Appendix F

Climate Change Emission Calculations

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Summary of Annual Greenhouse Gas Emissions

Table 1. GHG Emissions from Groundwater Substitution

Water Agency	Emissions (MTCO2e/year)			
	CO2	CH4	N2O	Total
Anderson-Cottonwood Irrigation District	148	0	0	148
Baber, Jack et al.	No Groundwater Substitution			0
Canal Farms	35	0	0	35
Conaway Preservation Group	No Groundwater Substitution			0
Eastside Mutual Water Company	626	1	2	629
Glenn-Colusa Irrigation District	1,032	1	3	1,036
Guisti Farms	898	1	3	902
Maxwell Irrigation District	535	1	1	537
Natomas Central Mutual Water Company	1,930	3	5	1,938
Pelger Mutual Water Company	257	0	1	258
Pelger Road 1700 LLC	164	0	1	165
Pleasant Grove-Verona Mutual Water Company	1,337	2	3	1,342
Princeton-Cordora-Glenn Irrigation District	982	1	2	985
Provident Irrigation District	1,685	2	4	1,691
Reclamation District 1004	1,014	1	2	1,018
Reclamation District 108	628	1	2	631
River Garden Farms	392	1	1	394
Sutter Mutual Water Company	266	1	1	267
Sycamore Mutual Water Company	181	0	1	182
T&P Farms	32	0	0	32
Te Velde Revocable Family Trust	198	0	1	199
Windswept Land & Livestock	125	0	0	125
Total	**12,464**	**17**	**33**	**12,514**

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Anderson-Cottonwood Irrigation District
Transfer Volume 4,800 acre-feet/year

Table 2. Anderson-Cottonwood Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Shasta	0	2	0	0	2
Tehama	0	0	0	0	0
Total	0	2	0	0	2

Table 3. Anderson-Cottonwood Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	GHG Emissions (MTCO2e per year) CO2	CH4	N2O	Total
Barney Street	Shasta	Electric	2012	200	5,500	85%	4,062	4,010	598,578	n/a	118	0.0100	0.0012	118	0.25	0.36	119
Crowley Gulch	Shasta	Electric	2012	50	1,000	15%	738	4,010	149,645	n/a	30	0.0025	0.0003	30	0.06	0.09	30
				Total	**6,500**	**100%**	**4,800**	**8,021**	**748,223**	**0**	**148**	**0.0125**	**0.0015**	**148**	**0.31**	**0.46**	**148**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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 Greenhouse Gas Emissions (Unmitigated)

Agency Canal Farms
Transfer Volume 1,000 acre-feet/year

Table 4. Canal Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	2	0	1	3
Total	0	2	0	1	3

Table 5. Canal Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/year)	Operation (hours/year)	Operation (kWh/yr)	Fuel Consumption (MMBtu/yr)	GHG Emissions (tonnes per year) CO2	CH4	N2O	(MTCO2e per year) CO2	CH4	N2O	Total
Dennis Well North	Colusa	Electric	unknown	125	3,500	29%	292	453	42,217	n/a	8	0.0007	0.0001	8	0.02	0.03	8
Dennis Well South	Colusa	Electric	unknown	125	3,500	29%	292	453	42,217	n/a	8	0.0007	0.0001	8	0.02	0.03	8
East Well	Colusa	Propane	unknown	250	5,000	42%	417	453	n/a	288	18	0.0009	0.0002	18	0.02	0.05	18
				Total	**12,000**	**100%**	**1,000**	**1,358**	**84,435**	**288**	**35**	**0.0023**	**0.0003**	**35**	**0.06**	**0.10**	**35**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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 bhp-hr =	2,542.5	Btu
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

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Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Eastside Mutual Water Company
Transfer Volume 2,230 acre-feet/year

Table 6. Eastside Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	2	0	0	0	2
Total	2	0	0	0	2

Table 7. Eastside Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	GHG Emissions (MTCO2e per year) CO2	CH4	N2O	Total
ATW-1	Colusa	Diesel	2006	215	2,500	45%	1,014	2,202	n/a	26,559	275	0.011	0.0022	275	0.28	0.66	276
ATW-2	Colusa	Diesel	2002	275	3,000	55%	1,216	2,202	n/a	33,971	352	0.014	0.0029	352	0.36	0.85	353
				Total	**5,500**	**100%**	**2,230**	**4,404**	**0**	**60,531**	**626**	**0.025**	**0.0051**	**626**	**0.64**	**1.52**	**629**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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

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Global Warming Potential

CO2	1
CH4	25
N2O	298

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 Greenhouse Gas Emissions (Unmitigated)

Agency Glenn-Colusa Irrigation District
Transfer Volume 11,300 acre-feet/year

Table 8. Glenn-Colusa Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	1	6	0	0	7
Colusa	4	6	0	0	10
Total	5	12	0	0	17

Table 9. Glenn-Colusa Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	(MTCO2e per year) CO2	CH4	N2O	Total
15-3-22H-3	Colusa	Diesel	unknown	121	800	2%	269	1,826	n/a	12,398	128	0.0052	0.0010	128	0.13	0.31	129
17-2-6B-1	Colusa	Electric	unknown	121	3,000	9%	1,009	1,826	164,925	n/a	33	0.0027	0.0003	33	0.07	0.10	33
GRS-22H-1	Glenn	Electric	unknown	121	2,300	7%	774	1,826	164,925	n/a	33	0.0027	0.0003	33	0.07	0.10	33
GRS-34N-1	Glenn	Diesel	unknown	121	2,500	7%	841	1,826	n/a	12,398	128	0.0052	0.0010	128	0.13	0.31	129
GRS-35A-2	Glenn	Electric	unknown	121	4,300	13%	1,446	1,826	164,925	n/a	33	0.0027	0.0003	33	0.07	0.10	33
GRS-84A-1	Glenn	Electric	unknown	121	2,500	7%	841	1,826	164,925	n/a	33	0.0027	0.0003	33	0.07	0.10	33
Haymen	Colusa	Diesel	unknown	121	2,250	7%	757	1,826	n/a	12,398	128	0.0052	0.0010	128	0.13	0.31	129
LaCroix 1	Glenn	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	33	0.0027	0.0003	33	0.07	0.10	33
LaCroix 2	Glenn	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	33	0.0027	0.0003	33	0.07	0.10	33
LaCroix 3	Glenn	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	33	0.0027	0.0003	33	0.07	0.10	33
Lagrande	Colusa	Diesel	unknown	121	3,000	9%	1,009	1,826	n/a	12,398	128	0.0052	0.0010	128	0.13	0.31	129
Reister 1	Colusa	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	33	0.0027	0.0003	33	0.07	0.10	33
Reister 2	Colusa	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	33	0.0027	0.0003	33	0.07	0.10	33
Reister 3	Colusa	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	33	0.0027	0.0003	33	0.07	0.10	33
Reister 4	Colusa	Electric	unknown	121	850	3%	286	1,826	164,925	n/a	33	0.0027	0.0003	33	0.07	0.10	33
Vann 1	Colusa	Diesel	unknown	121	3,000	9%	1,009	1,826	n/a	12,398	128	0.0052	0.0010	128	0.13	0.31	129
Vann 2	Colusa	Electric	unknown	121	4,000	12%	1,345	1,826	164,925	n/a	33	0.0027	0.0003	33	0.07	0.10	33
				Total	**33,600**	**100%**	**11,300**	**31,050**	**1,979,105**	**61,992**	**1,032**	**0.0590**	**0.0092**	**1,032**	**1.47**	**2.76**	**1,036**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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

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Global Warming Potential

CO2	1
CH4	25
N2O	298

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 Greenhouse Gas Emissions (Unmitigated)

Agency Guisti Farms
Transfer Volume 1,000 acre-feet/year

Table 10. Guisti Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	0	0	0	2	2
Total	0	0	0	2	2

Table 11. Guisti Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	(MTCO2e per year) CO2	CH4	N2O	Total
Guisti Well 1	Sutter	Propane	2015	150	3,200	50%	500	849	n/a	7,141	449	0.0214	0.0043	449	0.54	1.28	451
Guisti Well 2	Sutter	Propane	2015	150	3,200	50%	500	849	n/a	7,141	449	0.0214	0.0043	449	0.54	1.28	451
				Total	**6,400**	**100%**	**1,000**	**1,697**	**0**	**14,282**	**898**	**0.0428**	**0.0086**	**898**	**1.07**	**2.55**	**902**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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

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 Greenhouse Gas Emissions (Unmitigated)

Agency Maxwell Irrigation District
Transfer Volume 3,000 acre-feet/year

Table 12. Maxwell Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	2	0	0	0	2
Total	2	0	0	0	2

Table 13. Maxwell Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	GHG Emissions (MTCO2e per year) CO2	CH4	N2O	Total
MainWell	Colusa	Diesel	2006	215	3,800	50%	1,500	2,144	n/a	25,857	268	0.0109	0.0022	268	0.27	0.65	269
TuttleWell	Colusa	Diesel	2006	215	3,800	50%	1,500	2,144	n/a	25,857	268	0.0109	0.0022	268	0.27	0.65	269
				Total	**7,600**	**100%**	**3,000**	**4,288**	**0**	**51,715**	**535**	**0.0217**	**0.0043**	**535**	**0.54**	**1.29**	**537**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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

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Global Warming Potential

CO2	1
CH4	25
N2O	298

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 Greenhouse Gas Emissions (Unmitigated)

Agency Natomas Central Mutual Water Company
Transfer Volume 20,000 acre-feet/year

Table 14. Natomas Central Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sacramento	3	6	0	0	9
Sutter	1	14	0	0	15
Total	4	20	0	0	24

Table 15. Natomas Central Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	GHG Emissions (MTCO2e per year) CO2	CH4	N2O	Total
L-1	Sutter	Diesel	2013	120	1,600	4%	748	2,538	n/a	17,085	177	0.0072	0.0014	177	0.18	0.43	177
L-2	Sutter	Electric	unknown	30	1,900	4%	888	2,538	56,816	n/a	11	0.0009	0.0001	11	0.02	0.03	11
L-3	Sutter	Electric	unknown	125	1,300	3%	607	2,538	236,733	n/a	47	0.0039	0.0005	47	0.10	0.14	47
L-4	Sutter	Electric	unknown	125	1,300	3%	607	2,538	236,733	n/a	47	0.0039	0.0005	47	0.10	0.14	47
L-6	Sutter	Electric	unknown	125	2,000	5%	935	2,538	236,733	n/a	47	0.0039	0.0005	47	0.10	0.14	47
L-7	Sutter	Electric	unknown	125	1,200	3%	561	2,538	236,733	n/a	47	0.0039	0.0005	47	0.10	0.14	47
L-8	Sutter	Electric	unknown	125	2,800	7%	1,308	2,538	236,733	n/a	47	0.0039	0.0005	47	0.10	0.14	47
L-9	Sutter	Electric	unknown	125	1,500	4%	701	2,538	236,733	n/a	47	0.0039	0.0005	47	0.10	0.14	47
L-10	Sutter	Electric	unknown	125	1,000	2%	467	2,538	236,733	n/a	47	0.0039	0.0005	47	0.10	0.14	47
L-11	Sutter	Electric	unknown	125	1,500	4%	701	2,538	236,733	n/a	47	0.0039	0.0005	47	0.10	0.14	47
L-12	Sutter	Electric	unknown	125	1,500	4%	701	2,538	236,733	n/a	47	0.0039	0.0005	47	0.10	0.14	47
MAP	Sacramento	Electric	unknown	125	2,000	5%	935	2,538	236,733	n/a	60	0.0039	0.0005	60	0.10	0.14	60
Ose-1	Sacramento	Diesel	2013	200	1,800	4%	841	2,538	n/a	28,474	295	0.0120	0.0024	295	0.30	0.71	296
Ose-2	Sacramento	Electric	unknown	150	1,600	4%	748	2,538	284,080	n/a	72	0.0047	0.0006	72	0.12	0.17	73
Perry	Sacramento	Electric	unknown	125	2,000	5%	935	2,538	236,733	n/a	60	0.0039	0.0005	60	0.10	0.14	60
Spangler	Sutter	Electric	unknown	80	2,400	6%	1,121	2,538	151,509	n/a	30	0.0025	0.0003	30	0.06	0.09	30
TNBC Frazer	Sutter	Electric	unknown	125	2,000	5%	935	2,538	236,733	n/a	47	0.0039	0.0005	47	0.10	0.14	47
TNBC Bennett North	Sutter	Electric	unknown	125	2,000	5%	935	2,538	236,733	n/a	47	0.0039	0.0005	47	0.10	0.14	47
TNBC Atkinson	Sutter	Electric	unknown	125	1,800	4%	841	2,538	236,733	n/a	47	0.0039	0.0005	47	0.10	0.14	47
TNBC Fisherman's Lake	Sacramento	Electric	unknown	125	1,500	4%	701	2,538	236,733	n/a	60	0.0039	0.0005	60	0.10	0.14	60
TNBC Silva Dairy	Sacramento	Electric	unknown	125	1,100	3%	514	2,538	236,733	n/a	60	0.0039	0.0005	60	0.10	0.14	60
TNBC Betts	Sacramento	Electric	unknown	125	1,500	4%	701	2,538	236,733	n/a	60	0.0039	0.0005	60	0.10	0.14	60
Dhaliwal	Sacramento	Diesel	2013	180	2,500	6%	1,168	2,538	n/a	25,627	265	0.0108	0.0022	265	0.27	0.64	266
Willey	Sacramento	Diesel	2012	148	3,000	7%	1,402	2,538	n/a	21,071	218	0.0088	0.0018	218	0.22	0.53	219
				Total	**42,800**	**100%**	**20,000**	**60,907**	**4,516,870**	**92,257**	**1,930**	**0.1139**	**0.0170**	**1,930**	**2.85**	**5.06**	**1,938**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend
Engine power rating not provided; assumed to be equal to max 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

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Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Pelger Mutual Water Company
Transfer Volume 4,670 acre-feet/year

Table 16. Pelger Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	1	3	0	0	4
Total	1	3	0	0	4

Table 17. Pelger Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	(MTCO2e per year) CO2	CH4	N2O	Total
PMWC#1	Sutter	Electric	unknown	150	3,100	25%	1,149	2,013	225,320	n/a	44	0.0038	0.0005	44	0.09	0.14	45
Well 1 Tucker	Sutter	Electric	unknown	75	3,100	25%	1,149	2,013	112,660	n/a	22	0.0019	0.0002	22	0.05	0.07	22
Well 2 Flopet	Sutter	Diesel	2008	125	2,100	17%	778	2,013	n/a	14,115	146	0.0059	0.0012	146	0.15	0.35	147
Well 3 Klein	Sutter	Electric	unknown	150	4,300	34%	1,594	2,013	225,320	n/a	44	0.0038	0.0005	44	0.09	0.14	45
				Total	**12,600**	**100%**	**4,670**	**8,051**	**563,301**	**14,115**	**257**	**0.0153**	**0.0023**	**257**	**0.38**	**0.70**	**258**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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

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 Greenhouse Gas Emissions (Unmitigated)

Agency Pelger Road 1700 LLC
Transfer Volume 5,200 acre-feet/year

Table 18. Pelger Road 1700 LLC Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	0	4	0	0	4
Total	0	4	0	0	4

Table 19. Pelger Road 1700 LLC GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	GHG Emissions (MTCO2e per year) CO2	CH4	N2O	Total
North Well	Sutter	Electric	unknown	125	3,500	28%	1,433	2,224	207,431	n/a	41	0.0035	0.0004	41	0.09	0.13	41
South Well	Sutter	Electric	unknown	125	3,000	24%	1,228	2,224	207,431	n/a	41	0.0035	0.0004	41	0.09	0.13	41
Well #3	Sutter	Electric	unknown	125	3,100	24%	1,269	2,224	207,431	n/a	41	0.0035	0.0004	41	0.09	0.13	41
Well #4	Sutter	Electric	unknown	125	3,100	24%	1,269	2,224	207,431	n/a	41	0.0035	0.0004	41	0.09	0.13	41
				Total	**12,700**	**100%**	**5,200**	**8,895**	**829,722**	**0**	**164**	**0.0138**	**0.0017**	**164**	**0.35**	**0.50**	**165**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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 Greenhouse Gas Emissions (Unmitigated)

Agency Pleasant Grove-Verona Mutual Water Company
Transfer Volume 15,000 acre-feet/year

Table 20. Pleasant Grove-Verona Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	13	20	0	2	35
Total	13	20	0	2	35

Table 21. Pleasant Grove-Verona Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Pump Rate (gpm)	Pump Rate (% of Total)	Transfer Volume (AF/year)	Operation (hours/year)	Operation (kWh/yr)	Fuel Consumption (gal/yr) - diesel (MMBtu/yr) - propane	GHG Emissions (tonnes per year) CO2	CH4	N2O	(MTCO2e per year) CO2	CH4	N2O	Total
Kelly 190 Field Well #2	Sutter	Electric	unknown	30	2,000	2%	348	946	21,182	n/a	4	0.0004	0.0000	4	0.01	0.01	4
Kelly Windmill Field Well #2	Sutter	Electric	2002	62.1	2,000	2%	348	946	43,847	n/a	9	0.0007	0.0001	9	0.02	0.03	9
Kelly Windmill North Field Well	Sutter	Propane	2014	133	1,750	2%	305	946	n/a	320	20	0.0010	0.0002	20	0.02	0.06	20
Kelly306	Sutter	Electric	unknown	60	2,600	3%	453	946	42,365	n/a	8	0.0007	0.0001	8	0.02	0.03	8
MLF Clubhouse B Well	Sutter	Electric	unknown	300	2,500	3%	436	946	211,823	n/a	42	0.0035	0.0004	42	0.09	0.13	42
MLF Marsh Well	Sutter	Electric	unknown	300	2,500	3%	436	946	211,823	n/a	42	0.0035	0.0004	42	0.09	0.13	42
MLF Monster Well	Sutter	Electric	unknown	60	3,100	4%	540	946	42,365	n/a	8	0.0007	0.0001	8	0.02	0.03	8
MLF Well #1	Sutter	Electric	unknown	30	2,000	2%	348	946	21,182	n/a	4	0.0004	0.0000	4	0.01	0.01	4
MLF Well #16	Sutter	Electric	unknown	50	1,700	2%	296	946	35,304	n/a	7	0.0006	0.0001	7	0.01	0.02	7
MLF Well#11	Sutter	Diesel	2004	250	4,200	5%	732	946	n/a	13,270	137	0.0056	0.0011	137	0.14	0.33	138
MLF Well#12/17	Sutter	Electric	unknown	50	1,500	2%	261	946	35,304	n/a	7	0.0006	0.0001	7	0.01	0.02	7
MLF Well#13&#15	Sutter	Electric	2000	215	4,800	6%	836	946	151,806	n/a	30	0.0025	0.0003	30	0.06	0.09	30
MLF Well#2B	Sutter	Electric	2000	300	2,500	3%	436	946	211,823	n/a	42	0.0035	0.0004	42	0.09	0.13	42
Nicholas 72-Acre Field North	Sutter	Electric	unknown	40	5,000	6%	871	946	28,243	n/a	6	0.0005	0.0001	6	0.01	0.02	6
Nicholas 72-Acree Field South	Sutter	Diesel	2002	62.1	2,000	2%	348	946	n/a	3,296	34	0.0014	0.0003	34	0.03	0.08	34
Nicholas BBC Well	Sutter	Electric	unknown	30	2,500	3%	436	946	21,182	n/a	4	0.0004	0.0000	4	0.01	0.01	4
Nicholas Filipino Camp South	Sutter	Diesel	2002	62.1	2,000	2%	348	946	n/a	3,296	34	0.0014	0.0003	34	0.03	0.08	34
Nicholas Filipino Camp#2	Sutter	Electric	unknown	40	2,000	2%	348	946	28,243	n/a	6	0.0005	0.0001	6	0.01	0.02	6
Nicholas Johnston Field Well #2	Sutter	Electric	unknown	40	2,000	2%	348	946	28,243	n/a	6	0.0005	0.0001	6	0.01	0.02	6
Nicholas Sand Field Well	Sutter	Diesel	2002	62.1	2,000	2%	348	946	n/a	3,296	34	0.0014	0.0003	34	0.03	0.08	34
RiverRanch#19	Sutter	Diesel	2008	99	2,500	3%	436	946	n/a	5,255	54	0.0022	0.0004	54	0.06	0.13	55
S&O#16	Sutter	Electric	2014	159	2,000	2%	348	946	112,266	n/a	22	0.0019	0.0002	22	0.05	0.07	22
S&O#17	Sutter	Diesel	1999	101	3,000	3%	523	946	n/a	5,361	55	0.0023	0.0005	55	0.06	0.13	56
S&O#18A	Sutter	Diesel	1999	101	2,250	3%	392	946	n/a	5,361	55	0.0023	0.0005	55	0.06	0.13	56
S&O#19	Sutter	Diesel	2007	215	1,800	2%	314	946	n/a	11,412	118	0.0048	0.0010	118	0.12	0.29	119
S&O#20	Sutter	Propane	2014	154	2,150	2%	375	946	n/a	370	23	0.0011	0.0002	23	0.03	0.07	23
Willey#1	Sutter	Diesel	2000	168	2,250	3%	392	946	n/a	8,917	92	0.0037	0.0007	92	0.09	0.22	93
Willey#2	Sutter	Diesel	unknown	250	3,000	3%	523	946	n/a	13,270	137	0.0056	0.0011	137	0.14	0.33	138
Willey#3	Sutter	Electric	unknown	75	3,000	3%	523	946	52,956	n/a	10	0.0009	0.0001	10	0.02	0.03	11
Willey#4	Sutter	Diesel	1974	150	2,000	2%	348	946	n/a	7,962	82	0.0033	0.0007	82	0.08	0.20	83
Will-Lee Well#30	Sutter	Diesel	2000	100	2,500	3%	436	946	n/a	5,308	55	0.0022	0.0004	55	0.06	0.13	55
Will-Lee Well#31	Sutter	Electric	unknown	50	2,500	3%	436	946	35,304	n/a	7	0.0006	0.0001	7	0.01	0.02	7
Will-Lee Well#32	Sutter	Electric	unknown	300	2,500	3%	436	946	211,823	n/a	42	0.0035	0.0004	42	0.09	0.13	42
Will-Lee Well#33	Sutter	Electric	unknown	75	2,500	3%	436	946	52,956	n/a	10	0.0009	0.0001	10	0.02	0.03	11
Will-Lee Well#4A	Sutter	Diesel	2000	160	1,500	2%	261	946	n/a	8,493	88	0.0036	0.0007	88	0.09	0.21	88
				Total	**86,100**	**100%**	**15,000**	**33,115**	**1,600,038**	**n/a**	**1,337**	**0.0684**	**0.0116**	**1,337**	**1.71**	**3.46**	**1,342**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Conversion Factors

1 bhp-hr =	2,542.5	Btu
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

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 Greenhouse Gas Emissions (Unmitigated)

Agency Princeton-Codora-Glenn Irrigation District
Transfer Volume 6,600 acre-feet/year

Table 22. Princeton-Codora-Glenn Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	7	3	0	0	10
Colusa	2	1	0	0	3
Total	9	4	0	0	13

Table 23. Princeton-Codora-Glenn Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	(MTCO2e per year) CO2	CH4	N2O	Total
Joel Mann	Glenn	Diesel	unknown	180	3,500	9%	585	907	n/a	9,163	95	0.0038	0.0008	95	0.10	0.23	95
D.Withrow	Glenn	Diesel	unknown	180	1,000	3%	167	907	n/a	9,163	95	0.0038	0.0008	95	0.10	0.23	95
Chrisman	Glenn	Diesel	unknown	180	2,000	5%	334	907	n/a	9,163	95	0.0038	0.0008	95	0.10	0.23	95
D.Schmidt	Glenn	Diesel	2013	180	3,000	8%	501	907	n/a	9,163	95	0.0038	0.0008	95	0.10	0.23	95
Argo B	Glenn	Diesel	unknown	200	3,000	8%	501	907	n/a	10,182	105	0.0043	0.0009	105	0.11	0.25	106
Argo C	Glenn	Diesel	unknown	200	3,000	8%	501	907	n/a	10,182	105	0.0043	0.0009	105	0.11	0.25	106
F. Gomes	Colusa	Diesel	unknown	180	2,500	6%	418	907	n/a	9,163	95	0.0038	0.0008	95	0.10	0.23	95
Jones Well	Glenn	Electric	2012	200	3,500	9%	585	907	135,438	n/a	27	0.0023	0.0003	27	0.06	0.08	27
M. Cota	Colusa	Diesel	unknown	180	3,000	8%	501	907	n/a	9,163	95	0.0038	0.0008	95	0.10	0.23	95
Zoller A	Glenn	Diesel	unknown	180	3,000	8%	501	907	n/a	9,163	95	0.0038	0.0008	95	0.10	0.23	95
Clark #1	Glenn	Electric	unknown	200	4,000	10%	668	907	135,438	n/a	27	0.0023	0.0003	27	0.06	0.08	27
Clark #2	Glenn	Electric	unknown	200	4,000	10%	668	907	135,438	n/a	27	0.0023	0.0003	27	0.06	0.08	27
J. Southam	Colusa	Electric	unknown	200	4,000	10%	668	907	135,438	n/a	27	0.0023	0.0003	27	0.06	0.08	27
				Total	**39,500**	**100%**	**6,600**	**11,797**	**541,751**	**84,507**	**982**	**0.0445**	**0.0082**	**982**	**1.11**	**2.44**	**985**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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

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 Greenhouse Gas Emissions (Unmitigated)

Agency Provident Irrigation District
Transfer Volume 10,000 acre-feet/year

Table 24. Provident Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	13	3	0	0	16
Colusa	0	0	0	0	0
Total	13	3	0	0	16

Table 25. Provident Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	GHG Emissions (MTCO2e per year) CO2	CH4	N2O	Total
Weller62V	Glenn	Diesel	unknown	200	2,000	4%	400	1,086	n/a	12,187	126	0.0051	0.0010	126	0.13	0.31	127
L Hansen#1	Glenn	Diesel	unknown	200	3,800	8%	760	1,086	n/a	12,187	126	0.0051	0.0010	126	0.13	0.31	127
L Hansen#2	Glenn	Diesel	unknown	200	4,500	9%	900	1,086	n/a	12,187	126	0.0051	0.0010	126	0.13	0.31	127
K Hansen#1	Glenn	Diesel	unknown	200	2,600	5%	520	1,086	n/a	12,187	126	0.0051	0.0010	126	0.13	0.31	127
K Hansen#2	Glenn	Electric	unknown	120	3,500	7%	700	1,086	97,269	n/a	19	0.0016	0.0002	19	0.04	0.06	19
E Weller	Glenn	Diesel	unknown	200	2,500	5%	500	1,086	n/a	12,187	126	0.0051	0.0010	126	0.13	0.31	127
Weller#4	Glenn	Electric	unknown	120	3,500	7%	700	1,086	97,269	n/a	19	0.0016	0.0002	19	0.04	0.06	19
Calvert	Glenn	Diesel	unknown	150	3,000	6%	600	1,086	n/a	9,140	95	0.0038	0.0008	95	0.10	0.23	95
D. Alves	Glenn	Diesel	unknown	165	3,000	6%	600	1,086	n/a	10,054	104	0.0042	0.0008	104	0.11	0.25	104
D. Kennedy	Glenn	Electric	unknown	120	3,000	6%	600	1,086	97,269	n/a	19	0.0016	0.0002	19	0.04	0.06	19
G. Clark #1	Glenn	Diesel	unknown	200	3,000	6%	600	1,086	n/a	12,187	126	0.0051	0.0010	126	0.13	0.31	127
M. Jones #1	Glenn	Diesel	unknown	275	3,000	6%	600	1,086	n/a	16,757	173	0.0070	0.0014	173	0.18	0.42	174
M. Jones #2	Glenn	Diesel	unknown	250	3,000	6%	600	1,086	n/a	15,234	158	0.0064	0.0013	158	0.16	0.38	158
Perez and Perez	Glenn	Diesel	unknown	200	3,200	6%	640	1,086	n/a	12,187	126	0.0051	0.0010	126	0.13	0.31	127
S. Jones #1	Glenn	Diesel	unknown	170	3,200	6%	640	1,086	n/a	10,359	107	0.0044	0.0009	107	0.11	0.26	108
S. Jones #2	Glenn	Diesel	unknown	170	3,200	6%	640	1,086	n/a	10,359	107	0.0044	0.0009	107	0.11	0.26	108
				Total	**50,000**	**100%**	**10,000**	**17,379**	**291,807**	**157,213**	**1,685**	**0.0709**	**0.0138**	**1,685**	**1.77**	**4.11**	**1,691**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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

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 Greenhouse Gas Emissions (Unmitigated)

Agency Reclamation District 108
Transfer Volume 15,000 acre-feet/year

Table 26. Reclamation District 108 Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	3	0	0	3
Yolo	0	2	0	0	2
Total	0	5	0	0	5

Table 27. Reclamation District 108 GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	GHG Emissions (MTCO2e per year) CO2	CH4	N2O	Total
Well #4 Huff	Colusa	Electric	unknown	250	4,000	21%	3,141	4,265	795,721	n/a	157	0.0132	0.0016	157	0.33	0.48	158
Well #5 RiggsRanch	Colusa	Electric	unknown	150	1,700	9%	1,335	4,265	477,433	n/a	94	0.0079	0.0010	94	0.20	0.29	95
Well #6 CountyLine	Yolo	Electric	unknown	250	5,900	31%	4,634	4,265	795,721	n/a	157	0.0132	0.0016	157	0.33	0.48	158
Well#1 Heidrick	Colusa	Electric	unknown	100	3,500	18%	2,749	4,265	318,288	n/a	63	0.0053	0.0006	63	0.13	0.19	63
Well#7 Tract 6	Yolo	Electric	unknown	250	4,000	21%	3,141	4,265	795,721	n/a	157	0.0132	0.0016	157	0.33	0.48	158
				Total	**19,100**	**100%**	**15,000**	**21,325**	**3,182,885**	**0**	**628**	**0.0530**	**0.0065**	**628**	**1.32**	**1.94**	**631**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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 Greenhouse Gas Emissions (Unmitigated)

Agency	Reclamation District 1004
Transfer Volume	7,175 acre-feet/year

Table 28. Reclamation District 1004 Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	1	5	0	0	6
Colusa	17	5	0	0	22
Sutter	0	0	0	0	0
Total	18	10	0	0	28

