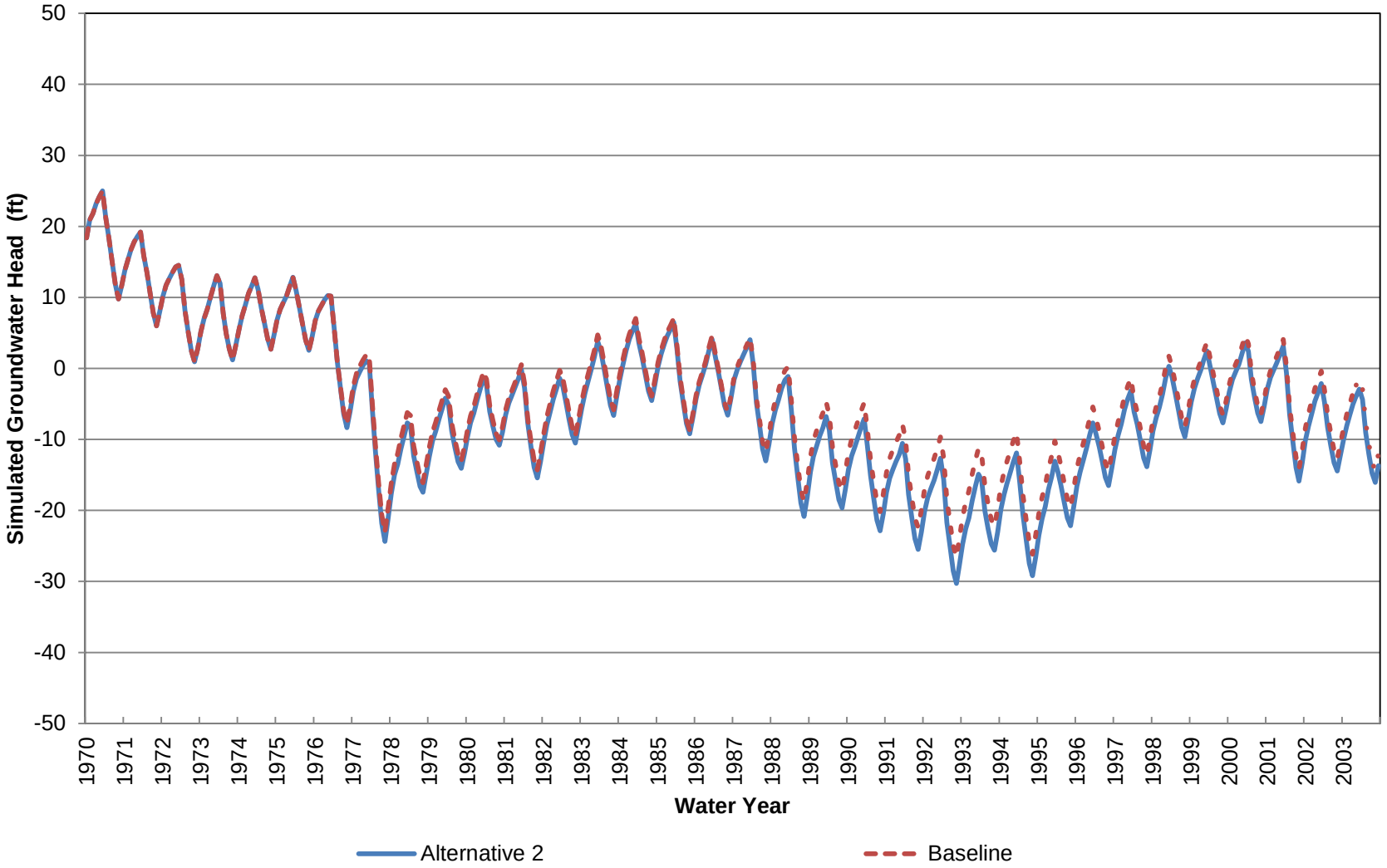
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 24 (Approximately 0-60 ft bgs)



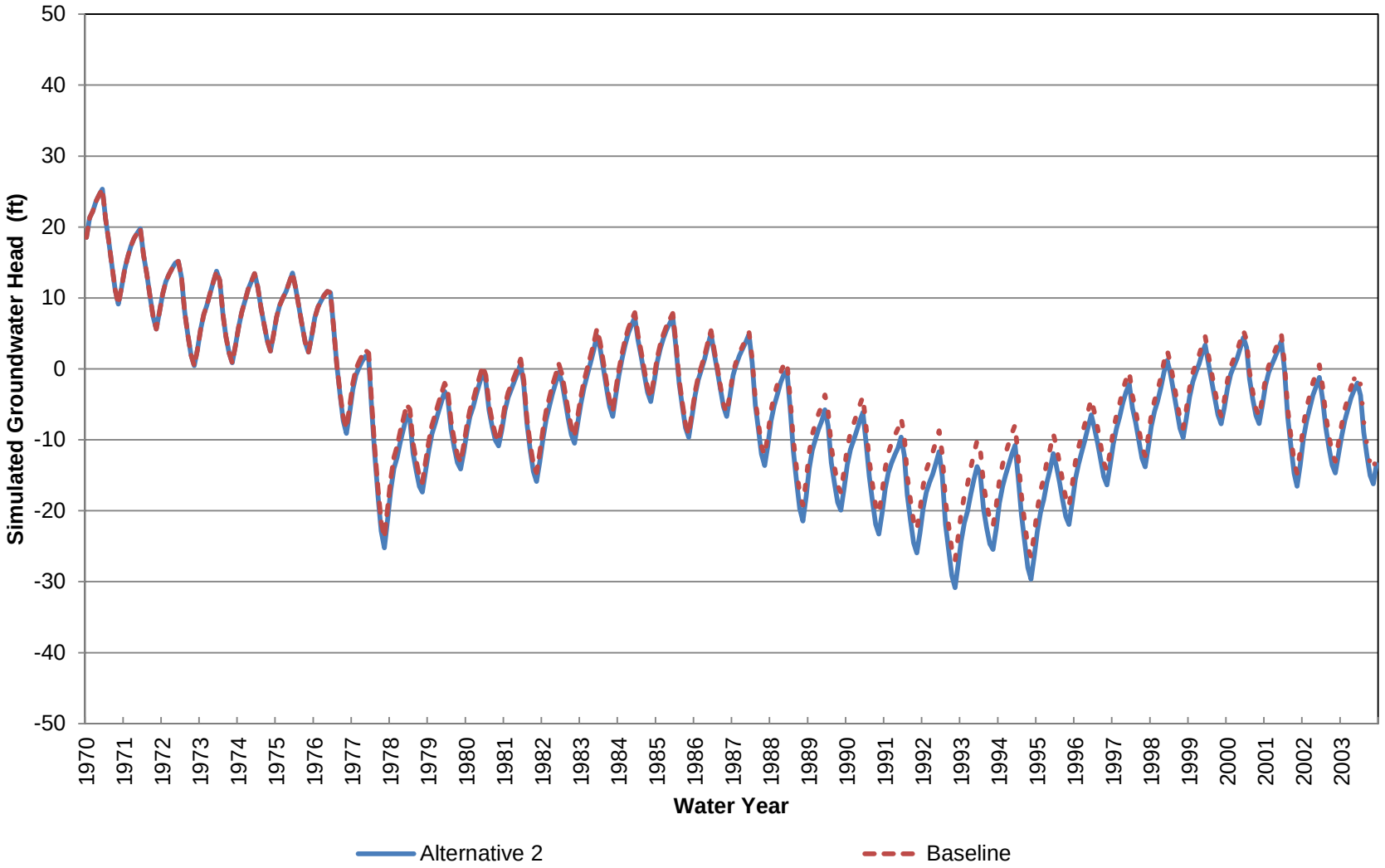
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 24 (Approximately 60-140 ft bgs)



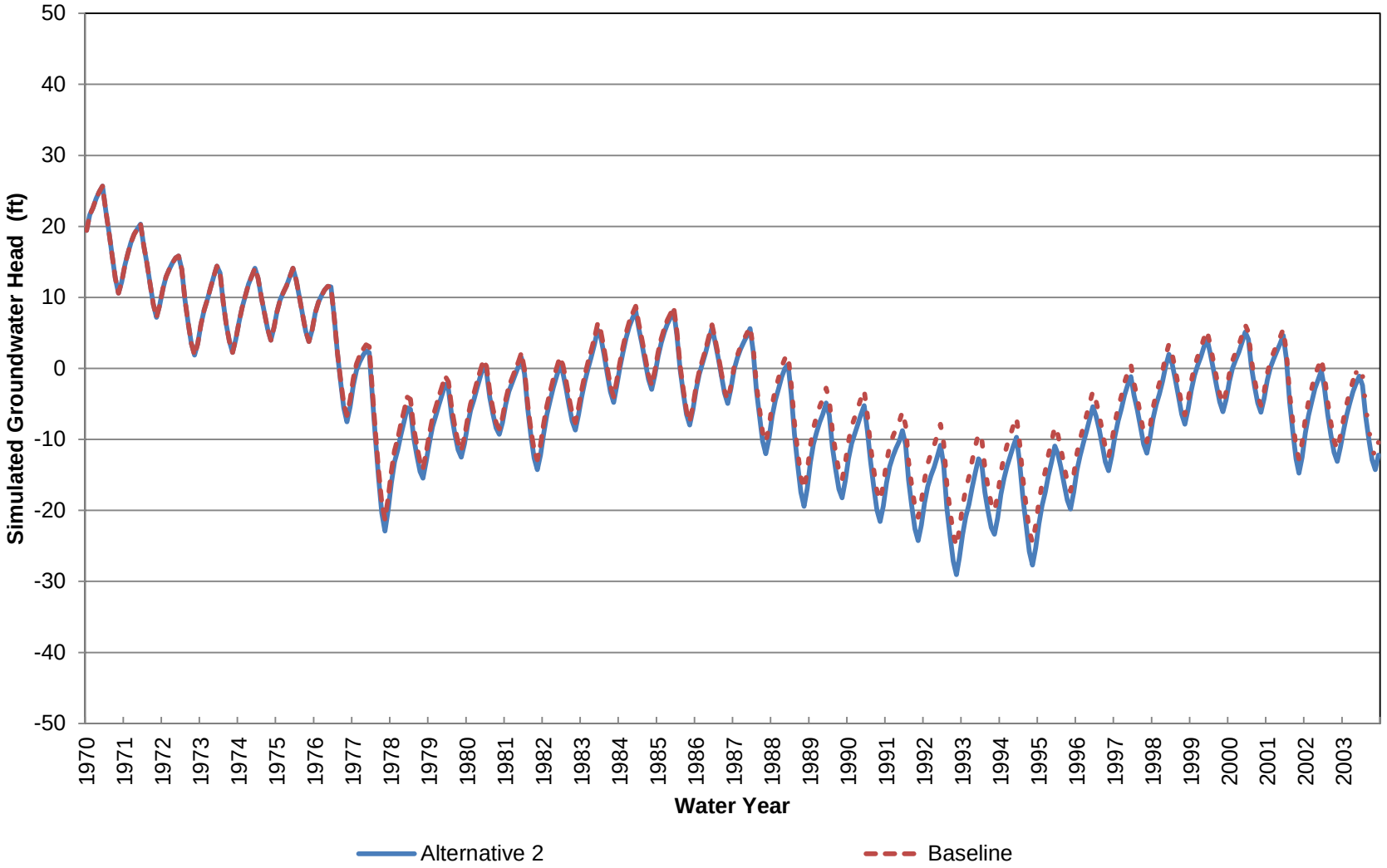
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 24 (Approximately 140-220 ft bgs)



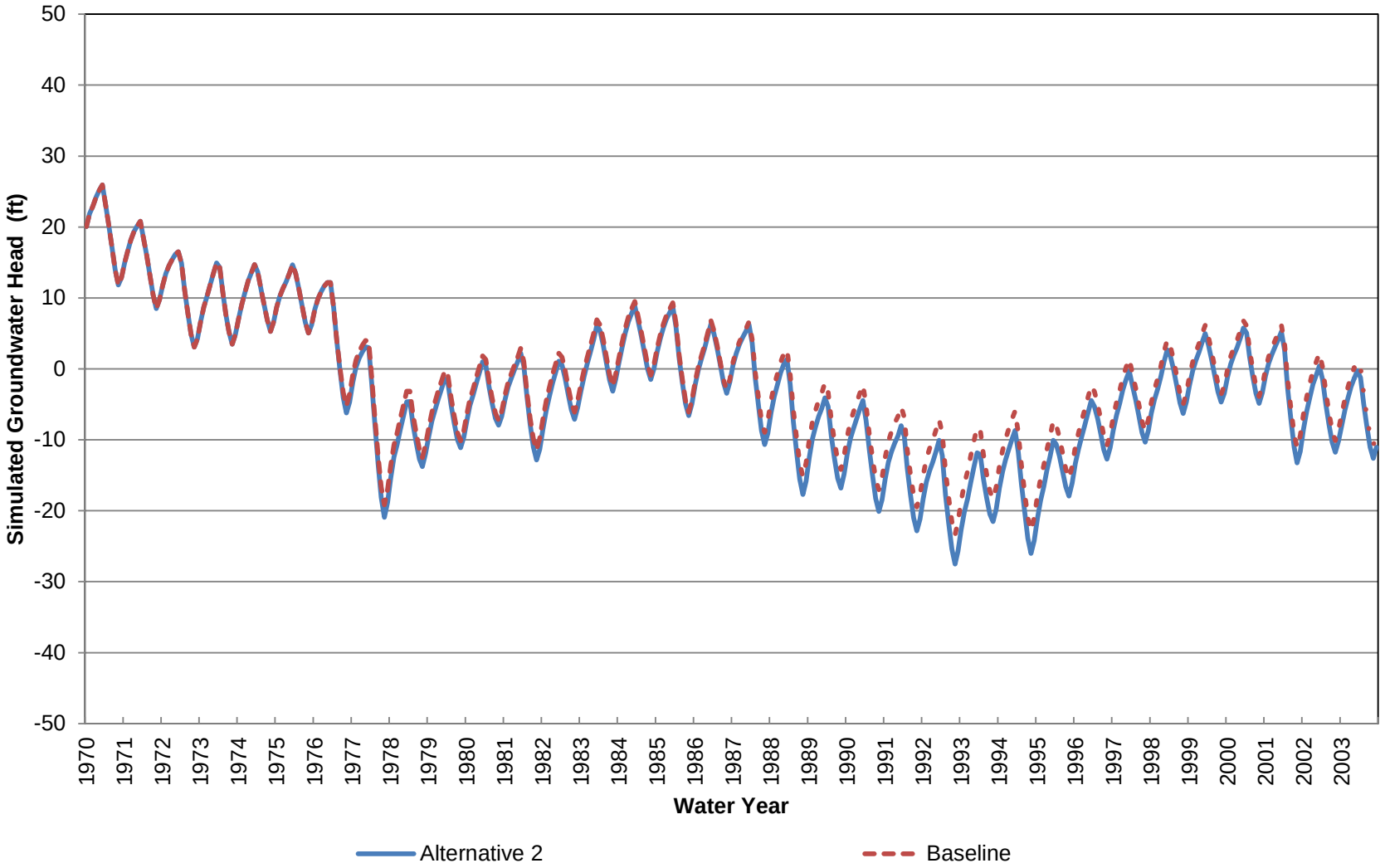
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 24 (Approximately 220-300 ft bgs)



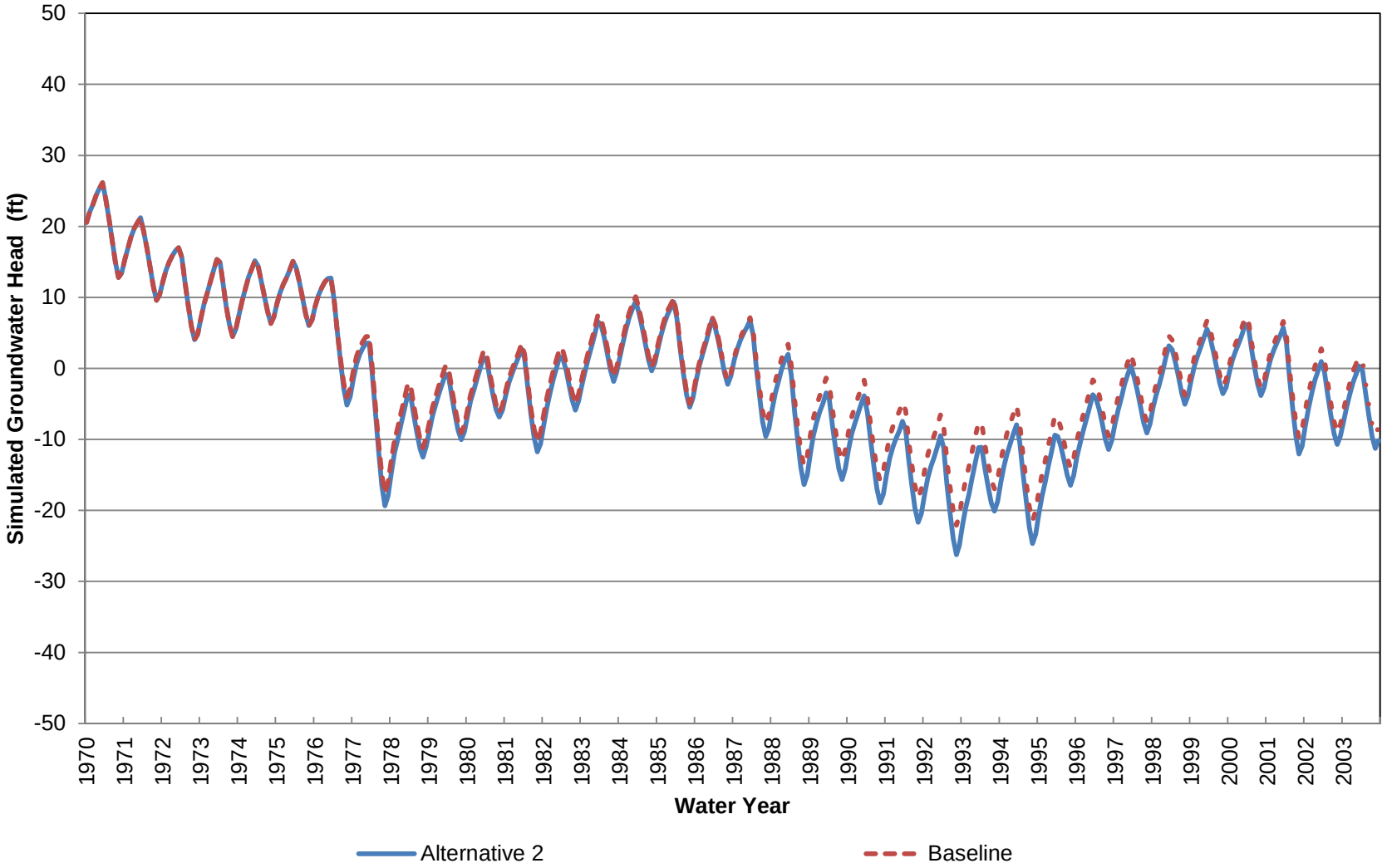
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 24 (Approximately 300-410 ft bgs)



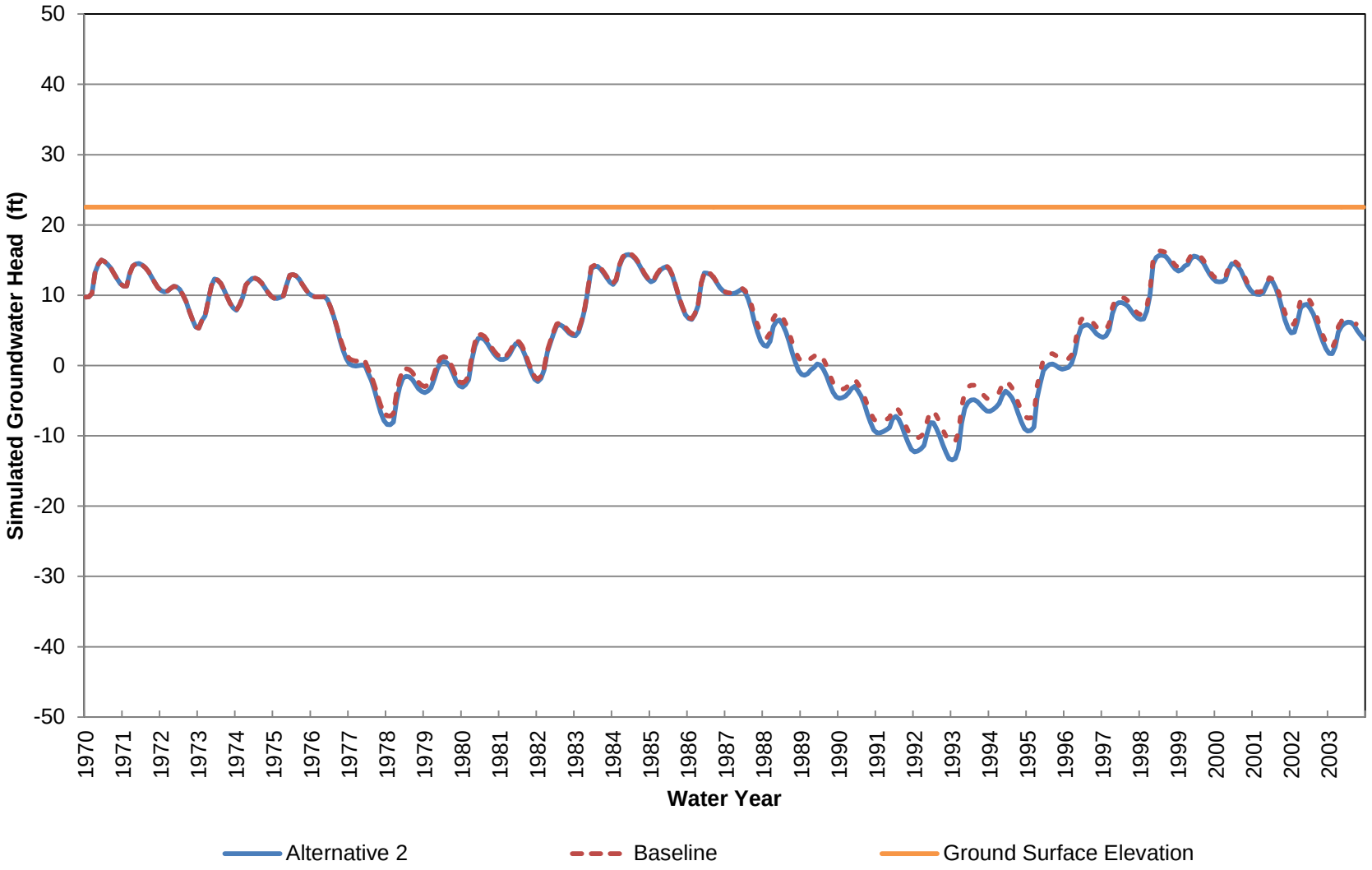
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 24 (Approximately 410-550 ft bgs)



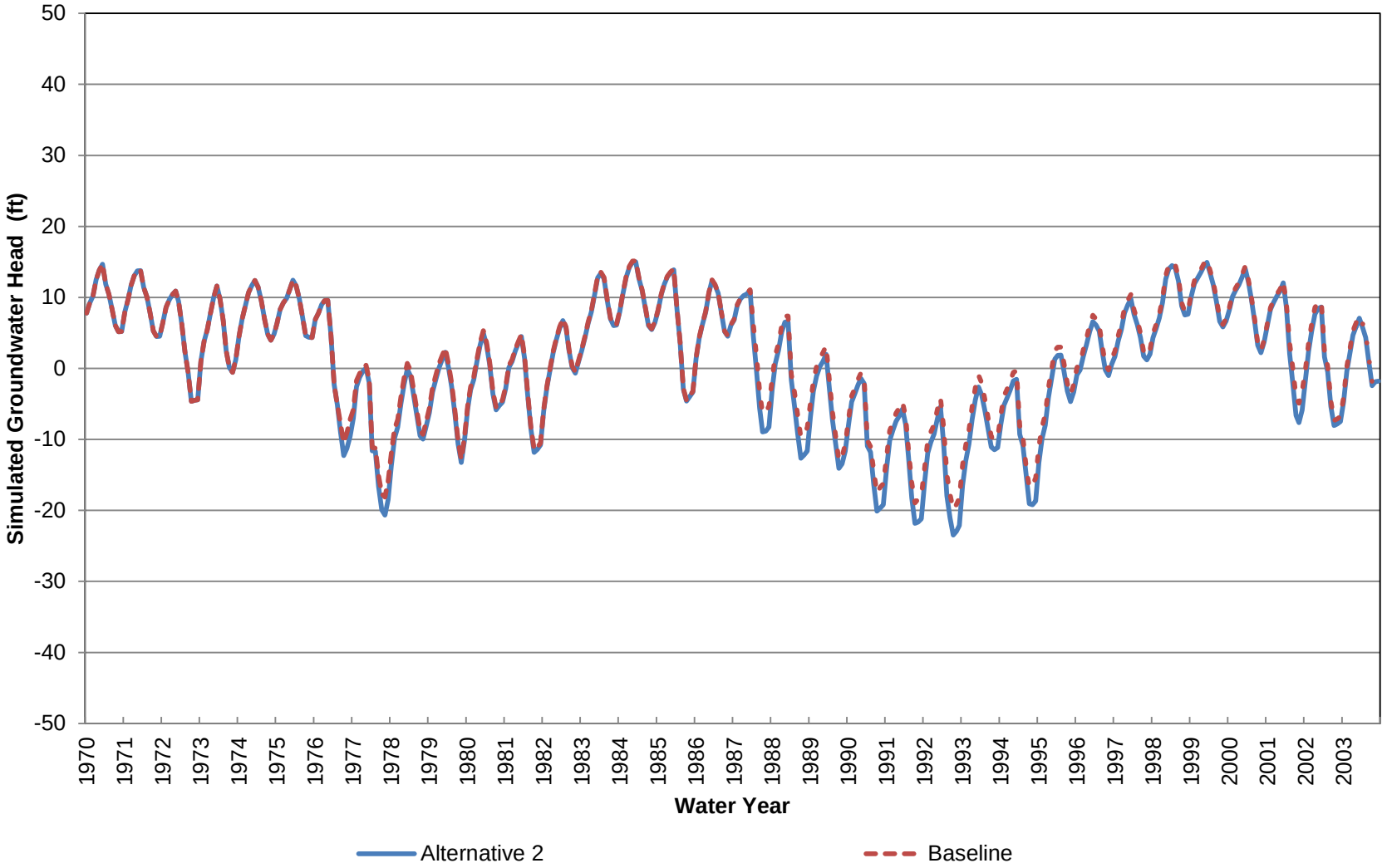
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 24 (Approximately 550-750 ft bgs)



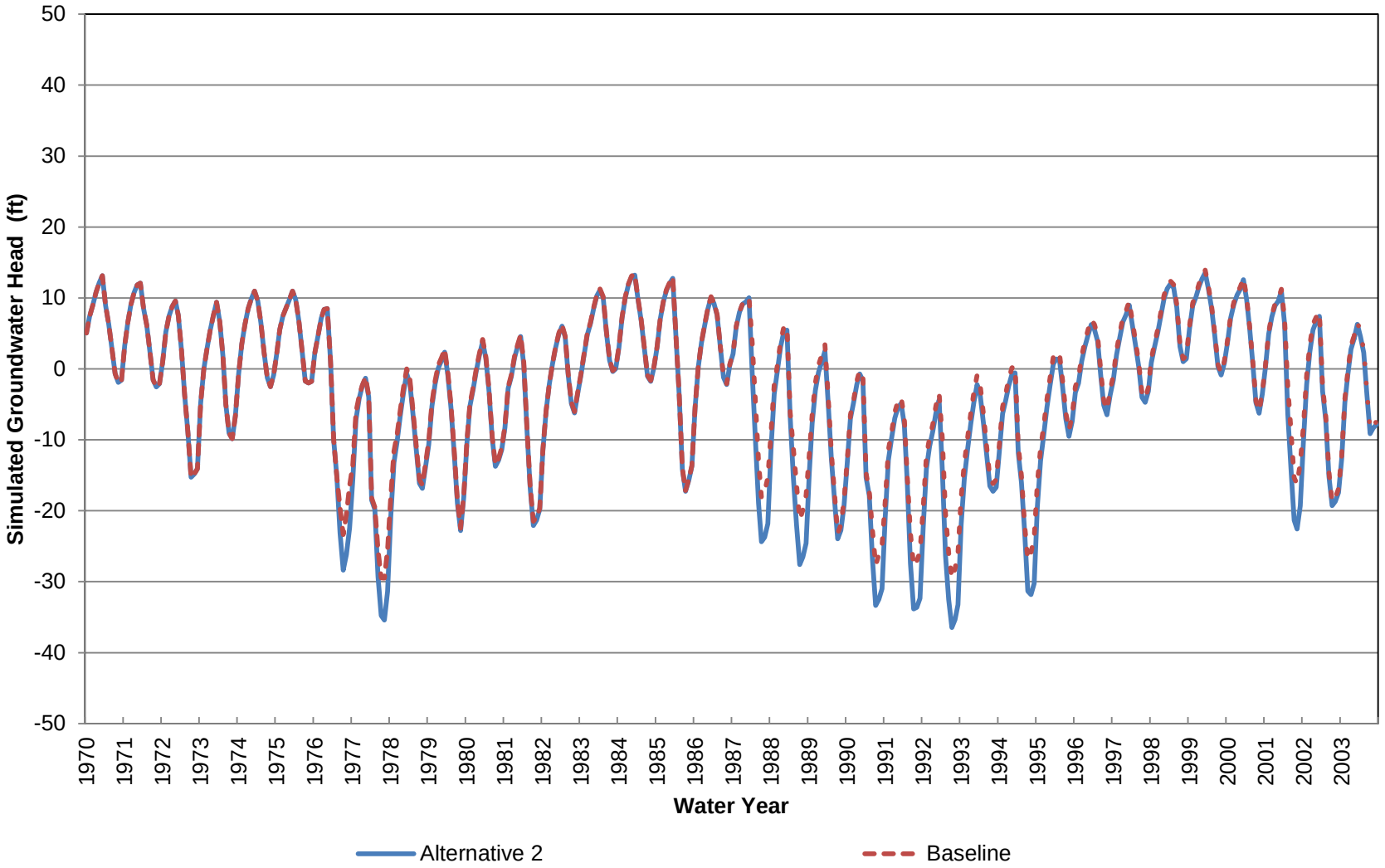
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 25 (Approximately 0-70 ft bgs)



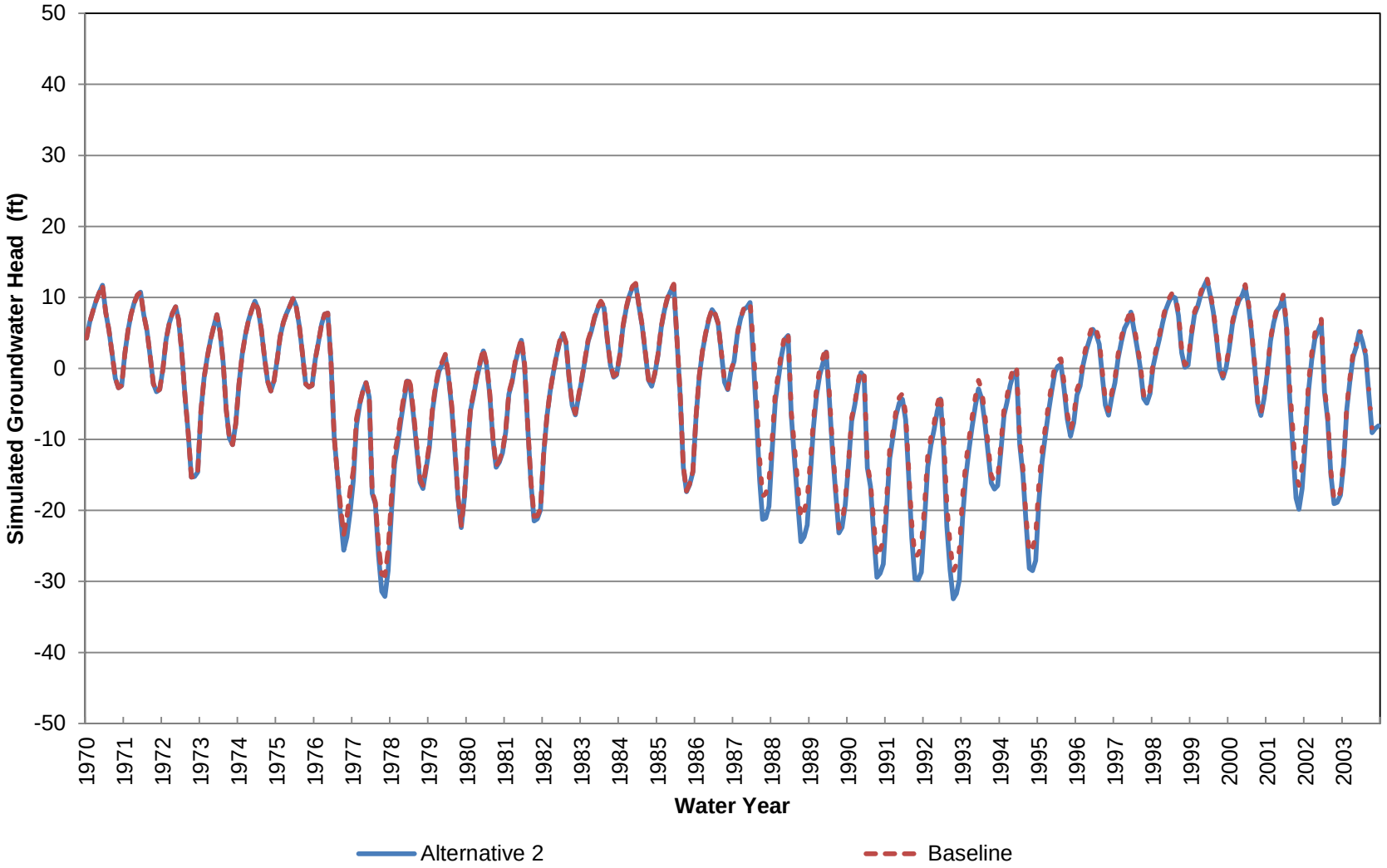
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 25 (Approximately 70-380 ft bgs)



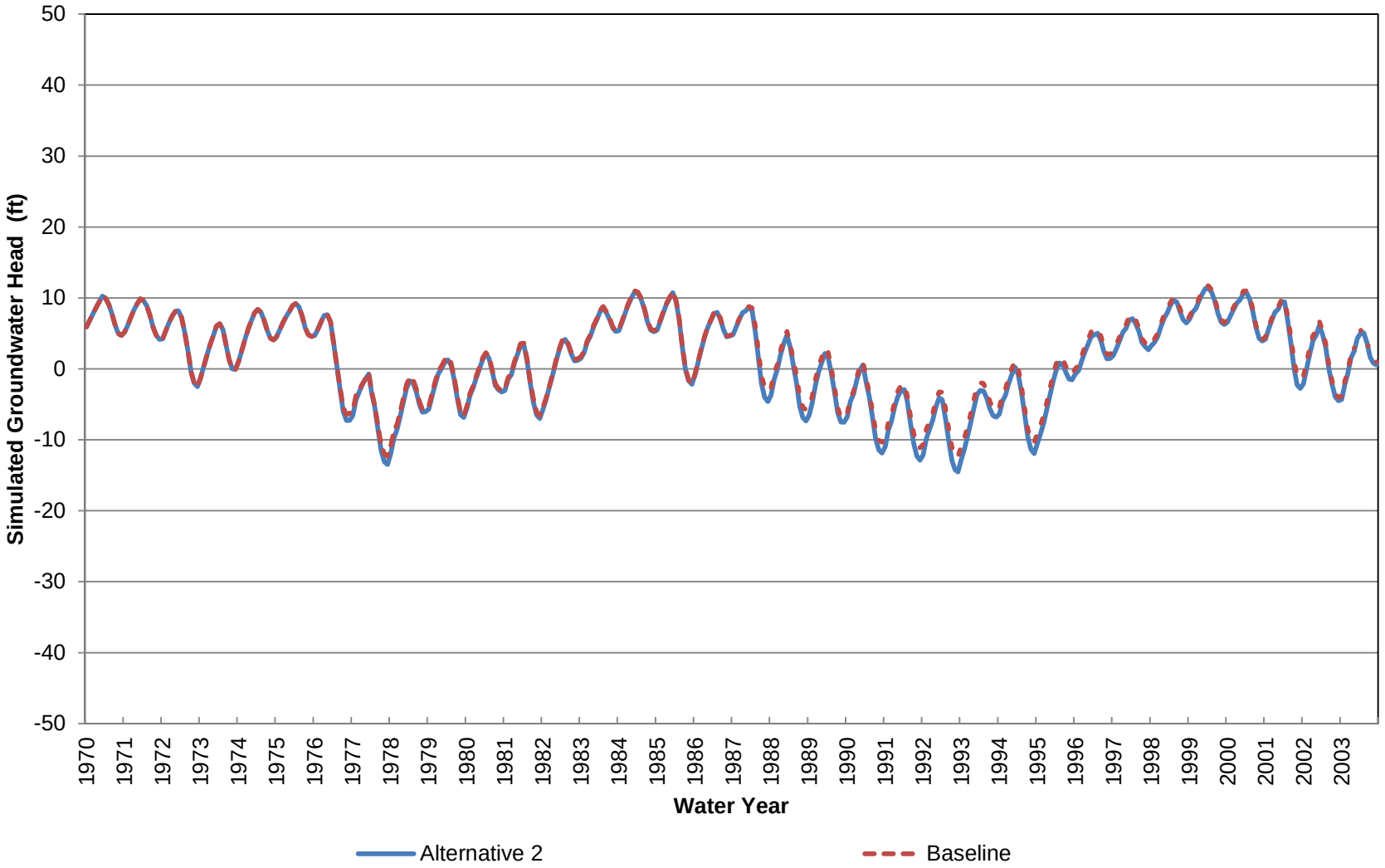
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 25 (Approximately 380-680 ft bgs)



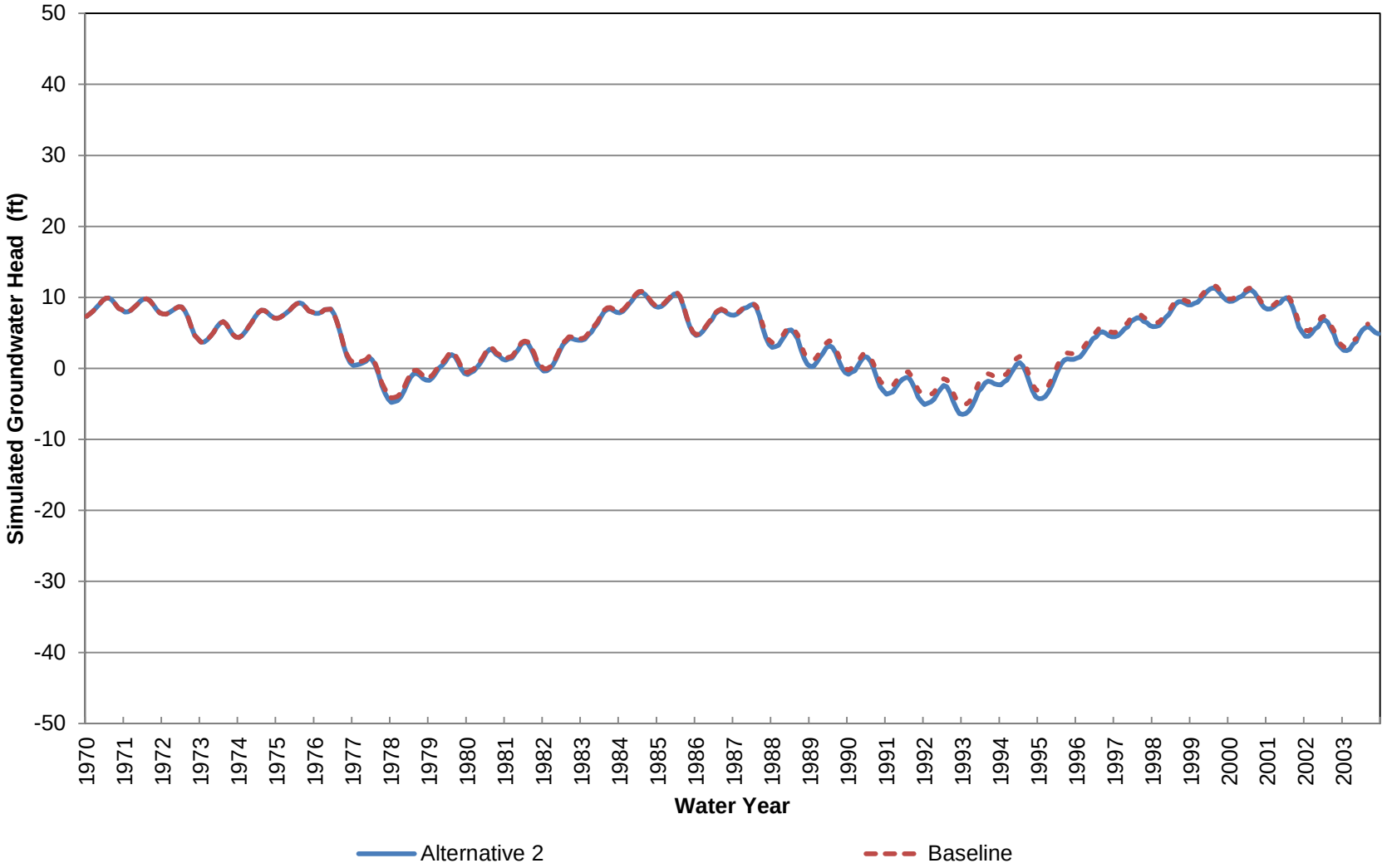
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 25 (Approximately 680-990 ft bgs)



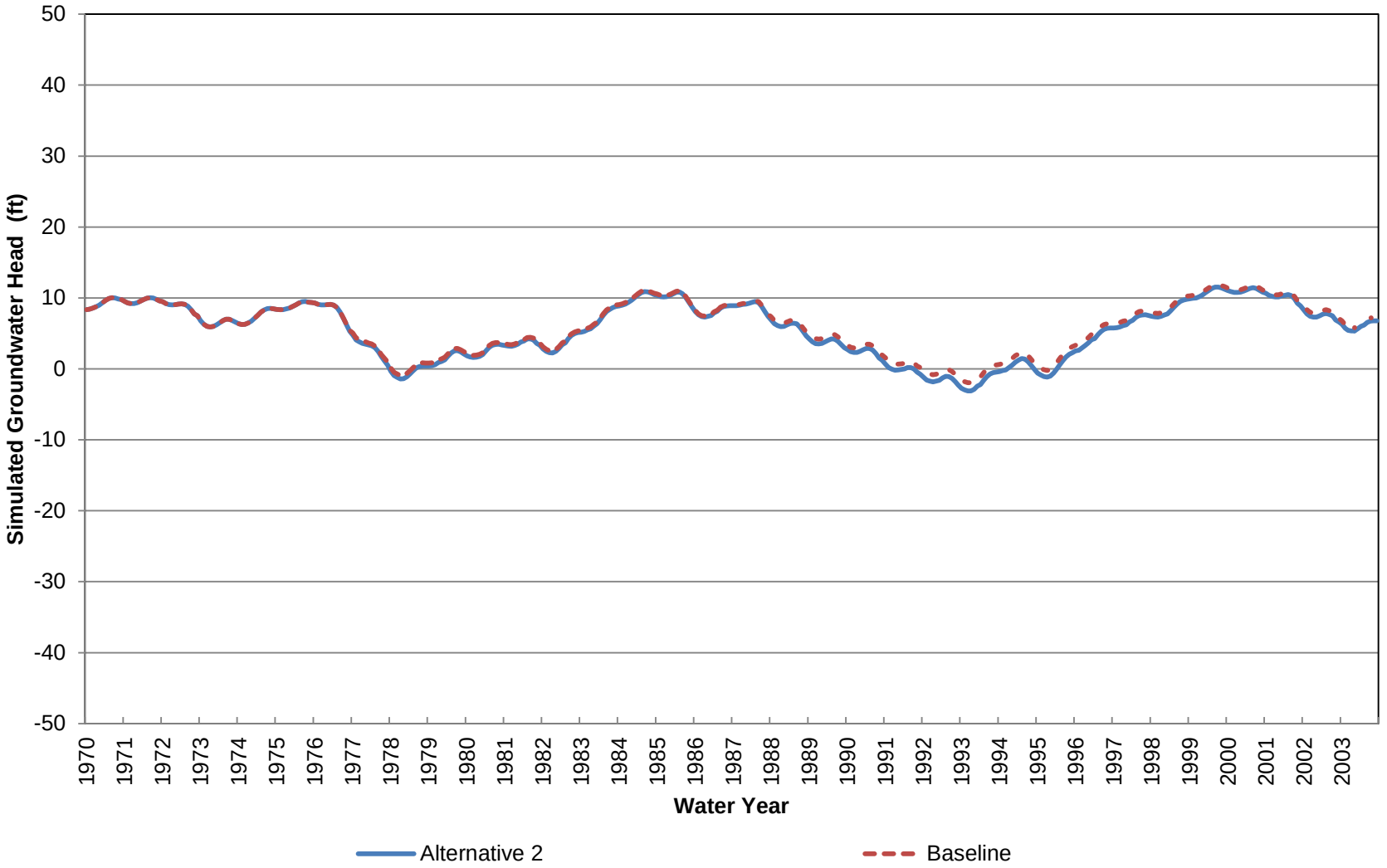
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 25 (Approximately 990-1530 ft bgs)



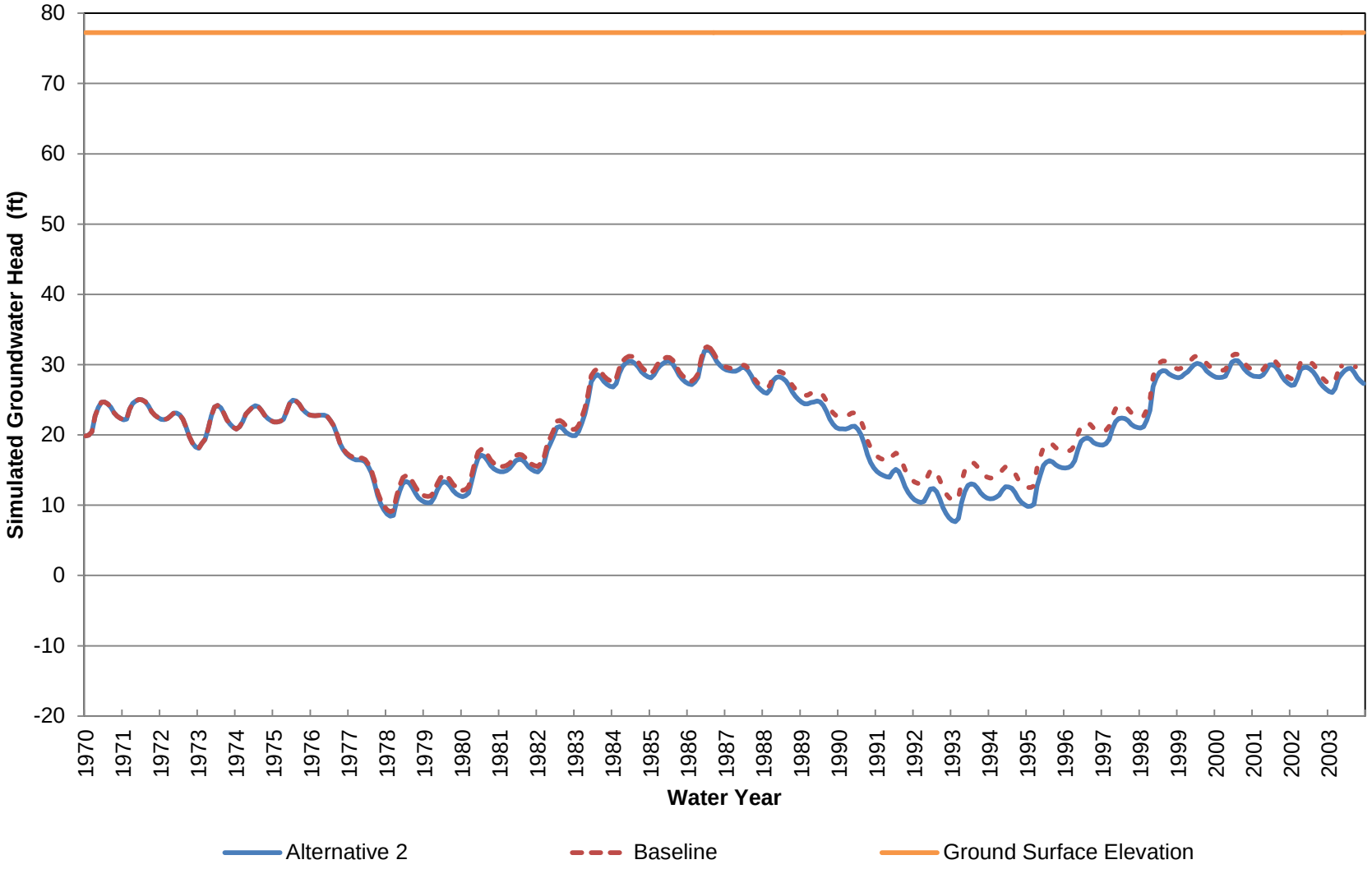
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 25 (Approximately 1530-2040 ft bgs)



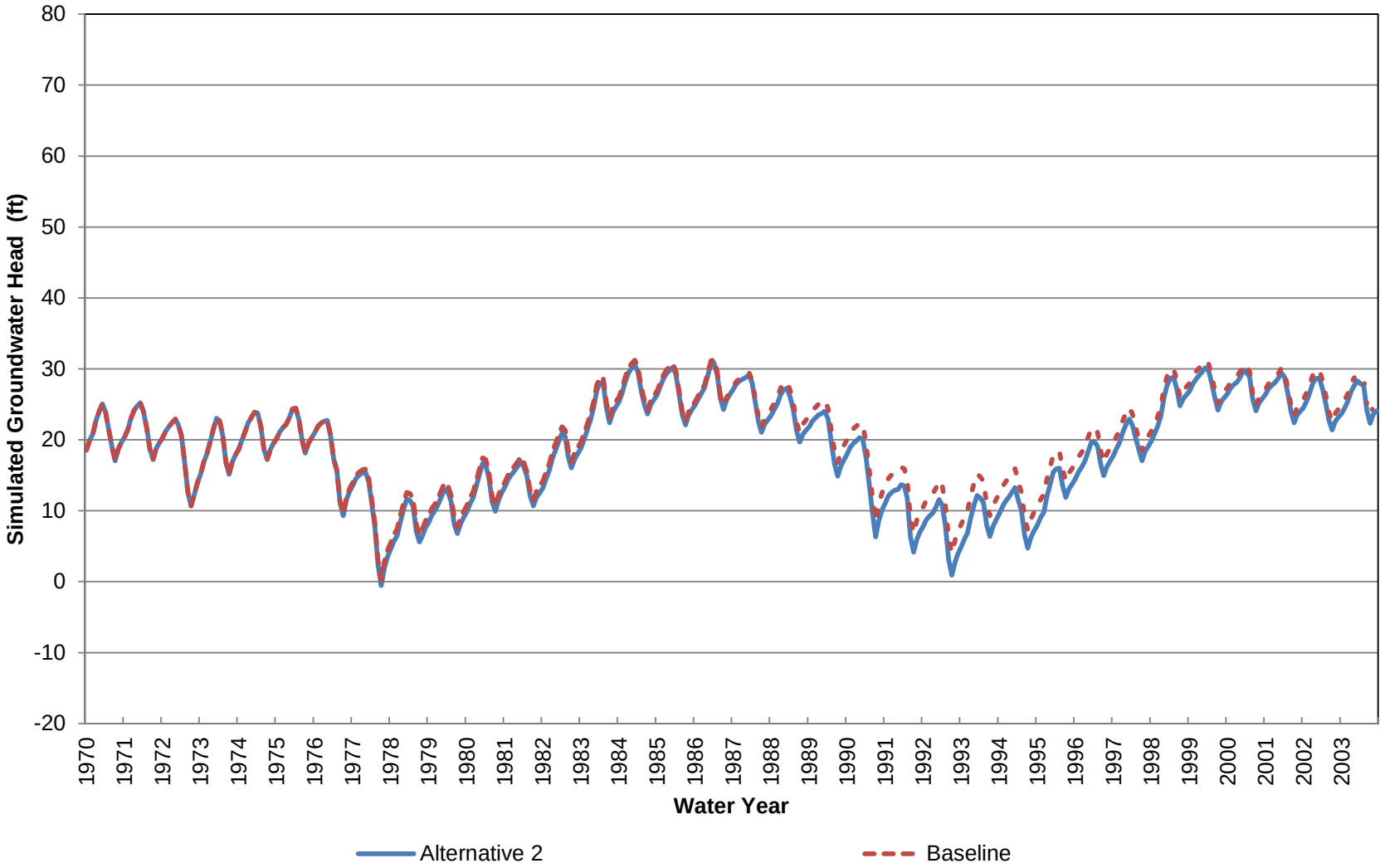
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 25 (Approximately 2040-2800 ft bgs)



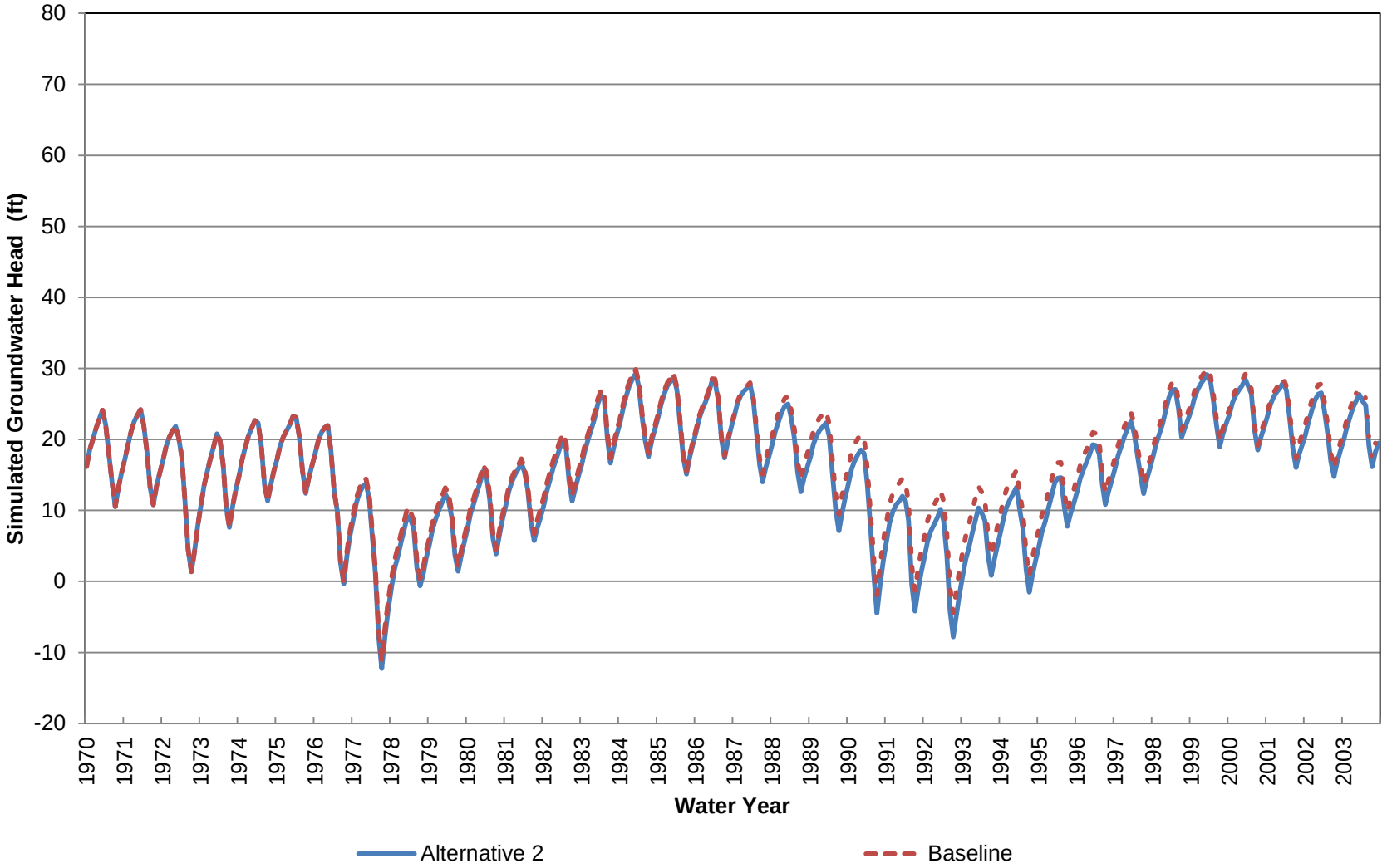
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 26 (Approximately 0-70 ft bgs)



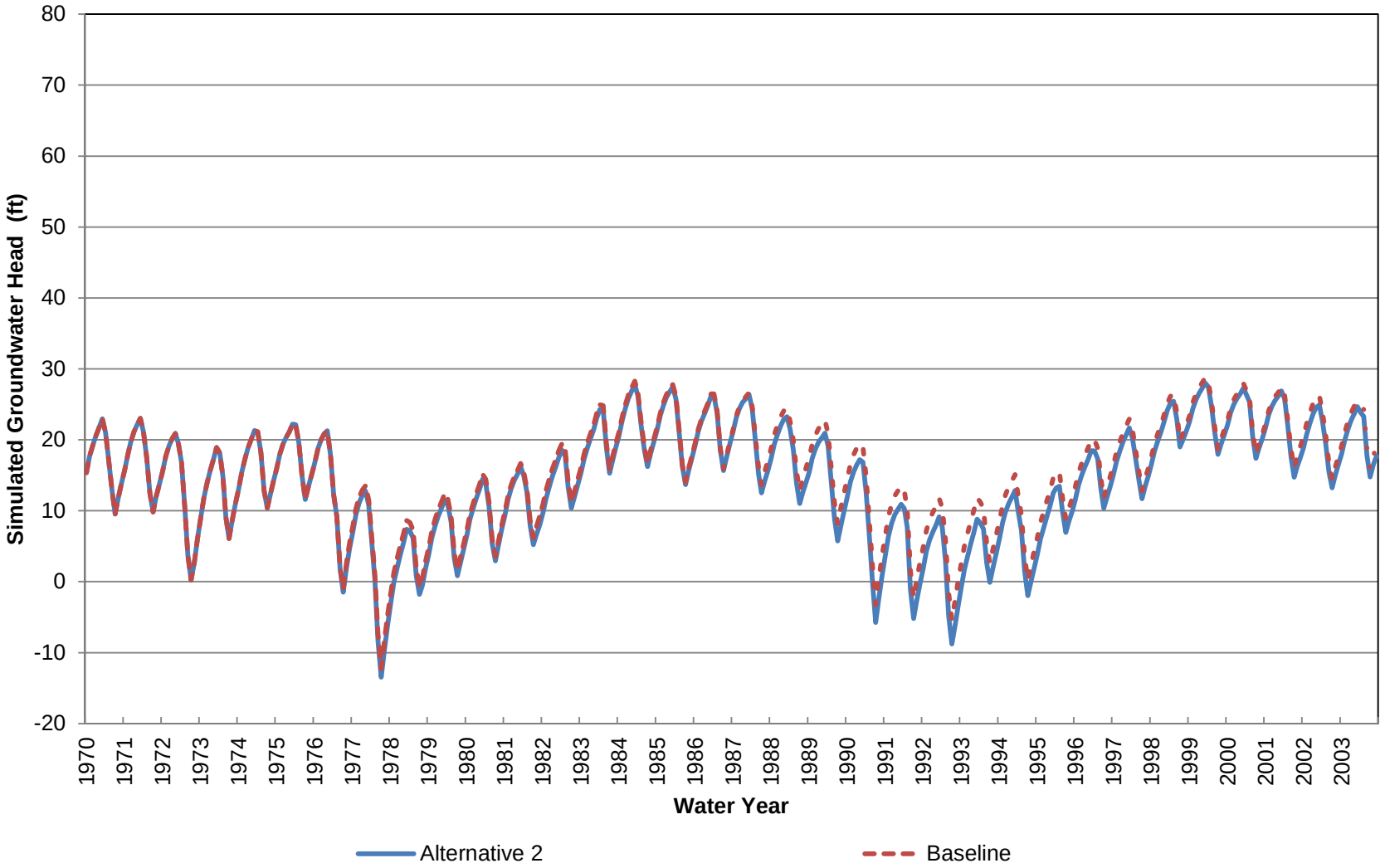
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 26 (Approximately 70-380 ft bgs)



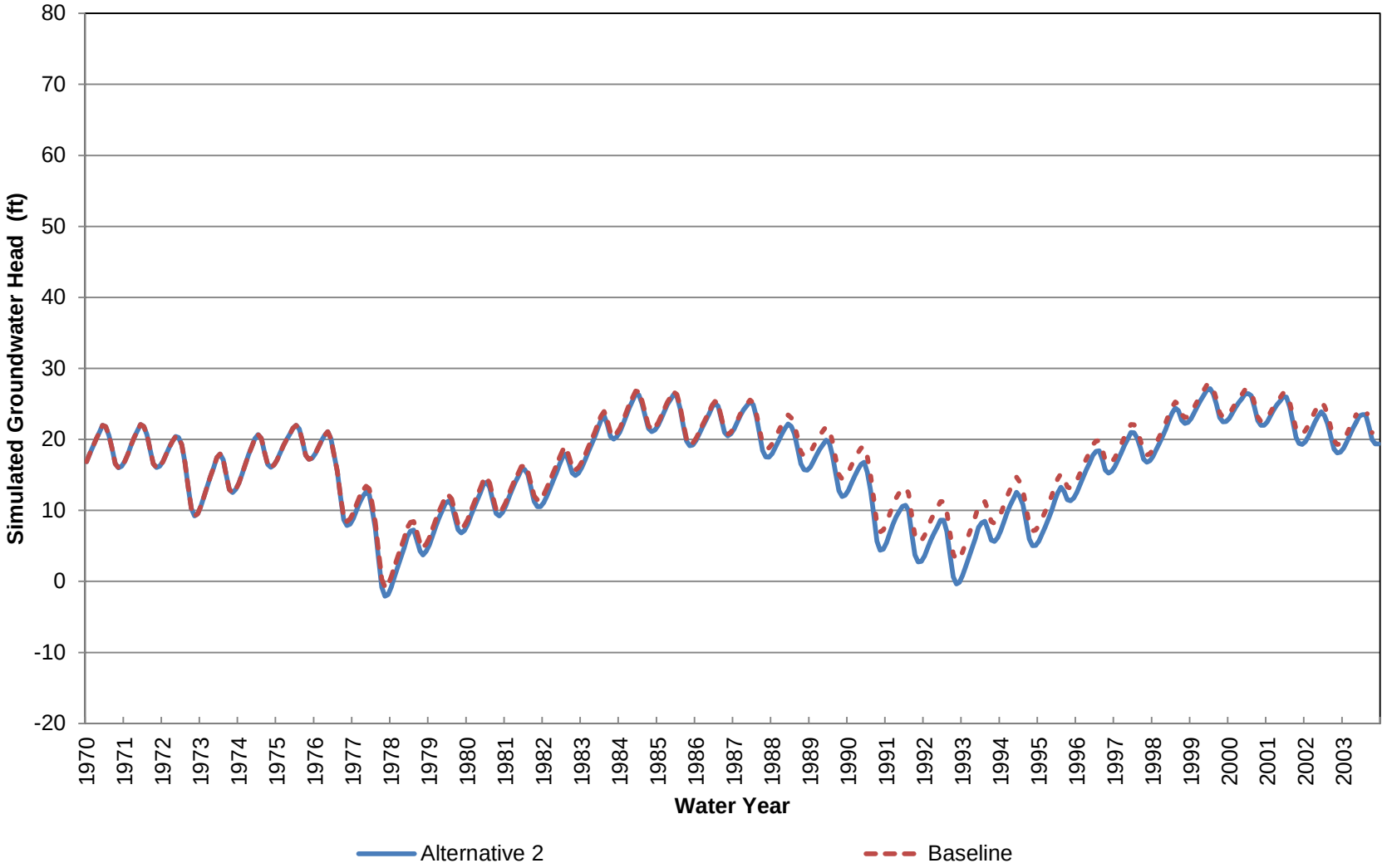
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 26 (Approximately 380-690 ft bgs)



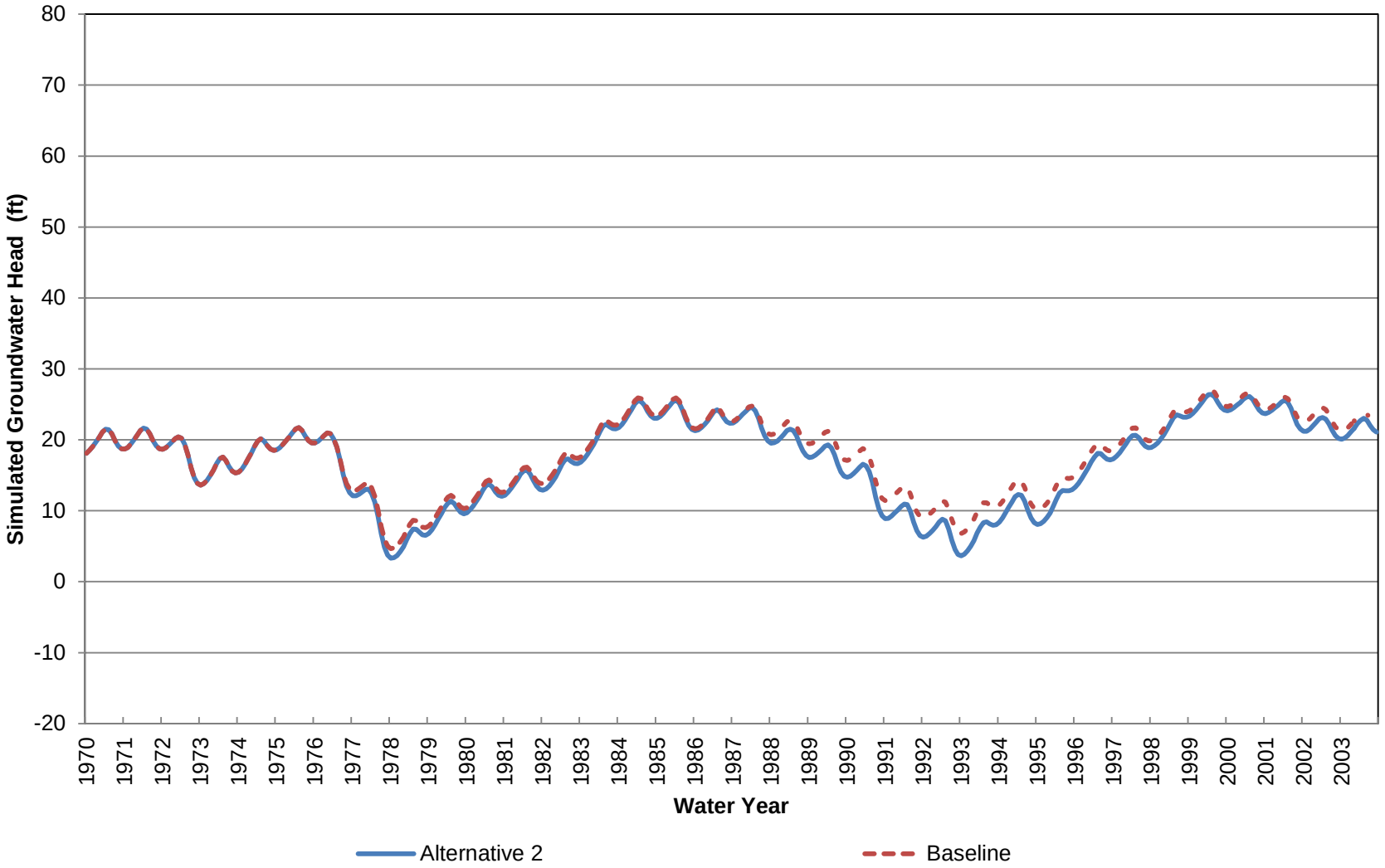
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 26 (Approximately 690-1000 ft bgs)



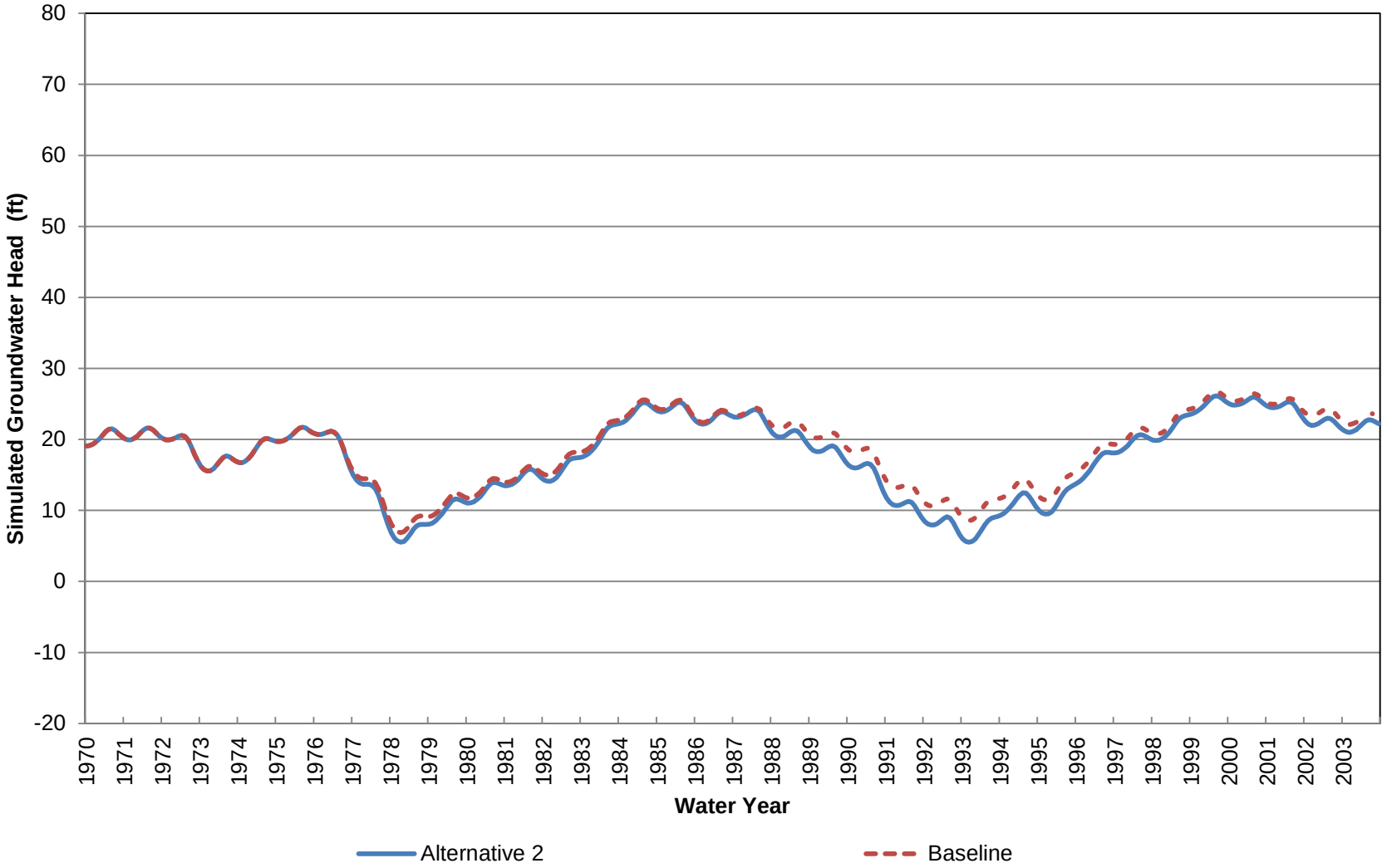
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 26 (Approximately 1000-1550 ft bgs)



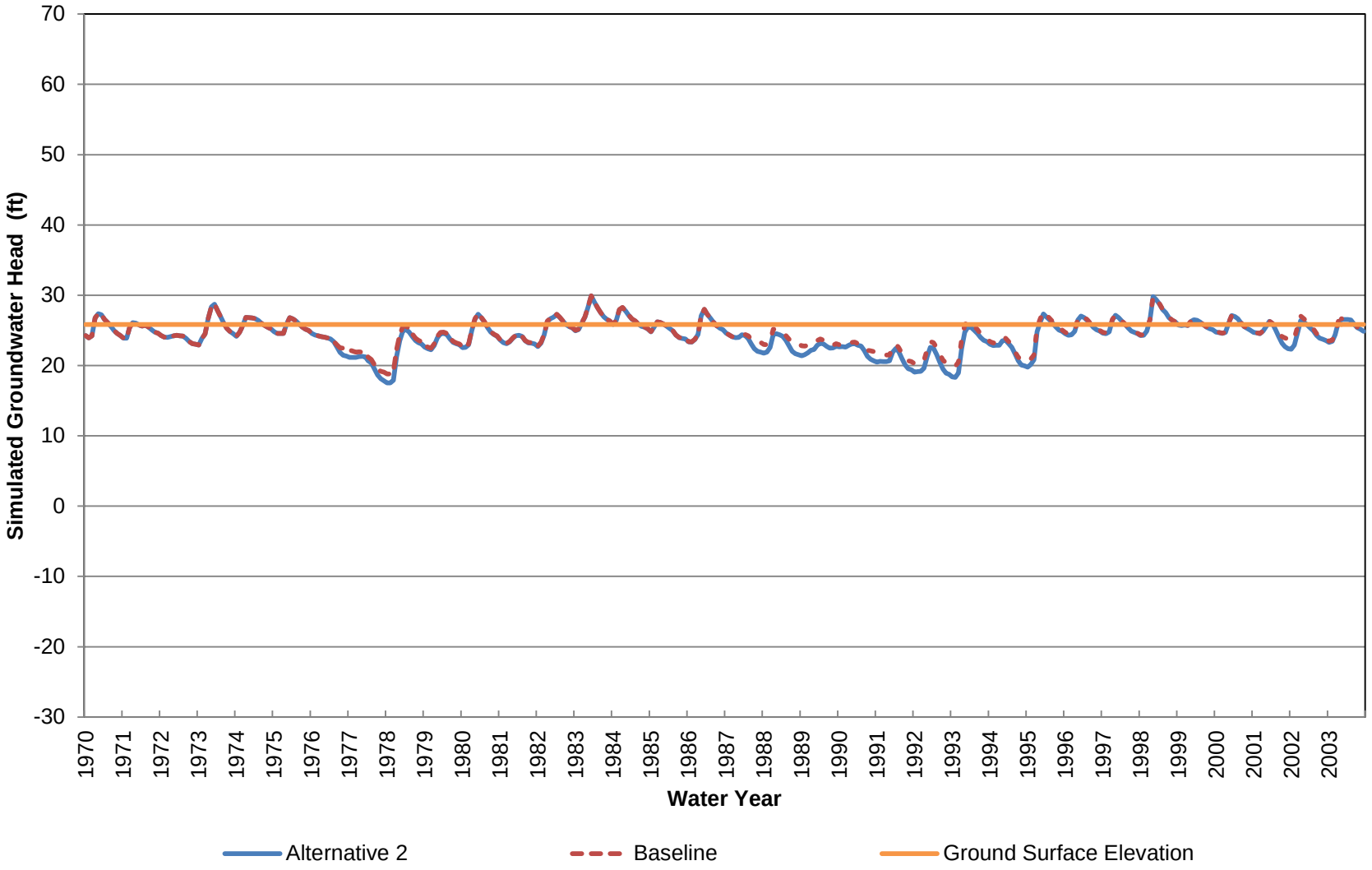
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 26 (Approximately 1550-2070 ft bgs)



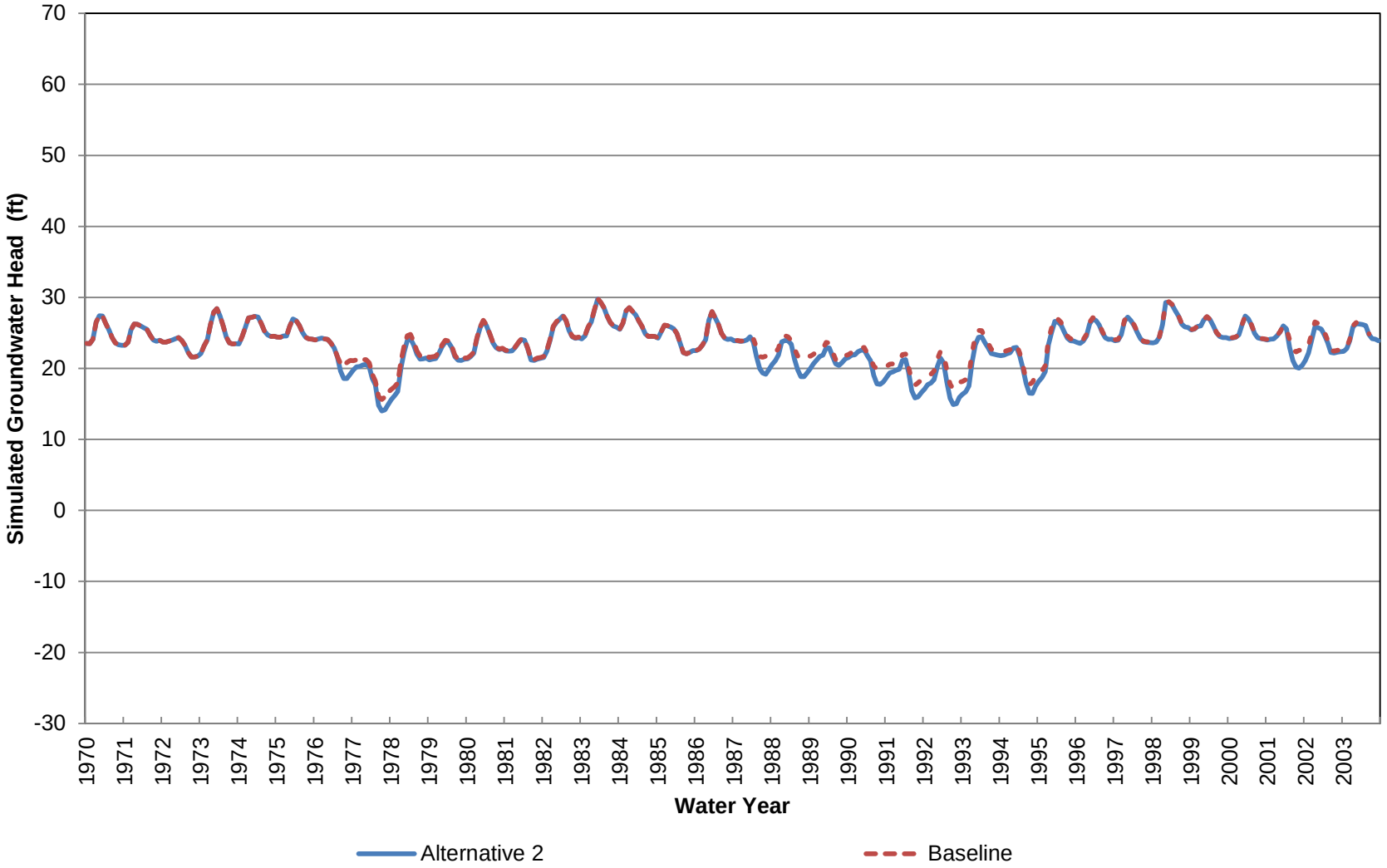
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 26 (Approximately 2070-2840 ft bgs)



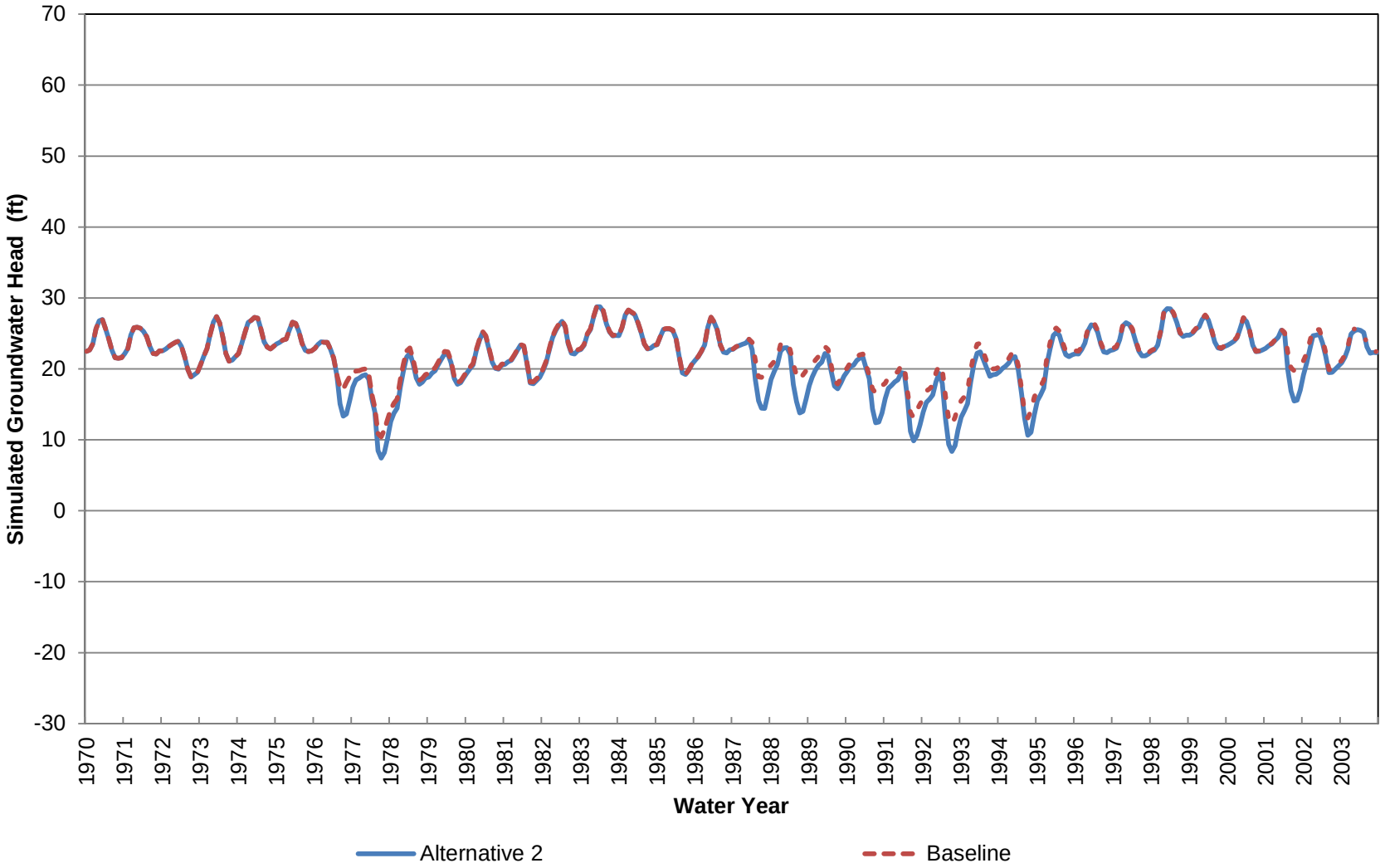
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 27 (Approximately 0-70 ft bgs)



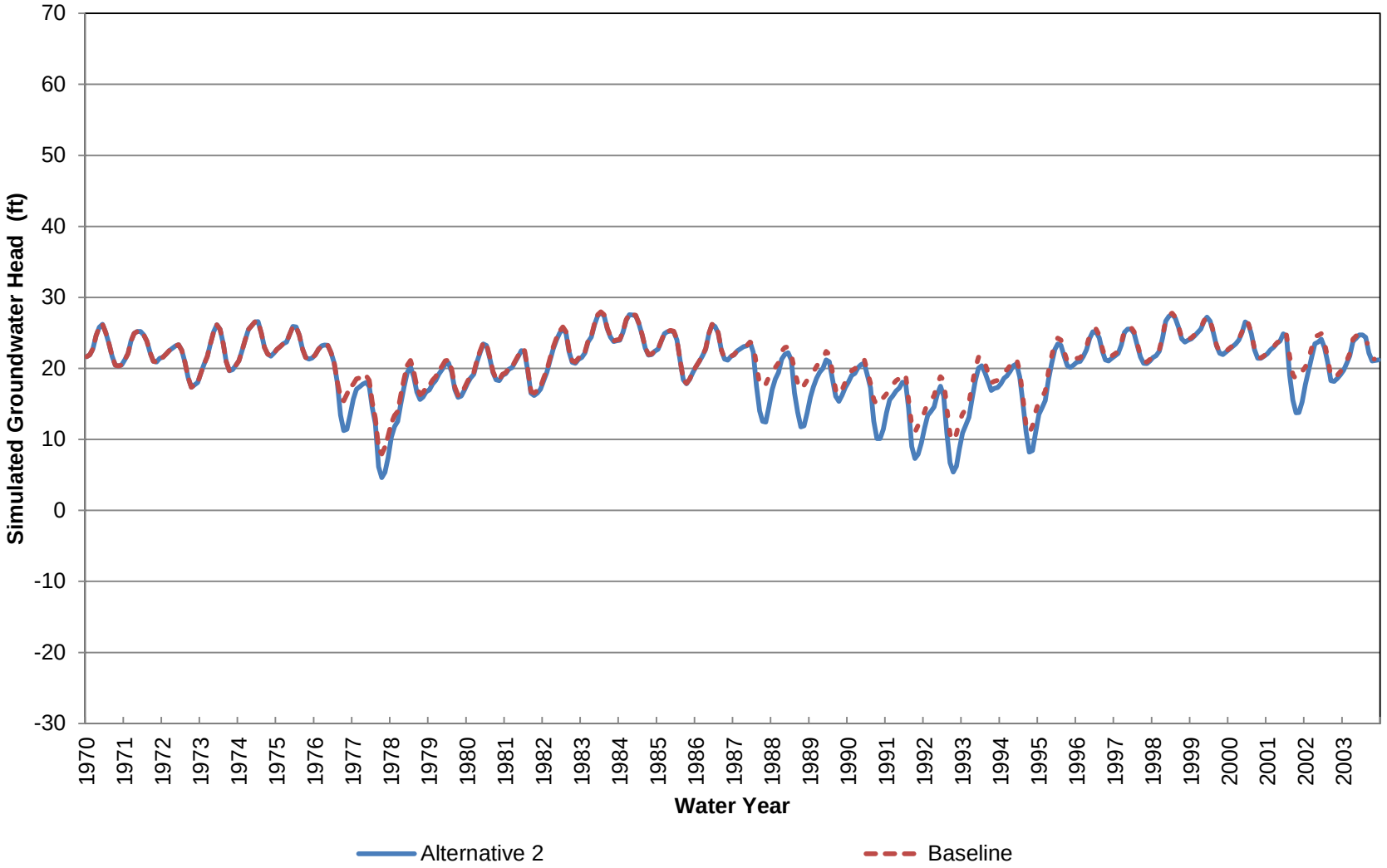
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 27 (Approximately 70-220 ft bgs)



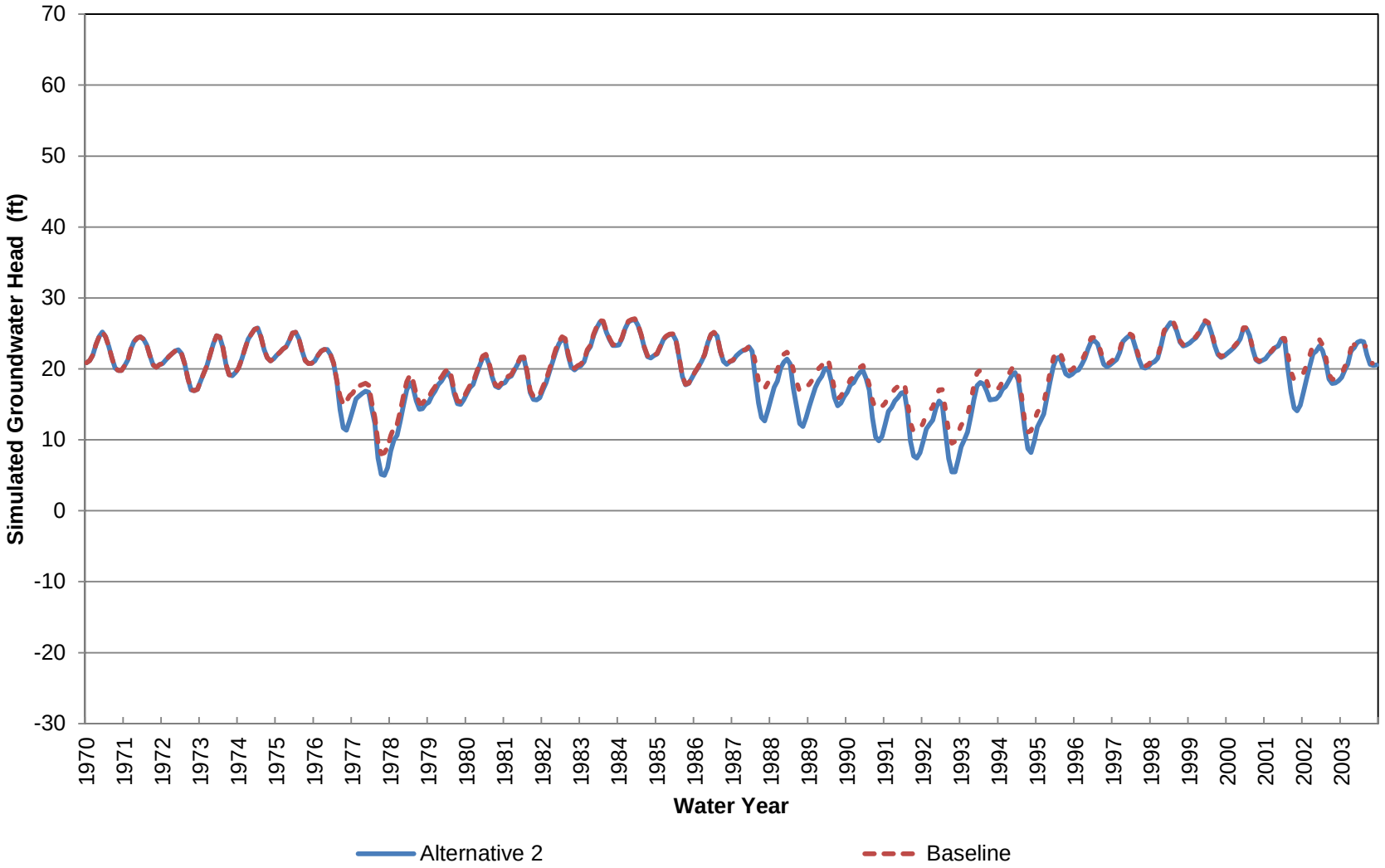
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 27 (Approximately 220-380 ft bgs)



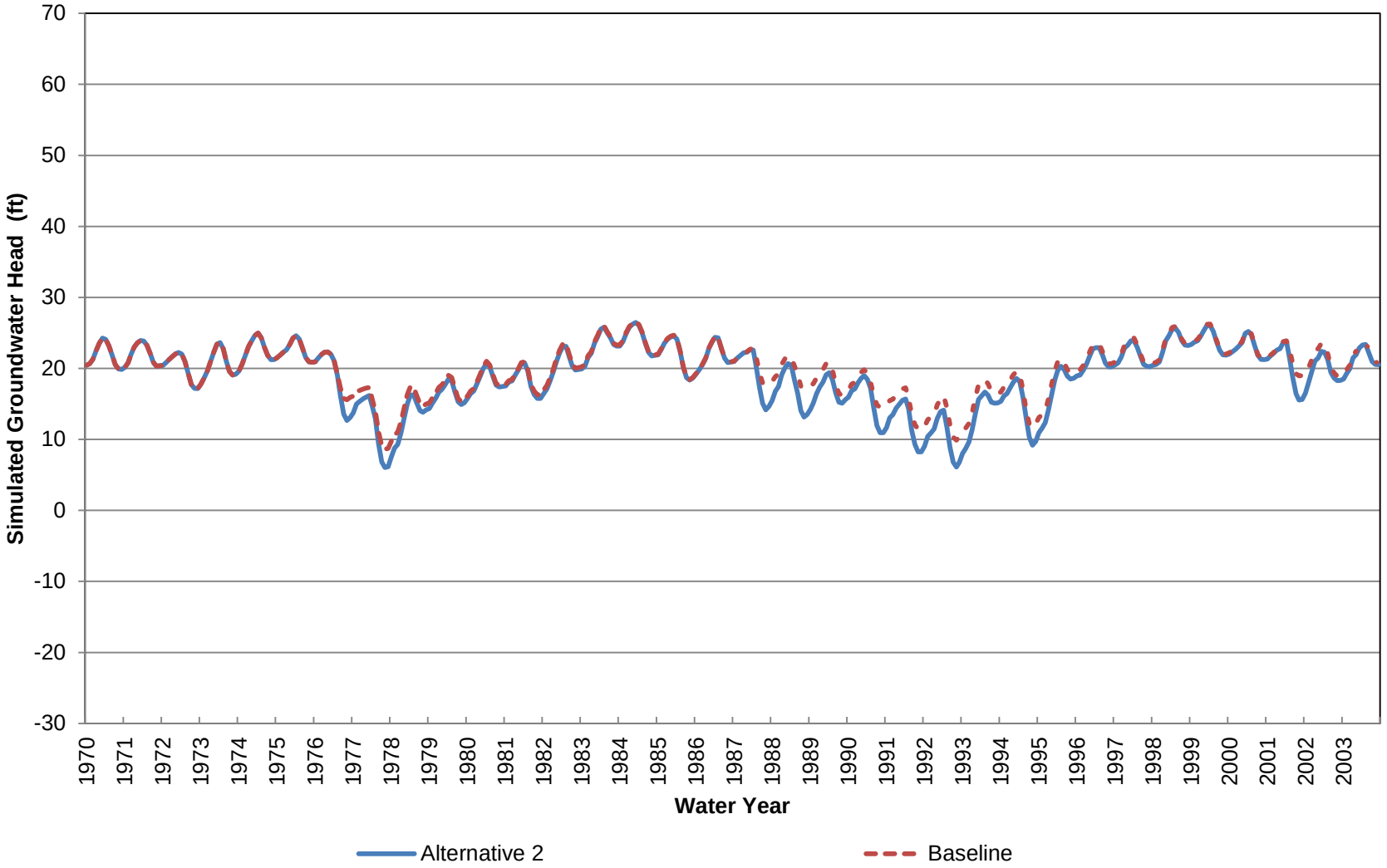
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 27 (Approximately 380-530 ft bgs)



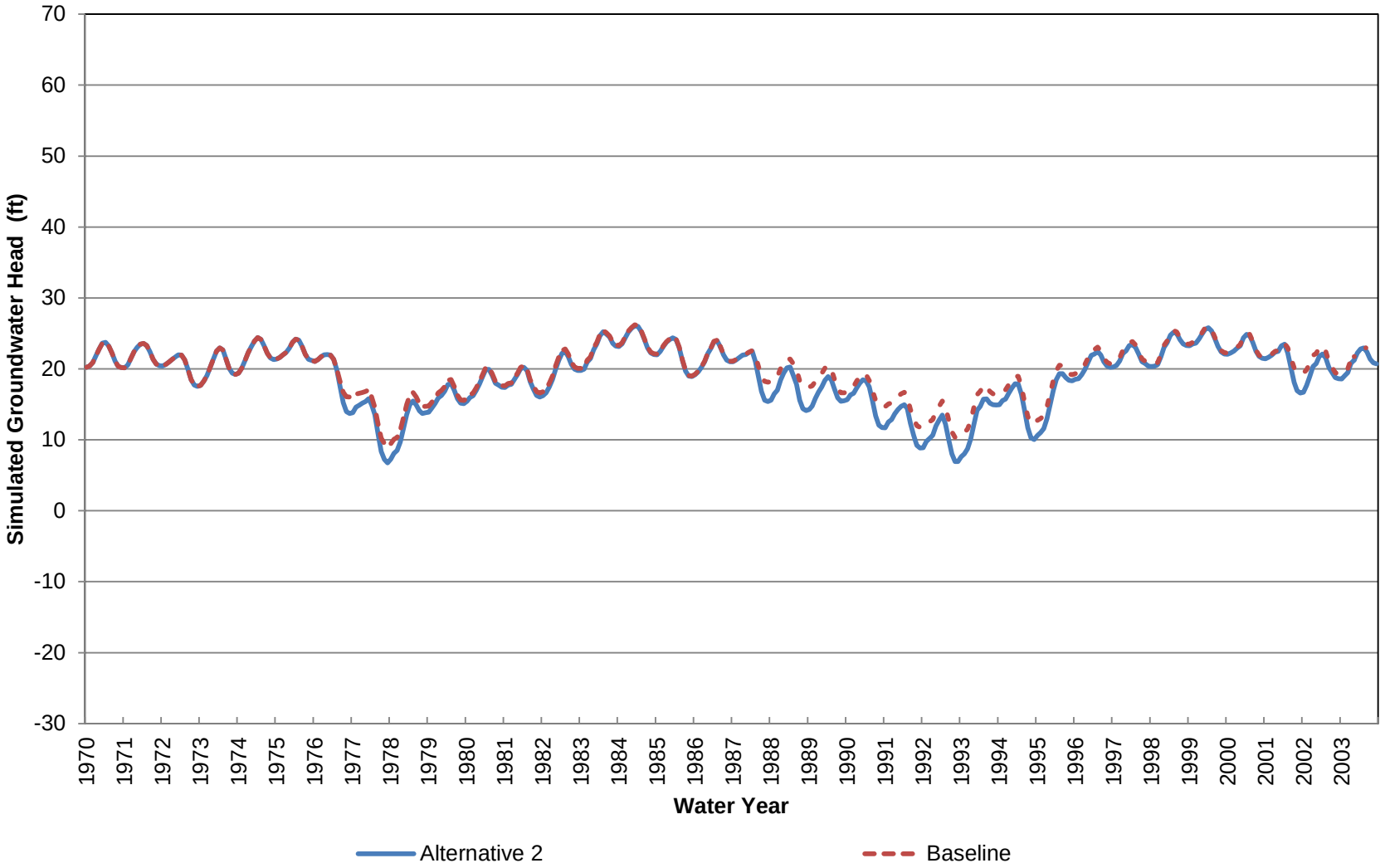
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 27 (Approximately 530-770 ft bgs)



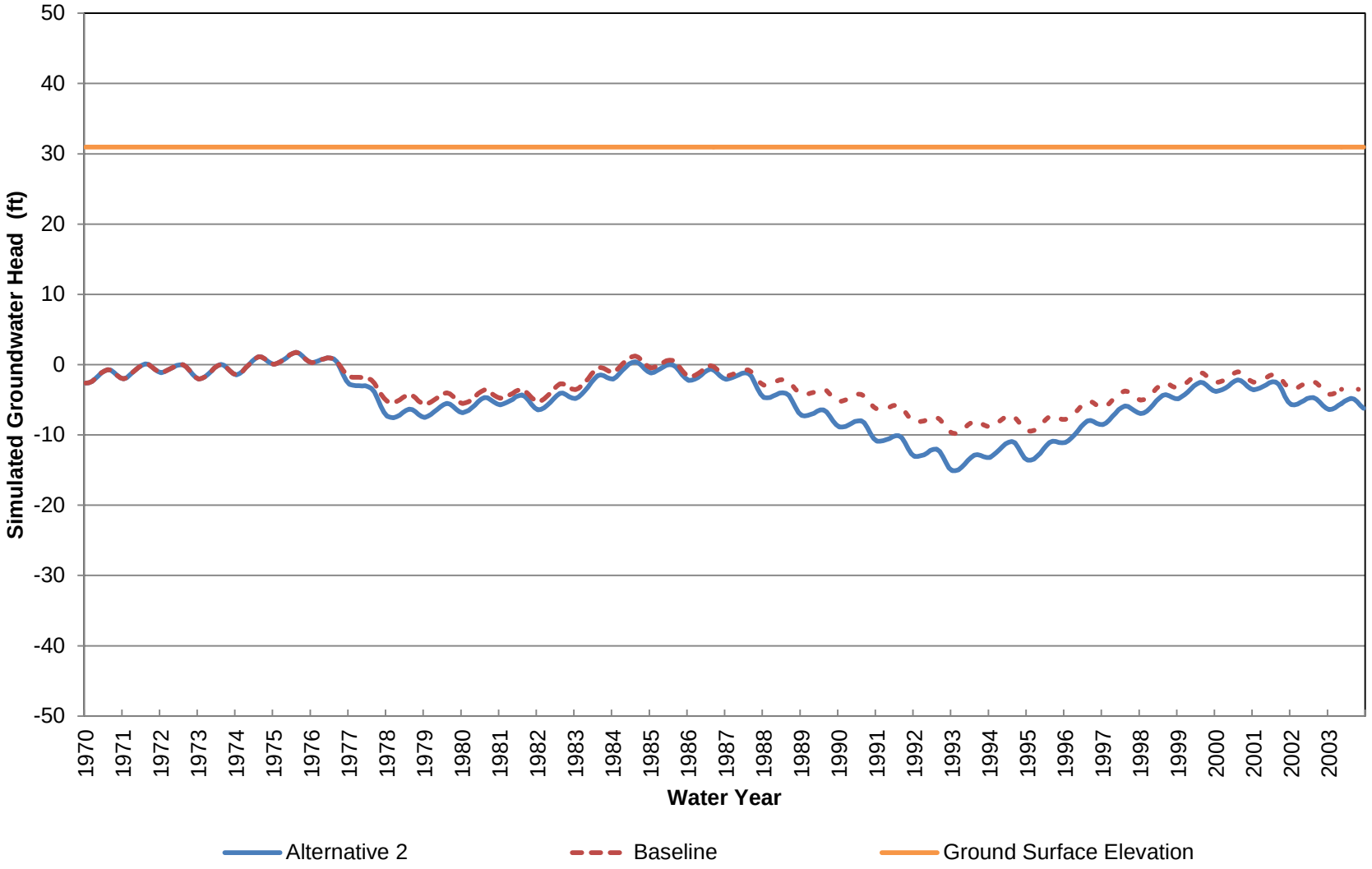
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 27 (Approximately 770-1030 ft bgs)



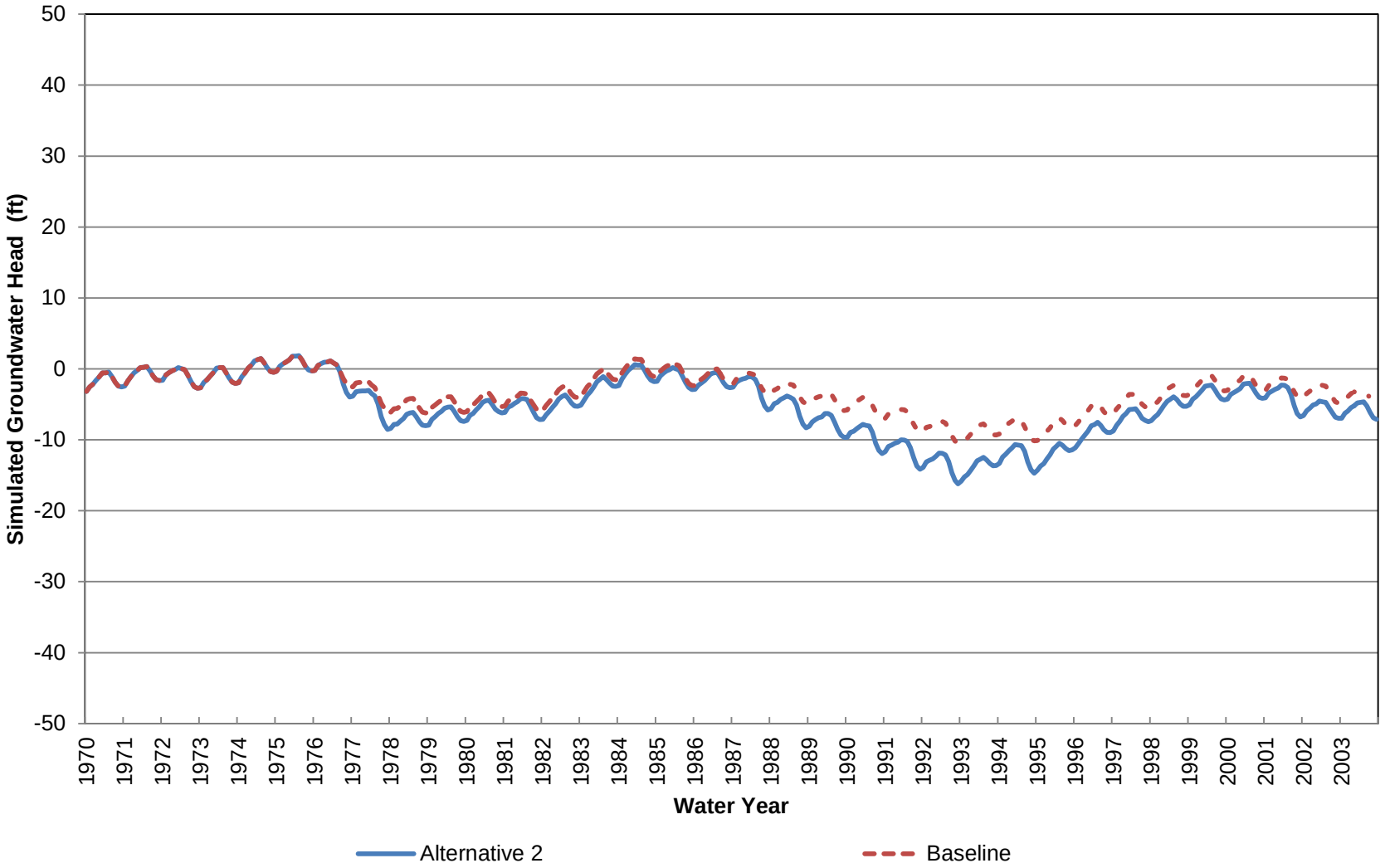
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 27 (Approximately 1030-1410 ft bgs)



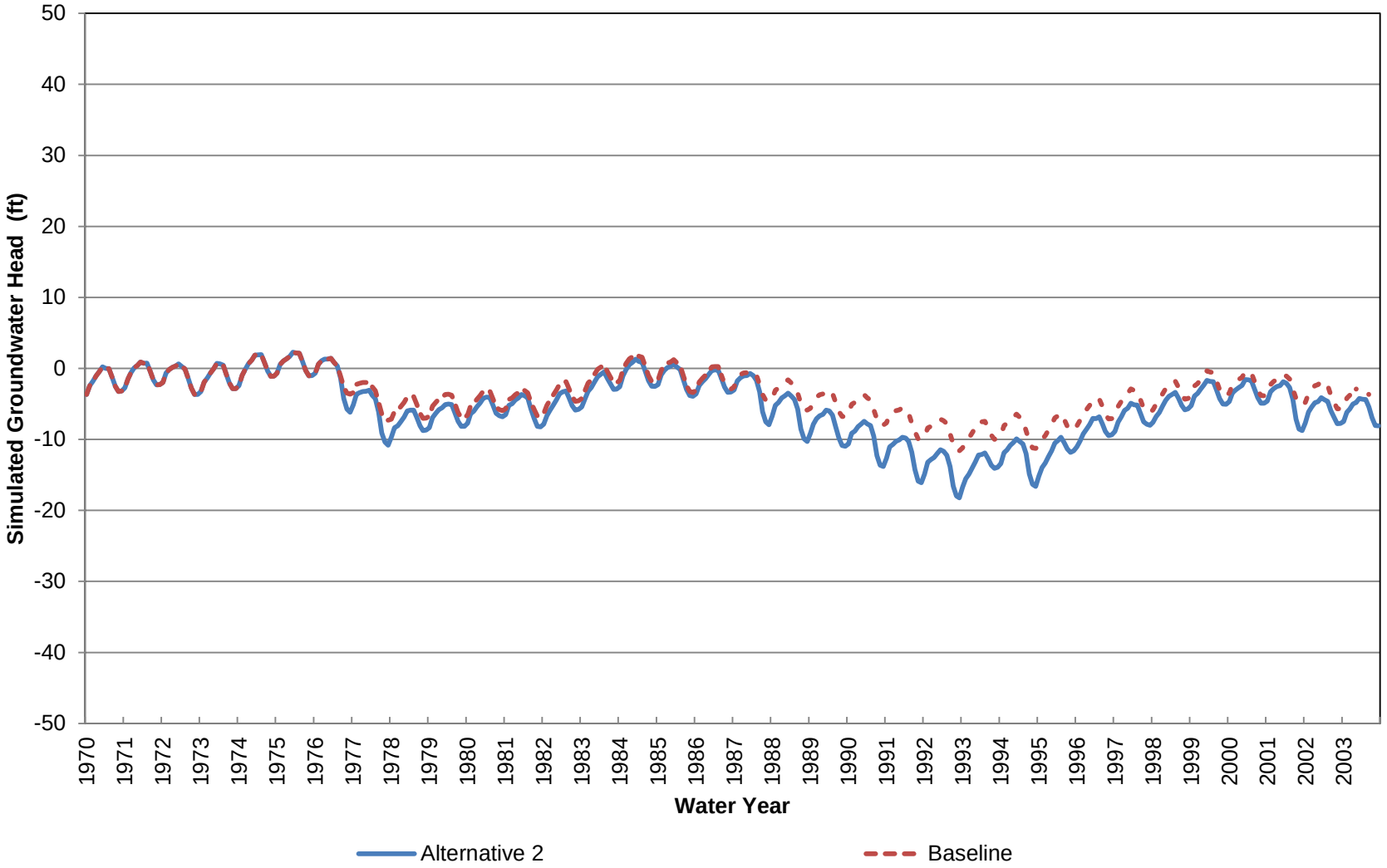
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 28 (Approximately 0-70 ft bgs)



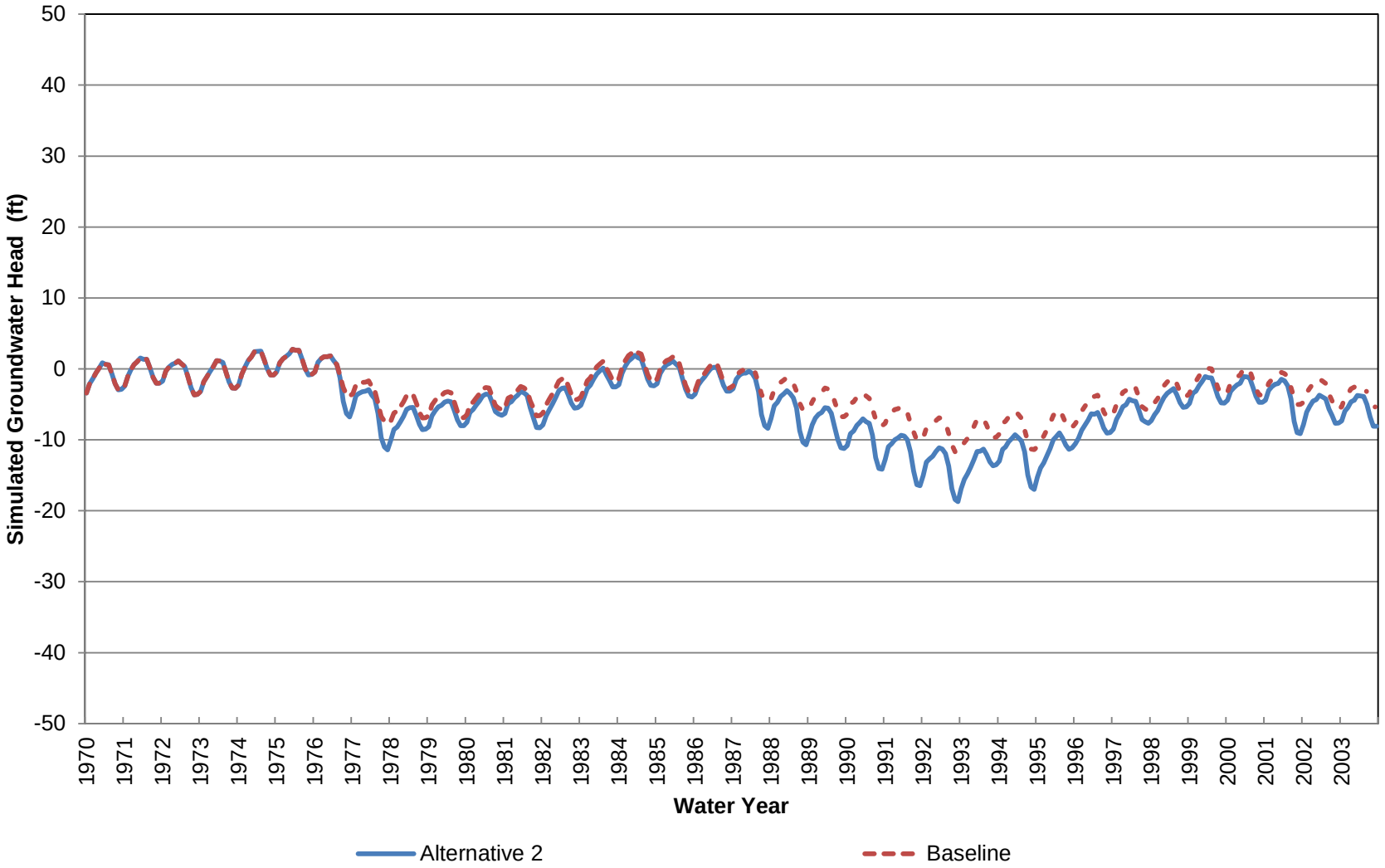
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 28 (Approximately 70-250 ft bgs)



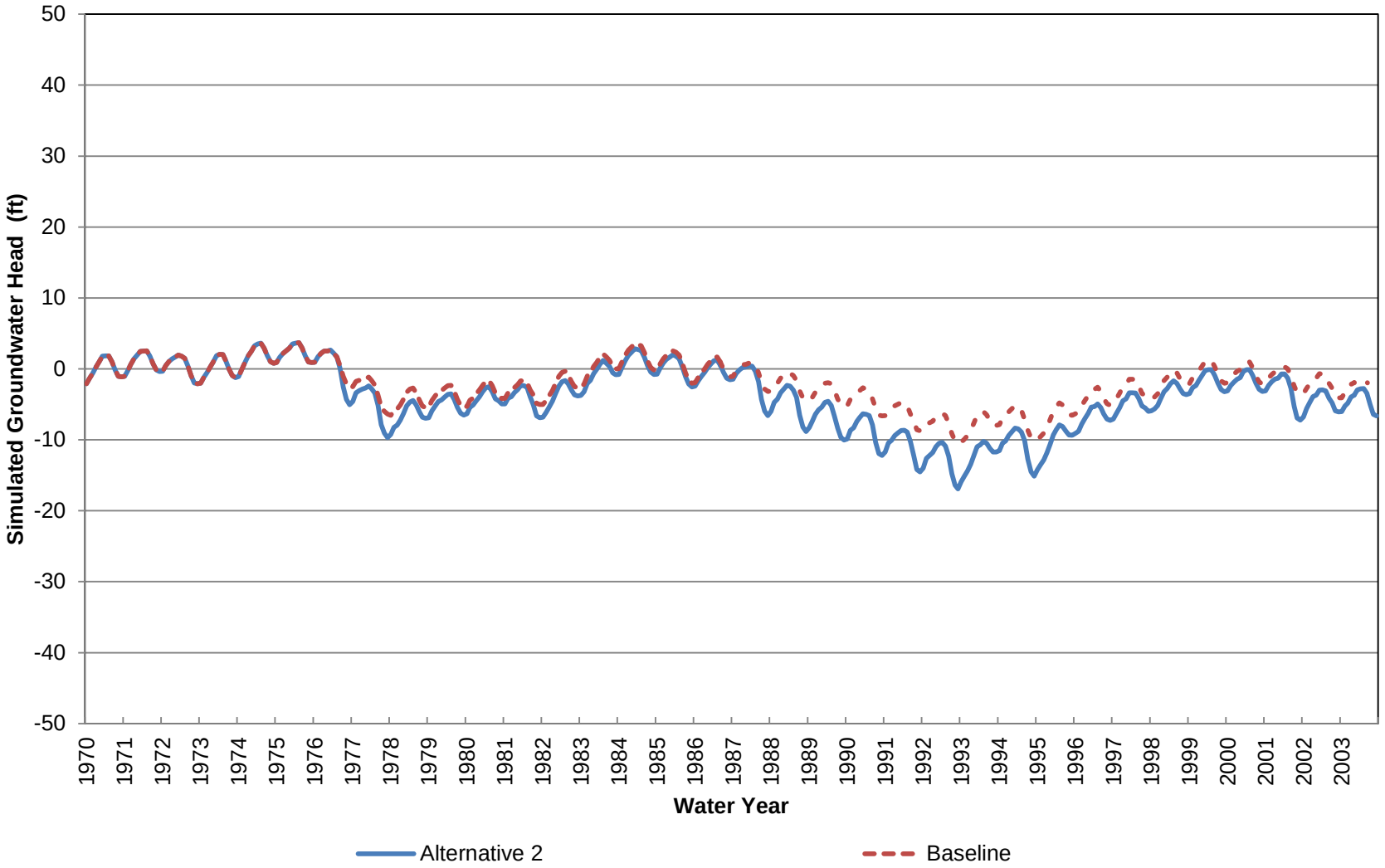
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 28 (Approximately 250-440 ft bgs)



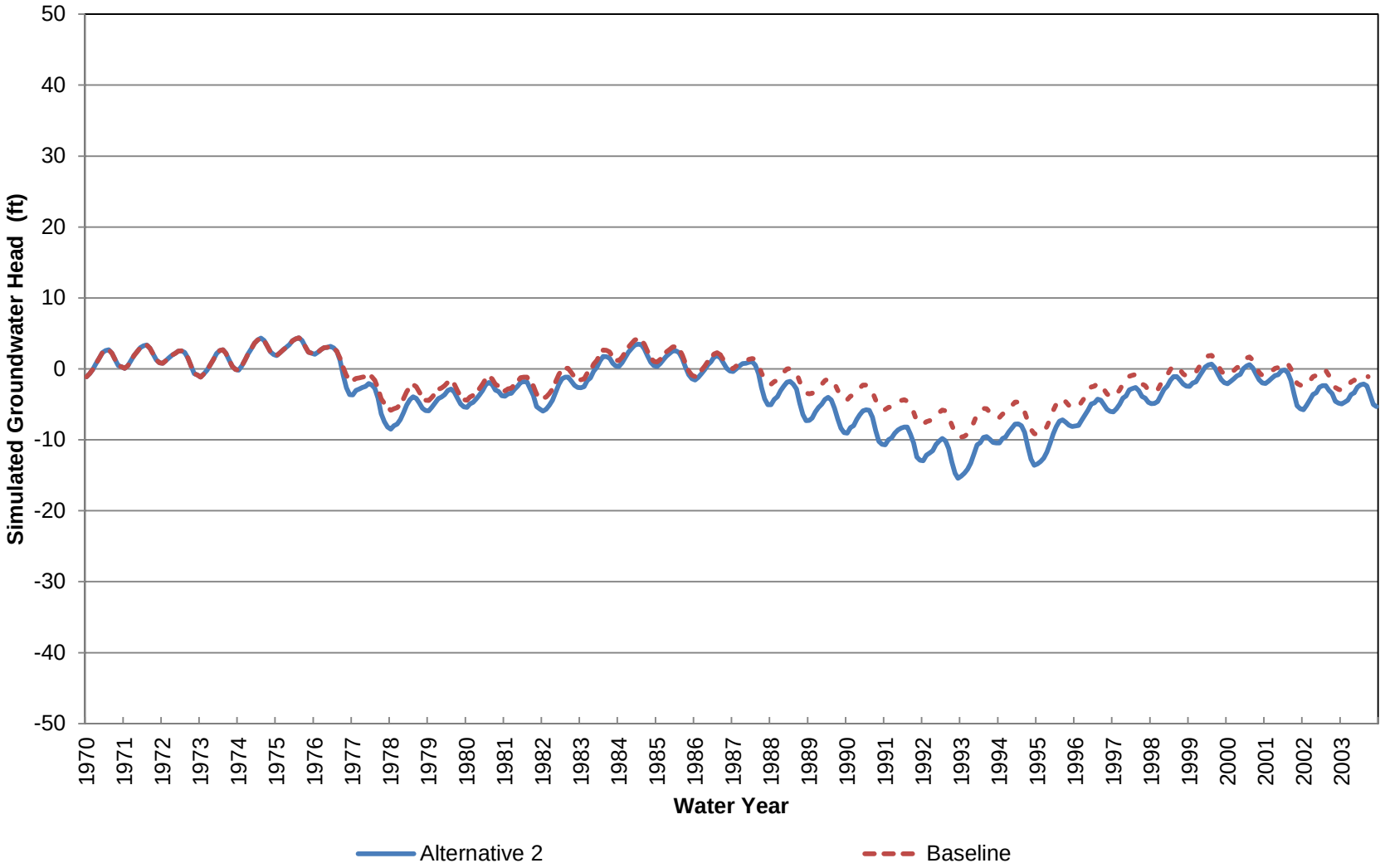
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 28 (Approximately 440-620 ft bgs)



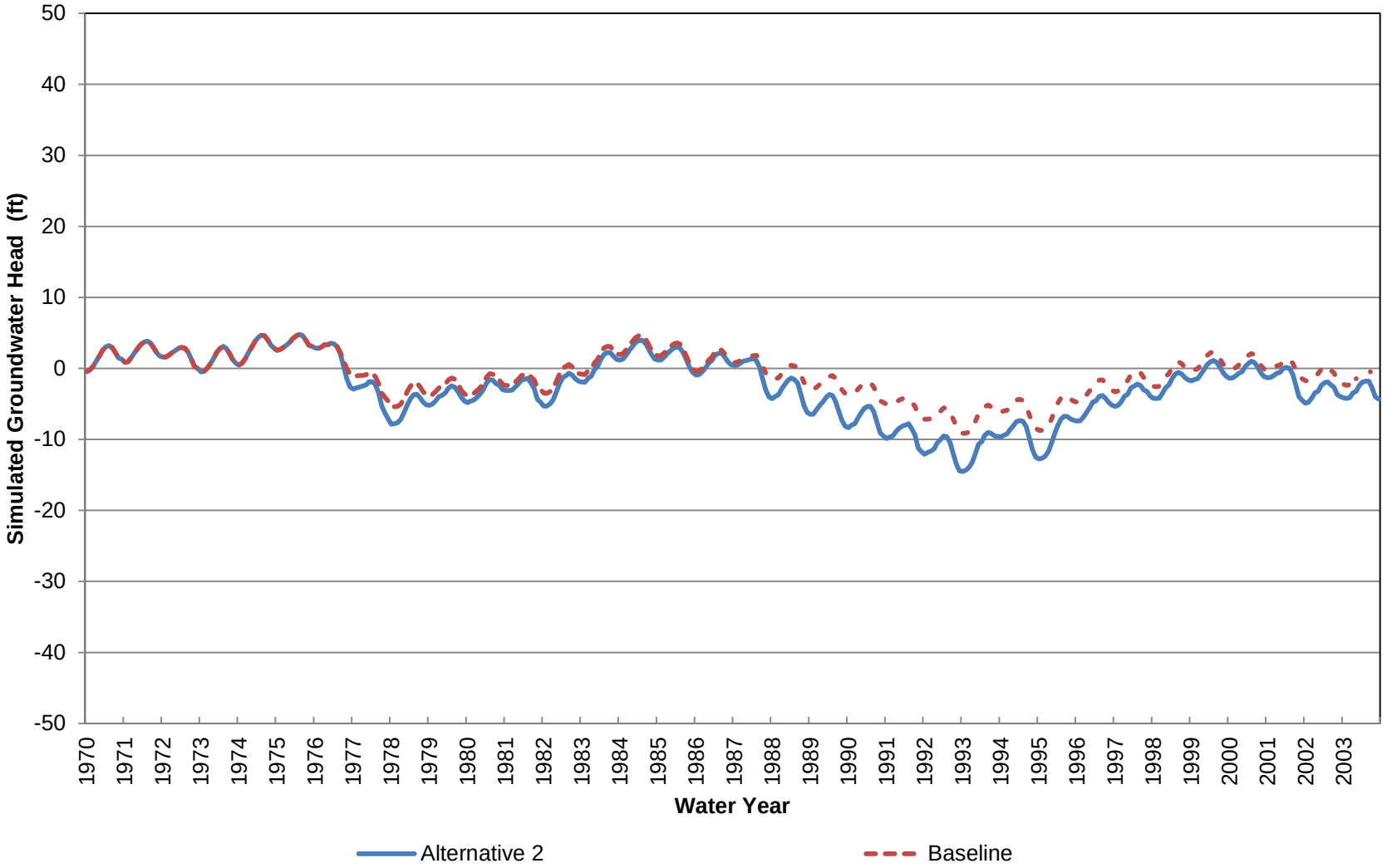
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 28 (Approximately 620-920 ft bgs)



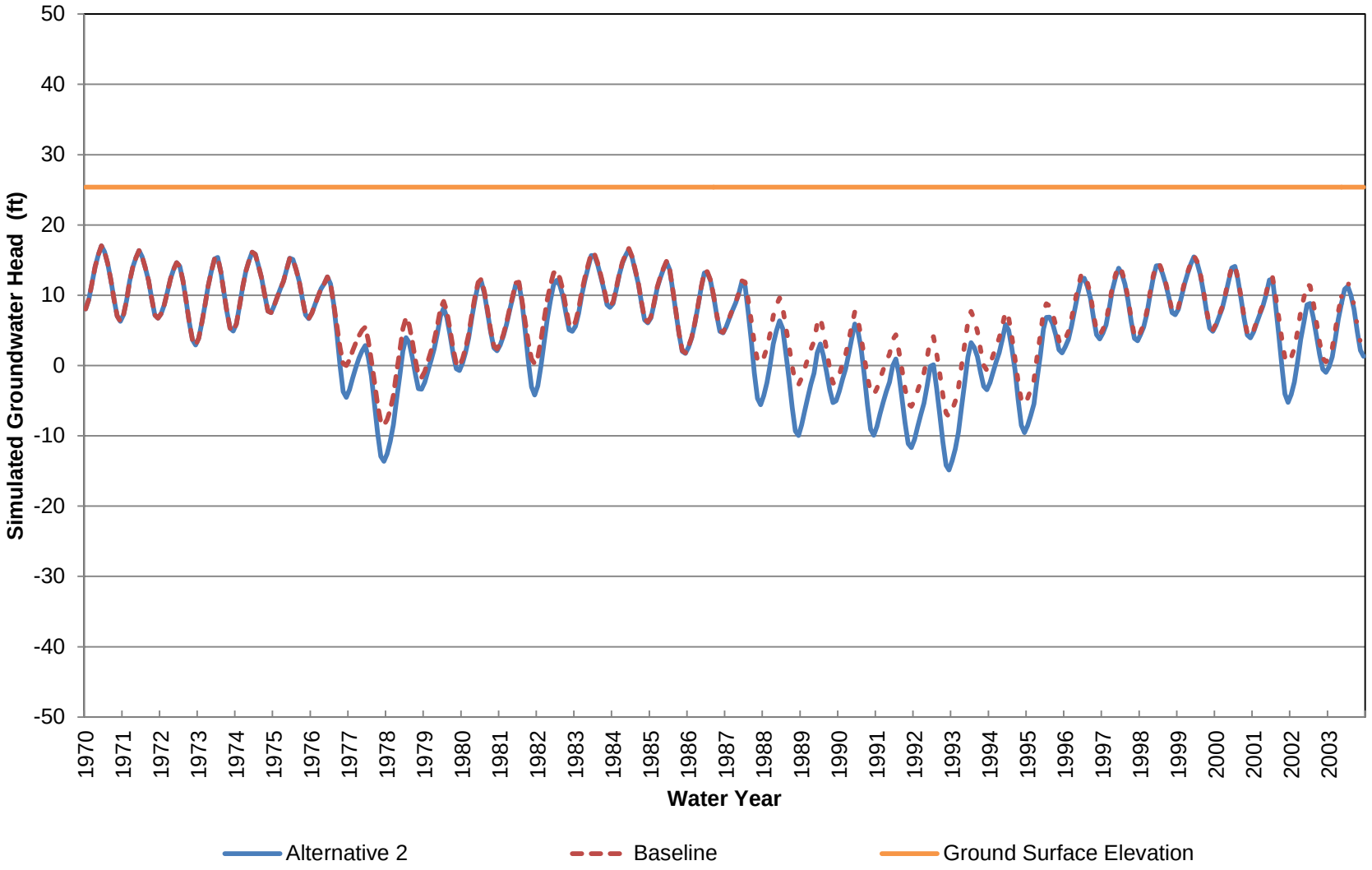
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 28 (Approximately 920-1220 ft bgs)



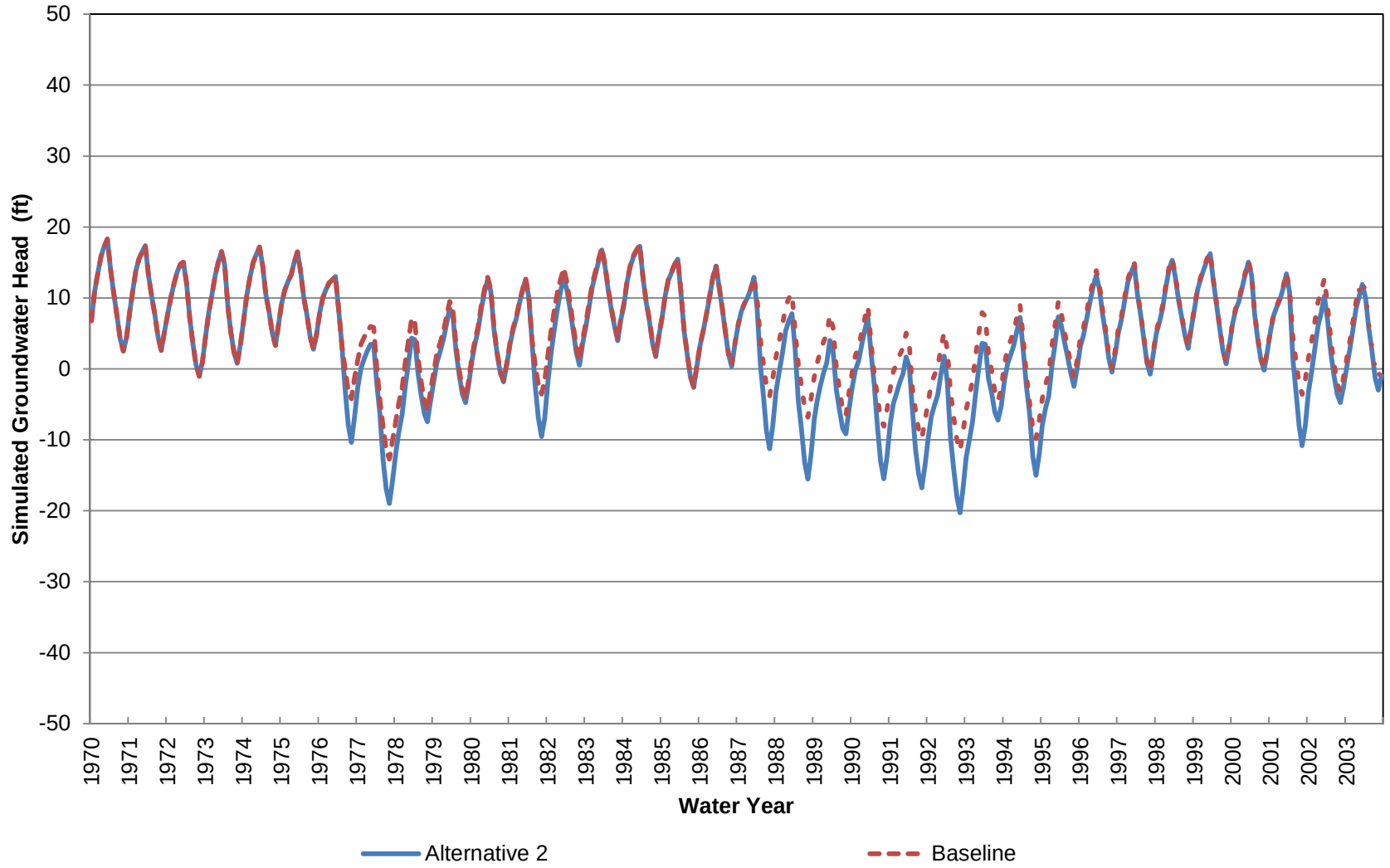
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 28 (Approximately 1220-1680 ft bgs)



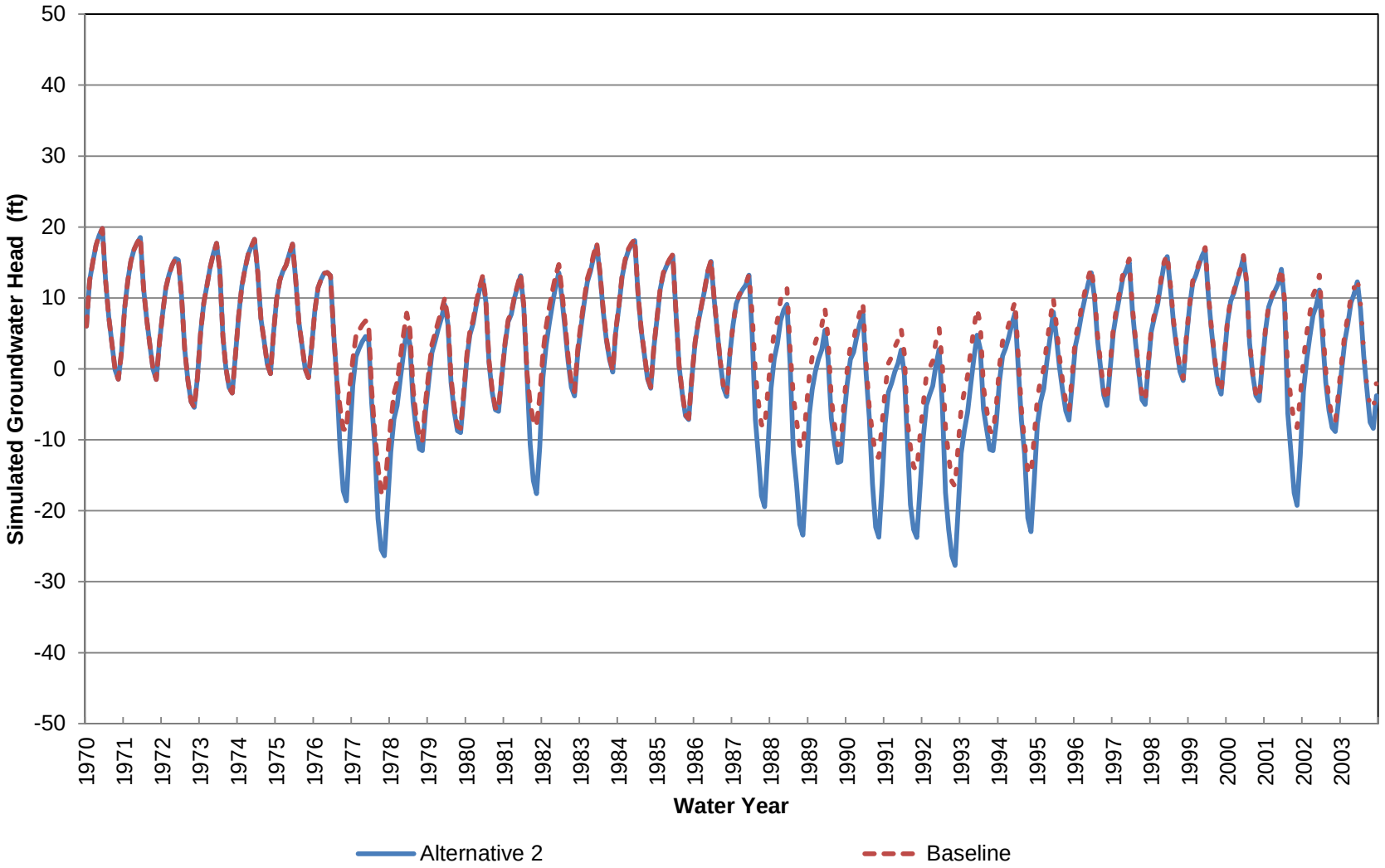
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 29 (Approximately 0-70 ft bgs)



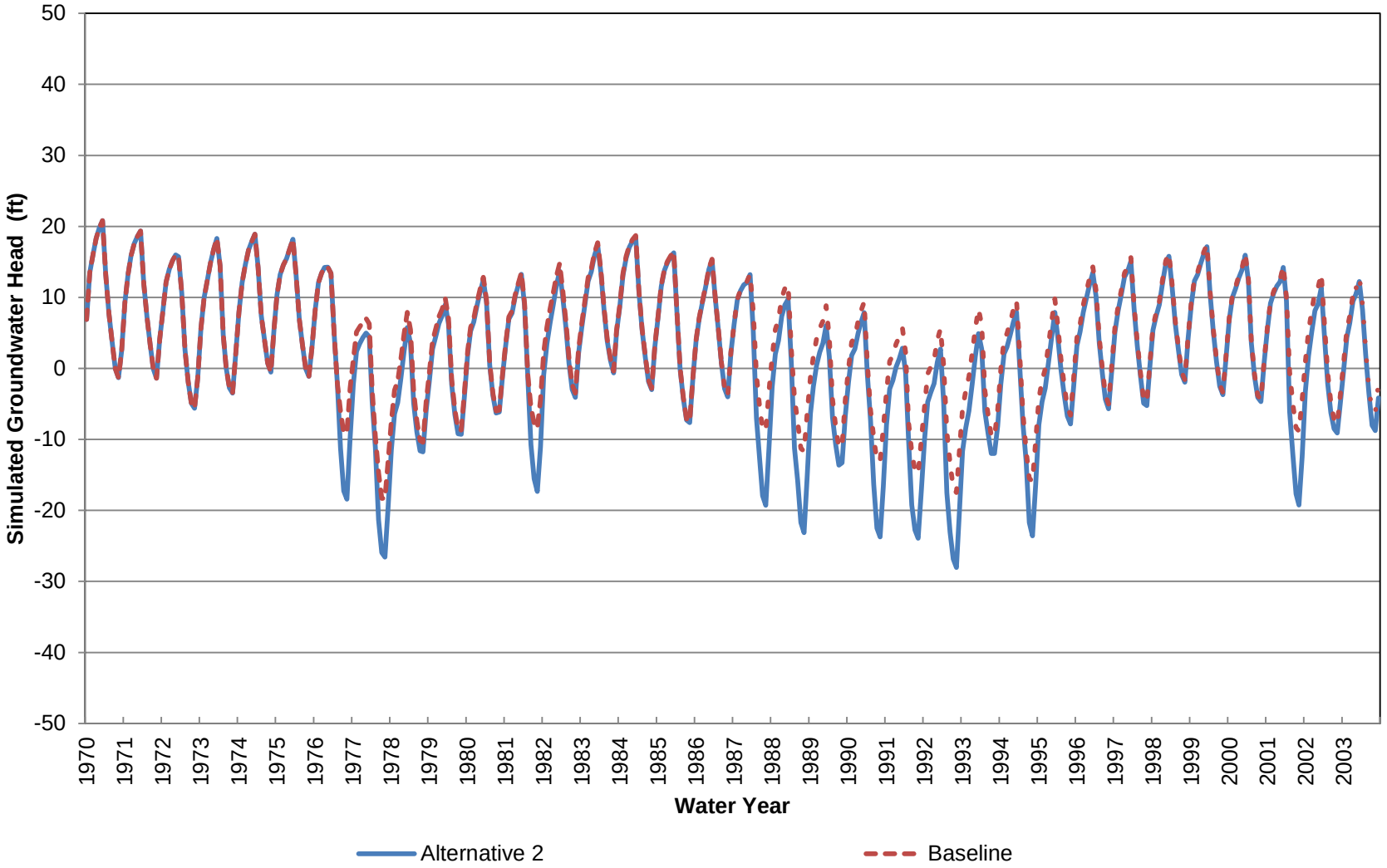
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 29 (Approximately 70-200 ft bgs)



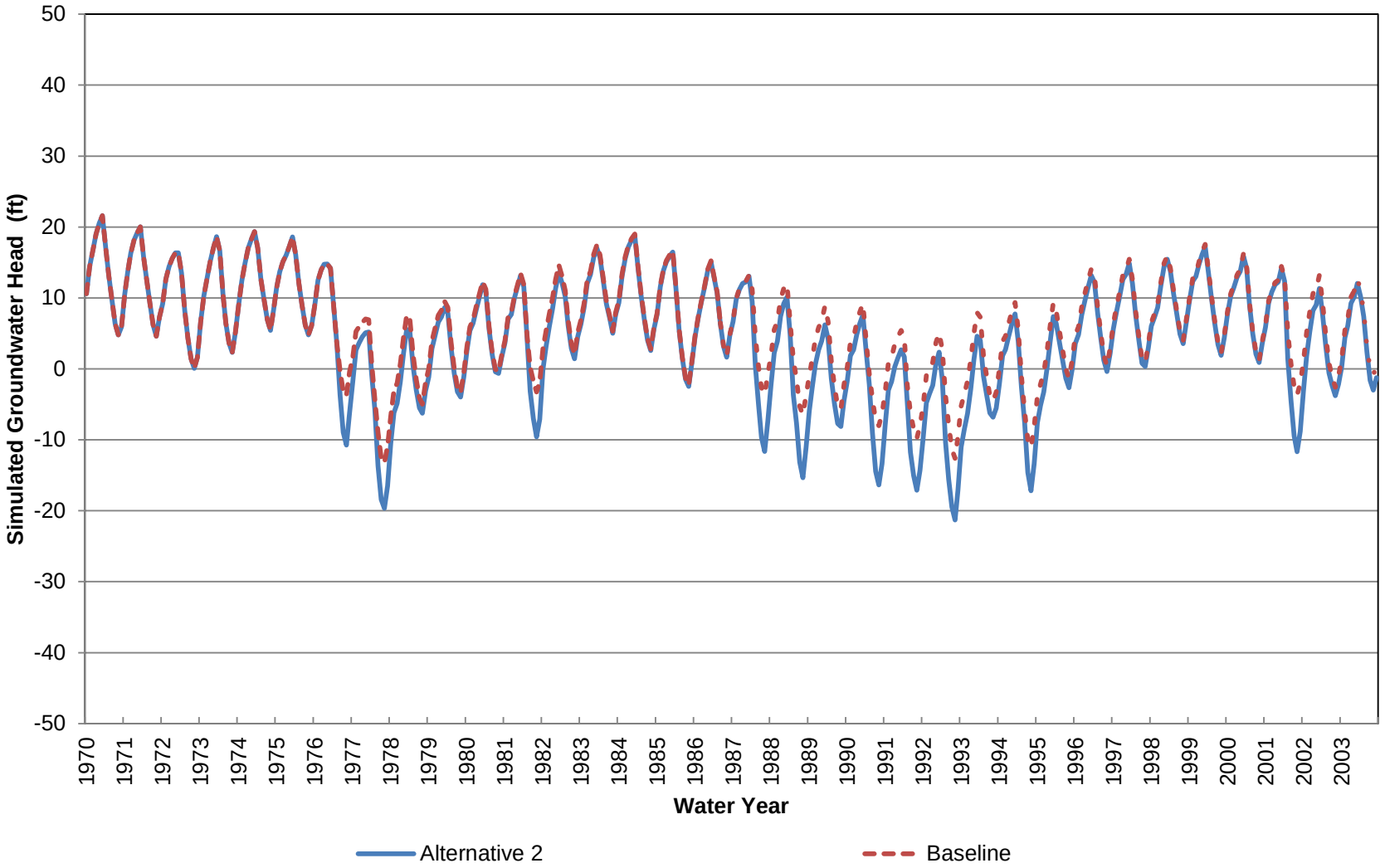
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 29 (Approximately 200-330 ft bgs)



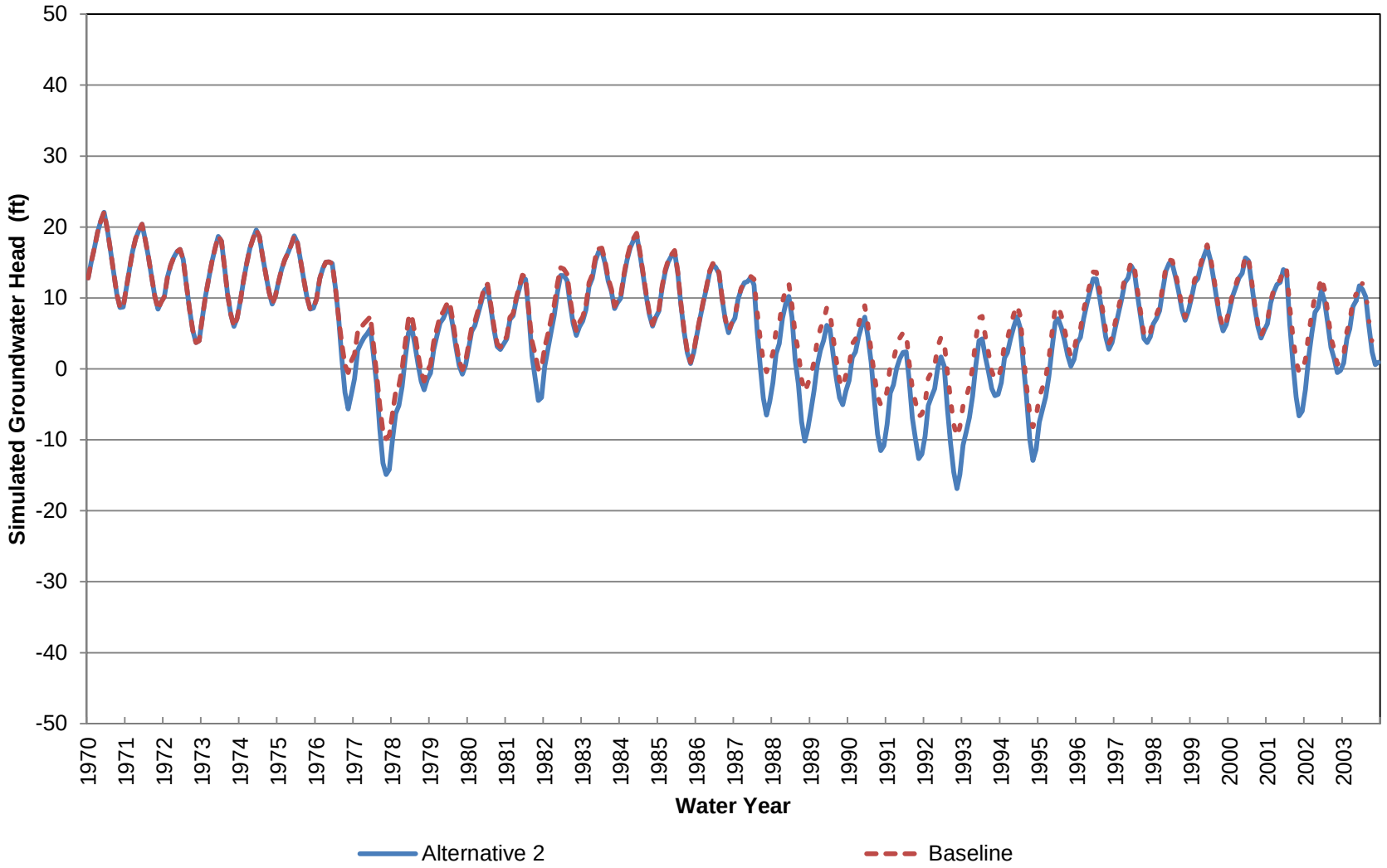
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 29 (Approximately 330-470 ft bgs)



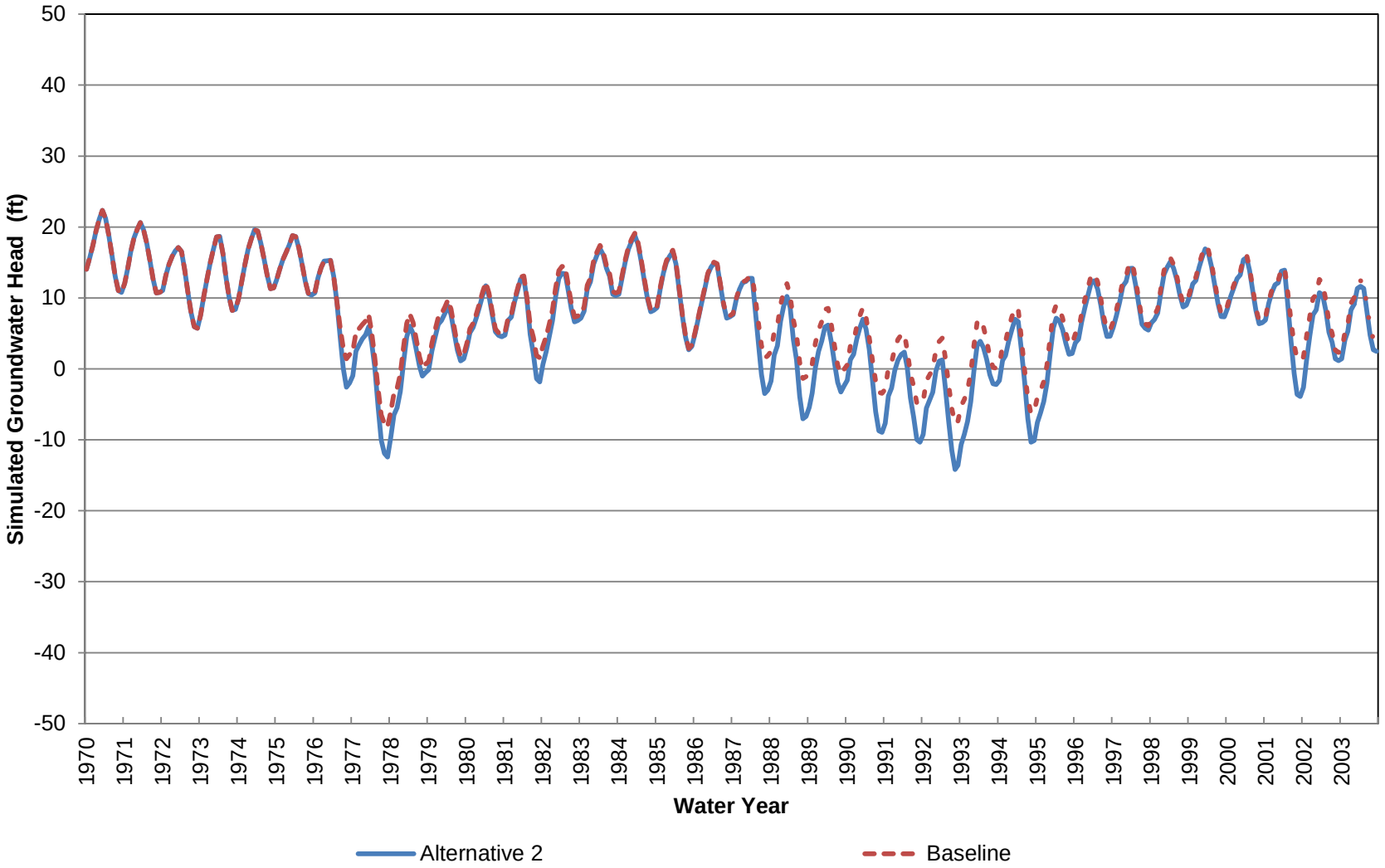
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 29 (Approximately 470-660 ft bgs)



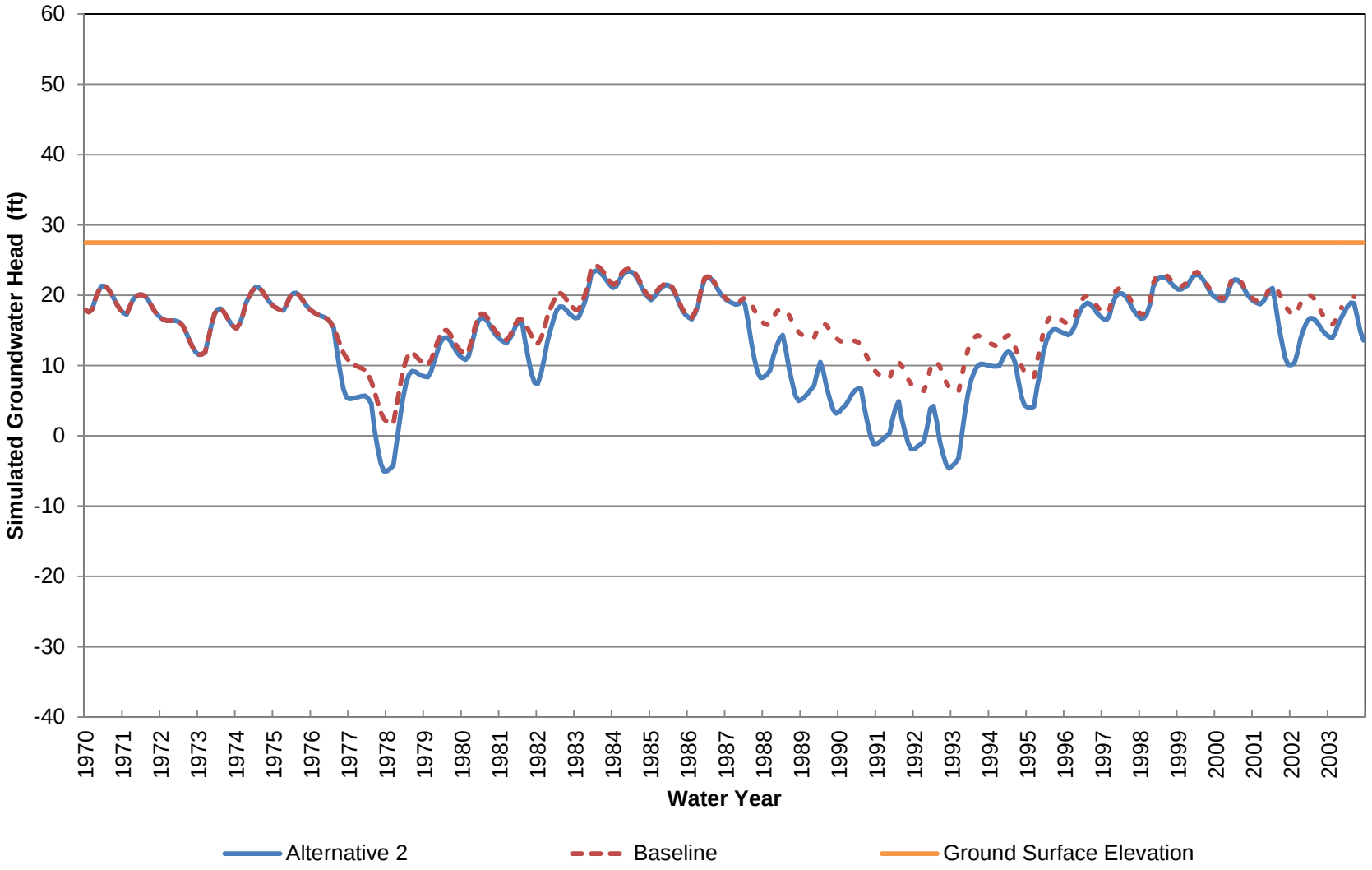
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 29 (Approximately 660-880 ft bgs)



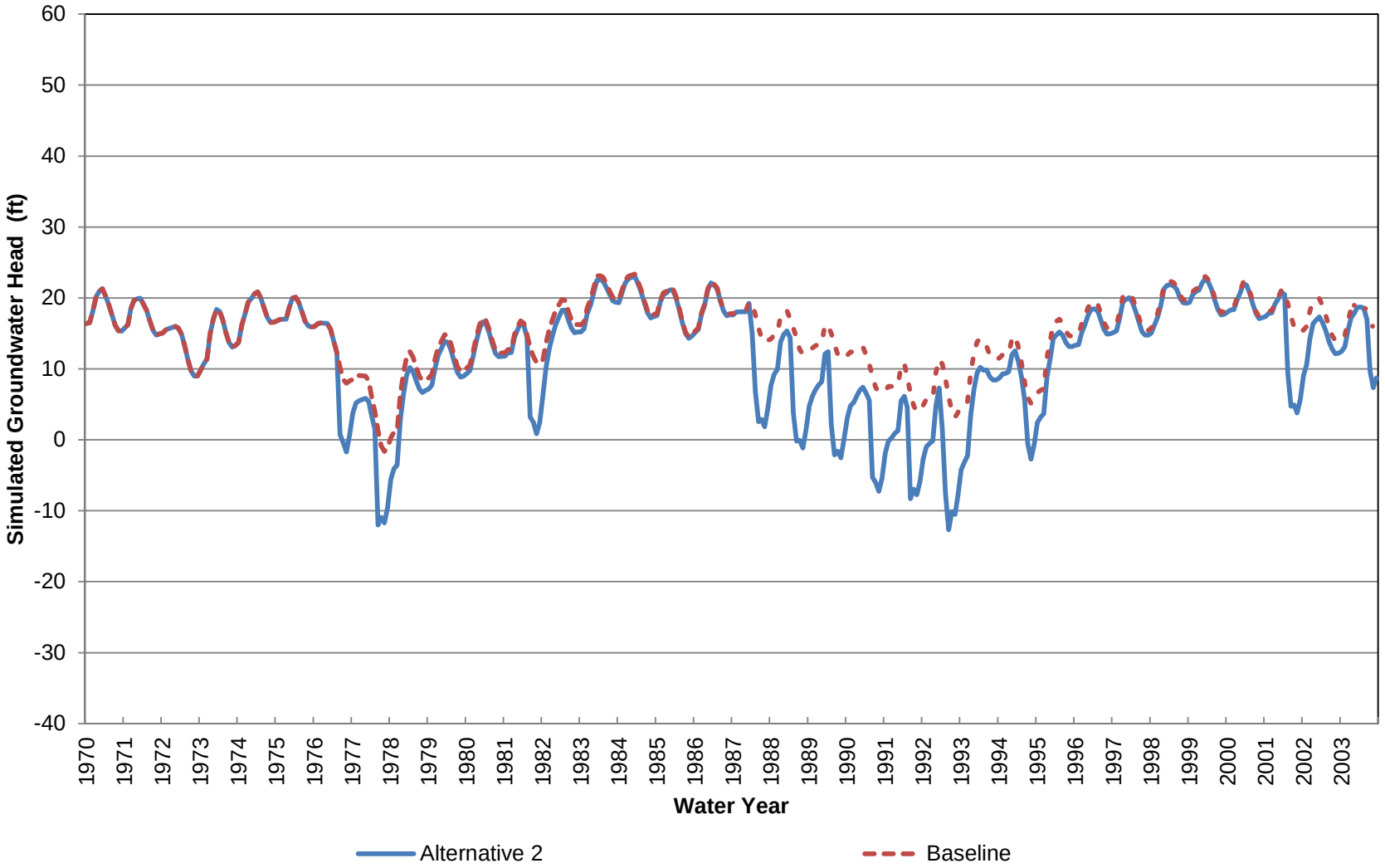
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 29 (Approximately 880-1210 ft bgs)



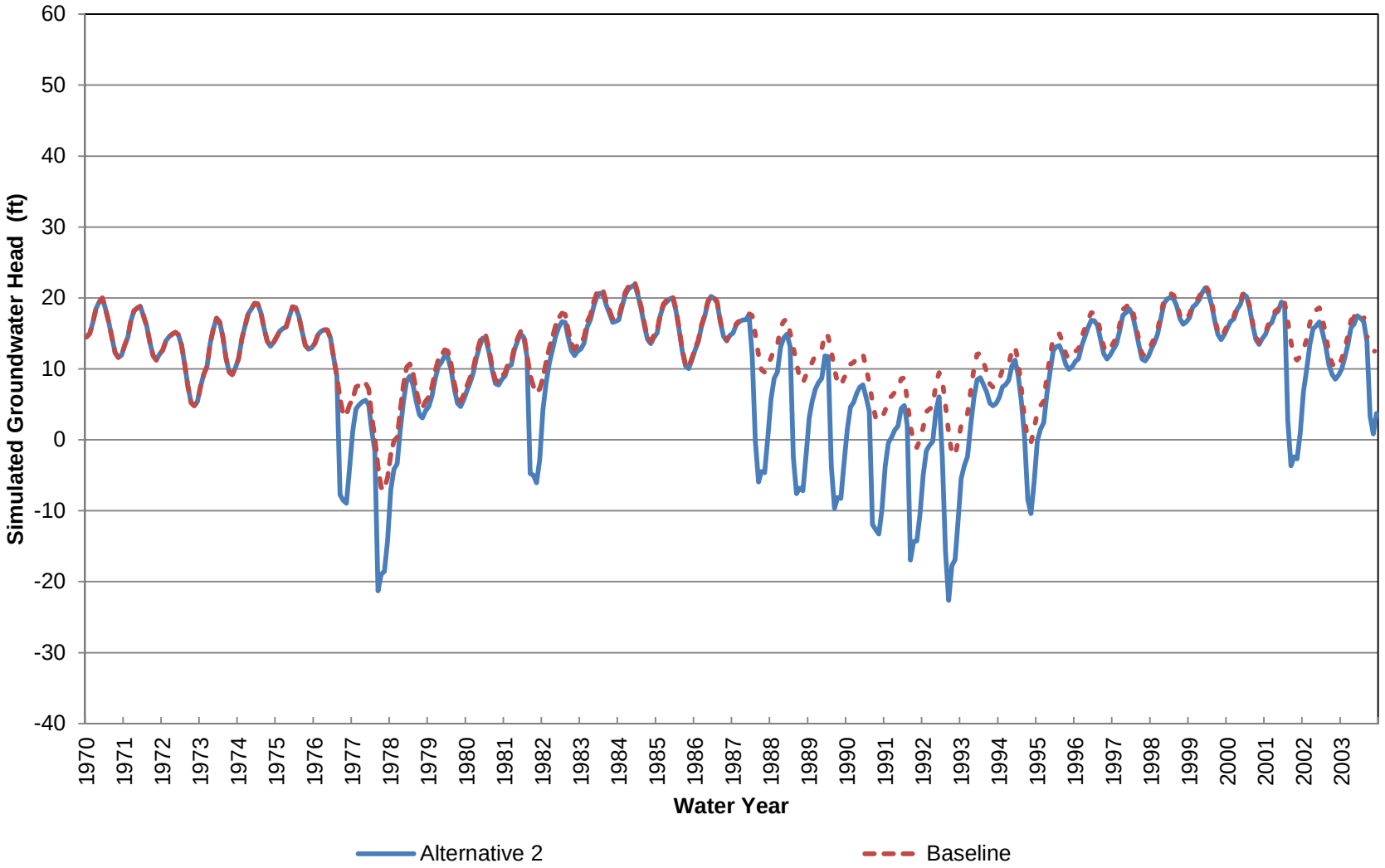
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 30 (Approximately 0-70 ft bgs)



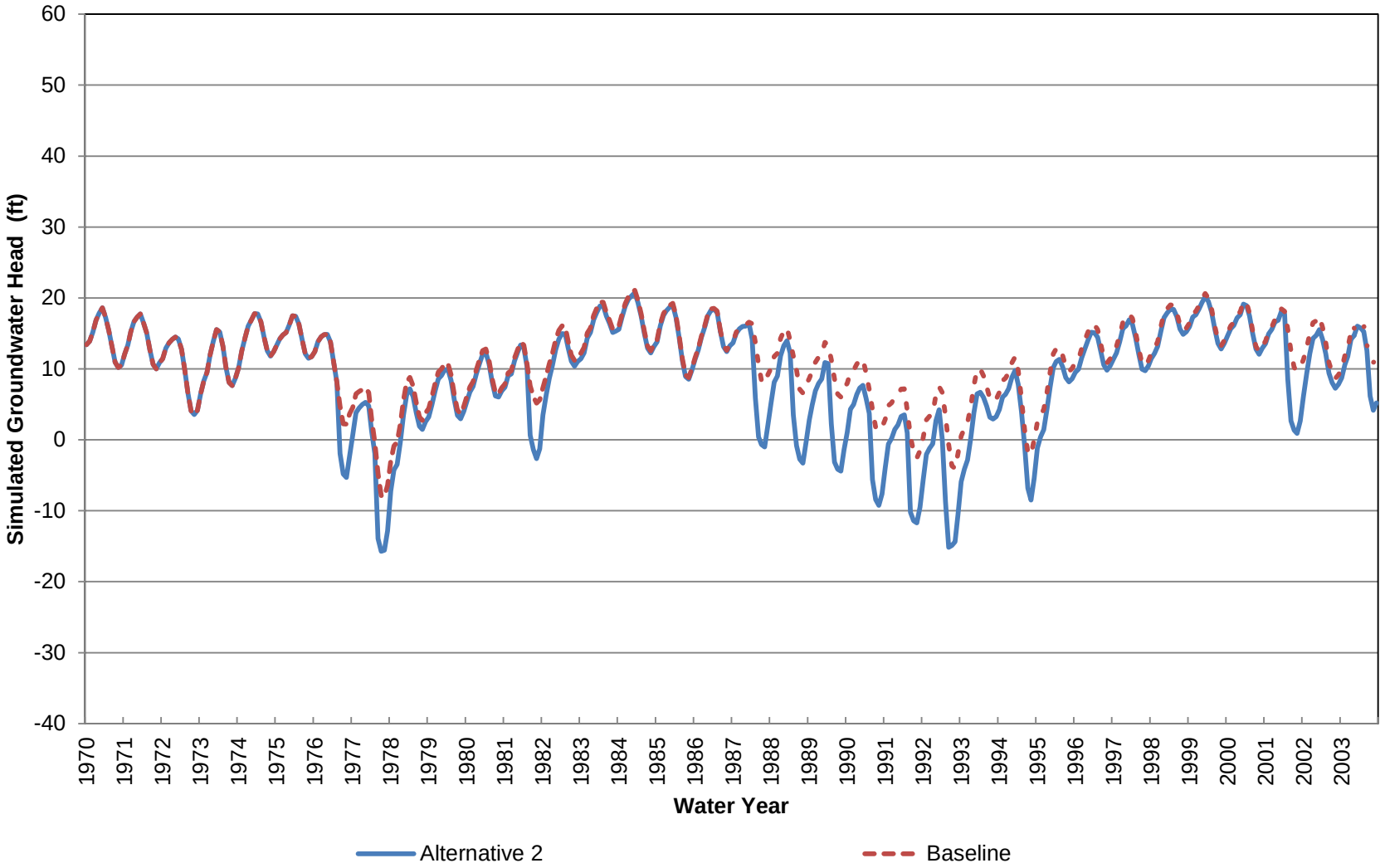
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 30 (Approximately 70-340 ft bgs)



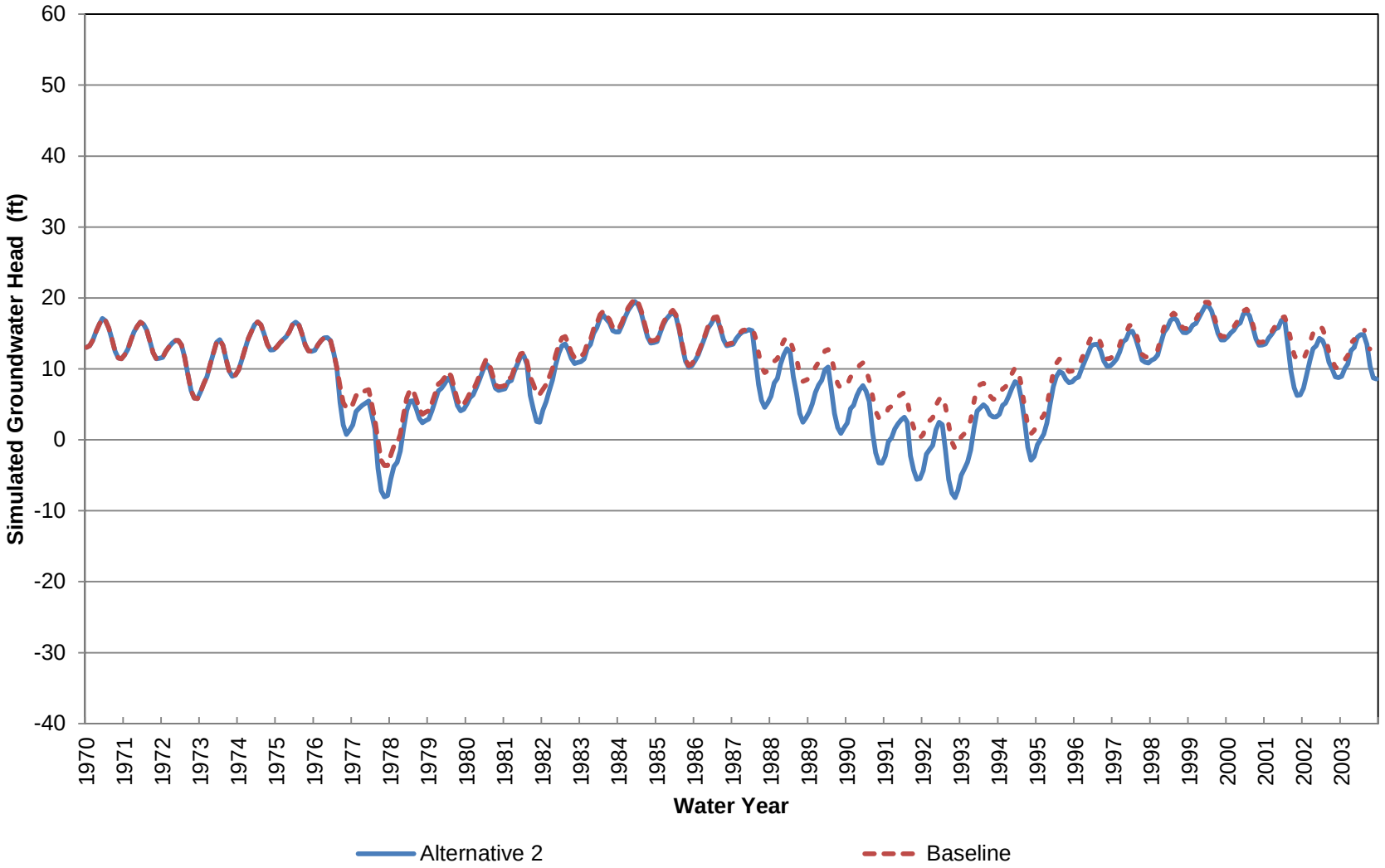
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 30 (Approximately 340-600 ft bgs)



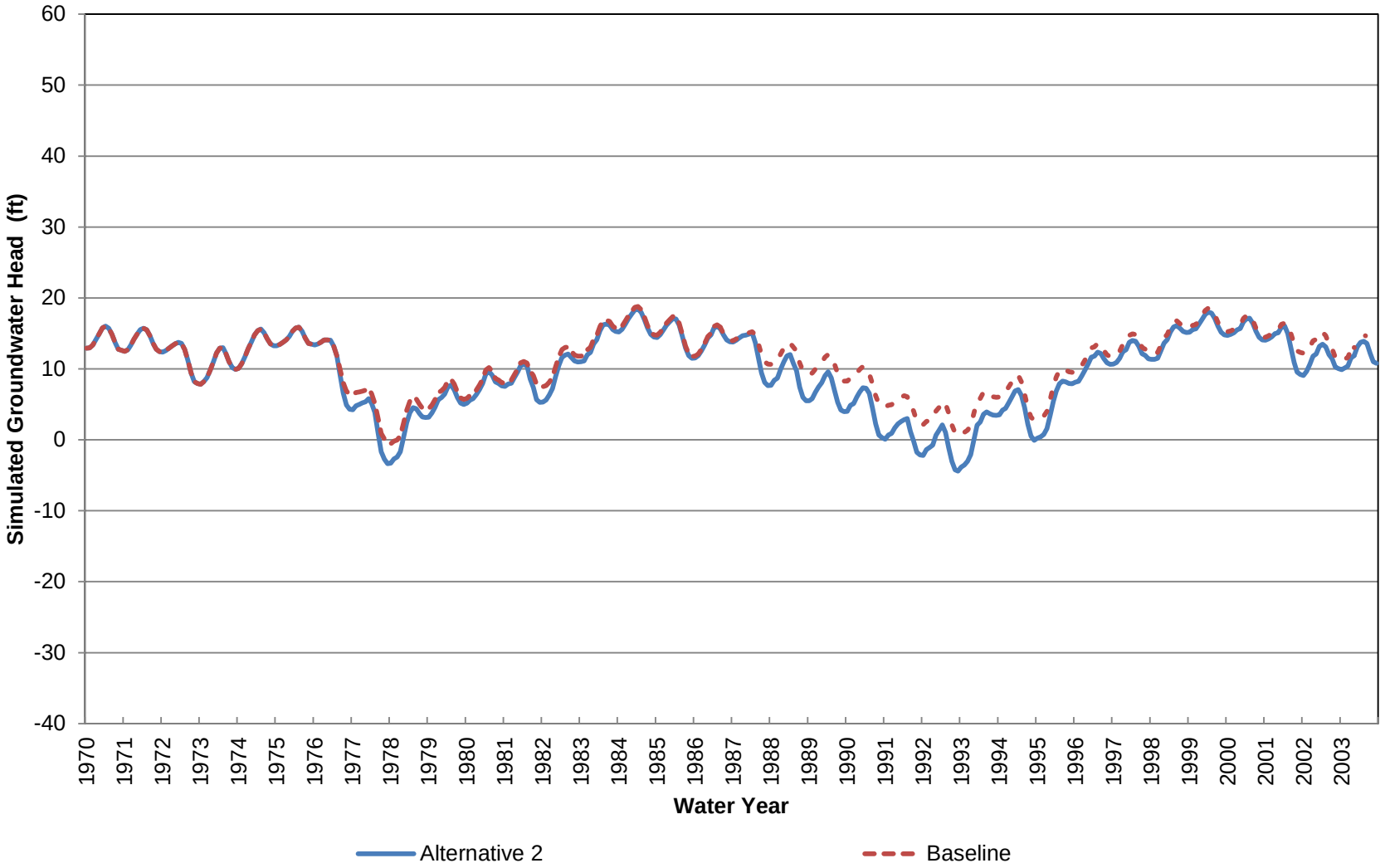
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 30 (Approximately 600-860 ft bgs)



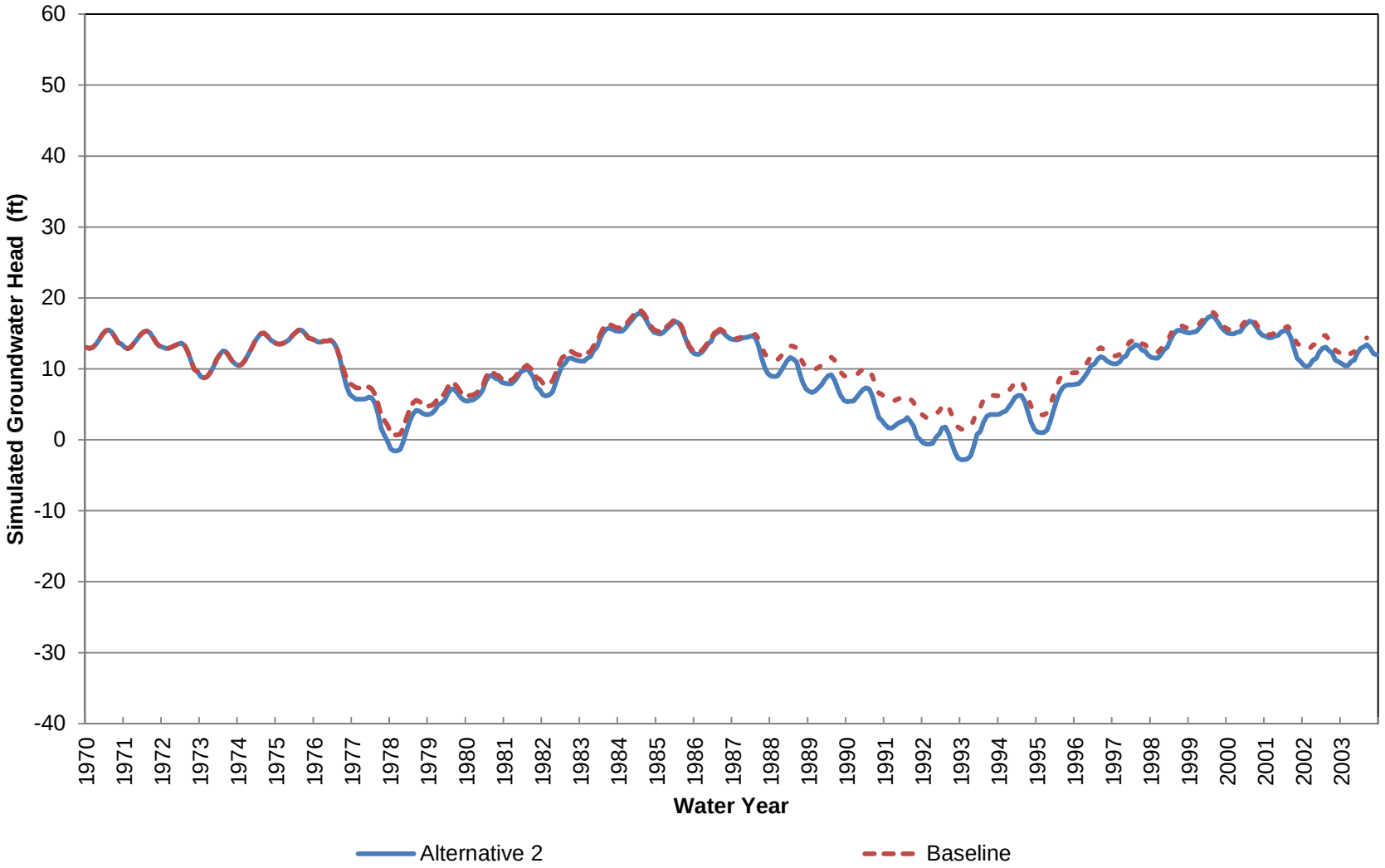
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 30 (Approximately 860-1330 ft bgs)