Table 29. Reclamation District 1004 GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	(MTCO2e per year) CO2	CH4	N2O	Total
Barale Well	Colusa	Diesel	TBD	225	4,000	4%	313	424	n/a	5,358	55	0.0023	0.0005	55	0.06	0.13	56
Behring Ranch 10 Field Well No. 496441	Colusa	Diesel	2008	225	5,800	6%	453	424	n/a	5,358	55	0.0023	0.0005	55	0.06	0.13	56
Behring Ranch Club House Well No.496461	Colusa	Electric	unknown	125	3,400	4%	266	424	39,596	n/a	8	0.0007	0.0001	8	0.02	0.02	8
Behring Ranch Nursery Well No. 17N1W10H1	Colusa	Diesel	TBD	225	1,000	1%	78	424	n/a	5,358	55	0.0023	0.0005	55	0.06	0.13	56
Behring Ranch Pearl Well No. 20094	Colusa	Diesel	TBD	225	2,500	3%	195	424	n/a	5,358	55	0.0023	0.0005	55	0.06	0.13	56
Behring Ranch West Well No.97863	Colusa	Electric	unknown	125	2,300	3%	180	424	39,596	n/a	8	0.0007	0.0001	8	0.02	0.02	8
Drumheller Well No.7	Colusa	Diesel	TBD	225	4,000	4%	313	424	n/a	5,358	55	0.0023	0.0005	55	0.06	0.13	56
East Morgan Well #1 No. 374667 17N01W14N001M	Colusa	Diesel	TBD	225	2,600	3%	203	424	n/a	5,358	55	0.0023	0.0005	55	0.06	0.13	56
East Morgan Well#2 No. 498195 17N01W15Q001M	Colusa	Diesel	TBD	225	1,300	1%	102	424	n/a	5,358	55	0.0023	0.0005	55	0.06	0.13	56
Gardener No. 374672	Colusa	Diesel	2008	215	3,500	4%	274	424	n/a	5,120	53	0.0022	0.0004	53	0.05	0.13	53
Gardener No. 498178	Colusa	Diesel	2009	215	3,500	4%	274	424	n/a	5,120	53	0.0022	0.0004	53	0.05	0.13	53
Hall Well No. X	Glenn	Electric	TBD	125	4,500	5%	352	424	39,596	n/a	8	0.0007	0.0001	8	0.02	0.02	8
Hall Well No.369428	Glenn	Electric	2011	125	4,500	5%	352	424	39,596	n/a	8	0.0007	0.0001	8	0.02	0.02	8
Mohammad No.e0084085 17N01W02D001M	Colusa	Electric	TBD	125	4,500	5%	352	424	39,596	n/a	8	0.0007	0.0001	8	0.02	0.02	8
Myers Well #1 No.3457	Glenn	Electric	2006	40	2,200	2%	172	424	12,671	n/a	2	0.0002	0.0000	2	0.01	0.01	3
Myers Well #2 No. 340884	Glenn	Electric	1982	100	4,100	4%	320	424	31,677	n/a	6	0.0005	0.0001	6	0.01	0.02	6
Rancho Caleta No. 726883	Colusa	Diesel	2004	170	4,500	5%	352	424	n/a	4,048	42	0.0017	0.0003	42	0.04	0.10	42
Sikes & Parachini Well #1 WS No.93124	Colusa	Diesel	2006	173	4,000	4%	313	424	n/a	4,120	43	0.0017	0.0003	43	0.04	0.10	43
Sikes & Parachini Well #2 WS No. 374682	Colusa	Diesel	2008	150	4,000	4%	313	424	n/a	3,572	37	0.0015	0.0003	37	0.04	0.09	37
Southam Sartain Well 18N01W26D001M	Glenn	Diesel	TBD	225	4,800	5%	375	424	n/a	5,358	55	0.0023	0.0005	55	0.06	0.13	56
Stone Well #6 No.11334	Colusa	Electric	2006	40	1,800	2%	141	424	12,671	n/a	2	0.0002	0.0000	2	0.01	0.01	3
Wilder Farms Well	Glenn	Electric	unknown	125	2,500	3%	195	424	39,596	n/a	8	0.0007	0.0001	8	0.02	0.02	8
Dan Charter Well#1	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0023	0.0005	55	0.06	0.13	56
Dan Charter Well#2	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0023	0.0005	55	0.06	0.13	56
GVL Well#1	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0023	0.0005	55	0.06	0.13	56
Behring Ranch Well	Colusa	Electric	unknown	125	4,000	4%	313	424	39,596	n/a	8	0.0007	0.0001	8	0.02	0.02	8
Claudia Charter	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0023	0.0005	55	0.06	0.13	56
GVL Well#2	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0023	0.0005	55	0.06	0.13	56
				Total	**91,800**	**100%**	**7,175**	**11,885**	**334,191**	**91,633**	**1,014**	**0.0440**	**0.0084**	**1,014**	**1.10**	**2.50**	**1,018**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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

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 Greenhouse Gas Emissions (Unmitigated)

Agency River Garden Farms
Transfer Volume 10,000 acre-feet/year

Table 30. River Garden Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Yolo	0	8	0	0	8
Total	0	8	0	0	8

Table 31. River Garden Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	GHG Emissions (MTCO2e per year) CO2	CH4	N2O	Total
Field 65 PW	Yolo	Electric	2008	125	2500	12%	1,226	2,663	248,399	n/a	49	0.0041	0.0005	49	0.10	0.15	49
Field 71 PW	Yolo	Electric	2001	125	1700	8%	834	2,663	248,399	n/a	49	0.0041	0.0005	49	0.10	0.15	49
Field 98 PW	Yolo	Electric	1963	125	2900	14%	1,422	2,663	248,399	n/a	49	0.0041	0.0005	49	0.10	0.15	49
Field 104 PW	Yolo	Electric	2008	125	2500	12%	1,226	2,663	248,399	n/a	49	0.0041	0.0005	49	0.10	0.15	49
Field 104-09 PW	Yolo	Electric	2009	125	2990	15%	1,466	2,663	248,399	n/a	49	0.0041	0.0005	49	0.10	0.15	49
Field 91-09 PW	Yolo	Electric	2009	125	2840	14%	1,392	2,663	248,399	n/a	49	0.0041	0.0005	49	0.10	0.15	49
Field 117 PW	Yolo	Electric	2009	125	1965	10%	963	2,663	248,399	n/a	49	0.0041	0.0005	49	0.10	0.15	49
Shop PW	Yolo	Electric	2009	125	3000	15%	1,471	2,663	248,399	n/a	49	0.0041	0.0005	49	0.10	0.15	49
				Total	**20,395**	**100%**	**10,000**	**21,303**	**1,987,190**	**0**	**392**	**0.0331**	**0.0041**	**392**	**0.83**	**1.21**	**394**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

Legend

	Information on engine not available; engine assumed to be electric based on other engines used 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 Greenhouse Gas Emissions (Unmitigated)

Agency Sutter Mutual Water Company
Transfer Volume 18,000 acre-feet/year

Table 32. Sutter Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	8	6	0	6	20
Total	8	6	0	6	20

Table 33. Sutter Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	(MTCO2e per year) CO2	CH4	N2O	Total
Van Ruiten Well	Sutter	Electric	unknown	75	2,500	5%	897	1,948	109,013	n/a	22	0.0018	0.0002	22	0.05	0.07	22
Frank Giusti	Sutter	Propane	2015	150	2,501	5%	897	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
Matteoli	Sutter	Diesel	2014	150	2,502	5%	897	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
L&N Farms	Sutter	Electric	unknown	250	2,503	5%	898	1,948	363,378	n/a	72	0.0060	0.0007	72	0.15	0.22	72
Well #1	Sutter	Electric	unknown	150	2,504	5%	898	1,948	218,027	n/a	43	0.0036	0.0004	43	0.09	0.13	43
Well #2	Sutter	Electric	unknown	150	2,505	5%	898	1,948	218,027	n/a	43	0.0036	0.0004	43	0.09	0.13	43
Well #3	Sutter	Propane	unknown	150	2,506	5%	899	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
Well #4	Sutter	Propane	unknown	150	2,507	5%	899	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
Well #5	Sutter	Diesel	unknown	150	2,508	5%	899	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
Well #6	Sutter	Diesel	unknown	150	2,509	5%	900	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
Well #7	Sutter	Diesel	unknown	150	2,510	5%	900	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
Well #8	Sutter	Diesel	unknown	150	2,511	5%	901	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
Well #9	Sutter	Electric	unknown	150	2,512	5%	901	1,948	218,027	n/a	43	0.0036	0.0004	43	0.09	0.13	43
Well #10	Sutter	Electric	unknown	150	2,513	5%	901	1,948	218,027	n/a	43	0.0036	0.0004	43	0.09	0.13	43
Well #11	Sutter	Propane	unknown	150	2,514	5%	902	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
Well #12	Sutter	Propane	unknown	150	2,515	5%	902	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
Well #13	Sutter	Propane	unknown	150	2,516	5%	902	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
Well #14	Sutter	Diesel	unknown	150	2,517	5%	903	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
Well #15	Sutter	Diesel	unknown	150	2,518	5%	903	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
Well #16	Sutter	Diesel	unknown	150	2,519	5%	903	1,948	n/a	16,390	0	0.0000	0.0000	0	0.00	0.00	0
				Total	**50,190**	**100%**	**18,000**	**38,954**	**1,344,498**	**229,463**	**266**	**0.0224**	**0.0027**	**266**	**0.56**	**0.82**	**267**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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

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 Greenhouse Gas Emissions (Unmitigated)

Agency Sycamore Mutual Water Company
Transfer Volume 8,000 acre-feet/year

Table 34. Sycamore Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	5	0	0	5
Total	0	5	0	0	5

Table 35. Sycamore Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	GHG Emissions (MTCO2e per year) CO2	CH4	N2O	Total
Well #15	Colusa	Electric	unknown	125	3,270	15%	1,183	1,966	183,356	n/a	36	0.0031	0.0004	36	0.08	0.11	36
Well #14	Colusa	Electric	unknown	125	3,270	15%	1,183	1,966	183,356	n/a	36	0.0031	0.0004	36	0.08	0.11	36
Well #11	Colusa	Electric	unknown	125	6,409	29%	2,320	1,966	183,356	n/a	36	0.0031	0.0004	36	0.08	0.11	36
Well #2b	Colusa	Electric	unknown	125	4,578	21%	1,657	1,966	183,356	n/a	36	0.0031	0.0004	36	0.08	0.11	36
Well #2a	Colusa	Electric	unknown	125	4,578	21%	1,657	1,966	183,356	n/a	36	0.0031	0.0004	36	0.08	0.11	36
				Total	**22,104**	**100%**	**8,000**	**9,828**	**916,778**	**0**	**181**	**0.0153**	**0.0019**	**181**	**0.38**	**0.56**	**182**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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 Greenhouse Gas Emissions (Unmitigated)

Agency T&P Farms
Transfer Volume 1,200 acre-feet/year

Table 36. T&P Farms Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	2	0	0	2
Total	0	2	0	0	2

Table 37. T&P Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	GHG Emissions (MTCO2e per year) CO2	CH4	N2O	Total
NW-3	Colusa	Electric	unknown	125	3,500	47%	560	869	81,057	n/a	16	0.0013	0.0002	16	0.03	0.05	16
NW-4	Colusa	Electric	unknown	125	4,000	53%	640	869	81,057	n/a	16	0.0013	0.0002	16	0.03	0.05	16
				Total	**7,500**	**100%**	**1,200**	**1,738**	**162,115**	**0**	**32**	**0.0027**	**0.0003**	**32**	**0.07**	**0.10**	**32**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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

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

Global Warming Potential

CO2	1
CH4	25
N2O	298

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Te Velde Revocable Family Trust
Transfer Volume 7,094 acre-feet/year

Table 38. Te Velde Revocable Family Trust Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Yolo	0	5	0	0	5
Total	0	5	0	0	5

Table 39. Te Velde Revocable Family Trust GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	GHG Emissions (MTCO2e per year) CO2	CH4	N2O	Total
GW1	Yolo	Electric	unknown	127	4,656	29%	2,090	2,438	231,042	n/a	46	0.0038	0.0005	46	0.10	0.14	46
GW10	Yolo	Electric	unknown	143	2,833	18%	1,272	2,438	260,150	n/a	51	0.0043	0.0005	51	0.11	0.16	52
GW9	Yolo	Electric	unknown	104	2,400	15%	1,077	2,438	189,200	n/a	37	0.0031	0.0004	37	0.08	0.12	38
GW3	Yolo	Electric	unknown	52	3,715	24%	1,668	2,438	94,600	n/a	19	0.0016	0.0002	19	0.04	0.06	19
GW4	Yolo	Electric	unknown	125	2,200	14%	988	2,438	227,404	n/a	45	0.0038	0.0005	45	0.09	0.14	45
				Total	**15,804**	**100%**	**7,094**	**12,189**	**1,002,395**	**0**	**198**	**0.0167**	**0.0020**	**198**	**0.42**	**0.61**	**199**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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 Greenhouse Gas Emissions (Unmitigated)

Agency Windswept Land & Livestock
Transfer Volume 2,000 acre-feet/year

Table 40. Windswept Land & Livestock Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sutter	0	3	0	0	3
Total	0	3	0	0	3

Table 41. Windswept Land & Livestock GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	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 (tonnes per year) CO2	CH4	N2O	GHG Emissions (MTCO2e per year) CO2	CH4	N2O	Total
Ag Well #1	Sutter	Electric	2013	200	3,200	42%	831	1,411	210,539	n/a	42	0.0035	0.0004	42	0.09	0.13	42
Ag Well #3	Sutter	Electric	unknown	200	2,500	32%	649	1,411	210,539	n/a	42	0.0035	0.0004	42	0.09	0.13	42
Ag Well #4	Sutter	Electric	unknown	200	2,000	26%	519	1,411	210,539	n/a	42	0.0035	0.0004	42	0.09	0.13	42
				Total	**7,700**	**100%**	**2,000**	**4,232**	**631,617**	**0**	**125**	**0.0105**	**0.0013**	**125**	**0.26**	**0.38**	**125**

Key:
AF = acre-feet
CH4 = methane
CO2 = carbon dioxide
gal/yr = gallons per year
GHG = greenhouse gas
gpm = gallons per minute
hp = horsepower
kW/yr = kilowatt hours per year
MTCO2e = metric tons carbon dioxide equivalent
N2O = nitrous oxide

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

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	

Engine Size Summary

Table 42. Engine Power Rating Summary by Fuel Type

Fuel Type	No. Engines	Avg. HP	Max HP	Min HP
Diesel	23	170	250	60
Electric	47	125	300	30
Natural Gas	0	n/a	0	0
Propane	3	180	250	135

GHG Emission Factors

Table 43. GHG Emission Factors for Electric Pumps

County	Utility Company	Emission Factors		
		CO2 (lbs/MWh)	CH4 (lbs/GWh)	N2O (lbs/GWh)
Colusa	Pacific Gas & Electric	434.92	36.7	4.5
Glenn	Pacific Gas & Electric	434.92	36.7	4.5
Sacramento	Sacramento Municipal Utility District	561.08	36.7	4.5
Shasta	Pacific Gas & Electric	434.92	36.7	4.5
Sutter	Pacific Gas & Electric	434.92	36.7	4.5
Tehama	Pacific Gas & Electric	434.92	36.7	4.5
Yolo	Pacific Gas & Electric	434.92	36.7	4.5

Table 44. Utility-Specific CO2 Emission Factors

2014 Emission Rates		
Utility	Factor Type	Emission Factor (lbs CO_2/MWh)
Sacramento Municipal Utility District	Retail Power	561.08
	Special Power	0.00
	Wholesale Power	803.58
Pacific Gas & Electric	System average	434.92

Source:
The Climate Registry. 2017. Utility-Specific Emission Factors. Accessed on: January 03, 2017. Available at: https://www.theclimateregistry.org/our-members/cris-public-reports/

Table 45. Diesel Emission Factors

Pollutant	Emission Factor	Unit	Emission Factor Description
CO2	10.35	kg/gallon	Table 12.1, Distillate Fuel Oil No. 2
CH4	0.003	kg/MMBtu	Table 12.9.1, Petroleum Products, Industrial
N2O	0.0006	kg/MMBtu	Table 12.9.1, Petroleum Products, Industrial
Heat Content	0.14	MMBtu/gallon	Table 12.1, Distillate Fuel Oil No. 2

Source: The Climate Registry. 2016. 2016 Climate Registry Default Emission Factors. Accessed on: January 3, 2017. Available at: https://www.theclimateregistry.org/wp-content/uploads/2014/11/2016-Climate-Registry-Default-Emission-Factors.pdf

Table 46. 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 12.9.1, Natural Gas, Industrial
N2O	0.0001	kg/MMBtu	Table 12.9.1, Natural Gas, Industrial
Heat Content	1,026	Btu/scf	Table 12.1, US Weighted Average

Source: The Climate Registry. 2016. 2016 Climate Registry Default Emission Factors. Accessed on: January 3, 2017. Available at: https://www.theclimateregistry.org/wp-content/uploads/2014/11/2016-Climate-Registry-Default-Emission-Factors.pdf

Table 47. Propane Emission Factors

Pollutant	Emission Factor	Unit	Emission Factor Description
CO2	62.87	kg/MMBtu	Table 12.1, Propane (liquid)
CH4	0.003	kg/MMBtu	Table 12.9.1, Petroleum Products, Industrial
N2O	0.0006	kg/MMBtu	Table 12.9.1, Petroleum Products, Industrial
Heat Content	0.09	MMBtu/gal	Table 12.1, Propane (liquid)

Source: The Climate Registry. 2016. 2016 Climate Registry Default Emission Factors. Accessed on: January 3, 2017. Available at: https://www.theclimateregistry.org/wp-content/uploads/2014/11/2016-Climate-Registry-Default-Emission-Factors.pdf

Table 48. Year 2012 eGRID Subregion Emissions - Greenhouse Gases

eGRID subregion acronym	eGRID subregion name	Carbon dioxide (CO2)		Methane (CH4)		Nitrous oxide (N2O)		Carbon dioxide equivalent (CO2e)	
		Emissions (tons)	Total output emission rate (lb/MWh)	Emissions (tons)	Total output emission rate (lb/GWh)	Emissions (tons)	Total output emission rate (lb/GWh)	Emissions (tons)	Total output emission rate (lb/MWh)
AKGD	ASCC Alaska Grid	2,271,327	950.5	235,717	49.3	36,096	7.6	2,279,397	953.9
AKMS	ASCC Miscellaneous	431,829	682.3	46,590	36.8	7,717	6.1	433,514	685.0
AZNM	WECC Southwest	58,722,243	878.5	8,885,668	66.5	1,246,386	9.3	59,008,733	882.8
CAMX	WECC California	58,517,758	619.9	6,937,645	36.7	846,220	4.5	58,708,429	621.9
ERCT	ERCOT All	182,296,859	1103.2	21,994,474	66.6	3,056,622	9.2	183,000,174	1,107.5
FRCC	FRCC All	119,182,697	1088.7	19,362,545	88.4	2,656,146	12.1	119,797,706	1,094.3
HIMS	HICC Miscellaneous	1,347,592	946.3	286,274	100.5	45,308	15.9	1,357,621	953.4
HIOA	HICC Oahu	5,948,003	1617.1	1,289,024	175.2	198,057	26.9	5,992,237	1,629.2
MROE	MRO East	21,264,234	1267.5	5,059,440	150.8	744,455	22.2	21,432,749	1,277.5
MROW	MRO West	133,211,094	1248.5	31,672,607	148.4	4,580,399	21.5	134,240,219	1,258.1
NEWE	NPCC New England	32,009,498	578.2	10,854,765	98.0	1,457,118	13.2	32,340,975	584.2
NWPP	WECC Northwest	156,526,173	915.7	33,824,194	98.9	4,918,566	14.4	157,643,705	922.3
NYCW	NPCC NYC/Westchester	13,351,441	699.4	955,968	25.0	116,269	3.0	13,379,501	700.9
NYLI	NPCC Long Island	6,941,550	1229.1	1,502,503	133.0	194,935	17.3	6,987,541	1,237.3
NYUP	NPCC Upstate NY	15,874,045	377.2	2,719,026	32.3	367,664	4.4	15,959,583	379.2
RFCE	RFC East	115,641,481	852.9	20,491,528	75.6	3,121,875	11.5	116,340,504	858.1
RFCM	RFC Michigan	65,795,773	1553.9	14,486,516	171.1	2,081,552	24.6	66,270,522	1,565.1
RFCW	RFC West	391,005,851	1497.1	84,252,343	161.3	12,367,250	23.7	393,807,342	1,507.8
RMPA	WECC Rockies	74,633,546	1774.0	15,595,812	185.3	2,257,672	26.8	75,147,241	1,786.2
SPNO	SPP North	41,178,975	1458.6	9,076,955	160.8	1,316,804	23.3	41,478,388	1,469.2
SPSO	SPP South	133,299,588	1586.3	25,225,795	150.1	3,671,417	21.8	134,133,529	1,596.3
SRMV	SERC Mississippi Valley	107,443,349	1160.0	16,725,200	90.3	2,400,141	13.0	107,990,986	1,165.9
SRMW	SERC Midwest	152,730,744	1606.8	35,647,560	187.5	5,183,070	27.3	153,908,419	1,619.2
SRSO	SERC South	153,297,552	1144.5	28,221,764	105.4	4,189,225	15.6	154,240,455	1,151.6
SRTV	SERC Tennessee Valley	164,450,131	1368.1	34,172,508	142.1	4,985,828	20.7	165,577,158	1,377.4
SRVC	SERC Virginia/Carolina	124,094,377	862.3	28,696,177	99.7	4,134,405	14.4	125,021,386	868.8
U.S.		**2,331,467,711**	**1143.0**	**458,218,597**	**112.3**	**66,181,198**	**16.2**	**2,346,478,012**	**1,150**

Source: U.S. Environmental Protection Agency. 2017. eGRID2014, Summary Tables. January 13. Available online at: https://www.epa.gov/sites/production/files/2015-10/documents/egrid2012_summarytables_0.pdf [Accessed on January 13, 2017].

Table 49. Reduced Exhaust Emissions from Cropland Idling

Water Agency	Groundwater Substitution	Cropland Idling/ Crop Shifting	GW Pumping Equivalent	Annual Emission (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	4,800	--	--	--	--	--	--	--	--	--
Baber, Jack et al.	--	2,310	544	234	0.014	0.0021	234	0.3	0.6	235
Canal Farms	1,000	635	149	64	0.0038	0.00058	64	0.1	0.2	64
Conaway Preservation Group	--	21,350	5,024	2,165	0.13	0.020	2,165	3.2	5.9	2,174
Pelger Road 1700 LLC	5,200	--	--	--	--	--	--	--	--	--
Eastside Mutual Water Company	2,230	1,846	434	187	0.011	0.0017	187	0.3	0.5	188
Guisti Farms	1,000	--	--	--	--	--	--	--	--	--
Glenn-Colusa Irrigation District	11,300	33,000	7,765	3,346	0.20	0.030	3,346	5.0	9.1	3,360
Maxwell Irrigation District	3,000	2,003	471	203	0.012	0.0018	203	0.3	0.5	204
Natomas Central Mutual Water Company	20,000	--	--	--	--	--	--	--	--	--
Pelger Mutual Water Company	4,670	2,538	597	257	0.015	0.0023	257	0.4	0.7	258
Pleasant Grove-Verona Mutual Water Company	15,000	9,000	2,118	913	0.054	0.0083	913	1.4	2.5	916
Princeton-Codora-Glenn Irrigation District	6,600	6,600	1,553	669	0.040	0.0061	669	1.0	1.8	672
Provident Irrigation District	10,000	9,900	2,329	1,003	0.060	0.009	1,003	1.5	2.7	1,008
Reclamation District 108	15,000	20,000	4,706	2,028	0.12	0.018	2,028	3.0	5.5	2,036
Reclamation District 1004	7,175	20,000	4,706	2,028	0.121	0.018	2,028	3.0	5.5	2,036
River Garden Farms	10,000	10,000	2,353	1,014	0.060	0.009	1,014	1.5	2.7	1,018
Sutter Mutual Water Company	18,000	18,000	4,235	1,825	0.109	0.017	1,825	2.7	4.9	1,832
Sycamore Mutual Water Company	8,000	7,000	1,647	710	0.042	0.0064	710	1.1	1.9	713
T&P Farms	1,200	890	209	90	0.0054	0.00082	90	0.1	0.2	90
Te Velde Revocable Family Trust	7,094	6,975	1,641	707	0.042	0.0064	707	1.1	1.9	710
Windswept Land & Livestock	2,000	--	--	--	--	--	--	--	--	--
Total	**151,269**	**172,047**	**40,481**	**17,442**	**1.04**	**0.16**	**17,442**	**25.9**	**47.2**	**17,515**

Notes:
Reclamation District 108 used to estimate emissions for other water agencies.
Engine power rating equal to 140 hp for RD-108 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).
RD-108 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 G

Giant Garter Snake Important Populations Maps

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IMPORTANT GIANT GARTER SNAKE POPULATIONS

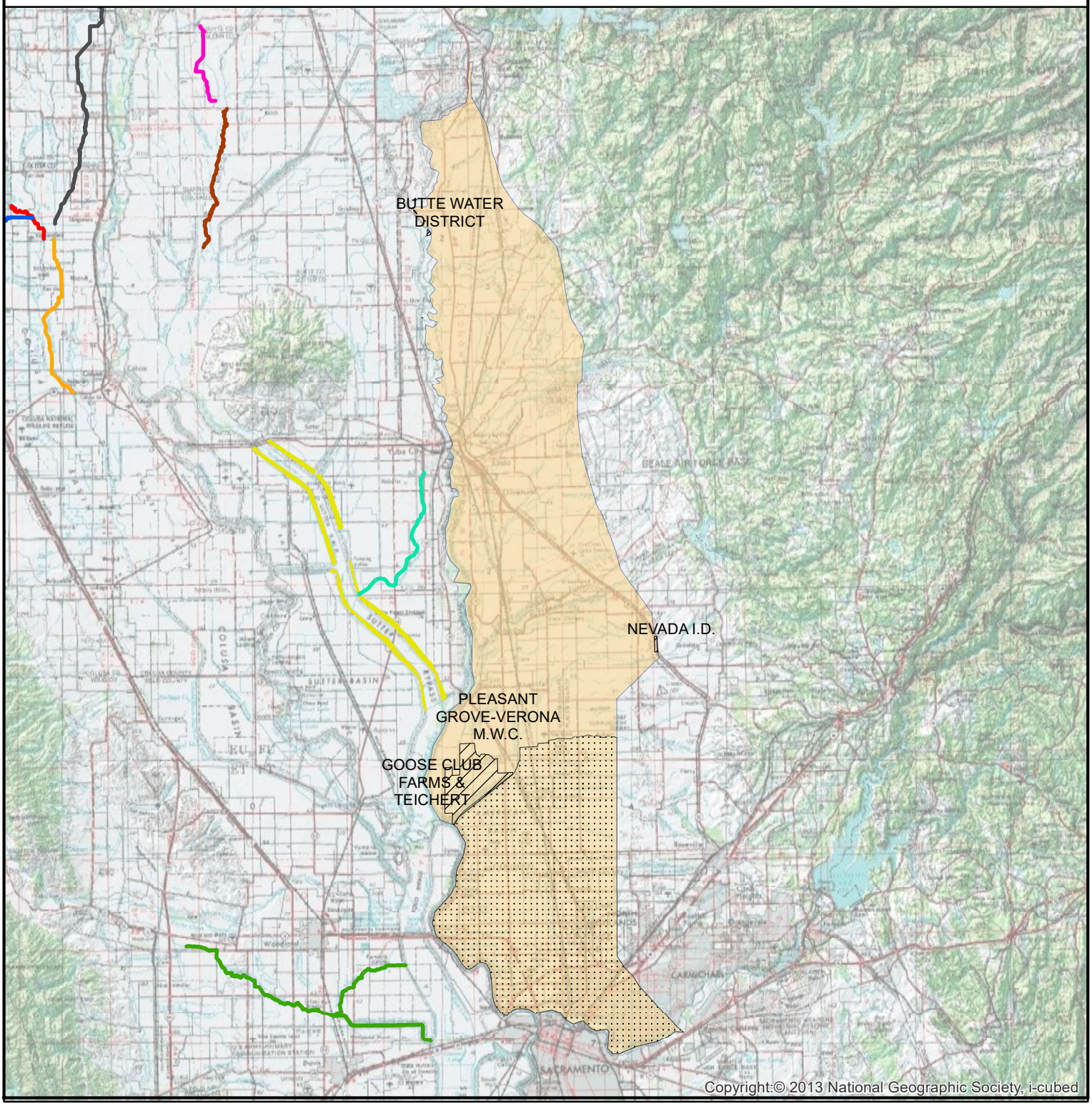
American Basin Recovery Unit

- Seller Areas in American Basin
- American Basin (376,104 acres)
- Butte Creek Selection
- Colusa Basin Drainage Canal Selection
- Colusa Drainage Canal
- Gilsizer Slough
- Hunters Creek Selection
- Logan Creek Selection
- Little Butte Creek
- Natomas Basin
- Sutter Bypass Toe Drain
- Willow Slough & Bypass

SELLER AREAS IN AMERICAN BASIN (acres)	
BUTTE WATER DISTRICT	55
GOOSE CLUB FARMS & TEICHERT	4
NEVADA IRRIGATION DISTRICT	132
PLEASANT-GROVE-VERONA MUTUAL WATER COMPANY	7429

Datum: NAD 1983

0 2.75 5.5 11 Miles



IMPORTANT GIANT GARTER SNAKE POPULATIONS

Butte Basin Recovery Unit

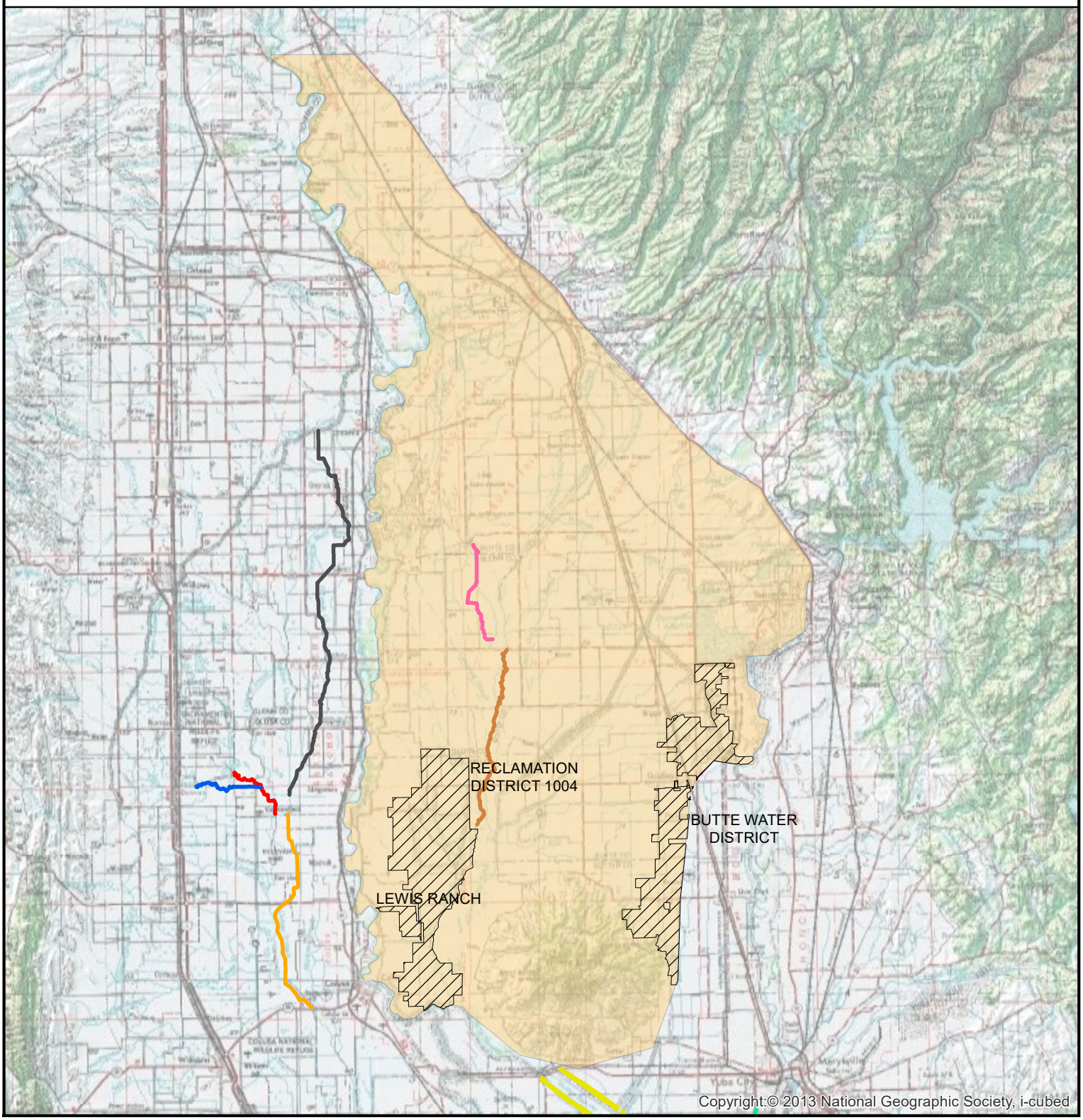
- Seller Areas in Butte Basin
- Butte Basin (479,117 acres)
- Butte Creek Selection
- Colusa Basin Drainage Canal Selection
- Colusa Drainage Canal
- Gilsizer Slough
- Hunters Creek Selection
- Little Butte Creek
- Logan Creek Selection
- Natomas Basin
- Willow Slough & Bypass
- Sutter Bypass Toe Drain