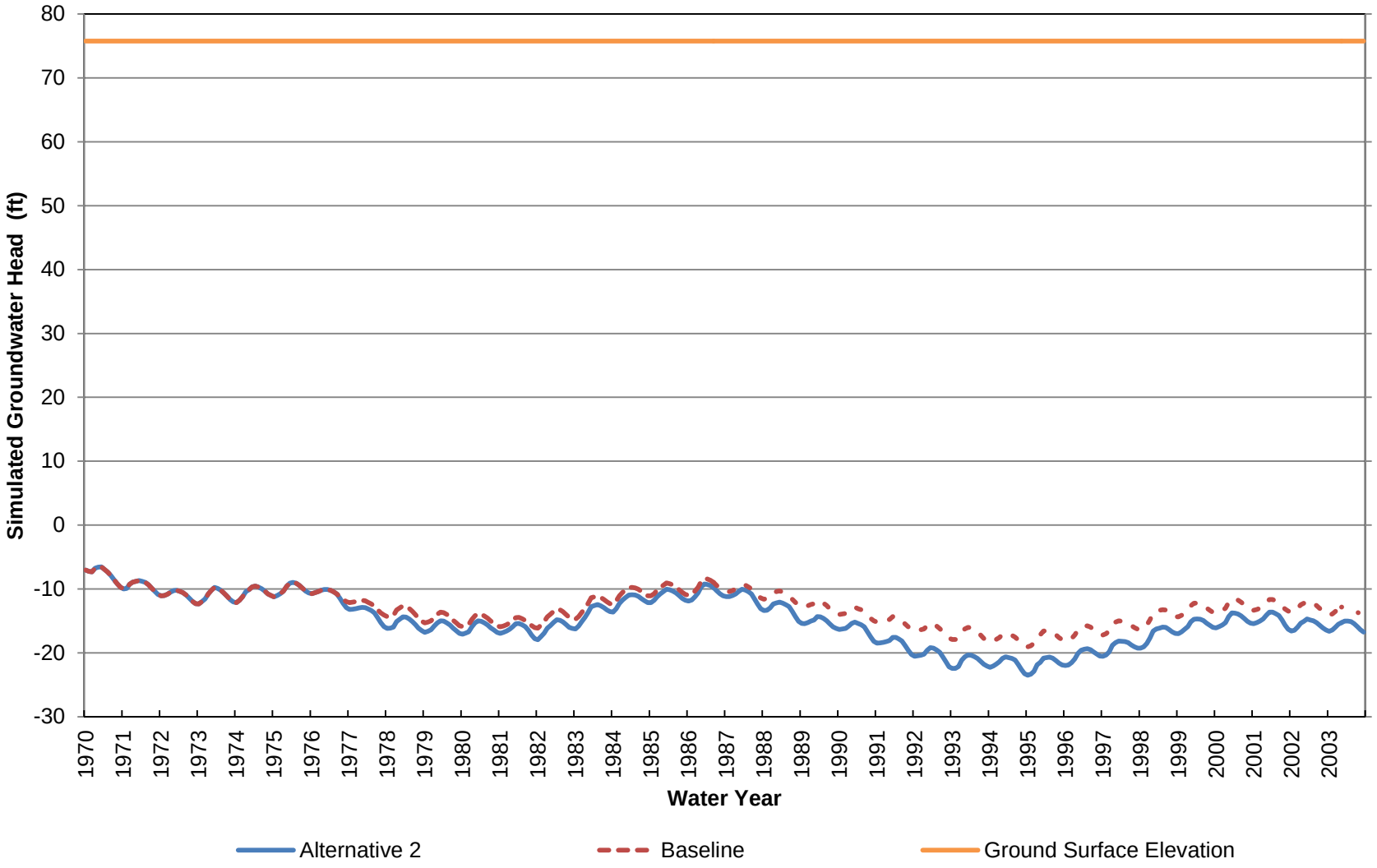
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 30 (Approximately 1330-1770 ft bgs)



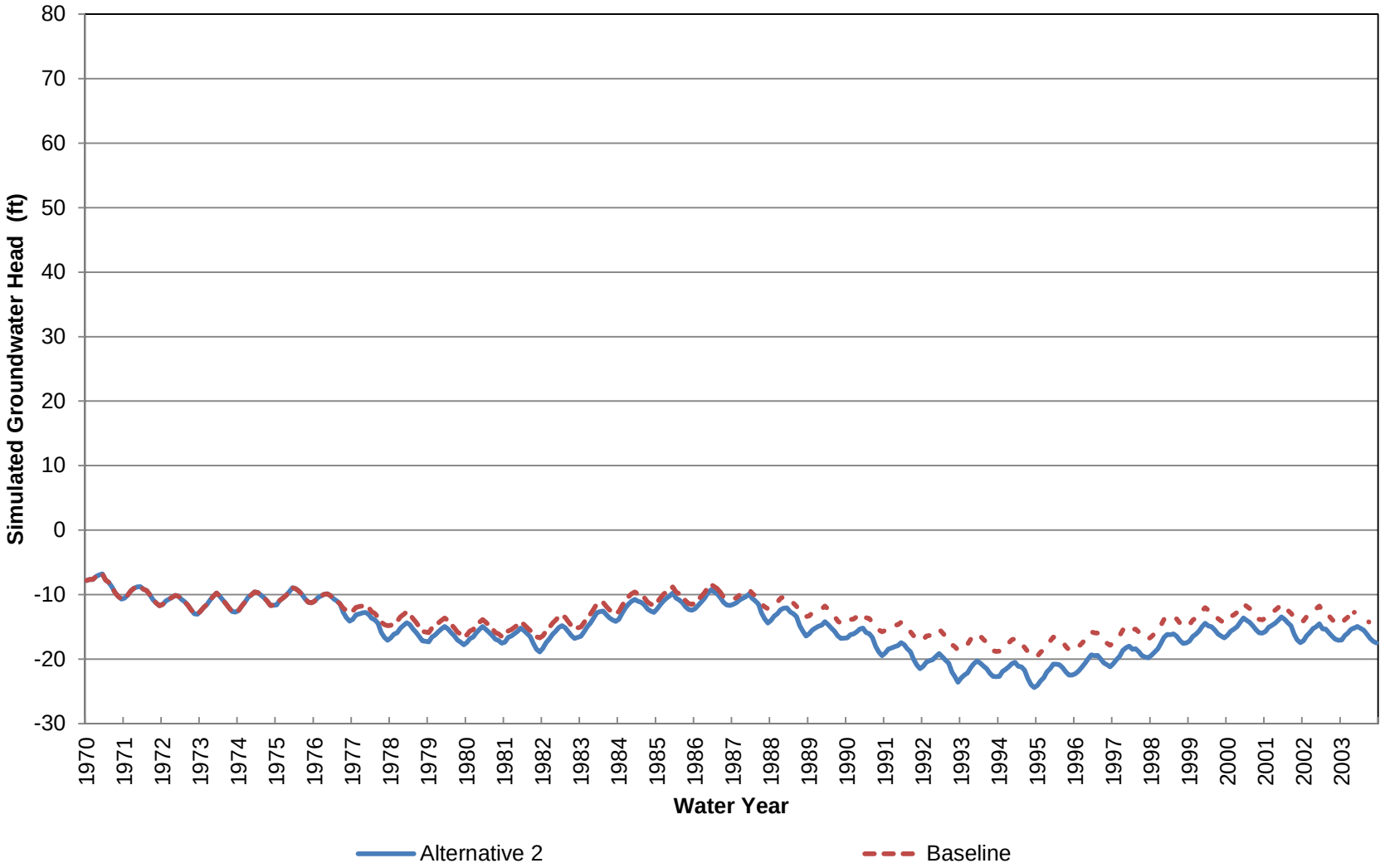
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 30 (Approximately 1770-2430 ft bgs)



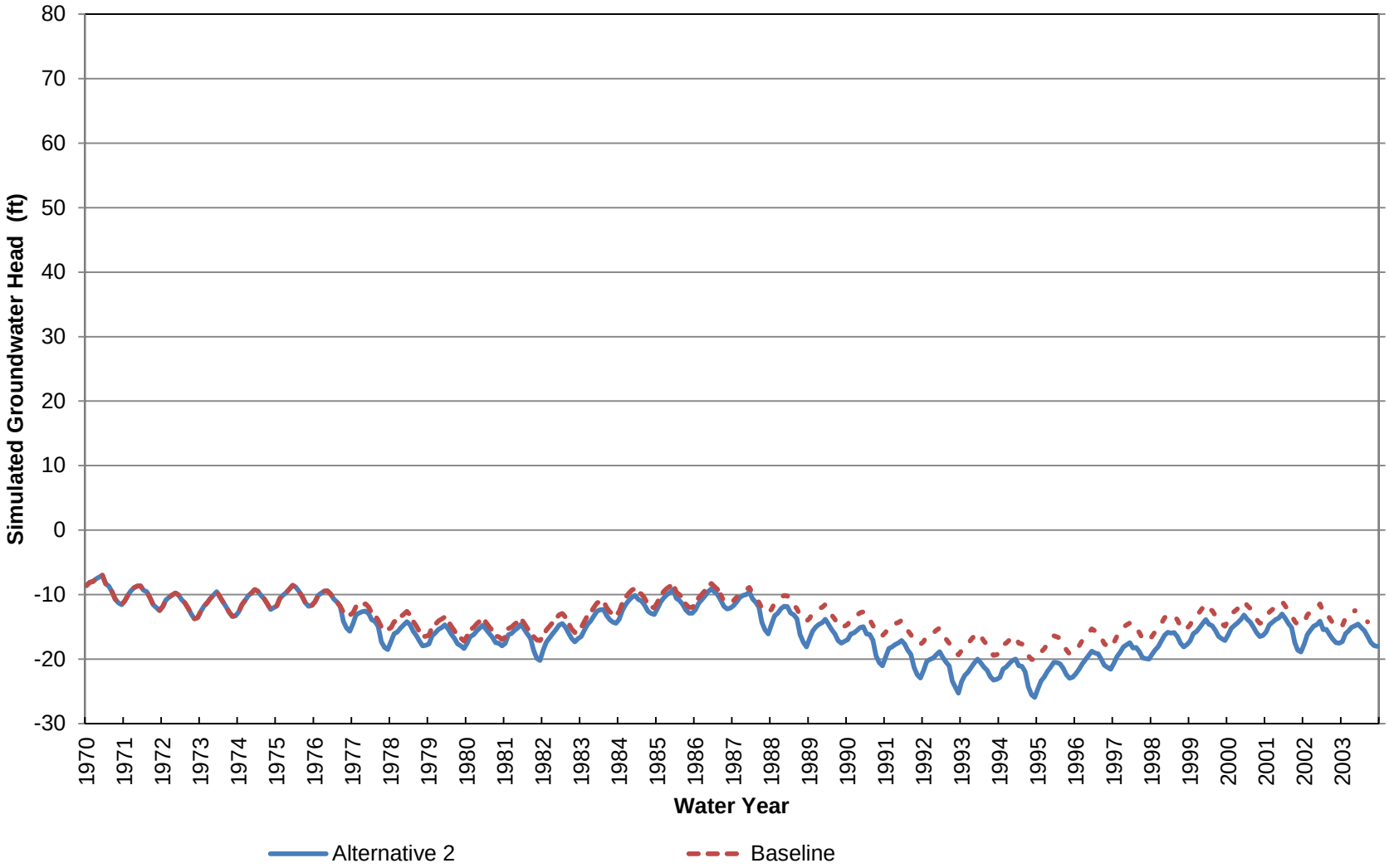
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 31 (Approximately 0-70 ft bgs)



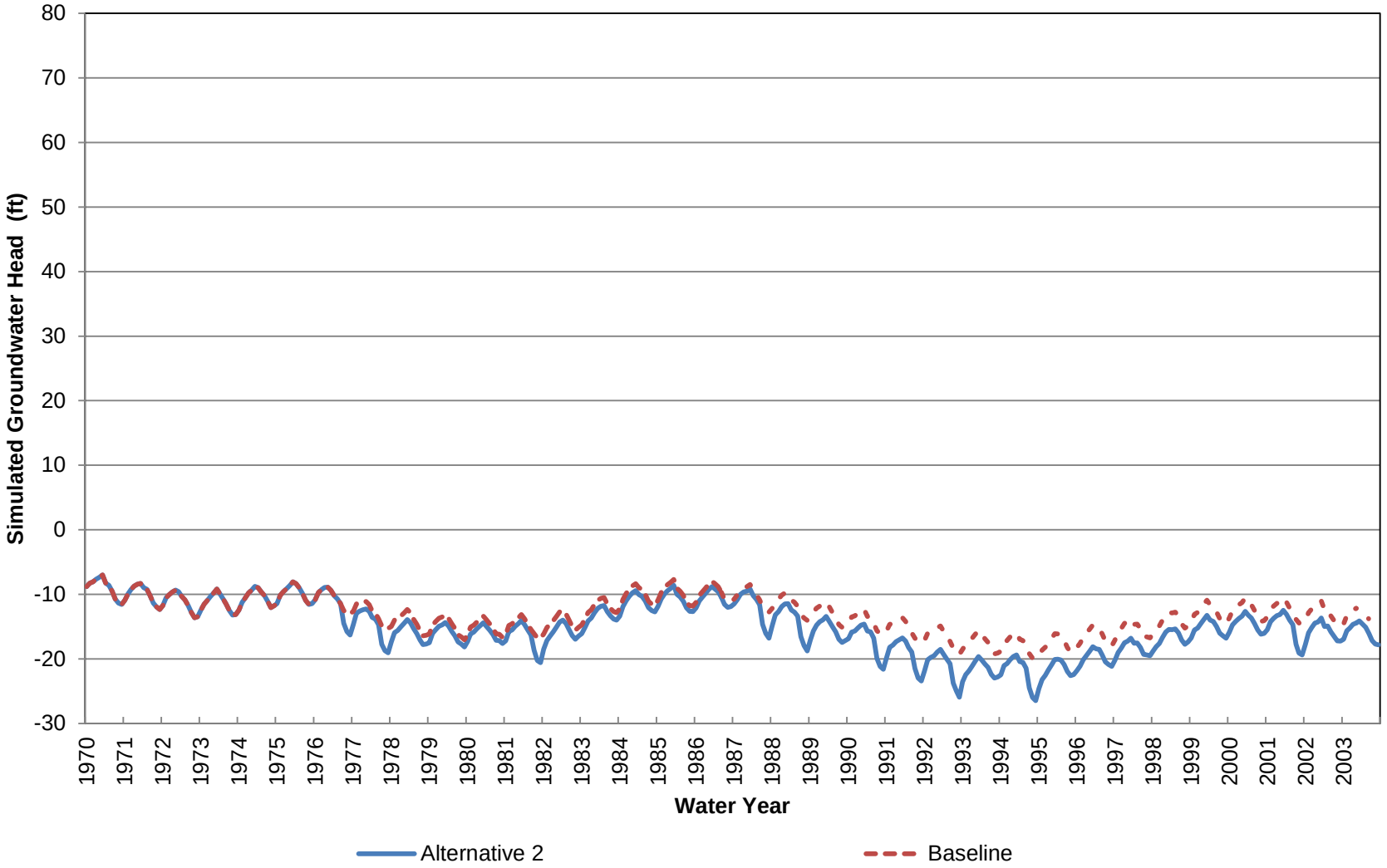
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 31 (Approximately 70-200 ft bgs)



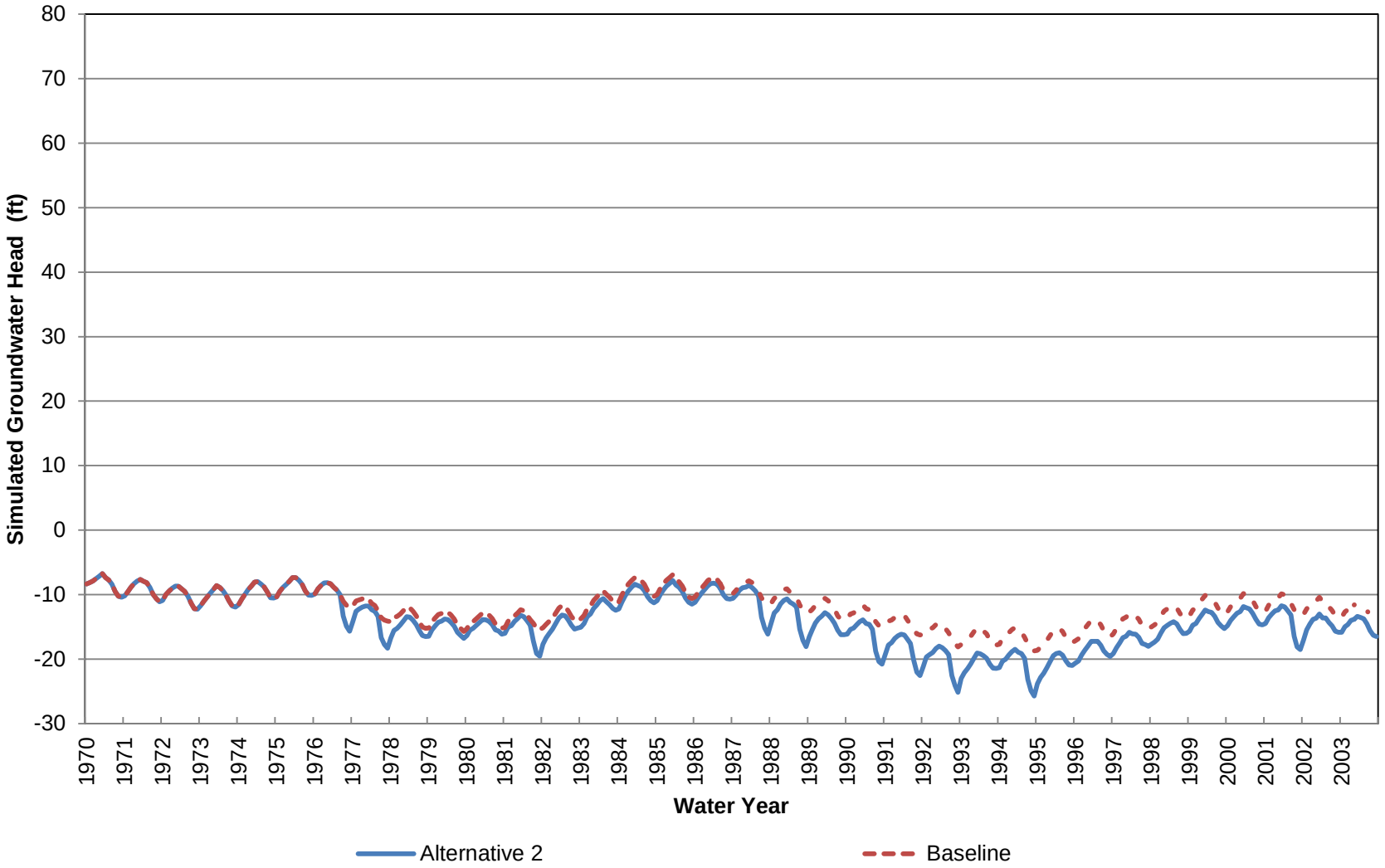
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 31 (Approximately 200-330 ft bgs)



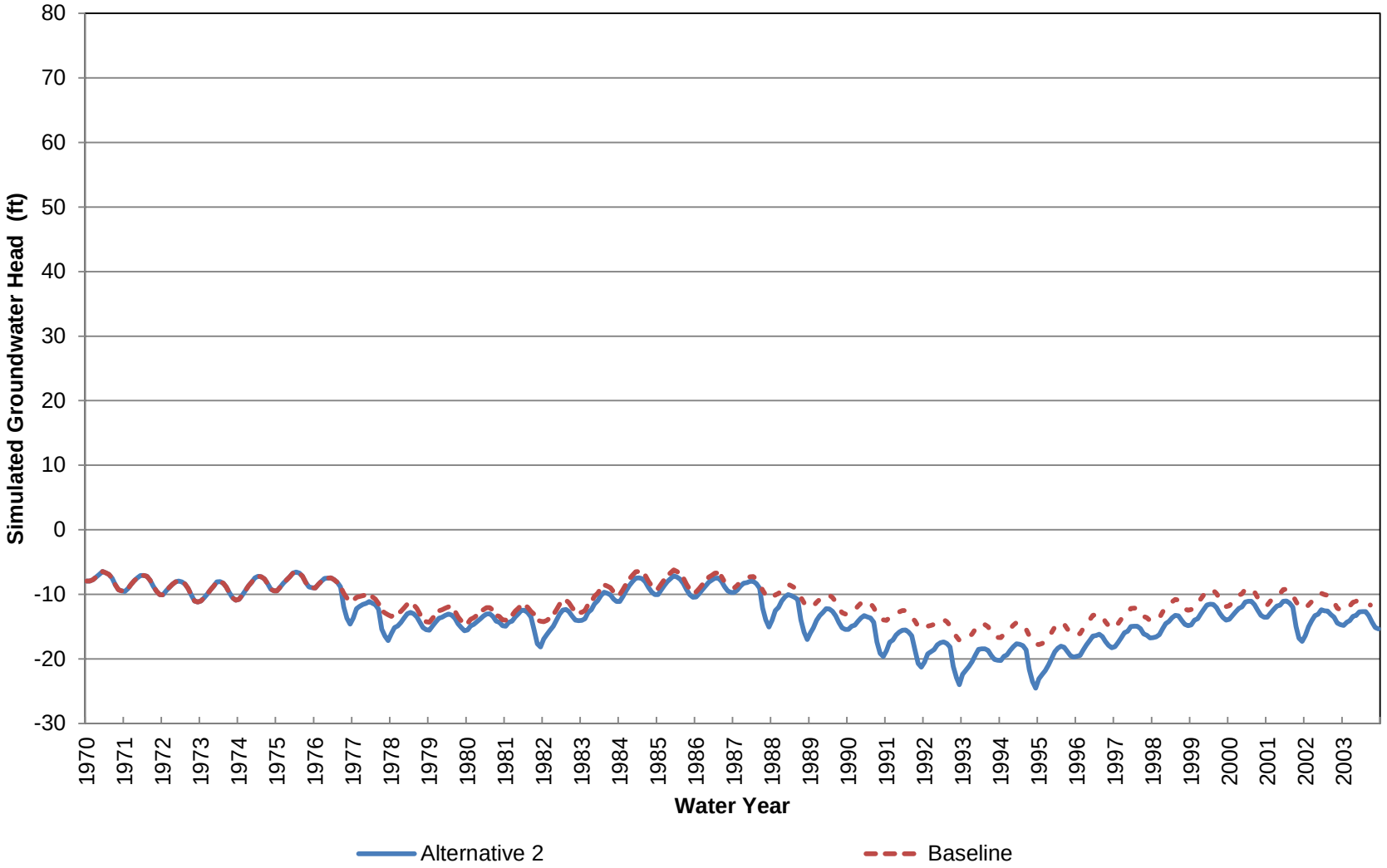
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 31 (Approximately 330-460 ft bgs)



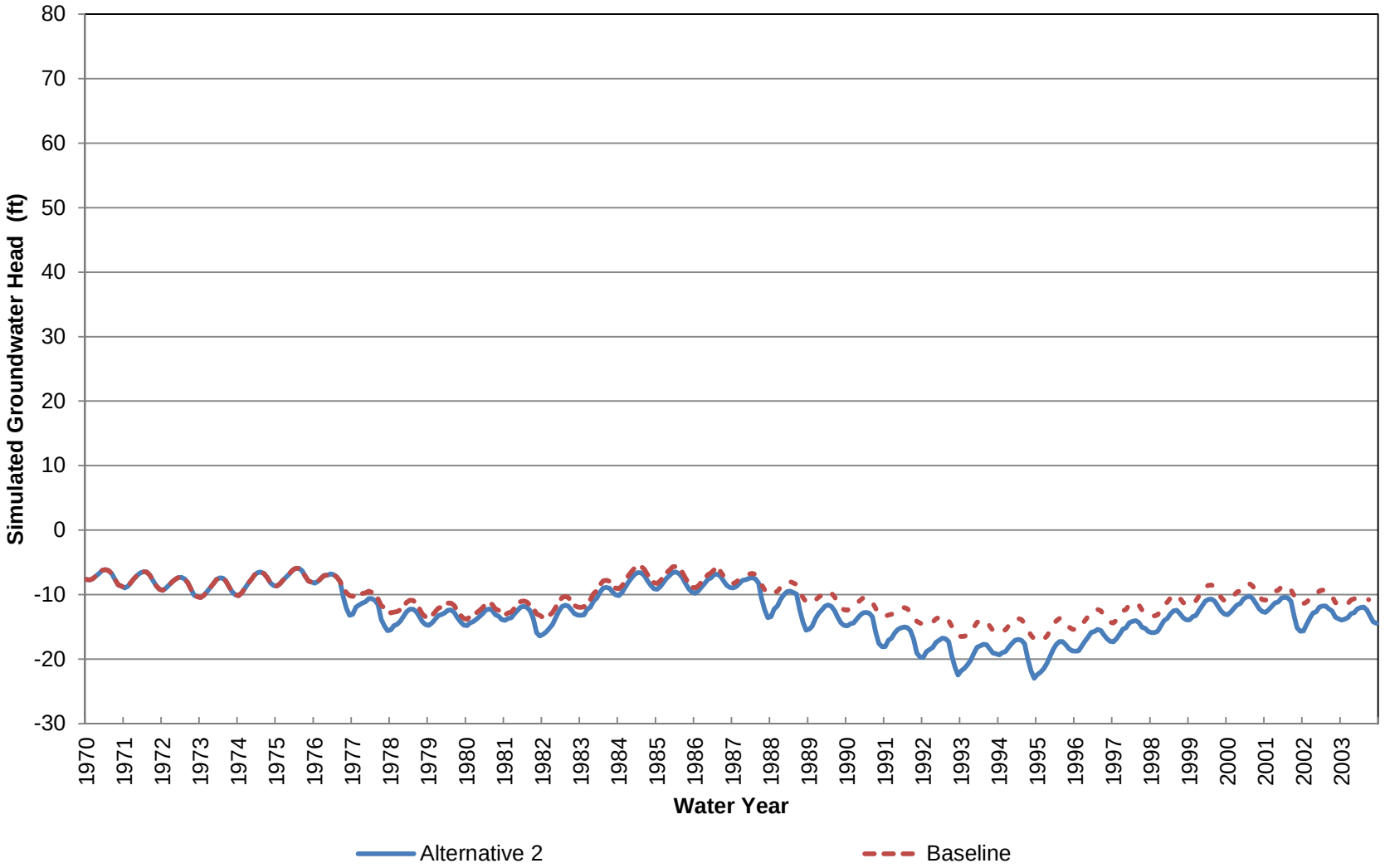
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 31 (Approximately 460-650 ft bgs)



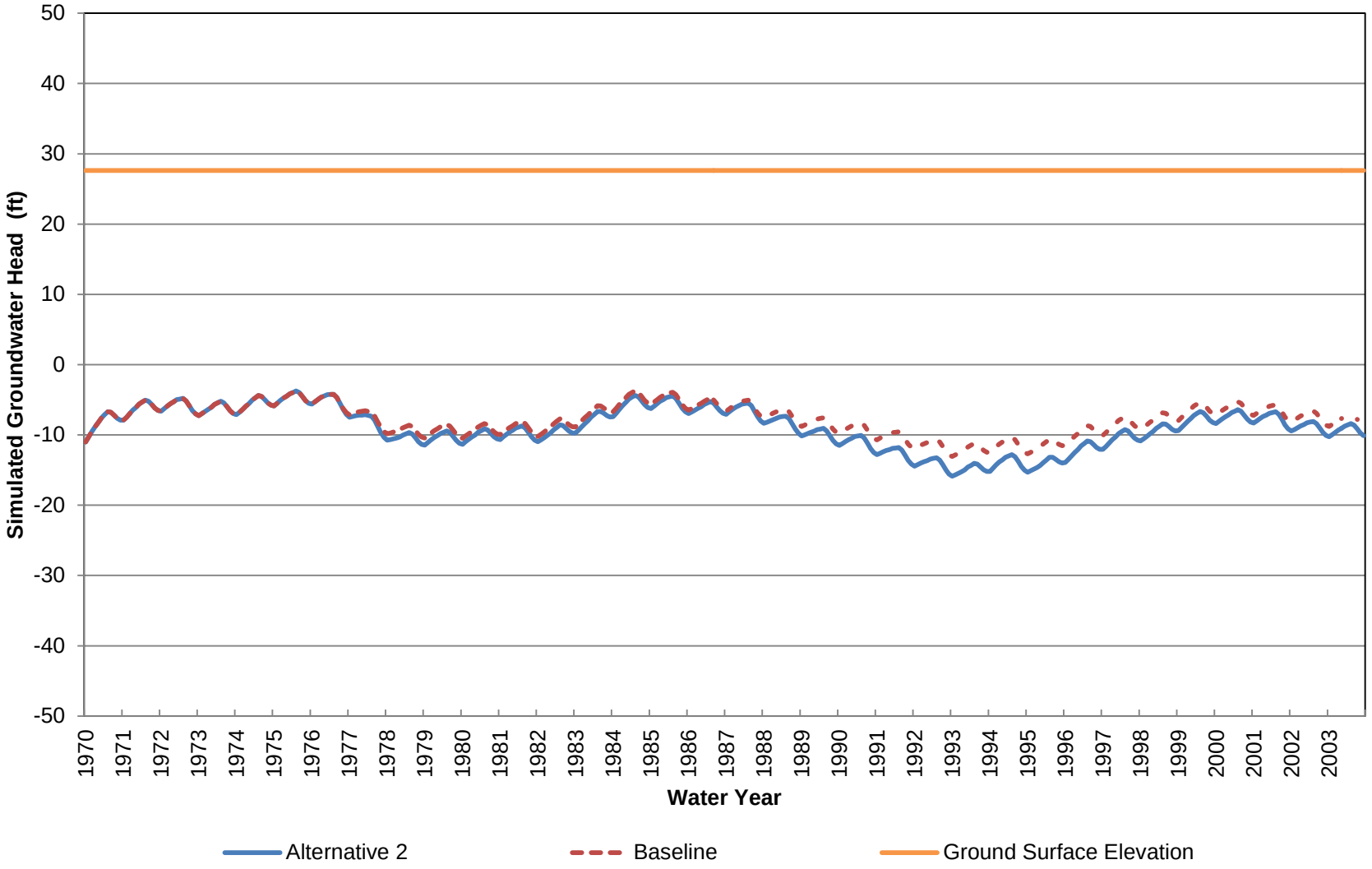
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 31 (Approximately 650-870 ft bgs)



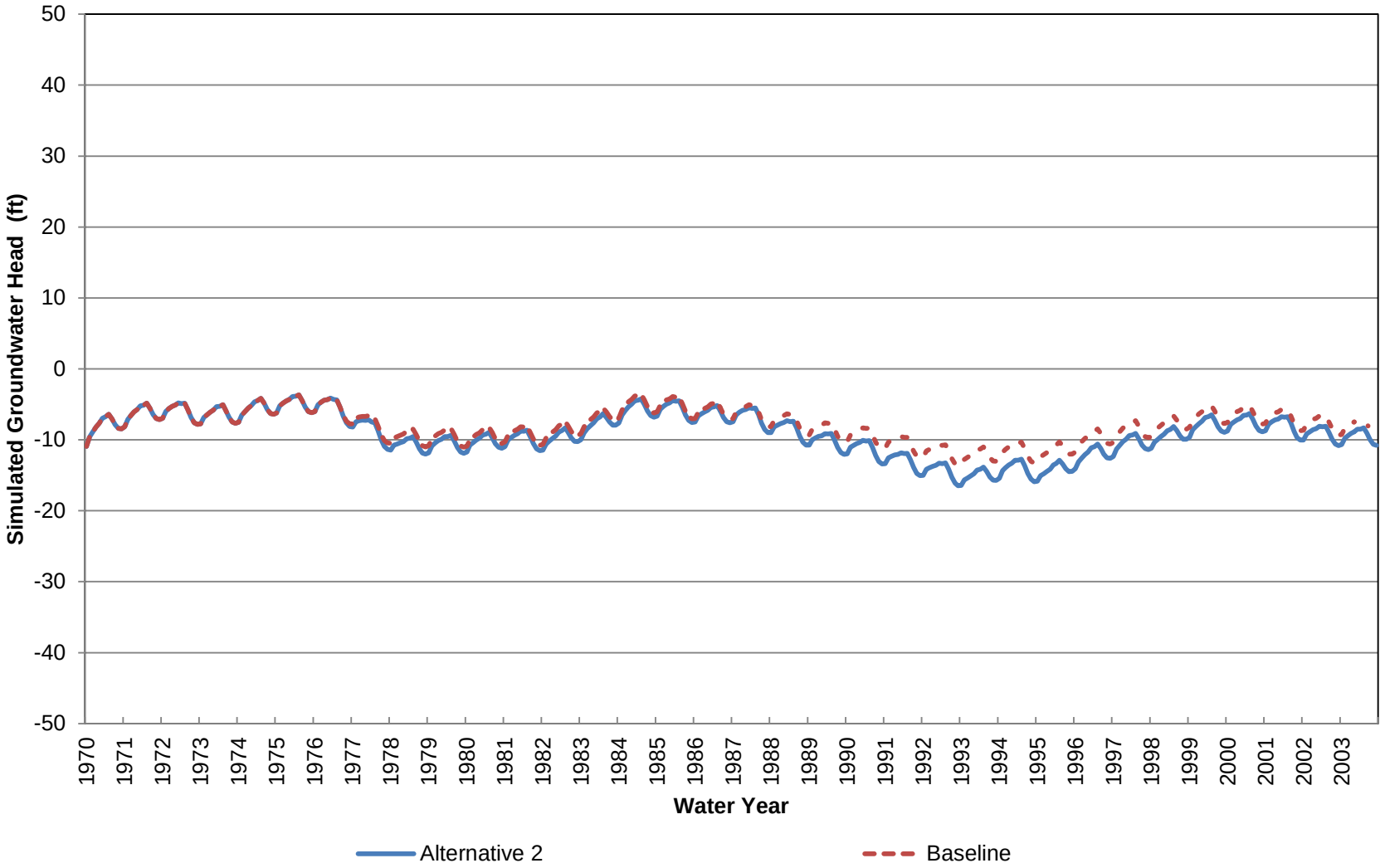
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 31 (Approximately 870-1190 ft bgs)



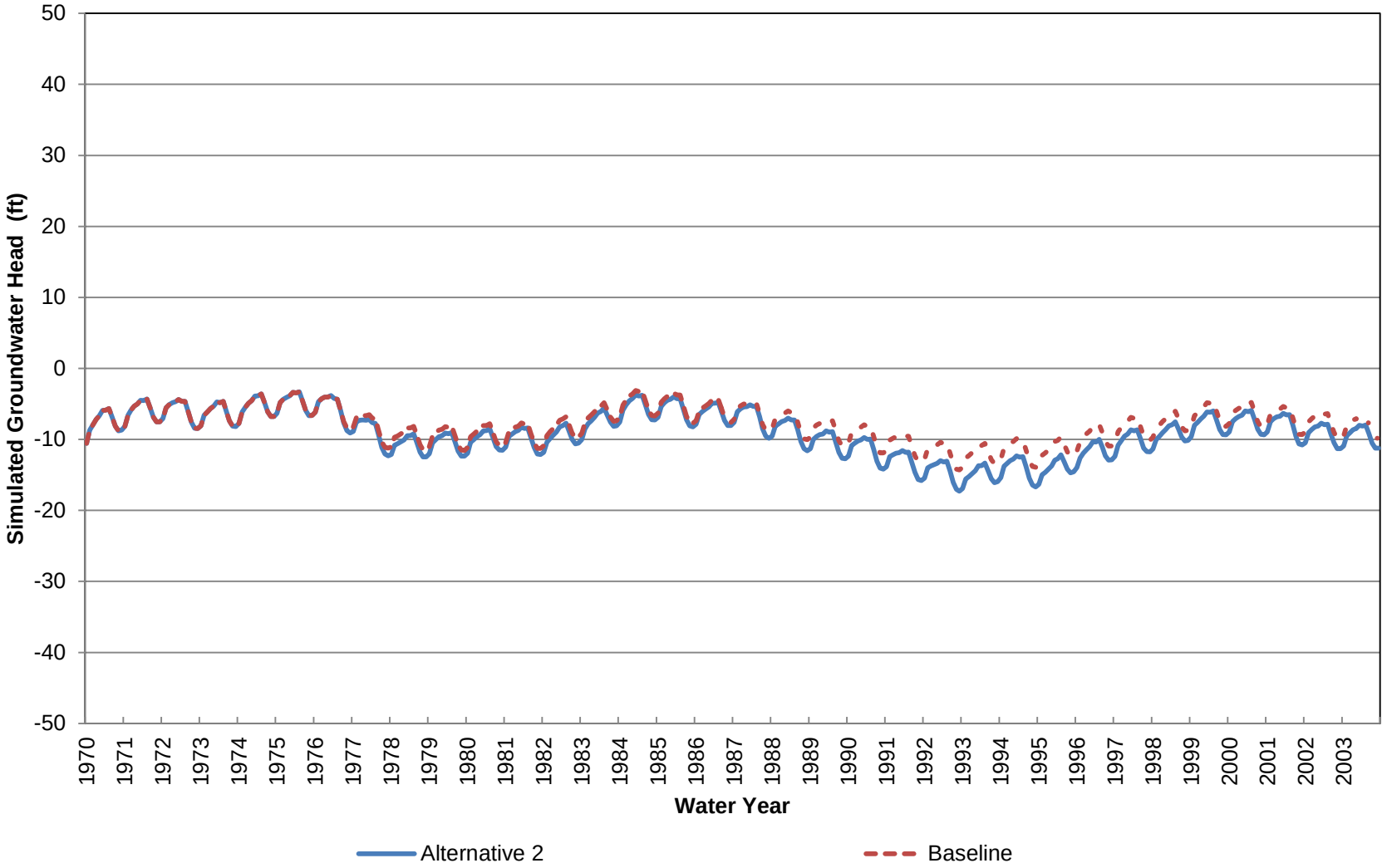
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 32 (Approximately 0-70 ft bgs)



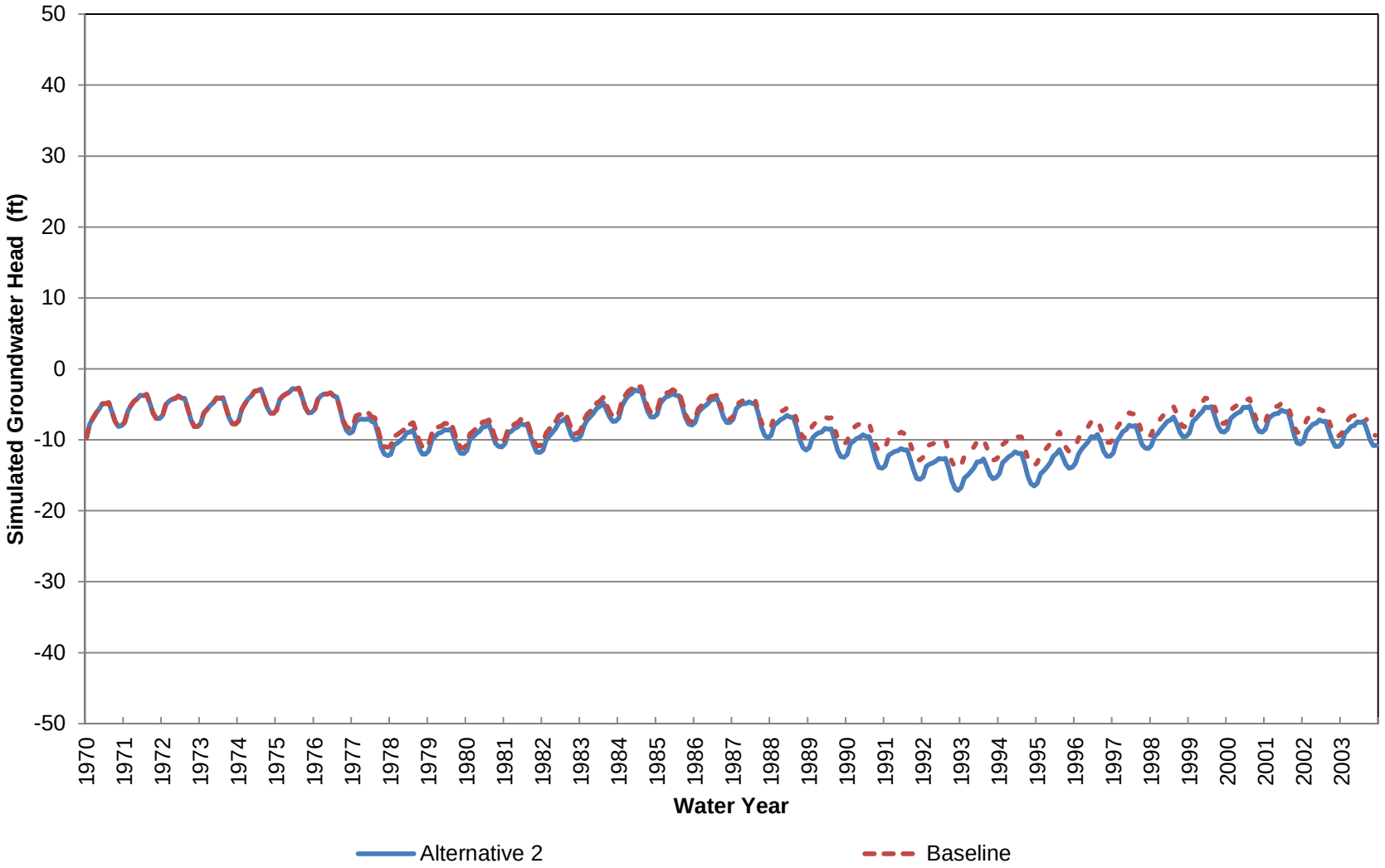
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 32 (Approximately 70-240 ft bgs)



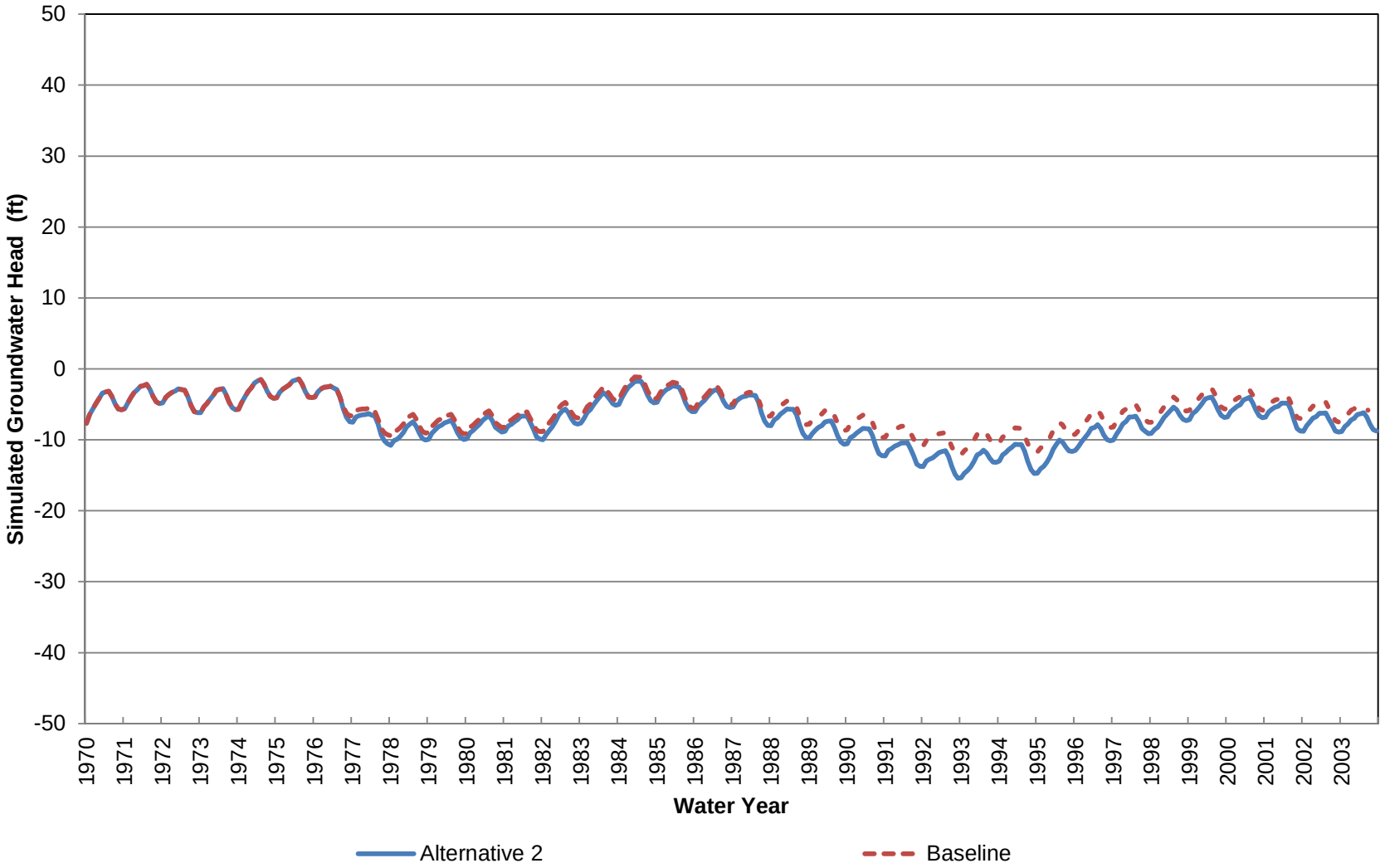
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 32 (Approximately 240-410 ft bgs)



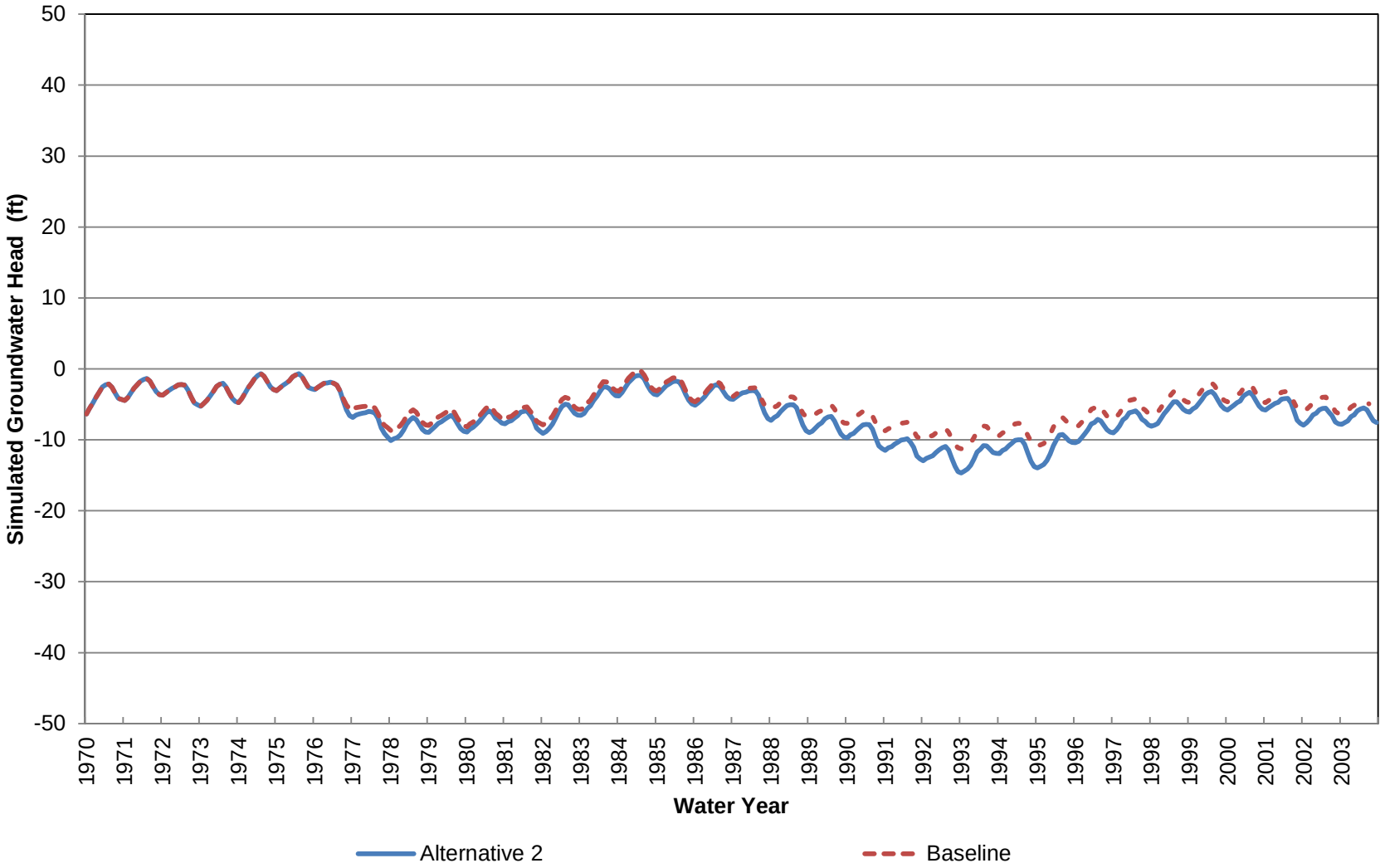
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 32 (Approximately 410-580 ft bgs)



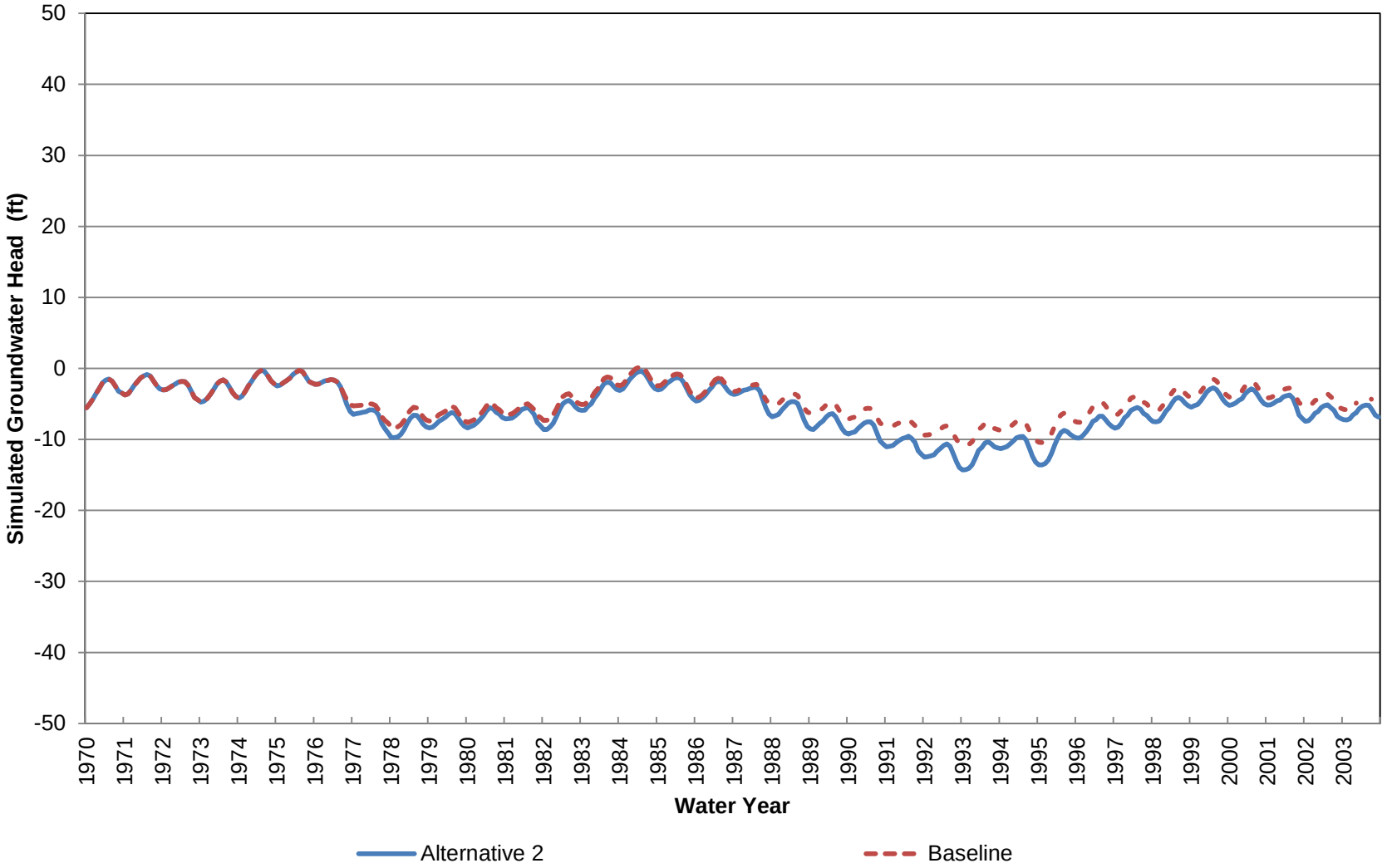
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 32 (Approximately 580-850 ft bgs)



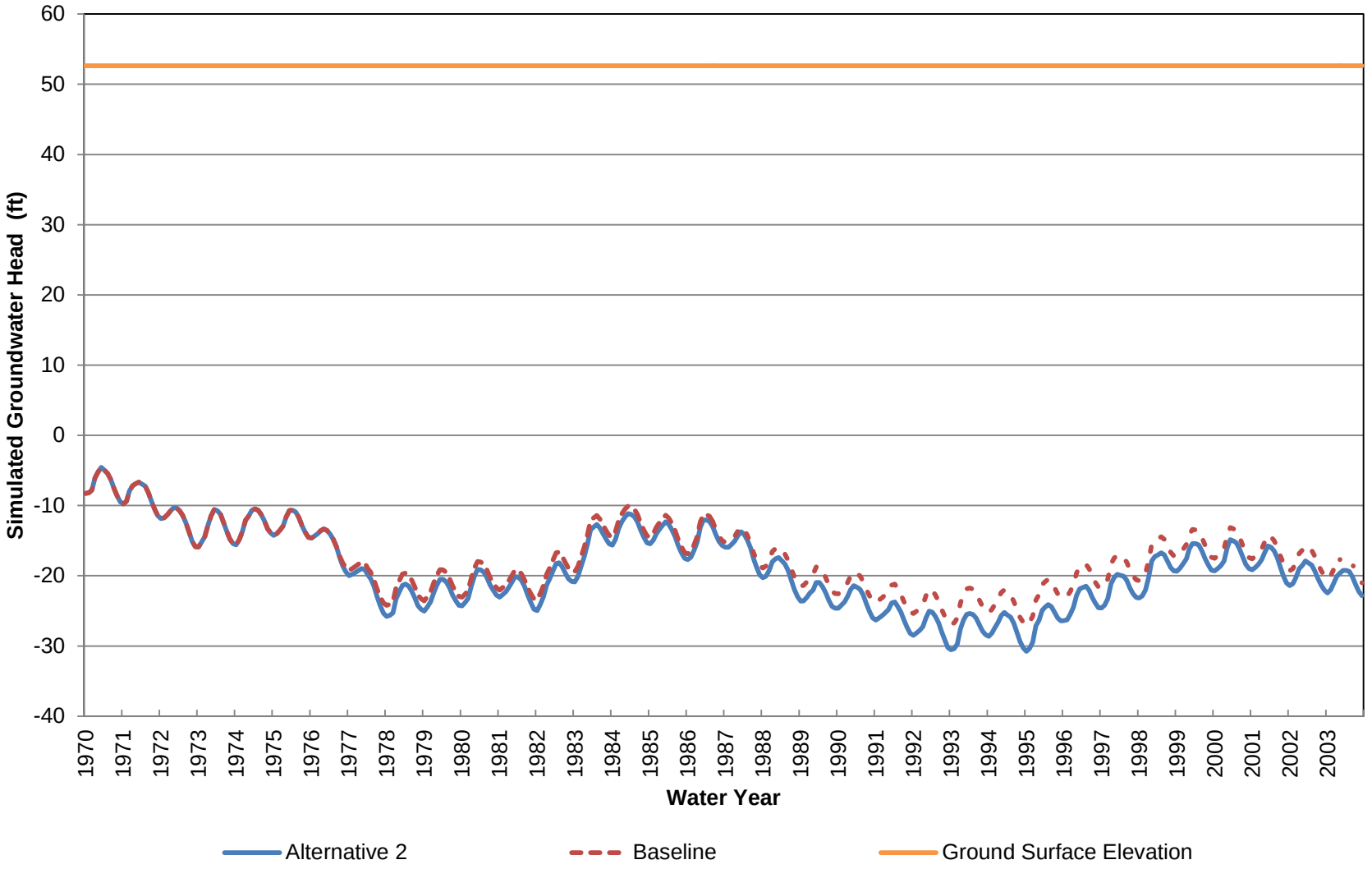
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 32 (Approximately 850-1140 ft bgs)



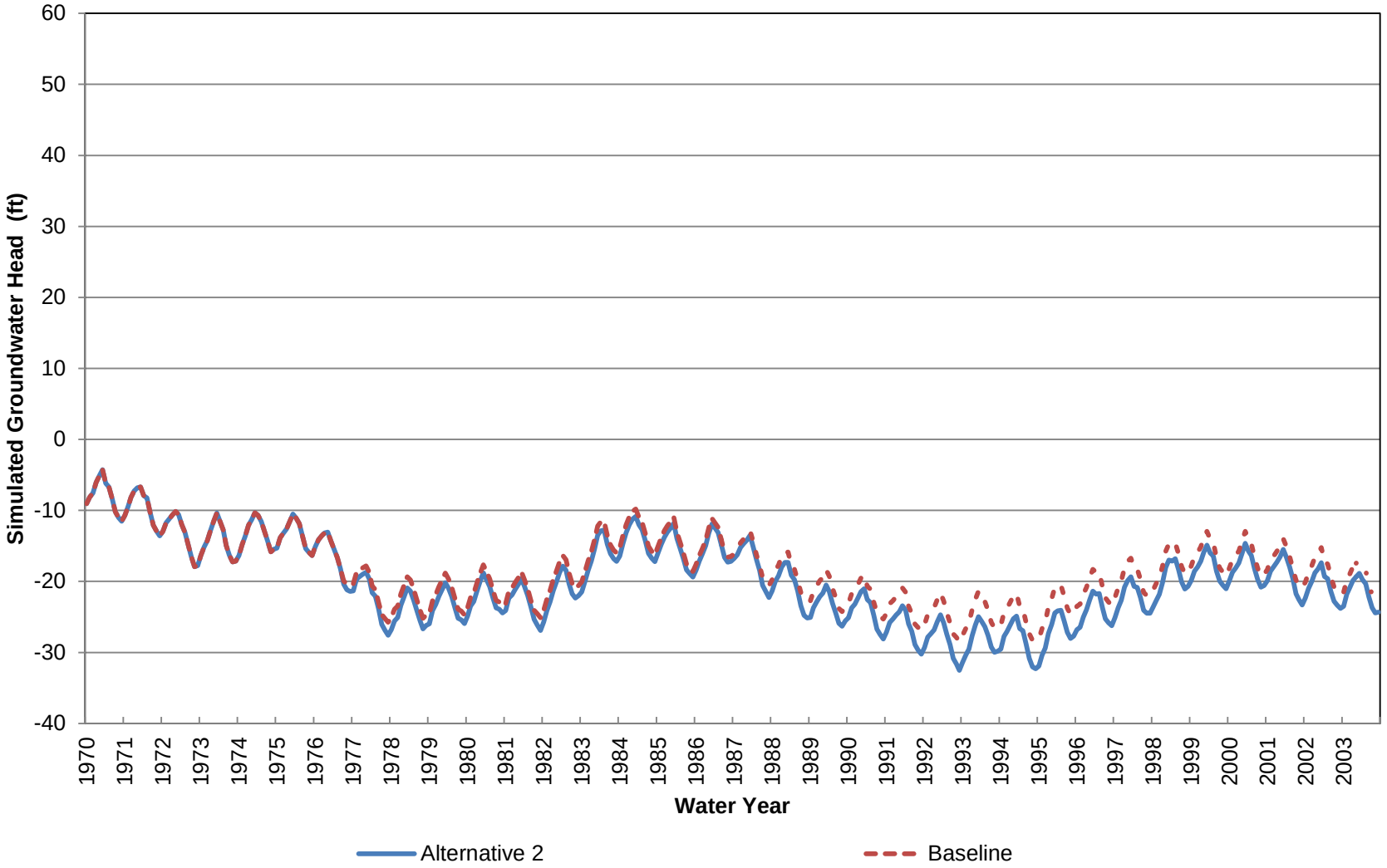
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 32 (Approximately 1140-1560 ft bgs)



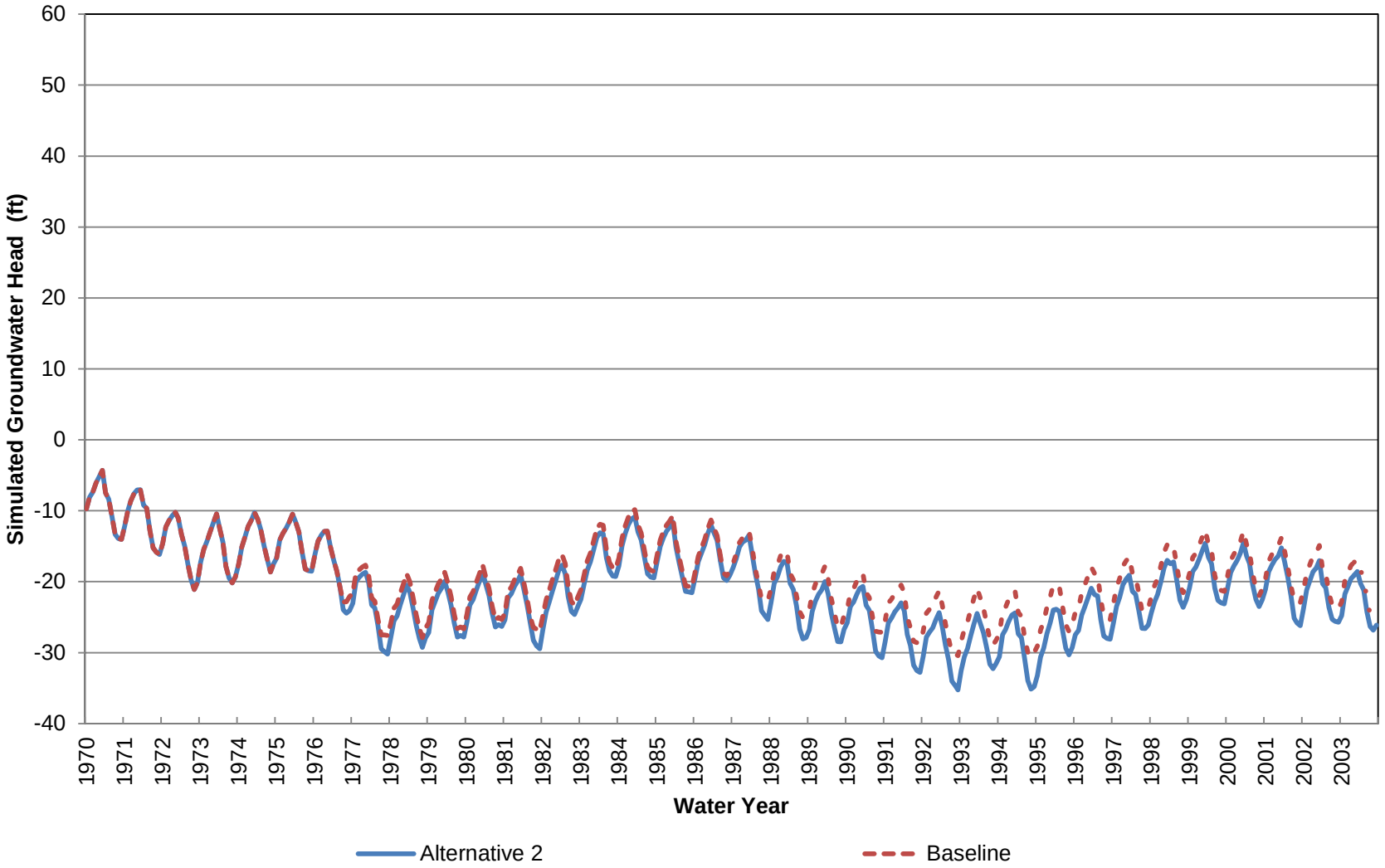
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 33 (Approximately 0-70 ft bgs)



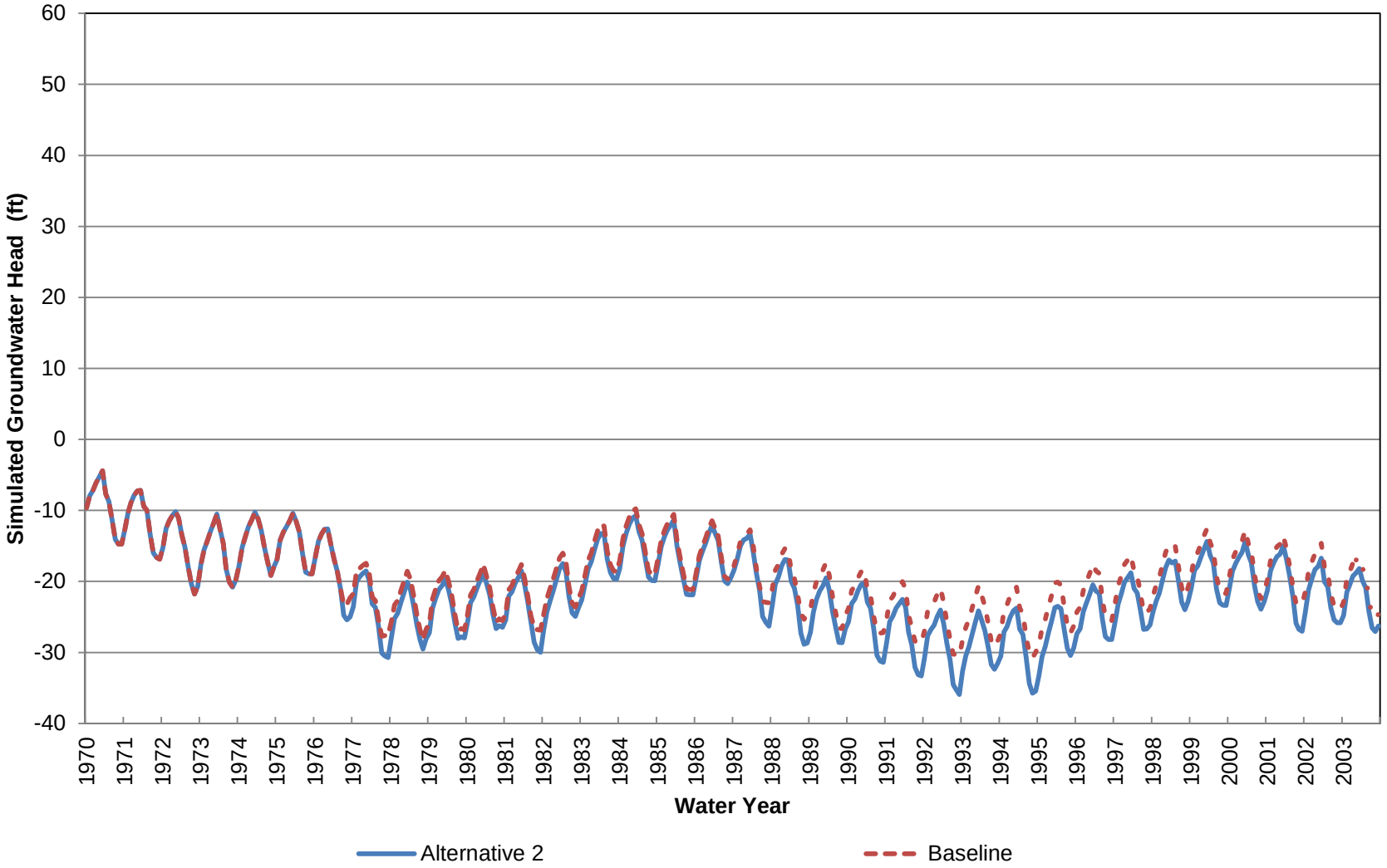
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 33 (Approximately 70-240 ft bgs)



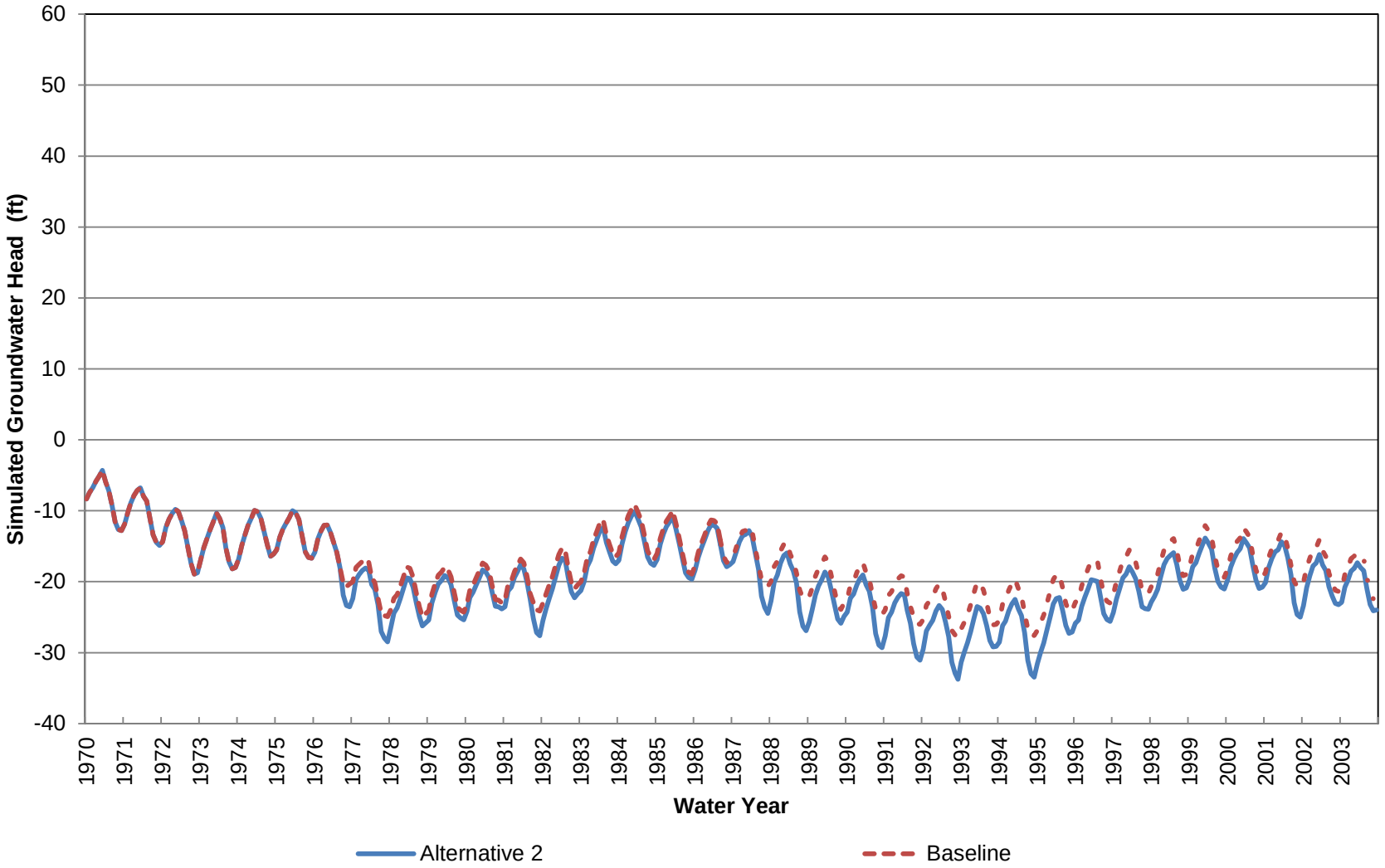
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 33 (Approximately 240-410 ft bgs)



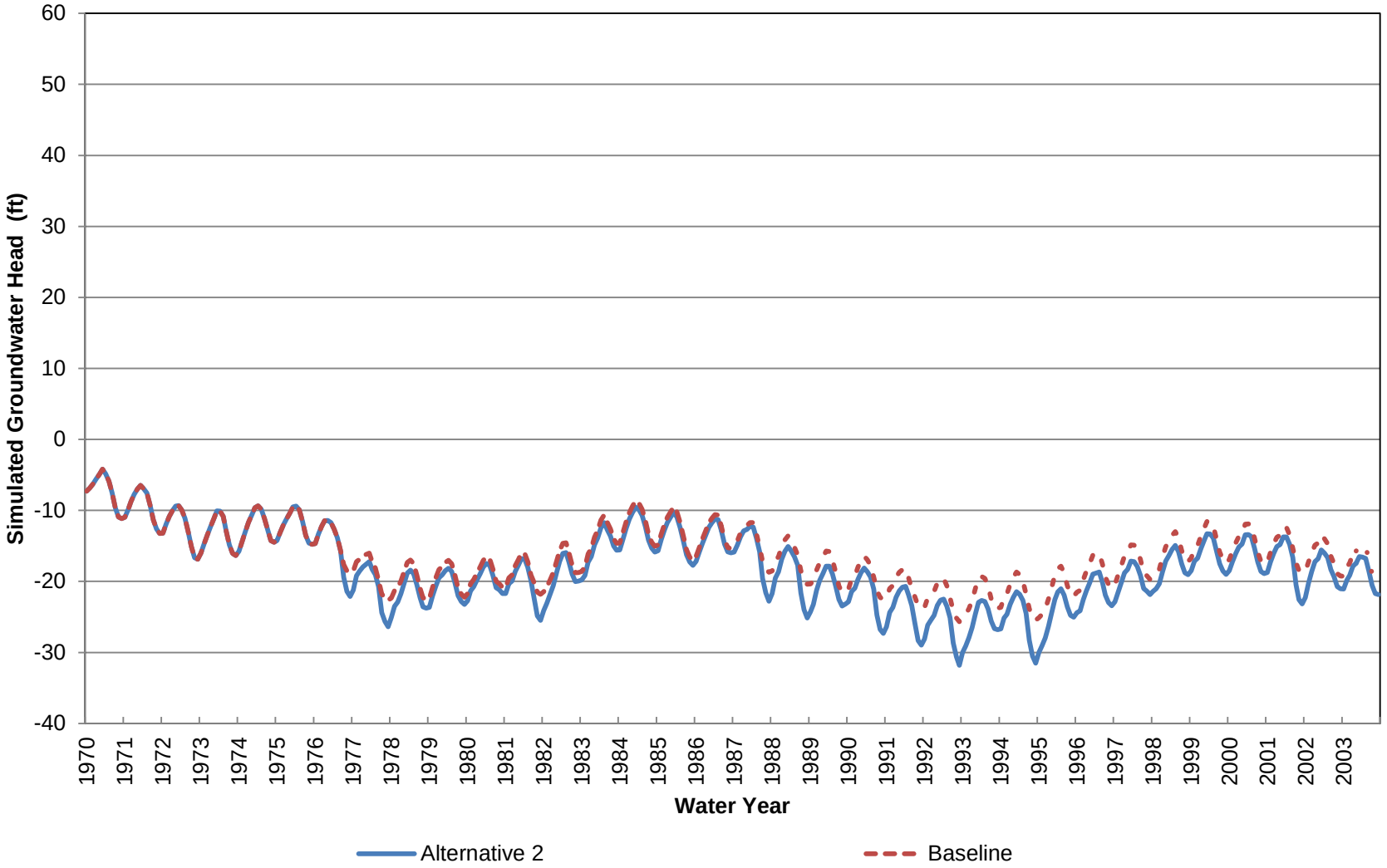
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 33 (Approximately 410-570 ft bgs)



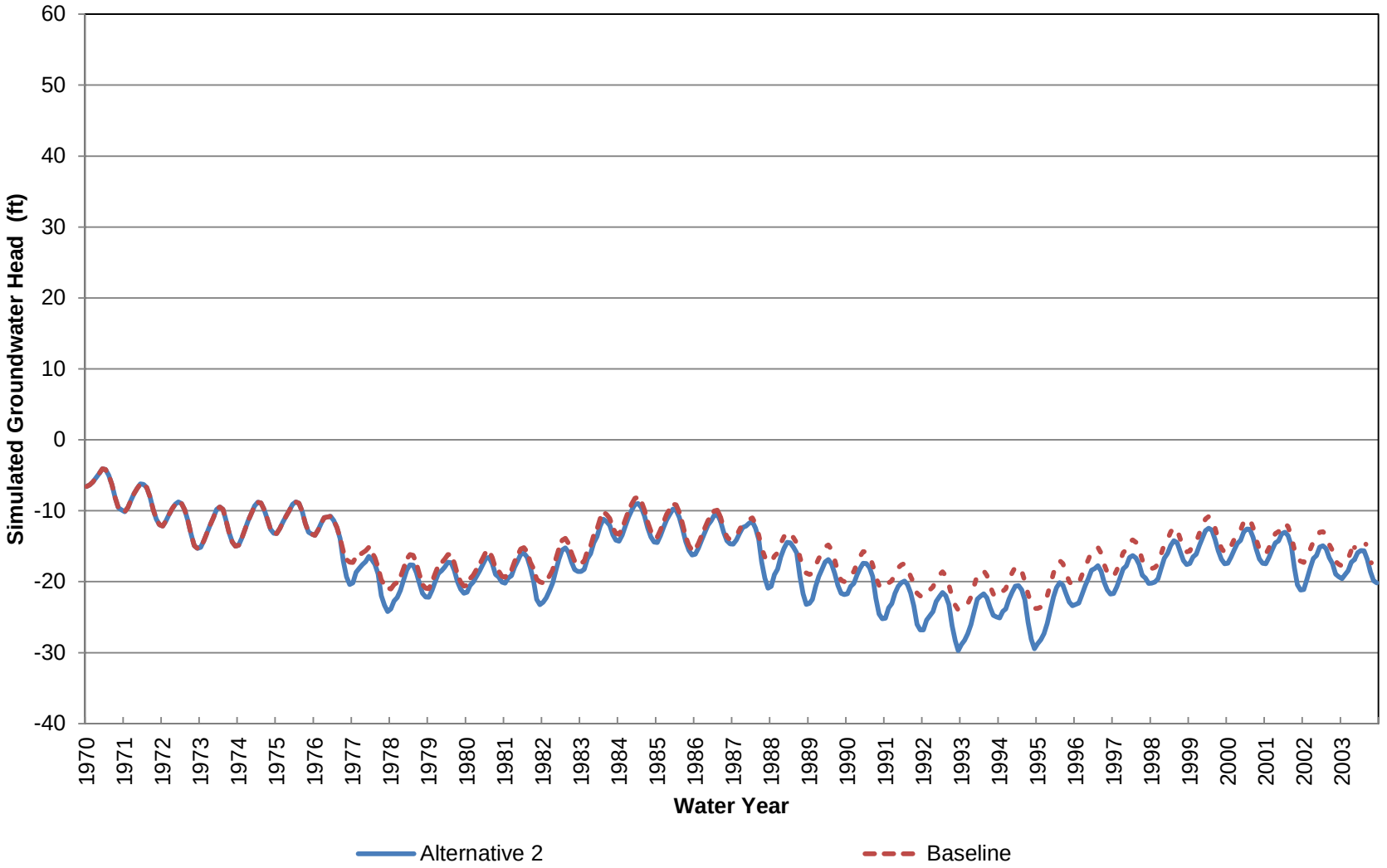
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 33 (Approximately 570-840 ft bgs)



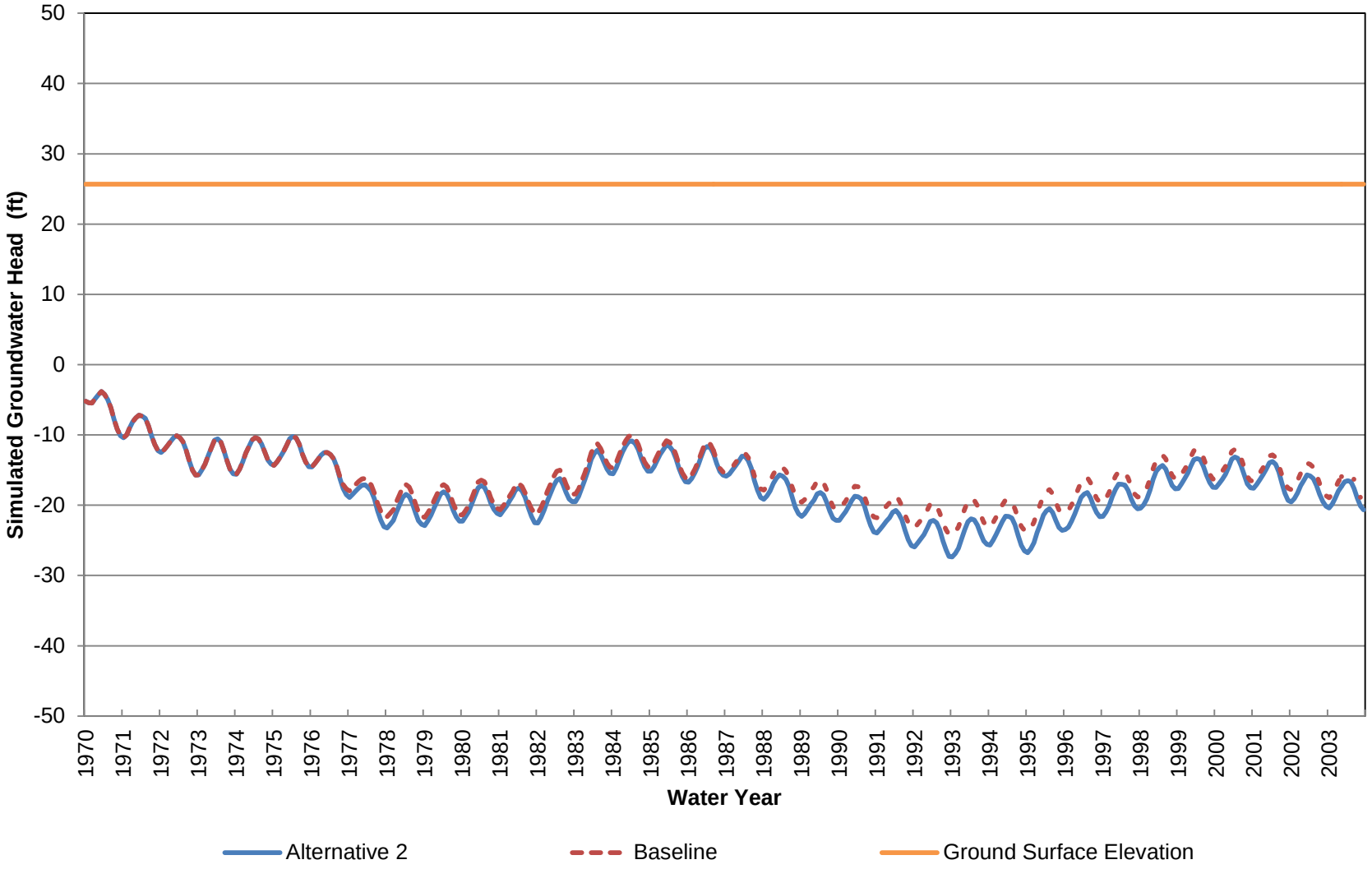
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 33 (Approximately 840-1120 ft bgs)



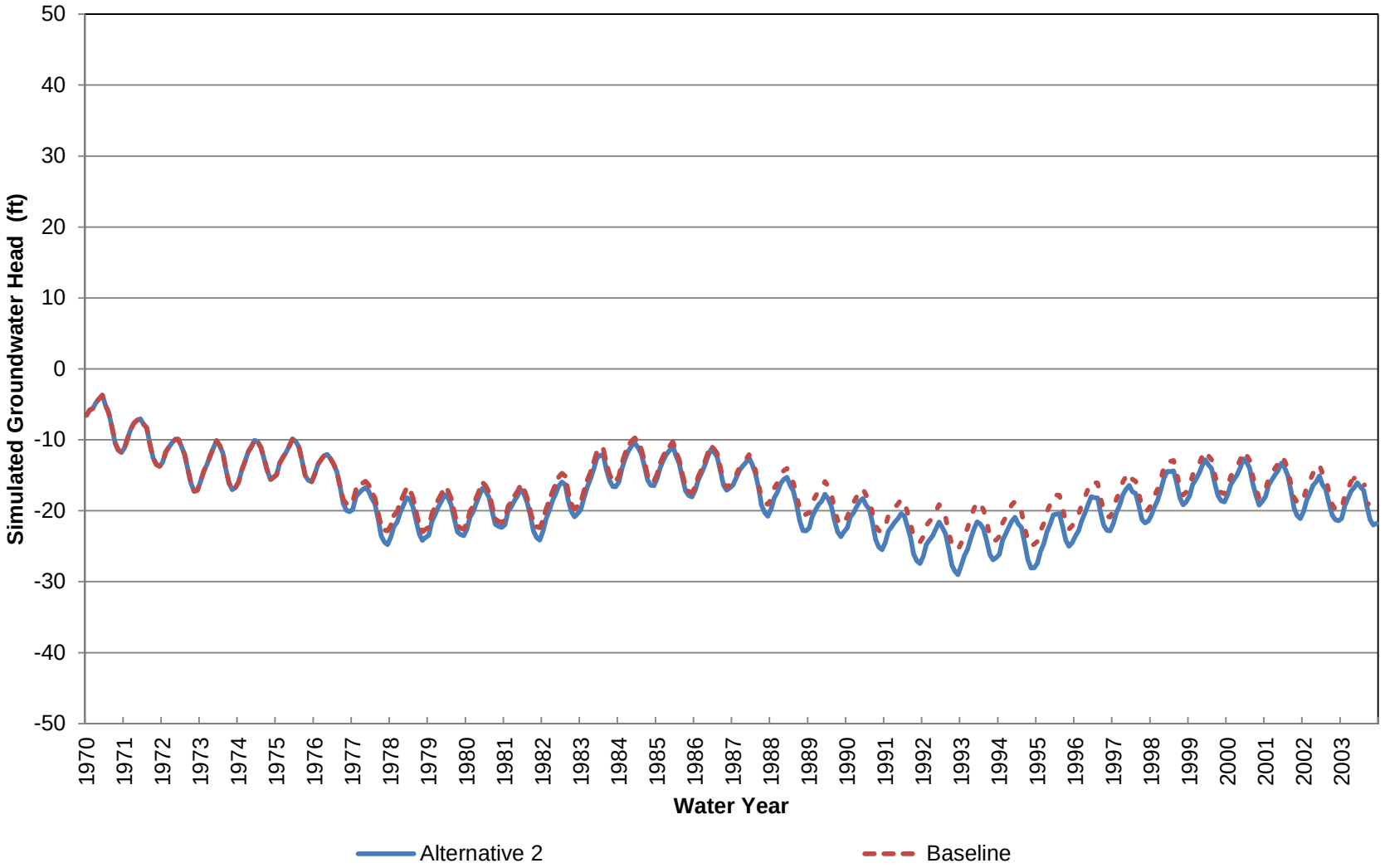
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 33 (Approximately 1120-1540 ft bgs)