SELLER AREAS IN BUTTE BASIN (acres)	
BUTTE WATER DISTRICT	17656
LEWIS RANCH	1172
RECLAMATION DISTRICT 1004	23159

Datum: NAD 1983

0 2.25 4.5 9 Miles

N



IMPORTANT GIANT GARTER SNAKE POPULATIONS

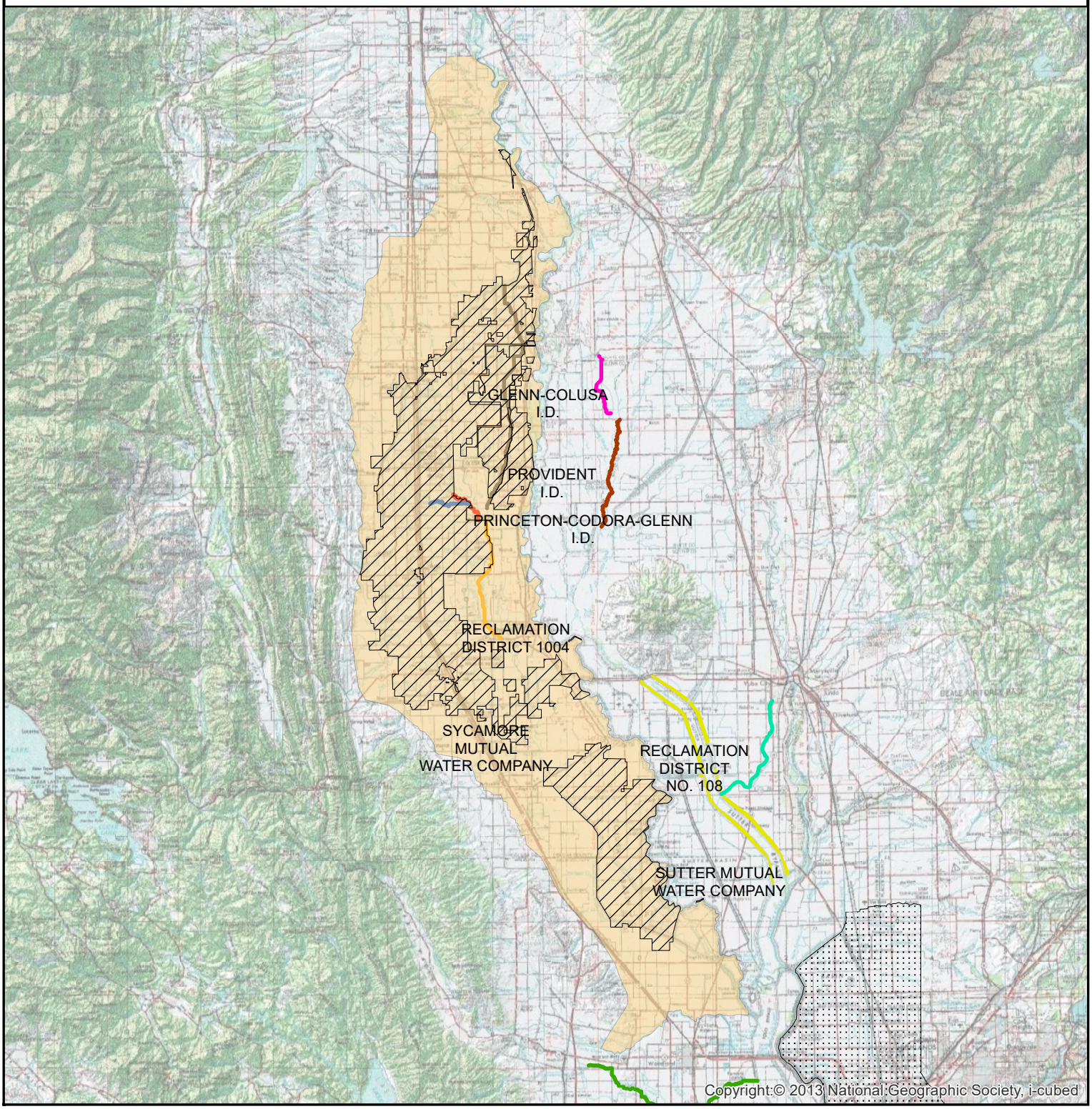
Colusa Basin Recovery Unit

- Seller Areas in Colusa Basin
- Colusa Basin (686,096 acres)
- Butte Creek Selection
- Colusa Basin Drainage Canal Selection
- Colusa Drainage Canal
- Gilsizer Slough
- Hunters Creek Selection
- Little Butte Creek
- Logan Creek Selection
- Natomas Basin
- Sutter Bypass Toe Drain
- Willow Slough & Bypass

SELLER AREAS IN COLUSA BASIN (acres)	
GLENN-COLUSA IRRIGATION DISTRICT	174886
PRINCETON-CORDORA-GLENN IRRIGATION DISTRCIT	12112
PROVIDENT IRRIGATION DISTRICT	17019
RECLAMATION DISTRICT 1004	54
RECLAMATION DISTRICT 108	58821
SUTTER MUTUAL WATER COMPANY	33
SYCAMORE MUTUAL WATER COMPANY	8431

Datum: NAD 1983

0 3.75 7.5 15 Miles



IMPORTANT GIANT GARTER SNAKE POPULATIONS

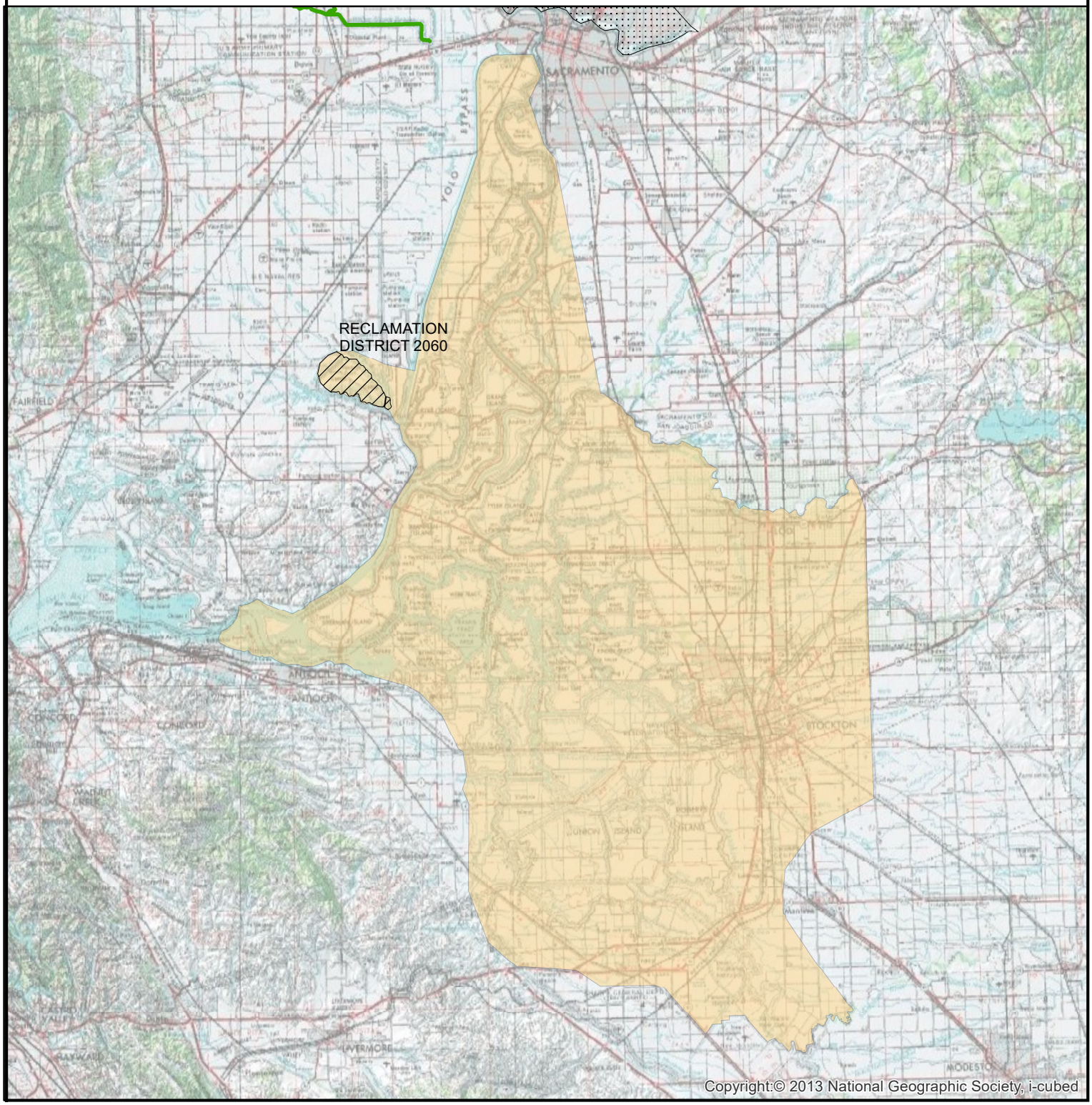
Delta Basin Recovery Unit

- Seller Areas in Delta Basin
- Delta Basin (786,268 acres)
- Butte Creek Selection
- Colusa Basin Drainage Canal Selection
- Colusa Drainage Canal
- Gilsizer Slough
- Hunters Creek Selection
- Little Butte Creek
- Logan Creek Selection
- Natomas Basin
- Willow Slough & Bypass
- Sutter Bypass Toe Drain

SELLER AREAS IN DELTA BASIN (acres)	
RECLAMATION DISTRICT 2060	5232

Datum: NAD 1983

0 2.75 5.5 11 Miles



IMPORTANT GIANT GARTER SNAKE POPULATIONS

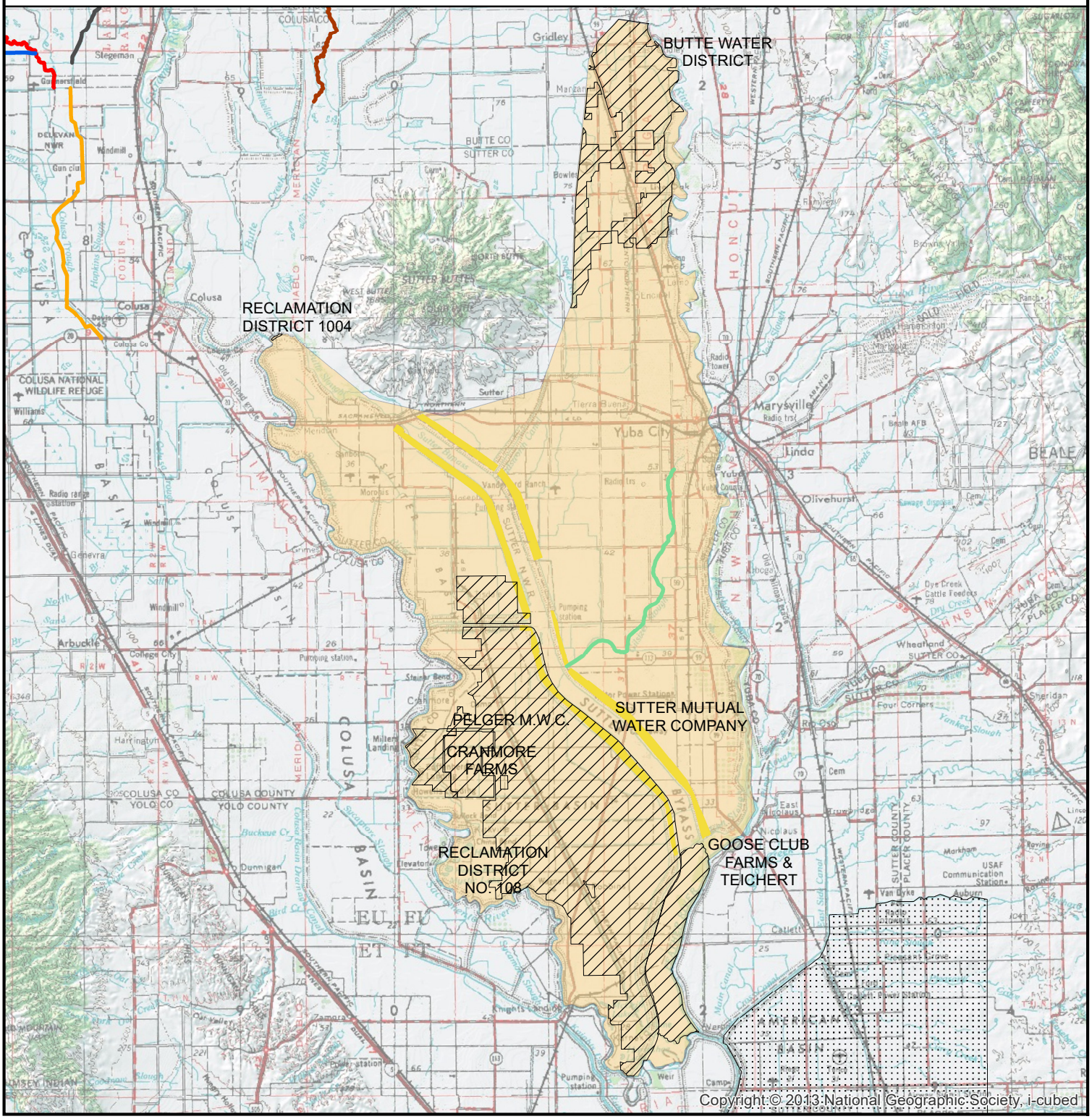
Sutter Basin Recovery Unit

- Seller Areas in Sutter Basin
- Sutter Basin (239,927 acres)
- Butte Creek Selection
- Colusa Basin Drainage Canal Selection
- Colusa Drainage Canal
- Gilsizer Slough
- Hunters Creek Selection
- Little Butte Creek
- Logan Creek Selection
- Natomas Basin
- Willow Slough & Bypass
- Sutter Bypass Toe Drain

SELLER AREAS IN SUTTER BASIN (acres)	
BUTTE WATER DISTRICT	14508
CRANMORE FARMS	2219
GOOSE CLUB FARMS & TEICHERT	5724
PELGER MUTUAL WATER COMPANY	2970
RECLAMATION DISTRICT 1004	23
RECLAMATION DISTRICT 108	0.02
SUTTER MUTUAL WATER COMPANY	51085

Datum: NAD 1983

0 1.75 3.5 7 Miles



IMPORTANT GIANT GARTER SNAKE POPULATIONS

Yolo Basin Recovery Unit

- Seller Areas in Yolo Basin
- Yolo Basin (410,915 acres)
- Butte Creek Selection
- Colusa Basin Drainage Canal Selection
- Colusa Drainage Canal
- Gilsizer Slough
- Hunters Creek Selection
- Little Butte Creek
- Logan Creek Selection
- Natomas Basin
- Sutter Bypass Toe Drain
- Willow Slough & Bypass

SELLER AREAS IN YOLO BASIN (acres)	
CONAWAY PRESERVATION GROUP, LLC	20463
PLEASANT-GROVE-VERONA MUTUAL WATER COMPANY	3
RECLAMATION DISTRICT 2060	9982
RECLAMATION DISTRICT 2068	13262
TE VELDE REVOCABLE FAMILY TRUST	4406
SUTTER MUTUAL WATER COMPANY	21
YOLO RANCH	3350

Datum: NAD 1983

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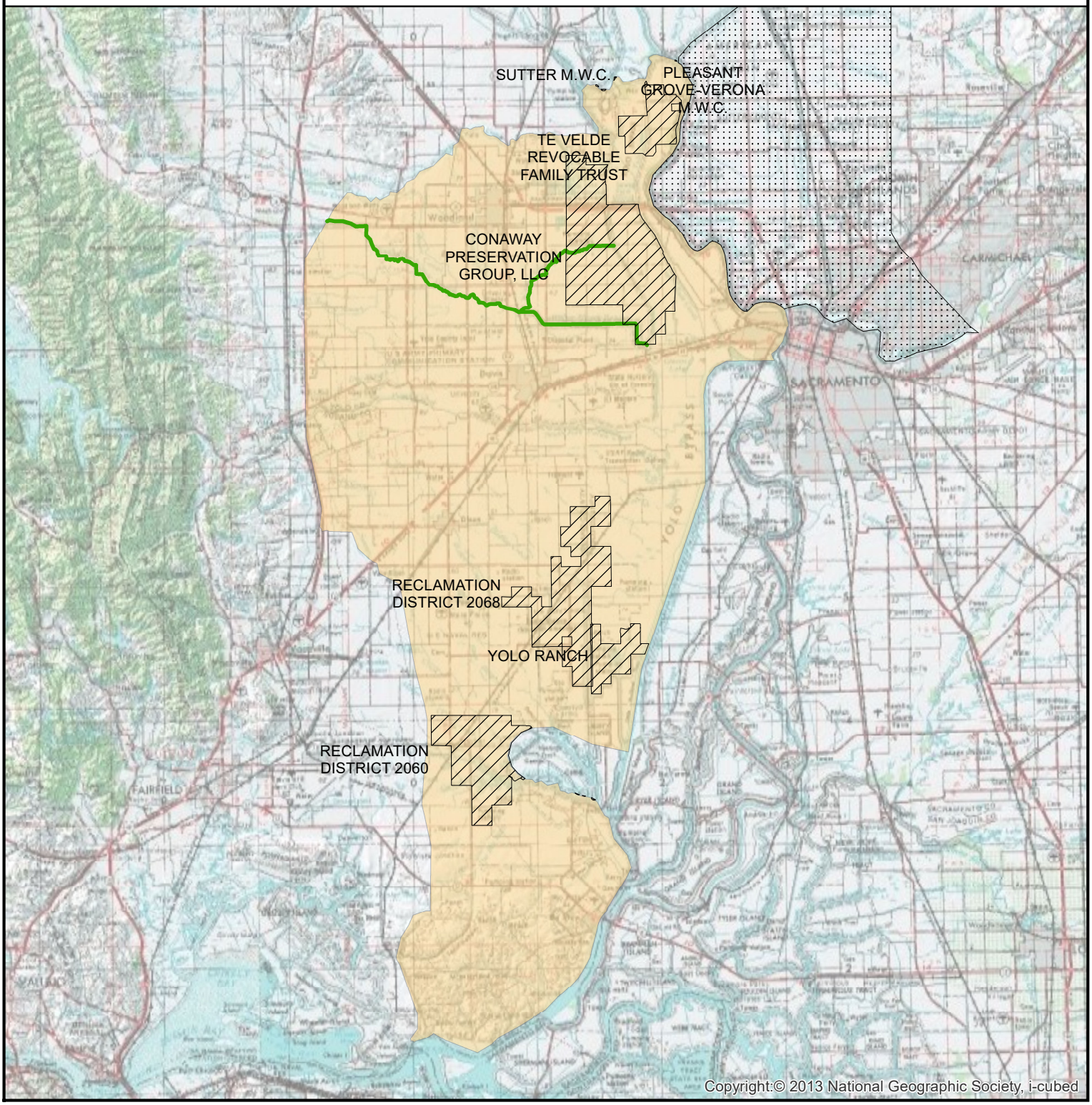
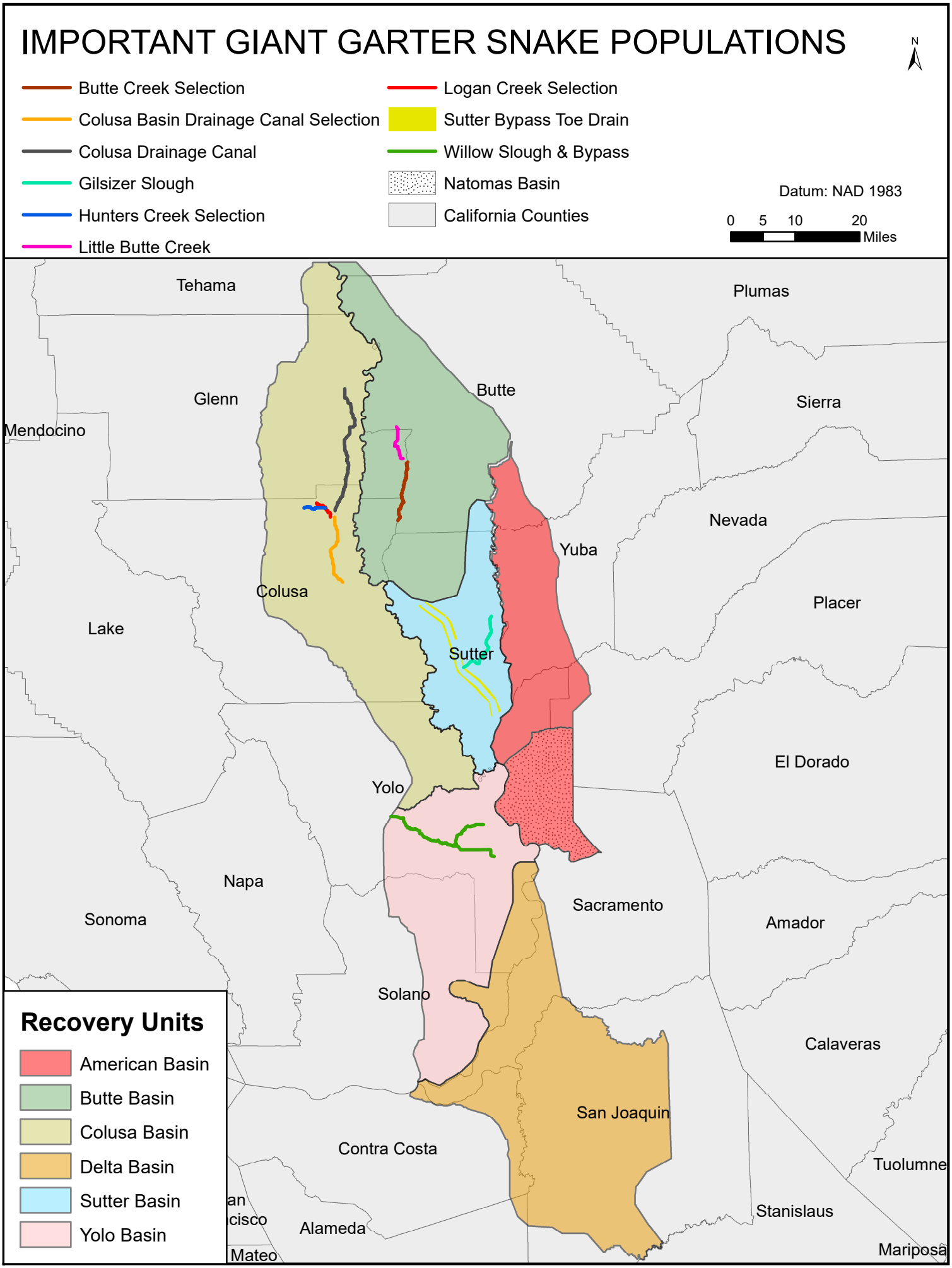


IMPORTANT GIANT GARTER SNAKE POPULATIONS



Appendix H
Groundwater Modeling Results

Numerical groundwater modeling analysis

Numerical groundwater modeling analysis was performed using the Sacramento Valley Finite Element Groundwater Model (SACFEM2013) developed to simulate groundwater conditions in the Sacramento Valley. SACFEM2013 was selected as the numerical modeling tool for this analysis based on the state of the model and its capabilities to simulate groundwater conditions at a greater level of detail than other potential modeling tools within the Seller Service Area. Reclamation commissioned a peer review of the SACFEM2013 model in 2010 (WRIME 2011). Revisions were made to the model and the revised model was used for the impacts analysis described here.

SACFEM2013 uses the MicroFEM finite-element numerical modeling code. MicroFEM is capable of simulating multiple aquifer systems in both steady state and transient conditions. The model is capable of simulating groundwater conditions and groundwater/surface water interactions in the valley. SACFEM2013 was also used to estimate how groundwater pumping and recharge affects surface water.

SACFEM2013 covers the entire Sacramento Valley Groundwater Basin from just north of Red Bluff to the Cosumnes River in the south (see Figure H-1). The model was calibrated to historic conditions from Water Years (WY) 1970 through WY 2009. This SACFEM2013 model simulation, which includes highly variable hydrology (from very wet periods to very dry periods), was used as a basis for simulating groundwater substitution pumping. Proposed water transfers for 2019 were simulated in SACFEM2013 using September 1977 hydrologic conditions because this year represents the driest condition available during the SACFEM2013 simulation period (WY 1970 to WY 2003).

Groundwater drawdown impacts associated with the groundwater substitution pumping from 187 wells that are part of the Proposed Action have been modeled to estimate effects to groundwater resources. Table H-1 summarizes the pumping details including pumping capacity and depth of the modeled groundwater substitution pumping wells. The locations and depths of these wells are specified in the model based on data collected from the potential groundwater substitution sellers.

Figures H-1, H-2, H-3, and H-4 show the simulated drawdown due to the Proposed Action under September 1977 hydrologic conditions. During dry years, surface water resources are limited and users have historically increased groundwater pumping to address shortages. Proposed water transfers for 2018 were simulated in SACFEM2013 using September 1977 hydrologic conditions because this year represents the driest condition available during the SACFEM2013 simulation period (WY 1970 to WY 2003). Simulating transfers during this period illustrates the potential to compound impacts from dry-year pumping as compared to the No Action Alternative.

- Figure H-1 shows the simulated drawdown at the water table based on results from the top layer of the SACFEM2013 model. This layer has a depth of up to 35 feet bgs.

- Figure H-2 shows simulated drawdown at approximately 200 to 300 feet bgs.
- Figure H-3 presents the simulated drawdown at approximately 300 to 400 feet bgs.
- Figure H-4 presents the simulated drawdown at approximately 700 to 900 feet bgs.
- Figure H-5 overlays the Indian Trust Assets (ITAs) within the Sacramento Valley Groundwater Basin over the simulated drawdown at the water table.

Drawdown at the water table (Figure H-5) represents the estimated decline in the groundwater surface within the shallow, unconfined portion of the aquifer (i.e., the height of water within a shallow groundwater well). The drawdown in the deeper portions of the aquifer (Figures H-2 through H-4) represents a change in hydraulic head (i.e., water pressure) in a well that is screened in this deeper portion of the aquifer.

Table H-1. Water Transfers through Groundwater Substitution under the Proposed Action

Groundwater Basin	Potential Seller	Number of Wells	Pumping Rate (gpm)	Range of Screened Interval (feet)
Redding Area	Anderson-Cottonwood Irrigation District	2	1,000 - 5,500	150 - 455
Sacramento Valley	Canal Farms	3	3,500 - 5,000	65 - 660
	Eastside Mutual Water Company	1	4,720	150 - 240
	Giusti Farms	2	3,200	150 - 400
	Glenn-Colusa Irrigation District	17	800 – 4,300	25 –945
	Maxwell Irrigation District	2	3,800	150 - 240
	Natomas Central Mutual Water Company	14	1,000 - 2,500	10 - 952
	Pelger Mutual Water Company	4	1,500 - 5,000	101 - 485
	Pelger Road 1700 LLC	4	3,000 - 3,500	200 - 820
	Pleasant Grove-Verona Mutual Water Company	35	1,500 - 5,000	99 - 260
	Princeton-Codora-Glenn Irrigation District	13	1,000 - 3,000	120 - 380
	Provident Irrigation District	16	2,000 – 4,500	100 - 420
	Reclamation District 108	5	1,700 - 5,900	250 - 680
	Reclamation District 1004	28	1,000 - 5,800	56 - 430
	River Garden Farms	8	1,700 - 3,000	170 - 686
	Sutter Mutual Water Company	20	2,500 – 5,000	160 - 400
	Sycamore Mutual Water Company	5	3,200 - 6,500	160 - 906
	T&P Farms	2	3,500 - 4,000	256 - 862
	Te Velde Revocable Family Trust	5	2,200 - 4,700	115 - 455
	Windswept Land & Livestock	3	2,000 – 3,200	120 - 580

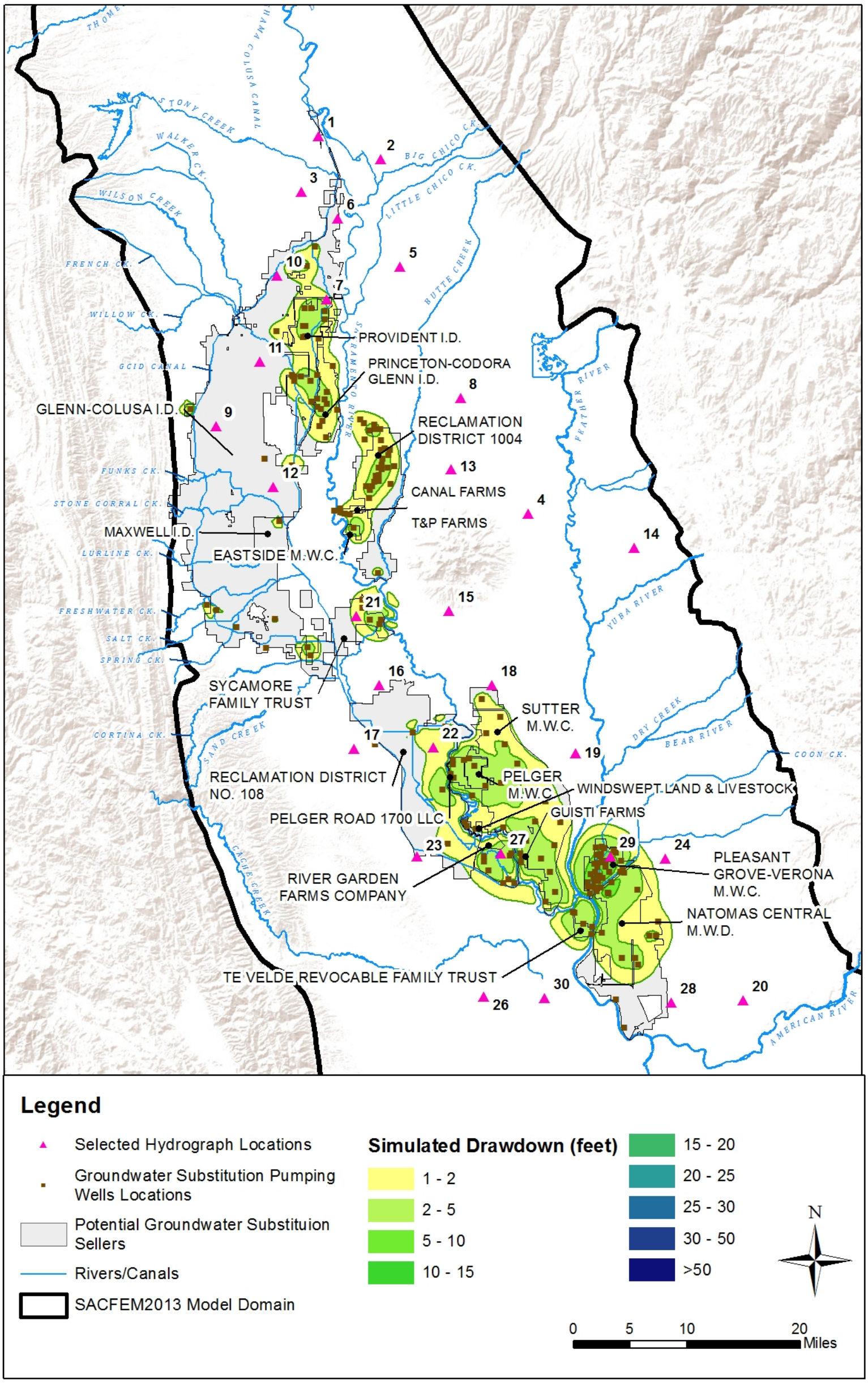


Figure H-1. Simulated Change in Water Table Elevation (0 to approximately 35 feet bgs), Based on September 1977 Hydrologic Conditions