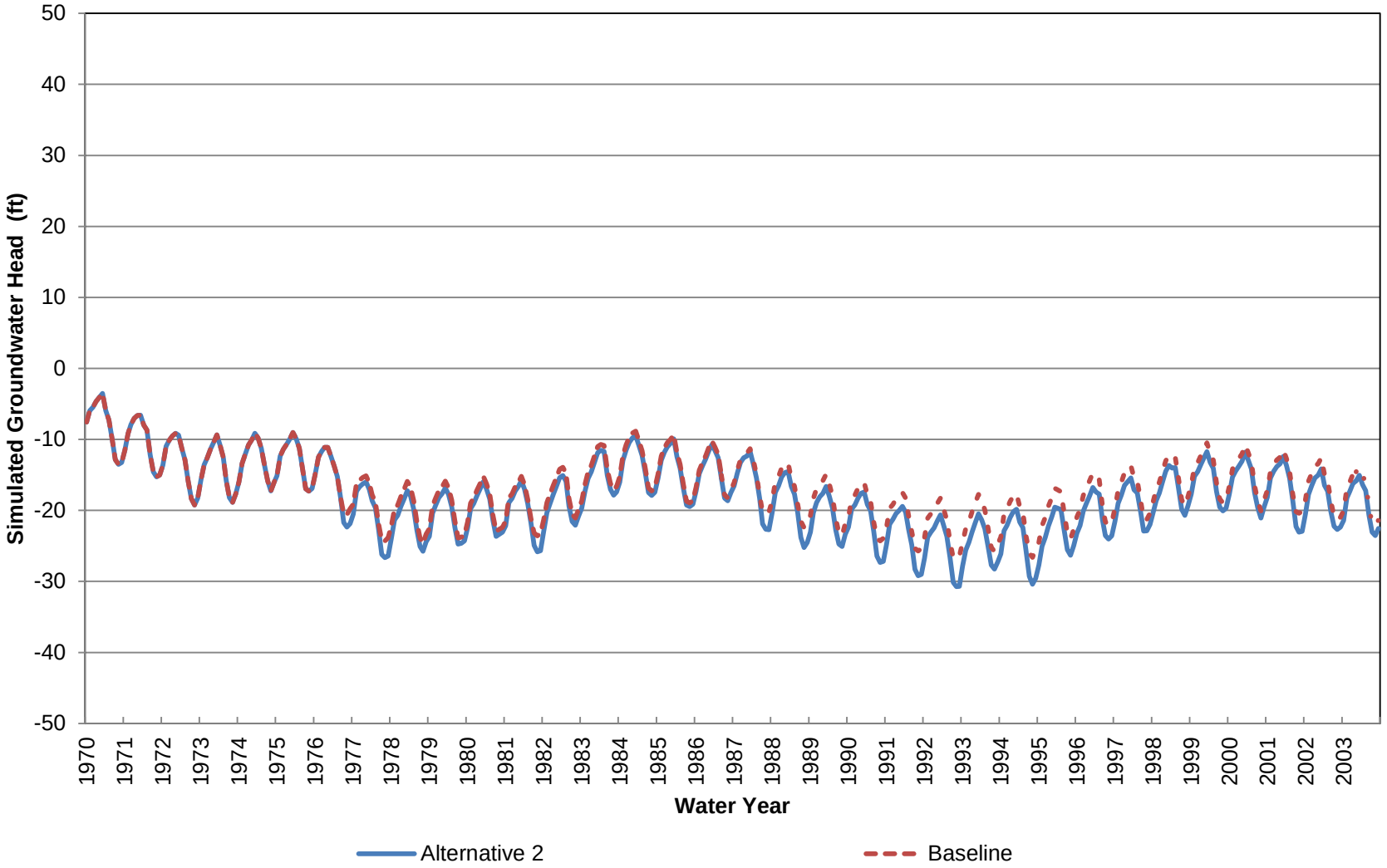
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Elevation at Location 34 (Approximately 0-70 ft bgs)



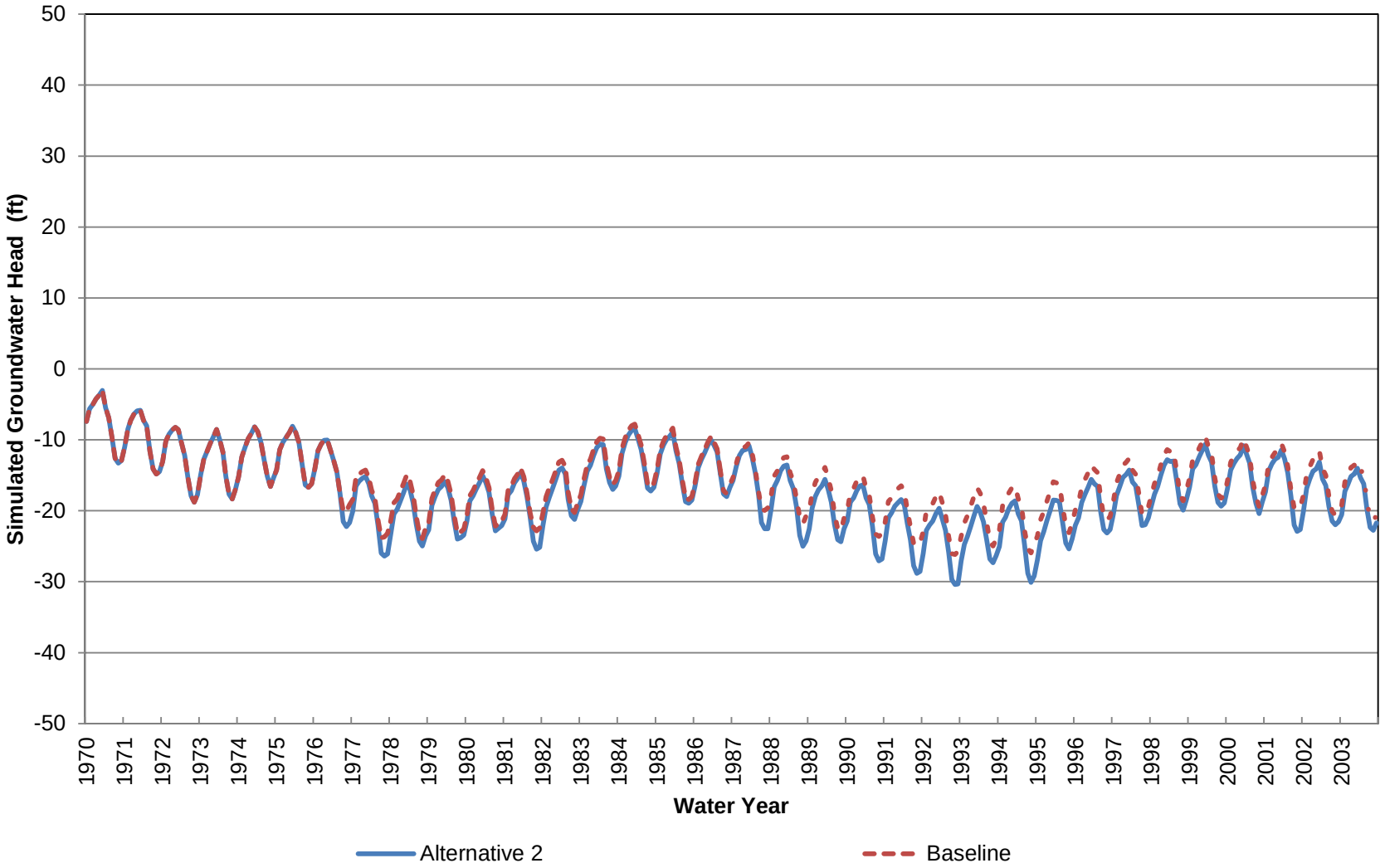
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 34 (Approximately 70-230 ft bgs)



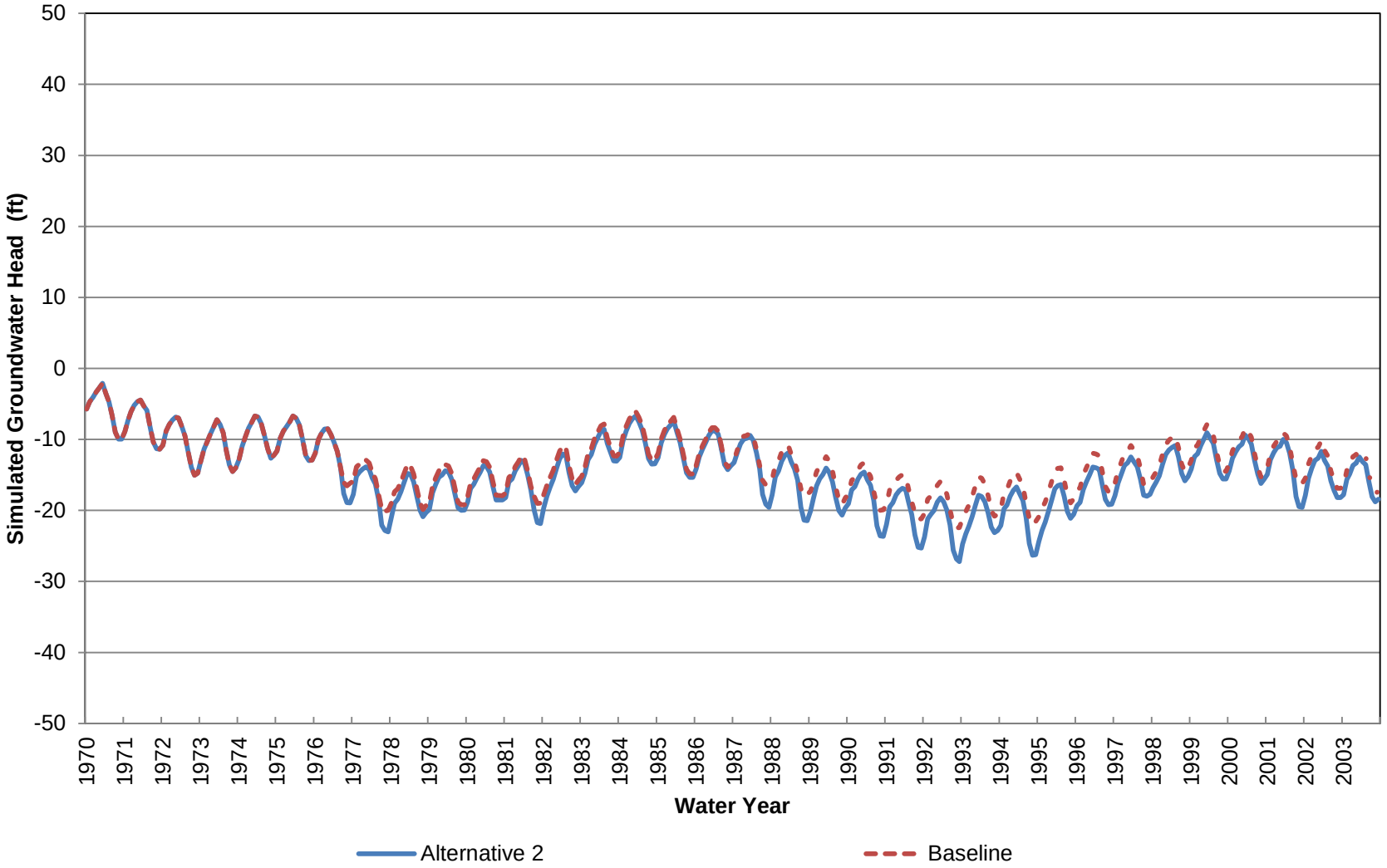
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 34 (Approximately 230-380 ft bgs)



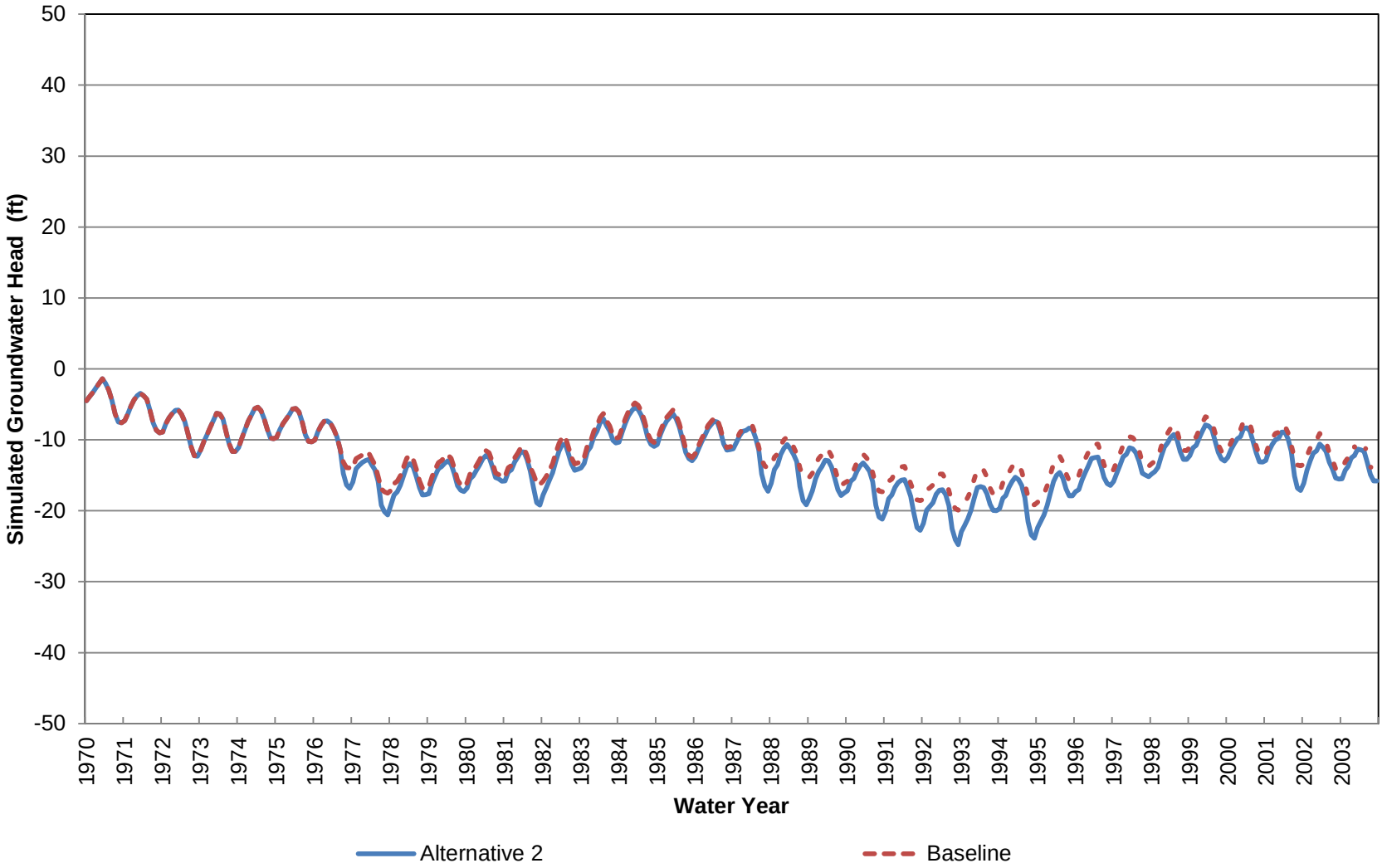
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 34 (Approximately 380-540 ft bgs)



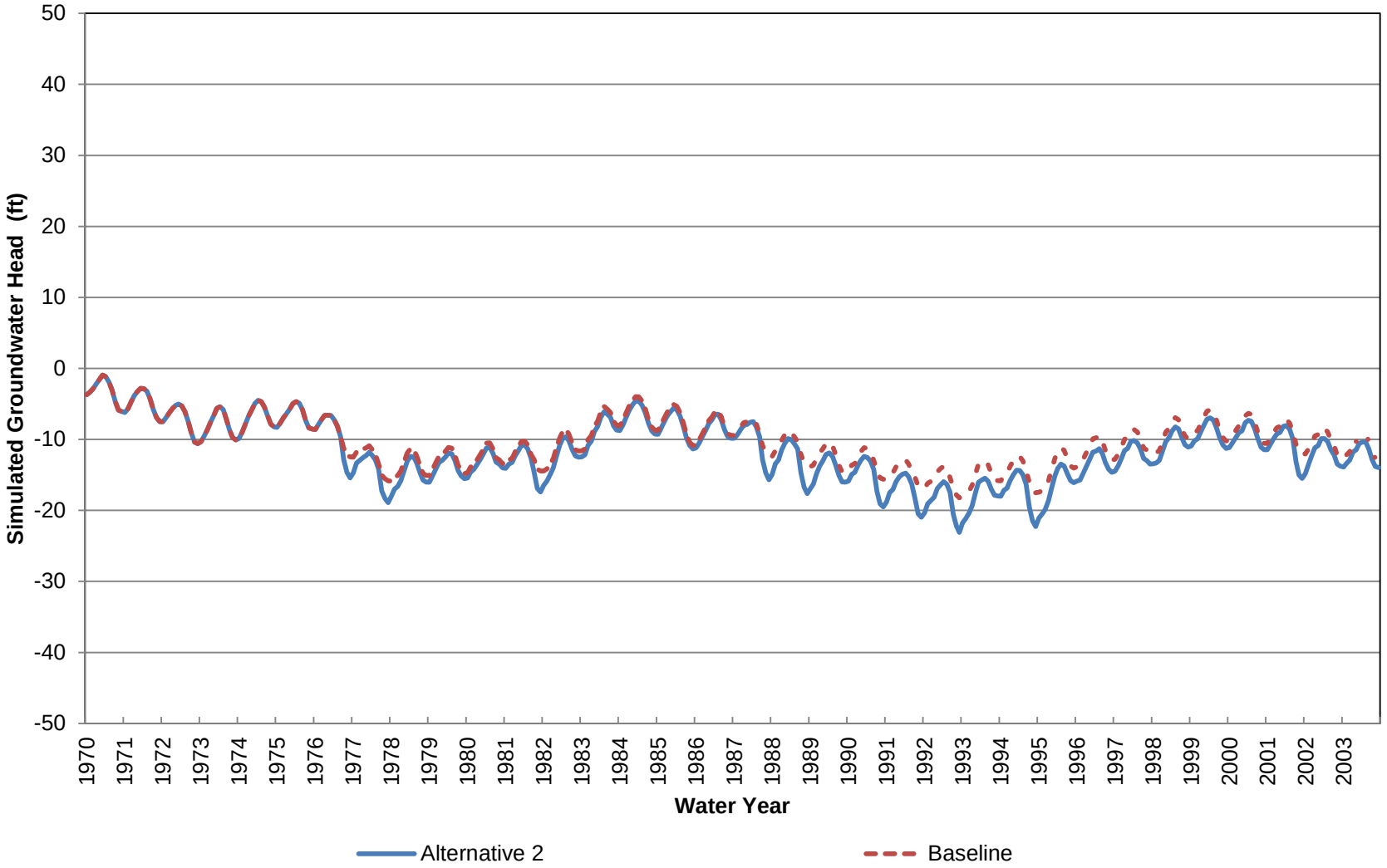
Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 34 (Approximately 540-780 ft bgs)



Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 34 (Approximately 780-1040 ft bgs)



Long-Term Water Transfers EIS/EIR
Simulated Groundwater Head at Location 34 (Approximately 1040-1430 ft bgs)



Appendix F

Air Quality Emission Calculations

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Table F-1. General Conformity Applicability Evaluation (Unmitigated Emissions)

County/ Nonattainment Area	Emissions (tons per year)							
	VOC	NOx	CO	SOx		PM10	PM2.5	
	Sacramento Metro[1,5]	Sacramento Metro[1,5]	Sacramento Area[2]	Sacramento[3,4]	Yuba City-Marysville[6]	Sacramento Co.	Sacramento[4]	Yuba City-Marysville[6]
Colusa	--	--	--	--	--	--	--	--
Glenn	--	--	--	--	--	--	--	--
Sacramento	2.1	71.9	5.6	0.010	--	0.2	0.2	--
Shasta	--	--	--	--	--	--	--	--
Solano	0.0	0.0	--	--	--	--	--	--
Sutter	2.3	19.5	--	--	3.1	--	--	0.8
Tehama	--	--	--	--	--	--	--	--
Yolo	0.7	7.9	--	--	--	--	--	--
Yuba	--	--	--	--	0.0	--	--	0.0
Total	5.1	99.3	5.6	0.010	3.1	0.2	0.2	0.8
Classification	Severe	Severe	Maintenance	PM2.5 Precursor	PM2.5 Precursor	Maintenance	Nonattainment	Nonattainment
De Minimis Threshold (tpy)	25	25	100	100	100	100	100	100
Exceed?	No	Yes	No	No	No	No	No	No

Note:

[1]The Sacramento Metro 8-hour O3 nonattainment area consists of Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties. Emissions occurring within the attainment area of these counties are excluded from the total emissions.

[2]The Sacramento Area CO maintenance area is based on the Census Bureau Urbanized Area and consists of parts of Placer, Sacramento, and Yolo Counties. The general conformity applicability evaluation is based on emissions that would occur within the entire county to be conservative.

[3]All counties are designated as attainment areas for SO2; however, since SO2 is a precursor to PM2.5, its emissions must be evaluated under general conformity.

[4]The 24-hour PM2.5 nonattainment area for Sacramento includes Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties. The general conformity applicability analysis assumes that all emissions that could occur within each county would occur within the Sacramento nonattainment area to be conservative.

[5]VOC and NOx emissions are excluded from Sutter County for Cranmore Farms, Garden Highway Mutual Water Company, Gilsizer Slough Ranch, Pelger Mutual Water Company, Reclamation District 1004, and Tule Basin Farms because they are located in areas designated as attainment for the federal 8-hour O3 NAAQS.

[6]The Yuba City-Marysville PM2.5 nonattainment area contains all of Sutter County and a part of Yuba County.

Table F-2. Emissions Outside of 8-Hour Ozone Nonattainment Area (tons per year)

Water Agency	County	VOC	NOx
Cranmore Farms	Sutter	Electric	Electric
Garden Highway Mutual Water Company	Sutter	Electric	Electric
Gilsizer Slough Ranch	Sutter	0.7	8.8
Pelger Mutual Water Company	Sutter	0.1	1.2
Reclamation District 1004	Sutter	n/a	n/a
Tule Basin Farms	Sutter	0.3	9.4
Total		1.0	19.3

Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

Table F-3. Daily VOC Emissions

Water Agency	Daily VOC Emissions (lbs/day)										
	Butte	**Colusa**	**Glenn**	**Sacramento**	**Shasta**	**Solano**	**Sutter**	**Tehama**	**Yolo**	**Yuba**	**Total**
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									13.32		13.32
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		1.55									1.55
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							0.92				0.92
Pleasant Grove-Verona Mutual Water Company							33.08		Electric		33.08
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		27.07	3.98				n/a				31.05
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				22.78							22.78
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							9.62				9.62
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							3.70				3.70
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**28.61**	**3.98**	**22.78**	**0.00**	**0.00**	**47.32**	**0.00**	**13.32**	**0.00**	**116.02**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

Table F-4. Daily NOx Emissions

Water Agency	Daily NOx Emissions (lbs/day)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									147.70		147.70
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		29.38									29.38
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							17.49				17.49
Pleasant Grove-Verona Mutual Water Company							285.31		Electric		285.31
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		354.91	49.10				n/a				404.01
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				787.78							787.78
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							118.61				118.61
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							128.06				128.06
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**384.29**	**49.10**	**787.78**	**0.00**	**0.00**	**549.47**	**0.00**	**147.70**	**0.00**	**1,918.33**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

Table F-5. Daily CO Emissions

Water Agency	Daily CO Emissions (lbs/day)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									125.01		125.01
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		27.06									27.06
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							23.01				23.01
Pleasant Grove-Verona Mutual Water Company							125.64		Electric		125.64
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		118.57	10.58				n/a				129.15
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				61.21							61.21
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							25.56				25.56
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							9.95				9.95
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**145.63**	**10.58**	**61.21**	**0.00**	**0.00**	**184.16**	**0.00**	**125.01**	**0.00**	**526.59**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

Table F-6. Daily SOx Emissions

Water Agency	Daily SOx Emissions (lbs/day)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									25.40		25.40
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		9.63									9.63
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							5.73				5.73
Pleasant Grove-Verona Mutual Water Company							31.29		Electric		31.29
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		36.05	3.25				n/a				39.29
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				0.11							0.11
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							7.84				7.84
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.02				0.02
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**45.68**	**3.25**	**0.11**	**0.00**	**0.00**	**44.89**	**0.00**	**25.40**	**0.00**	**119.32**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

Table F-7. Daily PM10 Emissions

Water Agency	Daily PM10 Emissions (lbs/day)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									6.39		6.39
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		1.55									1.55
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							1.38				1.38
Pleasant Grove-Verona Mutual Water Company							8.13		Electric		8.13
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		6.37	0.52				n/a				6.90
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				1.93							1.93
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							1.86				1.86
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.31				0.31
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**7.92**	**0.52**	**1.93**	**0.00**	**0.00**	**11.68**	**0.00**	**6.39**	**0.00**	**28.43**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Daily Groundwater Substitution Emissions by County (Unmitigated)

Table F-8. Daily PM2.5 Emissions

Water Agency	Daily PM2.5 Emissions (lbs/day)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									6.39		6.39
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		1.55									1.55
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							1.38				1.38
Pleasant Grove-Verona Mutual Water Company							8.00		Electric		8.00
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		6.30	0.51				n/a				6.81
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				1.93							1.93
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							1.81				1.81
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.31				0.31
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**7.84**	**0.51**	**1.93**	**0.00**	**0.00**	**11.50**	**0.00**	**6.39**	**0.00**	**28.17**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

Table F-9. Annual VOC Emissions

Water Agency	Annual VOC Emissions (tons per year)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									0.71		0.71
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		0.11									0.11
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							0.06				0.06
Pleasant Grove-Verona Mutual Water Company							2.26		Electric		2.26
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		1.03	0.15				n/a				1.18
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				2.08							2.08
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							0.71				0.71
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.27				0.27
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**1.14**	**0.15**	**2.08**	**0.00**	**0.00**	**3.31**	**0.00**	**0.71**	**0.00**	**7.39**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

Table F-10. Annual NOx Emissions

Water Agency	Annual NOx Emissions (tons per year)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									7.89		7.89
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		2.14									2.14
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							1.16				1.16
Pleasant Grove-Verona Mutual Water Company							19.53		Electric		19.53
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		13.49	1.87				n/a				15.36
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				71.89							71.89
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							8.79				8.79
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							9.38				9.38
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**15.64**	**1.87**	**71.89**	**0.00**	**0.00**	**38.86**	**0.00**	**7.89**	**0.00**	**136.14**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

Table F-11. Annual CO Emissions

Water Agency	Annual CO Emissions (tons per year)										
	Butte	**Colusa**	**Glenn**	**Sacramento**	**Shasta**	**Solano**	**Sutter**	**Tehama**	**Yolo**	**Yuba**	**Total**
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									6.68		6.68
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		1.97									1.97
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							1.53				1.53
Pleasant Grove-Verona Mutual Water Company							8.60		Electric		8.60
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		4.51	0.40				n/a				4.91
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				5.59							5.59
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							1.89				1.89
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.73				0.73
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**6.48**	**0.40**	**5.59**	**0.00**	**0.00**	**12.75**	**0.00**	**6.68**	**0.00**	**31.89**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

Table F-12. Annual SOx Emissions

Water Agency	Annual SOx Emissions (tons per year)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									1.36		1.36
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		0.70									0.70
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							0.38				0.38
Pleasant Grove-Verona Mutual Water Company							2.14		Electric		2.14
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		1.37	0.12				n/a				1.49
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				0.01							0.01
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							0.58				0.58
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.00				0.00
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**2.07**	**0.12**	**0.01**	**0.00**	**0.00**	**3.10**	**0.00**	**1.36**	**0.00**	**6.67**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

Table F-13. Annual PM10 Emissions

Water Agency	Annual PM10 Emissions (tons per year)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									0.34		0.34
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		0.11									0.11
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							0.09				0.09
Pleasant Grove-Verona Mutual Water Company							0.56		Electric		0.56
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		0.24	0.02				n/a				0.26
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				0.18							0.18
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							0.14				0.14
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.02				0.02
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**0.36**	**0.02**	**0.18**	**0.00**	**0.00**	**0.81**	**0.00**	**0.34**	**0.00**	**1.70**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Annual Groundwater Substitution Emissions by County (Unmitigated)

Table F-14. Annual PM2.5 Emissions

Water Agency	Annual PM2.5 Emissions (tons per year)										
	Butte	**Colusa**	**Glenn**	**Sacramento**	**Shasta**	**Solano**	**Sutter**	**Tehama**	**Yolo**	**Yuba**	**Total**
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									0.34		0.34
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		0.11									0.11
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							0.09				0.09
Pleasant Grove-Verona Mutual Water Company							0.55		Electric		0.55
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		0.24	0.02				n/a				0.26
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				0.18							0.18
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							0.13				0.13
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.02				0.02
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**0.35**	**0.02**	**0.18**	**0.00**	**0.00**	**0.80**	**0.00**	**0.34**	**0.00**	**1.68**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Anderson-Cottonwood Irrigation District	
Transfer Volume	5,226	acre feet/year
Location	Shasta	County
	Tehama	County

Federal Attainment Status

	Shasta	*Tehama*
PM10	A	A
PM2.5	A	A
O3	A	A

Engines not subject to ATCM if remotely-located.

Table F-15. Anderson-Cottonwood Irrigation District Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
Barney Street	Barney Street	Shasta	Electric	2012	200	n/a	5,500	85%	737	4,422	24	4,366
Crowley Gulch	Crowley Gulch	Shasta	Electric	2012	50	n/a	1,000	15%	134	804	24	4,366
						Total	**6,500**	**100%**	**871**	**5,226**	**48**	**8,733**
						Total (Shasta County)	**6,500**	**100%**	**871**	**5,226**	**48**	**8,733**
						Total (Tehama County)	**0**	**0**	**0**	**0**	**0**	**0**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Conversion Factors

1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Conaway Preservation Group	Federal Attainment Status			Peak Month
Transfer Volume	35,000 acre feet/year	PM10	A	*Engines subject to ATCM.*	9,964 AF/month
Location	Yolo County	PM2.5	N		72,735 gallons/minute
		O3	N		74% peak pump rate

Table F-16. Conaway Preservation Group Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)	Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr) VOC	NOx	CO	SOx	PM10	PM2.5	Daily Emissions (lbs/day) VOC	NOx	CO	SOx	PM10	PM2.5	Annual Emissions (tons per year) VOC	NOx	CO	SOx	PM10	PM2.5
ConawayPG12W-1	12W-1	Yolo	Electric		250	n/a	3,500	4%	357	1,253	18	1,944	n/a																		
ConawayPG12W-2	12W-2	Yolo	Electric	TBD	250	n/a	2,500	3%	255	895	18	1,944	n/a																		
ConawayPG12W-5	12W-5	Yolo	Electric	TBD	250	n/a	3,500	4%	357	1,253	18	1,944	n/a																		
ConawayPG13W-3	13W-3	Yolo	Electric		200	n/a	3,500	4%	357	1,253	18	1,944	n/a																		
ConawayPG16W-2	16W-2	Yolo	Diesel	2005	227	T2	1,600	2%	163	573	18	1,944	24,751	0.2	4.7	2.6	0.93	0.15	0.15	2.24	42.60	23.78	8.47	1.36	1.36	0.12	2.28	1.27	0.45	0.07	0.07
ConawayPG17W-3	17W-3	Yolo	Diesel	2005	227	T2	1,700	2%	173	608	18	1,944	24,751	0.2	4.7	2.6	0.93	0.15	0.15	2.24	42.60	23.78	8.47	1.36	1.36	0.12	2.28	1.27	0.45	0.07	0.07
ConawayPG1W-3	1W-3	Yolo	Electric		250	n/a	3,500	4%	357	1,253	18	1,944	n/a																		
ConawayPG20W-1	20W-1	Yolo	Electric		100	n/a	2,500	3%	255	895	18	1,944	n/a																		
ConawayPG21W-1	21W-1	Yolo	Electric	TBD	250	n/a	2,500	3%	255	895	18	1,944	n/a																		
ConawayPG21W-3	21W-3	Yolo	Electric		100	n/a	2,500	3%	255	895	18	1,944	n/a																		
ConawayPG24W-1	24W-1	Yolo	Electric	TBD	250	n/a	2,500	3%	255	895	18	1,944	n/a																		
ConawayPG31W-1	31W-1	Yolo	Electric		100	n/a	2,300	2%	234	823	18	1,944	n/a																		
ConawayPG32NW-1	32NW-1	Yolo	Electric		100	n/a	3,300	3%	336	1,181	18	1,944	n/a																		
ConawayPG32NW-2	32NW-2	Yolo	Electric		250	n/a	3,500	4%	357	1,253	18	1,944	n/a																		
ConawayPG32W-3	32W-3	Yolo	Electric		250	n/a	2,500	3%	255	895	18	1,944	n/a																		
ConawayPG33NW-1	33NW-1	Yolo	Electric		100	n/a	2,300	2%	234	823	18	1,944	n/a																		
ConawayPG33NW-2	33NW-2	Yolo	Electric		100	n/a	2,200	2%	224	787	18	1,944	n/a																		
ConawayPG33NW-3	33NW-3	Yolo	Electric		100	n/a	2,100	2%	214	752	18	1,944	n/a																		
ConawayPG33NW-4	33NW-4	Yolo	Electric		100	n/a	3,400	3%	346	1,217	18	1,944	n/a																		
ConawayPG33NW-5	33NW-5	Yolo	Electric		100	n/a	1,800	2%	183	644	18	1,944	n/a																		
ConawayPG33NW-6	33NW-6	Yolo	Electric		100	n/a	2,100	2%	214	752	18	1,944	n/a																		
ConawayPG33NW-7	33NW-7	Yolo	Electric		100	n/a	1,400	1%	143	501	18	1,944	n/a																		
ConawayPG33NW-8	33NW-8	Yolo	Electric		100	n/a	2,200	2%	224	787	18	1,944	n/a																		
ConawayPG5W-2	5W-2	Yolo	Electric		250	n/a	3,500	4%	357	1,253	18	1,944	n/a																		
ConawayPG5W-3	5W-3	Yolo	Electric		250	n/a	2,700	3%	275	966	18	1,944	n/a																		
ConawayPG6W-2	6W-2	Yolo	Electric		100	n/a	3,500	4%	357	1,253	18	1,944	n/a																		
ConawayPG7W-1	7W-1	Yolo	Electric		75	n/a	1,800	2%	183	644	18	1,944	n/a																		
ConawayPG7W-2	7W-2	Yolo	Electric		250	n/a	3,500	4%	357	1,253	18	1,944	n/a																		
ConawayPG7W-4	7W-4	Yolo	Electric		200	n/a	3,500	4%	357	1,253	18	1,944	n/a																		
ConawayPG7W-4S	7W-4S	Yolo	Electric		200	n/a	3,500	4%	357	1,253	18	1,944	n/a																		
ConawayPG8W-2	8W-2	Yolo	Diesel	2002	227	T1	2,300	2%	234	823	18	1,944	24,751	1.0	6.9	8.5	0.93	0.40	0.40	8.83	62.50	77.45	8.47	3.67	3.67	0.47	3.34	4.14	0.45	0.20	0.20
ConawayPG8W-2N	8W-2N	Yolo	Electric		200	n/a	1,500	2%	153	537	18	1,944	n/a																		
ConawayPGOW-1	OW-1	Yolo	Electric		100	n/a	2,600	3%	265	930	18	1,944	n/a																		
ConawayPGOW-2	OW-2	Yolo	Electric		100	n/a	3,400	3%	346	1,217	18	1,944	n/a																		
ConawayPGOW-3	OW-3	Yolo	Electric		125	n/a	3,400	3%	346	1,217	18	1,944	n/a																		
ConawayPGOW-4	OW-4	Yolo	Electric		100	n/a	1,700	2%	173	608	18	1,944	n/a																		
ConawayPGOW-5	OW-5	Yolo	Electric		125	n/a	2,000	2%	204	716	18	1,944	n/a																		
						Total	**97,800**	**100%**	**9,964**	**35,000**	**673**	**71,912**	**74,253**							**13.32**	**147.70**	**125.01**	**25.40**	**6.39**	**6.39**	**0.71**	**7.89**	**6.68**	**1.36**	**0.34**	**0.34**

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend

	Assumed to be electric (similar to 32W-2)
	Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type
	Emission factor based on NMHC+NOx emission standard

Conversion Factors

1 lb =	453.6	g
1 ton =	2,000	lbs
1 month =	30.4	days
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4	lb/hp-hr	*(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855	g/mL	*(Based on MSDS for Hess Diesel Fuel All Types)*
7.13	lb/gal	

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Cordua Irrigation District		
Transfer Volume	12,000	acre feet/year	
Location	Yuba	County	

Federal Attainment Status

PM10	A	*Engines subject to ATCM.*
PM2.5	N	
O3	A	

Table F-17. Cordua Irrigation District Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
COR1	COR1	Yuba	Electric		60	n/a	1,000	3%	129	323	23	1,757
COR2	COR2	Yuba	Electric		50	n/a	900	2%	116	291	23	1,757
COR3	COR3	Yuba	Electric		60	n/a	1,000	3%	129	323	23	1,757
COR4	COR4	Yuba	Electric		75	n/a	1,400	4%	181	453	23	1,757
COR5	COR5	Yuba	Electric		75	n/a	1,300	4%	168	420	23	1,757
COR8	COR8	Yuba	Electric		75	n/a	2,000	5%	259	647	23	1,757
COR9	COR9	Yuba	Electric		60	n/a	1,000	3%	129	323	23	1,757
COR10	COR10	Yuba	Electric		75	n/a	1,300	4%	168	420	23	1,757
COR11	COR11	Yuba	Electric		60	n/a	1,800	5%	233	582	23	1,757
COR12	COR12	Yuba	Electric		100	n/a	1,400	4%	181	453	23	1,757
COR13	COR13	Yuba	Electric		100	n/a	2,100	6%	272	679	23	1,757
COR14	COR14	Yuba	Electric		75	n/a	1,800	5%	233	582	23	1,757
COR18	COR18	Yuba	Electric	2013	100	n/a	2,000	5%	259	647	23	1,757
COR20	COR20	Yuba	Electric	2013	125	n/a	2,150	6%	278	695	23	1,757
COR21	COR21	Yuba	Electric		75	n/a	1,250	3%	162	404	23	1,757
COR22	COR22	Yuba	Electric		60	n/a	1,750	5%	226	566	23	1,757
COR23	COR23	Yuba	Electric		75	n/a	1,150	3%	149	372	23	1,757
COR25	COR25	Yuba	Electric	2013	75	n/a	1,600	4%	207	518	23	1,757
COR26	COR26	Yuba	Electric	2013	100	n/a	1,800	5%	233	582	23	1,757
COR27	COR27	Yuba	Electric		100	n/a	1,700	5%	220	550	23	1,757
COR16	COR16	Yuba	Electric		100	n/a	2,300	6%	298	744	23	1,757
COR17	COR17	Yuba	Electric		100	n/a	2,400	6%	311	776	23	1,757
COR24	COR24	Yuba	Electric		100	n/a	2,000	5%	259	647	23	1,757
						Total	**37,100**	**100%**	**4,800**	**12,000**	**531**	**40,402**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Conversion Factors

1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency Cranmore Farms
Transfer Volume 8,000 acre feet/year
Location Sutter County

Federal Attainment Status

PM10	A	*Engines subject to ATCM.*
PM2.5	N	
O3	N	

Table F-18. Cranmore Farms Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
Cranmore Farms1	1	Sutter	Electric	TBD	125	n/a	3,000	17%	343	1,333	20	2,414
Cranmore Farms2	2	Sutter	Electric	TBD	125	n/a	3,000	17%	343	1,333	20	2,414
Cranmore Farms3	3	Sutter	Electric	TBD	125	n/a	3,000	17%	343	1,333	20	2,414
Cranmore Farms4	4	Sutter	Electric	TBD	125	n/a	3,000	17%	343	1,333	20	2,414
Cranmore Farms5	5	Sutter	Electric	TBD	125	n/a	3,000	17%	343	1,333	20	2,414
Cranmore Farms6	6	Sutter	Electric	TBD	125	n/a	3,000	17%	343	1,333	20	2,414
						Total	**18,000**	**100%**	**2,056**	**8,000**	**122**	**14,482**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Conversion Factors

1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Eastside Mutual Water Company		Federal Attainment Status			Peak Month	
Transfer Volume	2,230	acre feet/year	PM10	A	*Engines not subject to ATCM if remotely-located.*	465	AF/month
Location	Colusa	County	PM2.5	A		3,396	gallons/minute
			O3	A		89%	peak pump rate

Table F-19. Eastside Mutual Water Company Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)	Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr) VOC	NOx	CO	SOx	PM10	PM2.5	Daily Emissions (lbs/day) VOC	NOx	CO	SOx	PM10	PM2.5	Annual Emissions (tons per year) VOC	NOx	CO	SOx	PM10	PM2.5
7631T	7631T	Colusa	Diesel	2006	215	T3	3,800	100%	465	2,230	22	3,187	38,441	0.1	2.8	2.6	0.93	0.15	0.15	1.55	29.38	27.06	9.63	1.55	1.55	0.11	2.14	1.97	0.70	0.11	0.11
						n/a	**3,800**	**100%**	**465**	**2,230**	**22**	**3,187**	**38,441**							**1.55**	**29.38**	**27.06**	**9.63**	**1.55**	**1.55**	**0.11**	**2.14**	**1.97**	**0.70**	**0.11**	**0.11**

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend
Emission factor based on NMHC+NOx emission standard

Conversion Factors

1 lb =	453.6	g
1 ton =	2,000	lbs
1 month =	30.4	days
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4	lb/hp-hr	*(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855	g/mL	*(Based on MSDS for Hess Diesel Fuel All Types)*
7.13	lb/gal	

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Glenn-Colusa Irrigation District	
Transfer Volume	25,000	acre feet/year
Location	Glenn	County
	Colusa	County

Federal Attainment Status

	Glenn	*Colusa*	
PM10	A	A	*Engines not subject to ATCM if remotely-located.*
PM2.5	A	A	
O3	A	A	

Table F-20. Glenn-Colusa Irrigation District Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
GCID 1	GCID 1	Glenn	Electric		110	n/a	3,305	10%	437	2,622	24	4,309
GCID 2	GCID 2	Glenn	Electric		110	n/a	3,305	10%	437	2,622	24	4,309
GCID 3	GCID 3	Glenn	Electric		110	n/a	3,305	10%	437	2,622	24	4,309
GCID 4	GCID 4	Glenn	Electric		110	n/a	3,305	10%	437	2,622	24	4,309
GCID 5	GCID 5	Glenn	Electric		110	n/a	2,605	8%	345	2,067	24	4,309
GCID X1	GCID X1	Glenn	Electric		110	n/a	2,389	8%	316	1,896	24	4,309
GCID X2	GCID X2	Glenn	Electric		110	n/a	3,305	10%	437	2,622	24	4,309
GCID X3	GCID X3	Glenn	Electric		110	n/a	2,605	8%	345	2,067	24	4,309
GCID X4	GCID X4	Glenn	Electric		110	n/a	2,389	8%	316	1,896	24	4,309
GCID X5	GCID X5	Glenn	Electric		110	n/a	2,605	8%	345	2,067	24	4,309
Test Hole 7	Test Hole 7	Glenn	Electric		110	n/a	2,389	8%	316	1,896	24	4,309
						Total	**31,507**	**100%**	**4,167**	**25,000**	**260**	**47,402**
						Total (Glenn County)	**31,507**	**100%**	**4,167**	**25,000**	**260**	**47,402**
						Total (Colusa County)	**0**	**0%**	**0**	**0**	**0**	**0**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Legend

	Assumed to be electric (similar to other wells operated by water agency)
	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6	g
1 ton =	2,000	lbs
1 month =	30.4	days
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Natomas Central Mutual Water Company	
Transfer Volume	30,000	acre feet/year
Location	Sacramento County	
	Sutter County	

Federal Attainment Status

	Sacramento	*Sutter*	
PM10	M	A	*Engines subject to ATCM.*
PM2.5	N	N	
O3	N	N	

Table F-21. Natomas Central Mutual Water Company Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
Natomas Central MWCWilley, Ed	Willey, Ed	Sacramento	Electric		250	n/a	5,500	2%	128	638	4	630
Natomas Central MWCOse, Mary-site 8, well 1	Ose, Mary-site 8, well 1	Sacramento	Electric		200	n/a	5,500	2%	128	638	4	630
Natomas Central MWCOse, Mary-site 9, well 2	Ose, Mary-site 9, well 2	Sacramento	Electric		150	n/a	5,500	2%	128	638	4	630
Natomas Central MWCLeal, Robert-site 1 well 2	Leal, Robert-site 1 well 2	Sutter	Electric		100	n/a	5,500	2%	128	638	4	630
Natomas Central MWCDeWitt, Jack-1	DeWitt, Jack-1	Sacramento	Electric		30	n/a	5,500	2%	128	638	4	630
Natomas Central MWCDeWitt, Jack-2	DeWitt, Jack-2	Sacramento	Electric		80	n/a	5,500	2%	128	638	4	630
Natomas Central MWCDeWitt, Jack-3	DeWitt, Jack-3	Sacramento	Electric		60	n/a	5,500	2%	128	638	4	630
Natomas Central MWCDeWitt, Jack-4	DeWitt, Jack-4	Sacramento	Electric		30	n/a	5,500	2%	128	638	4	630
Natomas Central MWCDeWitt, Jack-5	DeWitt, Jack-5	Sacramento	Electric		20	n/a	5,500	2%	128	638	4	630
Natomas Central MWCDeWitt, Jack-6	DeWitt, Jack-6	Sacramento	Electric		30	n/a	5,500	2%	128	638	4	630
Natomas Central MWCDeWitt, Jack-7	DeWitt, Jack-7	Sutter	Electric		25	n/a	5,500	2%	128	638	4	630
Natomas Central MWCDeWitt, Jack-7	DeWitt, Jack-7	Sutter	Electric		25	n/a	5,500	2%	128	638	4	630
Natomas Central MWCDeWitt, Jack--8	DeWitt, Jack--8	Sacramento	Electric		250	n/a	5,500	2%	128	638	4	630
Natomas Central MWCMorrison, Phil #2-site 5 well 14	Morrison, Phil #2-site 5 well 14	Sutter	Electric		40	n/a	5,500	2%	128	638	4	630
Natomas Central MWCBianchi, John- site 2, well 10	Bianchi, John- site 2, well 10	Sutter	Electric		60	n/a	5,500	2%	128	638	4	630
Natomas Central MWCBianchi, John-site 2 well 11	Bianchi, John-site 2 well 11	Sutter	Electric		80	n/a	5,500	2%	128	638	4	630
Natomas Central MWCLauppe and Sons	Lauppe and Sons	Sutter	Electric		40	n/a	5,500	2%	128	638	4	630
Natomas Central MWCWiley, Wane-site 7 , well 18	Wiley, Wane-site 7 , well 18	Sacramento	Electric		40	n/a	5,500	2%	128	638	4	630
Natomas Central MWCLeal, Robert L-1 (rice box)	Leal, Robert L-1 (rice box)	Sutter	Electric		30	n/a	5,500	2%	128	638	4	630
Natomas Central MWCLeal, Robert L-3	Leal, Robert L-3	Sutter	Electric		50	n/a	5,500	2%	128	638	4	630
Natomas Central MWCLeal, Robert L-4	Leal, Robert L-4	Sutter	Electric		110	n/a	5,500	2%	128	638	4	630
Natomas Central MWCLeal, Robert L-5	Leal, Robert L-5	Sutter	Electric		110	n/a	5,500	2%	128	638	4	630
Natomas Central MWCLeal, Robert L-6	Leal, Robert L-6	Sutter	Electric		110	n/a	5,500	2%	128	638	4	630
Natomas Central MWCLeal, Robert L-7	Leal, Robert L-7	Sutter	Electric		30	n/a	5,500	2%	128	638	4	630
Natomas Central MWCLeal, Robert L-8	Leal, Robert L-8	Sutter	Electric		200	n/a	5,500	2%	128	638	4	630
Natomas Central MWCLeal, Robert L-9	Leal, Robert L-9	Sutter	Electric		30	n/a	5,500	2%	128	638	4	630
Natomas Central MWCLeal, Robert L-2	Leal, Robert L-2	Sutter	Electric		30	n/a	5,500	2%	128	638	4	630
Natomas Central MWCLeal, Robert #1	Leal, Robert #1	Sutter	Electric		30	n/a	5,500	2%	128	638	4	630
Natomas Central MWCLeal, Robert #2	Leal, Robert #2	Sutter	Electric		40	n/a	5,500	2%	128	638	4	630
Natomas Central MWCSpangler, Dan-site 4 well 13	Spangler, Dan-site 4 well 13	Sutter	Electric		80	n/a	5,500	2%	128	638	4	630
Natomas Central MWCVestal, Sid	Vestal, Sid	Sutter	Electric		60	n/a	5,500	2%	128	638	4	630
Natomas Central MWCVestal, Sid-1	Vestal, Sid-1	Sutter	Electric		60	n/a	5,500	2%	128	638	4	630
Dewitt, Jack-9 Housley N	Dewitt, Jack-9 Housley N	Sutter	Electric		60	n/a	5,500	2%	128	638	4	630
Dewitt, Jack-10 Housley	Dewitt, Jack-10 Housley	Sutter	Electric		60	n/a	5,500	2%	128	638	4	630
Dewitt, Jack-11 Housley	Dewitt, Jack-11 Housley	Sutter	Electric		20	n/a	5,500	2%	128	638	4	630
Natomas Central MWCMorrison, Phil-#3 site 5 well 15	Morrison, Phil-#3 site 5 well 15	Sutter	Electric		40	n/a	5,500	2%	128	638	4	630
Natomas Central MWCMorrison, Phil-#4 site 5 well 16	Morrison, Phil-#4 site 5 well 16	Sutter	Electric		40	n/a	5,500	2%	128	638	4	630
Natomas Central MWCNBC-Frazer	NBC-Frazer	Sutter	Electric		50	n/a	5,500	2%	128	638	4	630
Natomas Central MWCNBC-Lucich North	NBC-Lucich North	Sutter	Electric		75	n/a	5,500	2%	128	638	4	630
Natomas Central MWCNBC- Natomas Farm#1	NBC- Natomas Farm#1	Sacramento	Electric		60	n/a	5,500	2%	128	638	4	630
Natomas Central MWCNBC-Cummings	NBC-Cummings	Sacramento	Electric		20	n/a	5,500	2%	128	638	4	630
Natomas Central MWCMorrison, Phillip-#5	Morrison, Phillip-#5	Sutter	Electric		60	n/a	5,500	2%	128	638	4	630
Natomas Central MWCPerry, Joe	Perry, Joe	Sacramento	Electric		125	n/a	5,500	2%	128	638	4	630
Natomas Central MWCNBC-Kismat-2	NBC-Kismat-2	Sacramento	Electric		30	n/a	5,500	2%	128	638	4	630
Natomas Central MWCNBC-Kismat-3	NBC-Kismat-3	Sutter	Electric		30	n/a	5,500	2%	128	638	4	630
Natomas Central MWCNBC-Kismat-4	NBC-Kismat-4	Sacramento	Electric		110	n/a	5,500	2%	128	638	4	630
Natomas Central MWCNBC-Sliva	NBC-Sliva	Sacramento	Electric		50	n/a	5,500	2%	128	638	4	630
						Total	**258,500**	100%	**6,000**	**30,000**	**195**	**29,623**
						Total (Sacramento County)	**93,500**	**36%**	**2,170**	**10,851**	**70**	**10,715**
						Total (Sutter County)	**165,000**	**64%**	**3,830**	**19,149**	**124**	**18,908**

Legend

	Assumed to be electric
	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Pelger Mutual Water Company		Federal Attainment Status			Peak Month	
Transfer Volume	3,750	acre feet/year	PM10	A	*Engines subject to ATCM.*	860	AF/month
Location	Sutter County		PM2.5	N		6,281	gallons/minute
			O3	N		66%	peak pump rate

Table F-22. Pelger Mutual Water Company Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)	Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr) VOC	NOx	CO	SOx	PM10	PM2.5	Daily Emissions (lbs/day) VOC	NOx	CO	SOx	PM10	PM2.5	Annual Emissions (tons per year) VOC	NOx	CO	SOx	PM10	PM2.5
Pelger MWCWell 1 Tucker	Well 1 Tucker	Sutter	Electric	0	110	n/a	3,100	33%	281	1,224	16	2,144	n/a																		
Pelger MWCWell 2 Flopet	Well 2 Flopet	Sutter	Diesel	2008	173	T3	2,100	22%	190	829	16	2,144	20,806	0.1	2.8	3.7	0.93	0.22	0.22	0.92	17.49	23.01	5.73	1.38	1.38	0.06	1.16	1.53	0.38	0.09	0.09
Pelger MWCWell 3 Klein	Well 3 Klein	Sutter	Electric	0	110	n/a	4,300	45%	389	1,697	16	2,144	n/a																		
						Total	**9,500**	**100%**	**860**	**3,750**	**49**	**6,431**	**20,806**							**0.92**	**17.49**	**23.01**	**5.73**	**1.38**	**1.38**	**0.06**	**1.16**	**1.53**	**0.38**	**0.09**	**0.09**

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend

	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type
	Emission factor based on NMHC+NOx emission standard

Conversion Factors

1 lb =	453.6	g
1 ton =	2,000	lbs
1 month =	30.4	days
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4	lb/hp-hr	*(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855	g/mL	*(Based on MSDS for Hess Diesel Fuel All Types)*
7.13	lb/gal	

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Pleasant Grove-Verona Mutual Water Company	Federal Attainment Status				Peak Month
Transfer Volume	18,000 acre feet/year		*Sutter*	*Yolo*		4,000 AF/month
Location	Sutter County	PM10	A	A	*Engines subject to ATCM.*	29,198 gallons/minute
	Yolo County	PM2.5	N	N		37% peak pump rate
		O3	N	N		

Table F-23. Pleasant Grove-Verona Mutual Water Company Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)	Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr) VOC	NOx	CO	SOx	PM10	PM2.5	Daily Emissions (lbs/day) VOC	NOx	CO	SOx	PM10	PM2.5	Annual Emissions (tons per year) VOC	NOx	CO	SOx	PM10	PM2.5
PGVMWCWill-Lee 4A	Will-Lee 4A	Sutter	Diesel	2000	160	T1	1,500	2%	77	345	9	1,248	11,206	1.1	6.9	3.0	0.93	0.22	0.21	3.67	22.09	9.75	2.99	0.71	0.69	0.25	1.51	0.67	0.20	0.05	0.05
PGVMWCRiver Ranch #19	River Ranch #19	Sutter	Diesel	1995	200	T0	2,500	3%	128	575	9	1,248	14,008	1.1	14.1	3.0	0.93	0.15	0.15	4.59	56.55	12.19	3.74	0.60	0.59	0.31	3.87	0.83	0.26	0.04	0.04
PGVMWCMLF #1	MLF #1	Sutter	Electric		30	n/a	2,000	3%	102	460	9	1,248	n/a																		
PGVMWCMLF #2	MLF #2	Sutter	Electric		250	n/a	5,000	6%	255	1,149	9	1,248	n/a																		
PGVMWCMLF Monster Well	MLF Monster Well	Sutter	Electric		60	n/a	3,100	4%	158	713	9	1,248	n/a																		
PGVMWCMLF #17/12	MLF #17/12	Sutter	Electric		50	n/a	1,500	2%	77	345	9	1,248	n/a																		
PGVMWCMLF #11	MLF #11	Sutter	Diesel	2004	250	T2	4,200	5%	215	966	9	1,248	17,510	0.2	4.7	2.6	0.93	0.15	0.15	1.24	23.52	13.13	4.67	0.75	0.75	0.08	1.61	0.90	0.32	0.05	0.05
PGVMWCMLF #13/15	MLF #13/15	Sutter	Electric		240	n/a	4,800	6%	245	1,103	9	1,248	n/a																		
PGVMWCMLF #16	MLF #16	Sutter	Electric		240	n/a	1,700	2%	87	391	9	1,248	n/a																		
PGVMWCWilley #1	Willey #1	Sutter	Diesel	2000	168	T1	3,000	4%	153	690	9	1,248	11,767	1.1	6.9	3.0	0.93	0.22	0.21	3.85	23.19	10.24	3.14	0.74	0.73	0.26	1.59	0.70	0.21	0.05	0.05
PGVMWCWilley #2	Willey #2	Sutter	Electric		250	n/a	3,000	4%	153	690	9	1,248	n/a																		
PGVMWCWilley #3	Willey #3	Sutter	Electric		250	n/a	2,000	3%	102	460	9	1,248	n/a																		
PGVMWCWilley #4	Willey #4	Sutter	Diesel	1974	150	T0	3,000	4%	153	690	9	1,248	10,506	1.1	14.1	3.0	0.93	0.22	0.21	3.44	42.41	9.14	2.80	0.66	0.65	0.24	2.90	0.63	0.19	0.05	0.04
PGVMWCScheidel&Osterli #18A	Scheidel&Osterli #18A	Sutter	Electric	TBD	250	n/a	2,500	3%	128	575	9	1,248	n/a																		
PGVMWCWill-Lee 30	Will-Lee 30	Sutter	Diesel	2000	100	T1	1,500	2%	77	345	9	1,248	7,004	1.1	6.9	3.0	0.93	0.22	0.21	2.29	13.81	6.09	1.87	0.44	0.43	0.16	0.94	0.42	0.13	0.03	0.03
PGVMWCWill-Lee 31	Will-Lee 31	Sutter	Electric		250	n/a	2,500	3%	128	575	9	1,248	n/a																		
PGVMWCWill-Lee 32	Will-Lee 32	Sutter	Electric		250	n/a	2,500	3%	128	575	9	1,248	n/a																		
PGVMWCWill-Lee 33	Will-Lee 33	Sutter	Electric		250	n/a	2,500	3%	128	575	9	1,248	n/a																		
PGVMWCNicholas Sand Field Well	Nicholas Sand Field Well	Sutter	Diesel	2002	62.1	T1	2,000	3%	102	460	9	1,248	4,350	1.1	6.9	3.0	0.93	0.30	0.29	1.42	8.57	3.78	1.16	0.37	0.37	0.10	0.59	0.26	0.08	0.03	0.03
PGVMWCNicholas Filipino Camp #2	Nicholas Filipino Camp #2	Sutter	Electric		40	n/a	2,000	3%	102	460	9	1,248	n/a																		
PGVMWCNicholas Filipino Camp South	Nicholas Filipino Camp South	Sutter	Diesel	2002	62.1	T1	2,000	3%	102	460	9	1,248	4,350	1.1	6.9	3.0	0.93	0.30	0.29	1.42	8.57	3.78	1.16	0.37	0.37	0.10	0.59	0.26	0.08	0.03	0.03
PGVMWCNicholas Johnston Field Well #2	Nicholas Johnston Field Well #2	Sutter	Electric		250	n/a	2,000	3%	102	460	9	1,248	n/a																		
PGVMWCNicholas Johnston Well	Nicholas Johnston Well	Yolo	Electric		250	n/a	2,000	3%	102	460	9	1,248	n/a																		
PGVMWCNicholas 72-acre Field South	Nicholas 72-acre Field South	Sutter	Diesel	2002	62.1	T1	2,000	3%	102	460	9	1,248	4,350	1.1	6.9	3.0	0.93	0.30	0.29	1.42	8.57	3.78	1.16	0.37	0.37	0.10	0.59	0.26	0.08	0.03	0.03
PGVMWCNicholas 72-Acre Field North	Nicholas 72-Acre Field North	Sutter	Electric		250	n/a	2,000	3%	102	460	9	1,248	n/a																		
PGVMWCNicholas BBC Well	Nicholas BBC Well	Sutter	Electric		250	n/a	2,000	3%	102	460	9	1,248	n/a																		
PGVMWCKelly 190 Field Well #2	Kelly 190 Field Well #2	Sutter	Electric		30	n/a	2,000	3%	102	460	9	1,248	n/a																		
PGVMWCKelly Windmill Field Well #2	Kelly Windmill Field Well #2	Sutter	Diesel	2002	62.1	T1	2,000	3%	102	460	9	1,248	4,350	1.1	6.9	3.0	0.93	0.30	0.29	1.42	8.57	3.78	1.16	0.37	0.37	0.10	0.59	0.26	0.08	0.03	0.03
PGVMWCKelly Windmill North Field Well	Kelly Windmill North Field Well	Sutter	Diesel	2002	62.1	T1	2,000	3%	102	460	9	1,248	4,350	1.1	6.9	3.0	0.93	0.30	0.29	1.42	8.57	3.78	1.16	0.37	0.37	0.10	0.59	0.26	0.08	0.03	0.03
PGVMWCKelly 306 Well	Kelly 306 Well	Sutter	Electric		250	n/a	2,600	3%	133	598	9	1,248	n/a																		
PGVMWCScheidel&Osterli #16	Scheidel&Osterli #16	Sutter	Diesel	1997	234	T1	3,400	4%	174	782	9	1,248	16,389	1.0	6.9	8.5	0.93	0.40	0.40	4.56	32.31	40.03	4.38	1.90	1.90	0.31	2.21	2.74	0.30	0.13	0.13
PGVMWCScheidel&Osterli #17	Scheidel&Osterli #17	Sutter	Diesel	1999	101	T0	1,500	2%	77	345	9	1,248	7,074	1.1	14.1	3.0	0.93	0.22	0.21	2.32	28.56	6.15	1.89	0.45	0.44	0.16	1.95	0.42	0.13	0.03	0.03
						Total	**78,300**	**100%**	**4,000**	**18,000**	**292**	**39,951**	**117,213**							**33.08**	**285.31**	**125.64**	**31.29**	**8.13**	**8.00**	**2.26**	**19.53**	**8.60**	**2.14**	**0.56**	**0.55**
						Total (Sutter County)	**76,300**	**97%**	**3,898**	**17,540**	**283**	**38,703**	**117,213**							**33.08**	**285.31**	**125.64**	**31.29**	**8.13**	**8.00**	**2.26**	**19.53**	**8.60**	**2.14**	**0.56**	**0.55**
						Total (Yolo County)	**2,000**	**3%**	**102**	**460**	**9**	**1,248**	**0**							**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend

	Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type
	Emission factor based on NMHC+NOx emission standard
	Emission factor based on AP-42 (engine not subject to emission standard for pollutant in ATCM)

Conversion Factors

1	lb =	453.6	g
1	ton =	2,000	lbs
1	month =	30.4	days
1	hour =	60	minutes
1	acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4	lb/hp-hr	*(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855	g/mL	*(Based on MSDS for Hess Diesel Fuel All Types)*
7.13	lb/gal	

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Reclamation District 108		
Transfer Volume	15,000	acre feet/year	
Location	Colusa	County	
	Yolo	County	

Federal Attainment Status

	Colusa	*Yolo*	
PM10	A	A	*Engines subject to ATCM.*
PM2.5	A	N	
O3	A	N	

Table F-24. Reclamation District 108 Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
RD 108Well#1 Heidrick	Well#1 Heidrick	Colusa	Electric		100	n/a	3,500	18%	458	2,749	23	4,265
RD 108Well #5 RiggsRanch	Well #5 RiggsRanch	Colusa	Electric		150	n/a	1,700	9%	223	1,335	23	4,265
RD 108Well #6 CountyLine	Well #6 CountyLine	Colusa	Electric		250	n/a	5,900	31%	772	4,634	23	4,265
RD 108Well#7 Tract 6	Well#7 Tract 6	Yolo	Electric		250	n/a	4,000	21%	524	3,141	23	4,265
RD 108Well #4 Huff	Well #4 Huff	Colusa	Electric		250	n/a	4,000	21%	524	3,141	23	4,265
						Total	**19,100**	**100%**	**2,500**	**15,000**	**117**	**21,325**
						Total (Colusa County)	**15,100**	**79%**	**1,976**	**11,859**	**93**	**17,060**
						Total (Yolo County)	**4,000**	**21%**	**524**	**3,141**	**23**	**4,265**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Conversion Factors

1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Reclamation District 1004		Federal Attainment Status					Peak Month	
Transfer Volume	7,175	acre feet/year		*Colusa*	*Glenn*	*Sutter*		2,870	AF/month
Location	Colusa County		PM10	A	A	A	*Engines subject to ATCM.*	20,950	gallons/minute
	Glenn County		PM2.5	A	A	N		29%	peak pump rate
	Sutter County		O3	A	A	N			

Table F-25. Reclamation District 1004 Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)	Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr) VOC	NOx	CO	SOx	PM10	PM2.5	Daily Emissions (lbs/day) VOC	NOx	CO	SOx	PM10	PM2.5	Annual Emissions (tons per year) VOC	NOx	CO	SOx	PM10	PM2.5
Gardener No. 374672	Gardener No. 374672	Colusa	Diesel	2008	215	T3	3,500	5%	138	345	7	535	6,456	0.1	2.8	2.6	0.93	0.15	0.15	0.50	9.46	8.71	3.10	0.50	0.50	0.02	0.36	0.33	0.12	0.02	0.02
Gardener No. 498178	Gardener No. 498178	Colusa	Diesel	2009	215	T3	3,500	5%	138	345	7	535	6,456	0.1	2.8	2.6	0.93	0.15	0.15	0.50	9.46	8.71	3.10	0.50	0.50	0.02	0.36	0.33	0.12	0.02	0.02
Stonewell #6 No. 11334	Stone Well #6 No.11334	Colusa	Electric	2006	40	n/a	1,800	2%	71	177	7	535	n/a																		
Drumheller Well #7	Drumheller Well No.7	Colusa	Diesel	TBD	225	T0	4,000	5%	158	394	7	535	6,756	1.1	14.1	3.0	0.93	0.15	0.15	3.98	49.10	10.58	3.25	0.52	0.51	0.15	1.87	0.40	0.12	0.02	0.02
Myers Well #1 No. 3457	Myers Well #1 No.3457	Colusa	Electric	2006	40	n/a	2,200	3%	87	217	7	535	n/a																		
Myers Well #2 No. 340884	Myers Well #2 No. 340884	Colusa	Electric	1982	100	n/a	4,100	6%	162	404	7	535	n/a																		
Sikes & Parachini #1 No. 93124	Sikes & Parachini Well #1 WS No.93124	Colusa	Diesel	2006	173	T2	4,000	5%	158	394	7	535	5,195	0.2	4.7	3.7	0.93	0.22	0.22	0.66	12.56	10.02	2.50	0.60	0.60	0.03	0.48	0.38	0.09	0.02	0.02
Sikes & Parachini #2 No. 374682	Sikes & Parachini Well #2 WS No. 374682	Colusa	Diesel	2008	150	T3	4,000	5%	158	394	7	535	4,504	0.1	2.8	3.7	0.93	0.22	0.22	0.35	6.60	8.69	2.16	0.52	0.52	0.01	0.25	0.33	0.08	0.02	0.02
Rancho Caleta No. 726883	Rancho Caleta No. 726883	Colusa	Diesel	2004	170	T2	4,500	6%	177	444	7	535	5,105	0.2	4.7	3.7	0.93	0.22	0.22	0.65	12.34	9.84	2.45	0.59	0.59	0.02	0.47	0.37	0.09	0.02	0.02
Behring Ranch Club House No. 496461	Behring Ranch Club House Well No.496461	Colusa	Electric		125	n/a	3,400	5%	134	335	7	535	n/a																		
Behring Ranch West Well No. 97863	Behring Ranch West Well No.97863	Colusa	Electric		125	n/a	2,300	3%	91	227	7	535	n/a																		
Behring Ranch 10 Field Well No. 496441	Behring Ranch 10 Field Well No. 496441	Colusa	Diesel	2008	225	T3	5,800	8%	229	572	7	535	6,756	0.1	2.8	2.6	0.93	0.15	0.15	0.52	9.90	9.12	3.25	0.52	0.52	0.02	0.38	0.35	0.12	0.02	0.02
Behring Ranch Pearl 20094	Behring Ranch Pearl Well No. 20094	Colusa	Diesel	TBD	225	T0	2,500	3%	99	246	7	535	6,756	1.1	14.1	3.0	0.93	0.15	0.15	3.98	49.10	10.58	3.25	0.52	0.51	0.15	1.87	0.40	0.12	0.02	0.02
Behring Ranch Nursery Well No. 17N1W10H1	Behring Ranch Nursery Well No. 17N1W10H1	Colusa	Diesel	TBD	225	T0	1,000	1%	39	99	7	535	6,756	1.1	14.1	3.0	0.93	0.15	0.15	3.98	49.10	10.58	3.25	0.52	0.51	0.15	1.87	0.40	0.12	0.02	0.02
Hall Well No. X	Hall Well No. X	Colusa	Electric	TBD	125	n/a	4,500	6%	177	444	7	535	n/a																		
Hall Well No. 369428	Hall Well No.369428	Colusa	Electric	2011	125	n/a	4,500	6%	177	444	7	535	n/a																		
East Morgan Well	East Morgan Well #1 No. 374667 17N01W14N001M	Colusa	Diesel	TBD	225	T0	2,600	4%	103	256	7	535	6,756	1.1	14.1	3.0	0.93	0.15	0.15	3.98	49.10	10.58	3.25	0.52	0.51	0.15	1.87	0.40	0.12	0.02	0.02
ast Morgan Well	East Morgan Well#2 No. 498195 17N01W15Q001M	Colusa	Diesel	TBD	225	T0	1,300	2%	51	128	7	535	6,756	1.1	14.1	3.0	0.93	0.15	0.15	3.98	49.10	10.58	3.25	0.52	0.51	0.15	1.87	0.40	0.12	0.02	0.02
Mohammad No.	Mohammad No.e0084085 17N01W02D001M	Colusa	Electric	TBD	125	n/a	4,500	6%	177	444	7	535	n/a																		
Southam Sartain	Southam Sartain Well 18N01W26D001M	Glenn	Diesel	TBD	225	T0	4,800	7%	189	473	7	535	6,756	1.1	14.1	3.0	0.93	0.15	0.15	3.98	49.10	10.58	3.25	0.52	0.51	0.15	1.87	0.40	0.12	0.02	0.02
Barale Well	Barale Well	Colusa	Diesel	TBD	225	T0	4,000	5%	158	394	7	535	6,756	1.1	14.1	3.0	0.93	0.15	0.15	3.98	49.10	10.58	3.25	0.52	0.51	0.15	1.87	0.40	0.12	0.02	0.02
						Total	**72,800**	**100%**	**2,870**	**7,175**	**148**	**11,240**	**81,767**							**31.05**	**404.01**	**129.15**	**39.29**	**6.90**	**6.81**	**1.18**	**15.36**	**4.91**	**1.49**	**0.26**	**0.26**
						Total (Colusa County)	**68,000**	**93%**	**2,681**	**6,702**	**141**	**10,705**	**75,010**							**27.07**	**354.91**	**118.57**	**36.05**	**6.37**	**6.30**	**1.03**	**13.49**	**4.51**	**1.37**	**0.24**	**0.24**
						Total (Glenn County)	**4,800**	**7%**	**189**	**473**	**7**	**535**	**6,756**							**3.98**	**49.10**	**10.58**	**3.25**	**0.52**	**0.51**	**0.15**	**1.87**	**0.40**	**0.12**	**0.02**	**0.02**
						Total (Sutter County)	**0**	**0%**	**0**	**0**	**0**	**0**	**0**							**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend

	Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type
	Emission factor based on NMHC+NOx emission standard

Conversion Factors

1 lb =	453.6	g
1 ton =	2,000	lbs
1 month =	30.4	days
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4	lb/hp-hr	*(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855	g/mL	*(Based on MSDS for Hess Diesel Fuel All Types)*
7.13	lb/gal	

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	River Garden Farms		
Transfer Volume	9,000	acre feet/year	
Location	Yolo	County	

Federal Attainment Status

PM10	A	*Engines subject to ATCM.*
PM2.5	N	
O3	N	

Table F-26. River Garden Farms Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
River Garden FarmsField 65 PW	Field 65 PW	Yolo	Electric	2008	110	n/a	2,500	14%	287	1,293	21	2,810
River Garden FarmsField 71 PW	Field 71 PW	Yolo	Electric	2001	110	n/a	1,700	10%	195	880	21	2,810
River Garden FarmsField 98 PW	Field 98 PW	Yolo	Electric	1963	110	n/a	2,900	17%	333	1,500	21	2,810
River Garden FarmsField 104 PW	Field 104 PW	Yolo	Electric	2008	110	n/a	2,500	14%	287	1,293	21	2,810
River Garden FarmsField 104-09 PW	Field 104-09 PW	Yolo	Electric	2009	110	n/a	2,990	17%	344	1,547	21	2,810
River Garden FarmsField 91-09 PW	Field 91-09 PW	Yolo	Electric	2009	110	n/a	2,840	16%	327	1,469	21	2,810
River Garden FarmsField 117 PW	Field 117 PW	Yolo	Electric	2009	110	n/a	1,965	11%	226	1,017	21	2,810
						Total	**17,395**	**100%**	**2,000**	**9,000**	**144**	**19,669**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Sycamore Mutual Water Company	
Transfer Volume	15,000 acre feet/year	
Location	Colusa County	

Federal Attainment Status

PM10	A	*Engines not subject to ATCM if remotely-located.*
PM2.5	A	
O3	A	

Table F-27. Sycamore Mutual Water Company Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
Sycamore Family Trust1	1	Colusa	Electric	TBD	125	n/a	3,000	9%	257	1,286	15	2,328
Sycamore Family Trust2	2	Colusa	Electric	TBD	125	n/a	3,000	9%	257	1,286	15	2,328
Sycamore Family Trust3	3	Colusa	Electric	TBD	125	n/a	3,000	9%	257	1,286	15	2,328
Sycamore Family Trust4	4	Colusa	Electric	TBD	125	n/a	3,000	9%	257	1,286	15	2,328
Sycamore Family Trust5	5	Colusa	Electric	TBD	125	n/a	3,000	9%	257	1,286	15	2,328
Sycamore Family Trust6	6	Colusa	Electric	TBD	125	n/a	3,000	9%	257	1,286	15	2,328
Sycamore Family Trust7	7	Colusa	Electric	TBD	125	n/a	3,000	9%	257	1,286	15	2,328
Sycamore Family Trust8	8	Colusa	Electric	TBD	125	n/a	3,000	9%	257	1,286	15	2,328
Sycamore Family Trust11	11	Colusa	Electric		100	n/a	2,500	7%	214	1,071	15	2,328
Sycamore Family Trust14	14	Colusa	Electric		100	n/a	2,500	7%	214	1,071	15	2,328
Sycamore Family Trust15	15	Colusa	Electric		75	n/a	2,500	7%	214	1,071	15	2,328
Sycamore Family Trust17	17	Colusa	Electric		125	n/a	3,500	10%	300	1,500	15	2,328
						Total	**35,000**	**100%**	**3,000**	**15,000**	**184**	**27,930**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Conversion Factors

1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Te Velde Revocable Family Trust		
Transfer Volume	7,094	acre feet/year	
Location	Yolo	County	

Federal Attainment Status

PM10	A	*Engines subject to ATCM.*
PM2.5	N	
O3	N	

Table F-28. Te Velde Revocable Family Trust Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
Te VeldeGW1	GW1	Yolo	Electric	N/A	127	n/a	4,656	29%	518	2,090	20	2,438
Te VeldeGW10	GW10	Yolo	Electric	N/A	143	n/a	2,833	18%	315	1,272	20	2,438
Te VeldeGW9	GW9	Yolo	Electric	N/A	104	n/a	2,200	14%	245	988	20	2,438
Te VeldeGW4	GW4	Yolo	Electric	N/A	125	n/a	3,715	24%	413	1,668	20	2,438
Te VeldeGW3	GW3	Yolo	Electric	N/A	52	n/a	2,400	15%	267	1,077	20	2,438
						Total	**15,804**	**100%**	**1,758**	**7,094**	**99**	**12,189**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Conversion Factors

1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	City of Sacramento
Transfer Volume	5,000 acre feet/year
Location	Sacramento County

Federal Attainment Status

PM10	M	*Engines subject to ATCM.*
PM2.5	N	
O3	N	

Table F-29. City of Sacramento Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
City of Sacramento WSA83	WELL83	Sacramento	electric		30	n/a	373	2%	29	88	14	1,278
City of Sacramento WSA92	WELL92	Sacramento	electric		50	n/a	785	4%	62	185	14	1,278
City of Sacramento WSA93	WELL93	Sacramento	electric		50	n/a	411	2%	32	97	14	1,278
City of Sacramento WSA94	WELL94	Sacramento	electric		50	n/a	879	4%	69	207	14	1,278
City of Sacramento WSA107	WELL107	Sacramento	electric		50	n/a	727	3%	57	171	14	1,278
City of Sacramento WSA116	WELL116	Sacramento	electric		75	n/a	673	3%	53	158	14	1,278
City of Sacramento WSA120	WELL120	Sacramento	electric		50	n/a	572	3%	45	135	14	1,278
City of Sacramento WSA122	WELL122	Sacramento	electric		50	n/a	470	2%	37	111	14	1,278
City of Sacramento WSA124	WELL124	Sacramento	electric		50	n/a	541	3%	42	127	14	1,278
City of Sacramento WSA126	WELL126	Sacramento	electric		50	n/a	433	2%	34	102	14	1,278
City of Sacramento WSA127	WELL127	Sacramento	electric		50	n/a	592	3%	46	139	14	1,278
City of Sacramento WSA129	WELL129	Sacramento	electric		50	n/a	466	2%	37	110	14	1,278
City of Sacramento WSA131	WELL131	Sacramento	electric		50	n/a	431	2%	34	101	14	1,278
City of Sacramento WSA133	WELL133	Sacramento	electric		150	n/a	757	4%	59	178	14	1,278
City of Sacramento WSA134	WELL134	Sacramento	electric		60	n/a	676	3%	53	159	14	1,278
City of Sacramento WSA137	WELL137	Sacramento	electric		75	n/a	541	3%	42	127	14	1,278
City of Sacramento WSA138	WELL138	Sacramento	electric		75	n/a	505	2%	40	119	14	1,278
City of Sacramento WSA139	WELL139	Sacramento	electric		50	n/a	818	4%	64	193	14	1,278
City of Sacramento WSA142	WELL142	Sacramento	electric		75	n/a	940	4%	74	221	14	1,278
City of Sacramento WSA143	WELL143	Sacramento	electric		50	n/a	379	2%	30	89	14	1,278
City of Sacramento WSA144	WELL144	Sacramento	electric		50	n/a	549	3%	43	129	14	1,278
City of Sacramento WSA153	WELL153	Sacramento	electric		100	n/a	1027	5%	81	242	14	1,278
City of Sacramento WSA154	WELL154	Sacramento	electric		50	n/a	502	2%	39	118	14	1,278
City of Sacramento WSA155	WELL155	Sacramento	electric		50	n/a	675	3%	53	159	14	1,278
City of Sacramento WSA156	WELL156	Sacramento	electric		75	n/a	525	2%	41	124	14	1,278
City of Sacramento WSA157	WELL157	Sacramento	electric		50	n/a	781	4%	61	184	14	1,278
City of Sacramento WSA158	WELL158	Sacramento	electric		50	n/a	781	4%	61	184	14	1,278
City of Sacramento WSA159	WELL159	Sacramento	electric		75	n/a	535	3%	42	126	14	1,278
City of Sacramento WSA164	WELL164	Sacramento	electric		150	n/a	1101	5%	86	259	14	1,278
City of Sacramento WSAX1	WELLX1	Sacramento	electric		150	n/a	1400	7%	110	329	14	1,278
City of Sacramento WSAX2	WELLX2	Sacramento	electric		150	n/a	1400	7%	110	329	14	1,278
						Total	**21,245**	**100%**	**1,667**	**5,000**	**434**	**39,623**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Legend

	Assumed to be electric (similar to other wells operated by water agency)
	Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type

Conversion Factors

1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Sacramento County Water Agency	Federal Attainment Status		
Transfer Volume	15,000 acre feet/year	PM10	M	*Engines subject to ATCM.*
Location	Sacramento County	PM2.5	N	
		O3	N	

Table F-30. Sacramento County Water Agency Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
Sacramento County WAW 040	W 040	Sacramento	Electric		115	n/a	1,160	2%	104	312	16	1,463
Sacramento County WAW 041	W 041	Sacramento	Electric		65	n/a	676	1%	61	182	16	1,463
Sacramento County WAW 042	W 042	Sacramento	Electric		77	n/a	727	1%	65	196	16	1,463
Sacramento County WAW 043	W 043	Sacramento	Electric		94	n/a	918	2%	82	247	16	1,463
Sacramento County WAW 044	W 044	Sacramento	Electric		73	n/a	515	1%	46	139	16	1,463
Sacramento County WAW 047	W 047	Sacramento	Electric		88	n/a	1,030	2%	92	277	16	1,463
Sacramento County WAW 049	W 049	Sacramento	Electric		92	n/a	853	2%	77	230	16	1,463
Sacramento County WAW 052	W 052	Sacramento	Electric		120	n/a	1,192	2%	107	321	16	1,463
Sacramento County WAW 056	W 056	Sacramento	Electric		200	n/a	3,000	5%	269	808	16	1,463
Sacramento County WAW 061	W 061	Sacramento	Electric		145	n/a	1,570	3%	141	423	16	1,463
Sacramento County WAW 062	W 062	Sacramento	Electric		100	n/a	455	1%	41	123	16	1,463
Sacramento County WAW 063	W 063	Sacramento	Electric		100	n/a	1,119	2%	100	301	16	1,463
Sacramento County WAW 064	W 064	Sacramento	Electric		141	n/a	1,205	2%	108	325	16	1,463
Sacramento County WAW 065	W 065	Sacramento	Electric		57	n/a	589	1%	53	159	16	1,463
Sacramento County WAW 066	W 066	Sacramento	Electric		125	n/a	1,700	3%	153	458	16	1,463
Sacramento County WAW 067	W 067	Sacramento	Electric		135	n/a	1,425	3%	128	384	16	1,463
Sacramento County WAW 068	W 068	Sacramento	Electric		141	n/a	1,624	3%	146	437	16	1,463
Sacramento County WAW 069	W 069	Sacramento	Electric		154	n/a	1,663	3%	149	448	16	1,463
Sacramento County WAW 070	W 070	Sacramento	Electric		200	n/a	1,500	3%	135	404	16	1,463
Sacramento County WAW 073	W 073	Sacramento	Electric		175	n/a	2,000	4%	180	539	16	1,463
Sacramento County WAW 074	W 074	Sacramento	Electric		50	n/a	500	1%	45	135	16	1,463
Sacramento County WAW 076	W 076	Sacramento	Electric		150	n/a	1,500	3%	135	404	16	1,463
Sacramento County WAW 077	W 077	Sacramento	Electric		125	n/a	2,000	4%	180	539	16	1,463
Sacramento County WAW 078	W 078	Sacramento	Electric		125	n/a	2,400	4%	216	647	16	1,463
Sacramento County WAW 087	W 087	Sacramento	Electric		150	n/a	1,900	3%	171	512	16	1,463
Sacramento County WAW 092	W 092	Sacramento	Electric		75	n/a	1,160	2%	104	312	16	1,463
Sacramento County WAW 095	W 095	Sacramento	Electric		200	n/a	2,200	4%	198	593	16	1,463
Sacramento County WAW 096	W 096	Sacramento	Electric		150	n/a	1,500	3%	135	404	16	1,463
Sacramento County WAW 105	W 105	Sacramento	Electric		200	n/a	1,500	3%	135	404	16	1,463
Sacramento County WAW 106	W 106	Sacramento	Electric		200	n/a	1,500	3%	135	404	16	1,463
Sacramento County WAW 109	W 109	Sacramento	Electric		200	n/a	2,600	5%	233	700	16	1,463
Sacramento County WAW 110	W 110	Sacramento	Electric		200	n/a	1,500	3%	135	404	16	1,463
Sacramento County WAW 112	W 112	Sacramento	Electric		100	n/a	1,500	3%	135	404	16	1,463
Sacramento County WAW 114	W 114	Sacramento	Electric		200	n/a	1,500	3%	135	404	16	1,463
Sacramento County WAW 129	W 129	Sacramento	Electric		200	n/a	1,500	3%	135	404	16	1,463
Sacramento County WAW 130	W 130	Sacramento	Electric		200	n/a	1,500	3%	135	404	16	1,463
Sacramento County WAW 122	W 122	Sacramento	Electric		200	n/a	1,500	3%	135	404	16	1,463
Sacramento County WAW 123	W 123	Sacramento	Electric		200	n/a	1,500	3%	135	404	16	1,463
Sacramento County WAW 124	W 124	Sacramento	Electric		200	n/a	1,500	3%	135	404	16	1,463
						Total	**55,681**	**100%**	**5,000**	**15,000**	**625**	**57,058**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Legend

Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type

Conversion Factors

1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency Sacramento Suburban Water District
Transfer Volume 30,000 acre feet/year
Location Sacramento County

Federal Attainment Status

PM10	M	*Engines subject to ATCM.*
PM2.5	N	
O3	N	

Peak Month

5,000	AF/month
36,498	gallons/minute
74%	peak pump rate

Table F-31. Sacramento Suburban Water District Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)	Fuel Consumption (MMBtu/yr)	Emission Factors (lb/MMBtu) VOC	NOx	CO	SOx	PM10	PM2.5	Daily Emissions (lbs/day) VOC	NOx	CO	SOx	PM10	PM2.5	Annual Emissions (tons per year) VOC	NOx	CO	SOx	PM10	PM2.5
Sacramento Suburban WD5	5	Sacramento	Electric		110	n/a	330	1%	34	201	18	3,312	n/a																		
Sacramento Suburban WD7	7	Sacramento	Electric		110	n/a	180	0%	18	110	18	3,312	n/a																		
Sacramento Suburban WD9	9	Sacramento	Electric		110	n/a	625	1%	64	381	18	3,312	n/a																		
Sacramento Suburban WD12	12	Sacramento	Electric		110	n/a	540	1%	55	329	18	3,312	n/a																		
Sacramento Suburban WD13	13	Sacramento	Electric		110	n/a	820	2%	83	500	18	3,312	n/a																		
Sacramento Suburban WD14	14	Sacramento	Electric		110	n/a	570	1%	58	348	18	3,312	n/a																		
Sacramento Suburban WD18	18	Sacramento	Electric		110	n/a	840	2%	85	512	18	3,312	n/a																		
Sacramento Suburban WD19	19	Sacramento	Electric		110	n/a	950	2%	97	579	18	3,312	n/a																		
Sacramento Suburban WD22	22	Sacramento	Electric		110	n/a	650	1%	66	396	18	3,312	n/a																		
Sacramento Suburban WD23	23	Sacramento	Electric		110	n/a	550	1%	56	335	18	3,312	n/a																		
Sacramento Suburban WD24	24	Sacramento	Electric		110	n/a	590	1%	60	360	18	3,312	n/a																		
Sacramento Suburban WD25	25	Sacramento	Electric		110	n/a	750	2%	76	457	18	3,312	n/a																		
Sacramento Suburban WD26	26	Sacramento	Electric		110	n/a	650	1%	66	396	18	3,312	n/a																		
Sacramento Suburban WD28	28	Sacramento	Electric		110	n/a	585	1%	59	357	18	3,312	n/a																		
Sacramento Suburban WD30	30	Sacramento	Electric		110	n/a	650	1%	66	396	18	3,312	n/a																		
Sacramento Suburban WD35	35	Sacramento	Electric		110	n/a	1000	2%	102	610	18	3,312	n/a																		
Sacramento Suburban WD37	37	Sacramento	Natural Gas		190	n/a	700	1%	71	427	18	3,312	4,405	0.118	4.08	0.317	0.00059	0.00999	0.00999	2.85	98.47	7.65	0.01	0.24	0.24	0.26	8.99	0.70	0.00	0.02	0.02
Sacramento Suburban WD38	38	Sacramento	Natural Gas		190	n/a	500	1%	51	305	18	3,312	4,405	0.118	4.08	0.317	0.00059	0.00999	0.00999	2.85	98.47	7.65	0.01	0.24	0.24	0.26	8.99	0.70	0.00	0.02	0.02
Sacramento Suburban WD40	40	Sacramento	Natural Gas		190	n/a	675	1%	69	412	18	3,312	4,405	0.118	4.08	0.317	0.00059	0.00999	0.00999	2.85	98.47	7.65	0.01	0.24	0.24	0.26	8.99	0.70	0.00	0.02	0.02
Sacramento Suburban WD41	41	Sacramento	Electric/Natural Gas		190	n/a	600	1%	61	366	18	3,312	4,405	0.118	4.08	0.317	0.00059	0.00999	0.00999	2.85	98.47	7.65	0.01	0.24	0.24	0.26	8.99	0.70	0.00	0.02	0.02
Sacramento Suburban WD43	43	Sacramento	Electric/Natural Gas		190	n/a	850	2%	86	518	18	3,312	4,405	0.118	4.08	0.317	0.00059	0.00999	0.00999	2.85	98.47	7.65	0.01	0.24	0.24	0.26	8.99	0.70	0.00	0.02	0.02
Sacramento Suburban WD45	45	Sacramento	Natural Gas		190	n/a	750	2%	76	457	18	3,312	4,405	0.118	4.08	0.317	0.00059	0.00999	0.00999	2.85	98.47	7.65	0.01	0.24	0.24	0.26	8.99	0.70	0.00	0.02	0.02
Sacramento Suburban WD47	47	Sacramento	Electric/Natural Gas		190	n/a	885	2%	90	540	18	3,312	4,405	0.118	4.08	0.317	0.00059	0.00999	0.00999	2.85	98.47	7.65	0.01	0.24	0.24	0.26	8.99	0.70	0.00	0.02	0.02
Sacramento Suburban WD50	50	Sacramento	Electric		110	n/a	500	1%	51	305	18	3,312	n/a																		
Sacramento Suburban WD51	51	Sacramento	Electric		110	n/a	285	1%	29	174	18	3,312	n/a																		
Sacramento Suburban WD60	60	Sacramento	Electric		110	n/a	600	1%	61	366	18	3,312	n/a																		
Sacramento Suburban WD65	65	Sacramento	Electric		110	n/a	1250	3%	127	762	18	3,312	n/a																		
Sacramento Suburban WD66	66	Sacramento	Electric		110	n/a	1350	3%	137	823	18	3,312	n/a																		
Sacramento Suburban WD69	69	Sacramento	Electric		110	n/a	450	1%	46	274	18	3,312	n/a																		
Sacramento Suburban WD70	70	Sacramento	Electric		110	n/a	350	1%	36	213	18	3,312	n/a																		
Sacramento Suburban WD71	71	Sacramento	Electric		110	n/a	2675	5%	272	1,631	18	3,312	n/a																		
Sacramento Suburban WD72	72	Sacramento	Electric		110	n/a	1850	4%	188	1,128	18	3,312	n/a																		
Sacramento Suburban WD73	73	Sacramento	Electric		110	n/a	3500	7%	356	2,134	18	3,312	n/a																		
Sacramento Suburban WD74	74	Sacramento	Electric		110	n/a	2700	5%	274	1,647	18	3,312	n/a																		
Sacramento Suburban WD75	75	Sacramento	Electric		110	n/a	1150	2%	117	701	18	3,312	n/a																		
Sacramento Suburban WD76	76	Sacramento	Electric		110	n/a	250	1%	25	152	18	3,312	n/a																		
Sacramento Suburban WD77	77	Sacramento	Electric		110	n/a	400	1%	41	244	18	3,312	n/a																		
Sacramento Suburban WD20A	20A	Sacramento	Electric		110	n/a	1100	2%	112	671	18	3,312	n/a																		
Sacramento Suburban WD2A	2A	Sacramento	Electric		110	n/a	995	2%	101	607	18	3,312	n/a																		
Sacramento Suburban WD32A	32A	Sacramento	Electric		110	n/a	1905	4%	194	1,162	18	3,312	n/a																		
Sacramento Suburban WD33A	33A	Sacramento	Electric		110	n/a	2675	5%	272	1,631	18	3,312	n/a																		
Sacramento Suburban WD3A	3A	Sacramento	Electric		110	n/a	370	1%	38	226	18	3,312	n/a																		
Sacramento Suburban WD40A	40A	Sacramento	Electric		110	n/a	2525	5%	257	1,540	18	3,312	n/a																		
Sacramento Suburban WD46R	46R	Sacramento	Electric/Natural Gas		190	n/a	800	2%	81	488	18	3,312	4,405	0.118	4.08	0.317	0.00059	0.00999	0.00999	2.85	98.47	7.65	0.01	0.24	0.24	0.26	8.99	0.70	0.00	0.02	0.02
Sacramento Suburban WD4B	4B	Sacramento	Electric		110	n/a	2675	5%	272	1,631	18	3,312	n/a																		
Sacramento Suburban WD55A	55A	Sacramento	Electric		110	n/a	2000	4%	203	1,220	18	3,312	n/a																		
Sacramento Suburban WD68R	68R	Sacramento	Electric		110	n/a	1600	3%	163	976	18	3,312	n/a																		
						Total	**49,195**	**100%**	**5,000**	**30,000**	**853**	**155,656**	**35,238**							**22.78**	**787.78**	**61.21**	**0.11**	**1.93**	**1.93**	**2.08**	**71.89**	**5.59**	**0.01**	**0.18**	**0.18**