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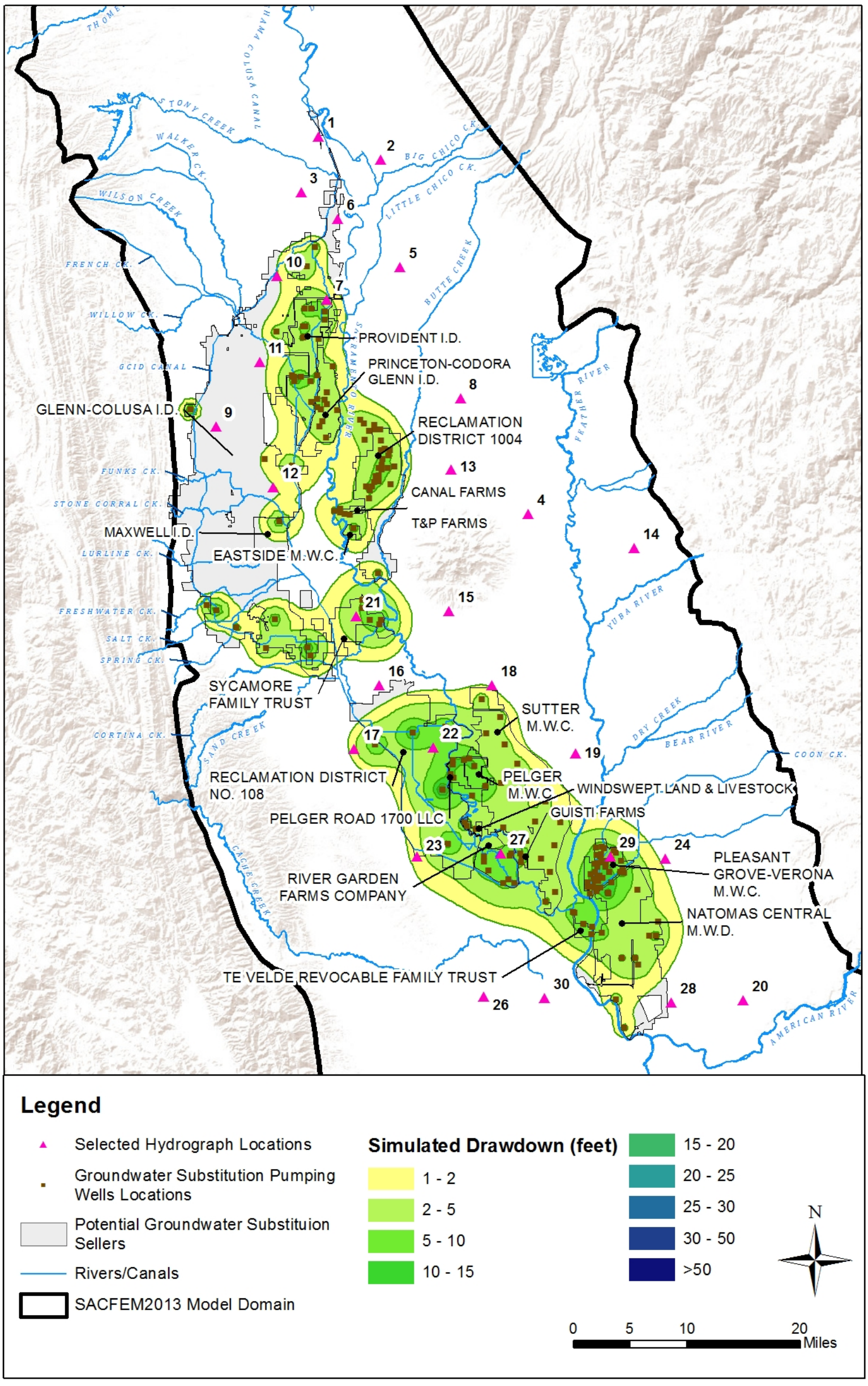

Figure H-2. Simulated Change in Groundwater Head (approximately 200 to 300 feet bgs), Based on September 1977 Hydrologic Conditions

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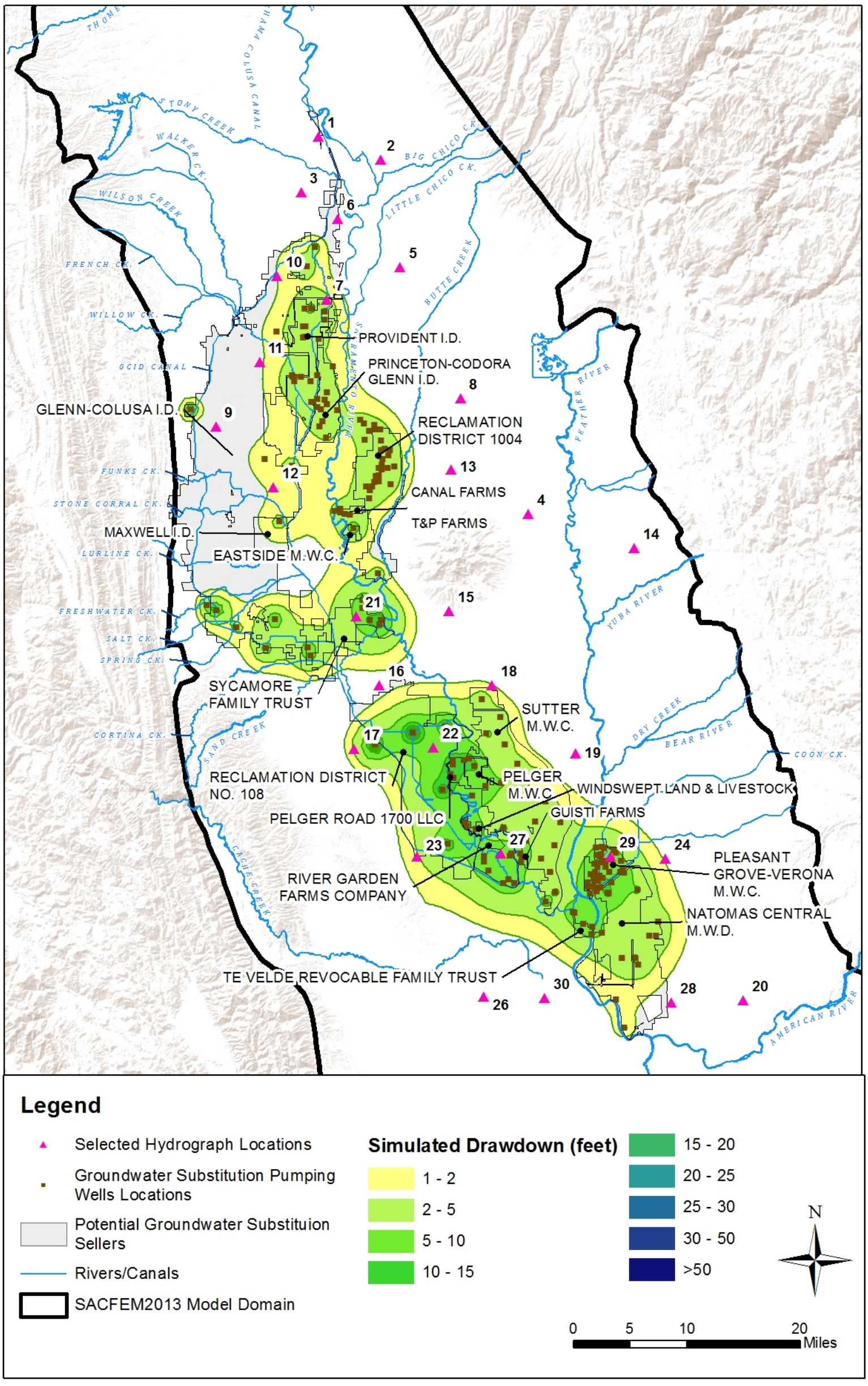

Figure H-3. Simulated Change in Groundwater Head (approximately 300 to 400 feet bgs), Based on September 1977 Hydrologic Conditions

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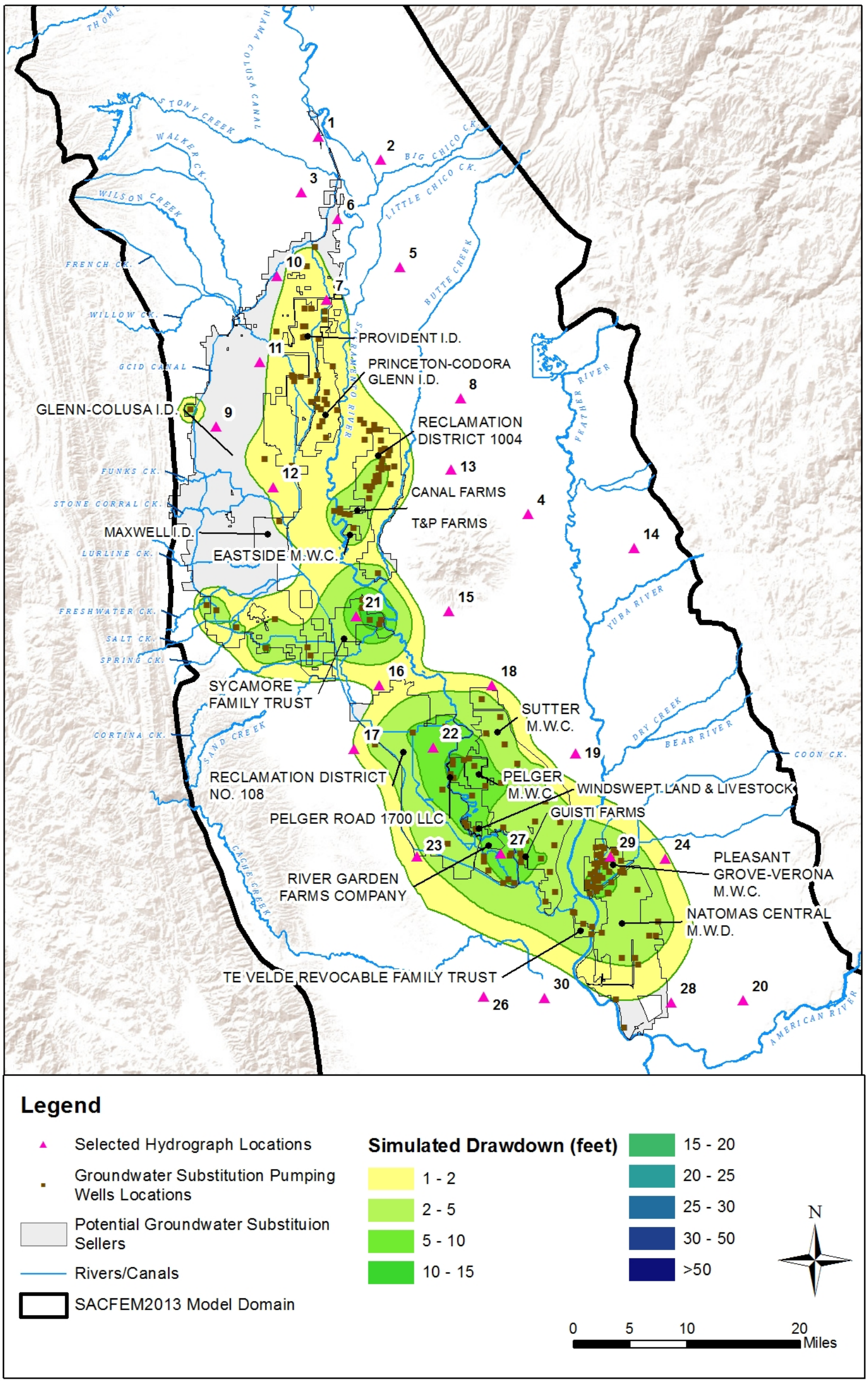


Figure H-4. Simulated Change in Groundwater Head (approximately 700 to 900 feet bgs), Based on September 1977 Hydrologic Conditions

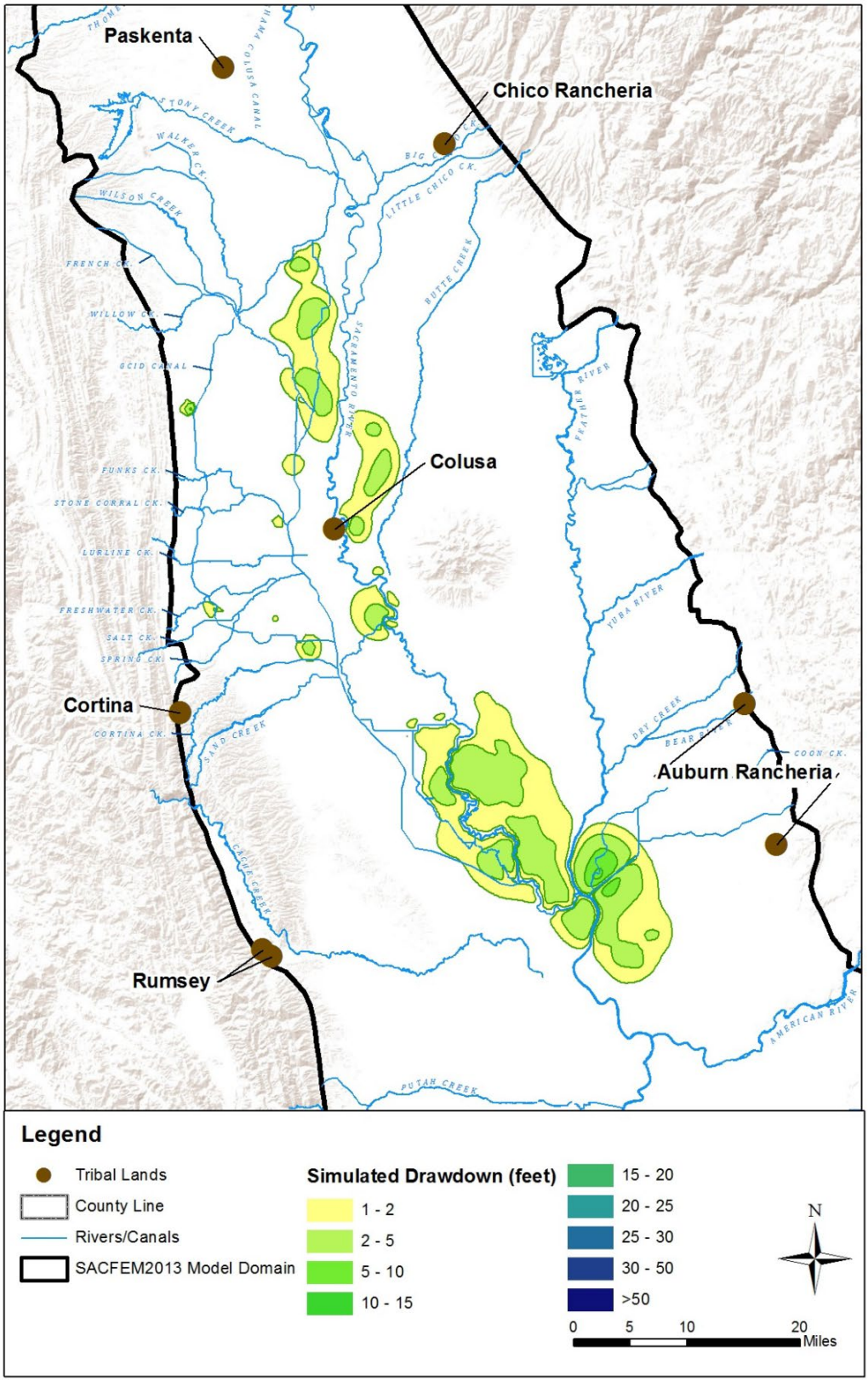
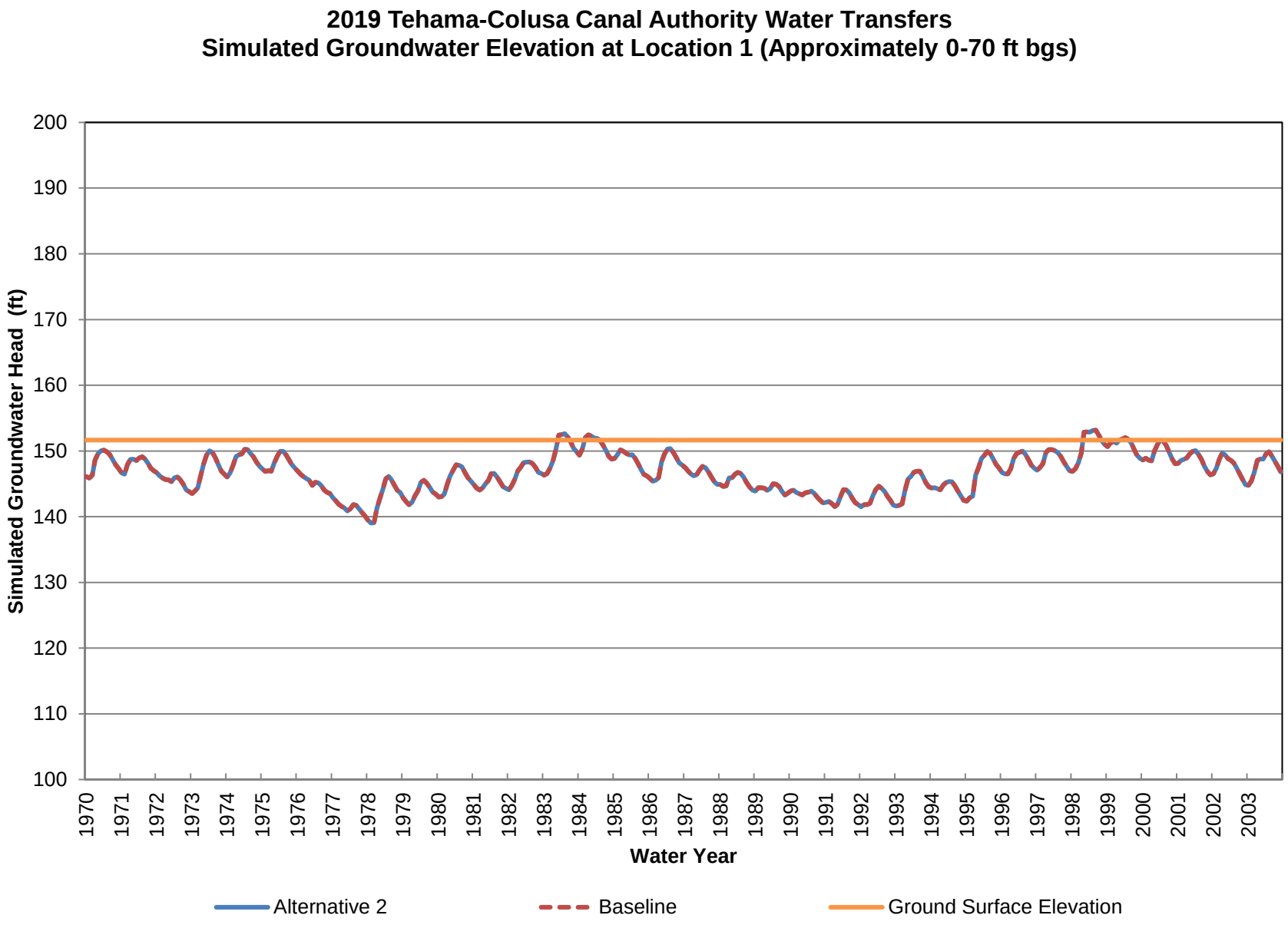


Figure H-5. Groundwater Effects to ITAs in the Sacramento Valley Groundwater Basin