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 MMBtu =	1,000,000	Btu
1 lb =	453.6	g
1 ton =	2,000	lbs
1 month =	30.4	days
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Natural Gas Engine Fuel Consumption

Estimated BSFC =	7,000	Btu/bhp-hr	(Estimated from Waukesha engine specifications)
Higher Heating Value	1,020	Btu/scf	(AP-42, Chapter 3.2: Natural Gas-fired Reciprocating Engines)

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Butte Water District	
Transfer Volume	5,500	acre feet/year
Location	Butte	County
	Sutter	County

Federal Attainment Status

	Butte	*Sutter*	
PM10	A	A	*Engines subject to ATCM.*
PM2.5	N	N	
O3	N	N	

Table F-32. Butte Water District Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
Butte Water District#1	#1	Sutter	Electric	2008 Floway 16 MKM	300	n/a	4,000	49%	447	2,683	20	3,643
Butte Water District#2	#2	Sutter	Electric	2008 Floway 16 DKH	350	n/a	4,200	51%	470	2,817	20	3,643
						Total	**8,200**	**100%**	**917**	**5,500**	**40**	**7,285**
						Total (Butte County)	**0**	**0%**	**0**	**0**	**0**	**0**
						Total (Sutter County)	**8,200**	**100%**	**917**	**5,500**	**40**	**7,285**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Conversion Factors

1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Garden Highway Mutual Water Company	
Transfer Volume	14,000 acre feet/year	
Location	Sutter County	

Federal Attainment Status

PM10	A	*Engines subject to ATCM.*
PM2.5	N	
O3	N	

Table F-33. Garden Highway Mutual Water Company Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
Garden Highway MWC4	#4	Sutter	Electric		110	n/a	2,300	12%	295	1,651	23	3,899
Garden Highway MWC17	#17	Sutter	Electric		110	n/a	3,100	16%	397	2,226	23	3,899
Garden Highway MWC19	#19	Sutter	Electric		110	n/a	2,800	14%	359	2,010	23	3,899
Garden Highway MWC22	#22	Sutter	Electric		110	n/a	2,700	14%	346	1,938	23	3,899
Garden Highway MWC23	#23	Sutter	Electric		110	n/a	2,200	11%	282	1,579	23	3,899
Garden Highway MWC24	#24	Sutter	Electric	TBD	110	n/a	3,200	16%	410	2,297	23	3,899
Garden Highway MWC25	#25	Sutter	Electric	TBD	110	n/a	3,200	16%	410	2,297	23	3,899
						Total	**19,500**	**100%**	**2,500**	**14,000**	**160**	**27,294**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Gilsizer Slough Ranch	Federal Attainment Status			Peak Month
Transfer Volume	3,900 acre feet/year	PM10	A	*Engines subject to ATCM.*	800 AF/month
Location	Sutter County	PM2.5	N		5,840 gallons/minute
		O3	N		97% peak pump rate

Table F-34. Gilsizer Slough Ranch Criteria Pollutant Emissions

													Emission Factors (g/bhp-hr)						Daily Emissions (lbs/day)						Annual Emissions (tons per year)					
Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)	Fuel Consumption (gal/yr)	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Gilsizer #1	Gilsizer #1	Sutter	Diesel		162	T0	2,016	33%	267	1,300	24	3,502	31,828	1.1	14.1	3.0	0.93	0.22	0.21	9.62	118.61	25.56	7.84	1.86	1.81	0.71	8.79	1.89	0.58	0.14	0.13
Gilsizer #2	Gilsizer #2	Sutter	Electric	TBD	110	n/a	2,016	33%	267	1,300	24	3,502	n/a																		
Gilsizer #3	Gilsizer #3	Sutter	Electric	TBD	110	n/a	2,016	33%	267	1,300	24	3,502	n/a																		
						Total	**6,048**	**100%**	**800**	**3,900**	**71**	**10,506**	**31,828**							**9.62**	**118.61**	**25.56**	**7.84**	**1.86**	**1.81**	**0.71**	**8.79**	**1.89**	**0.58**	**0.14**	**0.13**

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend
Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6	g
1 ton =	2,000	lbs
1 month =	30.4	days
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4	lb/hp-hr	*(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855	g/mL	*(Based on MSDS for Hess Diesel Fuel All Types)*
7.13	lb/gal	

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Goose Club Farms and Teichert Aggregates		
Transfer Volume	10,000	acre feet/year	
Location	Sutter	County	

Federal Attainment Status

PM10	A	*Engines subject to ATCM.*
PM2.5	N	
O3	N	

Table F-35. Goose Club Farms and Teichert Aggregates Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
Goose Club1	1	Sutter	Electric	TBD	125	n/a	3,000	8%	185	769	11	1,393
Goose Club2	2	Sutter	Electric	TBD	125	n/a	3,000	8%	185	769	11	1,393
Goose Club3	3	Sutter	Electric	TBD	125	n/a	3,000	8%	185	769	11	1,393
Goose Club4	4	Sutter	Electric	TBD	125	n/a	3,000	8%	185	769	11	1,393
Goose Club5	5	Sutter	Electric	TBD	125	n/a	3,000	8%	185	769	11	1,393
Goose Club6	6	Sutter	Electric	TBD	125	n/a	3,000	8%	185	769	11	1,393
Goose Club7	7	Sutter	Electric	TBD	125	n/a	3,000	8%	185	769	11	1,393
Goose Club8	8	Sutter	Electric	TBD	125	n/a	3,000	8%	185	769	11	1,393
Goose Club9	9	Sutter	Electric	TBD	125	n/a	3,000	8%	185	769	11	1,393
Goose Club10	10	Sutter	Electric	TBD	125	n/a	3,000	8%	185	769	11	1,393
Goose Club11	11	Sutter	Electric	TBD	125	n/a	3,000	8%	185	769	11	1,393
Goose Club12	12	Sutter	Electric	TBD	125	n/a	3,000	8%	185	769	11	1,393
Goose Club13	13	Sutter	Electric	TBD	125	n/a	3,000	8%	185	769	11	1,393
						Total	**39,000**	**100%**	**2,400**	**10,000**	**143**	**18,103**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Conversion Factors

1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Tule Basin Farms	Federal Attainment Status			Peak Month
Transfer Volume	7,320 acre feet/year	PM10	A	*Engines subject to ATCM.*	1,520 AF/month
Location	Sutter County	PM2.5	N		11,095 gallons/minute
		O3	N		96% peak pump rate

Table F-36. Tule Basin Farms Criteria Pollutant Emissions

		Well Location			Power Rating	Emission	Pump Rate		Transfer Volume		Operation		Fuel Consumption	Emission Factors (lb/MMBtu)						Daily Emissions (lbs/day)						Annual Emissions (tons per year)					
Description	Well	(County)	Fuel Type	Model Year	(hp)	Tier	(gpm)	(% of Total)	(AF/month)	(AF/year)	(hours/day)	(hours/year)	(MMBtu/yr)	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Tule Basin1	1	Sutter	Electric		125	n/a	3,050	27%	403	1,941	24	3,457	n/a																		
Tule Basin2	2	Sutter	Natural Gas	1985	190	n/a	3,600	31%	476	2,291	24	3,457	4,598	0.118	4.08	0.317	0.00059	0.00999	0.00999	3.70	128.06	9.95	0.02	0.31	0.31	0.27	9.38	0.73	0.00	0.02	0.02
Tule Basin3	3	Sutter	Electric		125	n/a	4,850	42%	641	3,087	24	3,457	n/a																		
						Total	**11,500**	**100%**	**1,520**	**7,320**	**71**	**10,371**	**4,598**							**3.70**	**128.06**	**9.95**	**0.02**	**0.31**	**0.31**	**0.27**	**9.38**	**0.73**	**0.00**	**0.02**	**0.02**

Conversion Factors

1 MMBtu =	1,000,000	Btu
1 ton =	2,000	lbs
1 month =	30.4	days
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Natural Gas Engine Fuel Consumption

Estimated BSFC =	7,000	Btu/bhp-hr	(Estimated from Waukesha engine specifications)
Higher Heating Value	1,020	Btu/scf	(AP-42, Chapter 3.2: Natural Gas-fired Reciprocating Engines)

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Reclamation District 2068	
Transfer Volume	4,500	acre feet/year
Location	Solano	County
	Yolo	County

Federal Attainment Status

	Solano	*Yolo*	
PM10	A	A	*Engines subject to ATCM.*
PM2.5	N	N	
O3	N	N	

Table F-37. Reclamation District 2068 Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
RD-2068TP-1	TP-1	Solano	Electric		75	n/a	1,500	25%	188	1,125	22	4,073
RD-2068GW-2	GW-2	Solano	Electric	TBD	75	n/a	1,500	25%	188	1,125	22	4,073
RD-2068GW-3	GW-3	Solano	Electric	TBD	75	n/a	1,500	25%	188	1,125	22	4,073
RD-2068GW-4	GW-4	Solano	Electric	TBD	75	n/a	1,500	25%	188	1,125	22	4,073
Total							**6,000**	**100%**	**750**	**4,500**	**89**	**16,293**
Total (Solano County)							**6,000**	**100%**	**750**	**4,500**	**89**	**16,293**
Total (Yolo County)							**0**	**0%**	**0**	**0**	**0**	**0**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Legend

Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type

Conversion Factors

1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Groundwater Substitution Air Quality Emissions (Unmitigated)

Agency	Pope Ranch	
Transfer Volume	2,800	acre feet/year
Location	Yolo	County

Federal Attainment Status

PM10	A	*Engines subject to ATCM.*
PM2.5	N	
O3	N	

Table F-38. Pope Ranch Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)
Pope RanchX1	X1	Yolo	Electric	TBD	110	n/a	2,117	50%	280	1,400	24	3,591
Pope RanchX2	X2	Yolo	Electric	TBD	110	n/a	2,117	50%	280	1,400	24	3,591
						Total	**4,234**	**100%**	**560**	**2,800**	**47**	**7,183**

Note: Local criteria pollutant emissions not estimated because all engines are electric.

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

CARB Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines

Table F-39. Summary of the Emission Standards for New Stationary Diesel-Fueled CI Engines > 50 BHP used in Agricultural Operations

Horsepower Range	Diesel PM [1] (g/bhp-hr)	HC (g/bhp-hr)	NOx (g/bhp-hr)	NMHC+NOx (g/bhp-hr)	CO (g/bhp-hr)
50<HP<100	0.3				
100<=HP<175	0.22				
175<=HP	0.15				

Source: See Section 93115.8(a)

Notes:

[1] Less than or equal to the emission standard OR Off-Road CI Engine Certification Standard for an off-road engine of the maximum rated power, whichever is more stringent.

[2] Off-Road CI Engine Certification Standard for an off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard, or Tier 1 standards.

[3] Prior to January 1, 2008, these limits shall not apply to engines sold from one agricultural operation to another and funded under State or federal incentive.

Table F-40. Emission Standards for Noncertified Greater than 50 BHP In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations

Horsepower (HP) Range	Compliance Date [1]	PM (g/bhp-hr)	HC [2,3] (g/bhp-hr)	NOx [2,3] (g/bhp-hr)	NMHC+NOx [2,3] (g/bhp-hr)	CO [2,3] (g/bhp-hr)
50<HP<75	2011	0.3				
75<=HP<100	2011	0.3				
100<=HP<175	2010	0.22				
175<=HP<=750	2010	0.15				
750<HP	2014	0.075				

Source: See Sections 93115.8(b) (2) and (4)

Note:

[1] Compliance date on or after December 31

[2] Engine Certification Standards for off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard.

[3] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in an agricultural operation shall not exceed Tier 1 standards in Title 13.

Table F-41. Emission Standards Tier 1- and Tier 2-Certified Greater than 50 BHP In-Use Stationary Diesel-Fueled Engines Used in Agricultural Operations

Horsepower Range (hp)	Compliance Date	PM (g/bhp-hr)	HC [2,3] (g/bhp-hr)	NOx [2,3] (g/bhp-hr)	NMHC+NOx [2,3] (g/bhp-hr)	CO [2,3] (g/bhp-hr)
50<HP<75	2015	0.02				
75<=HP<175	2015	0.01				
175<=hp<=750	2014	0.01				
750<HP	2014	0.075				

Source: See Sections 93115.8(b)(3) and (4)

Notes:

[1] Compliance date on or after December 31 or 12 years after the date of initial installation, whichever is later.

[2] Off-Road CI Engine Certification Standards for an off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard.

[3] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in agricultural operation shall not exceed Tier 1 standards in Tier 13, CCR, section 2423 for an off-road engine of the same maximum rated power irrespective of model year.

Table F-42. Tier 1, Tier 2, and Tier 3 Exhaust Emission Standards

Maximum Rated Power	Tier	Model Year	(g/kW-hr)					(g/hp-hr)				
			NOx	HC	NMHC+NOx	CO	PM	NOx	HC	NMHC+NOx	CO	PM
kW<8	T1	2000-2004	-	-	10.5	8.0	1	-	-	7.8	6.0	0.75
hp <11	T2	2005 -2007	-	-	7.5	8.0	0.8	-	-	5.6	6.0	0.60
8≤kW<19	T1	2000-2004	-	-	9.5	6.6	0.8	-	-	7.1	4.9	0.60
11<=hp<25	T2	2005 -2007	-	-	7.5	6.6	0.8	-	-	5.6	4.9	0.60
19≤kW<37	T1	2000-2003	-	-	9.5	5.5	0.8	-	-	7.1	4.1	0.60
25<=hp<50	T2	2004 -2007	-	-	7.5	5.5	0.6	-	-	5.6	4.1	0.45
37≤kW<56	T1	2000-2003	9.2	-	-	-	-	6.9	-	-	-	-
50<=hp<75	T2	2004-2007	-	-	7.5	5.0	0.4	-	-	5.6	3.7	0.30
	T3	2008 -2011	-	-	4.7	5.0	0.4	-	-	3.5	3.7	0.30
56≤kW<75	T1	2000-2003	9.2	-	-	-	-	6.9	-	-	-	-
75<=hp<100	T2	2004-2007	-	-	7.5	5.0	0.4	-	-	5.6	3.7	0.30
	T3	2008-2011	-	-	4.7	5.0	0.4	-	-	3.5	3.7	0.30
75≤kW<130	T1	2000-2002	9.2	-	-	-	-	6.9	-	-	-	-
100<=hp<175	T2	2003-2006	-	-	6.6	5.0	0.3	-	-	4.9	3.7	0.22
	T3	2007 -2011	-	-	4.0	5.0	0.3	-	-	3.0	3.7	0.22
130≤kW<225	T1	1996-2002	9.2	1.3	-	11.4	0.54	6.9	1.0	-	8.5	0.40
175<=hp<300	T2	2003-2005	-	-	6.6	3.5	0.2	-	-	4.9	2.6	0.15
	T3	2006 -2010	-	-	4.0	3.5	0.2	-	-	3.0	2.6	0.15
225≤kW<450	T1	1996-2000	9.2	1.3	-	11.4	0.54	6.9	1.0	-	8.5	0.40
300<=hp<600	T2	2001-2005	-	-	6.4	3.5	0.2	-	-	4.8	2.6	0.15
	T3	2006 -2010	-	-	4.0	3.5	0.2	-	-	3.0	2.6	0.15
450≤kW≤560	T1	1996-2001	9.2	1.3	-	11.4	0.54	6.9	1.0	-	8.5	0.40
600<=hp<750	T2	2002-2005	-	-	6.4	3.5	0.2	-	-	4.8	2.6	0.15
	T3	2006 -2010	-	-	4.0	3.5	0.2	-	-	3.0	2.6	0.15
kW>560	T1	2000-2005	9.2	1.3	-	11.4	0.54	6.9	1.0	-	8.5	0.40
hp>750	T2	2006 -2010	-	-	6.4	3.5	0.2	-	-	4.8	2.6	0.15

Source: Title 13, California Code of Regulations, Division 3, Chapter 9, Article 4, Section 2423, "Off-Road Compression-Ignition Engines and Equipment."

NOx and NMHC fraction - Table B-26

NOx	95%
NMHC	5%

http://www.arb.ca.gov/msprog/moyer/guidelines/cmp_guidelines_part4.pdf

PM Size Fractions

PM10	0.96
PM2.5	0.937
Ratio	0.98

CARB PMSIZE Profile No. 116 (STAT. I.C. ENGINE-DIESEL)

Table F-43. Tier 4 Exhaust Emission Standards

MAXIMUM ENGINE POWER	MODEL YEAR	TYPE	PM	NMHC+	NMHC	NOx	CO
			grams per horsepower-hour				
hp<11	2008 and later	FINAL	0.30	5.6	-	-	6.0
11<=hp<25							4.9
25<=hp<50	2008-2012	INTERIM	0.22	5.6	-	-	4.1
	2013 and later	FINAL	0.02	3.5			
50<=hp<75	2008-2012	INTERIM	0.22	3.5	-	-	3.7
	2013 and later	FINAL	0.02				
75<=hp<100	2012-2014	PHASE-IN	0.01	-	0.14	0.3	3.7
		PHASE-OUT		3.5	-	-	
		or/ ALT NOx			0.14	2.5	
	2015 and later	FINAL		-		0.3	
100<=hp<175	2012-2014	PHASE-IN	0.01	-	0.14	0.3	3.7
		PHASE-OUT		3.0	-	-	
		or/ ALT NOx		-	0.14	2.5	
	2015 and later	FINAL			0.14	0.3	
175<=hp<=750	2011-2013	PHASE-IN	0.01	-	0.14	0.3	2.6
	2014 and later	PHASE-OUT		3.0	-	-	
		or/ ALT NOx		-	0.14	1.5	
		FINAL				0.3	
750 hp<GEN<=1205 hp	2011-2014	INTERIM	0.07	-	0.30	2.6	2.6
	2015 and later	FINAL	0.02		0.14	0.5	
GEN>1205 hp	2011-2014	INTERIM	0.07	-	0.30		2.6
	2015 and later	FINAL	0.02		0.14	0.5	
ELSE>750 hp	2011-2014	INTERIM	0.07	-	0.30	2.6	2.6
	2015 and later	FINAL	0.03	-	0.14		

Source: Title 13, California Code of Regulations, Article 4, Section 2423, "Off-Road Compression-Ignition Engines and Equipment."

Table F-44. Engine Tier Matrix

HP Range	Year																			
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
hp <11	T0	T0	T0	T0	T1	T1	T1	T1	T1	T2	T2	T2	T4	T4	T4	T4	T4	T4	T4	T4
11<=hp<25	T0	T0	T0	T0	T1	T1	T1	T1	T1	T2	T2	T2	T4	T4	T4	T4	T4	T4	T4	T4
25<=hp<50	T0	T0	T0	T0	T1	T1	T1	T1	T2	T2	T2	T2	T4I	T4I	T4I	T4I	T4I	T4	T4	T4
50<=hp<75	T0	T0	T0	T0	T1	T1	T1	T1	T2	T2	T2	T2	T4I	T4I	T4I	T4I	T4I	T4	T4	T4
75<=hp<100	T0	T0	T0	T0	T1	T1	T1	T1	T2	T2	T2	T2	T3	T3	T3	T3	T4I	T4I	T4I	T4
100<=hp<175	T0	T0	T0	T0	T1	T1	T1	T2	T2	T2	T2	T3	T3	T3	T3	T3	T4I	T4I	T4I	T4
175<=hp<300	T1	T1	T1	T1	T1	T1	T1	T2	T2	T2	T3	T3	T3	T3	T3	T4I	T4I	T4I	T4	T4
300<=hp<600	T1	T1	T1	T1	T1	T2	T2	T2	T2	T2	T3	T3	T3	T3	T3	T4I	T4I	T4I	T4	T4
600<=hp<750	T1	T1	T1	T1	T1	T1	T2	T2	T2	T2	T3	T3	T3	T3	T3	T4I	T4I	T4I	T4	T4
hp>750	T0	T0	T0	T0	T1	T1	T1	T1	T1	T1	T2	T2	T2	T2	T2	T4I	T4I	T4I	T4I	T4

Key:

T0 = Tier 0 (Noncertified)
T1 = Tier 1
T2 = Tier 2
T3 = Tier 3
T4 = Tier 4
T4I = Tier 4 Interim

AP-42 Emission Factors

Table F-45. Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines [a]

	Gasoline Fuel		Diesel Fuel			
	Emission Factor		Emission Factor		Emission	
Pollutant	(lb/hp-hr) (power output)	(lb/MMBtu) (fuel input)	(lb/hp-hr) (power output)	(lb/MMBtu) (fuel input)	Factor Rating	Note
NOx	0.011	1.63	0.031	4.41	D	
CO	6.96E-03 [d]	0.99 [d]	6.68E-03	0.95	D	
SOx	5.91E-04	0.084	2.05E-03	0.29	D	
PM10	7.21E-04	0.1	2.20E-03	0.31	D	[b]
CO2	1.08	154	1.15	164	B	[c]
Aldehydes	4.85E-04	0.07	4.63E-04	0.07	D	
TOC						
Exhaust	0.015	2.1	2.47E-03	0.35	D	
Evaporative	6.61E-04	0.09	0.00	0.00	E	
Crankcase	4.85E-03	0.69	4.41E-05	0.01	E	
Refueling	1.08E-03	0.15	0.00	0.00	E	

Source: U.S. Environmental Protection Agency. 1996. Compilation of Air Pollutant Emission Factors (AP-42). Chapter 3.3: Gasoline and Diesel Industrial Engines.

Notes:

[a] References 2,5-6,9-14. When necessary, an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. To convert from lb/hp-hr to kg/kwhr, multiply by 0.608. To convert from lb/MMBtu to ng/J, multiply by 430. SCC = Source Classification Code. TOC = total organic compounds.

[b] PM-10 = particulate matter less than or equal to 10 :m aerodynamic diameter. All particulate is assumed to be 10 µm in size.

[c] Assumes 99% conversion of carbon in fuel to CO2 with 87 weight % carbon in diesel, 86 weight % carbon in gasoline, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb, and gasoline heating value of 20,300 Btu/lb.

[d] Instead of 0.439 lb/hp-hr (power output) and 62.7 lb/mmBtu (fuel input), the correct emissions factors values are 6.96 E-03 lb/hp-hr (power output) and 0.99 lb/mmBtu (fuel input), respectively. This is an editorial correction. March 24, 2009

For large stationary diesel engines (greater than 600 horsepower [hp]) see Chapter 3.4: Large Stationary Diesel and All Stationary Dual-Fuel Engines.

Table F-46. Uncontrolled Emission Factors for 4-Stroke Lean-Burn Engines [a]

Pollutant	Emission Factor (lb/MMBtu) [b] (fuel input)	Emission Factor Rating
NOx [c] 90 - 105% Load	4.08E+00	B
NOx [c] <90% Load	8.47E-01	B
CO [c] 90 - 105% Load	3.17E-01	C
CO [c] <90% Load	5.57E-01	B
CO2 [d]	1.10E+02	A
SO2 [e]	5.88E-04	A
TOC [f]	1.47E+00	A
Methane[g]	1.25E+00	C
VOC [h]	1.18E-01	C
PM10 (filterable) [i]	7.71E-05	D
PM2.5 (filterable) [i]	7.71E-05	D
PM Condensable [j]	9.91E-03	D

Source: U.S. Environmental Protection Agency. 2000. Compilation of Air Pollutant Emission Factors (AP-42). Chapter 3.2: Natural Gas-Fired Reciprocating Engines. July.
Notes:

[a] Reference 7. Factors represent uncontrolled levels. For NOx, CO, and PM10, “uncontrolled” means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, the data set may include units with control techniques used for NOx control, such as PCC“uncontrolled” means no oxidation control; and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM-10 = Particulate Matter ≤ 10 microns (μ) aerodynamic diameter. A “<“ sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

[b] Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA Method 19. To convert from (lb/MMBtu) to (lb/10^6 scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

lb/hp-hr = (lb/MMBtu) (heat input, MMBtu/hr) (1/operating HP, 1/hp)

[c] Emission tests with unreported load conditions were not included in the data set.

[d] Based on 99.5% conversion of the fuel carbon to CO2. CO2 [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO2, C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10^6 scf, and h = heating value of natural gas (assume 1020 Btu/scf at 60EF).

[e] Based on 100% conversion of fuel sulfur to SO2. Assumes sulfur content in natural gas of 2,000 gr/10^9scf.

[f] Emission factor for TOC is based on measured emission levels from 22 source tests.

[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor. Measured emission factor for methane compares well with the calculated emission factor, 1.31 lb/MMBtu vs. 1.25 lb/MMBtu, respectively.

[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds less ethane and methane.

[i] Considered ≤ 1 μ in aerodynamic diameter. Therefore, for filterable PM emissions, PM10(filterable) = PM2.5(filterable).

[j] PM Condensable = PM Condensable Inorganic + PM-Condensable Organic

Engine Size Summary

Table F-47. Summary of Average Engine Horsepower by Fuel Type

Average of HP	Fuel Type			
Agency	**Diesel**	**Electric**	**Natural Gas**	**Grand Total**
Anderson-Cottonwood Irrigation District		125		125
Butte Water District		325		325
City of Sacramento		60		60
Conaway Preservation Group	227	138		147
Cordua Irrigation District		82		82
Cranmore Farms		125		125
Eastside Mutual Water Company	215			215
Goose Club Farms and Teichert Aggregates		125		125
Pelger Mutual Water Company	173			173
Pleasant Grove-Verona Mutual Water Company	129	118		124
Reclamation District 1004	191	76		145
Reclamation District 108		200		200
Reclamation District 2068		75		75
Sacramento County Water Agency		116		116
Sycamore Mutual Water Company		117		117
Te Velde Revocable Family Trust		110		110
Tule Basin Farms		125	190	147
Grand Total	**162**	**110**	**190**	**117**

Table F-48. Summary of Maximum Engine Horsepower by Fuel Type

Max of HP	Fuel Type			
Agency	**Diesel**	**Electric**	**Natural Gas**	**Grand Total**
Anderson-Cottonwood Irrigation District		200		200
Butte Water District		350		350
City of Sacramento		150		150
Conaway Preservation Group	227	250		250
Cordua Irrigation District		125		125
Cranmore Farms		125		125
Eastside Mutual Water Company	215			215
Goose Club Farms and Teichert Aggregates		125		125
Pelger Mutual Water Company	173			173
Pleasant Grove-Verona Mutual Water Company	250	250		250
Reclamation District 1004	225	125		225
Reclamation District 108		250		250
Reclamation District 2068		75		75
Sacramento County Water Agency		200		200
Sycamore Mutual Water Company		125		125
Te Velde Revocable Family Trust		143		143
Tule Basin Farms		125	190	190
Grand Total	**250**	**350**	**190**	**350**

Table F-49. Summary of Minimum Engine Horsepower by Fuel Type

Min of HP	Fuel Type			
Agency	**Diesel**	**Electric**	**Natural Gas**	**Grand Total**
Anderson-Cottonwood Irrigation District		50		50
Butte Water District		300		300
City of Sacramento		30		30
Conaway Preservation Group	227	75		75
Cordua Irrigation District		50		50
Cranmore Farms		125		125
Eastside Mutual Water Company	215			215
Goose Club Farms and Teichert Aggregates		125		125
Pelger Mutual Water Company	173			173
Pleasant Grove-Verona Mutual Water Company	62	30		30
Reclamation District 1004	150	40		40
Reclamation District 108		100		100
Reclamation District 2068		75		75
Sacramento County Water Agency		50		50
Sycamore Mutual Water Company		75		75
Te Velde Revocable Family Trust		52		52
Tule Basin Farms		125	190	125
Grand Total	**62**	**30**	**190**	**30**

Table F-50. General Conformity Applicability Evaluation (Mitigated Emissions)

County/ Nonattainment Area	Emissions (tons per year)							
	VOC	NOx	CO	SOx		PM10	PM2.5	
	Sacramento Metro[1,5]	Sacramento Metro[1,5]	Sacramento Area[2]	Sacramento[3,4]	Yuba City-Marysville[6]	Sacramento Co.	Sacramento[4]	Yuba City-Marysville[6]
Colusa	--	--	--	--	--	--	--	--
Glenn	--	--	--	--	--	--	--	--
Sacramento	0.1	4.9	0.4	0.001	--	0.01	0.01	--
Shasta	--	--	--	--	--	--	--	--
Solano	0.0	0.0	--	--	--	--	--	--
Sutter	0.3	3.6	--	--	3.1	--	--	0.5
Tehama	--	--	--	--	--	--	--	--
Yolo	0.7	7.9	--	--	--	--	--	--
Yuba	--	--	--	--	0.0	--	--	0.0
Total	1.2	16.3	0.4	0.001	3.1	0.01	0.01	0.5
Classification	Severe	Severe	Maintenance	PM2.5 Precursor	PM2.5 Precursor	Maintenance	Nonattainment	Nonattainment
De Minimis Threshold (tpy)	25	25	100	100	100	100	100	100
Exceed?	No	No	No	No	No	No	No	No

Note:

[1]The Sacramento Metro 8-hour O3 nonattainment area consists of Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties. Emissions occurring within the attainment area of these counties are excluded from the total emissions.

[2]The Sacramento Area CO maintenance area is based on the Census Bureau Urbanized Area and consists of parts of Placer, Sacramento, and Yolo Counties. The general conformity applicability evaluation is based on emissions that would occur within the entire county to be conservative.

[3]All counties are designated as attainment areas for SO2; however, since SO2 is a precursor to PM2.5, its emissions must be evaluated under general conformity.

[4]The 24-hour PM2.5 nonattainment area for Sacramento includes Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties. The general conformity applicability analysis assumes that all emissions that could occur within each county would occur within the Sacramento nonattainment area to be conservative.

[5]VOC and NOx emissions are excluded from Sutter County for Cranmore Farms, Garden Highway Mutual Water Company, Gilsizer Slough Ranch, Pelger Mutual Water Company, Reclamation District 1004, and Tule Basin Farms because they are located in areas designated as attainment for the federal 8-hour O3 NAAQS.

[6]The Yuba City-Marysville PM2.5 nonattainment area contains all of Sutter County and a part of Yuba County.

Table F-51. Emissions Outside of 8-Hour Ozone Nonattainment Area (tons per year)

Water Agency	County	VOC	NOx
Cranmore Farms	Sutter	Electric	Electric
Garden Highway Mutual Water Company	Sutter	Electric	Electric
Gilsizer Slough Ranch	Sutter	0.1	1.8
Pelger Mutual Water Company	Sutter	0.1	1.2
Reclamation District 1004	Sutter	n/a	n/a
Tule Basin Farms	Sutter	0.3	1.4
Total		0.4	4.3

Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

Table F-52. Daily VOC Emissions

Water Agency	Daily VOC Emissions (lbs/day)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									13.32		13.32
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		1.55									1.55
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							0.92				0.92
Pleasant Grove-Verona Mutual Water Company							2.21		Electric		2.21
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		27.07	3.98				n/a				31.05
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				1.57							1.57
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							1.26				1.26
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							3.70				3.70
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**28.61**	**3.98**	**1.57**	**0.00**	**0.00**	**8.10**	**0.00**	**13.32**	**0.00**	**55.58**

Note:

Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

Table F-53. Daily NOx Emissions

Water Agency	Daily NOx Emissions (lbs/day)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									147.70		147.70
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		29.38									29.38
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							17.49				17.49
Pleasant Grove-Verona Mutual Water Company							22.80		Electric		22.80
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		354.91	49.10				n/a				404.01
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				54.26							54.26
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							23.92				23.92
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							19.21				19.21
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**384.29**	**49.10**	**54.26**	**0.00**	**0.00**	**83.42**	**0.00**	**147.70**	**0.00**	**718.77**

Note:

Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

Table F-54. Daily CO Emissions

Water Agency	Daily CO Emissions (lbs/day)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									125.01		125.01
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		27.06									27.06
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							23.01				23.01
Pleasant Grove-Verona Mutual Water Company							48.31		Electric		48.31
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		118.57	10.58				n/a				129.15
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				4.22							4.22
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							31.47				31.47
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							9.95				9.95
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**145.63**	**10.58**	**4.22**	**0.00**	**0.00**	**112.75**	**0.00**	**125.01**	**0.00**	**398.18**

Note:

Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

Table F-55. Daily SOx Emissions

Water Agency	Daily SOx Emissions (lbs/day)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									25.40		25.40
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		9.63									9.63
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							5.73				5.73
Pleasant Grove-Verona Mutual Water Company							13.72		Electric		13.72
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		36.05	3.25				n/a				39.29
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				0.01							0.01
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							7.84				7.84
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.02				0.02
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**45.68**	**3.25**	**0.01**	**0.00**	**0.00**	**27.32**	**0.00**	**25.40**	**0.00**	**101.65**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

Table F-56. Daily PM10 Emissions

Water Agency	Daily PM10 Emissions (lbs/day)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									6.39		6.39
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		1.55									1.55
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							1.38				1.38
Pleasant Grove-Verona Mutual Water Company							1.49		Electric		1.49
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		6.37	0.52				n/a				6.90
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				0.13							0.13
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							1.89				1.89
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.31				0.31
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**7.92**	**0.52**	**0.13**	**0.00**	**0.00**	**5.07**	**0.00**	**6.39**	**0.00**	**20.04**

Note:

Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Daily Groundwater Substitution Emissions by County (Mitigated)

Table F-57. Daily PM2.5 Emissions

Water Agency	Daily PM2.5 Emissions (lbs/day)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									6.39		6.39
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		1.55									1.55
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							1.38				1.38
Pleasant Grove-Verona Mutual Water Company							1.47		Electric		1.47
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		6.30	0.51				n/a				6.81
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				0.13							0.13
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							1.89				1.89
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.31				0.31
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**7.84**	**0.51**	**0.13**	**0.00**	**0.00**	**5.06**	**0.00**	**6.39**	**0.00**	**19.93**

Note:
Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

Table F-58. Annual VOC Emissions

Water Agency	Annual VOC Emissions (tons per year)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									0.71		0.71
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		0.11									0.11
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							0.06				0.06
Pleasant Grove-Verona Mutual Water Company							0.35		Electric		0.35
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		1.03	0.15				n/a				1.18
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				0.14							0.14
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							0.09				0.09
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.27				0.27
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**1.14**	**0.15**	**0.14**	**0.00**	**0.00**	**0.77**	**0.00**	**0.71**	**0.00**	**2.92**

Note:

Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

Table F-59. Annual NOx Emissions

Water Agency	Annual NOx Emissions (tons per year)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									7.89		7.89
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		2.14									2.14
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							1.16				1.16
Pleasant Grove-Verona Mutual Water Company							3.56		Electric		3.56
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		13.49	1.87				n/a				15.36
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				4.88							4.88
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							1.77				1.77
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							1.41				1.41
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**15.64**	**1.87**	**4.88**	**0.00**	**0.00**	**7.90**	**0.00**	**7.89**	**0.00**	**38.17**

Note:

Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

Table F-60. Annual CO Emissions

Water Agency	Annual CO Emissions (tons per year)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									6.68		6.68
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		1.97									1.97
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							1.53				1.53
Pleasant Grove-Verona Mutual Water Company							7.54		Electric		7.54
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		4.51	0.40				n/a				4.91
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				0.38							0.38
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							2.33				2.33
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.73				0.73
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**6.48**	**0.40**	**0.38**	**0.00**	**0.00**	**12.13**	**0.00**	**6.68**	**0.00**	**26.07**

Note:

Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

Table F-61. Annual SOx Emissions

Water Agency	Annual SOx Emissions (tons per year)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									1.36		1.36
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		0.70									0.70
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							0.38				0.38
Pleasant Grove-Verona Mutual Water Company							2.14		Electric		2.14
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		1.37	0.12				n/a				1.49
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				0.00							0.00
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							0.58				0.58
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.00				0.00
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**2.07**	**0.12**	**0.00**	**0.00**	**0.00**	**3.10**	**0.00**	**1.36**	**0.00**	**6.66**

Note:

Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

Table F-62. Annual PM10 Emissions

Water Agency	Annual PM10 Emissions (tons per year)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									0.34		0.34
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		0.11									0.11
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							0.09				0.09
Pleasant Grove-Verona Mutual Water Company							0.23		Electric		0.23
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		0.24	0.02				n/a				0.26
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				0.01							0.01
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							0.14				0.14
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.02				0.02
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**0.36**	**0.02**	**0.01**	**0.00**	**0.00**	**0.49**	**0.00**	**0.34**	**0.00**	**1.22**

Note:

Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Summary of Annual Groundwater Substitution Emissions by County (Mitigated)

Table F-63. Annual PM2.5 Emissions

Water Agency	Annual PM2.5 Emissions (tons per year)										
	Butte	Colusa	Glenn	Sacramento	Shasta	Solano	Sutter	Tehama	Yolo	Yuba	Total
Sacramento River of Analysis											
Anderson-Cottonwood Irrigation District					Electric			n/a			0.00
Conaway Preservation Group									0.34		0.34
Cordua Irrigation District										Electric	0.00
Cranmore Farms							Electric				0.00
Eastside Mutual Water Company		0.11									0.11
Glenn-Colusa Irrigation District		n/a	Electric								0.00
Natomas Central Mutual Water Company				Electric			Electric				0.00
Pelger Mutual Water Company							0.09				0.09
Pleasant Grove-Verona Mutual Water Company							0.23		Electric		0.23
Reclamation District 108		Electric							Electric		0.00
Reclamation District 1004		0.24	0.02				n/a				0.26
River Garden Farms									Electric		0.00
Sycamore Mutual Water Company		Electric									0.00
Te Velde Revocable Family Trust									Electric		0.00
American River Area of Analysis											
City of Sacramento				Electric							0.00
Sacramento County Water Agency				Electric							0.00
Sacramento Suburban Water District				0.01							0.01
Feather River Area of Analysis											
Butte Water District	n/a						Electric				0.00
Garden Highway Mutual Water Company							Electric				0.00
Gilsizer Slough Ranch							0.14				0.14
Goose Club Farms and Teichert Aggregates							Electric				0.00
Tule Basin Farms							0.02				0.02
Delta Region Area of Analysis											
Reclamation District 2068						Electric			n/a		0.00
Pope Ranch									Electric		0.00
Total	**0.00**	**0.35**	**0.02**	**0.01**	**0.00**	**0.00**	**0.48**	**0.00**	**0.34**	**0.00**	**1.21**

Note:

Counties designated as "n/a" (not applicable) if water agency is located in the county, but no engines would operate in the county.

Groundwater Substitution Air Quality Emissions (Mitigated)

Agency	Pleasant Grove-Verona Mutual Water Company		Federal Attainment Status				Peak Month	
Transfer Volume	18,000 acre feet/year			*Sutter*	*Yolo*		4,000	AF/month
Location	Sutter County		PM10	A	A	*Engines subject to ATCM.*	29,198	gallons/minute
	Yolo County		PM2.5	N	N		37%	peak pump rate
			O3	N	N			

Table F-64. Pleasant Grove-Verona Mutual Water Company Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)	Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr) VOC	NOx	CO	SOx	PM10	PM2.5	Daily Emissions (lbs/day) VOC	NOx	CO	SOx	PM10	PM2.5	Annual Emissions (tons per year) VOC	NOx	CO	SOx	PM10	PM2.5
PGVMWCWill-Lee 4A	Will-Lee 4A	Sutter	Diesel	2012	160	T4I	1,500	2%	77	345	4	1,248	11,206	0.14	0.3	3.7	0.93	0.01	0.01	0.20	0.42	5.26	1.31	0.02	0.02	0.03	0.07	0.82	0.20	0.00	0.00
PGVMWCRiver Ranch #19	River Ranch #19	Sutter	Diesel	2010	200	T3	2,500	3%	128	575	4	1,248	14,008	0.1	2.8	2.6	0.93	0.15	0.15	0.26	5.00	4.61	1.64	0.26	0.26	0.04	0.78	0.72	0.26	0.04	0.04
PGVMWCMLF #1	MLF #1	Sutter	Electric		30	n/a	2,000	3%	102	460	4	1,248	n/a																		
PGVMWCMLF #2	MLF #2	Sutter	Electric		250	n/a	5,000	6%	255	1,149	4	1,248	n/a																		
PGVMWCMLF Monster Well	MLF Monster Well	Sutter	Electric		60	n/a	3,100	4%	158	713	4	1,248	n/a																		
PGVMWCMLF #17/12	MLF #17/12	Sutter	Electric		50	n/a	1,500	2%	77	345	4	1,248	n/a																		
PGVMWCMLF #11	MLF #11	Sutter	Diesel	2011	250	T4I	4,200	5%	215	966	4	1,248	17,510	0.14	0.3	2.6	0.93	0.01	0.01	0.31	0.66	5.76	2.05	0.03	0.03	0.05	0.10	0.90	0.32	0.01	0.01
PGVMWCMLF #13/15	MLF #13/15	Sutter	Electric		240	n/a	4,800	6%	245	1,103	4	1,248	n/a																		
PGVMWCMLF #16	MLF #16	Sutter	Electric		240	n/a	1,700	2%	87	391	4	1,248	n/a																		
PGVMWCWilley #1	Willey #1	Sutter	Diesel	2012	168	T4I	3,000	4%	153	690	4	1,248	11,767	0.14	0.3	3.7	0.93	0.01	0.01	0.21	0.44	5.53	1.38	0.02	0.02	0.03	0.07	0.86	0.21	0.00	0.00
PGVMWCWilley #2	Willey #2	Sutter	Electric		250	n/a	3,000	4%	153	690	4	1,248	n/a																		
PGVMWCWilley #3	Willey #3	Sutter	Electric		250	n/a	2,000	3%	102	460	4	1,248	n/a																		
PGVMWCWilley #4	Willey #4	Sutter	Diesel	2010	150	T3	3,000	4%	153	690	4	1,248	10,506	0.1	2.8	3.7	0.93	0.22	0.22	0.20	3.75	4.94	1.23	0.30	0.30	0.03	0.59	0.77	0.19	0.05	0.05
PGVMWCScheidel&Osterli #18A	Scheidel&Osterli #18A	Sutter	Electric	TBD	250	n/a	2,500	3%	128	575	4	1,248	n/a																		
PGVMWCWill-Lee 30	Will-Lee 30	Sutter	Diesel	2012	100	T4I	1,500	2%	77	345	4	1,248	7,004	0.14	0.3	3.7	0.93	0.01	0.01	0.13	0.26	3.29	0.82	0.01	0.01	0.02	0.04	0.51	0.13	0.00	0.00
PGVMWCWill-Lee 31	Will-Lee 31	Sutter	Electric		250	n/a	2,500	3%	128	575	4	1,248	n/a																		
PGVMWCWill-Lee 32	Will-Lee 32	Sutter	Electric		250	n/a	2,500	3%	128	575	4	1,248	n/a																		
PGVMWCWill-Lee 33	Will-Lee 33	Sutter	Electric		250	n/a	2,500	3%	128	575	4	1,248	n/a																		
PGVMWCNicholas Sand Field Well	Nicholas Sand Field Well	Sutter	Diesel	2008	62.1	T4I	2,000	3%	102	460	4	1,248	4,350	0.2	3.3	3.7	0.93	0.22	0.22	0.10	1.82	2.04	0.51	0.12	0.12	0.01	0.28	0.32	0.08	0.02	0.02
PGVMWCNicholas Filipino Camp #2	Nicholas Filipino Camp #2	Sutter	Electric		40	n/a	2,000	3%	102	460	4	1,248	n/a																		
PGVMWCNicholas Filipino Camp South	Nicholas Filipino Camp South	Sutter	Diesel	2008	62.1	T4I	2,000	3%	102	460	4	1,248	4,350	0.2	3.3	3.7	0.93	0.22	0.22	0.10	1.82	2.04	0.51	0.12	0.12	0.01	0.28	0.32	0.08	0.02	0.02
PGVMWCNicholas Johnston Field Well #2	Nicholas Johnston Field Well #2	Sutter	Electric		250	n/a	2,000	3%	102	460	4	1,248	n/a																		
PGVMWCNicholas Johnston Well	Nicholas Johnston Well	Yolo	Electric		250	n/a	2,000	3%	102	460	4	1,248	n/a																		
PGVMWCNicholas 72-acre Field South	Nicholas 72-acre Field South	Sutter	Diesel	2008	62.1	T4I	2,000	3%	102	460	4	1,248	4,350	0.2	3.3	3.7	0.93	0.22	0.22	0.10	1.82	2.04	0.51	0.12	0.12	0.01	0.28	0.32	0.08	0.02	0.02
PGVMWCNicholas 72-Acre Field North	Nicholas 72-Acre Field North	Sutter	Electric		250	n/a	2,000	3%	102	460	4	1,248	n/a																		
PGVMWCNicholas BBC Well	Nicholas BBC Well	Sutter	Electric		250	n/a	2,000	3%	102	460	4	1,248	n/a																		
PGVMWCKelly 190 Field Well #2	Kelly 190 Field Well #2	Sutter	Electric		30	n/a	2,000	3%	102	460	4	1,248	n/a																		
PGVMWCKelly Windmill Field Well #2	Kelly Windmill Field Well #2	Sutter	Diesel	2008	62.1	T4I	2,000	3%	102	460	4	1,248	4,350	0.2	3.3	3.7	0.93	0.22	0.22	0.10	1.82	2.04	0.51	0.12	0.12	0.01	0.28	0.32	0.08	0.02	0.02
PGVMWCKelly Windmill North Field Well	Kelly Windmill North Field Well	Sutter	Diesel	2008	62.1	T4I	2,000	3%	102	460	4	1,248	4,350	0.2	3.3	3.7	0.93	0.22	0.22	0.10	1.82	2.04	0.51	0.12	0.12	0.01	0.28	0.32	0.08	0.02	0.02
PGVMWCKelly 306 Well	Kelly 306 Well	Sutter	Electric		250	n/a	2,600	3%	133	598	4	1,248	n/a																		
PGVMWCScheidel&Osterli #16	Scheidel&Osterli #16	Sutter	Diesel	2011	234	T4I	3,400	4%	174	782	4	1,248	16,389	0.14	0.3	2.6	0.93	0.01	0.01	0.29	0.62	5.39	1.92	0.03	0.03	0.05	0.10	0.84	0.30	0.00	0.00
PGVMWCScheidel&Osterli #17	Scheidel&Osterli #17	Sutter	Diesel	2010	101	T3	1,500	2%	77	345	4	1,248	7,074	0.1	2.8	3.7	0.93	0.22	0.22	0.13	2.53	3.32	0.83	0.20	0.20	0.02	0.39	0.52	0.13	0.03	0.03
						Total	**78,300**	**100%**	**4,000**	**18,000**	**128**	**39,951**	**117,213**							**2.21**	**22.80**	**48.31**	**13.72**	**1.49**	**1.47**	**0.35**	**3.56**	**7.54**	**2.14**	**0.23**	**0.23**
						Total (Sutter County)	**76,300**	**97%**	**3,898**	**17,540**	**124**	**38,703**	**117,213**							**2.21**	**22.80**	**48.31**	**13.72**	**1.49**	**1.47**	**0.35**	**3.56**	**7.54**	**2.14**	**0.23**	**0.23**
						Total (Yolo County)	**2,000**	**3%**	**102**	**460**	**4**	**1,248**	**0**							**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend

	Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type
	Emission factor based on NMHC+NOx emission standard
	Emissions of all pollutants consistent with the applicable tier necessary to control PM emissions under the ATCM for mitigation

Conversion Factors

1	lb =	453.6	g
1	ton =	2,000	lbs
1	month =	30.4	days
1	hour =	60	minutes
1	acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption

0.4	lb/hp-hr	*(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855	g/mL	*(Based on MSDS for Hess Diesel Fuel All Types)*
7.13	lb/gal	

Daily Hours of Operation	4

Groundwater Substitution Air Quality Emissions (Mitigated)

Agency	Sacramento Suburban Water District	Federal Attainment Status			Peak Month
Transfer Volume	30,000 acre feet/year	PM10	M	*Engines subject to ATCM.*	5,000 AF/month
Location	Sacramento County	PM2.5	N		36,498 gallons/minute
		O3	N		74% peak pump rate

Table F-65. Sacramento Suburban Water District Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)	Fuel Consumption (MMBtu/yr)	Emission Factors (lb/MMBtu) VOC	NOx	CO	SOx	PM10	PM2.5	Daily Emissions (lbs/day) VOC	NOx	CO	SOx	PM10	PM2.5	Annual Emissions (tons per year) VOC	NOx	CO	SOx	PM10	PM2.5
Sacramento Suburban WD5	5	Sacramento	Electric		110	n/a	330	1%	34	201	18	3,312	n/a																		
Sacramento Suburban WD7	7	Sacramento	Electric		110	n/a	180	0%	18	110	18	3,312	n/a																		
Sacramento Suburban WD9	9	Sacramento	Electric		110	n/a	625	1%	64	381	18	3,312	n/a																		
Sacramento Suburban WD12	12	Sacramento	Electric		110	n/a	540	1%	55	329	18	3,312	n/a																		
Sacramento Suburban WD13	13	Sacramento	Electric		110	n/a	820	2%	83	500	18	3,312	n/a																		
Sacramento Suburban WD14	14	Sacramento	Electric		110	n/a	570	1%	58	348	18	3,312	n/a																		
Sacramento Suburban WD18	18	Sacramento	Electric		110	n/a	840	2%	85	512	18	3,312	n/a																		
Sacramento Suburban WD19	19	Sacramento	Electric		110	n/a	950	2%	97	579	18	3,312	n/a																		
Sacramento Suburban WD22	22	Sacramento	Electric		110	n/a	650	1%	66	396	18	3,312	n/a																		
Sacramento Suburban WD23	23	Sacramento	Electric		110	n/a	550	1%	56	335	18	3,312	n/a																		
Sacramento Suburban WD24	24	Sacramento	Electric		110	n/a	590	1%	60	360	18	3,312	n/a																		
Sacramento Suburban WD25	25	Sacramento	Electric		110	n/a	750	2%	76	457	18	3,312	n/a																		
Sacramento Suburban WD26	26	Sacramento	Electric		110	n/a	650	1%	66	396	18	3,312	n/a																		
Sacramento Suburban WD28	28	Sacramento	Electric		110	n/a	585	1%	59	357	18	3,312	n/a																		
Sacramento Suburban WD30	30	Sacramento	Electric		110	n/a	650	1%	66	396	18	3,312	n/a																		
Sacramento Suburban WD35	35	Sacramento	Electric		110	n/a	1000	2%	102	610	18	3,312	n/a																		
Sacramento Suburban WD37	37	Sacramento	Natural Gas		190	n/a	700	1%	71	427	2.5	450	599	0.118	4.08	0.317	0.00059	0.00999	0.00999	0.39	13.57	1.05	0.00	0.03	0.03	0.04	1.22	0.09	0.00	0.00	0.00
Sacramento Suburban WD38	38	Sacramento	Natural Gas		190	n/a	500	1%	51	305	2.5	450	599	0.118	4.08	0.317	0.00059	0.00999	0.00999	0.39	13.57	1.05	0.00	0.03	0.03	0.04	1.22	0.09	0.00	0.00	0.00
Sacramento Suburban WD40	40	Sacramento	Natural Gas		190	n/a	675	1%	69	412	2.5	450	599	0.118	4.08	0.317	0.00059	0.00999	0.00999	0.39	13.57	1.05	0.00	0.03	0.03	0.04	1.22	0.09	0.00	0.00	0.00
Sacramento Suburban WD41	41	Sacramento	Electric		110	n/a	600	1%	61	366	18	3,312	n/a																		
Sacramento Suburban WD43	43	Sacramento	Electric		110	n/a	850	2%	86	518	18	3,312	n/a																		
Sacramento Suburban WD45	45	Sacramento	Natural Gas		190	n/a	750	2%	76	457	2.5	450	599	0.118	4.08	0.317	0.00059	0.00999	0.00999	0.39	13.57	1.05	0.00	0.03	0.03	0.04	1.22	0.09	0.00	0.00	0.00
Sacramento Suburban WD47	47	Sacramento	Electric		110	n/a	885	2%	90	540	18	3,312	n/a																		
Sacramento Suburban WD50	50	Sacramento	Electric		110	n/a	500	1%	51	305	18	3,312	n/a																		
Sacramento Suburban WD51	51	Sacramento	Electric		110	n/a	285	1%	29	174	18	3,312	n/a																		
Sacramento Suburban WD60	60	Sacramento	Electric		110	n/a	600	1%	61	366	18	3,312	n/a																		
Sacramento Suburban WD65	65	Sacramento	Electric		110	n/a	1250	3%	127	762	18	3,312	n/a																		
Sacramento Suburban WD66	66	Sacramento	Electric		110	n/a	1350	3%	137	823	18	3,312	n/a																		
Sacramento Suburban WD69	69	Sacramento	Electric		110	n/a	450	1%	46	274	18	3,312	n/a																		
Sacramento Suburban WD70	70	Sacramento	Electric		110	n/a	350	1%	36	213	18	3,312	n/a																		
Sacramento Suburban WD71	71	Sacramento	Electric		110	n/a	2675	5%	272	1,631	18	3,312	n/a																		
Sacramento Suburban WD72	72	Sacramento	Electric		110	n/a	1850	4%	188	1,128	18	3,312	n/a																		
Sacramento Suburban WD73	73	Sacramento	Electric		110	n/a	3500	7%	356	2,134	18	3,312	n/a																		
Sacramento Suburban WD74	74	Sacramento	Electric		110	n/a	2700	5%	274	1,647	18	3,312	n/a																		
Sacramento Suburban WD75	75	Sacramento	Electric		110	n/a	1150	2%	117	701	18	3,312	n/a																		
Sacramento Suburban WD76	76	Sacramento	Electric		110	n/a	250	1%	25	152	18	3,312	n/a																		
Sacramento Suburban WD77	77	Sacramento	Electric		110	n/a	400	1%	41	244	18	3,312	n/a																		
Sacramento Suburban WD20A	20A	Sacramento	Electric		110	n/a	1100	2%	112	671	18	3,312	n/a																		
Sacramento Suburban WD2A	2A	Sacramento	Electric		110	n/a	995	2%	101	607	18	3,312	n/a																		
Sacramento Suburban WD32A	32A	Sacramento	Electric		110	n/a	1905	4%	194	1,162	18	3,312	n/a																		
Sacramento Suburban WD33A	33A	Sacramento	Electric		110	n/a	2675	5%	272	1,631	18	3,312	n/a																		
Sacramento Suburban WD3A	3A	Sacramento	Electric		110	n/a	370	1%	38	226	18	3,312	n/a																		
Sacramento Suburban WD40A	40A	Sacramento	Electric		110	n/a	2525	5%	257	1,540	18	3,312	n/a																		
Sacramento Suburban WD46R	46R	Sacramento	Electric		110	n/a	800	2%	81	488	18	3,312	n/a																		
Sacramento Suburban WD4B	4B	Sacramento	Electric		110	n/a	2675	5%	272	1,631	18	3,312	n/a																		
Sacramento Suburban WD55A	55A	Sacramento	Electric		110	n/a	2000	4%	203	1,220	18	3,312	n/a																		
Sacramento Suburban WD68R	68R	Sacramento	Electric		110	n/a	1600	3%	163	976	18	3,312	n/a																		
						Total	**49,195**	**100%**	**5,000**	**30,000**	**790**	**144,209**	**2,394**							**1.57**	**54.26**	**4.22**	**0.01**	**0.13**	**0.13**	**0.14**	**4.88**	**0.38**	**0.00**	**0.01**	**0.01**

Legend

	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type
	Dual-fuel engine (electric and natural gas) required to operate in electric mode to mitigate emissions
	Operation of natural gas fired engines will be controlled to reduce emissions less than significance thresholds as mitigation

Conversion Factors

1 MMBtu =	1,000,000	Btu
1 lb =	453.6	g
1 ton =	2,000	lbs
1 month =	30.4	days
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Natural Gas Engine Fuel Consumption

Estimated BSFC =	7,000	Btu/bhp-hr	(Estimated from Waukesha engine specifications)
Higher Heating Value	1,020	Btu/scf	(AP-42, Chapter 3.2: Natural Gas-fired Reciprocating Engines)

Groundwater Substitution Air Quality Emissions (Mitigated)

Agency Gilsizer Slough Ranch
Transfer Volume 3,900 acre feet/year
Location Sutter County

Federal Attainment Status
PM10 A *Engines subject to ATCM.*
PM2.5 N
O3 N

Peak Month
800 AF/month
5,840 gallons/minute
97% peak pump rate

Table F-66. Gilsizer Slough Ranch Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)	Fuel Consumption (gal/yr)	Emission Factors (g/bhp-hr) VOC	NOx	CO	SOx	PM10	PM2.5	Daily Emissions (lbs/day) VOC	NOx	CO	SOx	PM10	PM2.5	Annual Emissions (tons per year) VOC	NOx	CO	SOx	PM10	PM2.5
Gilsizer #1	Gilsizer #1	Sutter	Diesel	2011	162	T3	2,016	33%	267	1,300	24	3,502	31,828	0.1	2.8	3.7	0.93	0.22	0.22	1.26	23.92	31.47	7.84	1.89	1.89	0.09	1.77	2.33	0.58	0.14	0.14
Gilsizer #2	Gilsizer #2	Sutter	Electric	TBD	110	n/a	2,016	33%	267	1,300	24	3,502	n/a																		
Gilsizer #3	Gilsizer #3	Sutter	Electric	TBD	110	n/a	2,016	33%	267	1,300	24	3,502	n/a																		
						Total	**6,048**	**100%**	**800**	**3,900**	**71**	**10,506**	**31,828**							**1.26**	**23.92**	**31.47**	**7.84**	**1.89**	**1.89**	**0.09**	**1.77**	**2.33**	**0.58**	**0.14**	**0.14**

Notes:
If a specific HP and emission tier combination has an emission standard of NMHC+NOx, then 95% of emissions assumed to be NOx and 5% of emissions assumed to be VOC (see CARB Carl Moyer Program Guidelines).
AP-42 emission factors used for SOx in all cases.
If an emission standard is not available for a given pollutant, then AP-42 emission factors used.
PM2.5 assumed to be 98% of PM10 emissions based on size fractions for stationary internal combustion diesel engines.

Legend
Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type
Based on NMHC+NOx standard

Conversion Factors
1 lb = 453.6 g
1 ton = 2,000 lbs
1 month = 30.4 days
1 hour = 60 minutes
1 acre-foot = 325,851 gallons
http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Diesel Engine Fuel Consumption
0.4 lb/hp-hr *(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)*
0.855 g/mL *(Based on MSDS for Hess Diesel Fuel All Types)*
7.13 lb/gal

Groundwater Substitution Air Quality Emissions (Mitigated)

Agency	Tule Basin Farms	Federal Attainment Status			Peak Month
Transfer Volume	7,320 acre feet/year	PM10	A	*Engines subject to ATCM.*	1,520 AF/month
Location	Sutter County	PM2.5	N		11,095 gallons/minute
		O3	N		96% peak pump rate

Table F-67. Tule Basin Farms Criteria Pollutant Emissions

Description	Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Emission Tier	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/month)	Transfer Volume (AF/year)	Operation (hours/day)	Operation (hours/year)	Fuel Consumption (MMBtu/yr)	Emission Factors (lb/MMBtu) VOC	NOx	CO	SOx	PM10	PM2.5	Daily Emissions (lbs/day) VOC	NOx	CO	SOx	PM10	PM2.5	Annual Emissions (tons per year) VOC	NOx	CO	SOx	PM10	PM2.5
Tule Basin1	1	Sutter	Electric		125	n/a	3,050	27%	403	1,941	24	3,457	n/a																		
Tule Basin2	2	Sutter	Natural Gas	1985	190	n/a	3,600	31%	476	2,291	24	3,457	4,598	0.118	0.61	0.317	0.00059	0.00999	0.00999	3.70	19.21	9.95	0.02	0.31	0.31	0.27	1.41	0.73	0.00	0.02	0.02
Tule Basin3	3	Sutter	Electric		125	n/a	4,850	42%	641	3,087	24	3,457	n/a																		
						Total	**11,500**	**100%**	**1,520**	**7,320**	**71**	**10,371**	**4,598**							**3.70**	**19.21**	**9.95**	**0.02**	**0.31**	**0.31**	**0.27**	**1.41**	**0.73**	**0.00**	**0.02**	**0.02**

Conversion Factors

1 MMBtu =	1,000,000	Btu
1 ton =	2,000	lbs
1 month =	30.4	days
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Natural Gas Engine Fuel Consumption

Estimated BSFC =	7,000	Btu/bhp-hr	(Estimated from Waukesha engine specifications)
Higher Heating Value	1,020	Btu/scf	(AP-42, Chapter 3.2: Natural Gas-fired Reciprocating Engines)

SCR control efficiency	85%

Table F-68. Summary of Cropland Idling Emissions by Water Agency

	Daily Emissions (lbs per day)						Annual Emissions (tons per year)					
Water Agency	**VOC**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**	**VOC**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
Butte Water District												
Exhaust Emissions	(1)	(13)	(17)	(4)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(142)	(21)	--	--	--	--	(13)	(2)
Harvesting	--	--	--	--	(17)	(2)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	6	1	--	--	--	--	1	0
Butte Water District Subtotal	(1)	(13)	(17)	(4)	(153)	(23)	(0)	(1)	(1)	(0)	(14)	(2)
Conaway Preservation Group												
Exhaust Emissions	(1)	(23)	(31)	(8)	(2)	(2)	(0)	(2)	(2)	(1)	(0)	(0)
Land Preparation	--	--	--	--	(205)	(31)	--	--	--	--	(18)	(3)
Harvesting	--	--	--	--	(40)	(6)	--	--	--	--	(4)	(1)
Wind Erosion	--	--	--	--	18	4	--	--	--	--	2	0
Conaway Preservation Group Subtotal	(1)	(23)	(31)	(8)	(228)	(35)	(0)	(2)	(2)	(1)	(21)	(3)
Cranmore Farms												
Exhaust Emissions	(0)	(3)	(4)	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(61)	(9)	--	--	--	--	(6)	(1)
Harvesting	--	--	--	--	(4)	(1)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	1	0	--	--	--	--	0	0
Cranmore Farms Subtotal	(0)	(3)	(4)	(1)	(64)	(10)	(0)	(0)	(0)	(0)	(6)	(1)
Glenn-Colusa Irrigation District												
Exhaust Emissions	(4)	(72)	(95)	(24)	(6)	(6)	(0)	(5)	(6)	(2)	(0)	(0)
Land Preparation	--	--	--	--	(1,550)	(232)	--	--	--	--	(140)	(21)
Harvesting	--	--	--	--	(96)	(14)	--	--	--	--	(9)	(1)
Wind Erosion	--	--	--	--	416	83	--	--	--	--	37	7
Glenn-Colusa Irrigation District Subtotal	(4)	(72)	(95)	(24)	(1,236)	(169)	(0)	(5)	(6)	(2)	(111)	(15)
Goose Club Farms and Teichert Aggregates												
Exhaust Emissions	(1)	(11)	(14)	(4)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(245)	(37)	--	--	--	--	(22)	(3)
Harvesting	--	--	--	--	(15)	(2)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	6	1	--	--	--	--	1	0
Goose Club Farms and Teichert Aggregates Subtotal	(1)	(11)	(14)	(4)	(255)	(39)	(0)	(1)	(1)	(0)	(23)	(3)
Pelger Mutual Water Company												
Exhaust Emissions	(0)	(3)	(4)	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(62)	(9)	--	--	--	--	(6)	(1)
Harvesting	--	--	--	--	(4)	(1)	--	--	--	--	(0)	(0)
Wind Erosion	--	--	--	--	1	0	--	--	--	--	0	0
Pelger Mutual Water Company Subtotal	(0)	(3)	(4)	(1)	(65)	(10)	(0)	(0)	(0)	(0)	(6)	(1)

Table F-68. Summary of Cropland Idling Emissions by Water Agency

Water Agency	Daily Emissions (lbs per day)						Annual Emissions (tons per year)					
	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Pleasant Grove-Verona Mutual Water Company												
Exhaust Emissions	(1)	(10)	(13)	(3)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(221)	(33)	--	--	--	--	(20)	(3)
Harvesting	--	--	--	--	(13)	(2)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	5	1	--	--	--	--	0	0
Pleasant Grove-Verona Mutual Water Company Subtotal	(1)	(10)	(13)	(3)	(230)	(35)	(0)	(1)	(1)	(0)	(21)	(3)
Reclamation District 108												
Exhaust Emissions	(1)	(22)	(29)	(7)	(2)	(2)	(0)	(1)	(2)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(338)	(51)	--	--	--	--	(30)	(5)
Harvesting	--	--	--	--	(33)	(5)	--	--	--	--	(3)	(0)
Wind Erosion	--	--	--	--	75	15	--	--	--	--	7	1
Reclamation District 108 Subtotal	(1)	(22)	(29)	(7)	(298)	(42)	(0)	(1)	(2)	(0)	(27)	(4)
Reclamation District 1004												
Exhaust Emissions	(1)	(11)	(14)	(4)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(238)	(36)	--	--	--	--	(21)	(3)
Harvesting	--	--	--	--	(15)	(2)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	44	9	--	--	--	--	4	1
Reclamation District 1004 Subtotal	(1)	(11)	(14)	(4)	(210)	(30)	(0)	(1)	(1)	(0)	(19)	(3)
Reclamation District 2068												
Exhaust Emissions	(0)	(8)	(11)	(3)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(39)	(6)	--	--	--	--	(4)	(1)
Harvesting	--	--	--	--	(7)	(1)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	5	1	--	--	--	--	0	0
Reclamation District 2068 Subtotal	(0)	(8)	(11)	(3)	(41)	(6)	(0)	(1)	(1)	(0)	(4)	(1)
Sycamore Mutual Water Company												
Exhaust Emissions	(1)	(11)	(14)	(4)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(242)	(36)	--	--	--	--	(22)	(3)
Harvesting	--	--	--	--	(15)	(2)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	66	13	--	--	--	--	6	1
Sycamore Mutual Water Company Subtotal	(1)	(11)	(14)	(4)	(191)	(26)	(0)	(1)	(1)	(0)	(17)	(2)

Table F-68. Summary of Cropland Idling Emissions by Water Agency

	Daily Emissions (lbs per day)						Annual Emissions (tons per year)					
Water Agency	**VOC**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**	**VOC**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
Te Velde Revocable Family Trust												
Exhaust Emissions	(0)	(8)	(10)	(3)	(1)	(1)	(0)	(1)	(1)	(0)	(0)	(0)
Land Preparation	--	--	--	--	(67)	(10)	--	--	--	--	(6)	(1)
Harvesting	--	--	--	--	(13)	(2)	--	--	--	--	(1)	(0)
Wind Erosion	--	--	--	--	6	1	--	--	--	--	1	0
Te Velde Revocable Family Trust Subtotal	(0)	(8)	(10)	(3)	(75)	(11)	(0)	(1)	(1)	(0)	(7)	(1)
Exhaust Emissions Total	(10)	(195)	(256)	(64)	(15)	(15)	(1)	(13)	(17)	(4)	(1)	(1)
Land Preparation Total	0	0	0	0	(3,409)	(511)	0	0	0	0	(307)	(46)
Harvesting Total	0	0	0	0	(271)	(41)	0	0	0	0	(24)	(4)
Wind Erosion Total	0	0	0	0	651	130	0	0	0	0	59	12
GRAND TOTAL	**(10)**	**(195)**	**(256)**	**(64)**	**(3,045)**	**(437)**	**(1)**	**(13)**	**(17)**	**(4)**	**(274)**	**(39)**

Size Fractions

Description	PM10	PM2.5	Ratio
PM Profile ID No. 411, Windblown Dust - Agricultural	0.5	0.1	0.2
PM Profile ID No. 417, Agricultural Tilling Dust	0.4543	0.0681	0.1499

Table F-69. Reduced Exhaust Emissions from Cropland Idling

Water Agency	Groundwater Substitution	Cropland Idling/ Crop Shifting	GW Pumping Equivalent	Reduced Daily Emissions (lbs/day)						Reduced Annual Emissions (tons/year)					
	(acre-feet/year)	(acre-feet/year)	(acre-feet/year)	VOC	NOx	CO	SOx	PM10	PM2.5	VOC	NOx	CO	SOx	PM10	PM2.5
Butte Water District	5,500	11,500	2,706	1	13	17	4	1	1	0.0	0.8	1.1	0.3	0.1	0.1
Conaway Preservation Group	35,000	21,349	5,023	1	23	31	8	2	2	0.1	1.6	2.0	0.5	0.1	0.1
Cranmore Farms	8,000	2,500	588	0	3	4	1	0	0	0.0	0.2	0.2	0.1	0.0	0.0
Glenn-Colusa Irrigation District	25,000	66,000	15,529	4	72	95	24	6	6	0.3	4.8	6.3	1.6	0.4	0.4
Goose Club Farms and Teichert Aggregates	10,000	10,000	2,353	1	11	14	4	1	1	0.0	0.7	1.0	0.2	0.1	0.1
Pelger Mutual Water Company	3,750	2,538	597	0	3	4	1	0	0	0.0	0.2	0.2	0.1	0.0	0.0
Pleasant Grove-Verona Mutual Water Company	18,000	9,000	2,118	1	10	13	3	1	1	0.0	0.7	0.9	0.2	0.1	0.1
Reclamation District 108	15,000	20,000	4,706	1	22	29	7	2	2	0.1	1.5	1.9	0.5	0.1	0.1
Reclamation District 1004	7,175	10,000	2,353	1	11	14	4	1	1	0.0	0.7	1.0	0.2	0.1	0.1
Reclamation District 2068	4,500	7,500	1,765	0	8	11	3	1	1	0.0	0.5	0.7	0.2	0.0	0.0
Sycamore Mutual Water Company	15,000	10,000	2,353	1	11	14	4	1	1	0.0	0.7	1.0	0.2	0.1	0.1
Te Velde Revocable Family Trust	7,094	6,975	1,641	0	8	10	3	1	1	0.0	0.5	0.7	0.2	0.0	0.0
Total	**154,019**	**177,362**	**41,732**	**10**	**195**	**256**	**64**	**15**	**15**	**0.7**	**12.9**	**17.0**	**4.2**	**1.0**	**1.0**

Notes:

Pelger Mutual Water Company used to estimate emissions for other water agencies.

Engine power rating equal to 250 hp for Pelger Mutual Water Company engines.

The Byron Buck memo is based on diesel-fueled engines with sizes ranging from 121 to 225 hp; all engines are noncertified (Tier 0).

Pelger Mutual Water Company engines are therefore determined to be a sufficient proxy to estimate the difference in emissions between groundwater substitution and cropland idling.

1 acre-foot of groundwater pumped = 4.25 acre-feet produced by fallowing

Source: Byron Buck & Associates. 2009. "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping."

Fugitive Dust Emissions from Cropland Idling

Table F-70. Land Preparation (Reduced Emissions)

District	County	Acres	Daily PM10 Emissions (lbs/day)	Annual PM10 Emissions (tons per year)
		Rice	Rice	Rice
Sacramento River Area of Analysis				
Anderson-Cottonwood Irrigation District	Shasta/Tehama	0	0	0
Conaway Preservation Group	Yolo	6,469	205	18
Cordua Irrigation District	Yuba	0	0	0
Cranmore Farms	Sutter	758	61	6
Eastside Mutual Water Company	Colusa	0	0	0
Glenn-Colusa Irrigation District	Glenn/Colusa	20,000	1,550	140
Natomas Central Mutual Water Company	Sacramento/Sutter	0	0	0
Pelger Mutual Water Company	Sutter	769	62	6
Pleasant Grove-Verona Mutual Water Company	Sutter	2,727	221	20
Reclamation District 108	Colusa/Yolo	6,061	338	30
Reclamation District 1004	Colusa/Glenn/Sutter	3,030	238	21
River Garden Farms	Yolo	0	0	0
Sycamore Mutual Water Company	Colusa	3,030	242	22
Te Velde Revocable Family Trust	Yolo	2,114	67	6
American River Area of Analysis				
City of Sacramento	Sacramento	0	0	0
Placer County Water Agency	Placer	0	0	0
Sacramento County Water Agency	Sacramento	0	0	0
Sacramento Suburban Water District	Sacramento	0	0	0
Yuba River Area of Analysis				
Browns Valley Irrigation District	Yuba	0	0	0
Feather River Area of Analysis				
Butte Water District	Butte/Sutter	3,485	142	13
Garden Highway Mutual Water Company	Sutter	0	0	0
Gilsizer Slough Ranch	Sutter	0	0	0
Goose Club Farms and Teichert Aggregates	Sutter	3,030	245	22
South Sutter Water District	Sutter/Placer	0	0	0
Tule Basin Farms	Sutter	0	0	0
Merced River Area of Analysis				
Merced Irrigation District	Merced	0	0	0
Delta Region Area of Analysis				
Reclamation District 2068	Solano/Yolo	2,273	39	4
Pope Ranch	Yolo	0	0	0
Total		**53,746**	**3,409**	**307**

Table F-71. Harvesting (Reduced Emissions)

District	County	Acres	Daily PM10 Emissions (lbs/day)	Annual PM10 Emissions (tons per year)
		Rice	Rice	Rice
Sacramento River Area of Analysis				
Anderson-Cottonwood Irrigation District	Shasta/Tehama	0	0	0
Conaway Preservation Group	Yolo	6,469	40	4
Cordua Irrigation District	Yuba	0	0	0
Cranmore Farms	Sutter	758	4	0
Eastside Mutual Water Company	Colusa	0	0	0
Glenn-Colusa Irrigation District	Glenn/Colusa	20,000	96	9
Natomas Central Mutual Water Company	Sacramento/Sutter	0	0	0
Pelger Mutual Water Company	Sutter	769	4	0
Pleasant Grove-Verona Mutual Water Company	Sutter	2,727	13	1
Reclamation District 108	Colusa/Yolo	6,061	33	3
Reclamation District 1004	Colusa/Glenn/Sutter	3,030	15	1
River Garden Farms	Yolo	0	0	0
Sycamore Mutual Water Company	Colusa	3,030	15	1
Te Velde Revocable Family Trust	Yolo	2,114	13	1
American River Area of Analysis				
City of Sacramento	Sacramento	0	0	0
Placer County Water Agency	Placer	0	0	0
Sacramento County Water Agency	Sacramento	0	0	0
Sacramento Suburban Water District	Sacramento	0	0	0
Yuba River Area of Analysis				
Browns Valley Irrigation District	Yuba	0	0	0
Feather River Area of Analysis				
Butte Water District	Butte/Sutter	3,485	17	1
Garden Highway Mutual Water Company	Sutter	0	0	0
Gilsizer Slough Ranch	Sutter	0	0	0
Goose Club Farms and Teichert Aggregates	Sutter	3,030	15	1
South Sutter Water District	Sutter/Placer	0	0	0
Tule Basin Farms	Sutter	0	0	0
Merced River Area of Analysis				
Merced Irrigation District	Merced	0	0	0
Delta Region Area of Analysis				
Reclamation District 2068	Solano/Yolo	2,273	7	1
Pope Ranch	Yolo	0	0	0
Total		**53,746**	**271**	**24**

Table F-72. Windblown Dust (Increased Emissions)

District	County	Acres Rice	Daily PM10 Emissions (lbs/day) Rice	Annual PM10 Emissions (tons per year) Rice
Sacramento River Area of Analysis				
Anderson-Cottonwood Irrigation District	Shasta/Tehama	0	--	--
Conaway Preservation Group	Yolo	6,469	18	2
Cordua Irrigation District	Yuba	0	--	--
Cranmore Farms	Sutter	758	1	0
Eastside Mutual Water Company	Colusa	0	--	--
Glenn-Colusa Irrigation District	Glenn/Colusa	20,000	416	37
Natomas Central Mutual Water Company	Sacramento/Sutter	0	--	--
Pelger Mutual Water Company	Sutter	769	1	0
Pleasant Grove-Verona Mutual Water Company	Sutter	2,727	5	0
Reclamation District 108	Colusa/Yolo	6,061	75	7
Reclamation District 1004	Colusa/Glenn/Sutter	3,030	44	4
River Garden Farms	Yolo	0	--	--
Sycamore Mutual Water Company	Colusa	3,030	66	6
Te Velde Revocable Family Trust	Yolo	2,114	6	1
American River Area of Analysis				
City of Sacramento	Sacramento	0	--	--
Placer County Water Agency	Placer	0	--	--
Sacramento County Water Agency	Sacramento	0	--	--
Sacramento Suburban Water District	Sacramento	0	--	--
Yuba River Area of Analysis				
Browns Valley Irrigation District	Yuba	0	--	--
Feather River Area of Analysis				
Butte Water District	Butte/Sutter	3,485	6	1
Garden Highway Mutual Water Company	Sutter	0	--	--
Gilsizer Slough Ranch	Sutter	0	--	--
Goose Club Farms and Teichert Aggregates	Sutter	3,030	6	1
South Sutter Water District	Sutter/Placer	0	--	--
Tule Basin Farms	Sutter	0	--	--
Merced River Area of Analysis				
Merced Irrigation District	Merced	0	--	--
Delta Region Area of Analysis				
Reclamation District 2068	Solano/Yolo	2,273	5	0
Pope Ranch	Yolo	0	--	--
Total		**53,746**	**651**	**59**

Note:
Fraction of PM10 (FRPM10) from wind erosion: 0.50
(PM10 Emissions = PM x FRPM10)

Conversions

1 ton =	2,000	pounds	
Project duration =	180	days	(assumes 6-month crop idling season)

Legend

	Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available.
	Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available (for Yolo County only).
	Windblown dust emission factor for pasture land used because emission factor for agricultural lands not available (for Sutter County only).