Groundwater head hydrographs for Locations 1 to 34


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 1 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
200
190
180
170
160
150
140
130
120
110
100
1970
1971
1972
1973
1974
1975
1976
1977
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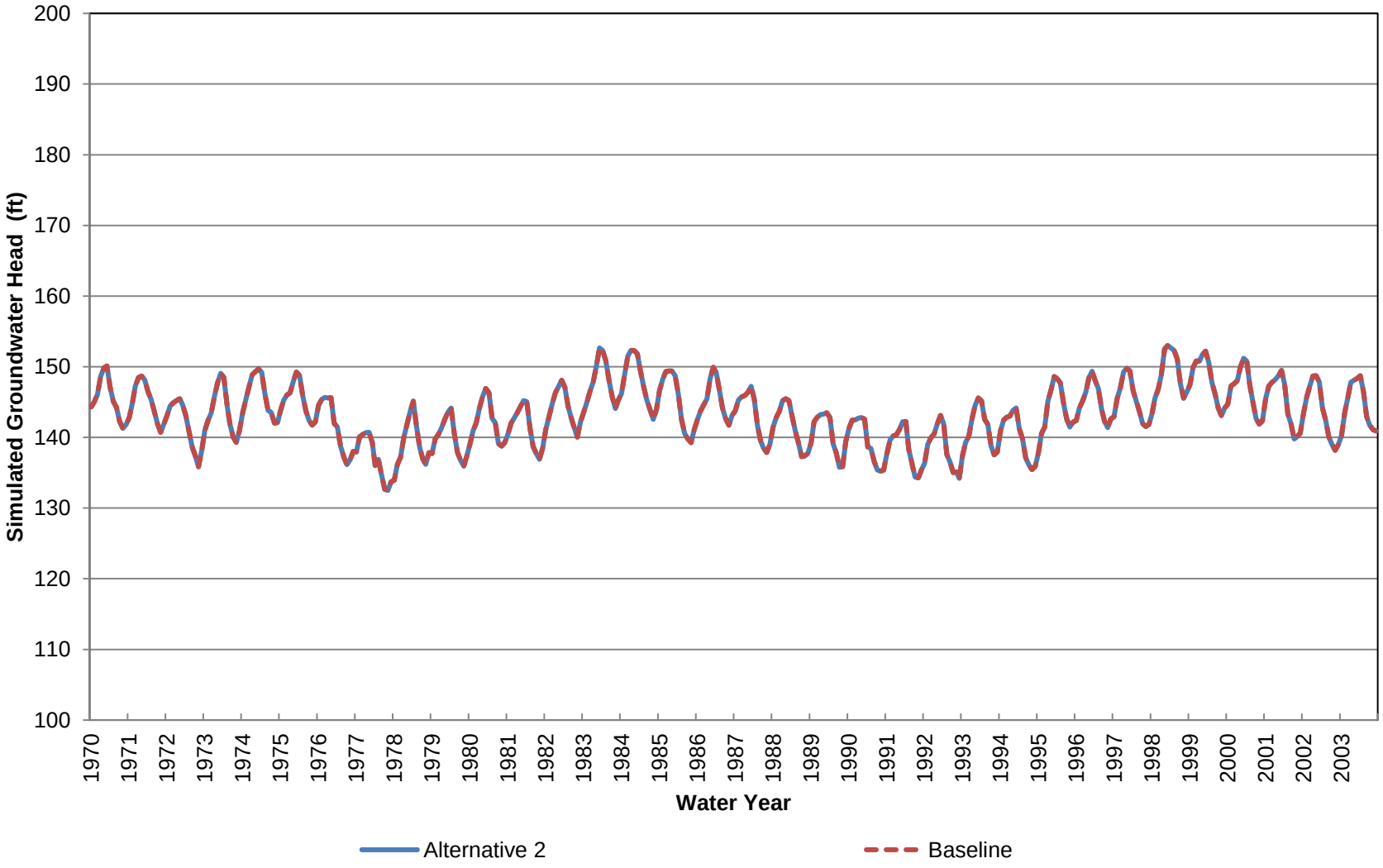
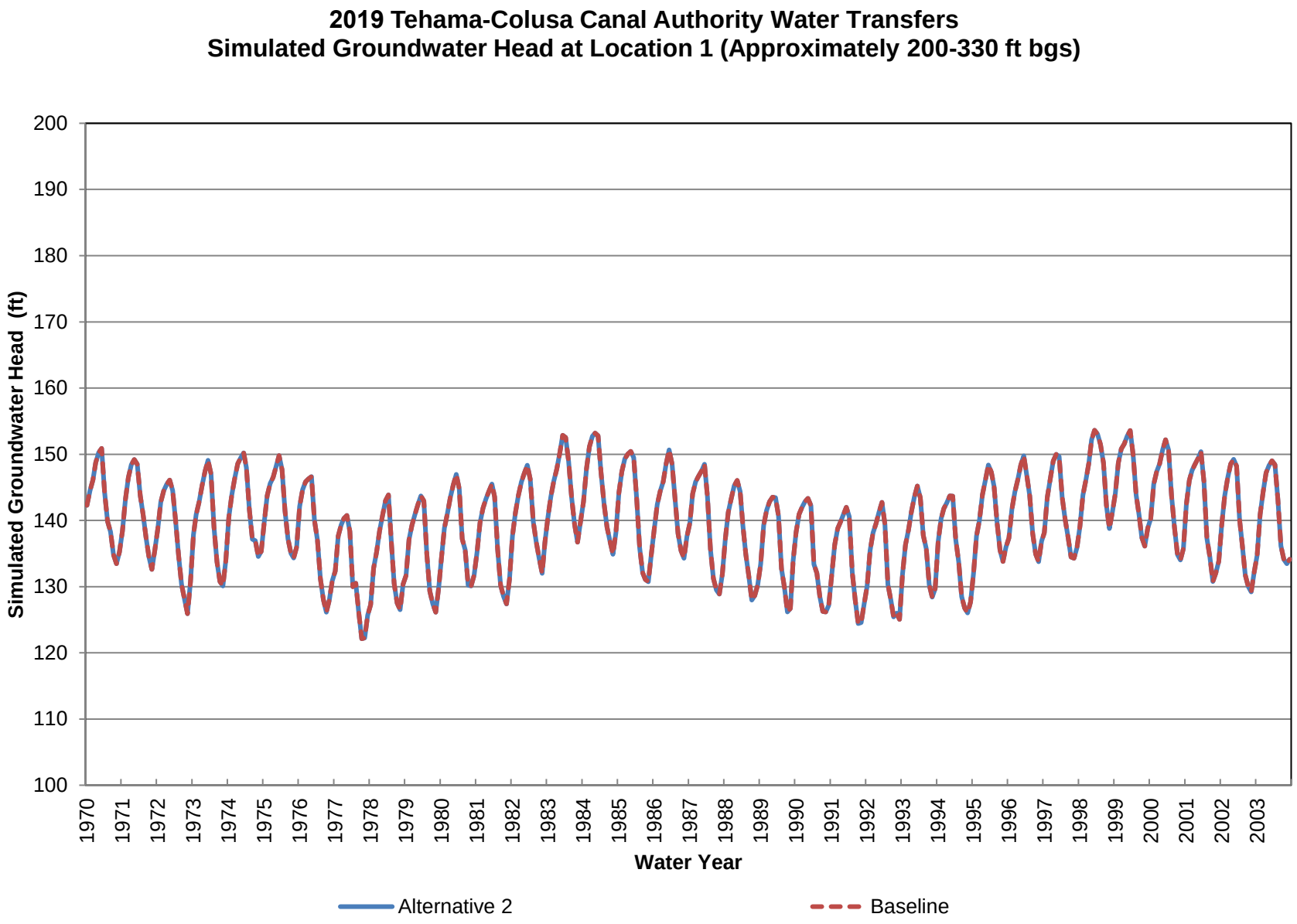
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 70-200 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 200-330 ft bgs)
Simulated Groundwater Head (ft)
200
190
180
170
160
150
140
130
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110
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1970
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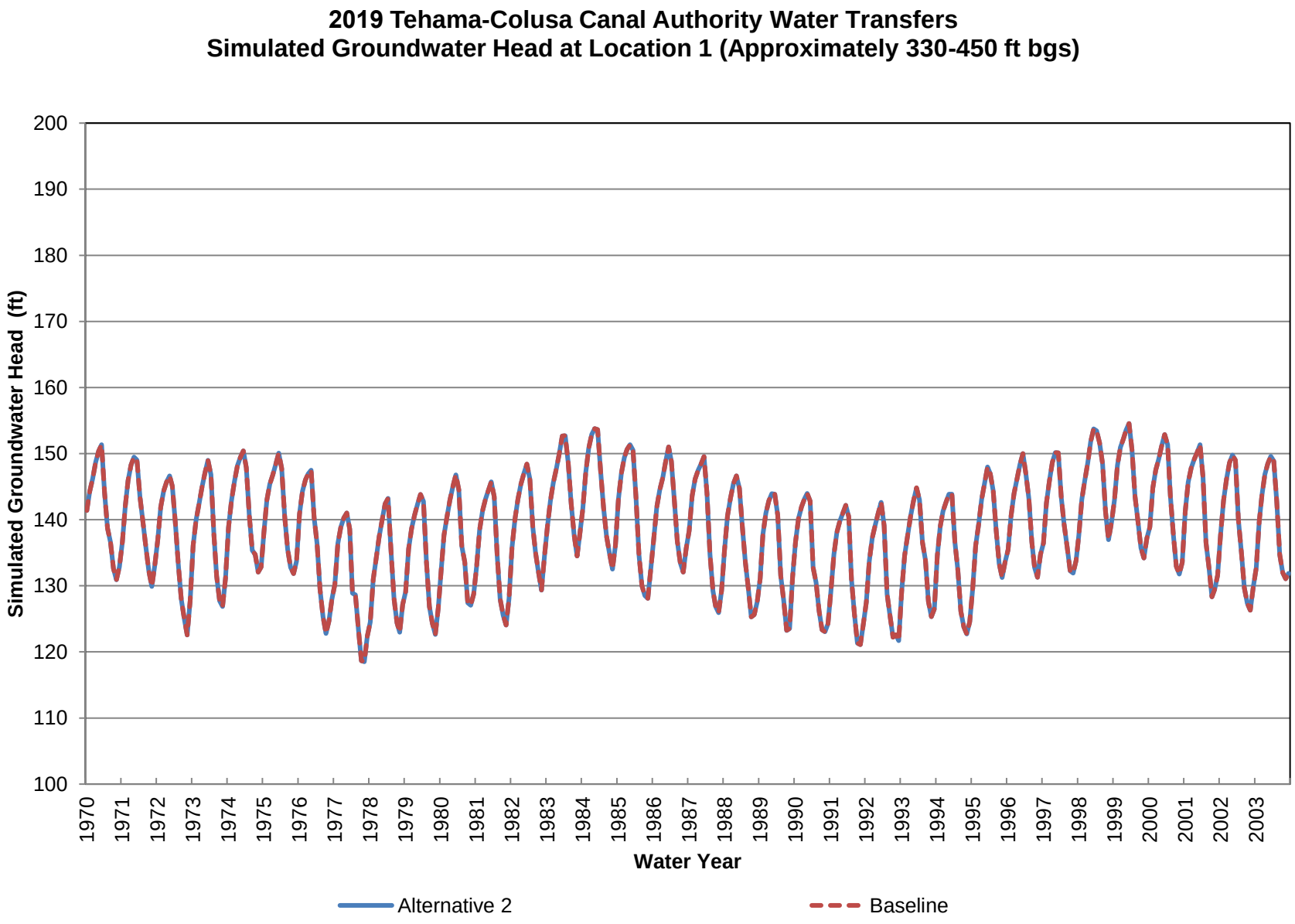
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 330-450 ft bgs)
Simulated Groundwater Head (ft)
200
190
180
170
160
150
140
130
120
110
100
1970
1971
1972
1973
1974
1975
1976
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1980
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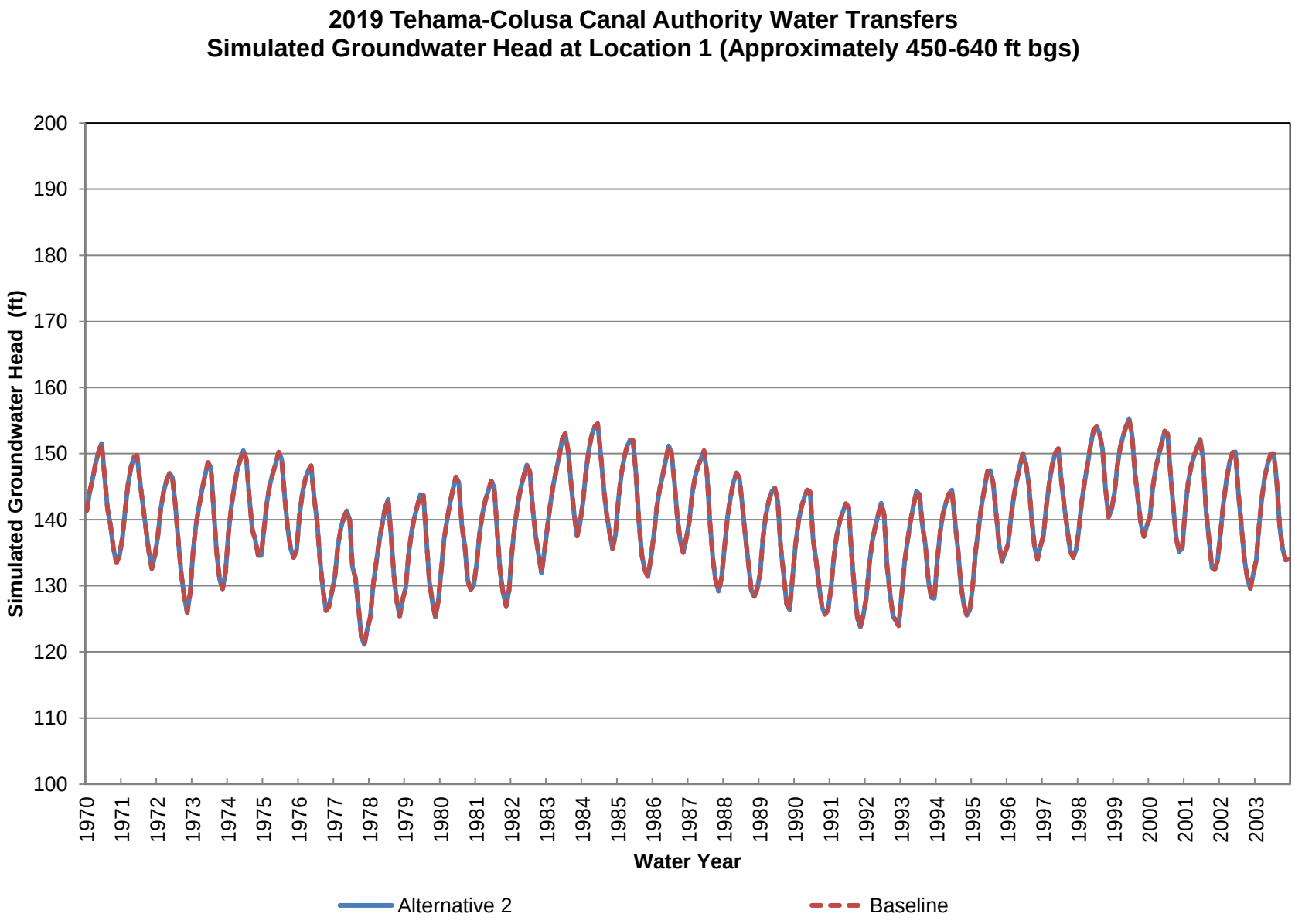
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 450-640 ft bgs)
Simulated Groundwater Head (ft)
200
190
180
170
160
150
140
130
120
110
100
1970
1971
1972
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1974
1975
1976
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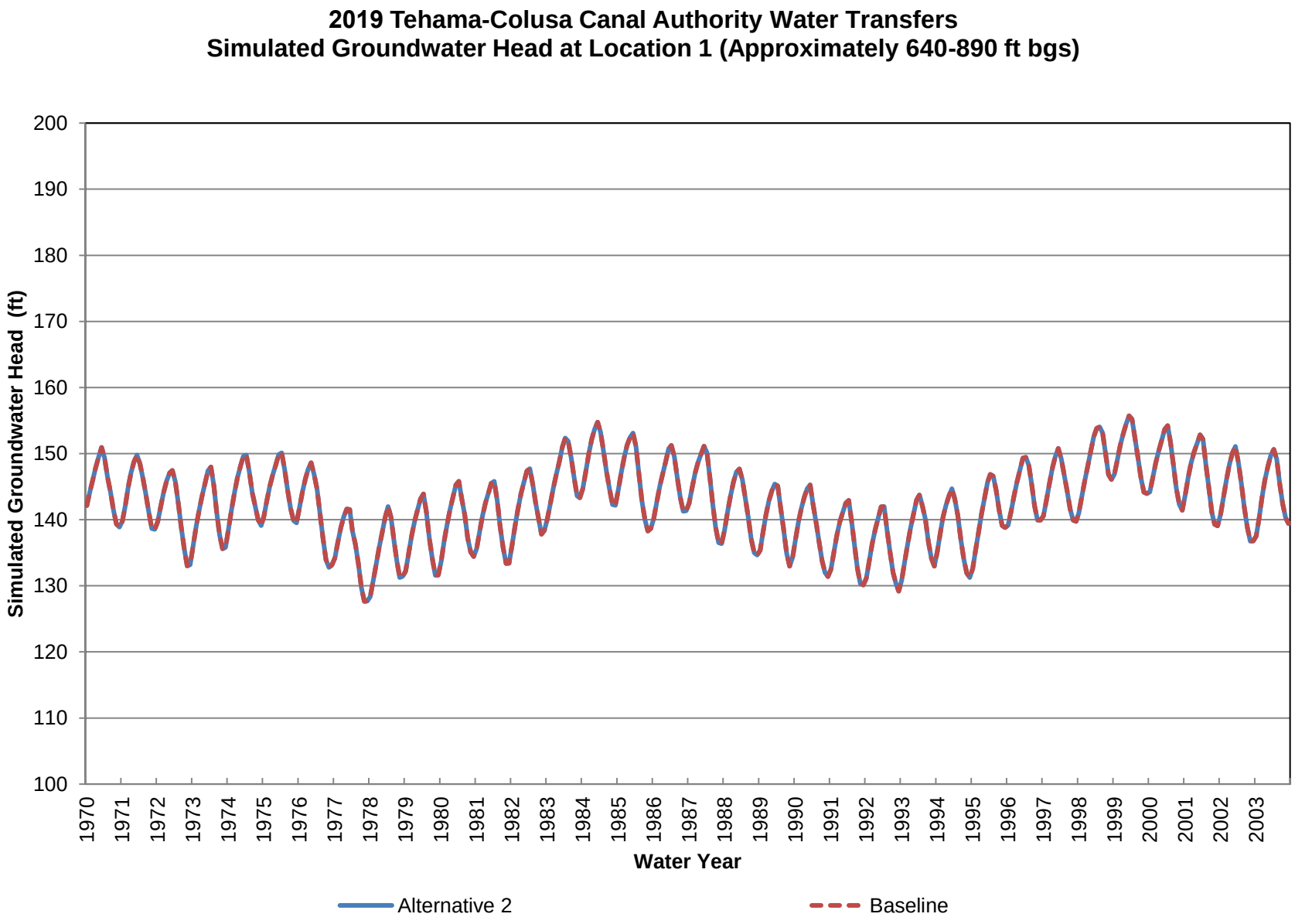
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 640-890 ft bgs)
Simulated Groundwater Head (ft)
200
190
180
170
160
150
140
130
120
110
100
1970
1971
1972
1973
1974
1975
1976
1977
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1979
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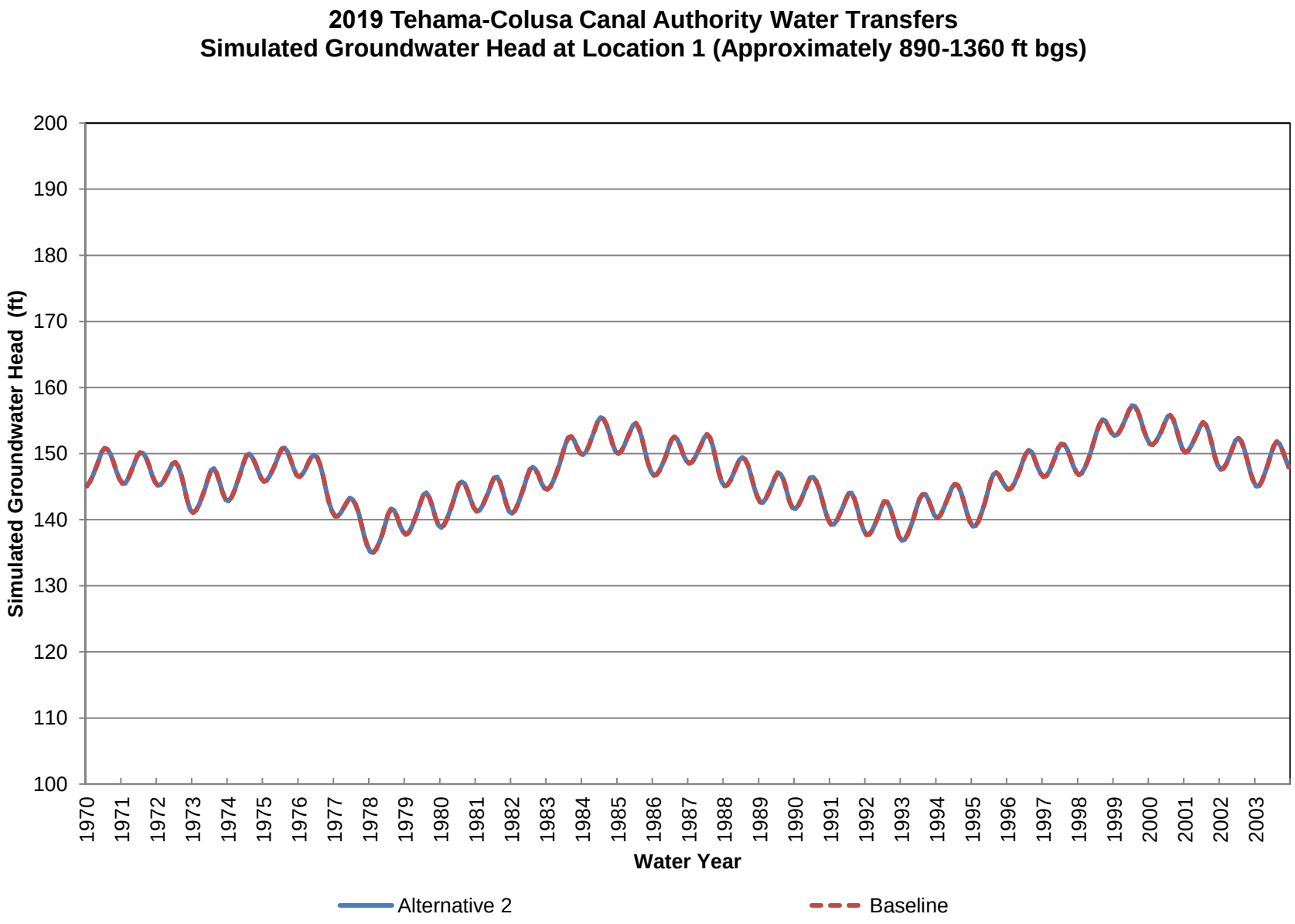
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 890-1360 ft bgs)
Simulated Groundwater Head (ft)
200
190
180
170
160
150
140
130
120
110
100
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
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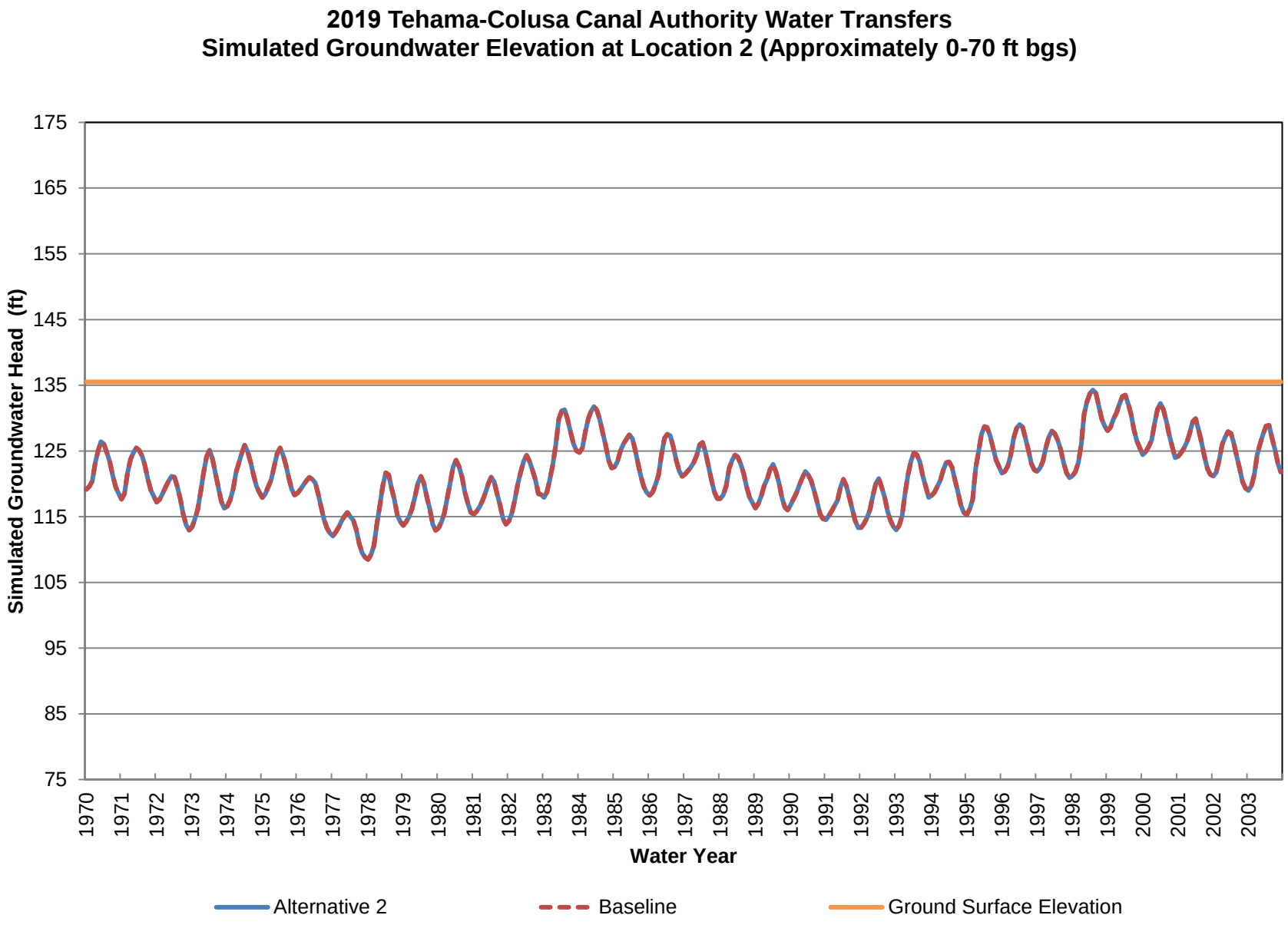
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 2 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
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1970
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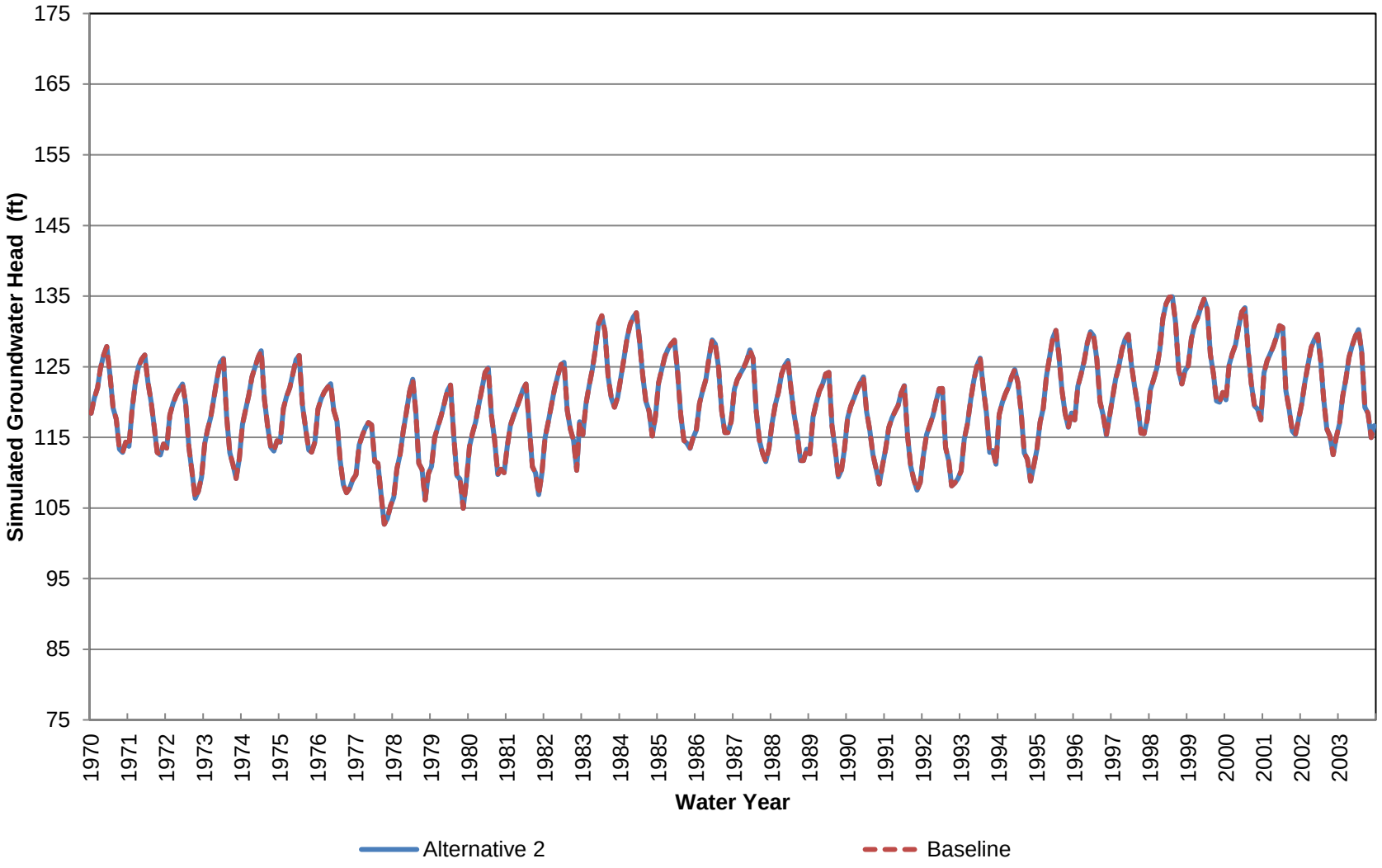
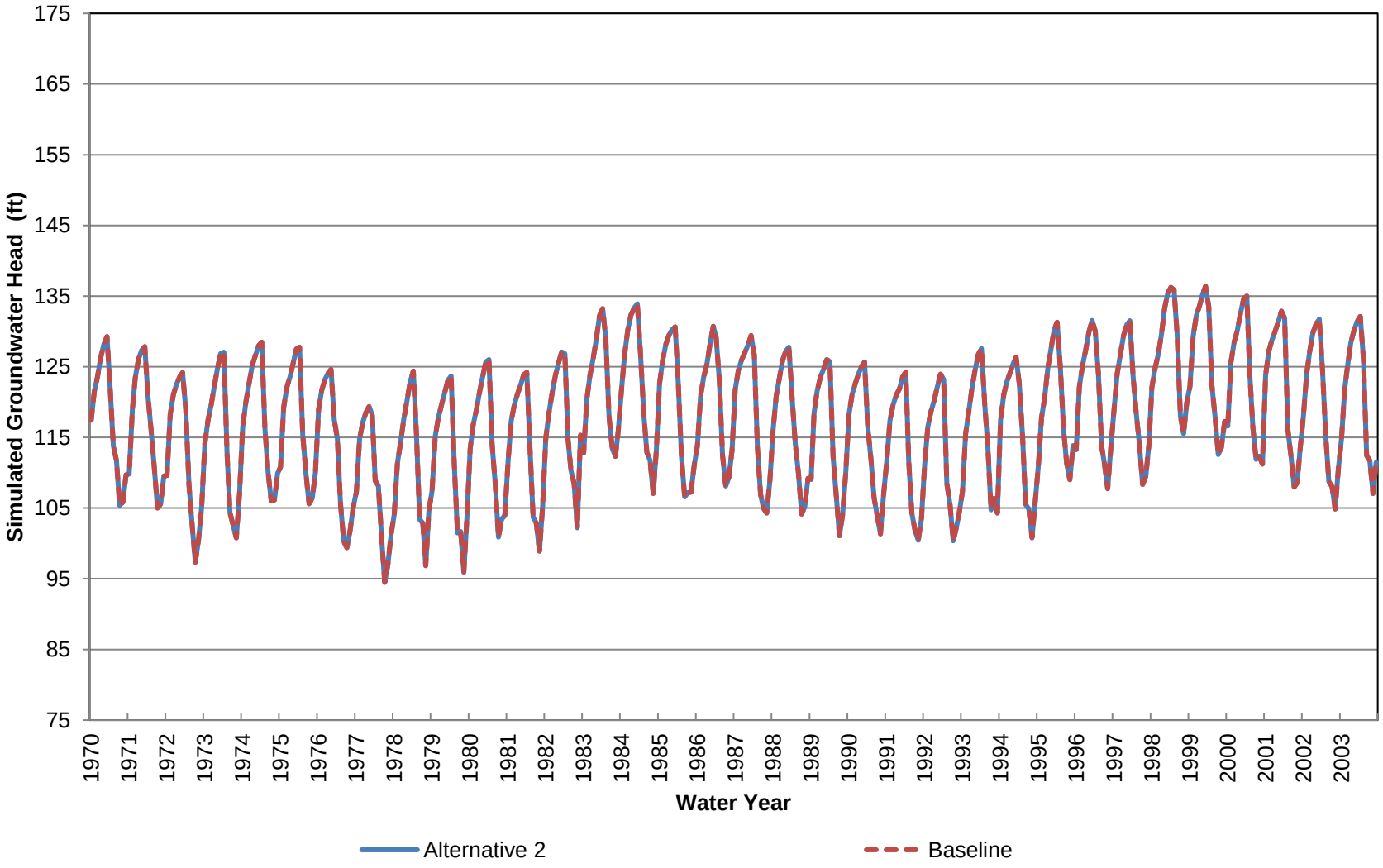
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

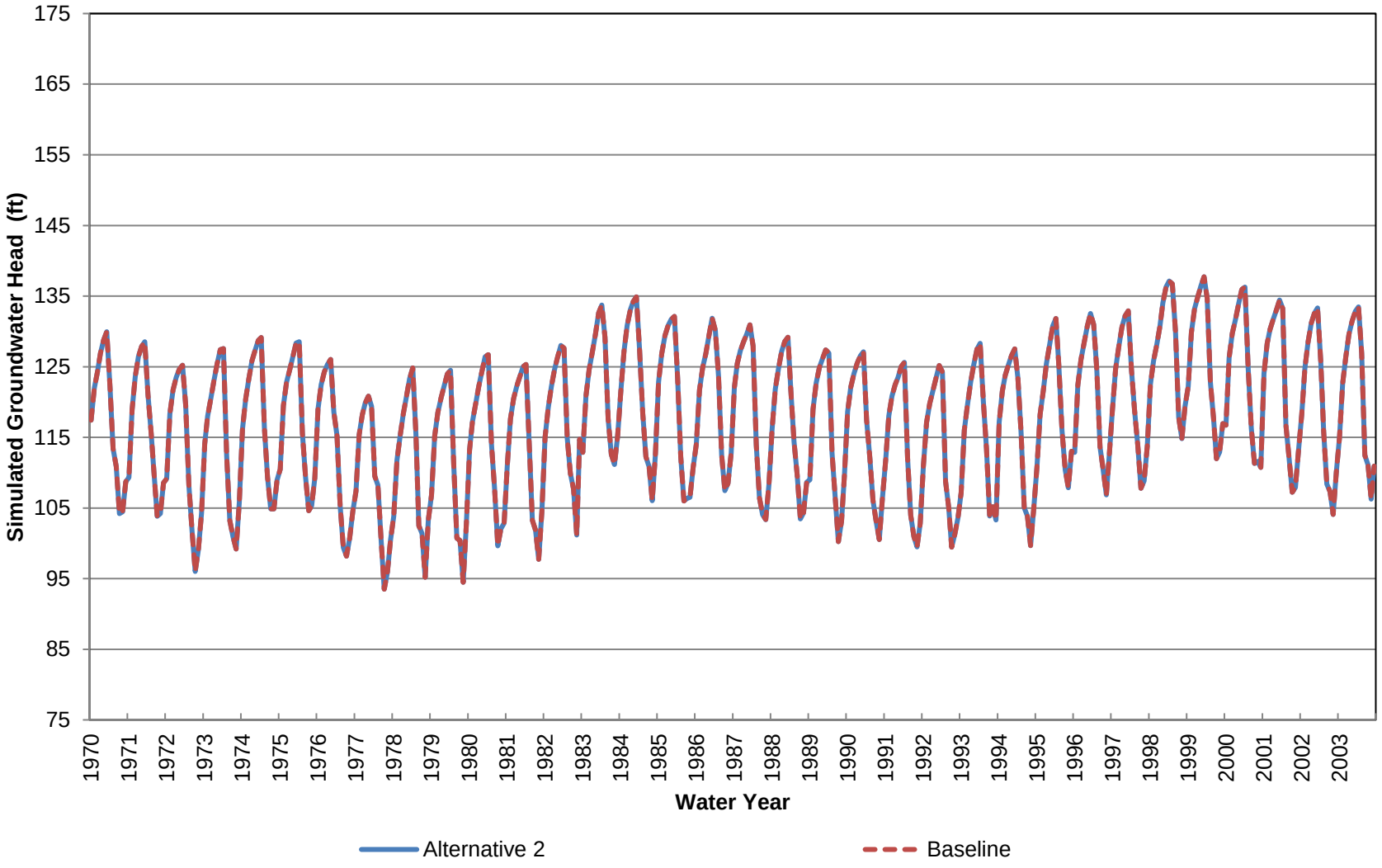
2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 70-190 ft bgs)

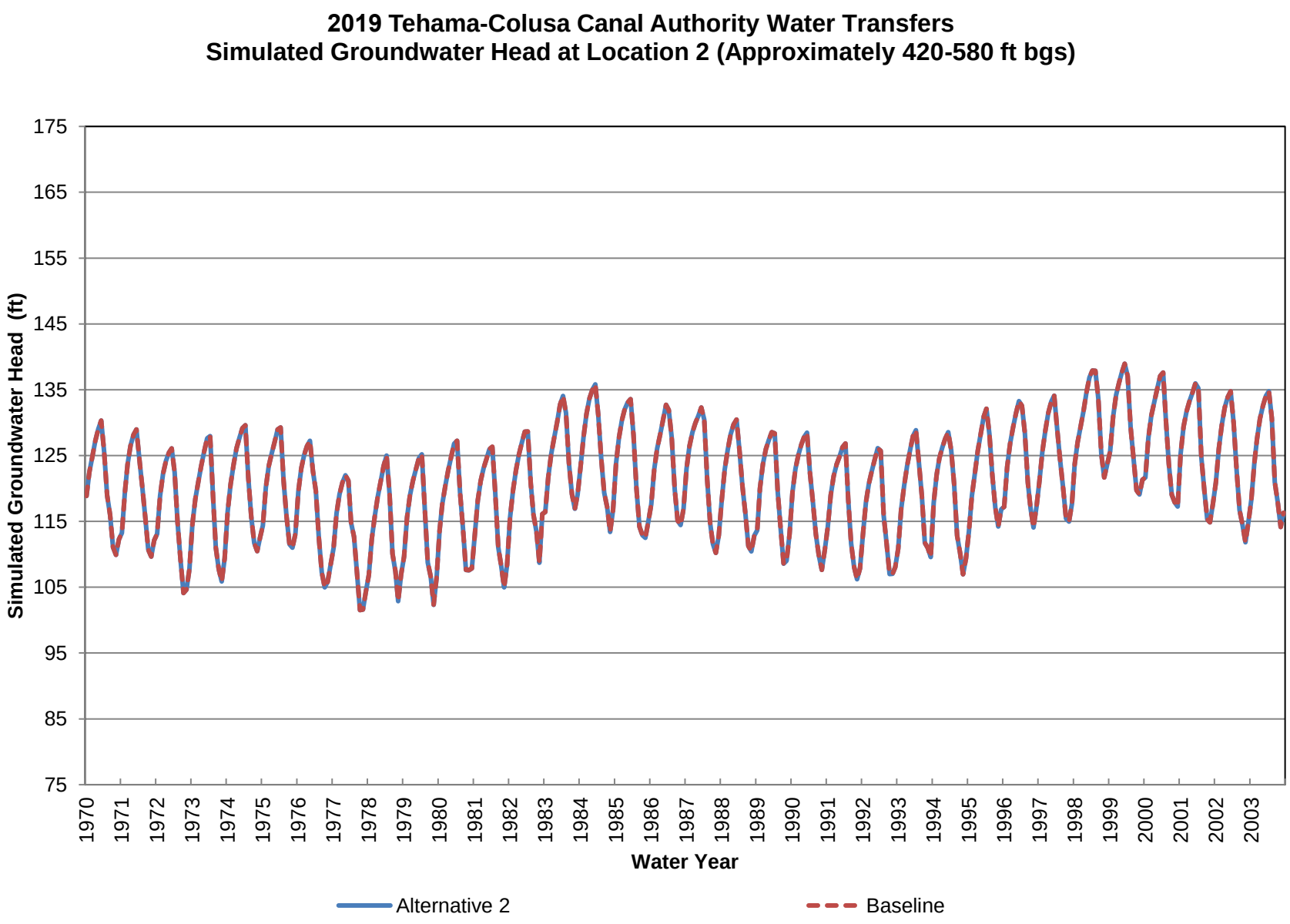


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 190-300 ft bgs)