Agricultural Land Preparation

Table F-73. Summary of Crop Profile, Acre-Pass, and Emission Factor

Crop profile	Land Preparation Operations	Category	Acre-Pass	Emission Factor	
				Operation (lbs PM10/Acre-pass)	Crop (lbs PM10/Acre/year)
Alfalfa	Unspecified	Discing	1.25	1.2	4
	Land Maintenance	Land Planing	0.2	12.5	
Almonds	Float	Land Planing	0.25	12.5	3.13
Citrus	Unspecified	Discing	0.06	1.2	0.07
Corn	List & Fertilize	Weeding	1	0.8	6.9
	Mulch Beds	Discing	1	1.2	
	Finish Disc	Discing	1	1.2	
	Land Maintenance	Land Planing	0.2	12.5	
	Stubble Disc	Discing	1	1.2	
Cotton	Land Preparation	Discing	4	1.2	8.9
	Land Maintenance	Land Planing	0.2	12.5	
	Seed Bed Preparation	Weeding	2	0.8	
DryBeans	Land Maintenance	Land Planing	0.2	12.5	7.7
	Chisel	Discing	1	1.2	
	Shaping	Weeding	1	0.8	
	Disc	Discing	2	1.2	
	Listing	Weeding	1	0.8	
Garbanzo	Chisel	Discing	1	1.2	7.7
	Listing	Weeding	1	0.8	
	Shaping	Weeding	1	0.8	
	Disc	Discing	2	1.2	
	Land Maintenance	Land Planing	0.2	12.5	
Garlic	Land Maintenance	Land Planing	0.2	12.5	6.5
	Disc & Roll	Discing	1	1.2	
	Chisel	Discing	1	1.2	
	List	Weeding	1	0.8	
	Shape Beds	Weeding	1	0.8	
Grapes-Raisin	Terrace	Weeding	1	0.8	2.6
	Spring Tooth	Weeding	0.2	0.8	
	Subsoil	Ripping	0.05	4.6	
	Disc & Furrow-out	Discing	1	1.2	
	Level (new vineyard)	Land Planing	0.02	12.5	
Grapes-Table	Subsoil	Ripping	0.05	4.6	0.83
	Disc & Furrow-out	Discing	0.5	1.2	
Grapes-Wine	Level (new vineyard)	Land Planing	0.02	12.5	1.5
	Spring Tooth	Weeding	0.2	0.8	
	Subsoil	Ripping	0.05	4.6	
	Disc & Furrow-out	Discing	0.75	1.2	
Lettuce*	Land Maintenance	Land Planing	0.2	12.5	12.75
	Disc & Roll	Discing	2/2	1.2	
	Chisel	Discing	2/2	1.2	
	List	Weeding	2/2	0.8	
	Plane	Land Planing	½	12.5	
	Shape Beds & Roll	Weeding	2/2	0.8	
Melon	Plow	Discing	1	1.2	5.7
	Shape Beds	Weeding	1	0.8	
	Land Maintenance	Land Planing	0.2	12.5	
	Disc	Discing	1	1.2	
No Land Prep.	Unspecified	Discing	0	1.2	0
Onions	List	Weeding	1	0.8	6.5
	Shape Beds	Weeding	1	0.8	
	Land Maintenance	Land Planing	0.2	12.5	
	Chisel	Discing	1	1.2	
	Disc & Roll	Discing	1	1.2	

Agricultural Land Preparation

Table F-73. Summary of Crop Profile, Acre-Pass, and Emission Factor

Crop profile	Land Preparation Operations	Category	Acre-Pass	Emission Factor	
				Operation (lbs PM10/Acre-pass)	Crop (lbs PM10/Acre/year)
Rice	Chisel	Discing	1	1.2	20
	Land Maintenance	Land Planing	0.2	12.5	
	Post Burn/Harvest Disc	Discing	0.5	1.2	
	Roll	Weeding	1	0.8	
	3 Wheel Plane	Land Planing	1	12.5	
	Harrow Disc	Discing	1	1.2	
	Stubble Disc	Discing	1	1.2	
Safflower	List	Weeding	1	0.8	4.5
	Land Maintenance	Land Planing	0.2	12.5	
	Stubble Disc	Discing	1	1.2	
Sugar Beets	Disc	Discing	1	1.2	22.8
	Land Plane	Land Planing	1	12.5	
	Subsoil-deep chisel	Ripping	1	4.6	
	Stubble Disc	Discing	1	1.2	
	List	Weeding	1	0.8	
	Land Maintenance	Land Planing	0.2	12.5	
Tomatoes	Bed Preparation	Weeding	2	0.8	10.1
	Land Preparation	Discing	5	1.2	
	Land Maintenance	Land Planing	0.2	12.5	
Vegetables	Land Maintenance	Land Planing	0.2	12.5	8.5
	Unspecified	Discing	5	1.2	
Wheat	Stubble Disc	Discing	1	1.2	3.7
	Land Maintenance	Land Planing	0.2	12.5	

Source:
CARB. 2003. Emission Inventory Documentation, Section 7.4: Agricultural Land Preparation. January.
Accessed on: May 5, 2012. Available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocresfarmop.htm

Agricultural Harvest Operations

Table F-74. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
101999	WHEAT ALL	Wheat	Wheat/1	5.8
104999	RYE FOR GRAIN	Wheat	Wheat/1	5.8
106199	RICE, FOR MILLING	Rice	Cotton/2	1.68
106269	FIELD CROP BY PRODUCTS	Cotton	Cotton/20	0.17
108999	FOOD GRAINS, MISC	Corn	Cotton/2	1.68
111559	CORN, WHITE	Corn	Cotton/40	0.08
111991	CORN FOR GRAIN	Corn	Cotton/2	1.68
111992	CORN FOR SILAGE	Corn	Cotton/20	0.17
112999	OATS FOR GRAIN	Wheat	Wheat/1	5.8
113994	BARLEY, MALTING	Wheat	Wheat/1	5.8
113995	BARLEY, FEED	Wheat	Wheat/1	5.8
113999	BARLEY, UNSPECIFIED	Wheat	Wheat/1	5.8
114991	SORGHUM, GRAIN	Wheat	Wheat/1	5.8
121219	COTTON LINT, UPLAND	Cotton	Cotton/1	3.37
121229	COTTON LINT, PIMA	Cotton	Cotton/1	3.37
121299	COTTON LINT, UNSPEC	Cotton	Cotton/1	3.37
132999	SUGAR BEETS	Sugar Beets	Cotton/2	1.68
151999	COTTONSEED	Cotton	Cotton/1	3.37
153999	PEANUTS, ALL	Safflower	Cotton/2	1.68
158269	SAFFLOWER	Safflower	Wheat/1	5.8
158316	SUNFLOWER SEED, PLANTING	Corn	Wheat/1	5.8
158319	SUNFLOWER SEED	Corn	Wheat/1	5.8
158499	JOJOBA	Melon	Cotton/40	0.08
161131	BEANS, LIMAS, LG. DRY	DryBeans	Cotton/2	1.68
161132	BEANS, LIMAS, BABY DRY	DryBeans	Cotton/2	1.68
161199	LIMA BEANS, UNSPECIFIED	DryBeans	Cotton/2	1.68
161717	BEANS, RED KIDNEY	DryBeans	Cotton/2	1.68
161721	BEANS, PINK	DryBeans	Cotton/2	1.68
161741	BEANS, BLACKEYE (PEAS)	DryBeans	Cotton/2	1.68
161742	BEANS, GARBANZO	Garbanzo	Cotton/2	1.68
162399	BEANS, FAVA	DryBeans	Cotton/2	1.68
163999	PEAS, DRY EDIBLE	DryBeans	Cotton/20	0.17
169999	BEANS,UNSPEC. DRY EDIBLE	DryBeans	Cotton/2	1.68
171019	SEED WHEAT	Wheat	Wheat/1	5.8
171049	SEED RYE	Wheat	Wheat/1	5.8
171069	SEED RICE	Rice	Cotton/2	1.68
171129	SEED OATS	Wheat	Wheat/1	5.8
171139	SEED BARLEY	Wheat	Wheat/1	5.8
171519	SEED, COTTON FOR PLANTING	Cotton	Cotton/1	3.37
171582	SEED, SAFFLOWER, PLANTING	Safflower	Wheat/1	5.8
171619	SEED BEANS	DryBeans	Cotton/2	1.68
171639	SEED PEAS	DryBeans	Cotton/20	0.17
171949	SEED, MISC FIELD CROP	Corn	Cotton/20	0.17
171959	SEED, VEG & VINECROP	Vegetables	Cotton/20	0.17
172119	SEED, ALFALFA	Alfalfa	Zero/1	0
172289	CLOVER, UNSPECIFIED SEED	Alfalfa	Zero/1	0
173079	SEED, BERMUDA GRASS	Alfalfa	Zero/1	0
173669	SEED, SUDAN GRASS	Alfalfa	Zero/1	0
173999	SEED, GRASS, UNSPECIFIED	Alfalfa	Zero/1	0
178999	SEED, OTHER (NO FLOWERS)	Alfalfa	Cotton/20	0.17
181999	HAY, ALFALFA	Alfalfa	Zero/1	0
188499	HAY, GRAIN	Alfalfa	Cotton/2	1.68
188799	HAY, WILD	Alfalfa	Cotton/2	1.68
188899	HAY, SUDAN	Alfalfa	Zero/1	0
188999	HAY, OTHER UNSPECIFIED	Alfalfa	Cotton/2	1.68

Agricultural Harvest Operations

Table F-74. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
194599	PASTURE, IRRIGATED	No Land	Zero/1	0
194699	PASTURE, RANGE	No Land	Zero/1	0
194799	PASTURE, MISC. FORAGE	No Land	Zero/1	0
195199	SILAGE	Wheat	Cotton/20	0.17
195299	HAY, GREEN CHOP	Alfalfa	Zero/1	0
195399	STRAW	Alfalfa	Wheat/1	5.8
198199	RICE, WILD	Rice	Cotton/2	1.68
198999	FIELD CROPS, UNSPEC.	Corn	Cotton/20	0.17
201119	ORANGES, NAVEL	Citrus	Cotton/40	0.08
201519	ORANGES, VALENCIAS	Citrus	Cotton/40	0.08
201999	ORANGES, UNSPECIFIED	Citrus	Cotton/40	0.08
202999	GRAPEFRUIT, ALL	Citrus	Cotton/40	0.08
203999	TANGERINES & MANDARINS	Citrus	Cotton/40	0.08
204999	LEMONS, ALL	Citrus	Cotton/40	0.08
205999	LIMES, ALL	Citrus	Cotton/40	0.08
206999	TANGELOS	Citrus	Cotton/40	0.08
207999	KUMQUATS	Citrus	Cotton/40	0.08
208059	CITRUS, MISC BY-PROD	Citrus	Cotton/40	0.08
209999	CITRUS, UNSPECIFIED	Citrus	Cotton/40	0.08
211999	APPLES, ALL	Citrus	Cotton/40	0.08
212199	PEACHES, FREESTONE	Citrus	Cotton/40	0.08
212399	PEACHES, CLINGSTONE	Citrus	Cotton/40	0.08
212999	PEACHES, UNSPECIFIED	Citrus	Cotton/40	0.08
213199	CHERRIES, SWEET	Citrus	Cotton/40	0.08
214199	PEARS, BARLETT	Citrus	Cotton/40	0.08
214899	PEARS, ASIAN	Citrus	Cotton/40	0.08
214999	PEARS, UNSPECIFIED	Citrus	Cotton/40	0.08
215199	PLUMS	Citrus	Cotton/40	0.08
215399	PLUMCOTS	Citrus	Cotton/40	0.08
215999	PRUNES, DRIED	Citrus	Cotton/40	0.08
216199	GRAPES, TABLE	Grapes-Table	Cotton/20	0.17
216299	GRAPES, WINE	Grapes-Wine	Cotton/20	0.17
216399	GRAPES, RAISIN	Grapes-Raisin	Cotton/20	0.17
216999	GRAPES, UNSPECIFIED	Grapes-Wine	Cotton/20	0.17
217999	APRICOTS, ALL	Citrus	Cotton/40	0.08
218199	NECTARINES	Citrus	Cotton/40	0.08
218299	PERSIMMONS	Citrus	Cotton/40	0.08
218399	POMEGRANATES	Citrus	Cotton/40	0.08
218499	QUINCE	Citrus	Cotton/40	0.08
218839	CHERIMOYAS	Citrus	Cotton/40	0.08
218889	ORCHARD BIOMASS	Almonds	Cotton/40	0.08
218899	FRUITS & NUTS, UNSPEC.	Citrus	Cotton/40	0.08
221999	AVOCADOS, ALL	Citrus	Cotton/40	0.08
224999	DATES	Citrus	Almonds/20	2.04
225999	FIGS, DRIED	Citrus	Almonds/20	2.04
226999	OLIVES	Citrus	Cotton/40	0.08
228019	GUAVAS	Citrus	Cotton/40	0.08
229999	KIWIFRUIT	Citrus	Cotton/40	0.08
230639	BERRIES, BLACKBERRIES	Grapes-Table	Cotton/40	0.08
230869	BERRIES, BOYSENBERRIES	Grapes-Table	Cotton/40	0.08
234799	BERRIES, LOGANBERRIES	Grapes-Table	Cotton/40	0.08
236199	BERRIES, RASPBERRIES	Grapes-Table	Cotton/40	0.08
237199	STRAWBERRIES, FRESH MKT	Melon	Cotton/40	0.08
237299	STRAWBERRIES, PROC	Melon	Cotton/40	0.08
237999	STRAWBERRIES, UNSPECIFIED	Melon	Cotton/40	0.08

Agricultural Harvest Operations

Table F-74. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
239999	BERRIES, BUSH, UNSPECIFIED	Grapes-Table	Cotton/40	0.08
261999	ALMONDS, ALL	Almonds	Almonds/1	40.77
263999	WALNUTS, ENGLISH	Almonds	Almonds/1	40.77
264999	PECANS	Almonds	Almonds/10	4.08
265999	WALNUTS, BLACK	Almonds	Almonds/1	40.77
266999	CHESTNUTS	Almonds	Almonds/10	4.08
267999	MACADAMIA NUT	Almonds	Almonds/10	4.08
268079	PISTACHIOS	Almonds	Almonds/10	4.08
268099	ALMOND HULLS	Almonds	Almonds/1	40.77
301999	ARTICHOKES	Melon	Cotton/40	0.08
302199	ASPARAGUS, FRESH MKT	Melon	Cotton/2	1.68
302299	ASPARAGUS, PROC	Melon	Cotton/2	1.68
302999	ASPARAGUS, UNSPECIFIED	Melon	Cotton/2	1.68
303999	BEANS, GREEN LIMAS	DryBeans	Cotton/2	1.68
304199	BEANS, SNAP FR MKT	DryBeans	Cotton/20	0.17
304299	BEANS, SNAP PROC	DryBeans	Cotton/20	0.17
304399	BEANS FRESH UNSPECIFIED	DryBeans	Cotton/20	0.17
304999	BEANS, UNSPECIFIED SNAP	DryBeans	Cotton/20	0.17
305999	BEETS, GARDEN	Sugar Beets	Cotton/2	1.68
306999	RAPINI	Sugar Beets	Cotton/40	0.08
307189	BROCCOLI,FOOD SERV	Vegetables	Cotton/40	0.08
307199	BROCCOLI, FR MKT	Vegetables	Cotton/40	0.08
307299	BROCCOLI, PROC	Vegetables	Cotton/40	0.08
307919	BROCCOLI, UNSPECIFIED	Vegetables	Cotton/40	0.08
308999	BRUSSELS SPROUTS	Melon	Cotton/40	0.08
309999	CABBAGE, CH. & SPECIALTY	Lettuce	Cotton/40	0.08
310999	CABBAGE, HEAD	Lettuce	Cotton/40	0.08
313189	CARROTS, FOOD SERV	Sugar Beets	Cotton/20	0.17
313199	CARROTS, FR MKT	Sugar Beets	Cotton/20	0.17
313299	CARROTS, PROC	Sugar Beets	Cotton/20	0.17
313999	CARROTS, UNSPECIFIED	Sugar Beets	Cotton/20	0.17
314189	CAULIFLOWER, FOOD SERV	Vegetables	Cotton/40	0.08
314199	CAULIFLOWER, FR MKT	Vegetables	Cotton/40	0.08
314299	CAULIFLOWER, PROC	Vegetables	Cotton/40	0.08
314999	CAULIFLOWER, UNSPECIFIED	Vegetables	Cotton/40	0.08
316189	CELERY, FOOD SERV	Lettuce	Cotton/40	0.08
316199	CELERY, FR MKT	Lettuce	Cotton/40	0.08
316299	CELERY, PROC	Lettuce	Cotton/40	0.08
316999	CELERY, UNSPECIFIED	Lettuce	Cotton/40	0.08
318999	RADICCHIO	Lettuce	Cotton/40	0.08
320999	CHIVES	Lettuce	Cotton/40	0.08
322999	COLLARD GREENS	Lettuce	Cotton/40	0.08
323999	CORN, SWEET ALL	Corn	Cotton/40	0.08
325999	CUCUMBERS	Vegetables	Cotton/40	0.08
330999	EGGPLANT, ALL	Vegetables	Cotton/40	0.08
331999	ENDIVE, ALL	Lettuce	Cotton/40	0.08
332999	ESCAROLE, ALL	Lettuce	Cotton/40	0.08
333999	ANISE (FENNEL)	Lettuce	Cotton/2	1.68
335999	GARLIC, ALL	Garlic	Cotton/2	1.68
337999	KALE	Lettuce	Cotton/40	0.08
338999	KOHLRABI	Lettuce	Cotton/40	0.08
339196	LETTUCE, BULK SALAD PRODS.	Lettuce	Cotton/40	0.08
339999	LETTUCE, UNSPECIFIED	Lettuce	Cotton/40	0.08
340999	LETTUCE, HEAD	Lettuce	Cotton/40	0.08
341999	LETTUCE, ROMAINE	Lettuce	Cotton/40	0.08

Agricultural Harvest Operations

Table F-74. Summary of Crop Emission Factor Assumptions

CDFA Crop Code	CDFA Crop Description	Crop Profile	Assumption	Emission Factor (lbs PM10/acre/yr)
342999	LETTUCE, LEAF	Lettuce	Cotton/40	0.08
343999	MELON, CANTALOUPE	Melon	Cotton/40	0.08
348999	MELON, HONEYDEW	Melon	Cotton/40	0.08
354299	MELON, UNSPECIFIED	Melon	Cotton/40	0.08
354999	MELON, WATER MELONS	Melon	Cotton/40	0.08
355999	MUSHROOMS	No Land Prep.	Zero/1	0
356999	MUSTARD	Lettuce	Cotton/40	0.08
357999	OKRA	Lettuce	Cotton/40	0.08
358999	ONIONS	Onions	Cotton/2	1.68
359999	PARSLEY	Lettuce	Cotton/40	0.08
361299	PEAS, GREEN, PROCESSING	DryBeans	Cotton/20	0.17
361999	PEAS, GREEN, UNSPECIFIED	DryBeans	Cotton/20	0.17
363999	PEPPERS, BELL	Tomatoes	Cotton/40	0.08
364999	PEPPERS, CHILI, HOT	Tomatoes	Cotton/40	0.08
366999	PUMPKINS	Melon	Cotton/20	0.17
367999	RADISHES	Sugar Beets	Cotton/40	0.08
368999	RHUBARB	Lettuce	Cotton/40	0.08
370999	RUTABAGAS	Sugar Beets	Cotton/2	1.68
372999	ONIONS, GREEN & SHALLOTS	Onions	Cotton/40	0.08
374189	SPINACH, FOOD SERV	Lettuce	Cotton/40	0.08
374199	SPINACH, FR MKT	Lettuce	Cotton/40	0.08
374299	SPINACH, PROC	Lettuce	Cotton/40	0.08
374999	SPINACH UNSPECIFIED	Lettuce	Cotton/40	0.08
375999	SQUASH	Melon	Cotton/20	0.17
376999	SWISSCHARD	Lettuce	Cotton/40	0.08
378199	TOMATOES, FRESH MARKET	Tomatoes	Cotton/40	0.08
378299	TOMATOES, PROCESSING	Tomatoes	Cotton/20	0.17
378999	TOMATOES, UNSPECIFIED	Tomatoes	Cotton/20	0.17
380999	TURNIPS, ALL	Sugar Beets	Cotton/2	1.68
381999	GREENS, TURNIP & MUSTARD	Lettuce	Cotton/40	0.08
387999	LEEKS	Onions	Cotton/40	0.08
391999	POTATOES, IRISH ALL	Sugar Beets	Cotton/2	1.68
392999	SWEET POTATOES	Sugar Beets	Cotton/2	1.68
393999	HORSERADISH	Onions	Cotton/40	0.08
394199	SALAD GREENS NEC	Lettuce	Cotton/40	0.08
394999	PEAS, EDIBLE POD (SNOW)	DryBeans	Cotton/20	0.17
395999	VEGETABLES, ORIENTAL, ALL	Vegetables	Cotton/40	0.08
396999	SPROUTS, ALFALFA & BEAN	Lettuce	Cotton/40	0.08
398199	CUCUMBERS, GREENHOUSE	No Land Prep.	Zero/1	0
398299	TOMATOES, GREENHOUSE	No Land Prep.	Zero/1	0
398399	TOMATOES, CHERRY	Tomatoes	Cotton/40	0.08
398499	TOMATILLO	Tomatoes	Cotton/40	0.08
398559	CILANTRO	Lettuce	Cotton/40	0.08
398599	SPICES AND HERBS	Lettuce	Cotton/40	0.08
398899	VEGETABLES, BABY	Vegetables	Cotton/40	0.08
398999	VEGETABLES, UNSPECIFIED	Vegetables	Cotton/20	0.17
832919	POTATOES SEED	Sugar Beets	Cotton/2	1.68
892999	NURSERY TURF	No Land Prep.	Zero 1	0

Source:

CARB. 2003. Emission Inventory Documentation, Section 7.5: Agricultural Harvest Operations. January.

Accessed on: May 5, 2012. Available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocresfarmop.htm.

Windblown Dust - Agricultural Lands

Table F-75. Windblown Dust - Agricultural Lands

Air Basin Code	County Name	Emission Factor (tons/acre/yr)	Process Rate (acres)	PM Emissions (tons/year)
NCC	Monterey	0.020478	279,178.00	5,717.07
	San Benito	0.015936	50,009.00	796.96
	Santa Cruz	0.002485	14,873.00	36.97
SCC	San Luis Obispo	0.006876	109,694.00	754.2
	Santa Barbara	0.00319	80,732.00	257.56
	Ventura	0.018418	54,568.00	1,005.02
SED	Imperial	0.141666	490,409.00	69,474.43
SJV	Fresno	0.013761	864,164.00	11,891.35
	Kern	0.008662	408,313.48	3,536.73
	Kings	0.012856	473,817.00	6,091.62
	Madera	0.008032	141,617.00	1,137.47
	Merced	0.013659	364,804.00	4,982.86
	San Joaquin	0.003527	387,278.00	1,365.96
	Stanislaus	0.009052	229,805.00	2,080.26
	Tulare	0.004693	471,664.00	2,213.29
SV	Butte	0.001154	116,869.00	134.87
	Colusa	0.004702	229,747.00	1,080.31
	Glenn	0.004957	186,067.00	922.39
	Placer	0.002172	6,962.90	15.12
	Sacramento	0.002479	117,770.00	291.92

Note:
Fraction of PM10 (FRPM10): 0.50
(PM10 Emissions = PM x FRPM10)

Table F-76. Windblown Dust - Pasture Lands

Air Basin Code	County Name	Emission Factor (tons/acre/yr)	Process Rate (acres)	PM Emissions (tons/year)
NCC	Monterey	0.00110562	1,108,000	1,225.03
	San Benito	0.00109336	512,000	559.8
	Santa Cruz	0.0001605	8,000	1.28
SCC	Santa Barbara	0.00021801	602,913	131.44
	San Luis Obispo	0.00046964	1,102,500	517.78
	Ventura	0.00050356	210,918	106.21
SED	Imperial	0.00867346	158,449	1,374.30
SJV	Fresno	0.00149089	907,300	1,352.69
	Kern	0.00082834	1,527,603	1,265.37
	Kings	0.00146875	142,777	209.7
	Madera	0.00116178	421,000	489.11
	Merced	0.00155578	642,700	999.9
	San Joaquin	0.0005228	167,700	87.67
	Stanislaus	0.00107875	434,300	468.5
	Tulare	0.00063424	713,400	452.47
SV	Butte	0.00014292	288,500	41.23
	Colusa	0.00046444	181,900	84.48
	Glenn	0.00048846	256,575	125.33
	Placer	0.00026499	65,656	17.4
	Sacramento	0.00019538	118,000	23.05
	Shasta	0.00034146	459,000	156.73
	Solano	0.00039453	131,360	51.83
	Sutter	0.00037084	71,500	26.51
	Tehama	0.00035146	955,350	335.76
	Yolo	0.00061919	136,870	84.75
	Yuba	0.00023892	207,600	49.6

Note:
Fraction of PM10 (FRPM10): 0.50
(PM10 Emissions = PM x FRPM10)

Source:
CARB. 1997. Emission Inventory Documentation, Section 7.12: Windblown Dust - Agricultural Lands. July. Accessed on: May 5, 2012. Available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocfugwbdst.htm.

Seasonal Profiles

Table F-77. Agricultural Land Preparation Seasonal Profile for Land Preparation

AB	ID #	County	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
SV	4	BUTTE	0.005	0.004	0.081	0.387	0.387	0.001	0.001	0.001	0.001	0.015	0.06	0.058
	6	COLUSA	0.009	0.016	0.079	0.355	0.355	0.002	0.002	0.002	0.002	0.035	0.074	0.07
	11	GLENN	0.018	0.013	0.094	0.331	0.331	0.003	0.004	0.004	0.004	0.028	0.087	0.082
	31	PLACER	0.005	0	0.076	0.415	0.415	0	0	0	0	0.026	0.031	0.031
	34	SACRAMENTO	0.078	0.014	0.123	0.117	0.123	0.016	0.016	0.016	0.016	0.071	0.205	0.205
	45	SHASTA	0.051	0	0.028	0.152	0.152	0	0.039	0	0	0.208	0.188	0.182
	48	SOLANO	0.075	0.039	0.089	0.003	0.004	0.004	0.004	0.004	0.004	0.128	0.328	0.318
	51	SUTTER	0.011	0.012	0.086	0.362	0.362	0.001	0.001	0.001	0.001	0.028	0.071	0.067
	52	TEHAMA	0.051	0.024	0.083	0.054	0.054	0	0	0	0	0.083	0.331	0.32
	57	YOLO	0.062	0.021	0.088	0.136	0.137	0.003	0.003	0.003	0.003	0.095	0.223	0.223
	58	YUBA	0.006	0	0.082	0.405	0.405	0	0	0	0	0.015	0.043	0.043

Source:

CARB. 2003. Emission Inventory Documentation, Section 7.4: Agricultural Land Preparation. January.

Accessed on: May 5, 2012. Available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocresfarmop.htm

Table F-78. Seasonal Profile for Agricultural Harvest Emissions

AB	ID #	County	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
SV	4	BUTTE	0	0	0	0	0	0.003	0.004	0.001	0.483	0.484	0.025	0
	6	COLUSA	0	0	0.001	0.001	0.001	0.037	0.052	0.016	0.408	0.411	0.073	0
	11	GLENN	0	0	0.001	0.001	0.001	0.03	0.032	0.002	0.446	0.45	0.036	0
	31	PLACER	0	0	0.014	0.014	0.014	0.014	0.014	0.014	0.409	0.395	0.112	0
	34	SACRAMENTO	0.002	0.002	0.009	0.009	0.009	0.222	0.284	0.071	0.206	0.137	0.044	0.002
	45	SHASTA	0	0	0.059	0.059	0.059	0.083	0.083	0.059	0.316	0.258	0.025	0
	48	SOLANO	0	0	0.003	0.003	0.003	0.196	0.229	0.035	0.274	0.247	0.01	0
	51	SUTTER	0	0	0.001	0.001	0.001	0.025	0.05	0.026	0.427	0.407	0.059	0
	52	TEHAMA	0	0	0.002	0.002	0.002	0.005	0.006	0.002	0.489	0.489	0.002	0
	57	YOLO	0	0	0.002	0.002	0.002	0.111	0.155	0.046	0.348	0.308	0.026	0
	58	YUBA	0	0	0.002	0.002	0.002	0.005	0.005	0.002	0.471	0.469	0.042	0

Source:

CARB. 2003. Emission Inventory Documentation, Section 7.5: Agricultural Harvest Operations. January.

Accessed on: May 5, 2012. Available at: http://www.arb.ca.gov/ei/areasrc/arbmiscprocresfarmop.htm.

Table F-79. Final Normalized Monthly Emission Profiles: Nonpasture

Basin	County	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SV	Butte	0.0114	0.0316	0.0333	0.2697	0.2156	0.0556	0.1253	0.0977	0.0498	0.0721	0.0227	0.0152
	Colusa	0.0037	0.0075	0.0171	0.1868	0.1818	0.1461	0.0998	0.1141	0.1099	0.1169	0.0106	0.0059
	Glenn	0.004	0.0116	0.0162	0.2311	0.0859	0.2114	0.0773	0.0466	0.0623	0.1652	0.0764	0.0122
	Placer	0.0052	0.0081	0.013	0.2733	0.261	0.0962	0.0877	0.0964	0.1024	0.0411	0.0107	0.0049
	Sacramento	0.0015	0.0025	0.0046	0.1199	0.1443	0.3286	0.13	0.1012	0.1297	0.0306	0.0046	0.0024
	Shasta	0.0019	0.0071	0.0082	0.0756	0.0984	0.3371	0.2219	0.1439	0.0436	0.055	0.0055	0.0018
	Solano	0.0008	0.0011	0.0021	0.0461	0.0884	0.1865	0.1423	0.145	0.1875	0.1902	0.0087	0.0013
	Sutter	0.0038	0.0057	0.0088	0.1846	0.2083	0.2042	0.0906	0.099	0.1433	0.0397	0.0084	0.0036
	Tehama	0.0021	0.0055	0.0059	0.0528	0.0666	0.3714	0.2149	0.157	0.0664	0.0505	0.0047	0.0021
	Yolo	0.0015	0.0022	0.0036	0.0787	0.1309	0.2377	0.1079	0.1054	0.1682	0.1528	0.0091	0.0019
	Yuba	0.0076	0.012	0.0182	0.2745	0.2564	0.1158	0.0768	0.0478	0.0804	0.066	0.0372	0.0073

Table F-80. Final Normalized Monthly Emission Profiles: Pasture

Basin	County	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SV	Butte	0.001	0.0029	0.0031	0.0294	0.0515	0.094	0.3024	0.2379	0.2041	0.0688	0.0034	0.0015
	Colusa	0.0005	0.0009	0.0022	0.0291	0.0582	0.218	0.1974	0.161	0.2281	0.1018	0.0019	0.0008
	Glenn	0.0006	0.0018	0.0025	0.0412	0.0287	0.2338	0.1275	0.0827	0.2331	0.2277	0.0185	0.002
	Placer	0.0005	0.0008	0.0013	0.0314	0.0677	0.2348	0.1734	0.1379	0.3101	0.0399	0.0017	0.0005
	Sacramento	0.0004	0.0006	0.0012	0.036	0.0571	0.2216	0.1705	0.1299	0.331	0.0495	0.0016	0.0006
	Shasta	0.0007	0.0019	0.0021	0.0214	0.0365	0.3573	0.2451	0.144	0.1219	0.0665	0.0018	0.0007
	Solano	0.0002	0.0003	0.0007	0.0182	0.0447	0.1497	0.148	0.1119	0.2964	0.2266	0.0028	0.0004
	Sutter	0.0005	0.0007	0.0012	0.0286	0.0617	0.2125	0.1566	0.1249	0.3636	0.0477	0.0016	0.0005
	Tehama	0.0007	0.0019	0.0021	0.0217	0.037	0.3624	0.2488	0.1461	0.1147	0.0621	0.0018	0.0007
	Yolo	0.0003	0.0005	0.0009	0.0226	0.0528	0.1794	0.1598	0.1228	0.2924	0.1656	0.0025	0.0004
	Yuba	0.0004	0.0006	0.001	0.0169	0.0356	0.1527	0.1783	0.1611	0.4092	0.0405	0.0033	0.0004

Appendix G

Climate Change Analysis Emission Calculations

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Summary of Annual Groundwater Substitution GHG Emissions by County

Table G-1. GHG Emissions from Groundwater Substitution

Water Agency	Emissions (MTCO2e per year)			
	CO2	CH4	N2O	Total
Sacramento River of Analysis				
Anderson-Cottonwood Irrigation District	164	0.26	0.66	165
Conaway Preservation Group	2,360	3.33	8.30	2,371
Cordua Irrigation District	496	0.79	2.00	499
Cranmore Farms	272	0.44	1.10	274
Eastside Mutual Water Company	392	0.40	0.95	394
Glenn-Colusa Irrigation District	785	1.26	3.17	789
Natomas Central Mutual Water Company	376	0.51	1.29	378
Pelger Mutual Water Company	283	0.33	0.80	285
Pleasant Grove-Verona Mutual Water Company	1,890	2.32	5.69	1,898
Reclamation District 108	642	1.03	2.59	646
Reclamation District 1004	900	0.95	2.28	903
River Garden Farms	326	0.52	1.32	327
Sycamore Mutual Water Company	490	0.79	1.98	493
Te Velde Revocable Family Trust	202	0.32	0.82	203
American River Area of Analysis				
City of Sacramento	483	0.66	1.66	485
Sacramento County Water Agency	1,427	1.95	4.92	1,434
Sacramento Suburban Water District	4,379	4.31	9.69	4,393
Feather River Area of Analysis				
Butte Water District	356	0.57	1.44	358
Garden Highway Mutual Water Company	452	0.72	1.83	454
Gilsizer Slough Ranch	441	0.52	1.25	443
Goose Club Farms and Teichert Aggregates	341	0.55	1.38	342
Tule Basin Farms	374	0.32	0.66	375
Delta Region Area of Analysis				
Reclamation District 2068	184	0.29	0.74	185
Pope Ranch	119	0.19	0.48	120
Total	**18,134**	**23.34**	**57.03**	**18,215**

Groundwater Substitution GHG Emissions

Agency	Anderson-Cottonwood Irrigation District	
Transfer Volume	5,226	acre feet/year
Location	Shasta	County
	Tehama	County

Table G-2. Anderson-Cottonwood Irrigation District Criteria Pollutant Emissions

										GHG Emissions						
			Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	(metric tons per year)			(metric tons CO2e per year)			
Description	Well	Fuel Type	(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Barney Street	Barney Street	Electric	200	5,500	85%	4,422	4,366	651,702	n/a	131	0.0084	0.0018	131	0.21	0.53	132
Crowley Gulch	Crowley Gulch	Electric	50	1,000	15%	804	4,366	162,926	n/a	33	0.0021	0.0004	33	0.05	0.13	33
			Total	**6,500**	**100%**	**5,226**	**8,733**	**814,628**	**0**	**164**	**0.0105**	**0.0022**	**164**	**0.26**	**0.66**	**165**

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Conaway Preservation Group
Transfer Volume	35,000 acre feet/year
Location	Yolo County

Table G-3. Conaway Preservation Group Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating (hp)	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/year)	Operation (hours/year)	Operation (kWh/yr)	Fuel Consumption (gal/yr)	GHG Emissions (metric tons per year) CO2	CH4	N2O	(metric tons CO2e per year) CO2	CH4	N2O	Total
ConawayPG12W-1	12W-1	Electric	250	3,500	4%	1,253	1,944	362,604	n/a	73	0.0047	0.0010	73	0.12	0.30	74
ConawayPG12W-2	12W-2	Electric	250	2,500	3%	895	1,944	362,604	n/a	73	0.0047	0.0010	73	0.12	0.30	74
ConawayPG12W-5	12W-5	Electric	250	3,500	4%	1,253	1,944	362,604	n/a	73	0.0047	0.0010	73	0.12	0.30	74
ConawayPG13W-3	13W-3	Electric	200	3,500	4%	1,253	1,944	290,083	n/a	59	0.0037	0.0008	59	0.09	0.24	59
ConawayPG16W-2	16W-2	Diesel	227	1,600	2%	573	1,944	n/a	24,751	253	0.0102	0.0020	253	0.26	0.61	254
ConawayPG17W-3	17W-3	Diesel	227	1,700	2%	608	1,944	n/a	24,751	253	0.0102	0.0020	253	0.26	0.61	254
ConawayPG1W-3	1W-3	Electric	250	3,500	4%	1,253	1,944	362,604	n/a	73	0.0047	0.0010	73	0.12	0.30	74
ConawayPG20W-1	20W-1	Electric	100	2,500	3%	895	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPG21W-1	21W-1	Electric	250	2,500	3%	895	1,944	362,604	n/a	73	0.0047	0.0010	73	0.12	0.30	74
ConawayPG21W-3	21W-3	Electric	100	2,500	3%	895	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPG24W-1	24W-1	Electric	250	2,500	3%	895	1,944	362,604	n/a	73	0.0047	0.0010	73	0.12	0.30	74
ConawayPG31W-1	31W-1	Electric	100	2,300	2%	823	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPG32NW-1	32NW-1	Electric	100	3,300	3%	1,181	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPG32NW-2	32NW-2	Electric	250	3,500	4%	1,253	1,944	362,604	n/a	73	0.0047	0.0010	73	0.12	0.30	74
ConawayPG32W-3	32W-3	Electric	250	2,500	3%	895	1,944	362,604	n/a	73	0.0047	0.0010	73	0.12	0.30	74
ConawayPG33NW-1	33NW-1	Electric	100	2,300	2%	823	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPG33NW-2	33NW-2	Electric	100	2,200	2%	787	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPG33NW-3	33NW-3	Electric	100	2,100	2%	752	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPG33NW-4	33NW-4	Electric	100	3,400	3%	1,217	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPG33NW-5	33NW-5	Electric	100	1,800	2%	644	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPG33NW-6	33NW-6	Electric	100	2,100	2%	752	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPG33NW-7	33NW-7	Electric	100	1,400	1%	501	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPG33NW-8	33NW-8	Electric	100	2,200	2%	787	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPG5W-2	5W-2	Electric	250	3,500	4%	1,253	1,944	362,604	n/a	73	0.0047	0.0010	73	0.12	0.30	74
ConawayPG5W-3	5W-3	Electric	250	2,700	3%	966	1,944	362,604	n/a	73	0.0047	0.0010	73	0.12	0.30	74
ConawayPG6W-2	6W-2	Electric	100	3,500	4%	1,253	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPG7W-1	7W-1	Electric	75	1,800	2%	644	1,944	108,781	n/a	22	0.0014	0.0003	22	0.04	0.09	22
ConawayPG7W-2	7W-2	Electric	250	3,500	4%	1,253	1,944	362,604	n/a	73	0.0047	0.0010	73	0.12	0.30	74
ConawayPG7W-4	7W-4	Electric	200	3,500	4%	1,253	1,944	290,083	n/a	59	0.0037	0.0008	59	0.09	0.24	59
ConawayPG7W-4S	7W-4S	Electric	200	3,500	4%	1,253	1,944	290,083	n/a	59	0.0037	0.0008	59	0.09	0.24	59
ConawayPG8W-2	8W-2	Diesel	227	2,300	2%	823	1,944	n/a	24,751	253	0.0102	0.0020	253	0.26	0.61	254
ConawayPG8W-2N	8W-2N	Electric	200	1,500	2%	537	1,944	290,083	n/a	59	0.0037	0.0008	59	0.09	0.24	59
ConawayPGOW-1	OW-1	Electric	100	2,600	3%	930	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPGOW-2	OW-2	Electric	100	3,400	3%	1,217	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPGOW-3	OW-3	Electric	125	3,400	3%	1,217	1,944	181,302	n/a	37	0.0023	0.0005	37	0.06	0.15	37
ConawayPGOW-4	OW-4	Electric	100	1,700	2%	608	1,944	145,041	n/a	29	0.0019	0.0004	29	0.05	0.12	29
ConawayPGOW-5	OW-5	Electric	125	2,000	2%	716	1,944	181,302	n/a	37	0.0023	0.0005	37	0.06	0.15	37
			Total	**97,800**	**100%**	**35,000**	**71,912**	**7,941,021**	**74,253**	**2,360**	**0.1334**	**0.0279**	**2,360**	**3.33**	**8.30**	**2,371**

Legend

	Assumed to be electric (similar to 32W-2)
	Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Cordua Irrigation District
Transfer Volume	12,000 acre feet/year
Location	Yuba County

Table G-4. Cordua Irrigation District Criteria Pollutant Emissions

										GHG Emissions						
			Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	(metric tons per year)			(metric tons CO2e per year)			
Description	Well	Fuel Type	(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
COR1	COR1	Electric	60	1,000	3%	323	1,757	78,654	n/a	16	0.0010	0.0002	16	0.03	0.06	16
COR2	COR2	Electric	50	900	2%	291	1,757	65,545	n/a	13	0.0008	0.0002	13	0.02	0.05	13
COR3	COR3	Electric	60	1,000	3%	323	1,757	78,654	n/a	16	0.0010	0.0002	16	0.03	0.06	16
COR4	COR4	Electric	75	1,400	4%	453	1,757	98,318	n/a	20	0.0013	0.0003	20	0.03	0.08	20
COR5	COR5	Electric	75	1,300	4%	420	1,757	98,318	n/a	20	0.0013	0.0003	20	0.03	0.08	20
COR8	COR8	Electric	75	2,000	5%	647	1,757	98,318	n/a	20	0.0013	0.0003	20	0.03	0.08	20
COR9	COR9	Electric	60	1,000	3%	323	1,757	78,654	n/a	16	0.0010	0.0002	16	0.03	0.06	16
COR10	COR10	Electric	75	1,300	4%	420	1,757	98,318	n/a	20	0.0013	0.0003	20	0.03	0.08	20
COR11	COR11	Electric	60	1,800	5%	582	1,757	78,654	n/a	16	0.0010	0.0002	16	0.03	0.06	16
COR12	COR12	Electric	100	1,400	4%	453	1,757	131,090	n/a	26	0.0017	0.0004	26	0.04	0.11	27
COR13	COR13	Electric	100	2,100	6%	679	1,757	131,090	n/a	26	0.0017	0.0004	26	0.04	0.11	27
COR14	COR14	Electric	75	1,800	5%	582	1,757	98,318	n/a	20	0.0013	0.0003	20	0.03	0.08	20
COR18	COR18	Electric	100	2,000	5%	647	1,757	131,090	n/a	26	0.0017	0.0004	26	0.04	0.11	27
COR20	COR20	Electric	125	2,150	6%	695	1,757	163,863	n/a	33	0.0021	0.0004	33	0.05	0.13	33
COR21	COR21	Electric	75	1,250	3%	404	1,757	98,318	n/a	20	0.0013	0.0003	20	0.03	0.08	20
COR22	COR22	Electric	60	1,750	5%	566	1,757	78,654	n/a	16	0.0010	0.0002	16	0.03	0.06	16
COR23	COR23	Electric	75	1,150	3%	372	1,757	98,318	n/a	20	0.0013	0.0003	20	0.03	0.08	20
COR25	COR25	Electric	75	1,600	4%	518	1,757	98,318	n/a	20	0.0013	0.0003	20	0.03	0.08	20
COR26	COR26	Electric	100	1,800	5%	582	1,757	131,090	n/a	26	0.0017	0.0004	26	0.04	0.11	27
COR27	COR27	Electric	100	1,700	5%	550	1,757	131,090	n/a	26	0.0017	0.0004	26	0.04	0.11	27
COR16	COR16	Electric	100	2,300	6%	744	1,757	131,090	n/a	26	0.0017	0.0004	26	0.04	0.11	27
COR17	COR17	Electric	100	2,400	6%	776	1,757	131,090	n/a	26	0.0017	0.0004	26	0.04	0.11	27
COR24	COR24	Electric	100	2,000	5%	647	1,757	131,090	n/a	26	0.0017	0.0004	26	0.04	0.11	27
			Total	**37,100**	**100%**	**12,000**	**40,402**	**2,457,942**	**0**	**496**	**0.0318**	**0.0067**	**496**	**0.79**	**2.00**	**499**

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency Cranmore Farms
Transfer Volume 8,000 acre feet/year
Location Sutter County

Table G-5. Cranmore Farms Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating (hp)	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/year)	Operation (hours/year)	Operation (kWh/yr)	Fuel Consumption (gal/yr)	GHG Emissions (metric tons per year) CO2	CH4	N2O	(metric tons CO2e per year) CO2	CH4	N2O	Total
Cranmore Farms1	1	Electric	125	3,000	17%	1,333	2,414	225,160	n/a	45	0.0029	0.0006	45	0.07	0.18	46
Cranmore Farms2	2	Electric	125	3,000	17%	1,333	2,414	225,160	n/a	45	0.0029	0.0006	45	0.07	0.18	46
Cranmore Farms3	3	Electric	125	3,000	17%	1,333	2,414	225,160	n/a	45	0.0029	0.0006	45	0.07	0.18	46
Cranmore Farms4	4	Electric	125	3,000	17%	1,333	2,414	225,160	n/a	45	0.0029	0.0006	45	0.07	0.18	46
Cranmore Farms5	5	Electric	125	3,000	17%	1,333	2,414	225,160	n/a	45	0.0029	0.0006	45	0.07	0.18	46
Cranmore Farms6	6	Electric	125	3,000	17%	1,333	2,414	225,160	n/a	45	0.0029	0.0006	45	0.07	0.18	46
			Total	**18,000**	**100%**	**8,000**	**14,482**	**1,350,958**	**0**	**272**	**0.0175**	**0.0037**	**272**	**0.44**	**1.10**	**274**

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Eastside Mutual Water Company	
Transfer Volume	2,230	acre feet/year
Location	Colusa	County

Table G-6. Eastside Mutual Water Company Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
7631T	7631T	Diesel	215	3,800	100%	2,230	3,187	n/a	38,441	392	0.0159	0.0032	392	0.40	0.95	394
			Total	**3,800**	**100%**	**2,230**	**3,187**	**0**	**38,441**	**392**	**0.0159**	**0.0032**	**392**	**0.40**	**0.95**	**394**

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Glenn-Colusa Irrigation District
Transfer Volume	25,000 acre feet/year
Location	Glenn County
	Colusa County

Table G-7. Glenn-Colusa Irrigation District Criteria Pollutant Emissions

										GHG Emissions						
			Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	(metric tons per year)			(metric tons CO2e per year)			
Description	Well	Fuel Type	(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
GCID 1	GCID 1	Electric	110	3,305	10%	2,622	4,309	353,744	n/a	71	0.0046	0.0010	71	0.11	0.29	72
GCID 2	GCID 2	Electric	110	3,305	10%	2,622	4,309	353,744	n/a	71	0.0046	0.0010	71	0.11	0.29	72
GCID 3	GCID 3	Electric	110	3,305	10%	2,622	4,309	353,744	n/a	71	0.0046	0.0010	71	0.11	0.29	72
GCID 4	GCID 4	Electric	110	3,305	10%	2,622	4,309	353,744	n/a	71	0.0046	0.0010	71	0.11	0.29	72
GCID 5	GCID 5	Electric	110	2,605	8%	2,067	4,309	353,744	n/a	71	0.0046	0.0010	71	0.11	0.29	72
GCID X1	GCID X1	Electric	110	2,389	8%	1,896	4,309	353,744	n/a	71	0.0046	0.0010	71	0.11	0.29	72
GCID X2	GCID X2	Electric	110	3,305	10%	2,622	4,309	353,744	n/a	71	0.0046	0.0010	71	0.11	0.29	72
GCID X3	GCID X3	Electric	110	2,605	8%	2,067	4,309	353,744	n/a	71	0.0046	0.0010	71	0.11	0.29	72
GCID X4	GCID X4	Electric	110	2,389	8%	1,896	4,309	353,744	n/a	71	0.0046	0.0010	71	0.11	0.29	72
GCID X5	GCID X5	Electric	110	2,605	8%	2,067	4,309	353,744	n/a	71	0.0046	0.0010	71	0.11	0.29	72
Test Hole 7	Test Hole 7	Electric	110	2,389	8%	1,896	4,309	353,744	n/a	71	0.0046	0.0010	71	0.11	0.29	72
			Total	**31,507**	**100%**	**25,000**	**47,402**	**3,891,180**	**0**	**785**	**0.0503**	**0.0106**	**785**	**1.26**	**3.17**	**789**

Legend

	Assumed to be electric (similar to other wells operated by water agency)
	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency: Natomas Central Mutual Water Company
Transfer Volume: 30,000 acre feet/year
Location: Sacramento County, Sutter County

Table G-8. Natomas Central Mutual Water Company Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Natomas Central MWCWilley, Ed	Willey, Ed	Electric	250	5,500	2%	698	689	128,527	n/a	30	0.0017	0.0004	30	0.04	0.10	31
Natomas Central MWCOse, Mary-site 8, well 1	Ose, Mary-site 8, well 1	Electric	200	5,500	2%	698	689	102,821	n/a	24	0.0013	0.0003	24	0.03	0.08	24
Natomas Central MWCOse, Mary-site 9, well 2	Ose, Mary-site 9, well 2	Electric	150	5,500	2%	698	689	77,116	n/a	18	0.0010	0.0002	18	0.02	0.06	18
Natomas Central MWCLeal, Robert-site 1 well 2	Leal, Robert-site 1 well 2	Electric	100	5,500	2%	698	689	51,411	n/a	12	0.0007	0.0001	12	0.02	0.04	12
Natomas Central MWCDeWitt, Jack-1	DeWitt, Jack-1	Electric	30	5,500	2%	698	689	15,423	n/a	4	0.0002	0.0000	4	0.00	0.01	4
Natomas Central MWCDeWitt, Jack-2	DeWitt, Jack-2	Electric	80	5,500	2%	698	689	41,129	n/a	10	0.0005	0.0001	10	0.01	0.03	10
Natomas Central MWCDeWitt, Jack-3	DeWitt, Jack-3	Electric	60	5,500	2%	698	689	30,846	n/a	7	0.0004	0.0001	7	0.01	0.03	7
Natomas Central MWCDeWitt, Jack-4	DeWitt, Jack-4	Electric	30	5,500	2%	698	689	15,423	n/a	4	0.0002	0.0000	4	0.00	0.01	4
Natomas Central MWCDeWitt, Jack-5	DeWitt, Jack-5	Electric	20	5,500	2%	698	689	10,282	n/a	2	0.0001	0.0000	2	0.00	0.01	2
Natomas Central MWCDeWitt, Jack-6	DeWitt, Jack-6	Electric	30	5,500	2%	698	689	15,423	n/a	4	0.0002	0.0000	4	0.00	0.01	4
Natomas Central MWCDeWitt, Jack-7	DeWitt, Jack-7	Electric	25	5,500	2%	698	689	12,853	n/a	3	0.0002	0.0000	3	0.00	0.01	3
Natomas Central MWCDeWitt, Jack-7	DeWitt, Jack-7	Electric	25	5,500	2%	698	689	12,853	n/a	3	0.0002	0.0000	3	0.00	0.01	3
Natomas Central MWCDeWitt, Jack--8	DeWitt, Jack--8	Electric	250	5,500	2%	698	689	128,527	n/a	30	0.0017	0.0004	30	0.04	0.10	31
Natomas Central MWCMorrison, Phil #2-site 5 well 14	Morrison, Phil #2-site 5 well 14	Electric	40	5,500	2%	698	689	20,564	n/a	5	0.0003	0.0001	5	0.01	0.02	5
Natomas Central MWCBianchi, John- site 2, well 10	Bianchi, John- site 2, well 10	Electric	60	5,500	2%	698	689	30,846	n/a	7	0.0004	0.0001	7	0.01	0.03	7
Natomas Central MWCBianchi, John-site 2 well 11	Bianchi, John-site 2 well 11	Electric	80	5,500	2%	698	689	41,129	n/a	10	0.0005	0.0001	10	0.01	0.03	10
Natomas Central MWCLauppe and Sons	Lauppe and Sons	Electric	40	5,500	2%	698	689	20,564	n/a	5	0.0003	0.0001	5	0.01	0.02	5
Natomas Central MWCWiley, Wane-site 7 , well 18	Wiley, Wane-site 7 , well 18	Electric	40	5,500	2%	698	689	20,564	n/a	5	0.0003	0.0001	5	0.01	0.02	5
Natomas Central MWCLeal, Robert L-1 (rice box)	Leal, Robert L-1 (rice box)	Electric	30	5,500	2%	698	689	15,423	n/a	4	0.0002	0.0000	4	0.00	0.01	4
Natomas Central MWCLeal, Robert L-3	Leal, Robert L-3	Electric	50	5,500	2%	698	689	25,705	n/a	6	0.0003	0.0001	6	0.01	0.02	6
Natomas Central MWCLeal, Robert L-4	Leal, Robert L-4	Electric	110	5,500	2%	698	689	56,552	n/a	13	0.0007	0.0002	13	0.02	0.05	13
Natomas Central MWCLeal, Robert L-5	Leal, Robert L-5	Electric	110	5,500	2%	698	689	56,552	n/a	13	0.0007	0.0002	13	0.02	0.05	13
Natomas Central MWCLeal, Robert L-6	Leal, Robert L-6	Electric	110	5,500	2%	698	689	56,552	n/a	13	0.0007	0.0002	13	0.02	0.05	13
Natomas Central MWCLeal, Robert L-7	Leal, Robert L-7	Electric	30	5,500	2%	698	689	15,423	n/a	4	0.0002	0.0000	4	0.00	0.01	4
Natomas Central MWCLeal, Robert L-8	Leal, Robert L-8	Electric	200	5,500	2%	698	689	102,821	n/a	24	0.0013	0.0003	24	0.03	0.08	24
Natomas Central MWCLeal, Robert L-9	Leal, Robert L-9	Electric	30	5,500	2%	698	689	15,423	n/a	4	0.0002	0.0000	4	0.00	0.01	4
Natomas Central MWCLeal, Robert L-2	Leal, Robert L-2	Electric	30	5,500	2%	698	689	15,423	n/a	4	0.0002	0.0000	4	0.00	0.01	4
Natomas Central MWCLeal, Robert #1	Leal, Robert #1	Electric	30	5,500	2%	698	689	15,423	n/a	4	0.0002	0.0000	4	0.00	0.01	4
Natomas Central MWCLeal, Robert #2	Leal, Robert #2	Electric	40	5,500	2%	698	689	20,564	n/a	5	0.0003	0.0001	5	0.01	0.02	5
Natomas Central MWCSpangler, Dan-site 4 well 13	Spangler, Dan-site 4 well 13	Electric	80	5,500	2%	698	689	41,129	n/a	10	0.0005	0.0001	10	0.01	0.03	10
Natomas Central MWCVestal, Sid	Vestal, Sid	Electric	60	5,500	2%	698	689	30,846	n/a	7	0.0004	0.0001	7	0.01	0.03	7
Natomas Central MWCVestal, Sid-1	Vestal, Sid-1	Electric	60	5,500	2%	698	689	30,846	n/a	7	0.0004	0.0001	7	0.01	0.03	7
Dewitt, Jack-9 Housley N	Dewitt, Jack-9 Housley N	Electric	60	5,500	2%	698	689	30,846	n/a	7	0.0004	0.0001	7	0.01	0.03	7
Dewitt, Jack-10 Housley	Dewitt, Jack-10 Housley	Electric	60	5,500	2%	698	689	30,846	n/a	7	0.0004	0.0001	7	0.01	0.03	7
Dewitt, Jack-11 Housley	Dewitt, Jack-11 Housley	Electric	20	5,500	2%	698	689	10,282	n/a	2	0.0001	0.0000	2	0.00	0.01	2
Natomas Central MWCMorrison, Phil-#3 site 5 well 15	Morrison, Phil-#3 site 5 well 15	Electric	40	5,500	2%	698	689	20,564	n/a	5	0.0003	0.0001	5	0.01	0.02	5
Natomas Central MWCMorrison, Phil-#4 site 5 well 16	Morrison, Phil-#4 site 5 well 16	Electric	40	5,500	2%	698	689	20,564	n/a	5	0.0003	0.0001	5	0.01	0.02	5
Natomas Central MWCNBC-Frazer	NBC-Frazer	Electric	50	5,500	2%	698	689	25,705	n/a	6	0.0003	0.0001	6	0.01	0.02	6
Natomas Central MWCNBC-Lucich North	NBC-Lucich North	Electric	75	5,500	2%	698	689	38,558	n/a	9	0.0005	0.0001	9	0.01	0.03	9
Natomas Central MWCNBC- Natomas Farm#1	NBC- Natomas Farm#1	Electric	60	5,500	2%	698	689	30,846	n/a	7	0.0004	0.0001	7	0.01	0.03	7
Natomas Central MWCNBC-Cummings	NBC-Cummings	Electric	20	5,500	2%	698	689	10,282	n/a	2	0.0001	0.0000	2	0.00	0.01	2
Natomas Central MWCMorrison, Phillip-#5	Morrison, Phillip-#5	Electric	60	5,500	2%	698	689	30,846	n/a	7	0.0004	0.0001	7	0.01	0.03	7
Natomas Central MWCPerry, Joe	Perry, Joe	Electric	125	5,500	2%	698	689	64,263	n/a	15	0.0008	0.0002	15	0.02	0.05	15
Natomas Central MWCNBC-Kismat-2	NBC-Kismat-2	Electric	30	5,500	2%	698	689	15,423	n/a	4	0.0002	0.0000	4	0.00	0.01	4
Natomas Central MWCNBC-Kismat-3	NBC-Kismat-3	Electric	30	5,500	2%	698	689	15,423	n/a	4	0.0002	0.0000	4	0.00	0.01	4
Natomas Central MWCNBC-Kismat-4	NBC-Kismat-4	Electric	110	5,500	2%	698	689	56,552	n/a	13	0.0007	0.0002	13	0.02	0.05	13
Natomas Central MWCNBC-Sliva	NBC-Sliva	Electric	50	5,500	2%	698	689	25,705	n/a	6	0.0003	0.0001	6	0.01	0.02	6
			Total	**236,500**	**100%**	**30,000**	**29,623**	**1,588,589**	**0**	**376**	**0.0205**	**0.0043**	**376**	**0.51**	**1.29**	**378**

Legend

	Assumed to be electric
	Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Pelger Mutual Water Company	
Transfer Volume	3,750	acre feet/year
Location	Sutter	County

Table G-9. Pelger Mutual Water Company Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Pelger MWCWell 1 Tucker	Well 1 Tucker	Electric	110	3,100	33%	1,224	2,144	175,980	n/a	35	0.0023	0.0005	35	0.06	0.14	36
Pelger MWCWell 2 Flopet	Well 2 Flopet	Diesel	173	2,100	22%	829	2,144	n/a	20,806	212	0.0086	0.0017	212	0.22	0.51	213
Pelger MWCWell 3 Klein	Well 3 Klein	Electric	110	4,300	45%	1,697	2,144	175,980	n/a	35	0.0023	0.0005	35	0.06	0.14	36
			Total	**9,500**	**100%**	**3,750**	**6,431**	**351,960**	**20,806**	**283**	**0.0132**	**0.0027**	**283**	**0.33**	**0.80**	**285**

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Pleasant Grove-Verona Mutual Water Company
Transfer Volume	18,000 acre feet/year
Location	Sutter County

Table G-10. Pleasant Grove-Verona Mutual Water Company Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
PGVMWCWill-Lee 4A	Will-Lee 4A	Diesel	160	1,500	2%	345	1,248	n/a	11,206	114	0.0046	0.0009	114	0.12	0.28	115
PGVMWCRiver Ranch #19	River Ranch #19	Diesel	200	2,500	3%	575	1,248	n/a	14,008	143	0.0058	0.0012	143	0.14	0.35	144
PGVMWCMLF #1	MLF #1	Electric	30	2,000	3%	460	1,248	27,951	n/a	6	0.0004	0.0001	6	0.01	0.02	6
PGVMWCMLF #2	MLF #2	Electric	250	5,000	6%	1,149	1,248	232,924	n/a	47	0.0030	0.0006	47	0.08	0.19	47
PGVMWCMLF Monster Well	MLF Monster Well	Electric	60	3,100	4%	713	1,248	55,902	n/a	11	0.0007	0.0002	11	0.02	0.05	11
PGVMWCMLF #17/12	MLF #17/12	Electric	50	1,500	2%	345	1,248	46,585	n/a	9	0.0006	0.0001	9	0.02	0.04	9
PGVMWCMLF #11	MLF #11	Diesel	250	4,200	5%	966	1,248	n/a	17,510	179	0.0072	0.0014	179	0.18	0.43	179
PGVMWCMLF #13/15	MLF #13/15	Electric	240	4,800	6%	1,103	1,248	223,607	n/a	45	0.0029	0.0006	45	0.07	0.18	45
PGVMWCMLF #16	MLF #16	Electric	240	1,700	2%	391	1,248	223,607	n/a	45	0.0029	0.0006	45	0.07	0.18	45
PGVMWCWilley #1	Willey #1	Diesel	168	3,000	4%	690	1,248	n/a	11,767	120	0.0049	0.0010	120	0.12	0.29	121
PGVMWCWilley #2	Willey #2	Electric	250	3,000	4%	690	1,248	232,924	n/a	47	0.0030	0.0006	47	0.08	0.19	47
PGVMWCWilley #3	Willey #3	Electric	250	2,000	3%	460	1,248	232,924	n/a	47	0.0030	0.0006	47	0.08	0.19	47
PGVMWCWilley #4	Willey #4	Diesel	150	3,000	4%	690	1,248	n/a	10,506	107	0.0043	0.0009	107	0.11	0.26	108
PGVMWCScheidel&Osterli #18A	Scheidel&Osterli #18A	Electric	250	2,500	3%	575	1,248	232,924	n/a	47	0.0030	0.0006	47	0.08	0.19	47
PGVMWCWill-Lee 30	Will-Lee 30	Diesel	100	1,500	2%	345	1,248	n/a	7,004	72	0.0029	0.0006	72	0.07	0.17	72
PGVMWCWill-Lee 31	Will-Lee 31	Electric	250	2,500	3%	575	1,248	232,924	n/a	47	0.0030	0.0006	47	0.08	0.19	47
PGVMWCWill-Lee 32	Will-Lee 32	Electric	250	2,500	3%	575	1,248	232,924	n/a	47	0.0030	0.0006	47	0.08	0.19	47
PGVMWCWill-Lee 33	Will-Lee 33	Electric	250	2,500	3%	575	1,248	232,924	n/a	47	0.0030	0.0006	47	0.08	0.19	47
PGVMWCNicholas Sand Field Well	Nicholas Sand Field Well	Diesel	62.1	2,000	3%	460	1,248	n/a	4,350	44	0.0018	0.0004	44	0.05	0.11	45
PGVMWCNicholas Filipino Camp #2	Nicholas Filipino Camp #2	Electric	40	2,000	3%	460	1,248	37,268	n/a	8	0.0005	0.0001	8	0.01	0.03	8
PGVMWCNicholas Filipino Camp South	Nicholas Filipino Camp South	Diesel	62.1	2,000	3%	460	1,248	n/a	4,350	44	0.0018	0.0004	44	0.05	0.11	45
PGVMWCNicholas Johnston Field Well #2	Nicholas Johnston Field Well #2	Electric	250	2,000	3%	460	1,248	232,924	n/a	47	0.0030	0.0006	47	0.08	0.19	47
PGVMWCNicholas Johnston Well	Nicholas Johnston Well	Electric	250	2,000	3%	460	1,248	232,924	n/a	47	0.0030	0.0006	47	0.08	0.19	47
PGVMWCNicholas 72-acre Field South	Nicholas 72-acre Field South	Diesel	62.1	2,000	3%	460	1,248	n/a	4,350	44	0.0018	0.0004	44	0.05	0.11	45
PGVMWCNicholas 72-Acre Field North	Nicholas 72-Acre Field North	Electric	250	2,000	3%	460	1,248	232,924	n/a	47	0.0030	0.0006	47	0.08	0.19	47
PGVMWCNicholas BBC Well	Nicholas BBC Well	Electric	250	2,000	3%	460	1,248	232,924	n/a	47	0.0030	0.0006	47	0.08	0.19	47
PGVMWCKelly 190 Field Well #2	Kelly 190 Field Well #2	Electric	30	2,000	3%	460	1,248	27,951	n/a	6	0.0004	0.0001	6	0.01	0.02	6
PGVMWCKelly Windmill Field Well #2	Kelly Windmill Field Well #2	Diesel	62.1	2,000	3%	460	1,248	n/a	4,350	44	0.0018	0.0004	44	0.05	0.11	45
PGVMWCKelly Windmill North Field Well	Kelly Windmill North Field Well	Diesel	62.1	2,000	3%	460	1,248	n/a	4,350	44	0.0018	0.0004	44	0.05	0.11	45
PGVMWCKelly 306 Well	Kelly 306 Well	Electric	250	2,600	3%	598	1,248	232,924	n/a	47	0.0030	0.0006	47	0.08	0.19	47
PGVMWCScheidel&Osterli #16	Scheidel&Osterli #16	Diesel	234	3,400	4%	782	1,248	n/a	16,389	167	0.0068	0.0014	167	0.17	0.40	168
PGVMWCScheidel&Osterli #17	Scheidel&Osterli #17	Diesel	101	1,500	2%	345	1,248	n/a	7,074	72	0.0029	0.0006	72	0.07	0.17	72
			Total	**78,300**	**100%**	**18,000**	**39,951**	**3,437,954**	**117,213**	**1,890**	**0.0930**	**0.0191**	**1,890**	**2.32**	**5.69**	**1,898**

Legend

	Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Reclamation District 108	
Transfer Volume	15,000	acre feet/year
Location	Colusa	County
	Yolo	County

Table G-11. Reclamation District 108 Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
RD 108Well#1 Heidrick	Well#1 Heidrick	Electric	100	3,500	18%	2,749	4,265	318,288	n/a	64	0.0041	0.0009	64	0.10	0.26	65
RD 108Well #5 RiggsRanch	Well #5 RiggsRanch	Electric	150	1,700	9%	1,335	4,265	477,433	n/a	96	0.0062	0.0013	96	0.15	0.39	97
RD 108Well #6 CountyLine	Well #6 CountyLine	Electric	250	5,900	31%	4,634	4,265	795,721	n/a	160	0.0103	0.0022	160	0.26	0.65	161
RD 108Well#7 Tract 6	Well#7 Tract 6	Electric	250	4,000	21%	3,141	4,265	795,721	n/a	160	0.0103	0.0022	160	0.26	0.65	161
RD 108Well #4 Huff	Well #4 Huff	Electric	250	4,000	21%	3,141	4,265	795,721	n/a	160	0.0103	0.0022	160	0.26	0.65	161
			Total	**19,100**	**100%**	**15,000**	**21,325**	**3,182,885**	**0**	**642**	**0.0411**	**0.0087**	**642**	**1.03**	**2.59**	**646**

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Reclamation District 1004	
Transfer Volume	7,175	acre feet/year
Location	Colusa County	
	Glenn County	
	Sutter County	

Table G-12. Reclamation District 1004 Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Gardener No. 374672	Gardener No. 374672	Diesel	215	3,500	5%	345	535	n/a	6,456	66	0.0027	0.0005	66	0.07	0.16	66
Gardener No. 498178	Gardener No. 498178	Diesel	215	3,500	5%	345	535	n/a	6,456	66	0.0027	0.0005	66	0.07	0.16	66
Stonewell #6 No. 11334	Stone Well #6 No.11334	Electric	40	1,800	2%	177	535	15,978	n/a	3	0.0002	0.0000	3	0.01	0.01	3
Drumheller Well #7	Drumheller Well No.7	Diesel	225	4,000	5%	394	535	n/a	6,756	69	0.0028	0.0006	69	0.07	0.17	69
Myers Well #1 No. 3457	Myers Well #1 No.3457	Electric	40	2,200	3%	217	535	15,978	n/a	3	0.0002	0.0000	3	0.01	0.01	3
Myers Well #2 No. 340884	Myers Well #2 No. 340884	Electric	100	4,100	6%	404	535	39,944	n/a	8	0.0005	0.0001	8	0.01	0.03	8
Sikes & Parachini #1 No. 93124	Sikes & Parachini Well #1 WS No.93124	Diesel	173	4,000	5%	394	535	n/a	5,195	53	0.0022	0.0004	53	0.05	0.13	53
Sikes & Parachini #2 No. 374682	Sikes & Parachini Well #2 WS No. 374682	Diesel	150	4,000	5%	394	535	n/a	4,504	46	0.0019	0.0004	46	0.05	0.11	46
Rancho Caleta No. 726883	Rancho Caleta No. 726883	Diesel	170	4,500	6%	444	535	n/a	5,105	52	0.0021	0.0004	52	0.05	0.13	52
Behring Ranch Club House No. 496461	Behring Ranch Club House Well No.496461	Electric	125	3,400	5%	335	535	49,930	n/a	10	0.0006	0.0001	10	0.02	0.04	10
Behring Ranch West Well No. 97863	Behring Ranch West Well No.97863	Electric	125	2,300	3%	227	535	49,930	n/a	10	0.0006	0.0001	10	0.02	0.04	10
Behring Ranch 10 Field Well No. 496441	Behring Ranch 10 Field Well No. 496441	Diesel	225	5,800	8%	572	535	n/a	6,756	69	0.0028	0.0006	69	0.07	0.17	69
Behring Ranch Pearl 20094	Behring Ranch Pearl Well No. 20094	Diesel	225	2,500	3%	246	535	n/a	6,756	69	0.0028	0.0006	69	0.07	0.17	69
Behring Ranch Nursery Well No. 17N1W10H1	Behring Ranch Nursery Well No. 17N1W10H1	Diesel	225	1,000	1%	99	535	n/a	6,756	69	0.0028	0.0006	69	0.07	0.17	69
Hall Well No. X	Hall Well No. X	Electric	125	4,500	6%	444	535	49,930	n/a	10	0.0006	0.0001	10	0.02	0.04	10
Hall Well No. 369428	Hall Well No.369428	Electric	125	4,500	6%	444	535	49,930	n/a	10	0.0006	0.0001	10	0.02	0.04	10
East Morgan Well	East Morgan Well #1 No. 374667 17N01W14N001M	Diesel	225	2,600	4%	256	535	n/a	6,756	69	0.0028	0.0006	69	0.07	0.17	69
ast Morgan Well	East Morgan Well#2 No. 498195 17N01W15Q001M	Diesel	225	1,300	2%	128	535	n/a	6,756	69	0.0028	0.0006	69	0.07	0.17	69
Mohammad No.	Mohammad No.e0084085 17N01W02D001M	Electric	125	4,500	6%	444	535	49,930	n/a	10	0.0006	0.0001	10	0.02	0.04	10
Southam Sartain	Southam Sartain Well 18N01W26D001M	Diesel	225	4,800	7%	473	535	n/a	6,756	69	0.0028	0.0006	69	0.07	0.17	69
Barale Well	Barale Well	Diesel	225	4,000	5%	394	535	n/a	6,756	69	0.0028	0.0006	69	0.07	0.17	69
			Total	**72,800**	**100%**	**7,175**	**11,240**	**321,551**	**81,767**	**900**	**0.0380**	**0.0076**	**900**	**0.95**	**2.28**	**903**

Legend

Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	River Garden Farms
Transfer Volume	9,000 acre feet/year
Location	Yolo County

Table G-13. River Garden Farms Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
River Garden FarmsField 65 PW	Field 65 PW	Electric	110	2,500	14%	1,293	2,810	230,661	n/a	47	0.0030	0.0006	47	0.07	0.19	47
River Garden FarmsField 71 PW	Field 71 PW	Electric	110	1,700	10%	880	2,810	230,661	n/a	47	0.0030	0.0006	47	0.07	0.19	47
River Garden FarmsField 98 PW	Field 98 PW	Electric	110	2,900	17%	1,500	2,810	230,661	n/a	47	0.0030	0.0006	47	0.07	0.19	47
River Garden FarmsField 104 PW	Field 104 PW	Electric	110	2,500	14%	1,293	2,810	230,661	n/a	47	0.0030	0.0006	47	0.07	0.19	47
River Garden FarmsField 104-09 PW	Field 104-09 PW	Electric	110	2,990	17%	1,547	2,810	230,661	n/a	47	0.0030	0.0006	47	0.07	0.19	47
River Garden FarmsField 91-09 PW	Field 91-09 PW	Electric	110	2,840	16%	1,469	2,810	230,661	n/a	47	0.0030	0.0006	47	0.07	0.19	47
River Garden FarmsField 117 PW	Field 117 PW	Electric	110	1,965	11%	1,017	2,810	230,661	n/a	47	0.0030	0.0006	47	0.07	0.19	47
			Total	**17,395**	**100%**	**9,000**	**19,669**	**1,614,626**	**0**	**326**	**0.0209**	**0.0044**	**326**	**0.52**	**1.32**	**327**

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Sycamore Mutual Water Company
Transfer Volume	15,000 acre feet/year
Location	Colusa County

Table G-14. Sycamore Mutual Water Company Criteria Pollutant Emissions

								Fuel	GHG Emissions						
			Power Rating	Pump Rate		Transfer Volume	Operation		Consumption	(metric tons per year)			(metric tons CO2e per year)			
Description	Well	Fuel Type	(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Sycamore Family Trust1	1	Electric	125	3,000	9%	1,286	2,328	217,118	n/a	44	0.0028	0.0006	44	0.07	0.18	44
Sycamore Family Trust2	2	Electric	125	3,000	9%	1,286	2,328	217,118	n/a	44	0.0028	0.0006	44	0.07	0.18	44
Sycamore Family Trust3	3	Electric	125	3,000	9%	1,286	2,328	217,118	n/a	44	0.0028	0.0006	44	0.07	0.18	44
Sycamore Family Trust4	4	Electric	125	3,000	9%	1,286	2,328	217,118	n/a	44	0.0028	0.0006	44	0.07	0.18	44
Sycamore Family Trust5	5	Electric	125	3,000	9%	1,286	2,328	217,118	n/a	44	0.0028	0.0006	44	0.07	0.18	44
Sycamore Family Trust6	6	Electric	125	3,000	9%	1,286	2,328	217,118	n/a	44	0.0028	0.0006	44	0.07	0.18	44
Sycamore Family Trust7	7	Electric	125	3,000	9%	1,286	2,328	217,118	n/a	44	0.0028	0.0006	44	0.07	0.18	44
Sycamore Family Trust8	8	Electric	125	3,000	9%	1,286	2,328	217,118	n/a	44	0.0028	0.0006	44	0.07	0.18	44
Sycamore Family Trust11	11	Electric	100	2,500	7%	1,071	2,328	173,695	n/a	35	0.0022	0.0005	35	0.06	0.14	35
Sycamore Family Trust14	14	Electric	100	2,500	7%	1,071	2,328	173,695	n/a	35	0.0022	0.0005	35	0.06	0.14	35
Sycamore Family Trust15	15	Electric	75	2,500	7%	1,071	2,328	130,271	n/a	26	0.0017	0.0004	26	0.04	0.11	26
Sycamore Family Trust17	17	Electric	125	3,500	10%	1,500	2,328	217,118	n/a	44	0.0028	0.0006	44	0.07	0.18	44
			Total	**35,000**	**100%**	**15,000**	**27,930**	**2,431,724**	**0**	**490**	**0.0314**	**0.0067**	**490**	**0.79**	**1.98**	**493**

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Te Velde Revocable Family Trust	
Transfer Volume	7,094	acre feet/year
Location	Yolo	County

Table G-15. Te Velde Revocable Family Trust Criteria Pollutant Emissions

										GHG Emissions						
			Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	(metric tons per year)			(metric tons CO2e per year)			
Description	Well	Fuel Type	(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Te VeldeGW1	GW1	Electric	127	4,656	29%	2,090	2,438	231,042	n/a	47	0.0030	0.0006	47	0.07	0.19	47
Te VeldeGW10	GW10	Electric	143	2,833	18%	1,272	2,438	260,150	n/a	52	0.0034	0.0007	52	0.08	0.21	53
Te VeldeGW9	GW9	Electric	104	2,200	14%	988	2,438	189,200	n/a	38	0.0024	0.0005	38	0.06	0.15	38
Te VeldeGW4	GW4	Electric	125	3,715	24%	1,668	2,438	227,404	n/a	46	0.0029	0.0006	46	0.07	0.19	46
Te VeldeGW3	GW3	Electric	52	2,400	15%	1,077	2,438	94,600	n/a	19	0.0012	0.0003	19	0.03	0.08	19
			Total	**15,804**	**100%**	**7,094**	**12,189**	**1,002,395**	**0**	**202**	**0.0130**	**0.0027**	**202**	**0.32**	**0.82**	**203**

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	City of Sacramento
Transfer Volume	5,000 acre feet/year
Location	Sacramento County

Table G-16. City of Sacramento Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
City of Sacramento WSA83	WELL83	electric	30	373	2%	88	1,278	28,615	n/a	7	0.0004	0.0001	7	0.01	0.02	7
City of Sacramento WSA92	WELL92	electric	50	785	4%	185	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA93	WELL93	electric	50	411	2%	97	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA94	WELL94	electric	50	879	4%	207	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA107	WELL107	electric	50	727	3%	171	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA116	WELL116	electric	75	673	3%	158	1,278	71,538	n/a	17	0.0009	0.0002	17	0.02	0.06	17
City of Sacramento WSA120	WELL120	electric	50	572	3%	135	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA122	WELL122	electric	50	470	2%	111	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA124	WELL124	electric	50	541	3%	127	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA126	WELL126	electric	50	433	2%	102	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA127	WELL127	electric	50	592	3%	139	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA129	WELL129	electric	50	466	2%	110	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA131	WELL131	electric	50	431	2%	101	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA133	WELL133	electric	150	757	4%	178	1,278	143,076	n/a	34	0.0018	0.0004	34	0.05	0.12	34
City of Sacramento WSA134	WELL134	electric	60	676	3%	159	1,278	57,230	n/a	14	0.0007	0.0002	14	0.02	0.05	14
City of Sacramento WSA137	WELL137	electric	75	541	3%	127	1,278	71,538	n/a	17	0.0009	0.0002	17	0.02	0.06	17
City of Sacramento WSA138	WELL138	electric	75	505	2%	119	1,278	71,538	n/a	17	0.0009	0.0002	17	0.02	0.06	17
City of Sacramento WSA139	WELL139	electric	50	818	4%	193	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA142	WELL142	electric	75	940	4%	221	1,278	71,538	n/a	17	0.0009	0.0002	17	0.02	0.06	17
City of Sacramento WSA143	WELL143	electric	50	379	2%	89	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA144	WELL144	electric	50	549	3%	129	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA153	WELL153	electric	100	1027	5%	242	1,278	95,384	n/a	23	0.0012	0.0003	23	0.03	0.08	23
City of Sacramento WSA154	WELL154	electric	50	502	2%	118	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA155	WELL155	electric	50	675	3%	159	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA156	WELL156	electric	75	525	2%	124	1,278	71,538	n/a	17	0.0009	0.0002	17	0.02	0.06	17
City of Sacramento WSA157	WELL157	electric	50	781	4%	184	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA158	WELL158	electric	50	781	4%	184	1,278	47,692	n/a	11	0.0006	0.0001	11	0.02	0.04	11
City of Sacramento WSA159	WELL159	electric	75	535	3%	126	1,278	71,538	n/a	17	0.0009	0.0002	17	0.02	0.06	17
City of Sacramento WSA164	WELL164	electric	150	1101	5%	259	1,278	143,076	n/a	34	0.0018	0.0004	34	0.05	0.12	34
City of Sacramento WSAX1	WELLX1	electric	150	1400	7%	329	1,278	143,076	n/a	34	0.0018	0.0004	34	0.05	0.12	34
City of Sacramento WSAX2	WELLX2	electric	150	1400	7%	329	1,278	143,076	n/a	34	0.0018	0.0004	34	0.05	0.12	34
			Total	**21,245**	**100%**	**5,000**	**39,623**	**2,041,221**	**0**	**483**	**0.0264**	**0.0056**	**483**	**0.66**	**1.66**	**485**

Legend

	Assumed to be electric (similar to other wells operated by water agency)
	Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Sacramento County Water Agency
Transfer Volume	15,000 acre feet/year
Location	Sacramento County

Table G-17. Sacramento County Water Agency Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Sacramento County WAW 040	W 040	Electric	115	1,160	2%	312	1,463	126,082	n/a	30	0.0016	0.0003	30	0.04	0.10	30
Sacramento County WAW 041	W 041	Electric	65	676	1%	182	1,463	71,349	n/a	17	0.0009	0.0002	17	0.02	0.06	17
Sacramento County WAW 042	W 042	Electric	77	727	1%	196	1,463	83,960	n/a	20	0.0011	0.0002	20	0.03	0.07	20
Sacramento County WAW 043	W 043	Electric	94	918	2%	247	1,463	103,064	n/a	24	0.0013	0.0003	24	0.03	0.08	25
Sacramento County WAW 044	W 044	Electric	73	515	1%	139	1,463	79,808	n/a	19	0.0010	0.0002	19	0.03	0.07	19
Sacramento County WAW 047	W 047	Electric	88	1,030	2%	277	1,463	95,585	n/a	23	0.0012	0.0003	23	0.03	0.08	23
Sacramento County WAW 049	W 049	Electric	92	853	2%	230	1,463	100,474	n/a	24	0.0013	0.0003	24	0.03	0.08	24
Sacramento County WAW 052	W 052	Electric	120	1,192	2%	321	1,463	130,941	n/a	31	0.0017	0.0004	31	0.04	0.11	31
Sacramento County WAW 056	W 056	Electric	200	3,000	5%	808	1,463	218,362	n/a	52	0.0028	0.0006	52	0.07	0.18	52
Sacramento County WAW 061	W 061	Electric	145	1,570	3%	423	1,463	158,061	n/a	37	0.0020	0.0004	37	0.05	0.13	38
Sacramento County WAW 062	W 062	Electric	100	455	1%	123	1,463	109,181	n/a	26	0.0014	0.0003	26	0.04	0.09	26
Sacramento County WAW 063	W 063	Electric	100	1,119	2%	301	1,463	109,181	n/a	26	0.0014	0.0003	26	0.04	0.09	26
Sacramento County WAW 064	W 064	Electric	141	1,205	2%	325	1,463	153,945	n/a	36	0.0020	0.0004	36	0.05	0.13	37
Sacramento County WAW 065	W 065	Electric	57	589	1%	159	1,463	62,670	n/a	15	0.0008	0.0002	15	0.02	0.05	15
Sacramento County WAW 066	W 066	Electric	125	1,700	3%	458	1,463	136,476	n/a	32	0.0018	0.0004	32	0.04	0.11	32
Sacramento County WAW 067	W 067	Electric	135	1,425	3%	384	1,463	147,820	n/a	35	0.0019	0.0004	35	0.05	0.12	35
Sacramento County WAW 068	W 068	Electric	141	1,624	3%	437	1,463	153,836	n/a	36	0.0020	0.0004	36	0.05	0.13	37
Sacramento County WAW 069	W 069	Electric	154	1,663	3%	448	1,463	168,019	n/a	40	0.0022	0.0005	40	0.05	0.14	40
Sacramento County WAW 070	W 070	Electric	200	1,500	3%	404	1,463	218,362	n/a	52	0.0028	0.0006	52	0.07	0.18	52
Sacramento County WAW 073	W 073	Electric	175	2,000	4%	539	1,463	191,067	n/a	45	0.0025	0.0005	45	0.06	0.16	45
Sacramento County WAW 074	W 074	Electric	50	500	1%	135	1,463	54,591	n/a	13	0.0007	0.0001	13	0.02	0.04	13
Sacramento County WAW 076	W 076	Electric	150	1,500	3%	404	1,463	163,772	n/a	39	0.0021	0.0004	39	0.05	0.13	39
Sacramento County WAW 077	W 077	Electric	125	2,000	4%	539	1,463	136,476	n/a	32	0.0018	0.0004	32	0.04	0.11	32
Sacramento County WAW 078	W 078	Electric	125	2,400	4%	647	1,463	136,476	n/a	32	0.0018	0.0004	32	0.04	0.11	32
Sacramento County WAW 087	W 087	Electric	150	1,900	3%	512	1,463	163,772	n/a	39	0.0021	0.0004	39	0.05	0.13	39
Sacramento County WAW 092	W 092	Electric	75	1,160	2%	312	1,463	81,886	n/a	19	0.0011	0.0002	19	0.03	0.07	19
Sacramento County WAW 095	W 095	Electric	200	2,200	4%	593	1,463	218,362	n/a	52	0.0028	0.0006	52	0.07	0.18	52
Sacramento County WAW 096	W 096	Electric	150	1,500	3%	404	1,463	163,772	n/a	39	0.0021	0.0004	39	0.05	0.13	39
Sacramento County WAW 105	W 105	Electric	200	1,500	3%	404	1,463	218,362	n/a	52	0.0028	0.0006	52	0.07	0.18	52
Sacramento County WAW 106	W 106	Electric	200	1,500	3%	404	1,463	218,362	n/a	52	0.0028	0.0006	52	0.07	0.18	52
Sacramento County WAW 109	W 109	Electric	200	2,600	5%	700	1,463	218,362	n/a	52	0.0028	0.0006	52	0.07	0.18	52
Sacramento County WAW 110	W 110	Electric	200	1,500	3%	404	1,463	218,362	n/a	52	0.0028	0.0006	52	0.07	0.18	52
Sacramento County WAW 112	W 112	Electric	100	1,500	3%	404	1,463	109,181	n/a	26	0.0014	0.0003	26	0.04	0.09	26
Sacramento County WAW 114	W 114	Electric	200	1,500	3%	404	1,463	218,362	n/a	52	0.0028	0.0006	52	0.07	0.18	52
Sacramento County WAW 129	W 129	Electric	200	1,500	3%	404	1,463	218,362	n/a	52	0.0028	0.0006	52	0.07	0.18	52
Sacramento County WAW 130	W 130	Electric	200	1,500	3%	404	1,463	218,362	n/a	52	0.0028	0.0006	52	0.07	0.18	52
Sacramento County WAW 122	W 122	Electric	200	1,500	3%	404	1,463	218,362	n/a	52	0.0028	0.0006	52	0.07	0.18	52
Sacramento County WAW 123	W 123	Electric	200	1,500	3%	404	1,463	218,362	n/a	52	0.0028	0.0006	52	0.07	0.18	52
Sacramento County WAW 124	W 124	Electric	200	1,500	3%	404	1,463	218,362	n/a	52	0.0028	0.0006	52	0.07	0.18	52
			Total	**55,681**	**100%**	**15,000**	**57,058**	**6,030,151**	**0**	**1,427**	**0.0779**	**0.0165**	**1,427**	**1.95**	**4.92**	**1,434**

Legend

Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Sacramento Suburban Water District
Transfer Volume	30,000 acre feet/year
Location	Sacramento County

Table G-18. Sacramento Suburban Water District Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(MMBtu/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Sacramento Suburban WD5	5	Electric	110	330	1%	201	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD7	7	Electric	110	180	0%	110	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD9	9	Electric	110	625	1%	381	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD12	12	Electric	110	540	1%	329	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD13	13	Electric	110	820	2%	500	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD14	14	Electric	110	570	1%	348	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD18	18	Electric	110	840	2%	512	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD19	19	Electric	110	950	2%	579	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD22	22	Electric	110	650	1%	396	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD23	23	Electric	110	550	1%	335	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD24	24	Electric	110	590	1%	360	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD25	25	Electric	110	750	2%	457	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD26	26	Electric	110	650	1%	396	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD28	28	Electric	110	585	1%	357	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD30	30	Electric	110	650	1%	396	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD35	35	Electric	110	1000	2%	610	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD37	37	Natural Gas	190	700	1%	427	3,312	n/a	4,405	234	0.004	0.000	234	0.11	0.13	234
Sacramento Suburban WD38	38	Natural Gas	190	500	1%	305	3,312	n/a	4,405	234	0.004	0.000	234	0.11	0.13	234
Sacramento Suburban WD40	40	Natural Gas	190	675	1%	412	3,312	n/a	4,405	234	0.004	0.000	234	0.11	0.13	234
Sacramento Suburban WD41	41	Electric/Natural Gas	190	600	1%	366	3,312	n/a	4,405	234	0.004	0.000	234	0.11	0.13	234
Sacramento Suburban WD43	43	Electric/Natural Gas	190	850	2%	518	3,312	n/a	4,405	234	0.004	0.000	234	0.11	0.13	234
Sacramento Suburban WD45	45	Natural Gas	190	750	2%	457	3,312	n/a	4,405	234	0.004	0.000	234	0.11	0.13	234
Sacramento Suburban WD47	47	Electric/Natural Gas	190	885	2%	540	3,312	n/a	4,405	234	0.004	0.000	234	0.11	0.13	234
Sacramento Suburban WD50	50	Electric	110	500	1%	305	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD51	51	Electric	110	285	1%	174	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD60	60	Electric	110	600	1%	366	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD65	65	Electric	110	1250	3%	762	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD66	66	Electric	110	1350	3%	823	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD69	69	Electric	110	450	1%	274	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD70	70	Electric	110	350	1%	213	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD71	71	Electric	110	2675	5%	1,631	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD72	72	Electric	110	1850	4%	1,128	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD73	73	Electric	110	3500	7%	2,134	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD74	74	Electric	110	2700	5%	1,647	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD75	75	Electric	110	1150	2%	701	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD76	76	Electric	110	250	1%	152	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD77	77	Electric	110	400	1%	244	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD20A	20A	Electric	110	1100	2%	671	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD2A	2A	Electric	110	995	2%	607	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD32A	32A	Electric	110	1905	4%	1,162	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD33A	33A	Electric	110	2675	5%	1,631	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD3A	3A	Electric	110	370	1%	226	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD40A	40A	Electric	110	2525	5%	1,540	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD46R	46R	Electric/Natural Gas	190	800	2%	488	3,312	n/a	4,405	234	0.004	0.000	234	0.11	0.13	234
Sacramento Suburban WD4B	4B	Electric	110	2675	5%	1,631	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD55A	55A	Electric	110	2000	4%	1,220	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
Sacramento Suburban WD68R	68R	Electric	110	1600	3%	976	3,312	271,867	n/a	64	0.004	0.001	64	0.09	0.22	65
			Total	**49,195**	**100%**	**30,000**	**155,656**	**10,602,801**	**35,238**	**4,379**	**0.1723**	**0.0325**	**4,379**	**4.31**	**9.69**	**4,393**

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Natural Gas Engine Fuel Consumption

Estimated BSFC =	7,000	Btu/bhp-hr
Higher Heating Vali	1,020	Btu/scf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Butte Water District	
Transfer Volume	5,500	acre feet/year
Location	Butte	County
	Sutter	County

Table G-19. Butte Water District Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Butte Water District#1	#1	Electric	300	4,000	49%	2,683	3,643	815,517	n/a	164	0.0105	0.0022	164	0.26	0.66	165
Butte Water District#2	#2	Electric	350	4,200	51%	2,817	3,643	951,437	n/a	192	0.0123	0.0026	192	0.31	0.78	193
			Total	**8,200**	**100%**	**5,500**	**7,285**	**1,766,954**	**0**	**356**	**0.0228**	**0.0048**	**356**	**0.57**	**1.44**	**358**

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Garden Highway Mutual Water Company
Transfer Volume	14,000 acre feet/year
Location	Sutter County

Table G-20. Garden Highway Mutual Water Company Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Garden Highway MWC4	#4	Electric	110	2,300	12%	1,651	3,899	320,073	n/a	65	0.0041	0.0009	65	0.10	0.26	65
Garden Highway MWC17	#17	Electric	110	3,100	16%	2,226	3,899	320,073	n/a	65	0.0041	0.0009	65	0.10	0.26	65
Garden Highway MWC19	#19	Electric	110	2,800	14%	2,010	3,899	320,073	n/a	65	0.0041	0.0009	65	0.10	0.26	65
Garden Highway MWC22	#22	Electric	110	2,700	14%	1,938	3,899	320,073	n/a	65	0.0041	0.0009	65	0.10	0.26	65
Garden Highway MWC23	#23	Electric	110	2,200	11%	1,579	3,899	320,073	n/a	65	0.0041	0.0009	65	0.10	0.26	65
Garden Highway MWC24	#24	Electric	110	3,200	16%	2,297	3,899	320,073	n/a	65	0.0041	0.0009	65	0.10	0.26	65
Garden Highway MWC25	#25	Electric	110	3,200	16%	2,297	3,899	320,073	n/a	65	0.0041	0.0009	65	0.10	0.26	65
			Total	**19,500**	**100%**	**14,000**	**27,294**	**2,240,511**	**0**	**452**	**0.0290**	**0.0061**	**452**	**0.72**	**1.83**	**454**

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Gilsizer Slough Ranch	
Transfer Volume	3,900	acre feet/year
Location	Sutter County	

Table G-21. Gilsizer Slough Ranch Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating (hp)	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/year)	Operation (hours/year)	Operation (kWh/yr)	Fuel Consumption (gal/yr)	GHG Emissions (metric tons per year) CO2	CH4	N2O	(metric tons CO2e per year) CO2	CH4	N2O	Total
Gilsizer #1	Gilsizer #1	Diesel	162	2,016	33%	1,300	3,502	n/a	31,828	325	0.0132	0.0026	325	0.33	0.79	326
Gilsizer #2	Gilsizer #2	Electric	110	2,016	33%	1,300	3,502	287,481	n/a	58	0.0037	0.0008	58	0.09	0.23	58
Gilsizer #3	Gilsizer #3	Electric	110	2,016	33%	1,300	3,502	287,481	n/a	58	0.0037	0.0008	58	0.09	0.23	58
			Total	**6,048**	**100%**	**3,900**	**10,506**	**574,961**	**31,828**	**441**	**0.0206**	**0.0042**	**441**	**0.52**	**1.25**	**443**

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Goose Club Farms and Teichert Aggregates
Transfer Volume	10,000 acre feet/year
Location	Sutter County

Table G-22. Goose Club Farms and Teichert Aggregates Criteria Pollutant Emissions

										GHG Emissions						
			Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	(metric tons per year)			(metric tons CO2e per year)			
Description	Well	Fuel Type	(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Goose Club1	1	Electric	125	3,000	8%	769	1,393	129,900	n/a	26	0.0017	0.0004	26	0.04	0.11	26
Goose Club2	2	Electric	125	3,000	8%	769	1,393	129,900	n/a	26	0.0017	0.0004	26	0.04	0.11	26
Goose Club3	3	Electric	125	3,000	8%	769	1,393	129,900	n/a	26	0.0017	0.0004	26	0.04	0.11	26
Goose Club4	4	Electric	125	3,000	8%	769	1,393	129,900	n/a	26	0.0017	0.0004	26	0.04	0.11	26
Goose Club5	5	Electric	125	3,000	8%	769	1,393	129,900	n/a	26	0.0017	0.0004	26	0.04	0.11	26
Goose Club6	6	Electric	125	3,000	8%	769	1,393	129,900	n/a	26	0.0017	0.0004	26	0.04	0.11	26
Goose Club7	7	Electric	125	3,000	8%	769	1,393	129,900	n/a	26	0.0017	0.0004	26	0.04	0.11	26
Goose Club8	8	Electric	125	3,000	8%	769	1,393	129,900	n/a	26	0.0017	0.0004	26	0.04	0.11	26
Goose Club9	9	Electric	125	3,000	8%	769	1,393	129,900	n/a	26	0.0017	0.0004	26	0.04	0.11	26
Goose Club10	10	Electric	125	3,000	8%	769	1,393	129,900	n/a	26	0.0017	0.0004	26	0.04	0.11	26
Goose Club11	11	Electric	125	3,000	8%	769	1,393	129,900	n/a	26	0.0017	0.0004	26	0.04	0.11	26
Goose Club12	12	Electric	125	3,000	8%	769	1,393	129,900	n/a	26	0.0017	0.0004	26	0.04	0.11	26
Goose Club13	13	Electric	125	3,000	8%	769	1,393	129,900	n/a	26	0.0017	0.0004	26	0.04	0.11	26
			Total	**39,000**	**100%**	**10,000**	**18,103**	**1,688,697**	**0**	**341**	**0.0218**	**0.0046**	**341**	**0.55**	**1.38**	**342**

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Tule Basin Farms	
Transfer Volume	7,320	acre feet/year
Location	Sutter	County

Table G-23. Tule Basin Farms Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(MMBtu/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Tule Basin1	1	Electric	125	3,050	27%	1,941	3,457	322,468	n/a	65	0.004	0.001	65	0.10	0.26	65
Tule Basin2	2	Natural Gas	190	3,600	31%	2,291	3,457	n/a	4,598	244	0.005	0.000	244	0.11	0.14	244
Tule Basin3	3	Electric	125	4,850	42%	3,087	3,457	322,468	n/a	65	0.004	0.001	65	0.10	0.26	65
			Total	**11,500**	**100%**	**7,320**	**10,371**	**644,935**	**4,598**	**374**	**0.0129**	**0.0022**	**374**	**0.32**	**0.66**	**375**

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Natural Gas Engine Fuel Consumption

Estimated BSFC =	7,000	Btu/bhp-hr
Higher Heating Value	1,020	Btu/scf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Reclamation District 2068	
Transfer Volume	4,500	acre feet/year
Location	Solano	County
	Yolo	County

Table G-24. Reclamation District 2068 Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating (hp)	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/year)	Operation (hours/year)	Operation (kWh/yr)	Fuel Consumption (gal/yr)	GHG Emissions (metric tons per year) CO2	CH4	N2O	(metric tons CO2e per year) CO2	CH4	N2O	Total
RD-2068TP-1	TP-1	Electric	75	1,500	25%	1,125	4,073	227,974	n/a	46	0.0029	0.0006	46	0.07	0.19	46
RD-2068GW-2	GW-2	Electric	75	1,500	25%	1,125	4,073	227,974	n/a	46	0.0029	0.0006	46	0.07	0.19	46
RD-2068GW-3	GW-3	Electric	75	1,500	25%	1,125	4,073	227,974	n/a	46	0.0029	0.0006	46	0.07	0.19	46
RD-2068GW-4	GW-4	Electric	75	1,500	25%	1,125	4,073	227,974	n/a	46	0.0029	0.0006	46	0.07	0.19	46
			Total	**6,000**	**100%**	**4,500**	**16,293**	**911,896**	**0**	**184**	**0.0118**	**0.0025**	**184**	**0.29**	**0.74**	**185**

Legend

Engine power rating not provided; assumed to be equal to maximum horsepower for all engines operating at the water agency with the same fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution GHG Emissions

Agency	Pope Ranch	
Transfer Volume	2,800	acre feet/year
Location	Yolo	County

Table G-25. Pope Ranch Criteria Pollutant Emissions

Description	Well	Fuel Type	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions (metric tons per year)			GHG Emissions (metric tons CO2e per year)			
			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Pope RanchX1	X1	Electric	110	2,117	50%	1,400	3,591	294,824	n/a	59	0.0038	0.0008	59	0.10	0.24	60
Pope RanchX2	X2	Electric	110	2,117	50%	1,400	3,591	294,824	n/a	59	0.0038	0.0008	59	0.10	0.24	60
			Total	**4,234**	**100%**	**2,800**	**7,183**	**589,648**	**0**	**119**	**0.0076**	**0.0016**	**119**	**0.19**	**0.48**	**120**

Legend

Engine power rating not provided; assumed to be equal to average horsepower for all engines operating in the study area for fuel type

Conversion Factors

1 lb =	453.6	g
1 tonne =	1,000	kg
1 tonne =	1,000,000	g
1 MWh =	1,000	kWh
1 GWh =	1,000,000	kWh
1 kW =	1.34	hp
1 hour =	60	minutes
1 acre-foot =	325,851	gallons

http://www.water.ca.gov/pubs/dwrnews/california_water_facts_card/waterfactscard.pdf

Global Warming Potential

CO2	1
CH4	25
N2O	298

Engine Size Summary

Table G-26. Summary of Average Engine Horsepower by Fuel Type

Average of HP	Fuel Type			
Agency	**Diesel**	**Electric**	**Natural Gas**	**Grand Total**
Anderson-Cottonwood Irrigation District		125		125
Butte Water District		325		325
City of Sacramento		60		60
Conaway Preservation Group	227	138		147
Cordua Irrigation District		82		82
Cranmore Farms		125		125
Eastside Mutual Water Company	215			215
Goose Club Farms and Teichert Aggregates		125		125
Pelger Mutual Water Company	173			173
Pleasant Grove-Verona Mutual Water Company	129	118		124
Reclamation District 1004	191	76		145
Reclamation District 108		200		200
Reclamation District 2068		75		75
Sacramento County Water Agency		116		116
Sycamore Mutual Water Company		117		117
Te Velde Revocable Family Trust		110		110
Tule Basin Farms		125	190	147
Grand Total	**162**	**110**	**190**	**117**

Table G-27. Summary of Maximum Engine Horsepower by Fuel Type

Max of HP	Fuel Type			
Agency	**Diesel**	**Electric**	**Natural Gas**	**Grand Total**
Anderson-Cottonwood Irrigation District		200		200
Butte Water District		350		350
City of Sacramento		150		150
Conaway Preservation Group	227	250		250
Cordua Irrigation District		125		125
Cranmore Farms		125		125
Eastside Mutual Water Company	215			215
Goose Club Farms and Teichert Aggregates		125		125
Pelger Mutual Water Company	173			173
Pleasant Grove-Verona Mutual Water Company	250	250		250
Reclamation District 1004	225	125		225
Reclamation District 108		250		250
Reclamation District 2068		75		75
Sacramento County Water Agency		200		200
Sycamore Mutual Water Company		125		125
Te Velde Revocable Family Trust		143		143
Tule Basin Farms		125	190	190
Grand Total	**250**	**350**	**190**	**350**

Table G-28. Summary of Minimum Engine Horsepower by Fuel Type

Min of HP	Fuel Type			
Agency	**Diesel**	**Electric**	**Natural Gas**	**Grand Total**
Anderson-Cottonwood Irrigation District		50		50
Butte Water District		300		300
City of Sacramento		30		30
Conaway Preservation Group	227	75		75
Cordua Irrigation District		50		50
Cranmore Farms		125		125
Eastside Mutual Water Company	215			215
Goose Club Farms and Teichert Aggregates		125		125
Pelger Mutual Water Company	173			173
Pleasant Grove-Verona Mutual Water Company	62	30		30
Reclamation District 1004	150	40		40
Reclamation District 108		100		100
Reclamation District 2068		75		75
Sacramento County Water Agency		50		50
Sycamore Mutual Water Company		75		75
Te Velde Revocable Family Trust		52		52
Tule Basin Farms		125	190	125
Grand Total	**62**	**30**	**190**	**30**

GHG Emission Factors

Table G-29. GHG Emission Factors for Electric Pumps

County	Utility Company	Emission Factors		
		CO2 (lbs/MWh)	CH4 (lbs/GWh)	N2O (lbs/GWh)
Colusa	Pacific Gas & Electric	444.62	28.49	6.03
Glenn	Pacific Gas & Electric	444.62	28.49	6.03
Merced	Pacific Gas & Electric	444.62	28.49	6.03
Placer	Pacific Gas & Electric	444.62	28.49	6.03
Sacramento	Sacramento Municipal Utility District	521.73	28.49	6.03
San Joaquin	Pacific Gas & Electric	444.62	28.49	6.03
Shasta	Pacific Gas & Electric	444.62	28.49	6.03
Solano	Pacific Gas & Electric	444.62	28.49	6.03
Sutter	Pacific Gas & Electric	444.62	28.49	6.03
Yolo	Pacific Gas & Electric	444.62	28.49	6.03
Yuba	Pacific Gas & Electric	444.62	28.49	6.03

Table G-30. Utility-Specific CO2 Emission Factors

2009 Emission Rates		
Utility	Factor Type	Emission Factor (lbs CO_2/MWh)
Modesto Irrigation District	Retail Power	1,036.17
	Special Power	0
	Wholesale Power	2,048.09
Pacific Gas & Electric	System Average	575.38
Bonneville Power Authority	System Average	93.17
2010 Emission Rates		
Utility	Factor Type	Emission Factor (lbs CO_2/MWh)
Sacramento Municipal Utility District	Retail Power	526.47
	Special Power	0.00
	Wholesale Power	828.58
Newmont Nevada Energy Investment	Wholesale Power	2,055.79
Pacific Gas & Electric	System Average	444.64
City of Vernon, Light and Power	System Average	775.83
Modesto Irrigation District	Retail Power	942.99
	Special Power	0.00
	Wholesale Power	2,026.12
Northern States Power Company (Xcel Energy)	System Average	1,047.20
Public Service Company of Colorado (Xcel Energy)	System Average	1,675.51
Southwestern Public Service Company (Xcel Energy)	System Average	1,552.05
Seattle City Light	Retail Power	45.57
	Special Power	0.00
	Wholesale Power	537.64
Bonneville Power Authority	System Average	134.70

2011 Emission Rates		
Utility	**Factor Type**	**Emission Factor (lbs CO_2/MWh)**
Pacific Gas & Electric	System Average	392.87
Bonneville Power Authority	System Average	47.86
Seattle City Light	Retail Power	13.77
	Special Power	0.00
	Wholesale Power	218.75
Sacramento Municipal Utility District	Retail Power	429.29
	Special Power	0.00
	Wholesale Power	795.14
City of Vernon, Light and Power	System Average	731.49
Northern States Power Company (Xcel Energy)	System Average	1,071.45
Public Service Company of Colorado (Xcel Energy)	System Average	1,618.19
Southwestern Public Service Company (Xcel Energy)	System Average	1,472.69
2012 Emission Rates		
Utility	**Factor Type**	**Emission Factor (lbs CO_2/MWh)**
City of Vernon, Light and Power	System Average	765.97
Pacific Gas & Electric	System Average	444.62
Sacramento Municipal Utility District	Retail Power	521.73
	Special Power	0.00
	Wholesale Power	799.77
Seattle City Light	Retail Power	25.62
	Special Power	0.00
	Wholesale Power	362.85
Metropolitan Water District of Southern California	Wholesale Power	658.73
	Self-consumed Power	157.87

Source:

The Climate Registry. 2014. Utility-Specific Emission Factors. Accessed on: May 12, 2014. Available at: http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/.

Table G-31. eGRID GHG Emission Factors

eGRID Subregion	eGRID Subregion Name	2010 Emission Rates		
		(lbs CO2/MWh)	(lbs CH4/GWh)	(lbs N2O/GWh)
AKGD	ASCC Alaska Grid	1,256.87	26.08	7.18
AKMS	ASCC Miscellaneous	448.57	18.74	3.68
AZNM	WECC Southwest	1,177.61	19.21	15.72
CAMX	WECC California	610.82	28.49	6.03
ERCT	ERCOT All	1,218.17	16.85	14.07
FRCC	FRCC All	1,196.71	38.91	13.75
HIMS	HICC Miscellaneous	1,330.16	73.98	13.88
HIOA	HICC Oahu	1,621.86	99.3	22.41
MROE	MRO East	1,610.80	24.29	27.52
MROW	MRO West	1,536.36	28.53	26.29
NEWE	NPCC New England	722.07	71.76	12.98
NWPP	WECC Northwest	842.58	16.05	13.07
NYCW	NPCC NYC/Westchester	622.42	23.81	2.8
NYLI	NPCC Long Island	1,336.11	81.49	10.28
NYUP	NPCC Upstate NY	545.79	16.3	7.24
RFCE	RFC East	1,001.72	27.07	15.33
RFCM	RFC Michigan	1,629.38	30.46	26.84
RFCW	RFC West	1,503.47	18.2	24.75
RMPA	WECC Rockies	1,896.74	22.66	29.21
SPNO	SPP North	1,799.45	20.81	28.62
SPSO	SPP South	1,580.60	23.2	20.85
SRMV	SERC Mississippi Valley	1,029.82	20.66	10.76
SRMW	SERC Midwest	1,810.83	20.48	29.57
SRSO	SERC South	1,354.09	22.82	20.89
SRTV	SERC Tennessee Valley	*1,389.20*	17.7	22.41
SRVC	SERC Virginia/Carolina	1,073.65	21.69	17.64

Source: U.S. Environmental Protection Agency. 2014. eGRID 9th edition Version 1.0 Year 2010 GHG Annual Output Emission Rates. Accessed on: May 12, 2014. Available at: http://www.epa.gov/cleanenergy/documents/egridzips/eGRID_9th_edition_V1-0_year_2010_GHG_Rates.pdf.

Table G-32. Diesel Emission Factors

Pollutant	Emission Factor	Unit	Emission Factor Description
CO2	10.21	kg/gallon	Table 12.1, Distillate Fuel Oil No. 2
CH4	0.003	kg/MMBtu	Table 12.9, Petroleum Products, Industrial
N2O	0.0006	kg/MMBtu	Table 12.9, Petroleum Products, Industrial
Heat Content	0.138	MMBtu/gallon	Table 12.1, Distillate Fuel Oil No. 2

Source: The Climate Registry. 2014. 2014 Climate Registry Default Emission Factors with U.S. EPA 11/29/2013 Update (Released: March 14, 2014). Accessed on: May 12, 2014. Available at: http://www.theclimateregistry.org/downloads/2014/03/2014-TCR-Default-EFs-with-EPA-11.29.2013-update.pdf

Table G-33. Natural Gas Emission Factors

Pollutant	Emission Factor	Unit	Emission Factor Description
CO2	53.06	kg/MMBtu	Table 12.1, US Weighted Average
CH4	0.001	kg/MMBtu	Table 12.9, Natural Gas, Industrial
N2O	0.0001	kg/MMBtu	Table 12.9, Natural Gas, Industrial
Heat Content	1,026	Btu/scf	Table 12.1, US Weighted Average

Source: The Climate Registry. 2014. 2014 Climate Registry Default Emission Factors with U.S. EPA 11/29/2013 Update (Released: March 14, 2014). Accessed on: May 12, 2014. Available at: http://www.theclimateregistry.org/downloads/2014/03/2014-TCR-Default-EFs-with-EPA-11.29.2013-update.pdf

Table G-34. Reduced Exhaust Emissions from Cropland Idling

Water Agency	Groundwater Substitution	Cropland Idling/ Crop	GW Pumping Equivalent	Annual Emissions (MT/year)			Annual Emissions (MTCO2e/year)			
	(acre-feet/year)	(acre-feet/year)	(acre-feet/year)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Anderson-Cottonwood Irrigation District	5,226	0	0	--	--	--	--	--	--	--
Browns Valley Irrigation District	0	0	0	--	--	--	--	--	--	--
Butte Water District	5,500	11,500	2,706	205	0.009	0.002	205	0.24	0.58	205
City of Sacramento	5,000	0	0	--	--	--	--	--	--	--
Conaway Preservation Group	35,000	21,349	5,023	380	0.018	0.004	380	0.44	1.07	381
Cordua Irrigation District	12,000	0	0	--	--	--	--	--	--	--
Cranmore Farms	8,000	2,500	588	44	0.002	0.000	44	0.05	0.13	45
Eastside Mutual Water Company	2,230	0	0	--	--	--	--	--	--	--
Garden Highway Mutual Water Company	14,000	0	0	--	--	--	--	--	--	--
Gilsizer Slough Ranch	3,900	0	0	--	--	--	--	--	--	--
Glenn-Colusa Irrigation District	25,000	66,000	15,529	1,174	0.055	0.011	1,174	1.36	3.31	1,178
Goose Club Farms and Teichert Aggregates	10,000	10,000	2,353	178	0.008	0.002	178	0.21	0.50	179
Merced Irrigation District	0	0	0	--	--	--	--	--	--	--
Natomas Central Mutual Water Company	30,000	0	0	--	--	--	--	--	--	--
Pelger Mutual Water Company	3,750	2,538	597	45	0.002	0.000	45	0.05	0.13	45
Placer County Water Agency	0	0	0	--	--	--	--	--	--	--
Pleasant Grove-Verona Mutual Water Company	18,000	9,000	2,118	160	0.007	0.002	160	0.19	0.45	161
Pope Ranch	2,800	0	0	--	--	--	--	--	--	--
Reclamation District 1004	7,175	10,000	2,353	178	0.008	0.002	178	0.21	0.50	179
Reclamation District 108	15,000	20,000	4,706	356	0.017	0.003	356	0.41	1.00	357
Reclamation District 2068	4,500	7,500	1,765	133	0.006	0.001	133	0.15	0.38	134
River Garden Farms	9,000	0	0	--	--	--	--	--	--	--
Sacramento County Water Agency	15,000	0	0	--	--	--	--	--	--	--
Sacramento Suburban Water District	30,000	0	0	--	--	--	--	--	--	--
South Sutter Water District	0	0	0	--	--	--	--	--	--	--
Sycamore Mutual Water Company	15,000	10,000	2,353	178	0.008	0.002	178	0.21	0.50	179
Te Velde Revocable Family Trust	7,094	6,975	1,641	124	0.006	0.001	124	0.14	0.35	125
Tule Basin Farms	7,320	0	0	--	--	--	--	--	--	--
Total	**290,495**	**177,362**	**41,732**	**3,154**	**0.146**	**0.030**	**3,154**	**3.66**	**8.91**	**3,167**

Notes:

Pelger Mutual Water Company used to estimate emissions for other water agencies.

Engine power rating equal to 250 hp for Pelger Mutual Water Company engines.

The Byron Buck memo is based on diesel-fueled engines with sizes ranging from 121 to 225 hp; all engines are noncertified (Tier 0).

Pelger Mutual Water Company engines are therefore determined to be a sufficient proxy to estimate the difference in emissions between groundwater substitution and cropland idling.

1 acre-foot of groundwater pumped = 4.25 acre-feet produced by fallowing

Source: Byron Buck & Associates. 2009. "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping."

Appendix H

Biological Resources Regulatory Setting

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Appendix H
Biological Resources Regulatory Setting

The following section describes laws, rules, regulations and policies that apply to the natural communities, common plants and wildlife, fisheries, and special-status species that occur within the area of analysis.

H.1 Federal

H.1.1 Endangered Species Act (ESA)

The Federal ESA defines "endangered" species as those in danger of extinction throughout all or a significant portion of their range. A "threatened" species is any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Additional special-status species include "candidate" species and "species of concern." Candidate species are those for which the U.S. Fish and Wildlife Service (USFWS), or National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) if applicable, has enough information on file to propose listing as endangered or threatened. A species that has been "delisted" is one whose population has met its recovery goal target and is no longer found to be in jeopardy of extinction. These agencies also may designate Critical Habitat for listed species.

Section 4 of the Federal ESA prohibits "take" of federally listed species without a permit that specifically authorizes that take. Take may be authorized through either a Section 10a1(a) permit for directed take of the species for scientific research, or through an incidental take permit, which allows an action to take of the species (under specifically prescribed conditions) where such take is incidental to the implementation of an otherwise lawful activity. Incidental take of a federally listed species may be addressed for a proposed project in one of two ways depending on whether the or not the project has a federal nexus. A federal nexus occurs when a project is authorized or funded by a federal agency. Projects without a federal nexus may address potential adverse impacts to species protected under Federal ESA Section 10, or (2) a federal lead agency regulates a proposed project in accordance with Federal ESA Section 7. As this project has a federal nexus, the Section 7 process will be followed. Section 7 defines a process for the federal lead agency to consult with the responsible federal resource agency (the USFWS or NOAA Fisheries), to determine whether proposed long-term water transfers are likely to adversely affect species that are listed or proposed for listing. The Section 7 process typically requires the preparation of a biological assessment (BA) by the federal lead

agency followed by the preparation of biological opinion (BO) by the responsible federal resource agency.

H.1.2 Fish and Wildlife Coordination Act (FWCA)

The FWCA (16 U.S. Code [USC] 661 et seq.) requires Federal agencies to consult with USFWS, or, in some instances, with NOAA Fisheries and with State fish and wildlife resource agencies before undertaking or approving water projects that control or modify surface water. The purpose of this consultation is to ensure that wildlife concerns receive equal consideration water resource development projects and are coordinated with the features of these projects. The consultation is intended to promote the conservation of fish and wildlife resources by preventing their loss or damage and to provide for the development and improvement of fish and wildlife resources in connection with water projects. Federal agencies undertaking water projects are required to fully consider recommendations made by USFWS, NOAA Fisheries, and State fish and wildlife resource agencies in project reports and to include measures to reduce impacts on fish and wildlife in project plans.

The 1988 amendment to the Fish and Wildlife Conservation Act mandates USFWS to identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA of 1973. In 2008, USFWS issued the most recent version of the National list of *Bird Species of Conservation Concern.*

H.1.3 Magnuson-Stevens Fisheries Act of 2006

The Amended Magnuson-Stevens Fishery Conservation and Management Act, also known as the Sustainable Fisheries Act (Public Law 104-297) is the primary law governing the marine fisheries of the United States. The law establishes requirements to provide for the sustainable management of these fisheries and to promote the protection of essential fish habitat. This Act requires all Federal agencies to consult with the Secretary of Commerce on activities, or proposed activities, authorized, funded, or undertaken by that agency that may adversely affect Essential Fish Habitat. The Essential Fish Habitat provisions of the Sustainable Fisheries Act are designed to protect fisheries habitat from being lost due to disturbance and degradation.

H.1.4 Migratory Bird Treaty Act (MBTA)

The MBTA domestically implements a series of international treaties that provide for migratory bird protection. The MBTA authorizes the Secretary of the Interior to regulate the taking of migratory birds. The act further provides that it is unlawful, except as permitted by regulations, “to pursue, take, or kill any migratory bird, or any part, nest or egg of any such bird…” (16 USC 703). This prohibition includes both direct and indirect acts, although harassment and habitat modification are not included unless they result in direct loss of birds, nests, or eggs. The current list of species protected by the MBTA can be found in the March 1, 2010 Federal Register (75 FR 9281). This list comprises several

hundred species, including essentially all native birds. Permits for take of nongame migratory birds can be issued only for specific activities, such as scientific collecting, rehabilitation, propagation, education, taxidermy, and protection of human health and safety and of personal property. USFWS publishes a list of birds of conservation concern (BCC) to identify migratory nongame birds that are likely to become candidates for listing under ESA without additional conservation actions. The BCC list is intended to stimulate coordinated and collaborative conservation efforts among federal, state, tribal, and private parties.

H.1.5 Executive Order 11990 (Protection of Wetlands)

Executive Order 11990 (Protection of Wetlands) requires Federal agencies to take actions to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands when undertaking Federal activities and programs. Any agency considering a proposal that might affect wetlands must evaluate factors affecting wetland quality and survival. These factors should include the proposal's effects on the public health, safety, and welfare due to modifications in water supply and water quality; maintenance of natural ecosystems and conservation of flora and fauna; and other recreational, scientific, and cultural uses.

H.2 State

H.2.1 California Endangered Species Act (CESA)

CESA (California Fish and Game Code Sections 2050–2116) was implemented in 1984 to prohibit the take of species that are listed as endangered and or threatened. CESA defines "endangered" species as those whose continued existence in California is jeopardized. State-listed "threatened" species are those not presently threatened with extinction, but which may become endangered if their environments change or deteriorate. Section 86 of the California Department of Fish and Game Code defines take as to "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." California Department of Fish and Wildlife (CDFW) administers CESA and authorizes incidental take through either California Fish and Game Code Section 2080.1 (consistency determination) or Section 2081 (Incidental Take Permit).

H.2.2 Fully Protected Species

Sections 3511, 3513, 4700, and 5050 of the California Fish and Game Code pertain to fully protected wildlife species (birds in Sections 3511 and 3513, mammals in Section 4700, and reptiles and amphibians in Section 5050) and strictly prohibit the take of these species. CDFW cannot issue a take permit for fully protected species, except under narrow conditions for scientific research or the protection of livestock, or if a Natural Community Conservation Plan (NCCP) has been adopted. Specifically, Section 3513 prohibits any take or

possession of birds designated by the MBTA as migratory nongame birds except as allowed by federal rules and regulations pursuant to the MBTA.

H.2.3 Protection of Birds and Raptors

Section 3503 of the Fish and Game Code prohibits the killing of birds and/or the destruction of bird nests. Section 3503.5 prohibits the killing of raptor species and/or the destruction of raptor nests. Typical violations include destruction of active bird and raptor nests as a result of tree removal, and failure of nesting attempts (loss of eggs and/or young) as a result of disturbance of nesting pairs caused by nearby human activity.

H.2.4 California Native Plant Protection Act (CNPPA)

The CNPPA of 1977 prohibits importation of rare and endangered plants into California, take of rare and endangered plants, or sale of rare and endangered plants. CESA defers to the CNPPA, which ensures that state-listed plant species are protected when state agencies are involved in projects subject to California Environmental Quality Act.

H.2.5 Natural Community Conservation Planning Act (NCCPA)

The NCCPA, California Fish and Game Code, Section 2800, et seq., was enacted to form a basis for broad-based planning to provide for effective protection and conservation of the State's wildlife heritage, while continuing to allow appropriate development and growth. The purpose of natural community conservation planning is to sustain and restore those species and their habitat identified by CDFW that are necessary to maintain the continued viability of biological communities impacted by human changes to the landscape. A NCCP identifies and provides for those measures necessary to conserve and manage natural biological diversity within the plan area while allowing compatible use of the land. CDFW may authorize the take of any identified species, including listed and non-listed species, pursuant to Section 2835 of the NCCPA, if the conservation and management of such species is provided for in an NCCP approved by CDFW. NCCPs in the planning area are described in greater detail in Section 3.6.1.2.5 Regional/Local Requirements. The proposed water transfers occurring in NCCP planning areas will not require separate incidental take permits pursuant to CESA for covered species if the project adheres to the requirements of the relevant plans.

H.2.6 Requirements of the 1995 Bay Delta Plan Water Quality Control Plan (1995 Delta WQCP) and Decision 1641

The State Water Resources Control Board (SWRCB) adopted its WQCP for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary in May 1995 and incorporated several elements of U.S. Environmental Protection Agency (USEPA), NOAA Fisheries, and USFWS regulatory objectives for water salinity and endangered species protection. The WQCP identifies the beneficial uses of the Bay-Delta that are to be protected and includes flow and water quality objectives that are intended to protect the beneficial uses. The plan also includes an implementation program for achieving the water quality objectives.

Under the Clean Water Act, the water quality standards comprise the uses and the quality objectives established to protect them.

Features of the current WQCP affect the proposed water transfers because they require certain Delta outflows and regulate actions that may be used to protect fish and benefit the environment.

H.3 State and Federal Laws and Regulations Governing Water Transfers and Water Acquisitions

H.3.1 The Water Code

Both State and Federal laws contain provisions that authorize, acknowledge, or support water transfers. The Water Code protects legal users of water and fish and wildlife during water transfers through the "no injury rule," analyses of impacts to fish and wildlife, evaluation of third-party impacts, and the 1707 process.

Water Code Sections 1435, 1725, and 1736 require that the SWRCB make a finding that certain proposed transfers not result in unreasonable effects on fish and wildlife or other instream beneficial uses. These Code Sections apply to specific types of water transfers (urgent, temporary, and long-term transfers) related to post-1914 water rights. Pre-1914 water rights are not subject to the permit system, although a change in use for instream flow may be permitted under Section 1707 on petition to the SWRCB. The proposed water transfers were conceived in compliance with these codes.

In the context of the proposed water transfers "third parties" are any persons and resources other than the entities transferring or receiving water. Although the Water Code does not define "third party impacts," they traditionally include impacts related to downstream water rights; adjacent groundwater users; fish and wildlife; and recreation, economic, and social impacts. Most third-party impacts are evaluated under Water Code Sections that protect prior rights and fish and wildlife as discussed above. However, Water Code Sections 386 and 1810 require evaluation of other third-party impacts for some specific transfers and prohibit such transfers from affecting the overall economy of the area or county from which the water is being transferred. Water Code Section 1810 states that transferors can utilize public water conveyance facilities as long as "this use of a water conveyance facility is to be made without injuring any legal user of water and without unreasonably affecting fish, wildlife, or other instream beneficial uses and without unreasonably affecting the overall economy or the environment of the county from which the water is being transferred."

Section 1707 of the Water Code allows water rights holders, including riparian rights holders, to dedicate their rights to instream uses "for the purpose of preserving or enhancing wetlands, fish and wildlife resources, or recreation in,

or on, the water." These transfers, from a consumptive use to a non-consumptive use with an identified need, may be temporary or permanent. The transfer must meet the following requirements for the SWRCB to consider approving the change in use:

- Will not increase the amount of water the person is entitled to use;
- Will not unreasonably affect any legal user of water; and
- Otherwise meets the requirements of Division 2 of the Water Code.

The petitioner can request that the water subject to transfer approval be in addition to water required for "Federal, State, or local regulatory requirements governing water quantity, water quality, instream flows, fish and wildlife, wetlands, recreation and other instream beneficial uses." If the petitioner does not submit this request to the SWRCB, then the water shall be used to meet any of the above requirements.

H.4 Other Pertinent Programs, Documents, Laws, and Agreements

Potential biological effects of water transfers in the project area have been previously addressed in documents.

H.4.1 Central Valley Project Improvement Act (CVPIA)

The CVPIA is a Federal statute passed in 1992 with the following purposes:

> *"To protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California; To address impacts of the Central Valley Project on fish, wildlife and associated habitats; To improve the operational flexibility of the Central Valley Project; To increase water-related benefits provided by the Central Valley Project to the State of California through expanded use of voluntary water transfers and improved water conservation; To contribute to the State of California's interim and long-term efforts to protect the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; To achieve a reasonable balance among competing demands for use of Central Valley Project water, including the requirements of fish and wildlife, agricultural, municipal and industrial and power contractors."*

The CVPIA changed the relative priorities of the various project purposes of the Central Valley Project (CVP) by making fish and wildlife protection, as a project purpose, equal to water supply for agricultural and urban uses.

CVPIA Section 3406(b)(2) (CVPIA[b][2]) authorized and directed the Secretary to dedicate and manage 800,000 acre-feet (AF) of CVP yield annually for the primary purpose of implementing the fish, wildlife, and habitat restoration purposes and measures authorized in CVPIA, to assist the State of California in its efforts to protect the waters of the Bay-Delta Estuary, and to help meet obligations legally imposed on the CVP under State or Federal law following the date of enactment of the CVPIA. This dedicated 800,000 AF of water, known as (b)(2) water, was included as a component of the CALFED Programmatic Environmental Impact Statement/Environmental Impact Report (PEIS/EIR) existing regulatory baseline for fishery protection conditions for environmental and fisheries protection measures.

The operation of CVP and the State Water Project (SWP) facilities is subject to BOs issued by USFWS and the NOAA Fisheries. These BOs are subject to ongoing litigation and are currently under review by the two services:

- Biological Opinion on Implementation of the CVPIA and Continued Operation and Maintenance of the Central Valley Project (NOAA Fisheries 2000),
- Biological Opinion on the Effects of the Long-Term Central Valley Project and State Water Project Operations Criteria and Plan (NOAA Fisheries 2004),
- Consultation on Long-Term Renewal of Water Service Contracts in the Delta-Mendota Canal Unit (NOAA Fisheries 2005),
- Reinitiation of Formal and Early Section 7 Endangered Species Consultation on the Coordinated Operations of the Central Valley Project and State Water Project and the Operational Criteria and Plan to Address Potential Critical Habitat Issues (USFWS 2005a),
- Conclusion of Consultation on Long-Term Renewal of Water Service Contracts in the Delta-Mendota Canal Unit (USFWS 2005b),
- Formal Endangered Species Consultation on the Operations and Maintenance Program Occurring on Bureau of Reclamation Lands within the South-Central California Area Office: Biological Opinion (USFWS 2005c),
- Biological opinions for CVP Water contracts,
- Biological Opinion on the Coordinated Operations of the CVP and SWP in California. (USFWS 2008), and
- Biological Opinion on California's Central Valley Water Project (NOAA Fisheries 2009).

H.5 Regional/Local Requirements

Both the ESA and the NCCPA include provisions for the development of conservation plans to protect vegetation and wildlife resources.

A Habitat Conservation Plan (HCP) is a planning document that is required for issuance of an incidental take permit under section 10 of the ESA. The HCP process provides opportunities to conserve listed species, while streamlining permitting for participants' development projects within the planning area. HCP documents typically includes the following information: the anticipated take of the proposed project; measures to avoid, minimize or mitigate impacts to the maximum extent practicable, and a funding mechanism for acquiring and managing lands containing the habitats on which the covered species depend. Covered species may include both listed and non-listed species. This may provide an extra level of certainty for permittees, given that no amendments to the plan would be required if a covered species becomes listed under the ESA before the completion of project activities.

A NCCP is a similar process provided under state law, with some key differences. While the federal and state ESAs focus on protection and recovery of species that have already declined, NCCPs take a broader approach, seeking to anticipate and avoid future conflicts between preservation and development, as well as compliance with the CESA. NCCPs focus on regional-scale protection of ecosystems along with compatible development. A local agency oversees cooperative development of an NCCP by landowners, environmental groups, and other stakeholders, with support provided by CDFW and USFWS.

Project actions within the HCP/NCCP areas will comply with applicable requirements for covered activities within plan areas for existing HCPs/NCCPs. A separate Section 7 Consultation will also be undertaken for the long-term water transfers.

There are 11 HCPs or NCCPs that are either adopted or under development for areas that overlap with, or occur in the vicinity of, the long-term water transfers area of analysis (CDFW 2014a):

- Butte Regional Conservation Plan (BRCP) – The BRCP is a cooperative planning effort between the Cities of Biggs, Chico, Gridley, Oroville, County of Butte, and Butte County Association of Governments. The plan will provide streamlined ESA permitting for transportation projects, land development and covered activities such as construction and maintenance of facilities and infrastructure, residential construction, and recreational activity-related construction. The BRCP also aims to provide comprehensive conservation of species, wetlands and ecosystems, specifically contributing to the protection of 41 plant, fish, and wildlife species within the 564,270 acre plan area (CDFW 2014b). The BRCP covers nine of the focal species for the long-term

water transfers including Red Bluff dwarf rush, Sacramento River winter-run Chinook salmon, and green sturgeon. This plan is under development.

- Bay-Delta Conservation Plan (BDCP) – The BDCP is a comprehensive conservation strategy for the Sacramento–San Joaquin River Delta (Delta) to protect ecosystem health, water quality, water supply, and California's economy, while permitting the operation of the CVP and State Water Project (SWP). The BDCP covers 56 species, including 11 of the focal species for the long-term water transfers including Central Valley Spring-run Chinook salmon, longfin smelt, and greater sandhill crane. This plan is under development. The draft BDCP and its corresponding draft EIS/EIR were published for public review and comment in December 2013 (Reclamation et al. 2013).

- East Contra Costa County HCP/NCCP – The East Contra Costa County HCP/NCCP was developed partially to address indirect and cumulative effects on terrestrial species from development supported by increases in water supply provided by Contra Costa Water District. Activities covered under the plan include public infrastructure projects, construction of residential and business development, and public infrastructure projects. The plan has been adopted by Contra Costa County, the Cities of Brentwood, Clayton, Pittsburg, and Oakley. The HCP/NCCP provides regional conservation and development guidelines to protect natural resources while improving the permit process for endangered species and wetland regulations. The plan will encompass a preserve system covering 30,300 acres of land that will be managed for the benefit of 28 species and the natural communities they depend upon (East Contra Costa County HCP Association 2006). The East Contra Costa County HCP covers 4 of the focal species for the long-term water transfers including giant garter snake, San Joaquin kit fox, and Western pond turtle.

- Natomas Basin HCP (NBHCP) - The NBHCP establishes a multi-species conservation program to mitigate the expected loss of habitat and incidental take and/or loss of covered species that would result from planned urban development. The plan covers 53,537 acres within the levees surrounding the Natomas Basin and 22 plant and wildlife species (The Natomas Basin Conservancy 2003). Covered activities under the plan include urban development, public and drainage improvements, water agency projects, and approved activities of the Natomas Basin Conservancy. Plan participants include the City of Sacramento, Sutter County, Sacramento County, and the acting regulatory agencies. The NBHCP covers four of the focal species for the long-term water transfers including giant garter snake, Western pond turtle, and white-faced ibis.

- Placer County Conservation Plan (PCCP) HCP/NCCP – The PCCP HCP/NCCP is intended to address the impacts associated primarily with unincorporated growth in western Placer County in addition to growth associated with the build-out of Lincoln's updated General Plan. The PCCP is intended to protect 31 special status species and federally regulated wetlands, as well as indirectly protect the habitat of hundreds of plant and wildlife species across approximately 201,000 acres of Western Placer County (Placer County Planning Services Division 2011). Covered activities include: urban development, in-stream projects, capital projects, operation and maintenance, rural development, conservation strategy implementation, and other Placer County conservation programs. Participants include the City of Lincoln, Placer County, Placer County Water Agency and South Placer Regional Transportation Authority. PCCP covers five of the focal species for the long-term water transfers including Ahart's dwarf rush, Red bluff dwarf rush, and Central Valley Steelhead. This plan is under development.

- San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP) – The SJMSCP was developed to provide guidelines for converting open space to other land uses, preserving agriculture, and protecting plant and wildlife species. Activities covered under the plan include urban development, mining, non-agricultural activities occurring outside of urban boundaries, transportation projects, non-federal flood control projects, maintenance activities, and similar public agency projects. San Joaquin County, the Cities of Stockton, Lodi, Manteca, Tracy, Ripon, Escalon, and Lathrop are the plan participants. The plan addresses 97 special-status plant, fish and wildlife species in over 900,000 acres of the San Joaquin County (San Joaquin County 2000). The SJMSCP covers 12 of the focal species for the long-term water transfers including Sandford's arrowhead, Red Bluff dwarf rush, and Delta smelt.

- Santa Clara Valley (SCV) HCP/NCCP – The SCV HCP/NCCP is a regional partnership between the County of Santa Clara, Santa Clara Valley Transportation Authority, Santa Clara Valley Water District, and the Cities of San Jose, Gilroy and Morgan Hill, and regulatory agencies. The plan encompasses approximately 440,318 acres and will address impacts primarily associated with the future uses of land identified in the plan area (CDFW 2014c). Land preservation would mitigate for the environmental impacts of planned urban and rural development, instream activities, public infrastructure operations and maintenance activities (e.g. water, transportation, etc.) and would enhance the long term viability of 21 threatened or endangered plant and wildlife species (CDFW 2014c). SCV HCP/NCCP covers three of the focal species for the long-term water transfers including San Joaquin kit fox, Western pond turtle, and tricolored blackbird.

- Solano Multispecies HCP (SMSHCP) – The SMSHCP plan area covers 585,000 acres (Solano County Water Agency 2009). It was developed to address species conservation in conjunction with urban development, flood control/infrastructure improvement activities, and to support the issuance of an incidental take permit under the Federal ESA for the Bureau of Reclamation's Solano Project Contract Renewal. Activities covered under the plan include preservation, restoration, invasive species control, and water quality improvement. Covered species include federally and state-listed fish species and other wildlife species of concern. Plan participants include Solano County, a small portion of Yolo County, Solano County Water Agency's contract service area, including the Cities of Fairfield, Vacaville, Vallejo, Suisun City, Solano Irrigation District, and the Main Prairie Water District. The SMSHCP covers eight of the focal species for the long-term water transfers including winter-run Chinook salmon, Central Valley steelhead, and longfin smelt. This plan is still under development.

- South Sacramento HCP (SSHCP) – The proposed SSHCP would address issues related to species conservation, agricultural protection, and urban development in 341,000 acres of south Sacramento County. Activities covered under the plan include construction of residential, commercial, and industrial buildings, and associated infrastructure. The plan is being prepared by Sacramento County, the Cities of Sacramento, Elk Grove, and Galt, and Rancho Powers Authority. The plan would cover 40 plant and wildlife species, including ten species that are listed by the state or federal governments. The SSHCP covers five of the focal species for the long-term water transfers including Ahart's dwarf rush, Greater sandhill crane, and giant garter snake. This plan is still under development.

- Yolo Natural Heritage Program (YNHP) – This plan is still under development and the program released a draft plan on June 28, 2013 (Yolo Natural Heritage Program 2013). This 653,818-acre county-wide HCP/NCCP will provide for the conservation of 32 sensitive species in five habitat types: wetland, riparian, oak woodland, grassland, and agriculture (Yolo Natural Heritage Program 2013). No aquatic species will be addressed in the YNHP. The plan describes measures that local agencies will implement to conserve biological resources, obtain permits for urban growth and public infrastructure projects, maintain the agricultural heritage of the county, and acquire permanent conservation easements for sensitive plant and wildlife species in the plan area. Plan participants include Yolo County, the Cities of Davis, Woodland, West Sacramento, and Winters. The YNHP covers four of the focal species for the long-term water transfers including giant garter snake, Western pond turtle, and purple martin.

- Yuba-Sutter NCCP/HCP – This plan is still under development. The Yuba-Sutter NCCP/HCP is a cooperative planning effort initiated by Yuba and Sutter Counties in connection with improvements to Highways 99 and 70, as well as future development in the area surrounding those highways. The plan covers approximately 210,000 acres and provides for the regional protection and management of 31 listed and other special-status species and their habitats (CDFW 2014d). Plan participants include the Counties of Yuba and Sutter, Cities of Yuba, Live Oak, and Wheatland. The Yuba-Sutter HCP covers five of the focal species for the long-term water transfers including greater sandhill crane, Western pond turtle, and tricolored blackbird.

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Appendix I

Special Status Animals and Plants with Potential to Occur in Area of Analysis

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Appendix I
Special-Status Animals and Plants with Potential to Occur in the Area of Analysis

Table I-1. Special-Status Animals with Potential to Occur in the Area of Analysis

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Invertebrates						
Bay checkerspot butterfly *Euphydryas editha bayensis*	T	--	Historically occurred east, west, and south of SF bay, to Mt. Diablo south to Hollister. Currently, restricted to six core areas on the west and southern edges of the SF bay - SF peninsula, San Mateo County, and Santa Clara County, Any site with appropriate habitat within historic range should be considered potentially occupied (The Xerces Society 2012)	Restricted to native grasslands on outcrops of serpentine soil. The primary host plant for this butterfly is *Plantago erecta (*Dwarf plantain*)*. Secondary host plant include *Othocarpus densiflorou*s, *O.purpurscens,* and Purple owl's clover. Prefers shallow, serpentine-derived soils.	Adult present in spring. Flight season late February to early May.	None. Occurrences have been documented in the Buyer Service Area and suitable habitat may be present in the area of analysis. However, no impacts are expected to native grasslands.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Conservancy fairy shrimp *Branchinecta conservatio*	E	--	Northern two-thirds of the Central Valley. It ranges from Vina Plains of Tehama County; Sacramento NWR in Glenn County; Jepson Prairie Preserve and surrounding area east of Travis Air Force Base, Solano County; Mapes Ranch west of Modesto, Stanislaus County.	Inhabits the ephemeral water of swales and vernal pools. It is most commonly found in grass or mud bottomed swales, earth sump, or basalt flow depression pools in unplowed grasslands.	Has been collected from early December to early May.	None. Occurrences have been documented within the Seller Service Area. Suitable habitat occurs within the area of analysis. No impacts to vernal pool or other habitats occupied by this species are anticipated. The species is not likely to occur to occur in rice fields and canals due to predators (i.e. fish).
Lange's metalmark butterfly *Apodemia mormo langei*	E	--	Restricted to sand dunes along the southern bank of the Sacramento-San Joaquin River. Within Contra Costa County, it is currently found only at Antioch Sand Dunes.	Inhabits stabilized dunes along the San Joaquin river and is endemic to Antioch sand dunes, Contra Costa county. The butterfly's primary host plant is *Eriogonum nudum var. auriculatum*. It feeds on nectar of other wildflowers, as well as host plant.	Breeding season is August - September, Larvae hatch during rainy months.	None. CNDDB occurrences have been documented within the Buyer Service Area, however no impacts to sand dunes are anticipated.
Longhorn fairy shrimp *Branchinecta longiantenna*	E	--	Restricted to northern, central, and portions of southern California; populations along the eastern margin of the Central Coast Mountains from Concord, Contra Costa County south to Soda Lake in San Luis Obispo County; the Kellogg Creek watershed; the Altamont Pass area; the western and northern boundaries of Soda Lake on the Carrizo Plain; and Kesterson National Wildlife Refuge in the Central Valley.	Endemic to the eastern marring of the central coast mountains in seasonally astatic grassland vernal pools. Found in ephemeral freshwater habitats, such as vernal pools and swales.	Has been observed from late December until late April.	None. Occurrences have been documented within the Seller Service Area. Suitable habitat may occur within the area of analysis. The species is not likely to occur to occur in rice fields and canals due to predators (i.e. fish). Transfers are not expected to impact any suitable grassland vernal pools or swales.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
San Bruno elfin butterfly *Callophrys mossii bayensis*	E	--	Found in vicinity of San Bruno mountains, San Mateo County (ESSIG 2012b).	Found in coastal, mountainous areas with grassy ground cover. Colonies are located on steep, north-facing slopes within the fog belt. Larval host plant is *Sedum spathulifolium.*	Year round	None. Occurrences have been documented in the Buyer Service Area and suitable habitat is present in the area. No impacts are anticipated to mountainous areas near San Bruno. Therefore no impacts to the species are expected.
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T	--	Occurs only in the Central Valley and surrounding foothills below 3,000 feet elevation (USFWS 1980).	Dependent on elderberry shrubs (host plant) as a food source. Potential habitat consists of shrubs with stems one inch in diameter within Central Valley.	Year round for host plant and exit holes; March to June for adults	None. Occurrences have been documented within the Seller Service Area. Suitable habitat may occur within the area. However, elderberry shrubs would not be impacted by transfers, therefore no impacts are anticipated to the species.
Vernal pool fairy shrimp *Branchinecta lynchi*	T	--	Endemic to the Central Valley, Central Coast Mountains, and South Coast Mountains of California. It ranges from the Vina Plains in Tehama County, through the Central Valley, and south along the Central Coast to northern Santa Barbara County.	Endemic to the grasslands of the Central Valley, central coast mountains, and south coast mountains. Inhabits the ephemeral water of swales and vernal pools. It is most commonly found in grassed or mud bottomed swales, earth sump, or basalt flow depression pools in unplowed grasslands.	Has been collected from early December to early May.	None. Occurrences have been documented in both the Buyer and the Seller Service areas. Rice fields and canals are not likely to support this species due to the presence of predators (i.e. fish), therefore no impacts are anticipated to the species. Transfers are not expected to impact vernal pools or natural wetlands.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Vernal pool tadpole shrimp *Lepidurus packardi*	E	--	Endemic to the northern portion of the Central Valley of California. This species occurs from the Millville Plains and Stillwater Plains in Shasta County south throughout the Central Valley to Merced County.	Found in a variety of natural and artificial seasonally ponded Sacramento valley habitat types including: vernal pools, swales, ephemeral drainages, stock ponds, reservoirs, ditches, backhoe pits, and ruts caused by vehicular activities.	Has been collected from early December to early May.	None. Occurrences have been documented in both the Buyer and the Seller Service area. Suitable habitat is present in the area. Rice fields and canals are not likely to support this species due to the presence of predators (i.e. fish), therefore there is a low potential for impacts to the species. Transfers are not expected to impact vernal pools or natural wetlands. No impacts to the species are expected.
Zayante band-winged grasshopper *Trimerotropis infantilis*	E	--	Known only from Santa Cruz County. Found in local Santa Cruz mountains (the Zayanite Sand Hills ecosystem) (Santa Cruz Public Libraries 2012).	Found in isolated sandstone deposits. Inhabits mostly sand parkland habitat, but also in areas with well-developed ground cover and in sparse chaparral with grass.	Flight season from late May - Oct.	None. Occurrences have been documented in the Buyer Service Area and suitable habitat is present in the area, however, no impacts to suitable habitat are anticipated.
Amphibians						
California red-legged frog *Rana aurora draytonii*	T	SSC	Northwestern California, from Mendocino County south to northwestern Baja California. May now be extirpated in the southern Sierra Nevada; other Sierra Nevada foothill populations are small and highly localized. Nearly all current Central Valley sites are on the Coast Range slope, usually below 1,200m (3,936 ft).	Usually found in or near quiet permanent water of streams, freshwater marshes, or (less often) ponds and other quiet bodies of water; also damp woods and meadows some distance from water. Occurs in sites with dense vegetation (e.g., willows) close to water.	Year round. Little movement away from streamside habitats. Occasionally found on roads at night during winter and spring rains.	None. Suitable habitat is present within the area and occurrences of this species have been previously documented in the Buyer Service Area. Environmental Commitments would cause potential impacts to California red-legged frog to beneglegible.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
California tiger salamander *Ambystoma californiense*	T^1, E^2	T	Found in annual grassland habitat, grassy understories of valley-foothill hardwood habitats, and uncommonly along stream courses in valley-foothill riparian habitats. Occurs from near Petaluma, Sonoma County, and east through the Central Valley to Yolo and Sacramento Counties and south to Tulare County.; and from the vicinity of San Francisco Bay south to Santa Barbara County. Occurs at elevations from 3m - 1,054m (3200ft).	Lives in vacant or mammal-occupied burrows, occasionally other underground retreats, throughout most of the year, in grassland, savanna, or open woodland habitats. Lays eggs on submerged stems and leaves, usually in shallow ephemeral or semi permanent pools and ponds that fill during heavy winter rains, sometimes in permanent ponds; breeding takes place in fish free pools and ponds.	Migrates up to two km between terrestrial habitat and breeding pond. Migrations may occur from November through April.	None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat may occur within the area, but would not be impacted by transfers. This species is not expected to occur in rice fields due to predatory fish. Existing Environmental Commitments would maintain flow and temperature in streams.
Foothill yellow-legged frog *Rana boylii*	--	SSC	This species is known from the Pacific drainages from Oregon to the upper San Gabriel River, Los Angeles County, California, including the coast ranges (west pf Cascade crest) and Sierra Nevada foothills in the United States. Isolated populations in San Joaquin County on the floor of the Central Valley. Elevation range extends from near sea level to 1940m (6370ft).	This species inhabits partially shaded, rocky streams at low to moderate elevations, in areas of chaparral, open woodland, and forest. Rarely encountered far from permanent water.	Year round. Significant seasonal movements for migrations from breeding area have not been reported.	None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat is present within the area. However Transfers are not expected to impact any suitable rocky stream and woodland habitats. No impact to the species is expected.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Western spadefoot toad *Spea hammondii*	--	SSC	This species occurs in the Central Valley and bordering foothills of California and along the Coast Ranges into northwestern Baja California, Mexico. In the Coast Ranges it is found from Point Conception, Santa Barbara County, south to Mexican border. Elevation ranges from near sea level to 1,363m (4,460 ft).	Lowlands to foothills, grasslands, open chaparral, pine-oak woodlands. Prefers short grass plains, sandy or gravelly soil. It is fossorial and breeds in temporary rain pools and slow-moving streams that do not contain bullfrogs, fish, or crayfish.	Year round. Usually in underground burrows most of year, but will travel several meters on rainy nights. Movement is rarely extensive.	None. Occurrences have been documented from both the Buyer and Seller Service Areas. Suitable habitat is present in the area. Transfers would not impact suitable upland habitat types. The species is not likely to occur in rice fields due to the presence of predatory fish, bullfrogs etc. Environmental Commitments to maintain flows will protect Western spadefoot toad.
Reptiles						
Alameda whipsnake *Masticophis lateralis euryxanthus*	T	T	Seven populations (recovery units) are known from Alameda and Contra Costa Counties, including the Mt. Diablo area and other East Bay Regional Parks, south almost to the border of Alameda and Santa Clara Counties. Likely occurred historically within San Joaquin and northern Santa Clara Counties.	The species is typically found in chaparral and scrub habitats, but it will also use adjacent grassland, oak savanna and woodland habitats. It is mostly found on south-facing slopes & ravines, with rock outcrops, deep crevices or abundant rodent burrows.	Year round.	None. Occurrences have been documented within the Buyers and Sellers Service Areas. No impacts to suitable habitat for Alameda whipsnake are anticipated.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
blunt-nosed leopard lizard *Gambelia sila*	E	E	Currently known from undeveloped land within the San Joaquin Valley and the Coast Range foothills. Historically, the blunt-nosed leopard lizard ranged from the San Joaquin Valley and foothills from Stanislaus County south to northern Santa Barbara and Ventura Counties, with observations below 800m elevation.	This species is a resident of sparsely vegetated alkali and desert scrub habitats in areas of low topographic relief. The lizard seeks cover in mammal burrows, under shrubs or structures such as fence posts.	Year round. Hibernates during winter and active from late-March - July.	None. Occurrences have been documented within the Buyer Service Area and suitable habitat is present within the area of analysis. No impacts to suitable habitat for blunt-nosed leopard lizard are anticipated.
coast horned lizard *Phrynosoma blainvillii*	--	SSC	Occurs in the Sierra Nevada foothills from Butte County to Kern County and throughout the central and southern California coast. Its elevational range extends up to 1200m (4000ft) in the Sierra Nevada foothills and up to 1800m (6000ft) in the mountains of southern California.	The species frequents a wide variety of habitats and is most commonly found in lowlands along sandy washes with scattered low bushes. It inhabits open areas for sunning, bushes for cover, patches of loose soil for burial & abundant supply of ants and other insects.	Year round.	None. Occurrences have been documented within both the Buyer and Seller Service Areas. No potential impacts to suitable habitat are anticipated.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
giant garter snake *Thamnophis gigas*	T	T	Endemic to wetlands in the Sacramento and San Joaquin Valleys from Chico, south to the Mendota Wildlife Area in Fresno County.	Marshes, sloughs, ponds, small lakes, streams and other waterways. Typically occurs in areas that provide adequate water during the active season with emergent wetland vegetation. Basking habitat consists of grassy areas or openings adjacent to aquatic habitat, and upland areas are also used for refuge from flood conditions (USFWS 2006)	Year round	High. Suitable habitat is present within the Buyer and Seller Service Areas. Suitable habitat in the Seller Service Area is intermittent based on normal variation in cropping. Direct impacts may include reduction in suitable aquatic habitat within the Seller Service Area. The greatest impact would occur during the breeding season. Conservation measures are in place to maintain aquatic habitat corridors within irrigation ditches.
San Francisco garter snake *Thamnophis sirtalis tetrataenia*	E	E	Historically occurred from north of the San Francisco-San Mateo County line south to Ano Nuevo State Reserve, west of the Santa Cruz Mountains (USFWS 2006b).	The species is found in the vicinity of freshwater marshes, ponds and slow moving streams in San Mateo county and the extreme northern Santa Cruz county. The snake prefers dense cover and water depths of at least 1ft. Upland areas near water are also very important for this species.	Year round	None. Suitable habitat may be present in a small portion of the Buyer Service Area within San Mateo County. No impacts to suitable San Francisco garter snake habitat are anticipated in association with the proposed Transfers.
San Joaquin whipsnake *Masticophis flagellum ruddocki*	--	SSC	Known from as far north as Arbuckle, Colusa County through the San Joaquin Valley and Coast Ranges south into Kern and Santa Barbara Counties.	The species is found in open, dry habitats with little or no tree cover, generally at elevations 20 - 900m. It is also found in valley grassland and saltbush scrub in the San Joaquin valley. The snake requires mammal burrows for refuge and oviposition sites.	Year round.	None. Suitable habitat is present within the Buyer Service Area in the San Joaquin Valley. There is a very low potential that this species could occur in or adjacent to agriculture within the Buyer Service Area, but no conversion of suitable habitat would occur in association with the proposed Transfers.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Silvery legless lizard *Anniella pulchra pulchra*	--	SSC	The silvery legless lizard ranges from Antioch in Contra Costa County south through the Coast, Transverse, and Peninsular Ranges along the western edge of the Sierra Nevada Mountains. It occurs in the San Joaquin Valley and Mojave Desert down into Baja California. In the Sierra Nevada foothills it may occur at elevations up to 1,800m asl. (Contra Costa County 2006).	Sandy or loose loamy soil. May occur under sparse vegetation of beaches, chaparral, or pine-oak woodland, or near sycamores, cottonwoods, or oaks that grow on stream terraces. Often found under logs, rocks, old boards, or compacted debris of woodrat nests. Requires refugia with soil moisture during hot conditions. Agriculture and disturbed sites are not known to support the species (Contra Costa County 2006).	Year round	None. Suitable habitat is present within both the Buyer and Seller Service Areas, and previous records exist within the Buyer Service Area. Transfers are not expected to impact suitable habitat for the silvery legless lizard.
Pacific pond turtle *Actinemys marmorata*	--	SSC	Ranged from extreme western Washington and British Columbia to northern Baja California, mostly to the west of the Cascade-Sierra crest.	The western pond turtle occupies a wide variety of wetland habitats including rivers and streams (both permanent and intermittent), lakes, ponds, reservoirs, permanent and ephemeral shallow wetlands, abandoned gravel pits, stock ponds, and sewage treatment.	Year round	High. Suitable habitat occurs within the area of analysis. Pond turtles may occur in ditches, canals, rice fields, etc. Environmental Commitments would cause potential impacts to California red-legged frog to be negligible.
Birds[3]						
Alameda song sparrow *Melospiza melodia pusillula*	--	SSC	Endemic, restricted to fringes of south San Francisco Bay (east to El Cerrito, south to Alviso and west to San Francisco). Largest concentration near Dumbarton Point salt marsh, Alameda County.	The species is a resident of salt marshes. It inhabits salicornia marshes, nests low in grindelia bushes and in salicornia.	Year round, non-migratory. Breeds late-Feb to mid-August.	None. Occurrences have been documented within the Buyer Service Area. Suitable habitat may occur within the area of analysis. However, Transfers are not expected to impact any suitable habitat (i.e. salt marshes).

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
American peregrine falcon *Falco peregrinus anatum*	D	E, FP	Throughout California. Uncommon resident that breeds along coast north of Santa Barbara, in the Sierra Nevada, and other northern CA mountains. Migrant birds occur along the coast and the western Sierra Nevada.	Breeds in woodland, forest and coastal habitats on protected cliffs and ledges. Riparian areas and coastal and inland wetlands are important habitats yearlong especially during the non-breeding season.	Year round. Coastal migrants occur in Spring and Fall.	None. Rice fields may provide suitable foraging habitat for the species, but birds could relocate to other habitat areas in the vicinity. No nesting habitat would be affected by Transfers.
Bald eagle *Haliaeetus leucocephalus*	D	E	Throughout California. Breeding mostly in Butte, Lake, Lassen, Plumas, Shasta, Siskiyou, and Trinity counties. Winter migrant at inland waters.	Riparian areas near coasts, rivers, and lakes. Nesting generally occurs in large old-growth trees in areas with little disturbance. In flooded fields, occasionally hunts for small mammals.	Year round. Local winter movements.	None. Occurrences have been documented within both the Buyer and Seller Service Area and both areas provide suitable habitat. No impacts to suitable nesting habitat are anticipated. Rice fields represent marginal foraging habitat. Birds would be able to relocate to other suitable habitat areas in the vicinity if fields were fallowed. Environmental commitments limit the amount of land that can be fallowed in a given county.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Bank swallow *Riparia riparia*	--	T	A neotropical migrant found primarily in riparian and other lowland habitats in California west of the deserts during the spring-fall period. Breeding population in California occurs along banks of the Sacramento and Feather rivers in the northern Central Valley. Casual in southern California in winter. Other colonies along the central coast from Monterey to San Mateo counties.	Requires vertical banks and cliffs with fine-textured or sandy soils near streams, rivers, ponds, lakes, and the ocean for nesting. Feeds primarily over grassland, shrub land, savannah, and open riparian areas during breeding season and over grassland, brushland, wetlands, and cropland during migration.	March-mid-September	None. Known from both the Buyer and Seller Service Areas. No suitable nesting habitat (i.e. cliffs) would be affected. There is potential that Transfers would reduce the area of cropland habitat used for foraging during migration (wetlands and croplands) due to changes in water application. However, fallow cropland would still providing suitable foraging habitat, and birds could forage at other croplands in the vicinity. Environmental commitments limit the amount of cropland idling that would occur.
black swift *Cypseloides niger*	--	SSC	Breeds locally in Sierra Nevada and Cascade range, San Gabriel, San Bernardino and San Jacinto Mts. Also in coastal bluffs and mountains from San Mateo County to San Luis Obispo County.	The bird breeds in small colonies on cliffs behind or adjacent to waterfalls in deep canyons and sea-bluffs above the surf. Found in moist crevice or cave on sea cliffs above the surf. Forage widely over many habitats. Avoids arid regions such as Great Basin, southern deserts and Central Valley.	Absent from October - April.	None. Occurrences have been documented within the Buyer Service Area. Suitable habitat may occur within the area of analysis. Habitat within the Buyers Service Area would not be affected, as water in excess of their CVP contract amount could not be procured, nor could this water be used to grow permanent crops. Therefore any change in habitat would fall within the normal range expected under their existing contracts.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Black tern *Chlidonias niger*	--	SSC	Common spring and summer visitor to fresh emergent wetlands of California.	Uses fresh emergent wetlands, lakes, ponds, moist grasslands, and agricultural fields. In migration, some take coastal routes and forage offshore.	April-September	High. No occurrences have been documented within either the Buyer or Seller Service Areas. However, suitable habitat (i.e. rice fields) is present, and the area of analysis is within the known range for the species. Therefore it has moderate potential to occur Water transfers could reduce suitable habitat for the species within the Seller Service Area. Conservation strategies are in place that would make potential impacts to this species to negligible.
Black-crowned night heron *Nycticorax nycticorax* (rookeries)	--	--	Year round resident and common in lowlands and foothills throughout most of California, including the Salton Sea and Colorado River areas, and very common locally in large nesting colonies. Uncommon in northwestern and rare in northeastern CA in midwinter. Uncommon in winter in southern deserts.	Feeds along the margins of lacustrine, large riverine, and fresh and saline emergent habitats. Nests and roosts in dense-foliaged trees and dense emergent wetlands.	Year round. Common nesting species from April -August.	None. No occurrences of black-crowned night heron have been documented within either the Buyer or Seller Service Areas. Suitable habitat is present in the area of analysis; however, no nesting or roosting habitats would be affected.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
cackling (=Aleutian Canada) goose *Branta hutchinsii leucopareia*	D	--	The species is found in during the winter in Del Norte County, San Francisco Bay-Delta, and South Central Valley.	Forages on natural pasture or pastures that are cultivated to grain. The species occurs on lakes, reservoirs and ponds. Preferred habitats include lacustrine, fresh emergent wetlands, moist grasslands, croplands, pastures, and meadows.	Year-round in northeastern California, except when water freezes. Wintering population in Caliornia migrates north and east to northeastern California. Winters on lakes and inland prairies.	None. Occurrences have been documented within both the Buyer and Seller Service Areas. The species distribution does not overlap with the major area where fallowing would occur. Transfers are not expected to impact breeding habitat (i.e. prefers islands in lakes).
California clapper rail *Rallus longirostris obsoletus*	E	E	Common locally around San Francisco, Monterey, and Morro bay.	Found in salt-water and brackish marshes traversed by tidal sloughs. The bird is associated with abundant growths of pickle weed, but feeds on mud-bottomed sloughs.	Year round. Non-migratory in coastal wetlands. Juveniles may disperse to freshwater wetlands late summer and autumn.	None. Occurrences have been documented within the Buyer Service Area. Suitable habitat may occur within the area of analysis. However, Transfers are not expected to impact any suitable habitat (i.e. salt-water marshes).
California horned lark *Eremophila alpestris actia*	--	WL	Found on coastal regions, chiefly from Sonoma to San Diego county, but also found in the main parts of San Joaquin Valley and east to the foothills.	Prefers short-grass prairie, mountain meadows, open coastal plains, alkali flats, "bald" hills, and fallow grain fields.	Year round in California. Some movement along the coast. May leave mountains in winter.	None. Occurrences have been documented within the Buyer Service Area. Suitable habitat occurs within the area of analysis. No impacts to breeding or foraging habitat are anticipated within the Buyer Service Area.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
California least tern *Sternula antillarum browni*	E	E	Nests along the coast from San Francisco Bay south to northern Baja California. Migratory in California. Breeding colonies in Southern California near marine and estuarine shores. In SF Bay found near salt ponds and estuarine shores.	Breeds on bare or sparsely vegetated, flat substrates, sand beaches, alkali flats, landfills or paved areas. Feeds in shallow, estuarine waters.	Late April in southern California to mid-May in northern California. Winters south of California. Absent from mid-October to late April.	None. Occurrences have been documented in the Buyer Service Area. Suitable habitat may occur within the area of analysis. No impacts are expected to suitable foraging or breeding habitat (i.e. sand beaches, alkali flats).
California yellow warbler *Dendroica petechia brewsteri*	--	SSC	Throughout California. From coastal Del Norte County., east to Modoc, south along coast range to Santa Barbara and Ventura County. Also found along western slope of Sierra Nevada to Kern County.	Frequents open to medium-density woodlands and forests with a heavy brush understory in breeding season. In migration, found in a variety of sparse to dense woodland and forest habitats. Breeds in montane chaparral, ponderosa pine and mixed conifer habitats.	April-October.	None. No occurrences have been documented in the area of analysis. The species is not likely to occur in rice fields, and no suitable habitat would be impacted (i.e. dense woodland and forest habitats).
Cooper's hawk *Accipiter cooperii*	--	WL	Throughout California. Breeds in southern Sierra Nevada foothills, New York Mountains, Owens Valley and local areas in southern California.	Frequents landscapes where wooded areas occur in patches and groves- live oak, riparian deciduous, other forest habitat near water. Often uses patchy woodlands and edges with snags for perching. Dense stands with moderate crown-depths used for nesting.	Year round. Breeding resident throughout wooded portion of California.	None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat occurs within the area of analysis. No potential impacts to preferred foraging or nesting habitat are anticipated.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Double-crested cormorant *Phalacrocorax pelagicus*	--	WL	Along the entire coast of California and on inland lakes, in fresh, salt and estuarine waters. Uncommon from San Luis Obispo County south and very rare to the north. Common on Colorado River reservoirs and common in the Central Valley.	Open water with offshore rocks, islands, steep cliffs, dead branches of trees, wharfs, jetties, or even transmission lines. Requires undisturbed nest-sites beside water, on islands or mainland. Uses wide rock ledges on cliffs; rugged slopes; and live or dead trees, especially tall ones. Found on inland lakes, fresh, and estuarine waters.	Year round along coastal regions. Winters inland.	None. No occurrences have been documented within the area of analysis, but the species could occur at reservoirs and inland ponds. No negative impacts to foraging or breeding habitat are expected.
ferruginous hawk *Buteo regalis*	--	WL	Winter resident and migrant at lower elevations and open grasslands in Modoc Plateau, Central Valley, and Coast ranges. Common winter resident of grassland and agriculture areas in southwestern California. Casual in northeast in summer.	Found in open grasslands, sagebrush flats, desert scrub, low foothills and fringes of pinyon-juniper habitats.	Migratory. Present in CA from Sept. to mid-April.	None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat occurs within the area of analysis. No potential impacts to preferred habitat are anticipated.
Golden eagle *Aquila chrysaetos*	T	E	Throughout California. Uncommon permanent resident and migrant throughout California, except of Central Valley. More common in southern California.	Riparian areas near coasts, rivers, and lakes. Nesting generally occurs in large old-growth trees in areas with little disturbance. Also in foothills, mountain areas, sage-juniper flats and desert.	Year round. Mostly resident moves down slope for winter and upslope after breeding season.	None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat occurs within the area of analysis. No impacts to nesting habitat are expected.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
grasshopper sparrow *Ammodramus savannarum*	--	SSC	Uncommon and local, summer resident and breeder in foothills and lowlands west of Cascade-Sierra Nevada crest from Mendocino and Trinity counties south to San Diego County Also found in Shasta Valley, Siskiyou County, coastal southern California.	Found in dense grasslands on rolling hills, lowland plains, in valleys and on hillsides on lower mountain slopes. Favors native grasslands with a mix of grasses, forbs and scattered shrubs.	Winters chiefly in southern California, in coastal areas. Summer resident March to May, migrates south in August and September. Fall migrants occur on the Farallon Islands in late September to early October.	None. Occurrences have been documented in the Seller Service Area. Suitable habitat may occur with the area of analysis. The species' habitat (i.e. dense grassland, lowland plain areas) would not be affect by Transfers.
Great blue heron *Ardea herodias* (rookeries)	--	--	Throughout California. Most rookeries are in southern California some scattered in northern California.	Found in shallow estuaries, fresh and saline emergent wetlands, along riverine and rocky marine shores, in croplands, pastures, salt ponds, and in mountains above foothills. Nests and roosts in large trees.	Year round. Near salt ponds from July to October. Near rookeries February to June or July.	None. Rookeries have been documented within the Buyer and Seller Service Areas. No impacts to rookeries are anticipated. Idling of cropland foraging habitat would be limited by the environmental commitments, and birds could use alternative suitable foraging areas in the vicinity.
Great egret *Ardea alba* (rookeries)	--	--	Throughout California, except for high mountains and deserts.	Feeds and rests in fresh, and saline emergent wetlands, along the margins of estuaries, lakes, and slow-moving streams, on mudflats and salt ponds, and in irrigated croplands and pastures. Nests roosts in large trees.	Year round	None. Occurrences have been documented in the Seller Service Area. No impacts to rookeries are anticipated. Idling of cropland foraging habitat would be limited by the environmental commitments, and birds could use alternative suitable foraging areas in the vicinity.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Greater sandhill crane *Grus canadensis tabida*	--	T, FP	Breeds only in Siskiyou, Modoc and Lassen counties and in Sierra Valley, Plumas and Sierra counties. Winters primarily in the Sacramento and San Joaquin valleys from Tehama south to Kings Counties.	In summer, this race occurs in and near wet meadow, shallow lacustrine, and fresh emergent wetland habitats. Frequents annual and perennial grassland habitats, moist croplands with rice or corn stubble, and open, emergent wetlands. It prefers relatively treeless plains.	Migration southward is September-October and northward is March-April.	High. No occurrences have been documented within the area of analysis, but occurrences have been recorded in Butte and Sutter Counties. Suitable foraging and winter roosting habitat is present within the area of analysis (i.e. rice fields). Conservation strategies are in place for this species and birds would have other suitable nesting sites available.
Least bell's vireo *Vireo bellii pusillus*	E	E	California to northern Baja. Rare, local, summer resident below about 600m (2000ft), mostly in San Benito and Monterey counties. Present in coastal southern CA from Santa Barbara County south.	Inhabits low, dense riparian growth along water or along dry parts of intermittent streams. Typically associated with willow, cottonwood, baccharis, wild blackberry, or mesquite in desert localities.	end of March to end of August	None. Occurrences have been documented in the Buyer Service Area. Suitable habitat may occur within the area of analysis. Transfers are not expected to impact any suitable willow or dense riparian habitat, therefore no impacts to the species are anticipated.
LeConte's thrasher *Toxostoma lecontei*	--	SSC	Uncommon to rare local resident of southern California deserts from southern Mono County south to Mexican border, western and southern San Joaquin Valley. Also in Joshua tree. Formerly north to Fresno County, rare north of Kern County.	A desert resident primarily of open desert wash, desert scrub, alkali desert scrub, and desert succulent scrub habitats. Nests in dense, spiny shrub or densely branched cactus in desert wash habitat.	Year round. Non migratory.	None. CNDDB occurrences have been documented in the Buyer Service Area. Suitable habitat is present in area of analysis. No impacts are anticipated to occur to suitable habitat (i.e. desert scrub).

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Little willow flycatcher *Empidonax traillii brewsteri*	--	E	Migrant at lower elevations, primarily in riparian habitats throughout Sierra Nevada and Cascade Range. Not found in north coast.	Most numerous where extensive thickets of low, dense willows edge on wet meadows, ponds, or backwaters. Dense willow thicket required for nesting and roosting. Feeds in willow thickets or low perches adjacent to meadows.	Spring (mid-May to early June) and fall (mid-August to early September)	None. This species has not been documented within the area of analysis according to CNDDB. Suitable habitat may be present within the area of analysis (i.e. dense willows), but would not be impacted by Transfers.
Loggerhead shrike *Lanius ludovicianus*	--	SSC	Common resident and winter visitor in lowland and foothills throughout California,. Rare on coastal slopes north of Mendocino County, occurring only in winter.	Found in broken woodlands, savannah, pinyon-juniper, Joshua tree, riparian woodlands, desert oases, scrub and washes. Prefers open country with perches for hunting, and fairly dense shrubs and brush for nesting. Rarely found in urbanized areas, but often found in open cropland.	Year round. In Great Basin, south to Inyo County, pop declines Nov.-March. Winter pop. More widespread in winter than during breeding season.	None. CNDDB occurrences have been documented in the Buyer Service Area. Suitable habitat may be present within the area of analysis. No impacts are anticipated to breeding or foraging habitats.
Long-billed curlew *Numenius americanus*	--	WL	Along the California coast, and in the Central and Imperial valleys.	Upland short grass prairies and wet meadows are used for nesting; coastal estuaries, open grasslands, and croplands are used in winter.	Winter migrant from July-April	Low. No CNDDB occurrences have been documented within the area of analysis, but the species is known to occur within the action area during winter migration. There is potential for impacts to suitable foraging habitat (i.e. cropland), although this may be reduced by environmental commitments, which protect winter foraging habitat in Butte Sink, and other wildlife management areas downstream. Birds can relocate to other suitable habitats within the area.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Long-eared owl *Asio otus*	--	SSC	Throughout California, except for entire floor of the Central Valley and locally on the southern coast.	Frequents dense, riparian and live oak thickets near meadow edges, and nearby woodland and forest habitats. Also found in dense conifer stands at higher elevations.	Year round	None. Occurrences have been documented in the Buyer Service Area. Suitable habitat occurs within the area of analysis. Transfers are not expected to impact any suitable habitat (i.e. forest and woodland habitats).
Merlin *Falco columbarius*	--	WL	Occurs in most of the western half of California below 3,900 ft. Rare in Mojave Desert and Channel Islands.	Frequents coastlines, open grasslands, savannahs, woodlands, lakes, wetlands, edges, and early successional stages. Ranges from annual grasslands to ponderosa pine and montane hardwood-conifer habitats.	Winter migrant from September-May	None. CNDDB occurrences have been documented in the Buyer Service Area. Suitable habitat is present in area of analysis. Foraging habitat may be altered, but Transfers would not decrease suitability. No negative impacts are anticipated.
Mountain plover *Charadrius montanus*	--	SSC	Found in Central Valley from Sutter and Yuba counties southward, foothill valleys west of San Joaquin Valley, Imperial Valley, plowed fields of Los Angeles and western San Bernardino County, and central Colorado river valley. Does not breed in California.	Found in short grasslands, freshly plowed fields, newly sprouting grain fields, and sod farms. Prefers grazed areas and areas with burrowing rodents.	Winter resident Sept. - March.	None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat occurs within the area of analysis. Foraging habitat may be affected, but Transfers would not reduce suitability. Can relocate to other habitats within the area.
Northern harrier *Circus cyaneus*	--	SSC	Throughout lowland California, concentrated in the Central Valley and coastal valleys.	Breeds in annual grasslands and wetlands. Prefers marshes and grasslands for foraging and nesting. Also uses agricultural fields for nesting and foraging, although nests may be destroyed by agricultural activities.	Year round, nomadic	None. CNDDB occurrences have been documented in the Buyer Service Area. Suitable habitat is present in area of analysis. Foraging and breeding habitat may be affected, but fallow fields would still represent suitable habitat. Birds can relocate to other habitats within the area.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Osprey *Pandion haliaetus*	--	WL	Northern California from Cascade Ranges south to Lake Tahoe, and along the coast south to Marin County.	Associated strictly with large, fish-bearing waters, primarily in ponderosa pine through mixed conifer habitats.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat occurs within the area of analysis. Water transfers would be subject to flow requirements. Therefore no impacts to foraging area expected. No impacts to nesting sites are anticipated.
prairie falcon *Falco mexicanus*	--	WL	Found from southeastern deserts northwest throughout Central Valley and inner Coast Ranges and Sierra Nevada. Mostly absent from northern coastal fog belt. Not found in upper elevation of Sierra Nevada.	Inhabits dry, open level or hilly terrain. Breeds on cliffs, forages far afield. Annual grassland to alpine meadows, but primarily perennial grasslands, rangeland, agricultural fields and desert scrub.	Permanent resident. Northern migrants winter in California. Upslope in summer, down slope in winter.	None. CNDDB occurrences have been documented in the Buyer Service Area. Suitable habitat is present within the area of analysis. Foraging habitat (i.e. agricultural fields) may be altered, but Transfers would not reduce suitability.
purple martin *Progne subis*	--	SSC	In south, found on the coast and interior mountain ranges. Absent from higher desert regions. In north, found on coast and inland to Modoc and Lassen counties. Absent from higher slopes of Sierra Nevada. Current breeding populations are known from western Santa Clara and Alameda counties, and western Placer County.	Inhabits woodlands, low elevation coniferous forest of Douglas-fir, ponderosa pine and Monterey pine. Uses open habitats during migration, including grassland, wet meadows, and fresh emergent wetlands.	Summer resident throughout California.	Low. CNDDB occurrences have been documented in the Seller Service Area. This species is restricted to fairly limited nesting sites with suitable cavities free of brood parasites. When wetlands are unavailable, rice fields may represent relatively high quality foraging habitat. This habitat may be slightly reduced by Transfers, but the species can relocate to other suitable habitat in the vicinity. Crop idling limitations are in place in the environmental commitments.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	--	SSC	Resident and summer visitor in San Francisco Bay area. Winter south along coast to San Diego county. Found in No. CA in summer months.	Found in fresh and salt water marshes. Requires thick, continuous cover to water surface for foraging and tall grasses, tulle and willows for nesting.	Year-round in southern California and San Francisco Bay, Summer resident in northern California.	None. Occurrences have been documented in the Buyer Service area and suitable habitat may be present in the area of analysis. Not known from rice fields. Water transfers would not affect suitable breeding or foraging habitat.
San Pablo song sparrow *Melospiza melodia samuelis*	--	SSC	Confined to emergent wetland along north side of San Francisco and San Pablo bay. Highest density at Petaluma River mouth.	A resident of salt marshes. The species inhabits tidal sloughs in salicornia marshes and nests in grindelia bordering slough channels.	Year round	None. Occurrences have been documented in the Buyer Service area and suitable habitat may be present in the area of analysis. However, no impacts are expected to salt water marshes.
Short-eared owl *Asio flammeus*	--	SSC	Endemic to marshes bordering the San Francisco, San Pablo Bays and Suisun Bay. Winter migrant in Central Valley, western Sierra Nevada foothills and coastline. Uncommon winter migrant in southern California. Breeding range includes: Del Norte, Humboldt, SF Bay Delta, northeastern Modoc plateau, south Lake Tahoe to Inyo County and San Joaquin valley.	Usually found in open areas with few trees, including grasslands, wet meadows, irrigated lands, saline and fresh emergent wetlands, and cleared forests. Occasionally in estuaries during breeding season. Ground nester in tall grasses, brush, ditches, and wetlands.	Year round. Migrants in CA from Sept. - April.	None. Occurrences have been documented in the Buyer Service Area. Suitable habitat occurs within the area of analysis. No impacts to breeding habitat would occur. Fallow rice fields would still represent suitable foraging habitat for the species.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Snowy egret *Egretta thula* (rookeries)	--	--	Throughout California.	Found along shores of coastal estuaries, fresh and saline emergent wetlands, ponds, slow-moving rivers, irrigation ditches, and wet fields.	Year round	None. Occurrences have been documented in the Buyer Service Area, however suitable habitat is present in both the Buyer and Seller Service area. No impacts to rookeries are anticipated. Idling of cropland foraging habitat would be limited by the environmental commitments, and birds could use alternative suitable foraging areas in the vicinity.
Suisun song sparrow *Melospiza melodia maxillaris*	--	SSC	Endemic, restrict to Suisun Marsh from Carquinez Strait east to the confluence of the Sacramento and San Joaquin rivers near Antioch. Highest numbers near Benicia State Park and Martinez shoreline.	Resident of brackish-water marshes. Inhabits cattails, tulles, sedges, and salicornia.	Year round. Non-migratory. Breeds early March to July.	None. Occurrences have been documented in the Buyer Service area and suitable habitat may be present in the area of analysis. However, no impacts are expected to brackish-water marshes.
Swainson's hawk *Buteo swainsoni*	--	T	Lower Sacramento and San Joaquin Valleys, the Klamath Basin, Northeastern plateau, Lassen County, and Mojave desert.	Nests in mature trees, including valley oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain and row crop fields.	Spring and summer resident; small wintering population in the Delta. Moves south to southern and interior CA Sept.-Oct. Moves north March-May.	None. CNDDB occurrences have been documented within both the Seller and Buyer Service Area. Suitable habitat is present within the area of analysis. Transfers may alter the composition of foraging habitat in the Buyer and Seller Service Areas, but these areas would still be suitable for the species, and additional habitats in the vicinity would be available. No impacts to breeding habitat are expected.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Tricolored blackbird *Agelaius tricolor*	--	SSC	A resident in California found throughout the Central Valley and in coastal districts from Sonoma County south. Found locally in northeastern California,. In winter, more widespread along central coast and San Francisco Bay area.	Breeds near fresh water, preferably in emergent wetlands with tall, dense cattails or tulles, but also in thickets of willow, blackberry, wild rose, tall herbs. Feeds in grassland and cropland habitats.	Year round. Leaves northeastern CA in fall and winter.	Low. CNDDB occurrences have been documented within both the Seller and Buyer Service Area. Suitable habitat is present within the area of analysis. Foraging habitat may be affected by Transfers. Environmental commitments limit cropland idling and birds can relocate to other adjacent foraging habitats within the area.
Western burrowing owl *Athene cunicularia hypugaea*	--	SSC	Central and southern coastal habitats, Central Valley, Great Basin, and deserts. Formerly common in appropriate habitat throughout the state, excluding humid northwest coastal forests and high mountains. Present on larger offshore islands.	Open annual grasslands or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Dependent upon burrowing mammals (especially California ground squirrel) for burrows.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat occurs within the area of analysis. Agricultural ditches may be suitable habitat for burrowing owl burrow and nesting activity. Water transfers would not affect the suitability of habitat for burrowing owl in the area of analysis.
Western snowy plover *Charadrius alexandrinus*	T	SSC	Along the west coast states, with inland nesting taking place at the Salton Sea, Mono Lake, and at isolated sites on the shores of alkali lakes in northeastern California, in the Central Valley, and southeastern deserts.	Nests, feeds, and takes cover on sandy or gravelly beaches along the coast, on estuarine salt ponds, alkali lakes, and at the Salton Sea.	Migration is from July-March (some year round populations).	None. Occurrences have been documented in the Buyer Service Area. There is a CNDDB occurrence in Yolo County, however this species is not likely to occur in rice fields. Suitable habitat may occur within the area of analysis. However Transfers are not expected to impact any suitable breeding or foraging habitat (i.e. sandy beaches or estuarine salt ponds).

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Western yellow-billed cuckoo *Coccyzus americanus*	C,	E	Uncommon to rare summer resident in scattered locations throughout California. Breeding population along Colorado river, Sacramento and Owen Valley, along South Fork of Kern River, Santa Ana River and Amargosa River. May be present along San Luis Rey River.	Deciduous riparian thickets or forests with dense, low-level or understory foliage, and which abut on slow-moving watercourses, backwaters, or seeps. Willow almost always a dominant component of the vegetation. In Sacramento Valley, also utilizes adjacent orchards, especially of walnut. Nests in sites with some willows, dense low-level or understory foliage, high humidity, and wooded foraging spaces.	Summer migration is from June-September.	None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present within the area of analysis. However this species is not likely to occur in rice fields due to lack of suitable foraging and roosting habitat (i.e. dense riparian thickets). No impacts are anticipated.
White-faced ibis *Plegadis chihi*	--	WL	Uncommon summer resident in sections of southern California, a rare visitor in the Central Valley, and is more widespread in migration. Uncommon to common in small pockets.	Feeds in fresh emergent wetlands, shallow lacustrine waters, muddy grounds of wet meadows, and irrigated or flooded pastures and croplands. Nests in dense, fresh emergent wetlands.	Present from April-October.	Low. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in area of analysis. Low potential impact to foraging habitat in the Seller Service Area. No potential impacts are expected to roosting habitat. Can relocate to other habitats within the area. Environmental commitments would limit acreage of allowable cropland idling.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
White-tailed kite *Elanus leucurus*	--	FP	Central Valley, coastal valleys, San Francisco Bay area, and low foothills of Sierra Nevada.	Savanna, open woodlands, marshes, partially cleared lands and cultivated fields, mostly in lowland situations. Rarely found away from agricultural areas. Feeds in open grasslands, meadows, farmlands and emergent wetlands. Nests located near open foraging area and placed on top of dense oak, willow or tree stands.	Year round	None. CNDDB occurrences have been documented within both the Seller and Buyer Service Area. Suitable habitat is present within the area of analysis. Foraging habitat may be altered, but would still be suitable for the species. No potential impacts to breeding habitat are anticipated.
yellow warbler *Dendroica petechia brewsteri*	--	SSC	Breeding range from coastal Del Norte County, east to Modoc plateau & Inyo County, south to coastal Santa Barbara and Ventura County., west to Kern County. Winters in Imperial and Colorado river valleys. Found up to 2500m (8000ft) in Sierra Nevada.	Associates with riparian habitats and prefers willows, cottonwood, aspens, sycamores, and alders. Nests in montane shrubbery in open conifer forests.	Summer resident throughout California.	None. Occurrences have been documented in the Buyer Service Area and suitable habitat is present with the area of analysis. No potential impacts are anticipated to riparian habitats.
yellow-headed blackbird *Xanthocephalus xanthocephalus*	--	SSC	Breeds east of Cascade range and Sierra Nevada, Imperial and Colorado River valley, in Central Valley and select locations in coast range west of Central Valley. Common in winter in Imperial Valley. Found as high as 2000m (6600ft) in San Bernardino Mountains.	Associated with freshwater emergent wetlands along lakes and ponds. Nesting timed with maximum emergence of aquatic insects. Feeds on cultivated grains, in emergent vegetation, and in nearby grasslands and croplands.	Year round, in parts of Central Valley. Summer range in eastern California, and parts of Central Valley. Present April through early May, and in September.	Low. Occurrences have been documented in the Buyer Service Area and suitable habitat is present within both the Buyer and Seller Service Area. Impacts to foraging habitat are expected in the Seller Service Area, but the birds can relocate to other habitat in the area. Environmental commitments would limit the amount of cropland idling in the area of analysis.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Mammals						
Alameda Island mole *Scapanus latimanus parvus*	--	WL	Only known from Alameda Island, Alameda County.	Found in a variety of habitats, especially annual and perennial grasslands. Prefers moist, friable soils and avoids flooded soils.	Year round	None. Occurrences have been documented in the Buyer Service Area. Transfers would not impact suitable habitat.
American badger *Taxidea taxus*	--	SSC	Throughout California.	Found in dry, open stages of most shrub, forest, and herbaceous habitats with friable soils.	Year round. Permanent resident except in North Coast area.	None. Occurrences have been documented in both the Buyer and Seller Service area and suitable habitat is present within the area of analysis. Suitable habitats are not expected to be impacted.
big free-tailed bat *Nyctinomops macrotis*	--	SSC	Rare in California. Vagrants found in San Diego County. and Alameda County (record is suspect).	Found in low-laying arid areas in Southern California and requires high cliffs or rocky outcrops for roosting sites.	Year round resident in San Diego County and Alameda County.	None. Occurrences have been documented in the Buyer Service Area and suitable habitat may be present in the area of analysis. Transfers would not impact suitable arid, rocky terrain habitat.
California wolverine *Gulo gulo*	PT	T, FP	A scarce resident of North Coast mountains and Sierra Nevada. Sightings range from Del Norte and Trinity counties. east through Siskiyou and Shasta counties., and south through Tulare County. A few possible sightings occur in the north coastal region as far south as Lake Couty. Habitat distribution in California is poorly known for the North Coast and northern Sierra Nevada.	In north coastal areas, has been observed in Douglas-fir and mixed conifer habitats. In the northern Sierra Nevada, have been found in mixed conifer, red fir, and lodge pole habitats, and probably use subalpine conifer, alpine dwarf-shrub, wet meadow, and montane riparian habitats. In the southern Sierra Nevada occur in red fir, mixed conifer, lodge pole, subalpine conifer, alpine dwarf-shrub, barren, and probably wet meadows, montane chaparral, and Jeffrey pine.	Year round (largely nocturnal)	None. Suitable habitat may occur within the area of analysis, however no CNDDB occurrences have been documented in the Buyer or Seller Service area. The species is not likely to occur in agriculture fields. No impacts are anticipated.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Fresno kangaroo rat *Dipodomys nitratoides exilis*	E	E	Western Fresno County. on the Alkali Sink Ecological Reserve and adjacent privately owned land.	Found in alkali sink-open grassland habitats. Prefers bare alkaline clay-based soils subject to seasonal inundation with more friable soil mounds around shrubs and grasses.	Year round. Breeds largely from March - June.	None. Occurrences have been documented in the Buyer Service Area. Suitable habitat present in the area of analysis. Transfers would not impact suitable habitat for this species (i.e. alkali sink grasslands).
giant kangaroo rat *Dipodomys ingens*	E	E	Found along western side of San Joaquin Valley (e.g. Carrizo Plain, Panoche Valley)	Found in annual grasslands and on and marginal habitat in alkali scrub. The species requires level terrain and sandy loam soils for burrowing.	Year round	None. Occurrences have been documented in the Buyer Service Area. Suitable habitat may be present in the area of analysis. However, no impacts are expected to suitable habitat (i.e. alkali desert scrub and annual grasslands).
Greater western mastiff bat E*umops perotis californicus*	--	SSC	Uncommon resident in southeastern San Joaquin Valley and Coastal Ranges from Monterey County southward through southern California, from the coast eastward to the Colorado Desert.	Occurs in many open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, annual and perennial grasslands, palm oases, chaparral, desert scrub, and urban areas. Crevices in cliff faces, high buildings, trees, and tunnels are required for roosting.	Year round (nocturnal activity)	None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in the area of analysis, bur no impacts are anticipated.
Nelson's antelope squirrel *Ammospermophilus nelsoni*	--	T	Found in the western San Joaquin valley from 200-1,200 ft. elevation. Found from southern Merced County to Kern, Kings and Tulare counties. In eastern portions of San Luis Obispo and Santa Barbara counties.	Found on dry sparsely vegetated loam soils. Requires widely scattered shrubs, forbs and grasses in broken terrain with gullies and washes.	Year round.	None. Occurrences have been documented with the Buyer Service Area. Suitable habitat may occur within the area of analysis. No impacts are anticipated to suitable upland habitats.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Pacific fisher *Martes pennati (pacifica) DPS*	C	SSC	Northern California coastal ranges up to Oregon, and the Sierra Nevada's.	Found in mature, dense, coniferous or mixed coniferous hardwood forest with closed canopies.	Year round	None. Occurrences have been documented with the Seller Service Area. Suitable habitat may occur within the area of analysis. No potential impacts are anticipated to suitable habitat (i.e. mixed conifer habitats).
pallid bat *Antrozous pallidus*	--	SC	Throughout California,, except for high Sierra Nevada from Shasta to Kern counties, northwestern corner of state from Del Norte & western Siskiyou cos. To northern Mendocino County.	Found in deserts, grasslands, scrublands, woodlands and forests. Most common in open, dry habitats with rocky areas for roosting.	Year round.	None. Occurrences have been documented with the Buyer Service Area. Suitable habitat may occur within the area of analysis. No impacts would occur to suitable habitat.
Ring-tailed cat *Brassariscus astutus*	--	FP	Ringtails are found in a variety of habitats centered around the semi-arid to arid climates of the west and southwest. Little information available on distribution and relative abundance among habitats.	Occurs in various riparian habitats, and in brush stands of most forest and shrub habitats, at low to middle elevations. Uses hollow trees, logs, snags, cavities in talus and other rocky areas, and other recesses are for cover.	Year round (nocturnal)	None. No CNDDB records of this species have been documented in the area of analysis. Suitable habitat is present in the area of analysis, but the species is not likely to occur in rice fields. No potential impact to suitable habitat are expected.
Riparian brush rabbit *Sylvilagus bachmani riparius*	E	E	Isolated populations on Caswell Memorial State Park on the Stanislaus River and along an overflow channel of the San Joaquin River.	Riparian thickets	Year round	None. No CNDDB records of this species have been documented in the area of analysis. Suitable habitat is present in the area of analysis, however, no potential impacts are expected to suitable habitat (i.e. riparian thickets).