2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 300-420 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 420-580 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
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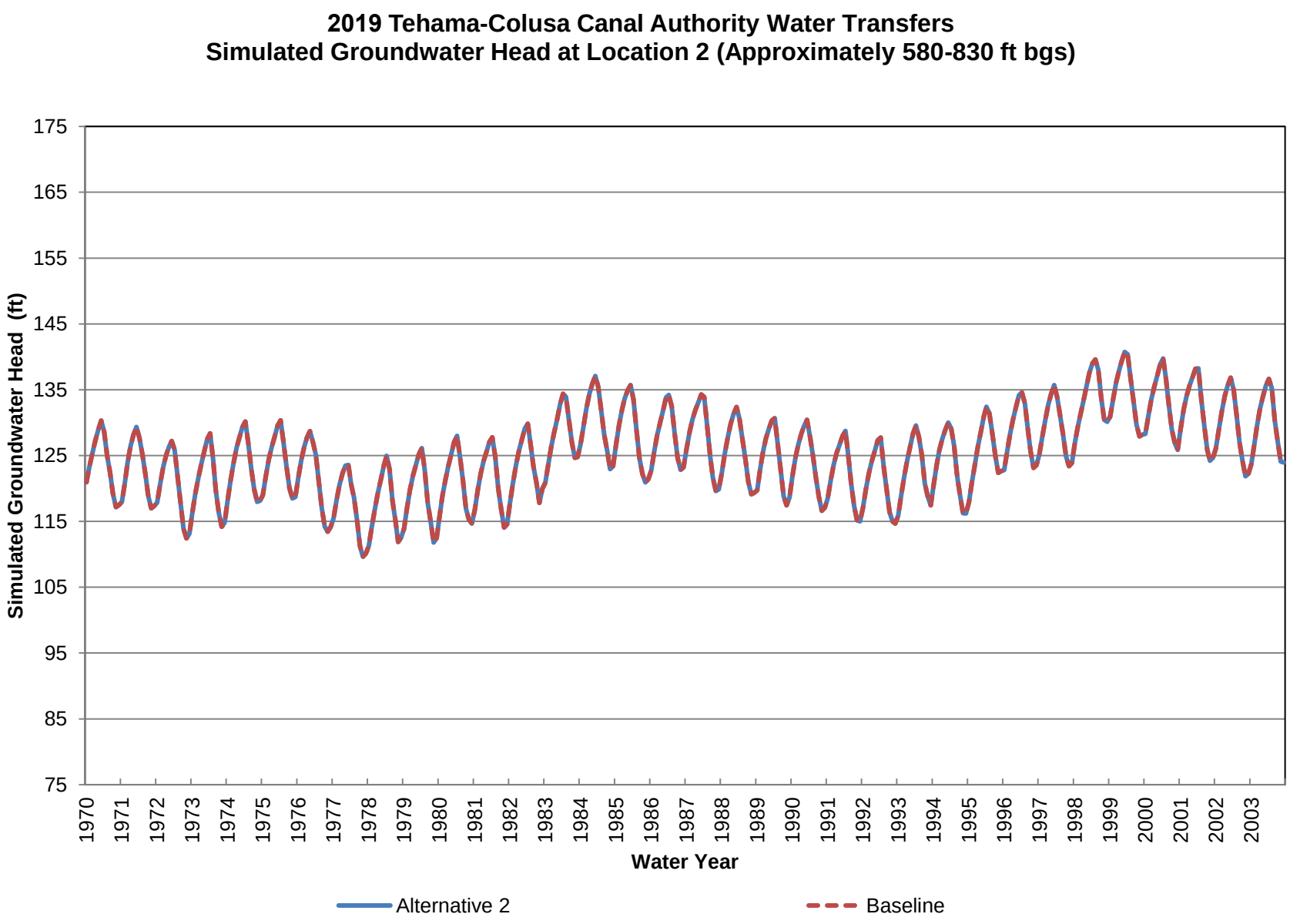
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 580-830 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
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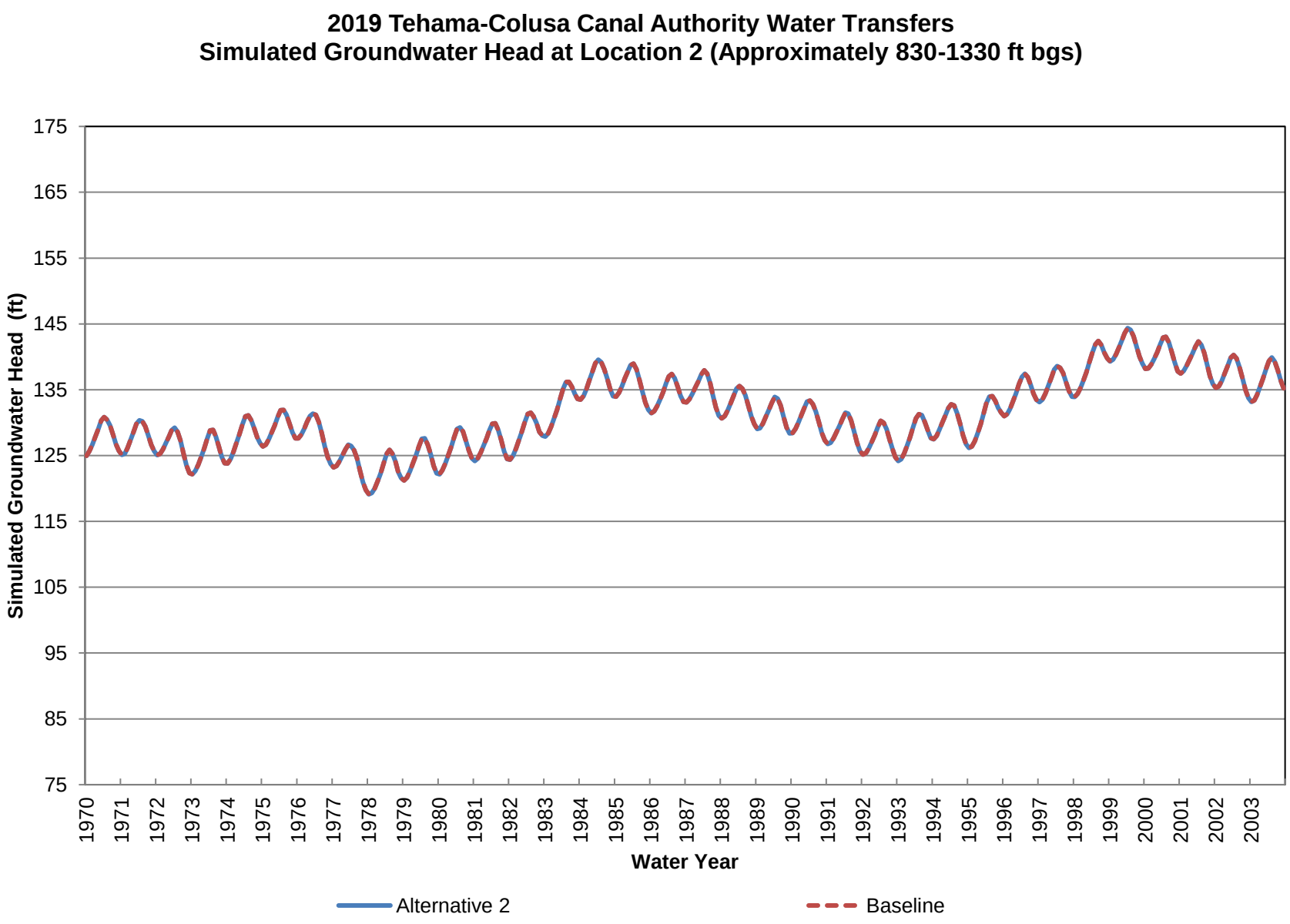
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 830-1330 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
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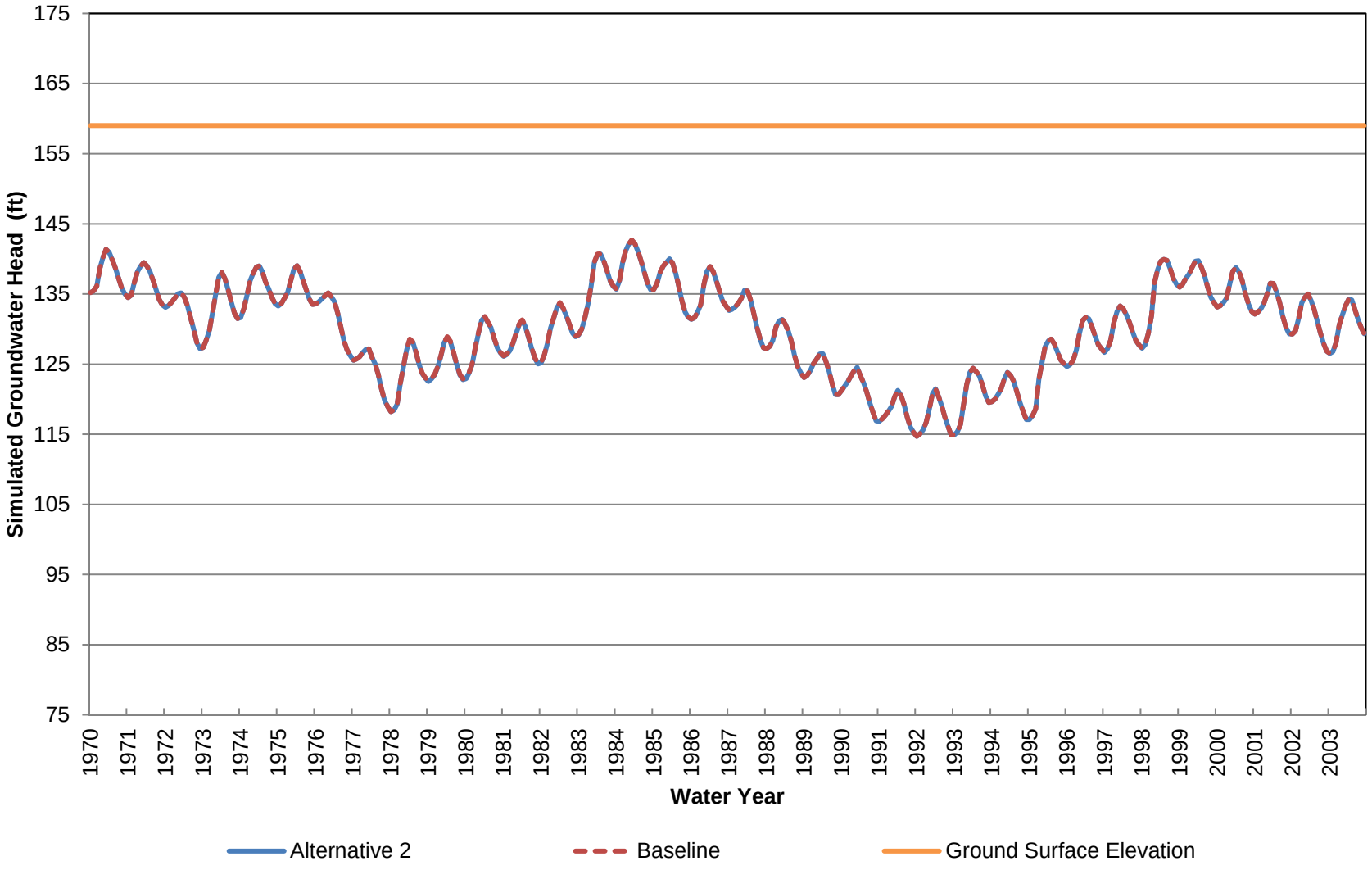
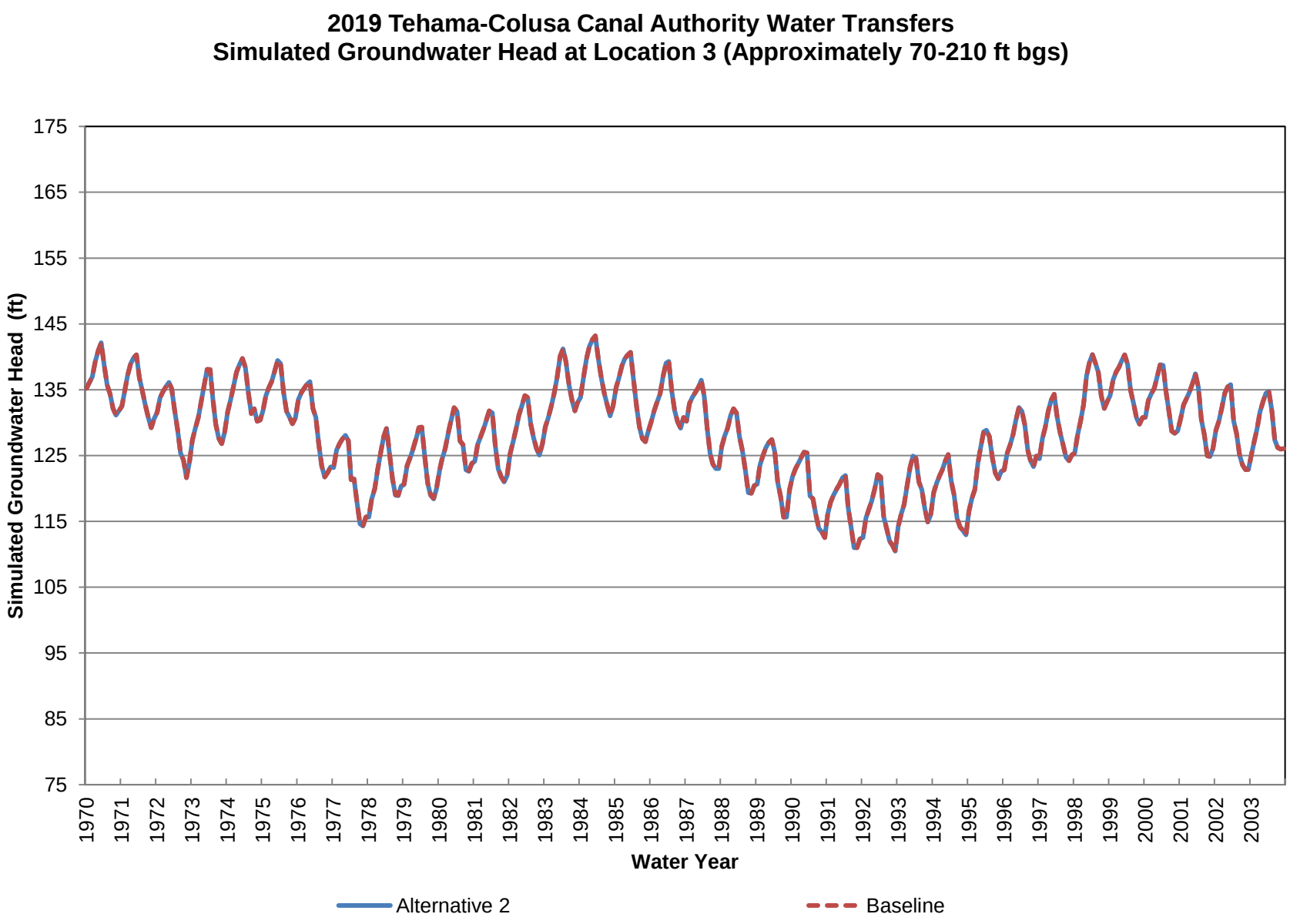
2002
2003
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 3 (Approximately 0-70 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 70-210 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
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1974
1975
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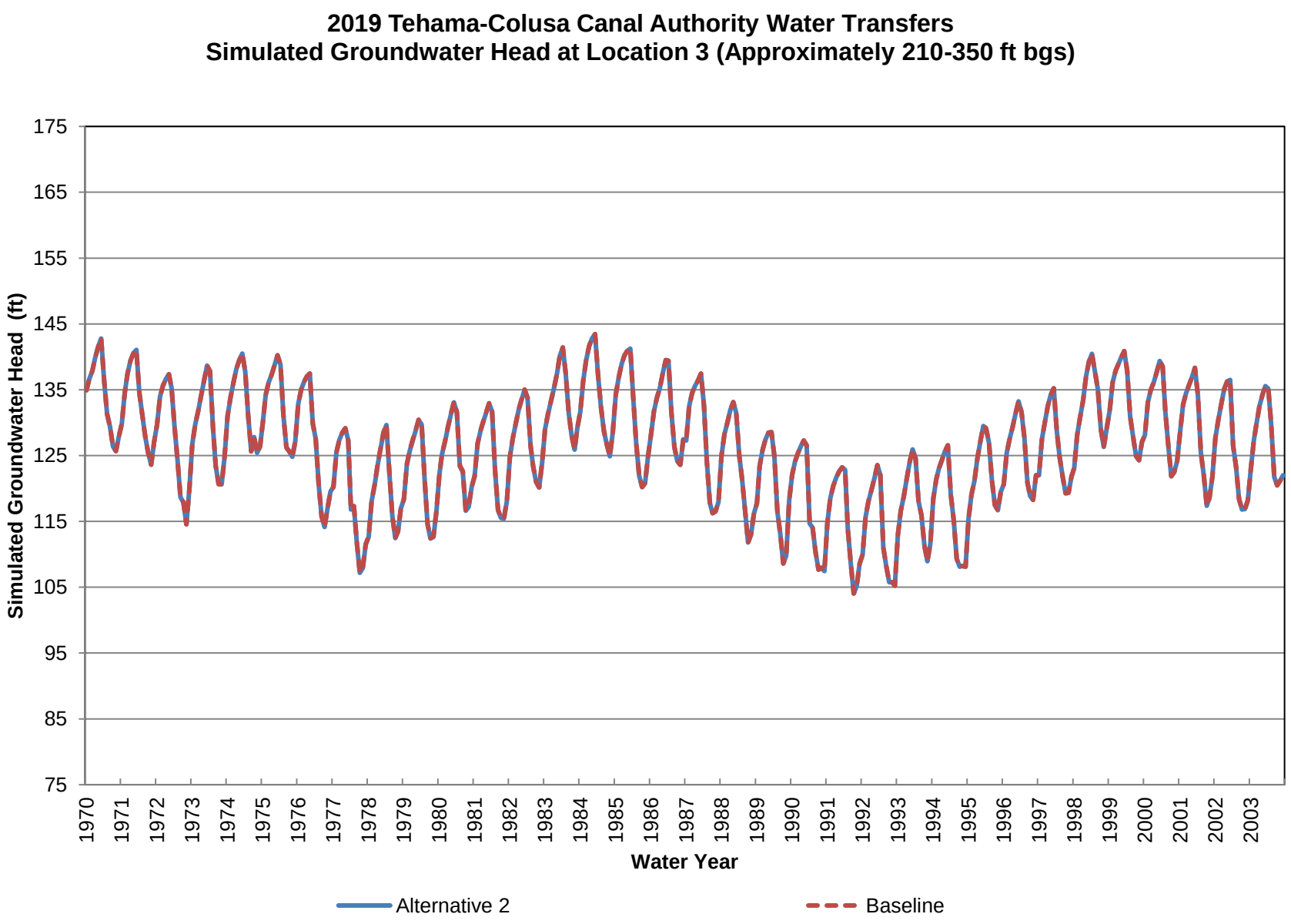
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 210-350 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
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1980
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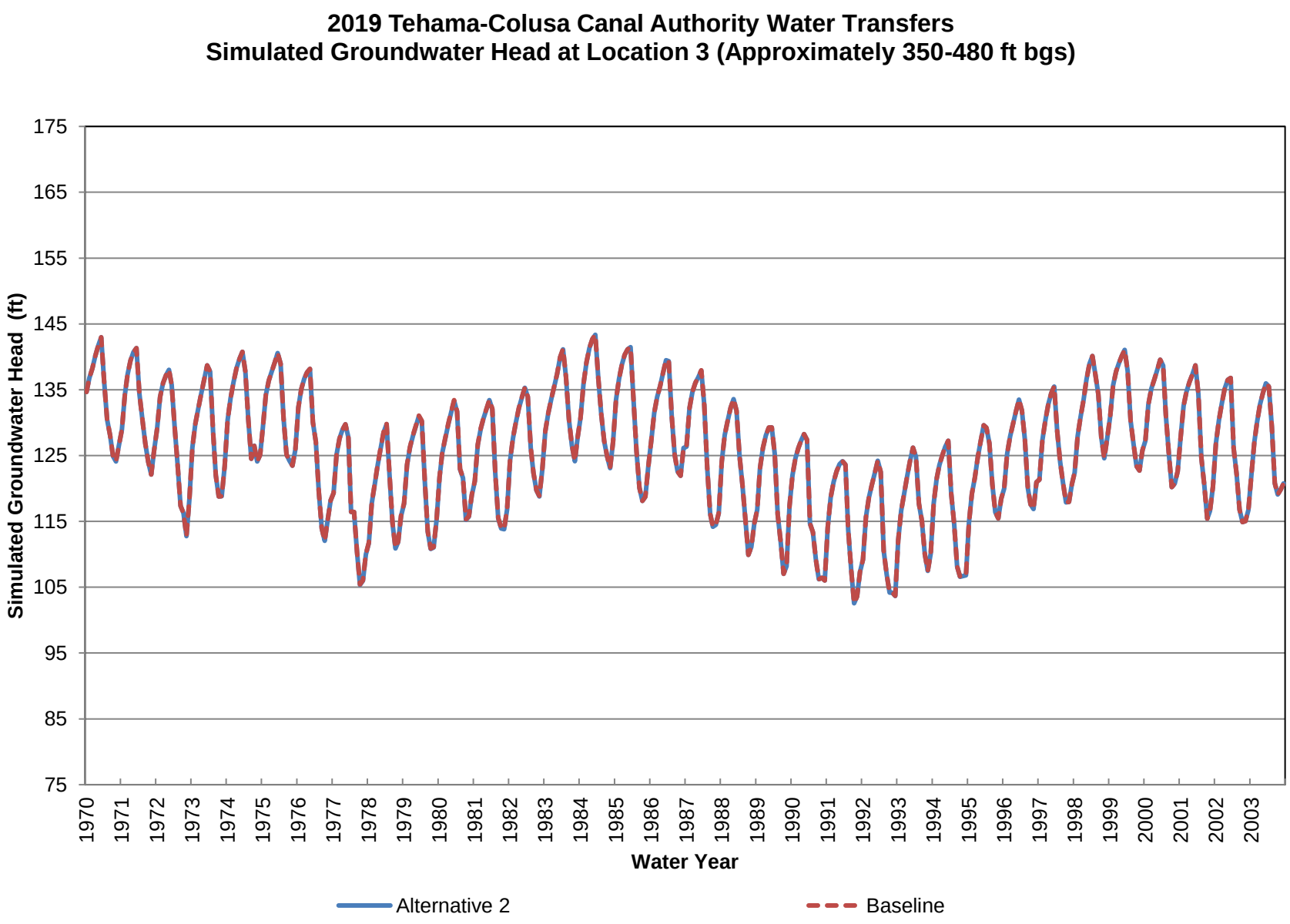
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 350-480 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
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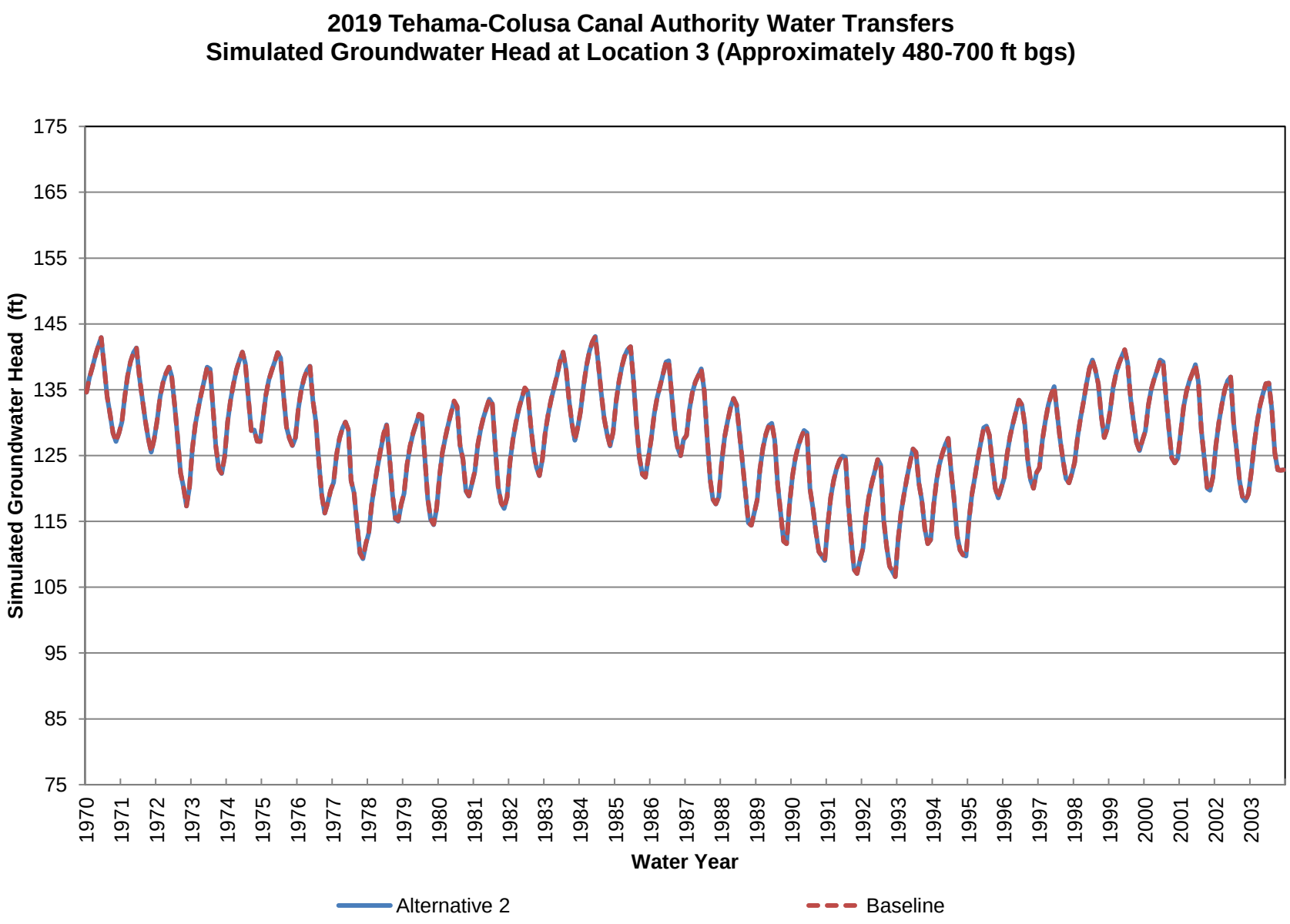
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 480-700 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
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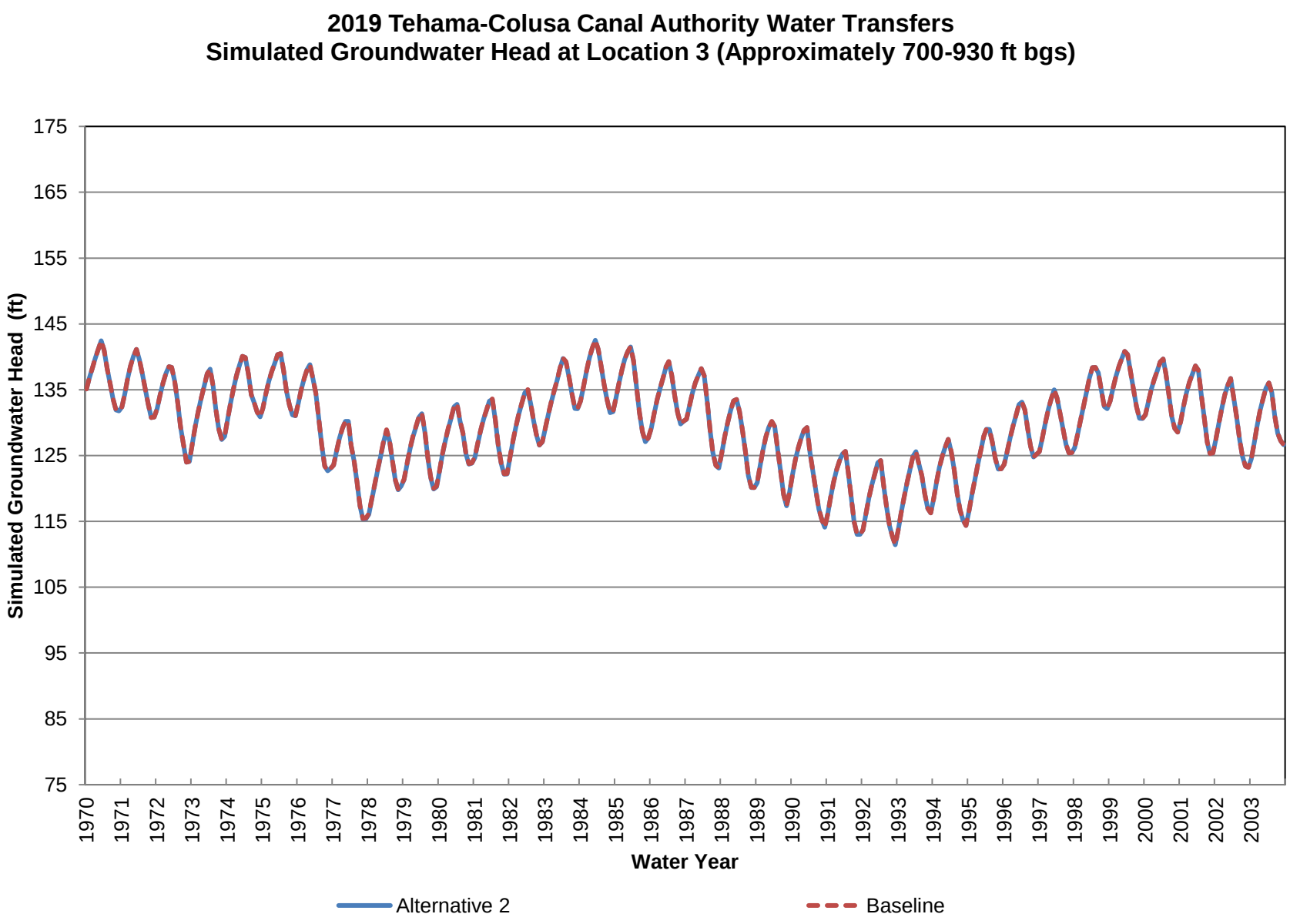
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 700-930 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
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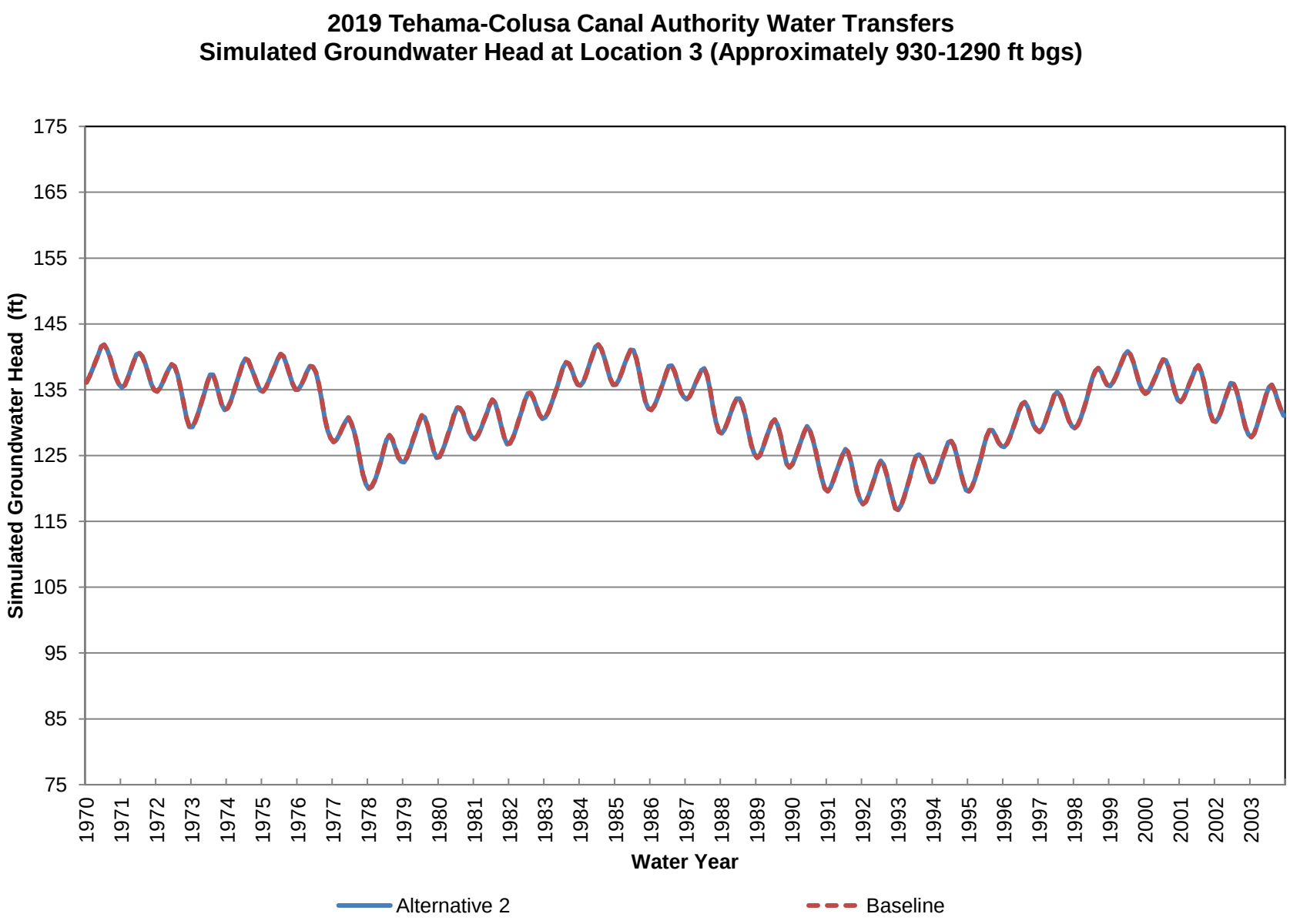
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 930-1290 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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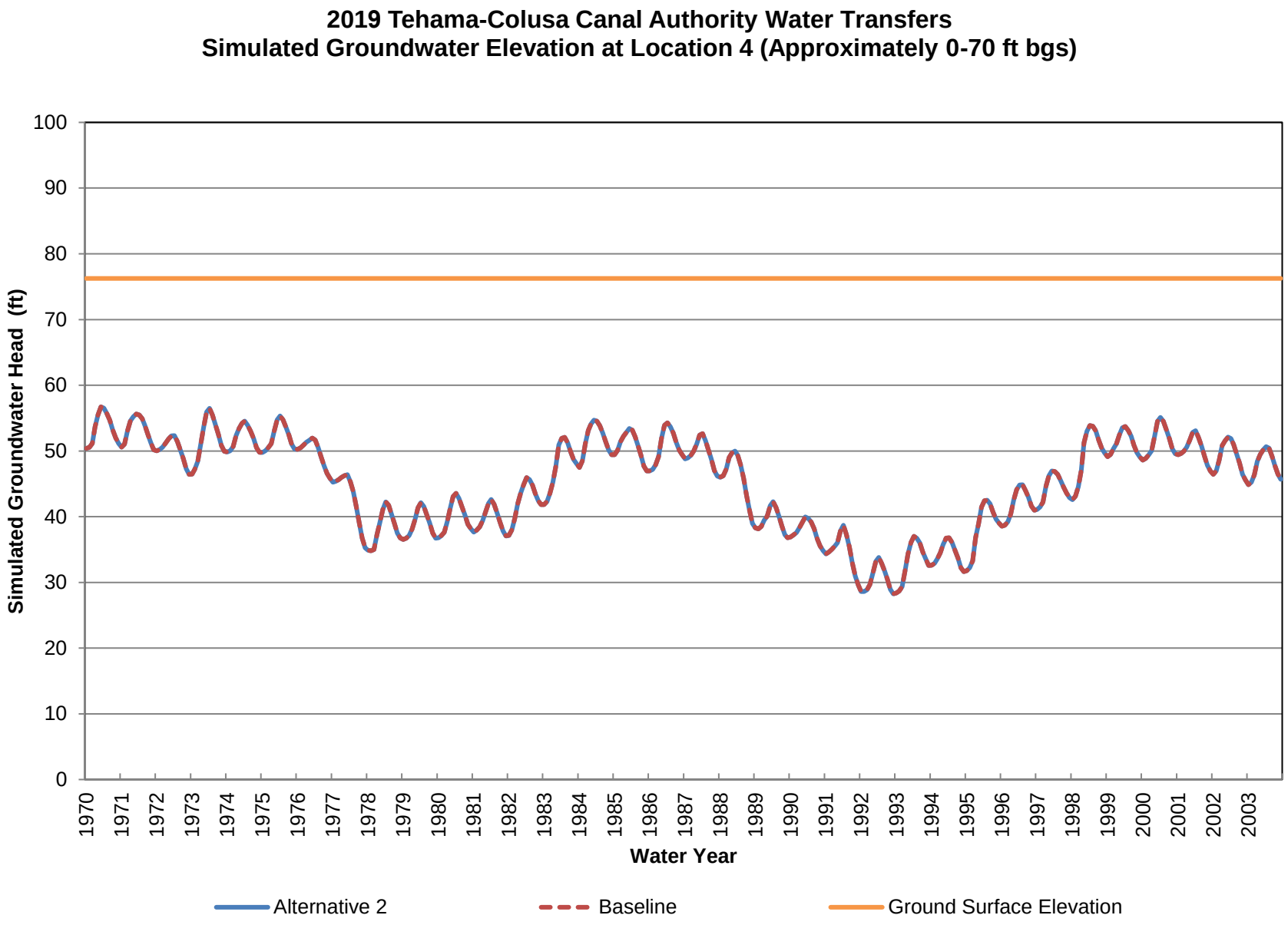