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Riparian (San Joaquin Valley) woodrat *Neotoma fuscipes riparia*	E	SSC	Found along the lower portions of the San Joaquin and Stanislaus rivers in the northern San Joaquin Valley. Historical records for the riparian woodrat are distributed along the San Joaquin, Stanislaus, and Tuolumne rivers, and Corral Hollow, in San Joaquin, Stanislaus, and Merced Counties.	Most numerous where shrub cover is dense and least abundant in open areas. Dens are usually built in willow thickets with oak over story.	Year round (nocturnal activity)	None. Suitable habitat present (i.e. dense shrubs) in both the Buyer and Seller Service Areas, however no CNDDB occurrences have been documented. No potential impacts are expected.
salt-marsh harvest mouse *Reithrodontomys raviventris*	E	E	Found in San Francisco Bay and its tributaries.	Found in saline emergent wetlands. Pickle weed is the primary habitat for the species. Requires higher grassland areas for flood escape.	Year round.	None. CNDDB occurrences have been documented in the Buyer Service Area and suitable habitat may be present in the area of analysis. Transfers would not impact saline wetlands and salt marshes.
salt-marsh wandering shrew *Sorex vagrans halicoetes*	--	SSC	Southern arm of the San Francisco Bay in San Mateo, Santa Clara, Alameda and Contra Costa counties (Bolster 1998).	Found in the salt marshes. Inhabits medium high marsh where abundant driftwood is scattered among salicornia.	Year round. Breeds February - June	None. CNDDB occurrences have been documented in the Buyer Service Area and suitable habitat may be present in the area of analysis. Transfers would not impact salt marshes.
San Francisco dusky-footed woodrat *Neotoma fuscipes annectens*	--	SSC	Oregon, California and northwestern Baja California. Within California it is known from Alameda, Contra Costa, San Mateo, and Santa Clara, and Santa Cruz Counties.	Found in forest habitats of moderate canopy and moderate to dense understory. The species may prefer chaparral and redwood habitats. Nest sites include tree cavities, logs, and talus slopes (Carraway and Verts 1991; NatureServe 2011).	December - September	None. Occurrences have been documented within the Buyer Service area and suitable habitat may be present in the area of analysis. Transfers would not impact forest, chaparral and redwood habitat.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
San Joaquin kit fox *Vulpes macrotis mutica*	E	T	Found only in the Central Valley area of California. Kit foxes currently inhabit suitable habitat in the San Joaquin valley and in surrounding foothills of the Coast Ranges, Sierra Nevada, and Tehachapi Mountains; from southern Kern County north to Contra Costa, Alameda, and San Joaquin counties on the west; and near La Grange, Stanislaus County on the east.	Found in annual grasslands or grassy open stages of vegetation dominated by scattered brush, shrubs, and scrub. Build dens for cover. Some agricultural areas may support these foxes.	Year round (mostly nocturnal, but often active during daytime in cool weather)	None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat is present within the area of analysis. San Joaquin kit fox have the potential to occur in inland and southern portions of the area of analysis. Changes in crop type could alter foraging habitat conditions in the Buyer Service Area, however buyers would not be allowed to buy more water than they were entitled to under their CVP contract. Transfer water would not be used to plant permanent crops, so cropping patterns would be within normal range considered under the CVP contracts and would be covered by the pertinent B.O. Conservation strategies are in place for this species.
San Pablo vole *Microtus californicus sanpabloensis*	--	SSC	Found in salt marshes of San Pablo creek on the south shore of San Pablo Bay.	Annual grassland, saline emergent wetlands, salt marsh.	Year round.	None. CNDDB occurrences have been documented in the Buyer Service Area and suitable habitat may be present in the area of analysis. Transfers would not impact the wetlands and salt marshes of San Pablo Bay.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
short-nosed kangaroo rat *Dipodomys nitratoides brevinasus*	--	WL	Found in the western side of San Joaquin valley, near the mouth of Panoche Creek in western Fresno County, south to near the mouth of San Emigdio Creek, in southwestern Kern County, and to northeast of Bakersfield. Also occurs in eastern San Benito Valley and Cuyama Valley, and Santa Barbara County (Bolster 1998).	Found in grassland and desert shrub, especially a triplex. Inhabits highly alkaline soils around soda lake and prefers flat to gently sloping terrain.	Year round	None. CNDDB occurrences have been documented in the Buyer Service Area and suitable habitat may be present in the area of analysis. Transfers would not impact suitable habitat for this species.
Tipton kangaroo rat *Dipodomys nitratoides nitratoides*	E	E	Found in the Tulare Lake basin of southern San Joaquin Valley, from approximately Lemoore and Hanford in Kings County to Visalia, Tipton, Delano and Bakersfield on the east.	The species is found in saltbush scrub and sink scrub communities. Requires soft friable soils. Currently limited to uncultivated ground with alkaline soils.	Year round	None. CNDDB occurrences have been documented in the Buyer Service Area and suitable habitat may be present in the area of analysis. Transfers would not impact suitable habitat for this species.
Tulare grasshopper mouse *Onychomys torridus tularensis*	--	SSC	Foothill and floor of the southern San Joaquin Valley from western Merced and eastern San Benito counties, east to Madera County, and south to foothills of Tehachapi and San Emigdio Mts. Also found on Carrizo Plains, eastern San Luis Obispo County, Cuyama Valley, parts of Kern County, Tulare Basin and Panoche Valley (Bolster 1998).	Found in hot, arid valleys and scrub deserts. Favors compact soils with sparse growth of perennial grasses.	Year round.	None. CNDDB occurrences have been documented in the Buyer Service Area. Suitable habitat is present within the area of analysis. Transfers would not impact suitable habitat for this species.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
western mastiff bat *Eumops perotis californicus*	--	SSC	Found in southeastern San Joaquin Valley and Coastal ranges from Monterey County southward through southern California and from the coast eastward to Colorado Desert.	Found in open, semi-arid habitats, including conifer and deciduous woodlands, coastal scrub, grasslands, and chaparral. Roost in crevices in cliff faces, high buildings, trees and tunnels.	Year round	None. CNDDB occurrences have been documented in the Buyer Service Area and suitable habitat is present within the area of analysis. No impacts are anticipated to feeding or roosting habitat.
western red bat *Lasiurus blossevillii*	--	SSC	Occurs from Shasta County to Mexican boarder, west of Sierra Nevada/Cascade crest and deserts. Winters in western lowlands and coastal regions south of SF bay. Not found in desert areas.	Found in trees 2-40ft above ground, from sea level up through mixed conifer forests. Prefers habitat edges and mosaics with trees. Feeds over a wide variety of habitats including grasslands, scrublands and croplands.	Year round. Migrates in spring (March-May) and autumn (Sept.-Oct). Migrates between summer and winter range.	None. Occurrences have been documented in the Buyer and Seller Service Area and suitable habitat is present within the area of analysis. No impacts to roosting habitat are anticipated. Transfers could alter the configuration of foraging habitat, but would not reduce suitability.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Fish						
Sacramento River Winter-run Chinook Salmon *Oncorhynchus tshawytcha*	E	E	Occurs on the mainstem Sacramento River from Keswick Dam, Shasta County (RM 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta; and in the Bay-Delta system. The area downstream of Red Bluff Diversion Dam is principally a migration corridor, although some rearing may occur during emigration.	Migrate to upstream freshwater habitat to mature and spawn. Once juveniles emerge from the gravel they seek low velocity, shallow-water areas to finish absorbing their yolk sac. Some disperse downstream when high-flow events correspond with emergence. In general, there is a shift in microhabitat use by juvenile Chinook to deeper, faster water as they grow larger. For juveniles, positive growth occurs at temperatures between 5-19 C. Temperatures greater than 24 C, even for short periods, is lethal. Salmon fry tend to move downstream, and smolts emigrate to the ocean, under conditions of increased flow, increased turbidity, and decreased temperatures.	Upstream Migration: Dec-Jul. Spawning: late Apr to early Aug Fry remain in river for five to ten months, prior to emigration. Emigration Sep.-Jan.	None. Species not present in the area of Analysis during period when transfers would occur. Potential impacts would not occur on the mainstem Sacramento River where flows are regulated by the Biological Opinions.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Central Valley Spring-run Chinook Salmon *Oncorhynchus tshawytcha*	T	T	Designated critical habitat for spring-run Chinook salmon includes San Francisco, San Pablo, and Suisun Bays, the Sacramento-San Joaquin Delta, and the Sacramento River from the Delta to Keswick Dam and the Feather River upstream to Thermalito Afterbay Dam. Spawning occurs above the valley floor in streams that have deep, cold pools where adult fish can hold over the summer before they spawn. Tributaries to the Sacramento River with independent spawning populations are Butte, Deer and Mill Creeks. Spawning may also occur on several other streams in the Area of Analysis including Thomes, Big Chico, and Antelope creeks, and the Yuba and Bear rivers. Rearing occurs in these streams and other the downstream portions of other streams tributary to the Sacramento, as well as in the Sutter and Yolo Bypasses, and in the Delta during outmigration of the young fish.	See Sacramento River winter-run Chinook salmon.	Upstream Migration and holding: Mar-Sep. Spawning: late Aug to Oct. Fry remain in river for three to 15 months, prior to emigration. Emigration Jan-Apr.	Low. Suitable habitat for over summer holding and spawning in the species primary spawning and rearing habitat is located upstream of the areas that would be affected by water transfers. Rearing habitat could potentially be affected by groundwater withdrawals in the lower sections of some streams. The sections of these waterways on the valley floor, where water transfers would occur, are typically too warm to support this species during the summer months. Potential impacts would not occur on the mainstem Sacramento River or the Feather River where the operating requirements specified in the Biological Opinions and D1641 would be met.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Fall/Late-fall Chinook Salmon *Oncorhynchus tshawytcha*	SC	SSC	Occur in the ocean from Alaska to California. Freshwater habitat use in the Central Valley occurs in the Sacramento River and all major tributaries and many minor ones, as well as in tributaries to the major tributaries to San Joaquin River, including the Merced River. In the Sacramento River, most spawning occurs between the Red Bluff Diversion Dam and Keswick Dam, although some fish spawn downstream of Red Bluff Diversion Dam. Small numbers also spawn in Battle Creek, Cottonwood Creek, Clear Creek, Mill Creek, as well as the Yuba and Bear rivers.	See Sacramento River winter-run Chinook salmon.	Fall Run: Upstream Migration: Jun-Dec. Spawning: late Sep to Dec. Fry remain in river one to seven months Emigration Dec-Mar. Late fall run: Upstream Migration: Oct-Apr. Spawning: Jan-Apr Fry remain in river seven to 13 months Emigration Dec-Mar.	Low. Operating requirements for all of the mainstem rivers would meet existing flow and temperature requirements as specified by the NMFS and USFWS BOs for the Long-term Operations of the State and Federal Water Projects and State Water Board Decision 1641. Water transfers from sellers upstream of the Delta may still result in some flow changes that would overlap spatially and temporally with the distribution of fall-run Chinook salmon emigrants, but flows would continue to meet regulatory requirements protective of this species. Transfers would not overlap the Chinook upstream migration, spawning or incubation periods.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
California Central Valley DPS Steelhead *Oncorhynchus mykiss*	T	SSC	Designated critical habitat includes all waters tributary to the San Francisco Bay from confluence of the Sacramento and San Joaquin River to the lowest impassible barrier. Within these reaches it includes all areas within the ordinary high water mark of the water body. Found in all major rivers and tributaries and may use smaller tributaries, and ephemeral tributaries when available.	Immigration from the ocean into the Delta, the Sacramento and San Joaquin River watersheds occurs when large amounts of cold water is available from winter rains. Spawning occurs in mainstem rivers and their tributaries to. The first year or two of life is spent in cool, clear, fast-flowing permanent streams and rivers where riffles predominate over pools, where there is ample cover in the form of riparian vegetation of undercut banks, and where invertebrate prey is diverse and abundant. Habitat preferences depend on fish size/age, with fry concentrating in shallow water along stream edges with low water velocities, juveniles occurring in deeper, faster water among rocks or other cover, and larger fish seeking out a wide variety of deeper habitats close to fast water. Optimal temperatures for growth are approximately 15-18 C.	Central Valley steelhead are mainly winter-run steelhead, which mature in the ocean and arrive in freshwater nearly ready to spawn. Upstream Migration: Aug-Apr. Spawning: Dec to Apr. Fry generally remain in river for one to three years. Emigration Oct-Jul.	Moderate. Uses the upper Sacramento River above Red Bluff Diversion Dam and the portions of all accessible tributaries to the Sacramento and San Joaquin Rivers with suitable temperatures for spawning and rearing. The Sacramento River below RBDD is used primarily as a migratory corridor. Water transfers from July through September, from sellers upstream of the Delta could overlap spatially and temporally with California Central Valley steelhead rearing in this region where water temperatures are suitable. Stream sections on the valley floor, where transfers could affect stream flow, are generally too warm to support rearing during the summer months, but rearing may occur above the valley floor where suitable temperatures occur. Potential impacts would not occur on the mainstem Sacramento River or the Feather River where the operating requirements specified in the Biological Opinions and D1641 would be met.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
North American Green sturgeon *Acipenser medirostris*	T	SSC	Ranges from Mexico to Alaska. The southern DPS includes spawning population in the Sacramento River, fish living in the Sacramento River, the Sacramento-San Joaquin Delta, and the San Francisco estuary. Not known to occur in the San Joaquin River. Critical habitat include: coastal marine waters from Monterey Bay to the Washington/Canada boarder; coastal bays and estuaries in California, Oregon, and Washington; fresh water rivers in the Central Valley. Proposed inland critical habitat includes Sacramento River downstream of Keswick Dam, Feather River downstream of Thermalito Dam, Yuba River downstream of Daguerre Dam, portions of Sutter and Yolo Bypasses, and the legal Delta.	Southern DPS: Adult immigrate into the Delta from the ocean to begin spawning migration into the Sacramento River. Spawning occurs in the Sacramento River (upstream of Hamilton City and downstream of Keswick Dam), both downstream and upstream of RBDD; a small number have been observed spawning in the Feather River during high flow years. Moyle (2002). Preferred spawning habitat contain large cobble in deep and cool pools with turbulent water. Water temp in spawning and egg incubation are critical; temp greater than 19C are lethal. Rear in fresh and estuarine areas for one to four years before dispersing into salt water. Occur in shallow water and move to deeper more saline areas as they mature. Emigration occurs as larvae drift downriver from freshwater spawning/rearing areas of Sacramento River watershed through the Delta to the ocean. Subadults inhabit the Delta and bays during summer months, while adults are associated with seawater and mixing zones of bays and estuaries and found in lower stretches of some rivers. Adult and juvenile green sturgeon are thought to use the same migratory routes as Chinook salmon.	Immigration: late Feb. to Jun. Spawning: March to July. After spawning, adults over-summer in deep pools of the Sacramento River from June to Nov. and emigrate to the ocean in fall and early winter and flows increase and temperatures decrease. Rearing: year-round.	Low. Potential impacts would not occur on the mainstem Sacramento River or the Feather River where the operating requirements specified in the Biological Opinions and D1641 would be met.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Delta smelt *Hypomesus transpacificus*	T	E	Endemic to Bay-Delta estuary. Primarily distributed downstream of Isleton on the Sacramento River, downstream of Mossdale on the San Joaquin River, Suisun Bay and Suisun marsh, freshwater regions of the Delta. Designated critical habitat (59 FR 65256) extends throughout Suisun Bay, the length of Goodyear, Suisun, Cutoff, first Mallard and Montezuma sloughs, and the contiguous waters of the legal Delta.	Primarily inhabit low salinity waters of estuary prior to migrating into freshwater habitats to spawn. Spawning occurs in slough and shallow edge area in the Delta and Sacramento River; spawning can occur in the Sacramento River as far upstream as Sacramento and in the Cache Slough region, the Mokelumne River system, and the San Joaquin River upstream as far as Prisoner's Point. Spawning occurs at water temperatures ranging from approximately 7C to 22C. Rearing juveniles remain in spawning areas, near or just above the X2 region of the Delta. Adult delta smelt abundance in the fall has been in the northwestern Delta in the channel of the Sacramento River. Although delta smelt tolerate a wide range of temperatures (<6C to > 25C), warm water temperatures restrict their distribution more than colder water temperatures.	Delta and Suisun Bay – year round	Low. Potential impacts would not occur in the Delta as the operating requirements specified in the Biological Opinions and D1641 would be met. Minor changes in flow could occur in the Delta as a result of water transfers, but these flows would be small. Principal rearing areas during the summer and fall are in and around Suisun Bay and in the Cache Slough region.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Longfin smelt *Spirinchus thaleichthys*	C [4]	T	Occur along the Pacific coast of North America; widespread within the Bay-Delta estuary, in the lower Sacramento River (downstream of Rio Vista), in the San Joaquin River (downstream of Medford Island). Also common in nearshore coastal marine waters.	Spawns at the transition zone between freshwater and slightly brackish water over sandy or gravel substrates at temperatures from 7 C to 14.5 C. Spawning occurs in the Sacramento River mainstem, as far upstream as Rio Vista, the San Joaquin River as far upstream as Medford Island, and in other waterways within the Delta. Hatching coincides with annual peak Delta outflows, which coincide with high turbidity. Larval smelt concentrate in near-surface, fresh and brackish waters. Distribution of larval and juvenile smelt depends on freshwater outflows from the Delta during the late-spring, eventually inhabiting the bays as well as nearshore coastal marine habitats. Longfin smelt do not occupy areas with temperatures greater than 22 C in combination with salinities greater than 26 ppt.	Spawning: November to June. Fry and juveniles have generally left the Delta by May or June.	None. Potential impacts would not occur in the Delta as the operating requirements specified in the Biological Opinions and D1641 would be met. Minor changes in flow could occur in the Delta as a result of water transfers, but these flows would be small. Longfin smelt do not occur in the Delta during the transfer period.

Common Name *Scientific Name*	**Federal Special Status***	**State Special Status***	**Distribution**	**Habitat Association**	**Seasonal Occurrence**	**Potential Impact**
Hardhead	--	SSC	Hardhead are widely distributed in low to mid elevation streams in the Main Sacramento-San Joaquin river drainage as well as the Russian River drainage. Their range extends from the Ken River, in Kern County to the Pit River south of the Goose Lake drainage but are absent in the valley reaches.	Hardhead are typically found in undisturbed areas of the larger middle- and low elevation streams. Elevational range of hardhead is 10-1,450 m. Most streams in which they occur have summer temperatures in excess of 20°C.	Year-round	Low. Hardhead are largely excluded from the valley floor reaches of the streams and rivers within the Area of Analysis due to warm summer temperatures and the abundance of introduced fish.
Sacramento splittail	--	SSC	Endemic to the lakes and rivers of the Central Valley. Current distribution generally restricted to the Delta, Suisun Bay, Suisun Marsh, the lower portions of the Napa and Petaluma rivers, and other parts of the San Francisco estuary. They may occur in the Sacramento River upstream as far as Red Bluff Diversion Dam and on the San Joaquin as far upstream as Salt Slough in wet years. They may also occur in the lower Feather and American rivers during these wetter periods. The Sutter and Yolo bypasses are important spawning areas today.	Inhabit estuarine to fresh waters. Spawning occurs primarily on inundated floodplains. Tend to be found in slow-moving sections of rivers and sloughs, and in the Delta and Suisun Marsh. YOY splittail are commonly found between Rio Vista and Chipps island indicating that juveniles prefer more riverine habitat.	Year round in the Delta, Sacramento and San Joaquin Rivers.	Low. Operating requirements for all of the mainstem rivers would meet existing flow and temperature requirements as specified by the NMFS and USFWS BOs for the Long-term Operations of the State and Federal Water Projects and State Water Board Decision 1641.

[1] Central CA DPS

[2] Santa Barbara and Sonoma Counties

[3] All bird species listed below and many other birds are protected during the nesting season under the federal Migratory Bird Treaty Act.

[4] USFWS has found that the San Francisco Bay-Delta Distinct Population Segment (DPS) of longfin smelt warrants protection under the federal Endangered Species Act, but higher priority listing actions currently preclude their listing.

*Status explanations:
F=Federal
E= listed as endangered under the federal Endangered Species Act
T= listed as threatened under the federal Endangered Species Act
PT= proposed for listing as threatened under the federal Endangered Species Act.
C = Candidate for listing under the federal Endangered Species Act
D= delisted.
S=State
E= listed as endangered under the California Endangered Species Act.
T= listed as threatened under the California Endangered Species Act.
SSC=Species of Special Concern

Table I-2. Special-Status Plants with Potential to Occur in the Area of Analysis

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
adobe sanicle *Sanicula maritima*	-/R/ 1B.1	Alameda, Monterey, San Francisco, and San Luis Obispo Counties.	Meadows and seeps, valley and foothill grassland, chaparral, coastal prairie. Moist clay or ultramafic soils from 30-240m asl.	February - May	**None.** Adobe sanicle has been previously documented in the Buyer Service Area. Water transfer may increase the area of marginal habitat for this species in the Buyer Service Area. No negative impacts are expected.
Ahart's dwarf rush *Juncus leiospermus* var. *ahartii*	-/-/ 1B	Butte, Calaveras, Placer, Sacramento, Tehama, and Yuba Counties.	Valley and foothill grassland (mesic). May occur in disturbed areas including agricultural fields and locations with gopher digging activity (CNDDB 2012).	March-May	**Low.** Suitable grassland habtat occurs within the area of analysis and this species has been previously documented within the Seller Service Area. There is a low potential that this species would occur in managed rice fields.
Alkali milk-vetch *Astragalus tener var. tener*	-/-/ 1B.2	Central western California including Yolo County.	Subalkaline flats and areas around vernal pools.	March-June	**None.** Not likely to occur in rice fields, no suitable habitat (i.e. subalkali flats) would be affected by Transfers.
Anderson's manzanita *Arctostaphylos andersonii*	-/-/ 1B.2	Santa Clara, Santa Cruz, and San Mateo Counties.	Broadleaved upland forest, chaparral, North coast coniferous forest. Open sites in redwood forest from 180 - 800m asl.	November - May	**None.** Previously documented within the Buyer Service Area. No suitable habitat would be affected by the proposed Transfers.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Antioch Dunes evening-primrose *Oenothera deltoides* ssp. *howellii*	E/E/ 1B.1	Found only in Contra Costa and Sacramento Counties.	Occurs in inland dunes.	March-September	**None.** CNDDB records for this species have been documented within the Buyer Service Area. Not likely to occur in rice fields, and no inland dune habitat should be affected by Transfers.
arcuate bush-mallow *Malacothamnus arcuatus*	-/-/ 1B.2	Santa Clara, Santa Cruz, and San Mateo Counties.	Chaparral within gravelly alluvium from 80 - 335m asl.	April - September	**None.** Previously observed within the Buyer Service Area. No impacts to suitable habitat are anticipated in association with the proposed Transfers.
Baker's navarretia *Navarretia leucocephala* ssp. *bakeri*	-/-/ 1B.1	Colusa, Glenn, Lake, Lassen, Mendocino, Marin, Napa, Solano, Sonoma, Sutter, Tehama, and Yolo Counties.	Cismontane woodland, meadows and seeps, vernal pools, valley and foothill grassland, lower montane coniferous forest. Vernal pools and swales, adobe or alkaline soils from 5 - 950m.	April - July	**None.** The CNDDB contains records of this species within the Seller Service Area. It is very unlikely that Baker's navarretia would establish in rice fields, given the lack of adobe or akaline soils.
bearded popcorn-flower *Plagiobothrys hystriculus*	-/-/ 1B.1	Napa, Solano, and Yolo Counties.	Vernal pools, valley and foothill grassland in wet sites from 10-50m. This species is only known from a few very limited occurrences at the edges of vernal pools, such as at Jepson Prairie and in the Montezuma Hills.	April - May	**None.** Previous records of bearded popcorn-flower exist within the Seller Service Area. This species is not expected to occur in rice fields. No vernal pools or grassland habitats would be affected by the proposed Transfers.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Ben Lomond buckwheat *Eriogonum nudum* var. *decurrens*	-/-/ 1B.1	Alameda, Santa Clara, and Santa Cruz Counties.	Chaparral, cismontane woodland, lower montane coniferous forest. Ponderosa pine sandhills in Santa Cruz County from 50 - 800m asl.	June - October	**None.** The CNDDB contains occurences of this species in the Buyer Service Area. No chaparral or woodland habitats would be affected by the proposed Transfers.
bent-flowered fiddleneck *Amsinckia lunaris*	-/-/ 1B.2	Alameda, Contra Costa, Colusa, Lake, Marin, Napa, San Benito, Santa Clara, Santa Cruz, San Mateo, Sonoma, and Yolo Counties.	Cismontane woodland, valley and foothill grassland from 50 - 500m.	March - June	**None.** Bent-flowered fiddleneck has been previously documented within the Buyer Service Area. Although suitable habitat occurs within the area of analysis, none would be affected by the proposed actions.
big-scale balsamroot *Balsamorhiza macrolepis* var. *macrolepis*	-/-/ 1B.2	Alameda, Butte, Colusa, El Dorado, Lake, Mariposa, Napa, Placer, Santa Clara, Solano, Sonoma, Tehama, and Tuolumne Counties.	Valley and foothill grassland, cismontane woodland. Sometimes on serpentine. 35 - 1000m	March - June	**None.** This species has been previously documented within both the Buyer and Seller Service Areas. However it is not expected to occur in rice fields due to lack of suitable habitat.
big tarplant *Blepharizonia plumosa*	-/-/ 1B.1	Alameda, Contra Costa, San Joaquin, Solano, and Stanislaus Counties.	Valley and foothill grassland. Dry hills and plains in annual grassland. Clay to clay-loam soils, usually on slopes and often in burned areas 15 - 455m asl.	July - October	**None.** Big tarplant has been observed within the Buyer Service Area. Transfers would not affect suitable habitat for this species.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Boggs Lake hedge-hyssop *Gratiola hetersepela*	-/E/1B	Dispersed throughout the Sacramento and Central Valley. Also in Oregon.	Marshes, swamps, and vernal pools (clay).	April - August	**None.** A CNDDB occurrence has been documented within the Seller Service Area. This species may withstand some disturbances, such as cattle. However, modifications of natural hydrology by agriculture or other activities are considered a threat to the species, and Boggs Lake hedge-hyssop is not expected to occur within planted rice fields. No marsh or vernal pool habitat would be affected by the proposed Transfers.
Bolander's water-hemlock *Cicuta maculata var. bolanderi*	-/-/ 2.1	Occurs within California, Arizona, New Mexico, and Washington. In California it is found in Contra Costa, Los Angeles, Marin, Sacramento, Santa Barbara, San Luis Obispo, and Solano Counties.	Marshes, fresh or brackish water 0 - 200m asl.	July - September	**None.** Bolander's water hemlock has been previously documented within the Buyer Service Area. No marsh, fresh or brackish water habitat would be affected by the proposed Transfers.
Brandegee's clarkia *Clarkia biloba* ssp. *brandegeeae*	-/-/ 1B.2	Butte, El Dorado, Nevada, Placer, Sacramento, Sierra, and Yuba Counties.	Chaparral, cismontane woodland, often in roadcuts 295 - 885m asl.	May - July	**None.** This species has been previously recorded within the Seller Service Area. No impacts to suitable habitat are expected.
Brandegee's eriastrum *Eriastrum brandegeeae*	-/-/ 1B.2	Contra Costa, Colusa, Glenn, Lake, Santa Clara, Shasta, San Mateo, Tehama, and Trinity Counties.	Chaparral, cismontane woodland. On barren volcanic soils, often in open areas from 345 - 1000m asl.	April - August	**None.** Records of Brandegee's eriastrum exist for the Buyer Service Area. Suitable habitat would not be affected by Transfers.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Brewer's western flax *Hesperolinon breweri*	-/-/ 1B.2	Contra Costa, Napa and Solano Counties.	Chaparral, cismontane woodland, valley and foothill grassland. Often in rocky serpentine soils in serpentine chaparral and serpentine grassland from 30 - 885m asl.	May - July	**None.** Brewer's western flax has been previously observed within the Buyer Service Area. Suitable habitat would not be affected by Transfers.
Brittlescale *Atriplex depressa*	-/-/1B.2	Western Central Valley and valleys of adjacent foothills.	Alkali grassland, alkali meadow, alkali scrub, and vernal pools. Usually in alkali scalds or alkaline clay in meadows or annual grassland. Rarely associated with riparian areas, marshes, or vernal pools 1 - 320m asl.	April-October	**None.** Occurrences of this species have been documented in both the Buyer and Seller Service Areas in the CNDDB. This species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali and vernal pools).
Butte County fritillary *Fritillaria eastwoodiae*	-/-/3.2	Butte, El Dorado, Nevada, Placer, Placer, Shasta, Tehama and Yuba Counties.	Chaparral, cismontane woodland, lower montane coniferous forest. Usually on dry slopes but also found in wet places. Soils can be serpentine, red clay, or sandy loam 40 - 1500m asl.	March - June	**None.** Butte County fritillary has been previously observed within the Seller Service Area. Rice fields do not provide suitable habitat for this species, and it is therefore not expected to be impacted by Transfers.
California jewel-flower *Caulanthus californicus*	E/E/ 1B.1	Fresno, Kings, Kern, Santa Barbara, San Luis Obispo, and Tulare Counties.	Chenopod scrub, valley and foothill grassland, pinyon-juniper woodland. From various valley habitats in both the Central Valley and Carrizo Plain 65 - 900m asl.	February - May	**None.** CNDDB records of this species exist for the Buyer Service Area. Suitable habitat would not be affected by Transfers.
California seablite *Suaeda californica*	E/-/ 1B.1	Alameda, Contra Costa, Santa Clara, San Francisco, and San Luis Obispo Counties.	Marshes and swamps. Margins of coastal salt marshes 0 - 5m asl.	July - October	**None.** California seablite has been previously observed within the Buyer Service Area. No impacts to suitable habitat within the Buyer Service Area are expected to occur.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
caper-fruited tropidocarpum *Tropidocarpum capparideum*	-/-/ 1B.1	Alameda, Contra Costa, Fresno, Glenn, Monterey, Santa Clara, San Joaquin, and San Luis Obispo Counties.	Valley and foothill grassland in alkaline clay 0 - 455m asl.	March - April	**None.** CNDDB records exist for the Buyer Service Area. Transfers are not expected to impact suitable habitat for this species.
Carquinez goldenbush *Isocoma arguta*	-/-/ 1B.1	Occurs in Solano County.	Valley and foothill grassland. Alkaline soils, flats, lower hills. On low benches near drainanges and on tops and sides of mounds in swale habitat 1 - 20m asl.	August - December	**None.** Previously documented within the Buyer Service Area. Transfers would not affect water levels in the Seller Service Area and would only increase the levels in the Buyer Service Area.
chaparral harebell *Campanula exigua*	-/-/ 1B.2	Alameda, Contra Costa, San Benito, Santa Clara, and Stanislaus Counties.	Chaparral on rocky sites, usually on serpentine soils 300 - 1250m asl.	May - June	**None.** Chaparral harebell has been observed within the Buyer Service Area. However, Transfers are not expected to affect suitable habitat for this species.
chaparral ragwort *Senecio aphanactis*	-/-/ 2.2	California and Baja California. Within California, the species occurs in Alameda, Contra Costa, Fresno, Los Angeles, Merced, Monterey, Orange, Riverside, Santa Barbara, Santa Clara, the Channel Islands, San Diego, San Luis Obispo, Solano and Ventura Counties.	Cismontane woodland, coastal scrub. Drying alkaline flats 20 - 575m asl.	January - April	**None.** Previous records of this species exist within the Buyer Service Area. Transfers are not expected to affect suitable habitat for chaparral ragwort.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Choris' popcorn-flower *Plagiobothrys chorisianus* var. *chorisianus*	-/-/ 1B.2	Alameda, Santa Cruz, San Francisco, and San Mateo Counties.	Chaparral, coastal scrub, coastal prairie (mesic sites) 15 - 100m asl.	March - June	**None.** Choris' popcorn flower has been documented within the Buyer Service Area. No impacts to suitable habitat are anticipated in association with the proposed Transfers.
Colusa grass *Neostapfia colusana*	T/E/1B.1	Southern Sacramento Valley, and northern San Joaquin Valley.	Vernal pools.	May-July	**None.** According to the CNDDB, this species has been previously documented in the Seller Service Area. However, this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
Colusa layia *Layia septentrionalis*	-/-/ 1B.2	Colusa, Glenn, Lake, Mendocino, Napa, Sonoma, Sutter, Tehama, and Yolo Counties.	Chaparral, cismontane woodland, valley and foothill grassland. Scattered colonies in fields and grassy slopes in sandy or serpentine soil 145 - 1095m asl.	April - May	**None.** CNDDB records exist for the Seller Service Area. Transfers are not expected to impact suitable habitat for this species given that rice fields do not provide appropriate conditions.
Congdon's tarplant *Centromadia parryi* ssp. *congdonii*	-/-/ 1B.2	Alameda, Contra Costa, Monterey, Santa Clara, Santa Cruz, San Luis Obispo, San Mateo, and Solano Counties.	Valley and foothill grassland. Alkaline soils, sometimes described as heavy white clay 1 - 230m asl.	May - November	**None.** Although this species has been documented within the Buyer Service Area (CNDDB), no impacts to suitable habitat are expected.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Contra Costa goldfields *Lasthenia conjugens*	E/-/1B.1	San Francisco Bay Delta Regions, and scattered coastal areas.	Cismontane woodlands, playas, valley and foothill grasslands, and vernal pools. Often occurs in vernal pools, swales, and low depressions in open grassy areas 1 - 445m asl.	March-June	**None.** According to the CNDDB, this species has been previously documented within the Buyer Service Area. No impacts to suitable habitat (i.e. vernal pools, playas) are expected.
Contra Costa manzanita *Arctostaphylos manzanita* ssp. *laevigata*	-/-/1B.2	Contra Costa County.	Chaparral on rocky slopes 500 - 1100m asl.	January - April	**None.** Contra Costa manzanita has been observed within the Buyer Service Area. No impacts to suitable habitat for this species are expected.
Contra Costa wallflower *Erysimum capitatum* var. *angustatum*	E/E/1B.1	Contra Costa County	Inland dunes. Stabalized dunes of sand and clay near Antioch along the San Joaquin River 3 - 20m asl.	March - July	**None.** Records of this species exist within the Buyer Service Area. Suitable habitat would not be affected by Transfers.
coyote ceanothus *Ceanothus ferrisiae*	E/-/1B.1	Santa Clara County	Chaparral, valley and foothill grassland, coastal scrub. Serpentine sites in the Mt. Hamilton Range 120 - 455m asl.	January - May	**None.** The CNDDB contains records of this species within the Buyer Service Area. No suitable habitat for coyote ceanothus is expected to be impacted by the proposed Transfers.
Crampton's tuctoria (Solano grass) *Tuctoria mucronata*	E/E/1B	Located only in Yolo and Solano Counties.	Valley and foothill grassland (mesic), and vernal pools.	April-August	**None.** Occurrences have been documented outside of the area of analysis. Not likely to occur in rice fields. Suitable habitat within the Seller Service Area would not be impacted by Transfers.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Delta coyote-thistle(button celery) *Eryngium racemosum*	-/E/1B	Calaveras, Contra Costa, Merced, San Joaquin, and Stanislaus Counties.	Riparian scrub and vernally mesic clay depressions.	June-October	**None.** No occurrences have been documented within the area of analysis, but the species is known from Contra Costa, Merced, San Joaquin and Stanislaus Counties. No suitable habitat would be impacted by the proposed Transfers.
Delta mudwort *Limosella subulata*	-/-/ 2.1	Contra Costa, Marin, Sacramento, San Joaquin, Solano Counties.	Riparian scrub, freshwater marsh, brackish marsh. Usually on intertidal flats and muddy banks of the Delta in marshy or scrubby riparian associations, often with Lilaeopsis masonii 0 - 3m asl. Typically occurs with other rare plant species.	May - August	**None.** Previous CNDDB records exist within the Buyer Service Area, and suitable habitat is also present within the Seller Service Area. This species is not expected to occur within rice fields given that it is sensitive to alteration of natural hydrology and other disturbances (SCWA 2007).
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	-/-/ 1B.2	Contra Costa, Napa, Sacramento, San Joaquin, Solano, Sonoma, Yolo Counties.	Coastal salt marsh. In coastal salt marsh with Distichlis, Salicornia, Frankenia, etc from 0-3m asl.	May - September	**None.** Suitable habitat is present within the area of analysis, and CNDDB records exist for the Buyers Service Area. Transfers are not expected to impact suitable habitat for this species (i.e. coastal salt marshes).

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Diablo helianthella *Helianthella castanea*	-/-/ 1B.2	Alameda, Contra Costa, Marin, San Francisco, San Mateo.	Broadleaved upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, valley and foothill grassland. Usually in chaparral/oak woodland interface in rocky, azonal soils. Often in partial shade 25-1150m asl.	March - June	**None.** Diablo helianthella has been previously documented within the Buyer Service Area. No impacts to suitable habitat for this species are anticipated.
diamond-petaled California poppy *Eschscholzia rhombipetala*	-/-/ 1B.1	Alameda, Contra Costa, Colusa, San Joaquin, San Luis Obispo, Stanislaus Counties.	Valley and foothill grassland. Alkaline clay slopes and flats. 0 - 975m asl.	March - April	**None.** This species has been previously documented within the Buyer Service Area. No impacts to suitable habitat are anticipated.
dubious pea *Lathyrus sulphureus* var. *argillaceus*	-/-/ 3	Calaveras, El Dorado, Nevada, Placer, Shasta, Tehama Counties.	Cismontane woodland, lower montane coniferous forest, upper montane coniferous forest 150-305m asl.	April - May	**None.** CNDDB records of dubious pea exist within the Seller Service Area. Transfers actions would not affect suitable habitat for this species.
dwarf downingia *Downingia pusilla*	-/-/ 2.2	Occurs in California and South America. Within California: Amador, Fresno, Merced, Napa, Placer, Sacramento, San Joaquin, Solano, Sonoma, Stanislaus, Tehama, Yuba.	Vernal pools. Many historical occurences are extirpated. In beds of vernal pools 1 - 880m asl.	March - May	**None.** Previously observed within the Seller Service Area. Not likely to establish in rice fields, due to lack of suitable habitat (i.e., vernal pools).
elongate copper moss *Mielichhoferia elongata*	-/-/ 2.2	Occurs in California, Colorado and Oregon. Within California, occurs in Fresno, Humboldt, Lake, Mariposa, Marin, Nevada, Placer, Plumas, Santa Cruz, Trinity, and Tulare Counties.	Cismontane woodland on very acidic, metamorphic rock or substrate, usually in higher portions in fens.	--	**None.** CNDDB records exist for the Seller Service Area. Transfers are not expected to affect suitable habitat for this species.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Ferris' milk-vetch *Astragalus tener* var. *ferrisae*	-/-/1B.1	Sacramento Valley.	Subalkaline flats and areas around vernal pools.	March-June	**None.** The species has been previously documented within the Seller Service Area. Not likely to occur in rice fields, due to lack of suitable habitat.
fragrant fritillary *Fritillaria liliacea*	-/-/ 1B.2	Alameda, Contra Costa, Monterey, Marin, San Benito, Santa Clara, San Francisco, San Mateo, Solano, Sonoma Counties.	Cismontane woodland, valley and foothill grassland. Grassy areas from 635 - 855m asl.	February - April	**None.** Previous records exist within the Buyer Service Area. Transfers are not expected to impact suitable habitat for fragrant fritillary.
Franciscan onion *Allium peninsulare* var. *franciscanum*	-/-/ 1B.2	Mendocino, Santa Clara, San Mateo, Sonoma Counties.	Cismontane woodland, valley and foothill grassland. Clay soils, often on serpentine. Dry hillsides from 100 - 300m asl.	May - June	**None.** Previous records of franciscan onion exist for the Buyer Service Area. The proposed Transfers is not expected to impact suitable habitat for this species.
Franciscan thistle *Cirsium andrewsii*	-/-/ 1B.2	Contra Costa, Marin, San Francisco, San Mateo, Sonoma Counties.	Coastal bluff scrub, broadleaved upland forest, coastal scrub. Sometimes serpentine seeps 0 - 135m asl.	March - July	**None.** Has been observed within the Buyer Service Area. No impacts to suitable habitat for Franciscan thistle are anticipated.
Greene's tuctoria *Tuctoria greeni*	E/R/1B.1	Butte, Colusa, Fresno, Glenn, Madera, Merced, Modoc, Shasta, San Joaquin, Stanislaus, Tehama, and Tulare Counties.	Vernal pools.	May-July	**None.** There is a CNDDB occurrence within the Seller Service Area, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
hairless popcorn-flower *Plagiobothrys glaber*	-/-/ 1A	Alameda, Marin, San Benito, Santa Clara Counties.	Meadows and seeps, marshes and swamps. Coastal salt marshes and alkaline meadows 5-180m asl.	March - May	**None.** This species has been documented by CNDDB within the Buyer Service Area. Transfers are not expected to impact suitable habitat for this species within the Buyer Service Area.
hairy Orcutt grass *Orcuttia pilosa*	E/E/1B.1	Northern Sacramento Valley, Pit River Valley; isolated populations in Lake and Sacramento counties.	Vernal pools.	May - September	**None.** Hairy Orcutt grass has previously been documented by the CNDDB in the Seller Service Area. However this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
Hall's bush-mallow *Malacothamnus hallii*	-/-/ 1B.2	Contra Costa, Lake, Mendocino, Merced, Santa Clara, San Mateo, Stanislaus Counties.	Chaparral. Some populations on serpentine 10 - 550m asl.	May - October	**None.** Previous records exist within the Buyer Service Area. Transfers are not expected to impact suitable habitat for Hall's bush-mallow.
Hall's tarplant *Deinandra halliana*	-/-/ 1B.1	Fresno, Monterey, San Benito, San Luis Obispo Counties.	Cismontane woodland, valley and foothill grassland, vernal pools. In grassland and not necessarily in vernal pools 200 - 1000m asl.	April - May	**None.** Hall's tarplant has been observed within the Buyer Service Area. Transfers are not expected to impact vernal pools or other suitable habitat for this species within the Buyer Service Area.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Hartweg's golden sunburst *Pseudobahia bahiifolia*	E/E/1B	Found in El Dorado, Fresno, Madera, Merced, Stanislaus, Tuolumne, and Yuba Counties.	Cismontane woodland, valley and foothill grassland, often acidic.	April - May	**None.** There are CNDDB occurrences within Yolo County outside of the area of analysis. This species is not likely to be affected by Transfers given that it is not likely to occur in rice fields.
Heartscale *Atriplex cordulata*	-/-/1B	Western Central Valley and valleys of adjacent foothills.	Alkali grasslands, alkali meadows, and alkali scrub.	May - October	**None.** CNDDB occurrences have been documented within the Seller Service Area (Butte, Colusa, Yolo, and Glenn Counties). However this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali areas).
Heckard's pepper-grass *Lepidium latipes* var**.** *heckardii*	-/-/1B	Glenn, Solano, and Yolo Counties.	Valley and foothill grassland alkaline flats.	March-May	**None.** This species has been previously documented within the Seller Service Area. However it is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali flats).
Henderson's bent grass *Agrostis hendersonii*	- /-/ 3.2	Found in Butte, Calaveras, Merced, Placer, Shasta, and Tehama Counties. Also found in Oregon.	Vernal pools.	March- June	**None.** CNDDB records for this species occur within the Seller Service Area. Not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
Hispid bird's beak *Cordylanthus mollis* ssp. *hispidus*	-/-/1B.1	Alameda, Kern, Fresno, Merced, Placer, and Solano Counties.	Meadows and seeps, playas, valley and foothill grasslands (alkali).	June-September	**None.** Previously observed within the Seller Service Area according to CNDDB records. Not likely to occur in rice fields, no suitable habitat present.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
hooked popcorn-flower *Plagiobothrys uncinatus*	-/-/ 1B.2	Monterey, San Benito, Santa Clara, San Luis Obispo, and Stanislaus Counties.	Chaparral, cismontane woodland, valley and foothill grassland, coastal bluff scrub. Sandstone outcrops and canyon sides, often in burned or disturbed areas 300 - 820m asl.	April - May	**None.** Hooked popcorn-flower has been documented within the Buyer Service Area. No impacts to suitable habitat for this species are anticipated.
Hoover's button-celery *Eryngium aristulatum* var. *hooverii*	-/-/ 1B.1	Alameda, San Benito, Santa Clara, San Diego, San Luis Obispo Counties.	Vernal pools. Alkaline depressions, vernal pools, roadside ditches and other wet places near the coast 5 - 45m asl.	July - August	**None.** This species has been documented within the Buyer Service Area. Suitable habitat for the species is present (e.g. irrigated agriculture and ditches), but no impacts to suitable habitat are expected within the Buyer Service Area.
Hoover's cryptantha *Cryptantha hooveri*	-/-/ 1A	Contra Costa, Kern, Madera, Stanislaus Counties.	Valley and foothill grassland in coarse sand up to 150m asl.	April - May	**None.** Hoover's cryptantha has been observed within the Buyer Service Area. No impacts to suitable habitat for this species are anticipated.
Hoover's eriastrum *Eriastrum hooveri*	D/-/ 4.2	Contra Costa, Kern, Madera, Stanislaus Counties.	Chenopod scrub, valley and foothill grassland, pinyon-juniper woodland. On sparsely vegetated alkaline alluvial fans, also in the Temblor Range on sandy soils 50 - 915m asl.	April - May	**None.** This species has previously been documented within the Buyer Service Area. No suitable habitat for this species would be impacted by the proposed Transfers.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Hoover's spurge *Chamaesyce hooveri*	T/-/ 1B.2	Scattered in Glenn, Butte, Colusa, Merced, Stanislaus, Tehama, and Tulare Counties.	Vernal pools.	July-September	**None.** According to the CNDDB occurrences have been documented in the Seller Service Area. However, this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
Hospital Canyon larkspur *Delphinium californicum* ssp. *interius*	-/-/ 1B.2	Alameda, Contra Costa, Merced, Monterey, San Benito, Santa Clara, San Joaquin, and Stanislaus Counties.	Cismontane woodland, chaparral. In wet, boggy meadows, openings in chaparral and in canyons 225 - 1060m asl.	April - June	**None.** Hospital Canyon larkspur has been observed within the Buyer Service Area. There is suitable habitat for this species in the area of analysis, but the proposed actions are not expected to impact these habitat in the Buyer Service Area.
Indian valley brodiaea *Broiaea coronaria* ssp. *rosea*	-/E/1B	Scattered in Glenn, Lake, Colusa, and Tehama Counties.	Closed cone coniferous forest, chaparral, valley and foothill grasslands (serpentinite).	May-June	**None.** CNDDB occurrences have been documented outside of the area of analysis. This species is not likely to occur in rice fields due to lack of suitable habitat.
Indian Valley bush-mallow *Malacothamnus aboriginum*	-/-/ 1B.2	Alameda, Contra Costa, Merced, Monterey, San Benito, Santa Clara, San Joaquin, and Stanislaus Counties.	Cismontane woodland, chaparral. Granitic outcrops and sandy bare soil, often in disturbed soils 150 - 1700m asl.	April - June	**None.** Indian Valley bush-mallow has been observed within the Buyers Service Area. The proposed Transfers should not affect suitable habitat for this species.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Jepson's milk-vetch *Astragalus rattanii var. jepsonianus*	-/-/1B.2	Colusa, Glenn, Lake, Napa, Tehama, and Yolo Counties.	Chaparral, cismontane woodland, valley and foothill grassland, often serpentinite.	April-June	**None.** Although suitable habitat exists, no CNDDB records have been documented within the area of analysis. This species is not likely to be impacted as rice fields do not provide suitable habitat.
Keck's checkerbloom *Sidalcea keckii*	E/-/1B.1	Colusa, Fresno, Merced, Napa, Solano, Tulare, and Yolo Counties.	Cismontane woodlands, foothill and valley grasslands (serpentinite).	April-May	**None.** No CNDDB occurrences of this species are known for the area of analysis. Suitable habitat is present, but would not be impacted by the proposed Transfers.
Kellogg's horkelia *Horkelia cuneata* ssp. *sericea*	-/-/ 1B.1	Alameda, Monterey, Marin, Santa Barbara, Santa Cruz, San Francisco, San Luis Obispo, and San Mateo Counties.	Closed-cone coniferous forest, coastal scrub, chaparral. Within old dunes, coastal sandhills, openings from 10 - 200m asl.	April - September	**None.** Records of Kellog's horkelia exist in the Buyer Service Area. Transfers are not expected to affect suitable habitat for this species within the area of analysis.
Kings Mountain manzanita *Arctostaphylos regismontana*	-/-/ 1B.2	Santa Clara, Santa Cruz, and San Mateo Counties.	Broadleaved upland forest, chaparral, north coast coniferous forest. Granitic or sandstone outcrops 305 - 730m asl.	January - April	**None.** This species has been previously observed within the Buyer Service Area. Suitable habitat is presented but would not be impacted by the proposed Transfers.
large-flowered fiddleneck *Amsinckia grandiflora*	E/E/ 1B.1	Alameda, Contra Costa, and San Joaquin Counties.	Cismontane woodland, valley and foothill grassland. Annual grassland in various soils 275 - 550m asl.	April - May	**None.** Large-flowered fiddleneck has been recorded by the CNDDB within the Buyer Service Area. No impacts would occur to suitable habitat.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Layne's ragwort *Packera layneae*	T/-/1B	Butte, El Dorado, Tuolumne, and Yuba Counties.	Chaparral and cismontane woodland, rocky and often serpentinite.	April-August	**None.** There is a CNDDB occurrence within Butte County, outside the area of analysis. Although suitable habitat is present within the area of analysis, it is not expected to be impacted by the proposed Transfers.
Legenere *Legenere limosa*	-/-/1B.1	Sacramento Valley and south of the North Coast Ranges.	Vernal pools from 1-880m asl.	April-June	**None.** Legenere has been documented within both the Buyer and Seller Service Areas. Not likely to occur in rice fields, no suitable habitat present (i.e. vernal pools).
Lesser saltscale *Atriplex minuscula*	-/-/1B	Found in Butte, Fresno, Kern, Madera, Merced, Stanislaus, and Tulare Counties.	Chenopod scrub, playas, valley and foothill grasslands (alkali and sandy).	May-October	**None.** No CNDDB records exist for the area of analysis, but it has been documented within some of the counties. Suitable habitat occurs within the Buyer Service Area, but would not be impacted by the proposed Transfers.
Lime Ridge navarretia *Navarretia gowenii*	-/-/ 1B.1	Occurs within Contra Costa and Stanislaus Counties in California.	Chaparral on calcium carbonate rich soil with high clay content, 180 - 305m asl.	May - June	**None.** Previously documented within the Buyer Service Area. No suitable habitat for Lime Ridge navarretia would be affected by the proposed Transfers.
Loma Prieta hoita *Hoita strobilina*	-/-/ 1B.1	Alameda, Contra Costa, Santa Clara, Santa Cruz Counties.	Chaparral, cismontane woodland, riparian woodland. Within serpentine at mesic sites.	May - October	**None.** CNDDB records of Loma Prieta hoita exist for the Buyer Service Area. No impacts are expected within suitable habitat for this species.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Lone buckwheat *Eriogonum apricum* var. *apricum*	E/E/1B	Found in Amador and Sacramento Counties.	Chaparral.	July-October	**None.** Although it has been documented, no CNDDB records exist within the area of analysis. This species is not likely to occur in rice fields due to lack of suitable habitat.
Lost Hills crownscale *Atriplex coronata* var. *vallicola*	-/-/ 1B.2	Fresno, Kings, Kern, Merced, and San Luis Obispo Counties.	Chenopod scrub, valley and foothill grassland, vernal pools. In powdery, alkaline soils that are vernally moist with Frankenia, Atriplex spp. And Distichlis. 0 - 605m asl.	April - August	**None.** This species has been documented within the Buyer Service Area. No impacts to suitable habitat are expected.
lost thistle *Cirsium praeteriens*	-/-/ 1A	Little information exists on this plant. San Mateo and Santa Clara Counties. Little information exists on this species. It was collected from the Palo Alto area at the turn of the 20th century. Not observed since 1901.	0 - 100m asl.	June - July	**None.** CNDDB records of lost thistle exist for the Buyer Service Area. Very limited information is available. Based on status information it is likely to be extirpated and would therefore be unlikely to occur within an area impacted by transfers.
maple-leaved checkerbloom *Sidalcea malachroides*	-/-/ 4.2	Occurs within California and Oregon. In California the species occurs in Del Norte, Humboldt, Mendocino, Monterey, Santa Clara, Santa Cruz, and Sonoma Counties.	Broadleafed upland forest, coastal prairie, coastal scrub, North Coast coniferous forest. Woodlands and clearings near coast, often in disturbed areas 2 - 760m asl.	March - August	**None.** This species has been previously documented within the Buyer Service Area. No impacts to areas of suitable habitat are anticipated.
Marsh checkerbloom *Sidalcea oregana* ssp. *hydrophila*	-/-/1B	Glenn, Lake, Mendocino, and Napa Counties.	Meadows and seeps, and riparian forest.	June-August	**None.** Suitable habitat present within Glenn County in the area of analysis. This species is not expected to establish in rice fields, and therefore no impacts are anticipated.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Mason's lilaeopsis *Lilaeopsis masonii*	-/R/ 1B.1	Alameda, Contra Costa, Marin, Napa, Sacramento, San Joaquin, Solano, and Yolo Counties.	Freshwater and brackish marshes, riparian scrub. Tidal zones, in muddy or silty soil formed through river deposition or river bank erosion 0 - 10m asl. Populations may be ephemeral, using freshly deposited or exposed sediments (SCWA 2007).	April - November	**None.** Previous records of this species exist within the Buyer Service Area. This species is not expected to establish within rice fields.
Merced phacelia *Phacelia ciliata var. opaca*	-/-/ 1B.2	Merced County.	Valley and foothill grassland. Adobe or clay soils of valley floors, open hills or alkaline flats 60 - 150m asl.	February - May	**None.** Merced phacelia has been documented within the Seller Service Area. Transfers are not expected to affect suitable habitat for this species.
Metcalf Canyon jewel-flower *Streptanthus albidus* ssp. *albidus*	E/-/ 1B.1	Santa Clara County.	Valley and foothill grassland. Relatively open areas in dry grassy meadows on serpentine soils 45 - 245m asl.	April - July	**None.** This species was previously observed within the Buyer Service Area according to CNDDB. No Transfers-related impacts to suitable habitat for Metcalf Canyon jewel-flower are anticipated.
Milo Baker's lupine *Lupinus milo-bakeri*	-/T/1B	Glenn and Mendocino Counties.	Cismontane woodlands, foothill and valley grasslands.	June-September	**None.** Although suitable habitat is present within the area of analysis, no CNDDB records have been documented in either the Buyer or Seller Service Areas. This species is not likely to occur in rice fields due to lack of suitable habitat.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
most beautiful jewel-flower *Streptanthus albidus* ssp. *peramoenus*	-/-/ 1B.2	Alameda, Contra Costa, Monterey, Santa Clara, and San Luis Obispo Counties.	Chaparral, valley and foothill grassland, cismontane woodland, serpentine outcrops, on ridges and slopes 120 - 730m asl.	March - October	**None.** Most beautiful jewel-flower has been previously observed within the Buyer Service Area. No Transfers-related impacts to suitable habitat for this species are expected.
Mount Day rockcress *Boechera rubicundula*	-/-/ 1B.1	Santa Clara County.	Rocky slopes in chaparral at 1200m asl.	April - May	**None.** According to CNDDB, this species was documented within the Buyer Service Area. No suitable habitat for this species would be affected by Transfers.
Mt. Diablo buckwheat *Eriogonum truncatum*	-/-/ 1B.1	Alameda, Contra Costa, and Solano Counties.	Chaparral, coastal scrub, valley and foothill grassland. Dry, exposed clay or sandy substrates 100 - 600m asl.	April - December	**None.** This species has been observed within the Buyer Service Area. No suitable habitat would be affected by Transfers.
Mt. Diablo fairy-lantern *Calochortus pulchellus*	-/-/ 1B.2	Alameda, Contra Costa, and Solano Counties.	Chaparral, cismontane woodland, riparian woodland, valley and foothill grassland on wooded and brushy slopes 200 - 800m asl.	April - June	**None.** Mt. Diablo fairy-lantern has been documented within the Buyer Service Area. No impacts to suitable habitat for this species are expected.
Mt. Diablo jewel-flower *Streptanthus hispidus*	-/-/ 1B.3	Contra Costa County.	Valley and foothill grassland, chaparral, talus or rocky outcrops 275 - 970m asl.	March - June	**None.** The Mt. Diablo jewel-flower has been documented in the Buyer Service Area. No impacts to suitable habitat area anticipated.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Mt. Diablo manzanita *Arctostaphylos auriculata*	-/-/ 1B.3	Contra Costa County.	Chaparral in canyons and on slopes. On sandstone 120 - 500m asl.	January - March	**None.** This species was previously observed within the Buyer Service Area according to CNDDB. No Transfers-related impacts to suitable habitat for Mt. Diablo phacelia are anticipated.
Mt. Diablo phacelia *Phacelia phacelioides*	-/-/ 1B.2	Contra Costa, San Benito, Santa Clara, and Stanislaus Counties.	Chaparral, cismontane woodland. Adjacent to trails, on rock outcrops and talus slopes, sometimes on serpentine 500 - 1370m asl.	April - May	**None.** Mt. Diablo phacelia has been documented within the Buyer Service Area. No impacts to suitable habitat for this species are expected.
Mt. Hamilton coreopsis *Leptosyne hamiltonii*	-/-/ 1B.2	Alameda, Santa Clara, and Stanislaus Counties.	Cismontane woodland. On steep shale talus with open southwestern exposure 530 - 1300m asl.	March - May	**None.** CNDDB records of Mt. Hamilton coreopsis exist within the Buyer Service Area. Transfers would not affect suitable habitat for this species.
Mt. Hamilton fountain thistle *Cirsium fontinale* var. *campylon*	-/-/ 1B.2	Alameda, Santa Clara, and Stanislaus Counties.	Cismontane woodland, chaparral, valley and foothill grassland. In seasonal and perennial drainages on serpentine soil 95 - 890m asl.	February - October	**None.** This species has been documented within the Buyers Service Area. No impacts to suitable habitat within the area of analysis are anticipated.
Mt. Hamilton jewel-flower *Streptanthus callistus*	-/-/ 1B.3	Santa Clara County.	Chaparral, cismontane woodland. Open talus slopes on shale with grey pine and/or black oak 600 - 790m asl.	April - May	**None.** Mt. Hamilton jewel-flower has been documented within the Buyers Service Area by CNDDB. Transfers would not impact suitable habitat for this species.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Mt. Hamilton lomatium *Lomatium observatorium*	-/-/ 1B.2	Santa Clara and Stanislaus Counties.	Cismontane woodland. Open to partially shaded openings in Pinus coulteri - Oak woodland. Sedimentary Franciscan rocks and volcanic soils 1219 - 1330m asl.	March - May	**None.** Mt. Hamilton lomatium has been documented within the Buyers Service Area by CNDDB. Transfers would not impact suitable habitat for this species.
Munz's tidy-tips *Layia munzii*	-/-/ 1B.2	Fresno, Kern, and San Luis Obispo Counties.	Chenopod scrub, valley and foothill grassland. Hillsides in white-grey alkaline clay soils with grasses and chenopod scrub associates 45 - 760m asl.	March - April	**None.** This species has been observed within the Buyer Service Area. No suitable habitat would be affected by Transfers.
Norris' beard moss *Didymodon norrisii*	-/-/ 2.2	Butte, Contra Costa, Colusa, Humboldt, Lake, Los Angeles, Madera, Monterey, Mariposa, Nevada, Plumas, San Benito, Santa Cruz, Shasta, Sierra, Sonoma, Tehama, Tulare, and Tuolumne Counties.	Cismontane woodland, lower montane coniferous forest. Moss from seasonally wet sheet drainages on exposed rock slabs or terraces that completely dry in summer.	--	**None.** Records of Norris' beard moss exist for the Buyer Service Area. Transfers would not impact suitable habitat for this species.
Northern California black walnut *Juglans hindsii*	-/-/1B	Native stands reported in Napa and Contra Costa Counties.	Riparian woodland.	April-May	**None.** Previously documented within the Buyer Service Area. Transfers would not impact suitable habitat for this species.
Oregon meconella *Meconella oregana*	-/-/ 1B.1	Occurs in California, Oregon and Washington. Within California occurs in Contra Costa and Santa Clara Counties.	Coastal prairie and coastal scrub in open, moist places 250 - 500m asl.	March - April	**None.** Oregon meconella has been observed within the Buyer Service Area. Transfers would not affect suitable habitat for this species.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
oval-leaved viburnum *Viburnum ellipticum*	-/-/2.3	Occurs in California, Oregon and Washington. Within California occurs in Contra Costa, El Dorado, Fresno, Glenn, Humboldt, Mendocino, Napa, Placer, Shasta, Sonoma and Tehama Counties.	Chaparral, cismontane woodland, and lower montane coniferous forest 215 - 1400m asl.	May - June	**None.** This species has been previously documented within the Buyer Service Area. Suitable habitat for oval-leaved viburnum is not expected to be affected by Transfers.
pallid manzanita *Arctostaphylos pallida*	T/E/1B.1	Alameda and Contra Costa Counties.	Broadleafed upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, coastal scrub. Grows on uplifted marine terraces on siliceous shale or thin chert at 185 - 465m asl. May require fire.	December - March	**None.** Pallid manzanita has been observed within the Buyer Service Area. No Transfers-related impacts to suitable habitat are anticipated.
Palmate-bracted bird's-beak *Cordylanthus palmatus*	E/E/1B.1	Found in Glenn and Colusa Counties and within the Central Valley.	Alkali meadow, alkali scrub, valley and grasslands.	May-October	**None.** CNDDB records of this species exist for the Seller Service Area. Not likely to occur in rice fields; no suitable habitat is present (i.e. alkali areas).
Panoche pepper-grass *Lepidium jaredii* ssp. *album*	-/-/ 1B.2	Fresno, San Benito, and San Luis Obispo Counties.	Valley and foothill grassland. White or grey clay lenses on steep slopes. Incidental in alluvial fans and washes. Clay and gypsum-rich soils 65 - 910m asl.	February - June	**None.** Panoche pepper-grass has previously been documented within the Buyer Service Area. The proposed Transfers would not impact suitable habitat for this species.
Peruvian dodder *Cuscuta obtusiflora* var. *glandulosa*	-/-/ 2.2	Known from California, Baja Califronia, Sonora and Texas. Within California records exist from Butte, Los Angeles, Merced, Sacramento, San Bernardino, Sonoma and Sutter Counties.	Marshes and swamps (freshwater). Freshwater marsh 15 - 280m asl.	July - October	**None.** CNDDB records of this species exist for the Seller Service Area. Peruvian dodder is unlikely to become established within rice fields.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Pincushion navarretia *Navarretia myersii* ssp. *myersii*	-/-/1B.1	Alamdor, Calaveras, Merced, Placer, and Sacramento Counties.	Vernal pools (often acidic).	May	**None.** Previously documented in the Seller Service Area. No vernal pools would be affected by Transfers.
pink creamsacs *Castilleja rubicundula* ssp. *rubicundula*	-/-/ 1B.2	Butte, Contra Costa, Colusa, Glenn, Lake, Napa, Plumas, San Benito, Santa Clara, and Shasta Counties.	Chaparral, meadows and seeps, valley and foothill grassland. Openings in chaparral or grasslands. On serpentine 20 - 900m asl.	April - June	**None.** Pink creamsacs has been previously documented within the Buyer Service Area. No impacts to suitable habitat for this species are anticipated.
Point Reyes bird's-beak *Chloropyron maritimum* ssp. *palustre*	-/-/ 1B.2	California and Oregon. Within California it occurs in Alameda, Humboldt, Marin, Santa Clara, San Francisco, San Mateo, and Sonoma Counties.	Coastal salt marsh, usually in coastal salt marsh with Salicornia, Distichlis, Jaumea, Spartina, etc 0 - 15m.	June - October	**None.** CNDDB records of this species exist for the Buyer Service Area. Suitable habitat for this species is not expected to be affected by Transfers.
Presidio clarkia *Clarkia franciscana*	E/E/1B.1	Alameda and San Francisco Counties	Coastal scrub, valley and foothill grassland. Serpentine outcrops in grassland or scrub 20 - 335m.	May - July	**None.** Presidio clarkia has been previously observed within the Buyer Service Area. Suitable habitat exists in the area of analysis, but would not be affected by the proposed Transfers.
Recurved larkspur *Delphinium recurvatum*	-/-/1B	Disbursed throughout the Sacramento and Central Valley.	Chenopod scrub, cismontane, valley and foothill grasslands (alkali).	March-June	**None.** According to the CNDDB this species has been previously recorded in the Buyer Service Area. Suitable habitat exists (i.e. alkali areas) in the area of analysis, but would not be affected by the proposed Transfers.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Red Bluff dwarf rush *Juncus leiospermus* var. *leiospermus*	-/-/1B.1	Butte, Placer, Shasta, and Tehama Counties.	Chaparral, valley and foothill grassland, cismontane woodlands, vernal pools. Vernally mesic sites. Sometimes on edges of vernal pools 30 - 1020m asl. The species has also been documented within intermittant drainages and in areas with pocket gopher and ground squirrel activity (BRCP 2011).	March - May	**Low.** Red Bluff dwarf rush has been previously documented within the Seller Service Area. Given that the species has some tolerance for disturbance, is a low potential for red bluff dwarf rush to establish within rice fields, which may represent marginal habitat.
Red Hills soaproot *Chlorogalum grandiflorum*	-/-/1B.2	Amador, Butte, Calaveras, El Dorado, Placer and Tuolumne Counties.	Cismontane woodland, chaparral, lower montane coniferous forest. Occurs frequently on serpentine or gabbro, but also on non-ultramafic substrates, often on historically disturbed sites.	May - June	**None.** CNDDB records of this species exist within the Seller Service Area. This species is not expected to occur within rice fields due to lack of suitable habitat (i.e., serpentine areas).
Red mountain catchfly *Silene campanulata* ssp. *campanulata*	-/E/1B	Found in Colusa, Glenn, Mendocino, Shasta, Tehama, and Trinity Counties.	Chaparral and lower montane coniferous forest, usually sepentinite and rocky.	April-July	**None.** There is a CNDDB occurrences in the vicinity, within counties in the area of analysis. However this species is not likely to occur in rice fields due to lack of suitable habitat.
robust spineflower *Chorizanthe robusta* var. *robusta*	E/-/1B.1	Alameda, Monterey, Marin, Santa Clara, Santa Cruz, San Francisco, and San Mateo Counties.	Cismontane woodland, coastal dunes, coastal scrub. Sandy terraces and bluffs or in loose sand 3 - 120m asl.	April - September	**None.** Robust spineflower has been documented within the Buyer Service Area. Transfers are not expected to affect suitable habitat for this species.
rock sanicle *Sanicula saxatilis*	-/-/ 1B.2	Contra Costa and Santa Clara Counties.	Broadleafed upland forest, chaparral, valley and foothill grassland. Bedrock outcrops and talus slopes in chaparral or oak woodland habitat 625 - 1215m asl.	April - May	**None.** CNDDB records of this species exist within the Buyer Service Area. Suitable habitat for rock sanicle is not expected to be affected by Transfers.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
round-leaved filaree *California macrophylla*	-/-/1B.1	California, Baja California, Oregon.	Cismontane woodland, valley and foothill grassland. Clay soils 15 - 1200m asl.	March - May	**None.** Round-leaved filaree has been previously documented within both the Buyer and Seller Service Areas. No Transfers-related impacts to suitable habitat for the species are anticipated.
Sacramento Orcutt grass *Orcuttia viscida*	E/E/1B.1	Valley grasslands and freshwater wetlands.	Vernal pools.	May-June	**None.** CNDDB records of this species exist for the Seller Service Area. Sacramento Orcutt grass is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
saline clover *Trifolium hydrophilum*	-/-/ 1B.2	California's Central coast and Bay Area.	Marshes and swamps, valley and foothill grassland, vernal pools. Mesic, alkaline sites 0 - 300m asl.	April - June	**Low.** Records of saline clover exist within both the Buyer and Seller Service Areas. Rice fields may represent marginally suitable habitat for this species. There is a low potential for impacts within the Seller Service Area (Colusa, Solano, and Yolo Counties).
San Benito pentachaeta *Pentachaeta exilis* ssp. *aeolica*	-/-/ 1B.2	Monterey, San Benito, and Santa Clara Counties.	Cismontane woodland, valley and foothill grassland. Grassy areas from 635 - 855m asl.	March - May	**None.** This species has previously been documented within the Buyer Service Area. No suitable habitat for this species would be impacted by the proposed Transfers.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
San Francisco Bay spineflower *Chorizanthe cuspidata* var. *cuspidata*	-/-/ 1B.2	Alameda, Marin, San Francisco, San Mateo, and Sonoma Counties.	Coastal bluff scrub, coastal dunes, coastal prairie, coastal scrub. Sandy soil on terraces and slopes 5 - 550m asl.	April - August	**None.** San Francisco Bay spineflower has been observed within the Buyer Service Area. No impacts to suitable habitat for this species are anticipated in association with the proposed Transfers.
San Francisco collinsia *Collinsia multicolor*	-/-/ 1B.2	Monterey, Marin, Santa Clara, Santa Cruz, San Francisco, and San Mateo Counties.	Closed-cone coniferous forest, coastal scrub. On decomposed shale (mudstone) mixed with humus 30 - 250m asl.	March - May	**None.** This species has been documented within the Buyer Service Area. No impacts to suitable habitat are expected.
San Francisco popcorn-flower *Plagiobothrys diffusus*	-/E/1B.1	Alameda, Santa Cruz, San Francisco, and San Mateo Counties.	Valley and foothill grassland, coastal prairie. Historically known from grassy slopes with marine influence 60 - 485m asl.	March - June	**None.** San Francisco popcorn-flower has been observed within the Buyer Service Area. No impacts to suitable habitat for this species are anticipated in association with the proposed Transfers.
San Joaquin spearscale *Atriplex joaquiniana*	-/-/1B.2	Western Central Valley and valleys of adjacent foothills.	Alkali grasslands, and alkali scrub.	April-September	**None.** Has been previously documented within both the Buyer and Seller Service Areas. Not likely to occur in rice fields, no suitable habitat present (i.e. alkali areas).
San Joaquin woollythreads *Monolopia congdonii*	E/-/1B.2	Fresno, Kings, Kern, Santa Barbara, San Benito, San Luis Obispo, and Tulare Counties.	Chenopod scrub and valley and foothill grassland. Alkaline or loamy plains, sandy soils 60 - 800m asl.	February - May	**None.** San Joaquin woollythreads was previously documented within the Buyer Service Area. No impacts to suitable habitat are anticipated.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Sanford's arrowhead *Sagittaria sanfordii*	-/-/1B	Central Valley.	Freshwater marshes, shallow streams, and ditches.	May-August	**Moderate.** Sanford's arrowhead has been previously documented within the Seller Service Area. Not likely to establish in rice fields, but ditches represent suitable habitat. There is a moderate potential that this species would be affected by the proposed Transfers.
Santa Clara red ribbons *Clarkia concinna ssp. automixa*	-/-/ 4.3	Alameda and Santa Clara Counties.	Cismontane woodland, chaparral on slopes and near drainages 90-970m asl.	April - July	**None.** CNDDB records for this species exist for the Buyer Service Area. No suitable habitat for this species should be affected by Transfers.
Santa Clara Valley dudleya *Dudleya abramsii* ssp. *setchellii*	E/-/ 1B.1	Santa Clara County.	Valley and foothill grassland, cismontane woodland. On rocky serpentine outcrops and on rocks within grassland or woodland 80 - 335m asl.	April - October	**None.** Santa Clara Valley dudleya has been previously documented within the Buyer Service Area. Suitable habitat for this species would not be impacted by the proposed Transfers.
Santa Cruz tarplant, *Holocarpha macradenia*	T/E/1B.1	Alameda, Contra Costa, Monterey, Marin, Santa Cruz, and Solano Counties.	Coastal prairie, valley and foothill grassland. Light, sandy soil or sandy clay, often with non-natives 10 - 260masl.	June - October	**None.** Santa Cruz tarplant has been observed within the Buyer Service Area, according to CNDDB records. No impacts to suitable habitat are anticipated.
Santa Cruz Mountains beardtongue *Penstemon rattanii* var. *kleei*	-/-/ 1B.2	Santa Clara and Santa Cruz Counties	Chaparral, lower montane coniferous forest. Sandy shale slopes, sometimes in the transition between forest and chaparral 400 - 1100m asl.	May - June	**None.** This species has been observed within the Buyer Service Area. No suitable habitat would be affected by Transfers.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Santa Cruz Mountains pussypaws *Calyptridium parryi* var. *hesseae*	-/-/ 1B.1	Monterey, Santa Clara, Santa Cruz, San Luis Obispo, and Stanislaus Counties.	Chaparral, cismontane woodland, sandy or gravelly openings 305 - 1530m asl.	May - August	**None.** CNDDB records of Santa Cruz Mountains pussypaws exist for the Buyer Service Area. Suitable habitat for this species is not expected to be affected by Transfers.
Santa Cruz tarplant, *Holocarpha macradenia*	T/E/1B.1	Alameda, Contra Costa, Monterey, Marin, Santa Cruz, and Solano Counties.	Coastal prairie, valley and foothill grassland. Light, sandy soil or sandy clay, often with non-natives 10 - 260masl.	June - October	**None.** Santa Cruz tarplant has been observed within the Buyer Service Area, according to CNDDB records. No impacts to suitable habitat are anticipated.
Scadden Flat checkerbloom *Sidalcea stipularis*	-/E/ 1B.1	Nevada County. Known from two occurences near Grass Valley.	Marshes and swamps. Typical habitat includes montane marshes fed by springs 700 - 740m asl.	July - August	**None.** This species has been previously documented within the Seller Service Area. It is not likely to establish in rice fields due to lack of suitable habitat (i.e. montane marsh).
Sharsmith's harebell *Campanula sharsmithiae*	-/-/ 1B.2	Santa Clara and Stanislaus Counties.	Chaparral. Serpentine barrens 480 - 1820m asl.	April - June	**None.** Sharsmith's harebell has been observed within the Buyer Service Area. No impacts to suitable habitat for this species are expected.
Sharsmith's onion *Allium sharsmithiae*	-/-/ 1B.3	Alameda, Santa Clara, and Stanislaus Counties.	Cismontane woodland. Rocky, serpentine slopes 400 - 1200m asl.	March - May	**None.** CNDDB records for this species occur within the Buyer Service Area. Suitable habitat for this species should not be impacted by the proposed Transfers.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Sheldon's sedge *Carex sheldonii*	-/-/2.2	Occurs in California, Idaho, Nevada, Oregon, Utah and Washington. Within California the species occurs in Lassen, Modoc, Placer, and Plumas Counties.	Lower montane coniferous forest, marshes and swamps, riparian scrub. Mesic sites along creeks and in wet meadows 1065 - 1755m asl.	May - August	**None.** Sheldon's sedge has been observed within the Seller Service Area. Although rice fields may provide the appropriate moisture conditions, this species occurs at very high elevations and is therefore not expected to be impacted by the proposed Transfers.
shining navarretia *Navarretia nigelliformis* ssp. *radians*	-/-/1B.2	Alameda, Contra Costa, Fresno, Merced, Monterey, San Benito, San Joaquin, and San Luis Obispo Counties.	Cismontane woodland, valley and foothill grassland, and vernal pools 200 - 1000m asl. Known from grassland, and may not necessarily occur in vernal pools.	April - July	**None.** Previous CNDDB records of shining navarettia exist for the Seller Service Area. This species is unlikely to establish within rice fields due to lack of suitable habitat (i.e., vernal pools and native grassland).
Sierra blue grass *Poa sierrae*	-/-/1B.3	Butte, Madera, Nevada, Placer, Plumas, Shasta Counties.	Lower montane coniferous forest. Shady, moist, rocky slopes often in canyons 365 - 1160m asl.	April - June	**None.** This species has been documented within the Seller Service Area. This species is not likely to be impacted, given that it requires shaded rocky slope habitat not provided in rice fields.
showy golden madia *Madia radiata*	-/-/1B.1	Contra Costa, Fresno, Kings, Kern, Monterey, Santa Barbara, San Benito, Santa Clara, San Joaquin, San Luis Obispo, and Stanislaus Counties.	Valley and foothill grassland, cismontane woodland, chenopod scrub. Mostly on adobe clay in grassland or among shrubs 25 - 1125m asl.	March - May	**None.** Showy golden madia has been observed within the Buyer Service Area. No projec impacts to suitable habitat for this species are anticipated.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Slender Orcutt grass *Orcuttia tenuis*	T/E/1B.1	Northern Sacramento Valley, Pit River Valley; isolated populations in Lake and Sacramento Counties.	Vernal pools.	May-October	**None.** The CNDDB contains records of slender Orcutt grass in the Seller Service Area. However, this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
slender-leaved pondweed *Stuckenia filiformis*	-/-/ 2.2	Occurs in California, Arizona, Nevada, Oregon, and Washington.	Marshes and swamps. Shallow, clear water of lakes and drainage channels 15 - 2310m asl.	May - July	**None.** Slender-leaved pondweed has been previously documented within the Buyer Service Area. It is not expected to occur within rice fields in the Seller Service Area given the lack of suitable natural lake and stream habitat.
slender silver moss *Anomobryum julaceum*	-/-/ 2.2	California and Oregon. Within California it occurs in Butte, Contra Costa, Humboldt, Los Angeles, Mariposa, Santa Barbara, Santa Cruz, Shasta, and Sonoma Counties.	Broadleafed upland forest, lower montane coniferous forest, north coast coniferous forest. Grows on damp rocks and soil in acidic substrates and on roadcuts 100 - 1000m asl.	--	**None.** CNDDB records of slender silver moss exist for the Buyer Service Area. Suitable habitat for this species is not expected to be affected by Transfers.
smooth lessingia *Lessingia micradenia var. glabrata*	-/-/ 1B.2	Santa Clara County.	Chaparral. Serpentine often on roadsides 120 - 485m asl.	July - November	**None.** This species has been previously documented within the Buyer Service Area. No impacts to chaparral or serpentine areas are anticipated.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Soft bird's beak *Cordylanthus mollis* ssp. *mollis*	E/R/1B.2	Located in Contra Costa, Marin, Napa, Sacramento, Solano, and Sonoma Counties.	Coastal salt marshes and swamps.	July-November	**None.** CNDDB occurrences exist for the Buyer Service Area, however this species is not likely to be affect by Transfers due to lack of suitable habitat (i.e. coastal salt marshes).
stinkbells *Fritillaria agrestis*	-/-/ 4.2	Occurs in Central and Northern California, including Alameda, Contra Costa, Fresno, Kern, Mendocino, Merced, Monterey, Mariposa, Placer, Sacramento, Santa Barbara, San Benito, Santa Clara, Santa Cruz, San Luis Obispo, San Mateo, Stanislaus, Tuolumne, Ventura, and Yuba Counties.	Cismontane woodland, chaparral, valley and foothill grassland. Sometimes on serpentine, mostly in non-native grassland or in grassy openings in clay soil 95 - 890m asl.	March - June	**None.** This species has been documented within both the Buyer and the Seller Service Areas. No impacts to suitable habitat for stinkbells are anticipated.
Succulent owl's clover *Castilleja campestris* ssp. *succulenta*	T/E/1B.2	Fresno, Madera, Merced, Mariposa, San Joaquin, and Stanislaus Counties.	Vernal pools.	April-May	**None.** Succulent owl's clover has beend ocumented in the Seller Service Area, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Suisun Marsh aster *Symphyotrichum lentum*	-/-/ 1B.2	Contra Costa, Napa, Sacramento, San Joaquin, Solano, and Yolo Counties.	Saline and freshwater marshes and swamps. Most often seen along sloughs with Phragmites, Scirpus, blackberry, Typha, etc at 0-3m asl.	May - November	**None.** This species has been previously documented within both the Buyer and Seller Service Areas. This species is not expected to occur within rice fields given its sensitivity to habitat alteration and agricultural amendments. Environmental commitments would require that downstream flows are maintained, such that no impacts are anticipated in the natural habitats for the species.
talus fritillary *Fritillaria falcata*	-/-/ 1B.2	Alameda, Monterey, San Benito, Santa Clara, and Stanislaus Counties.	Chaparral, cismontane woodland, lower montane coniferous forest. On shale, granite, or serpentine talus 300 - 1525m asl.	March - May	**None.** Talus fritillary has been observed within the Buyer Service Area. Suitable habitat for this species is not expected to be affected.
Temblor buckwheat *Eriogonum temblorense*	-/-/ 1B.2	Fresno, Kern, Monterey, and San Luis Obispo Counties.	Valley and foothill grassland. Barren clay or sandstone substrates 300 - 1000m asl.	April - September	**None.** Records of temblor buckwheat exist within the Buyer Service Area. Transfers are not expected to impact any suitable habitat for this species.
Tiburon buckwheat *Eriogonum luteolum var. caninum*	-/-/ 1B.2	Alameda, Contra Costa, Marin, Sonoma Counties.	Chaparral, valley and foothill grassland, cismontane woodland, coastal prairie. Serpentine soils on sandy to gravelly sites 0 - 700m asl.	May - September	**None.** Has been observed within the Buyer Service Area. No impacts to suitable habitat for Tiburon buckwheat are expected.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
Tiburon paintbrush *Castilleja affinis* ssp. *neglecta*	E/T/ 1B.2	Marin, Napa, and Santa Clara Counties.	Valley and foothill grassland. Rocky serpentine sites 75 - 400m asl.	April - June	**None.** CNDDB records of Tiburon paintbrush exist within the Buyer Service Area. Transfers are not expected to impact suitable habitat for this species.
Tracy's eriastrum *Eriastrum tracyi*	-/R/ 1B.2	Colusa, Fresno, Glenn, Kern, Santa Clara, Shasta, Stanislaus, Tehama, Trinity, and Tulare Counties.	Chaparral, cismontane woodland. Gravelly shale or clay, often in open areas 315 - 760m asl.	June - July	**None.** Previously documented within the Buyer Service Area. No impacts to suitable habitat for this species are expected.
vernal pool smallscale *Atriplex persistens*	-/-/ 1B.2	Colusa, Glenn, Madera, Merced, Solano, Stanislaus, and Tulare Counties.	Vernal pools. Alkaline vernal pools 10 - 115m asl.	June - October	**None.** Vernal pool smallscale has been documented within the Seller Service Area. This species is not likely to establish within rice fields given the lack of vernal pool and alkaline habitat.
western leatherwood *Dirca occidentalis*	-/-/ 1B.2	Alameda, Contra Costa, Marin, Santa Clara, San Mateo, and Sonoma Counties.	Broadleafed upland forest, chaparral, closed-cone coniferous forest, cismontane woodland, north coast coniferous forest, riparian forest, riparian woodland. On mesic sites on brushy slopes 30-550m asl within mixed evergreen and foothill woodland communities.	January - April	**None.** CNDDB records of this species exist within the Buyer Service Area. Suitable habitat for western leatherwood is not expected to be affected by Transfers.

Common Name *Scientific name*	**Special Status* (F/S/RPR)**	**Distribution**	**Habitat Association**	**Blooming Period**	**Potential Impact**
white-flowered rein orchid *Piperia candida*	-/-/ 1B.2	California, Oregon, Washington. Within California the species occurs in Del Norte, Humboldt, Mendocino, Santa Clara, Santa Cruz, Siskiyou, San Mateo, Sonoma, and Trinity Counties.	North coast coniferous forest, lower montane coniferous forest, broad leafed upland forest. Coast ranges from Santa Cruz County North on serpentine. Forest duff, mossy banks, rock outcrops and muskeg 0 - 1200m asl.	March - September	**None.** White-flowered rein orchid has been documented within the Buyer Service Area. However, no impacts to suitable habitat for this species are anticipated in the Buyer Service Area.
woodland woollythreads *Monolopia gracilens*	-/-/ 1B.2	Alameda, Contra Costa, Monterey, Santa Clara, Santa Cruz, San Luis Obispo, and San Mateo Counties.	Chaparral, valley and foothill grassland (serpentine), cismontane woodland, broad leafed upland forests, north coast coniferous forest. Grassy sites in openings, sandy to rocky soils. Often seen on serpentine after burns but may have only a weak affinity to serpentine.	February - July	**None.** Has been observed within the Buyer Service Area. No impacts to suitable habitat for woodland woolly threads are anticipated.
woolly rose-mallow *Hibiscus lasiocarpos* var. *occidentalis*	-/-/ 1B.2	Butte, Contra Costa, Colusa, Glenn, Sacramento, San Joaquin, Solano, Sutter, and Yolo Counties.	Marshes and swamps (freshwater). Moist, freshwater-soaked river banks and low peat islands in sloughs. Known from the Delta watershed 0 - 150m asl.	June - September	**None.** Previously observed in the Buyer Service Area. Not likely to establish in rice fields given the lack of suitable habitat (marsh and swamp). This species is sensitive to habitat disturbance and agricultural amendments.
Wright's trichocoronis *Trichocoronis wrightii* var. *wrightii*	-/-/ 2.1	Colusa, Merced, Riverside, San Joaquin, and Sutter Counties.	Marshes and swamps, riparian forest, meadows and seeps, vernal pools. Mud flats of vernal lakes, drying river beds and alkali meadows 5 - 435m asl.	May - September	**Low.** According to the CNDDB, this species has previously been recorded in the Seller Service Area. Rice fields are not expected to support this species given the lack of suitable natural habitats.

RPR=California Rare Plant Rank
1B= Rare, threatened, or endangered in California and elsewhere
2= Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere

3= Plants about which we need more information - A review list
*Status explanations:
F=Federal
E= listed as endangered under the federal Endangered Species Act
T= listed as threatened under the federal Endangered Species Act
S=State
E=Endangered
T=Threatened
R=Rare
SSC=Species of Special Concern

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