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 4 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
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1988
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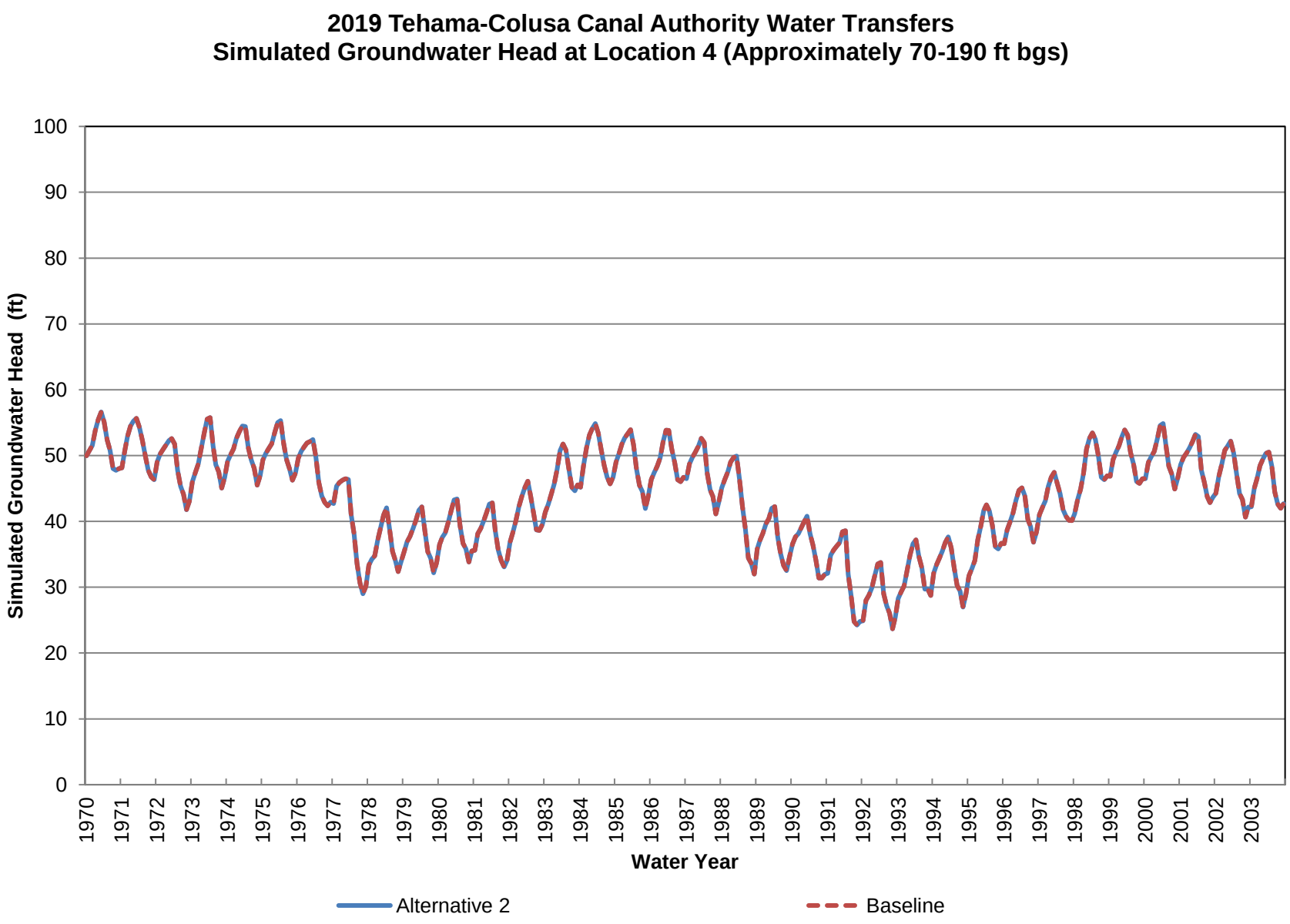
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 70-190 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
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1986
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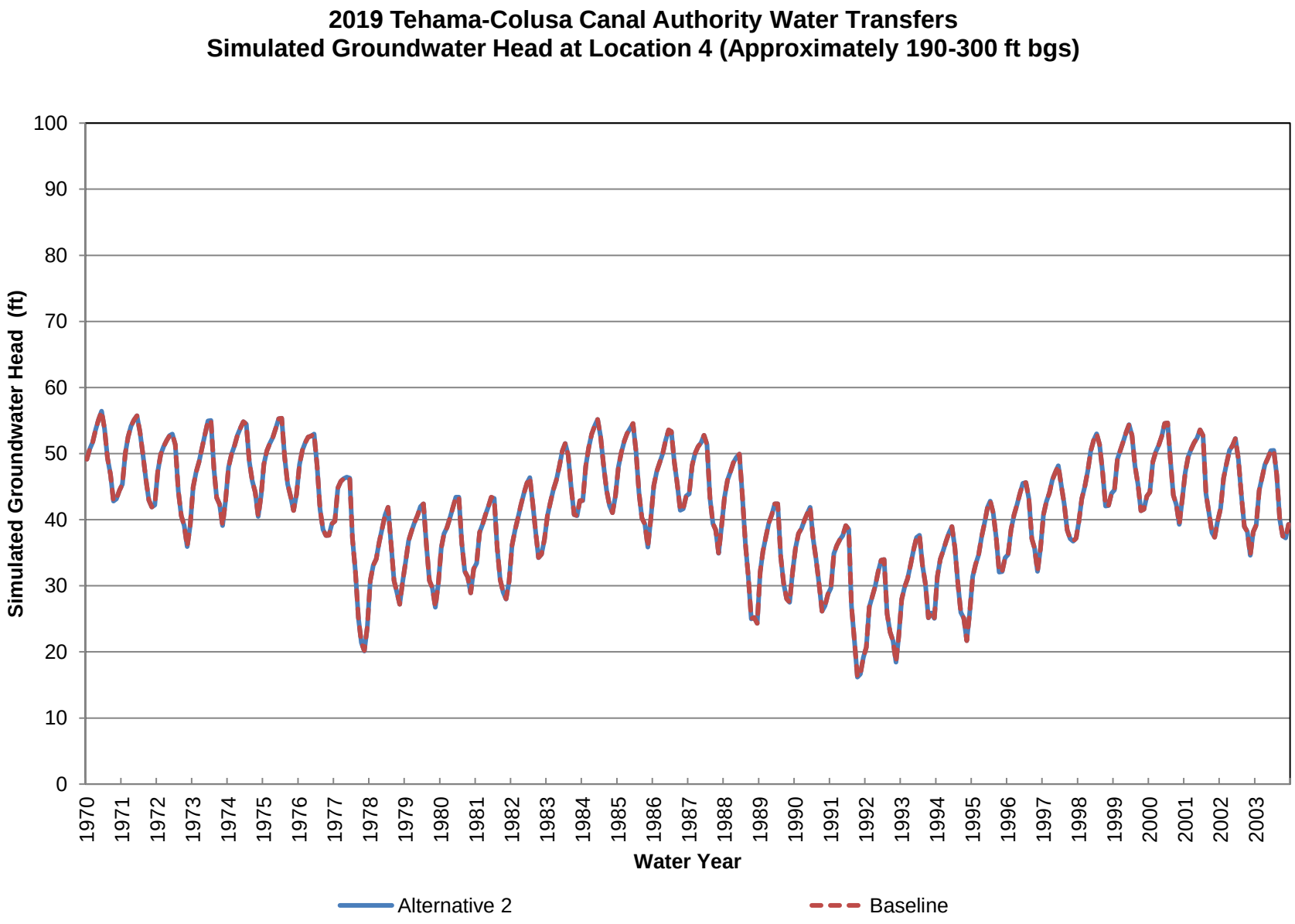
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 190-300 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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1983
1984
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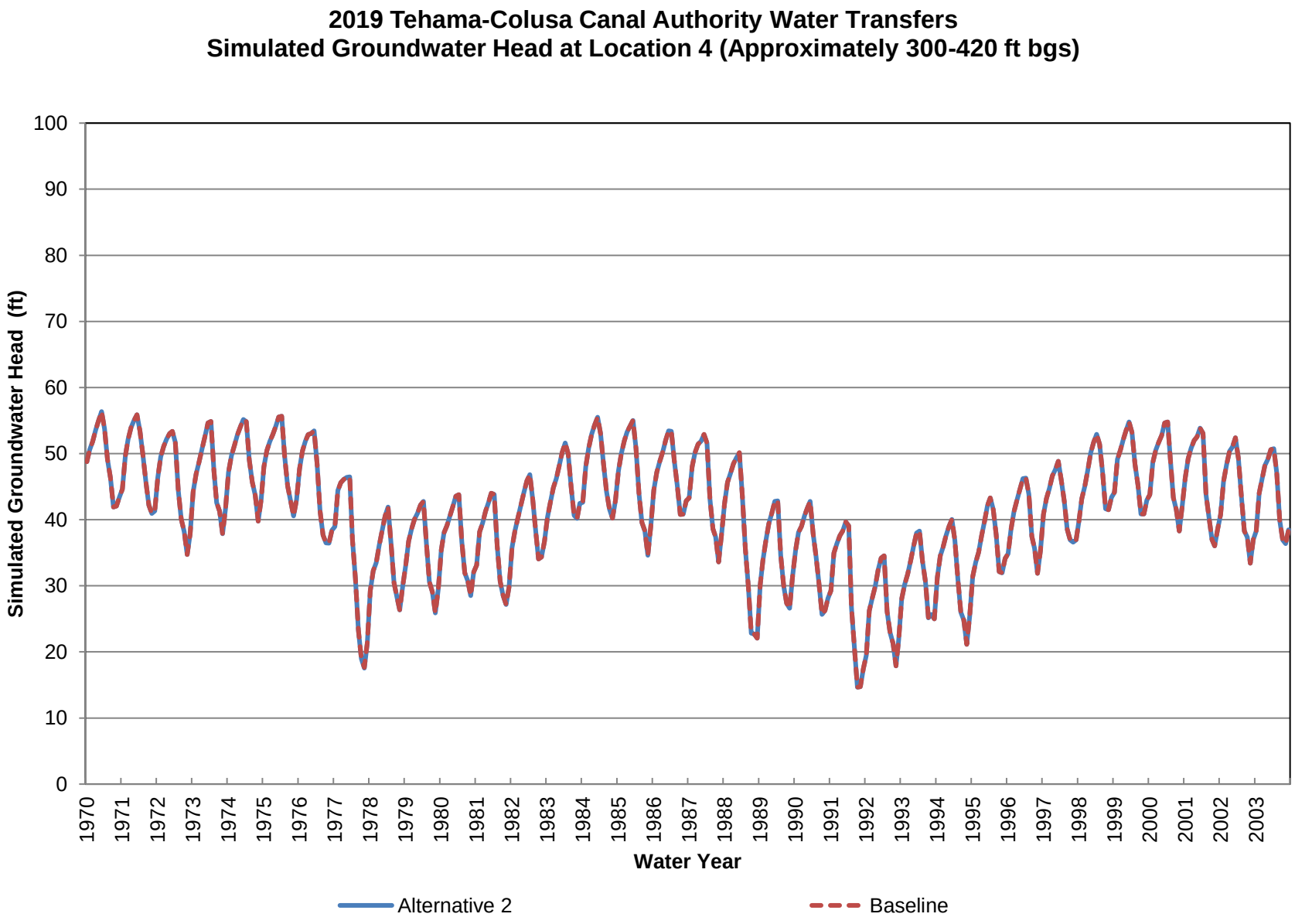
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 300-420 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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1983
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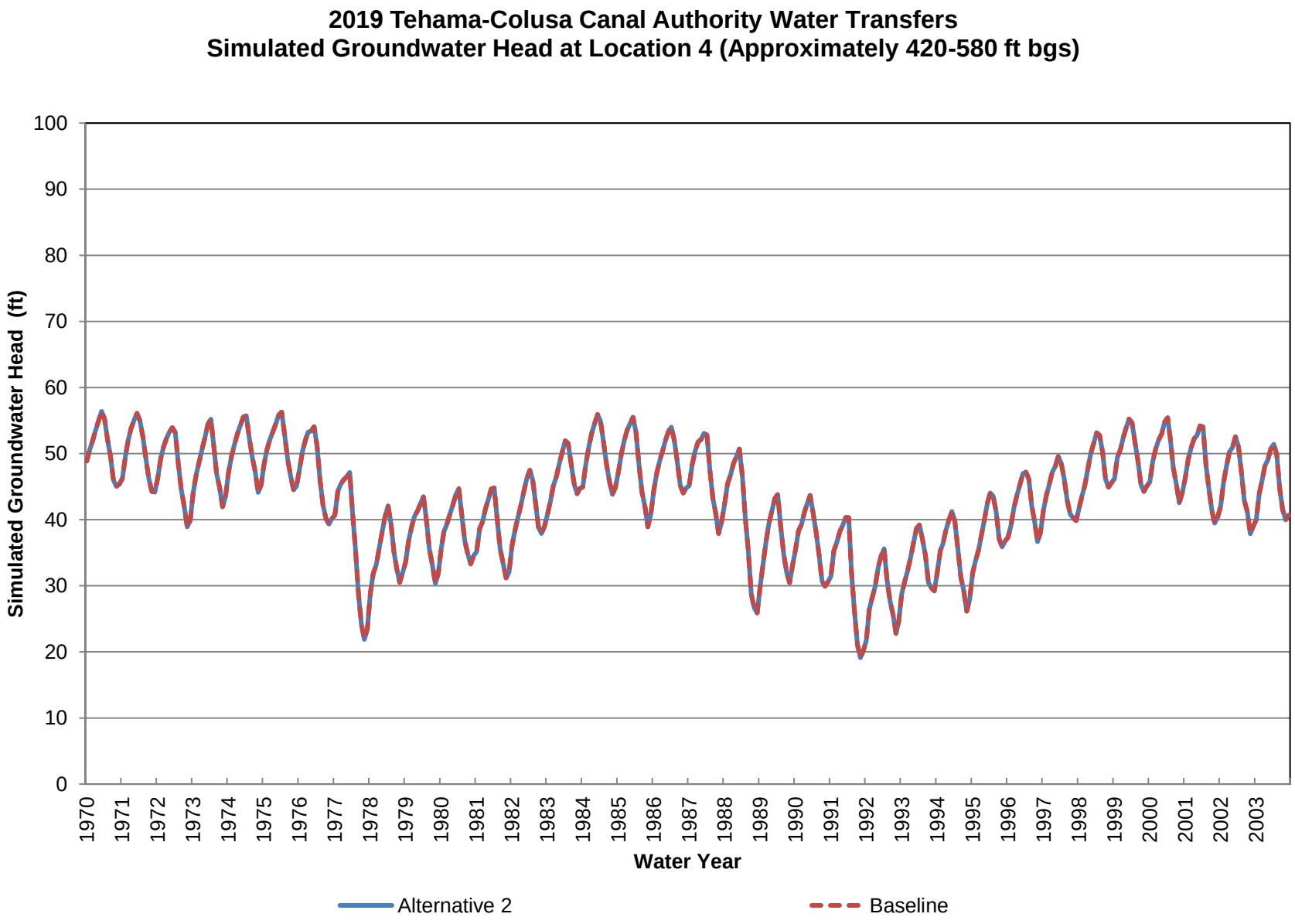
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 420-580 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
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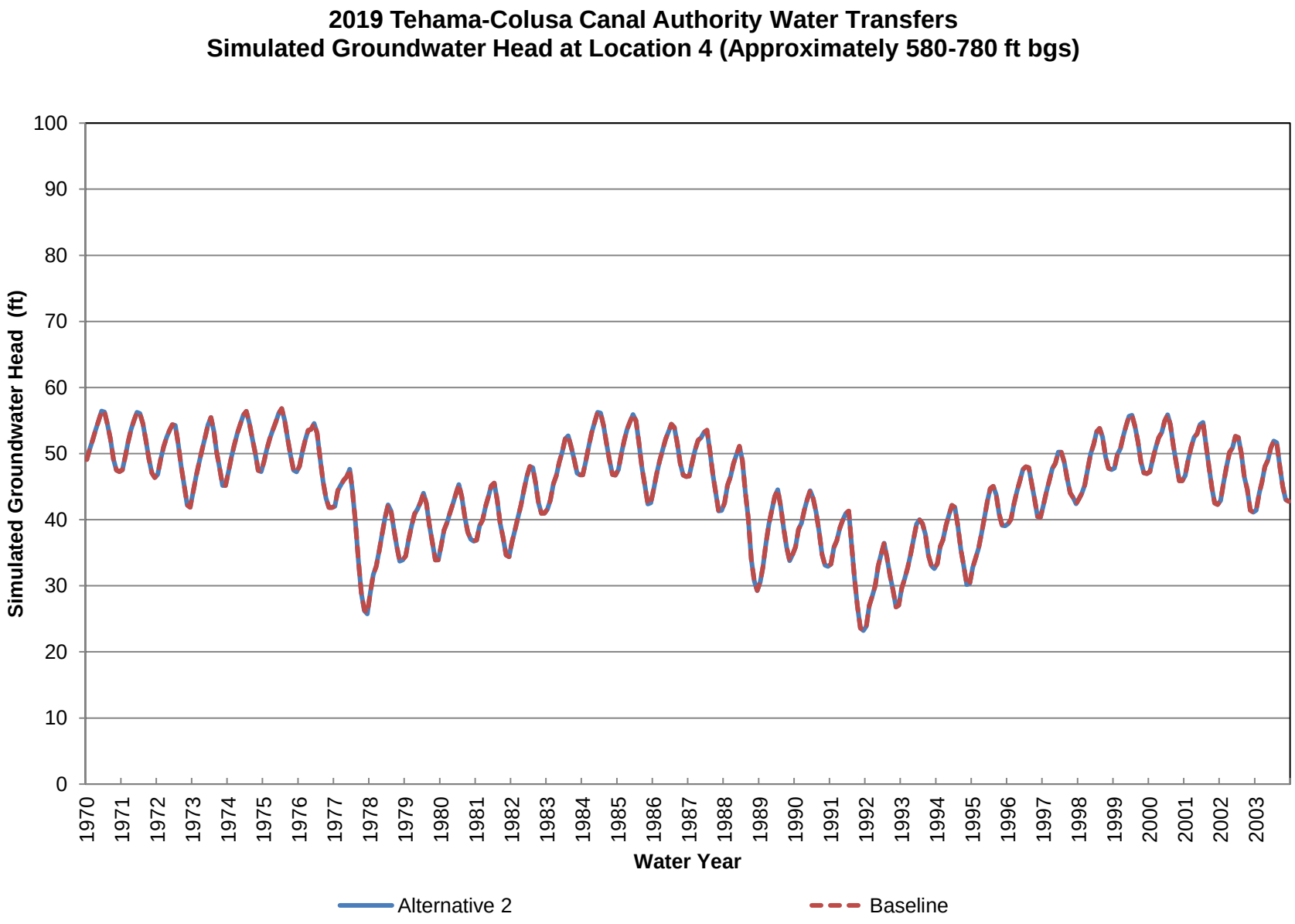
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 580-780 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
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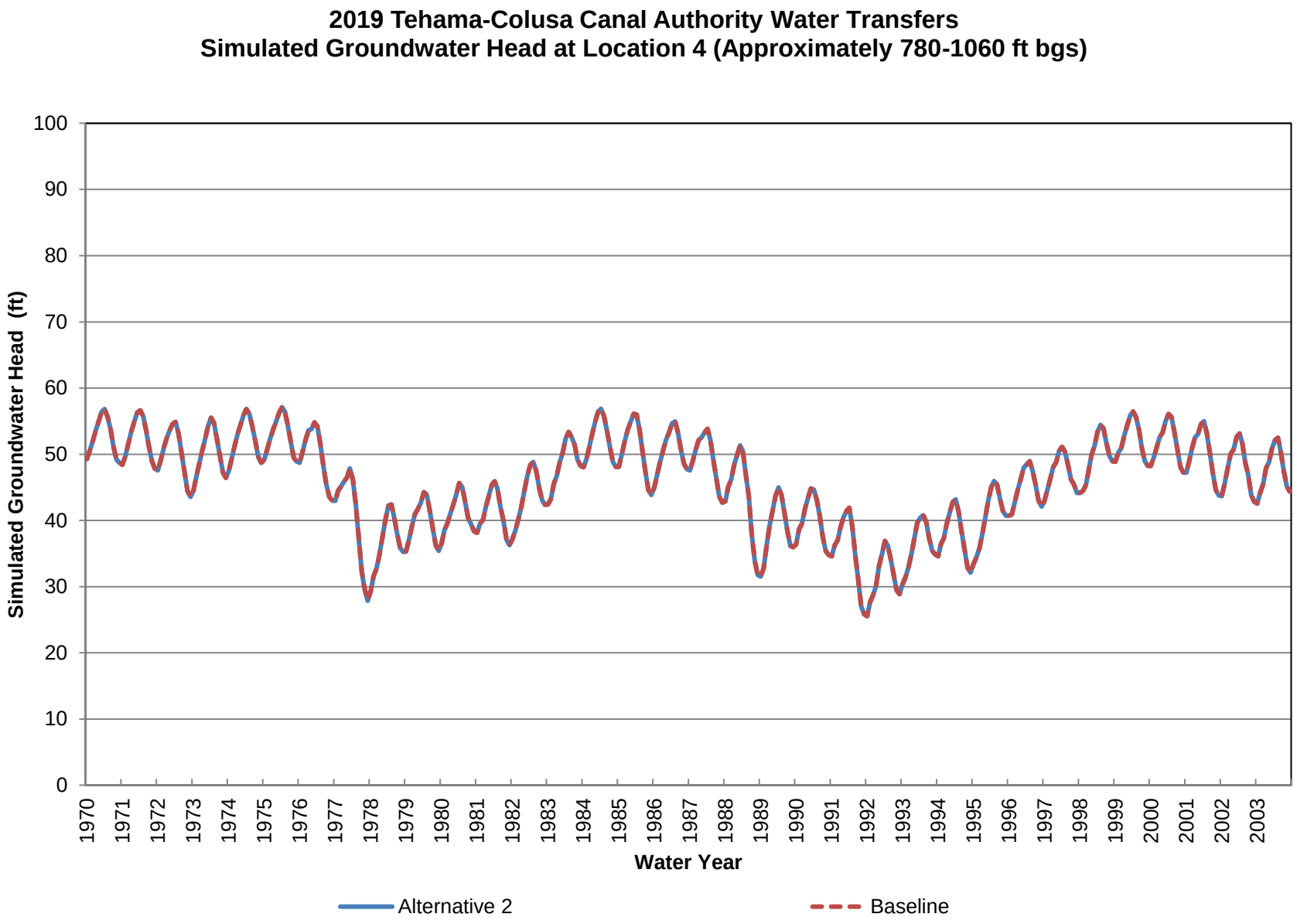
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 780-1060 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
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60
50
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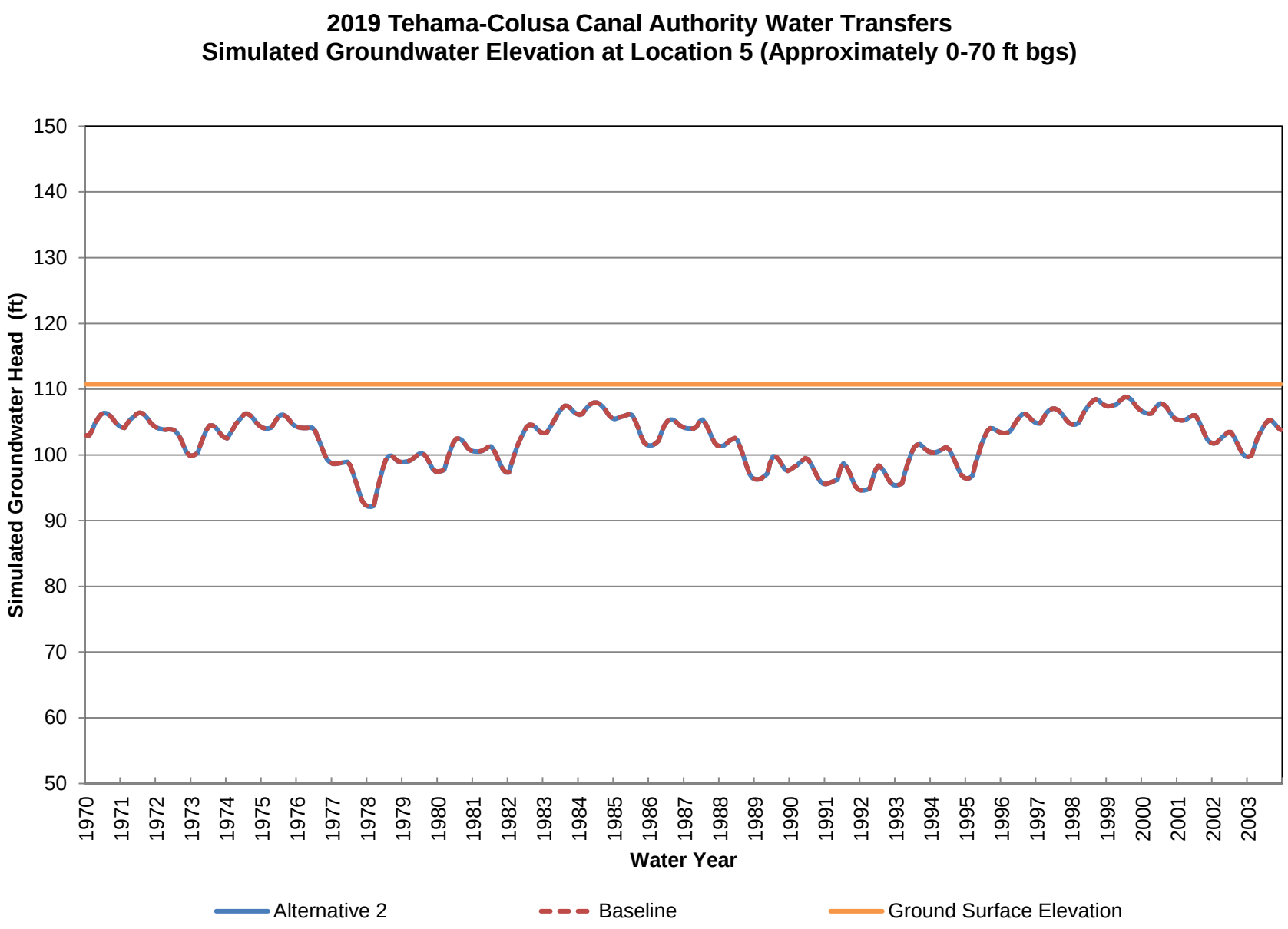
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 5 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
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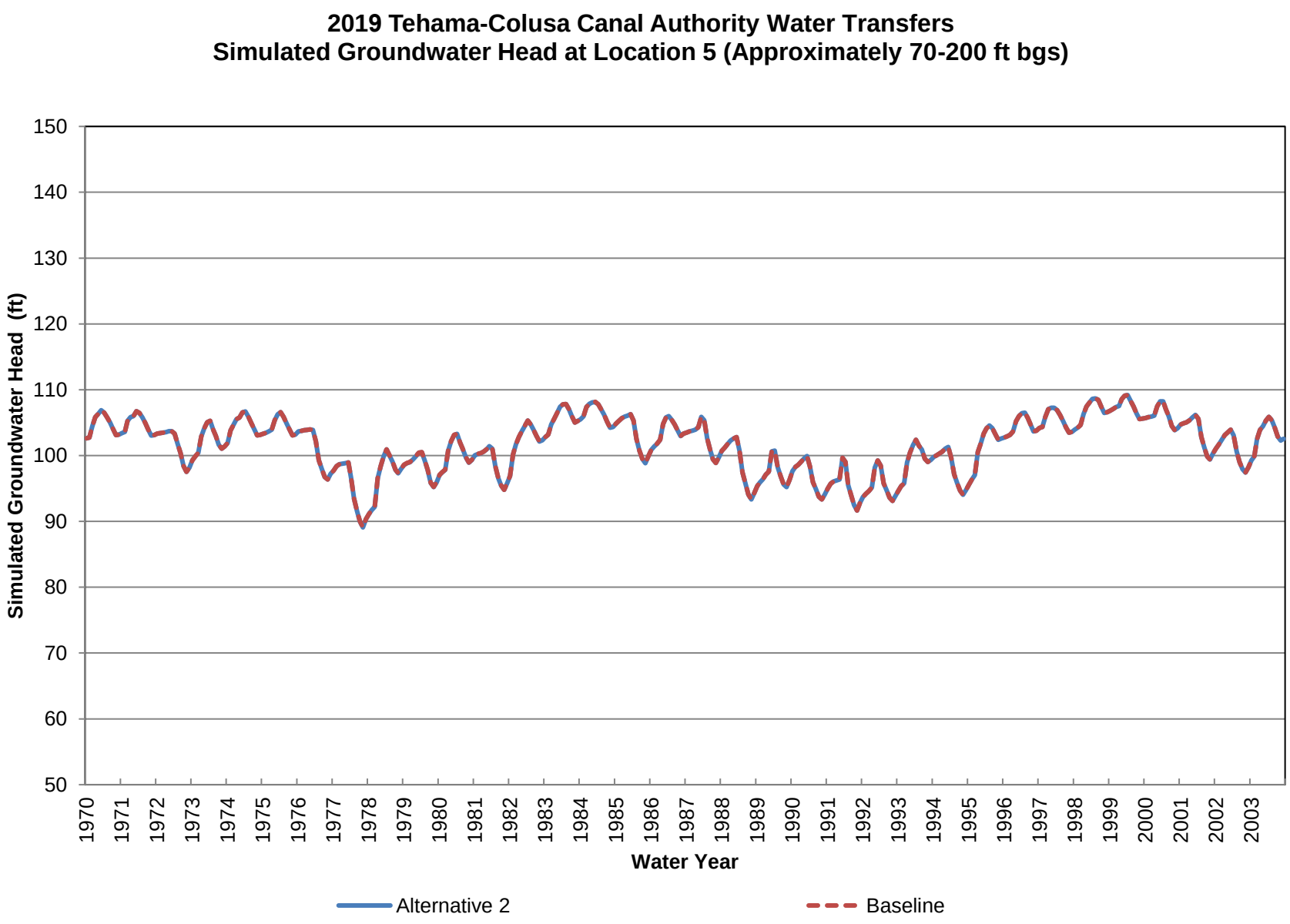
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 70-200 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
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100
90
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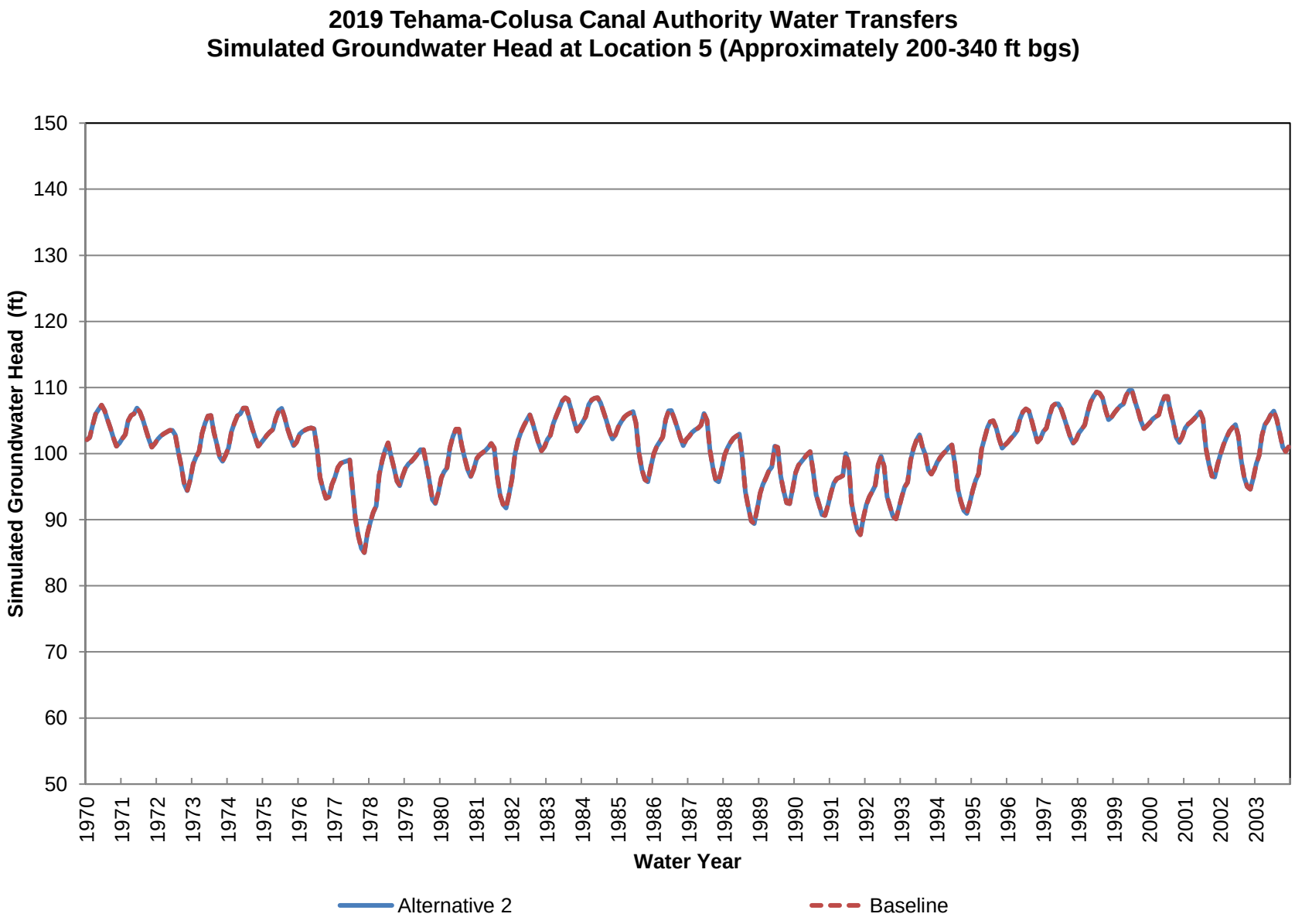
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 200-340 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
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100
90
80
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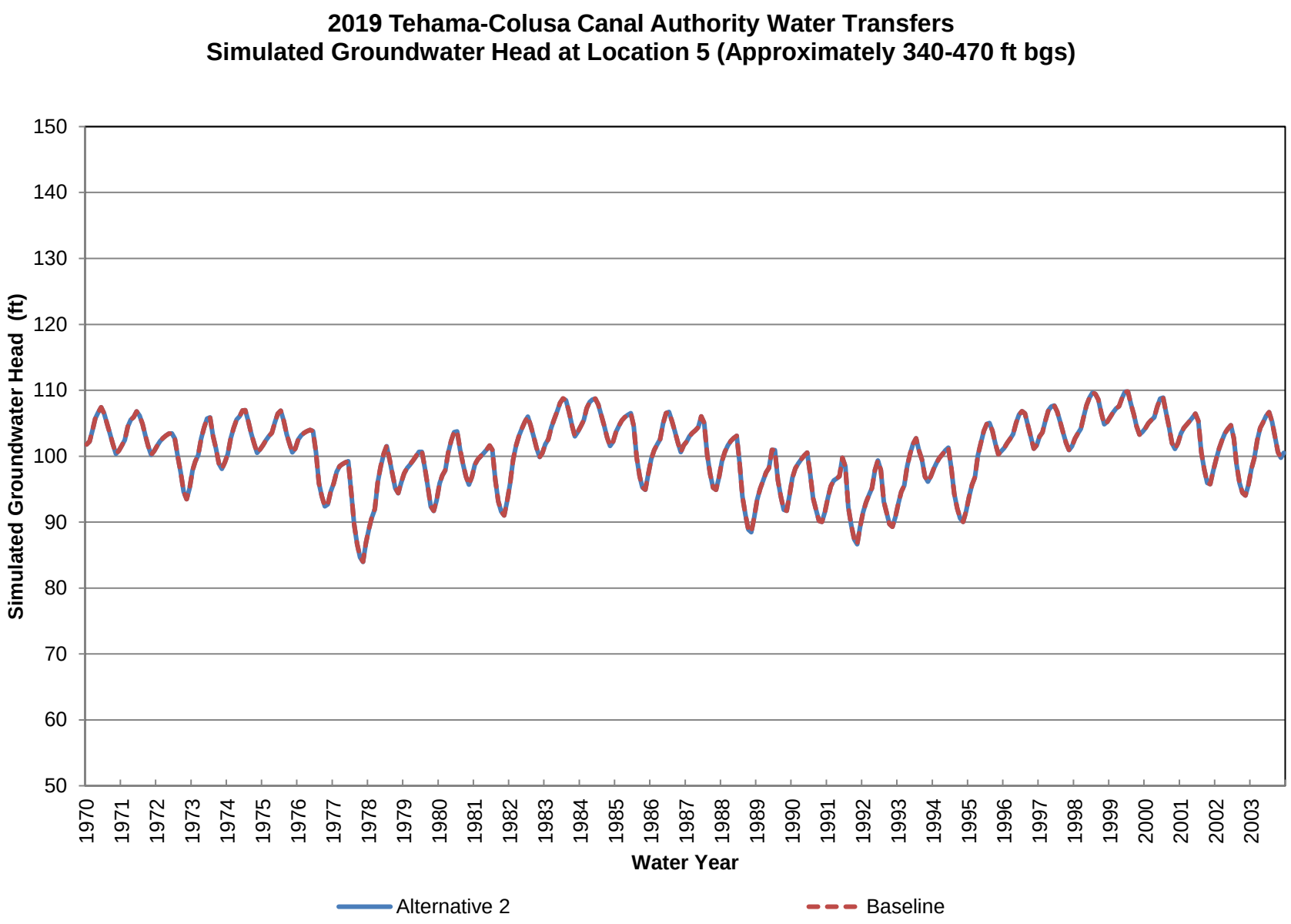
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 340-470 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
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100
90
80
70
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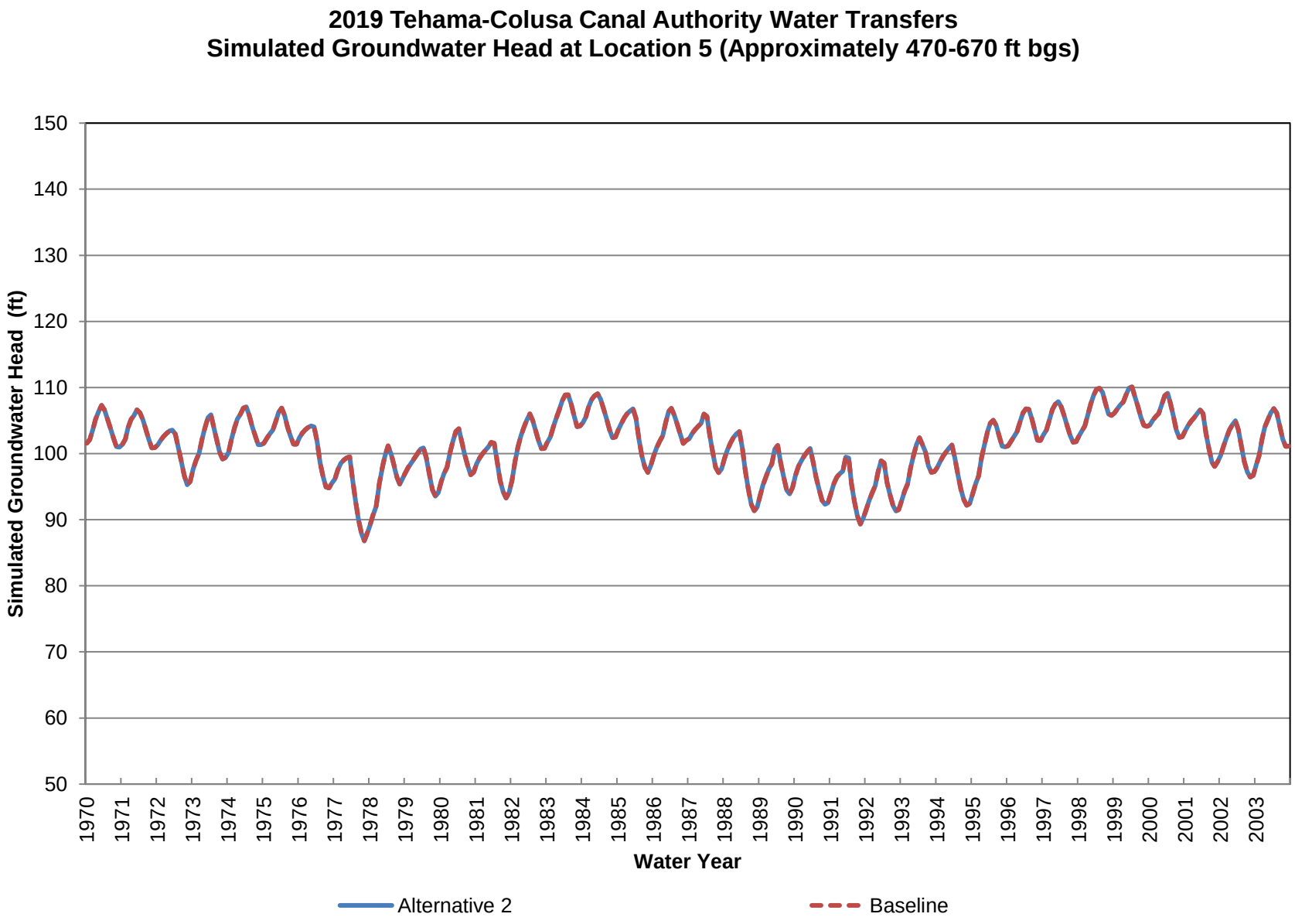
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 470-670 ft bgs)
Simulated Groundwater Head (ft)
150
140
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100
90
80
70
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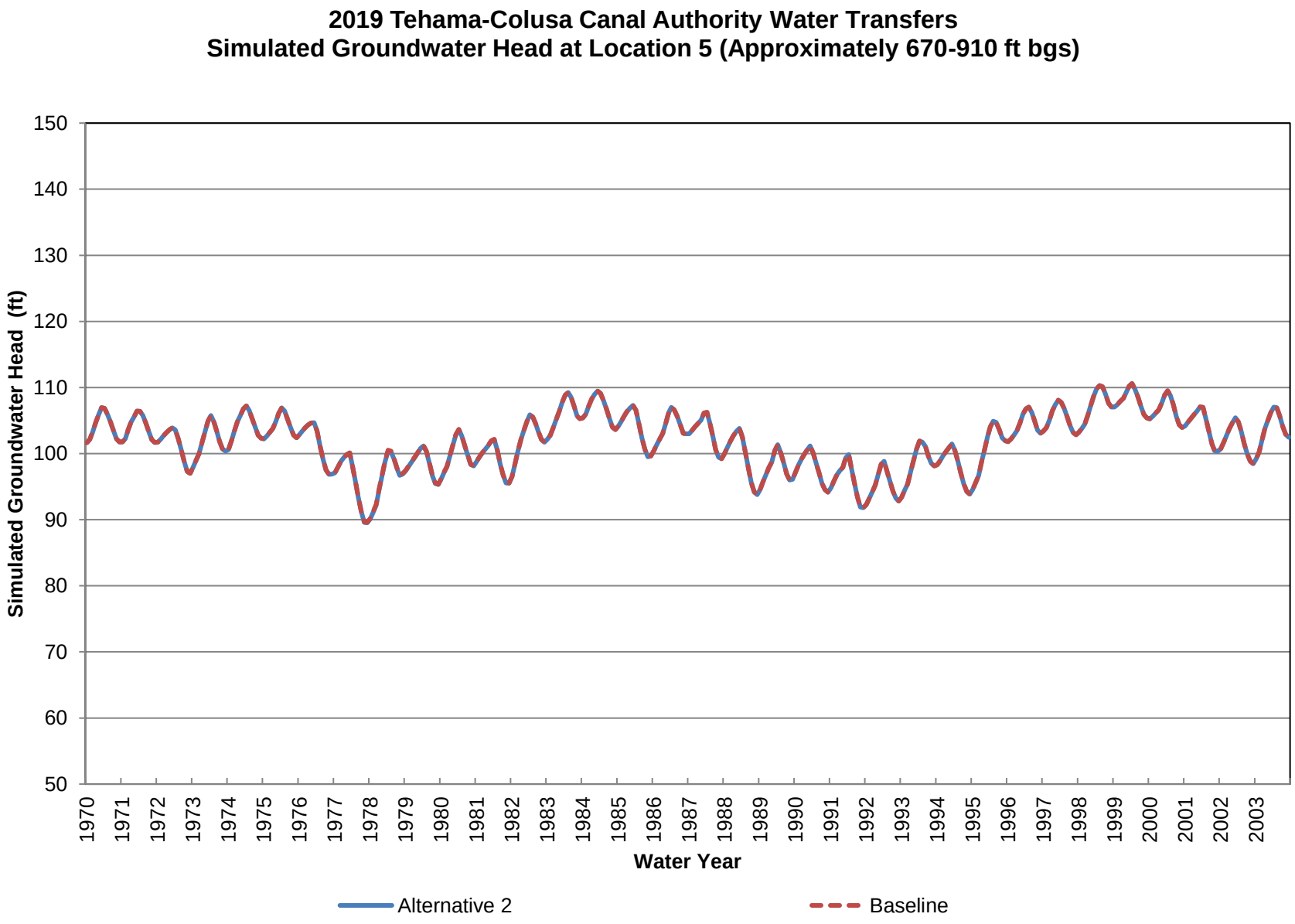
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 670-910 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
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110
100
90
80
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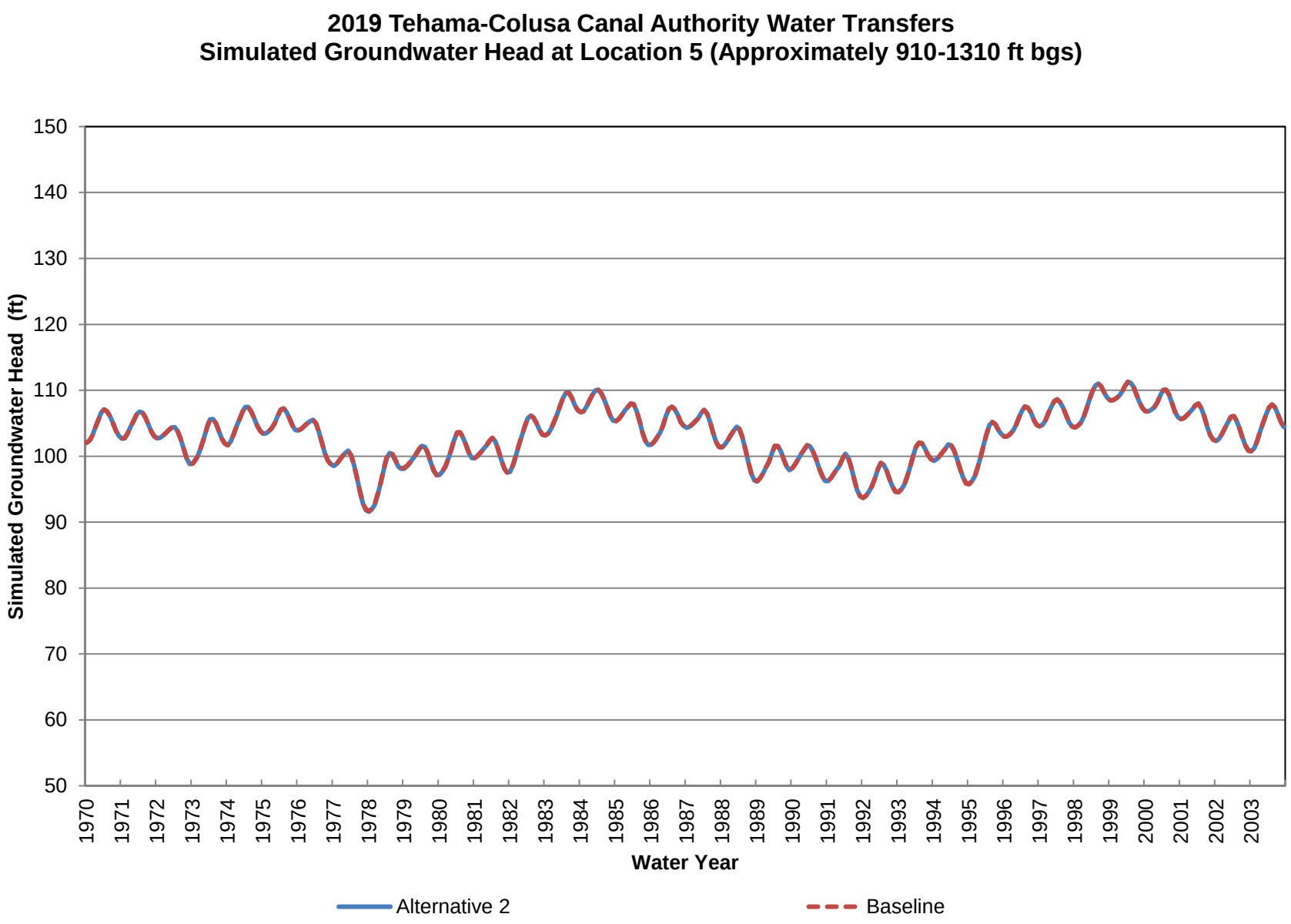
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 910-1310 ft bgs)
Simulated Groundwater Head (ft)
150
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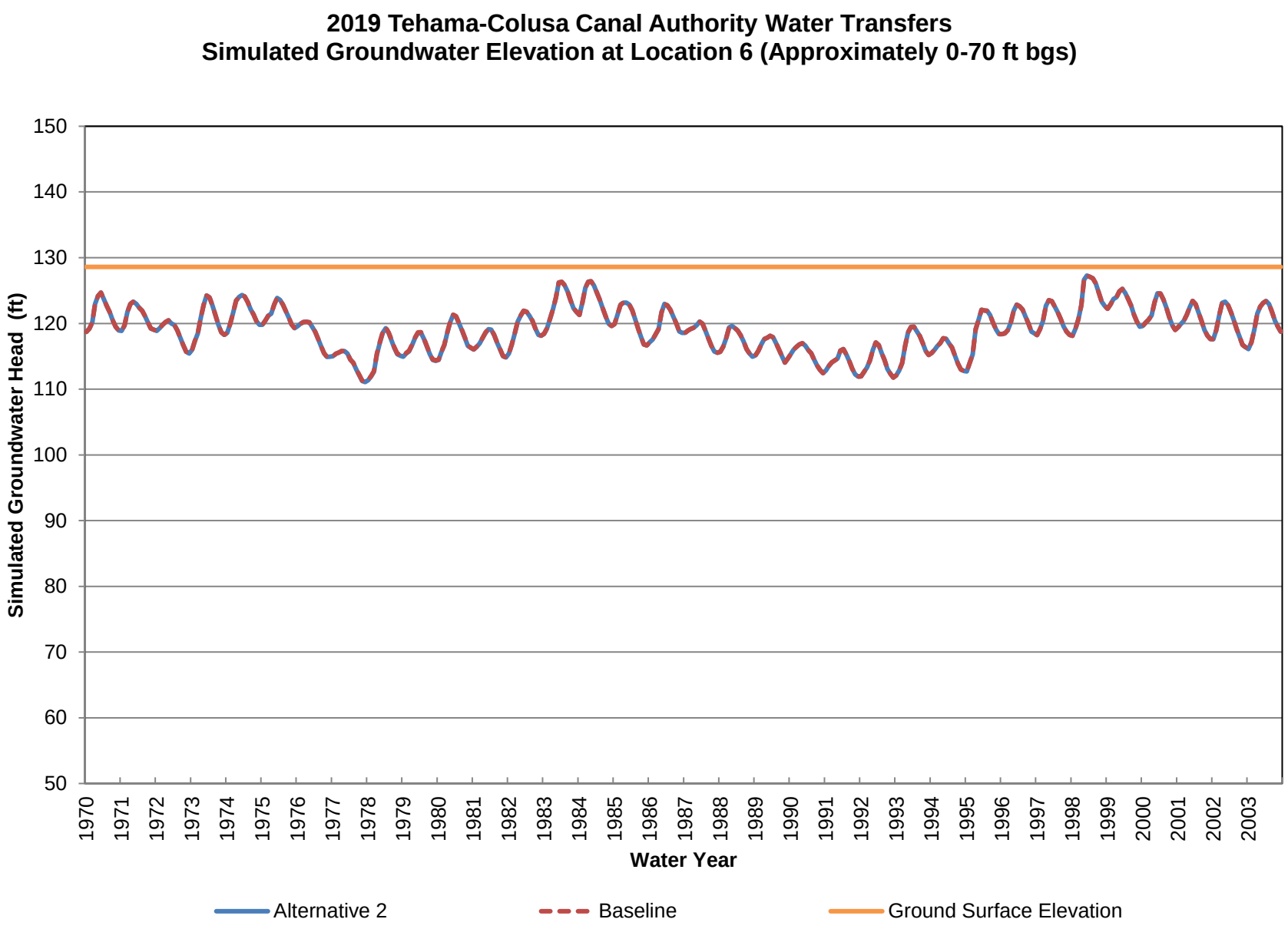
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 6 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
150
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110
100
90
80
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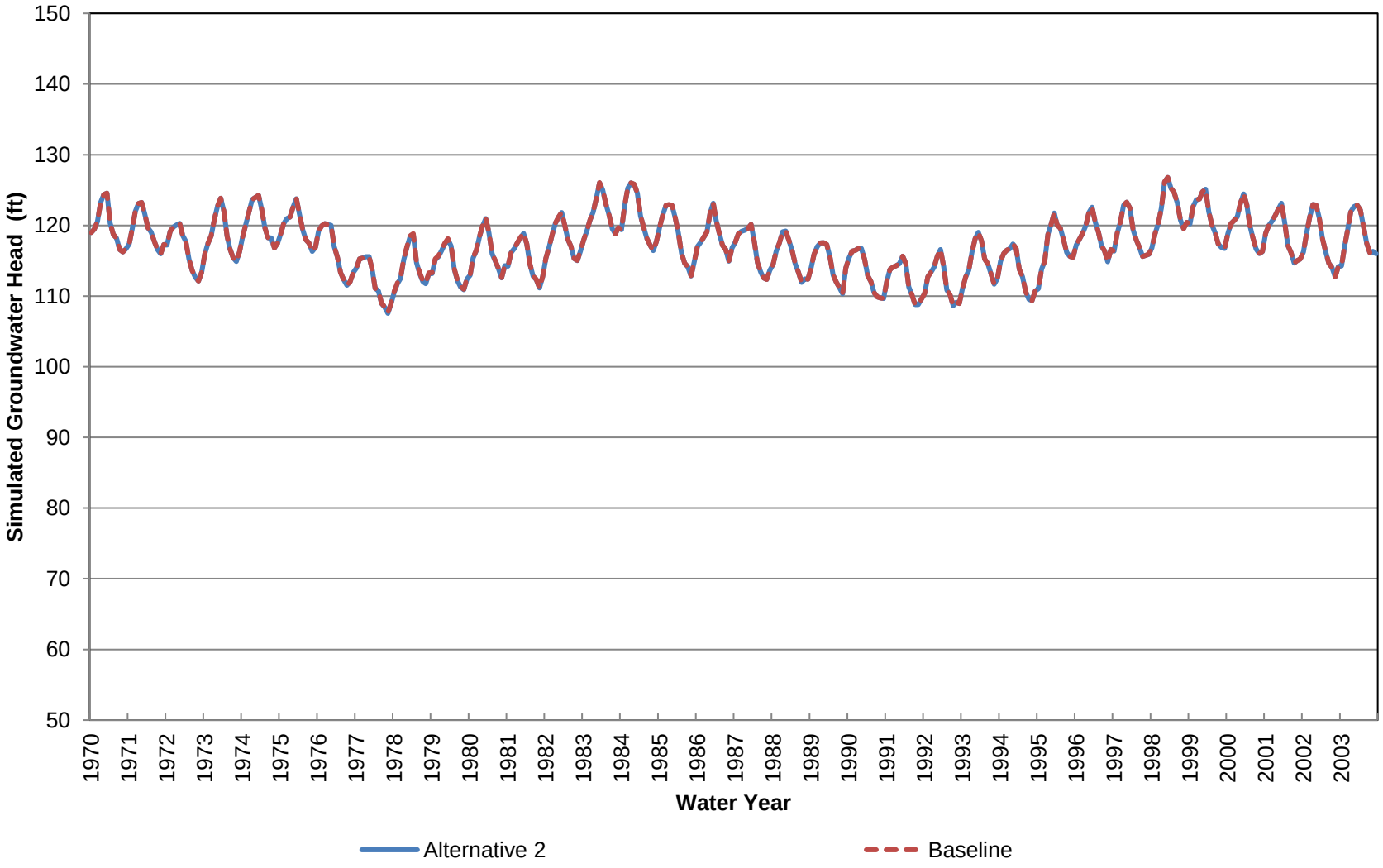
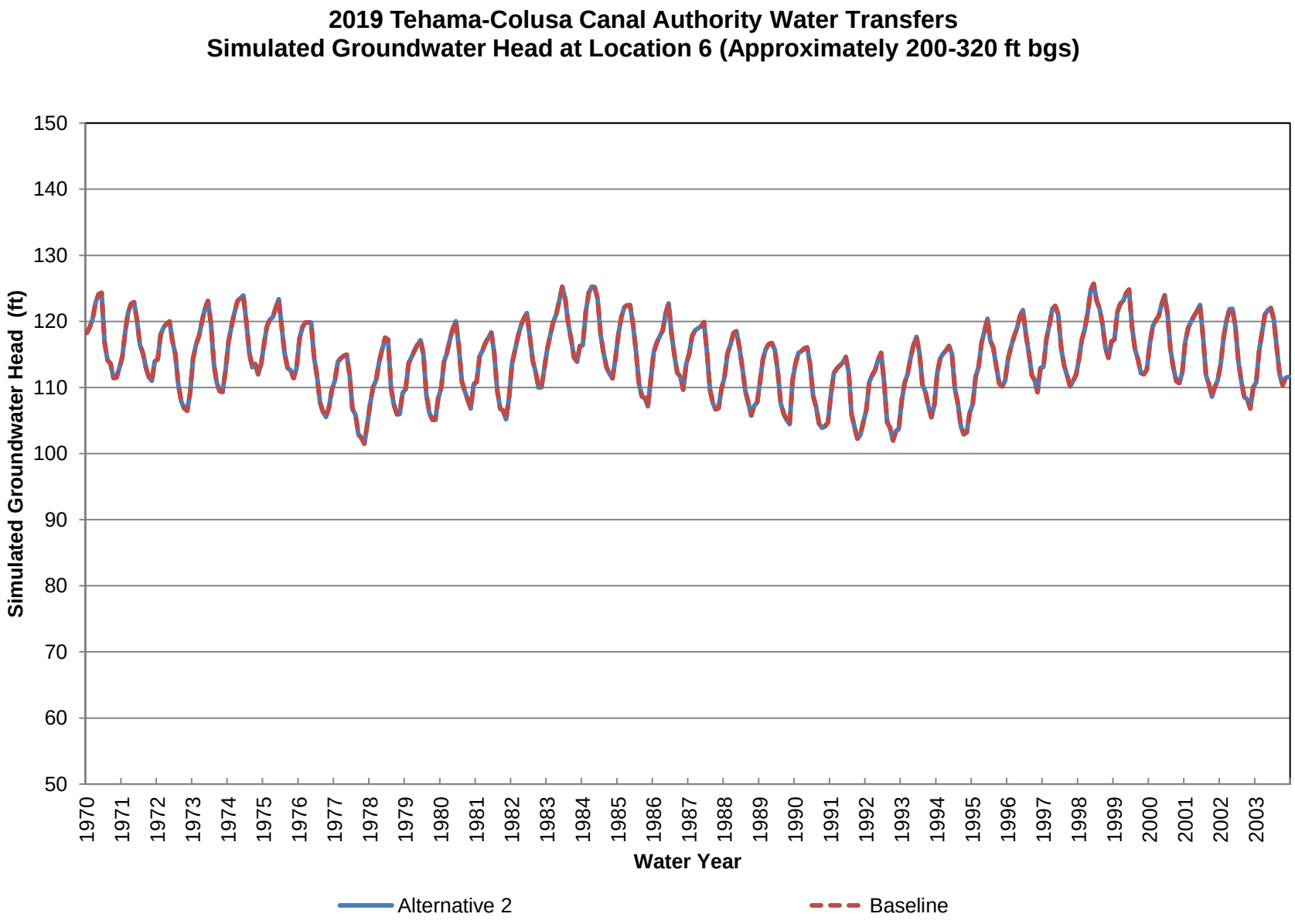
Water Year
Alternative 2
Baseline
Ground Surface Elevation

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 70-200 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 200-320 ft bgs)
Simulated Groundwater Head (ft)
150
140
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100
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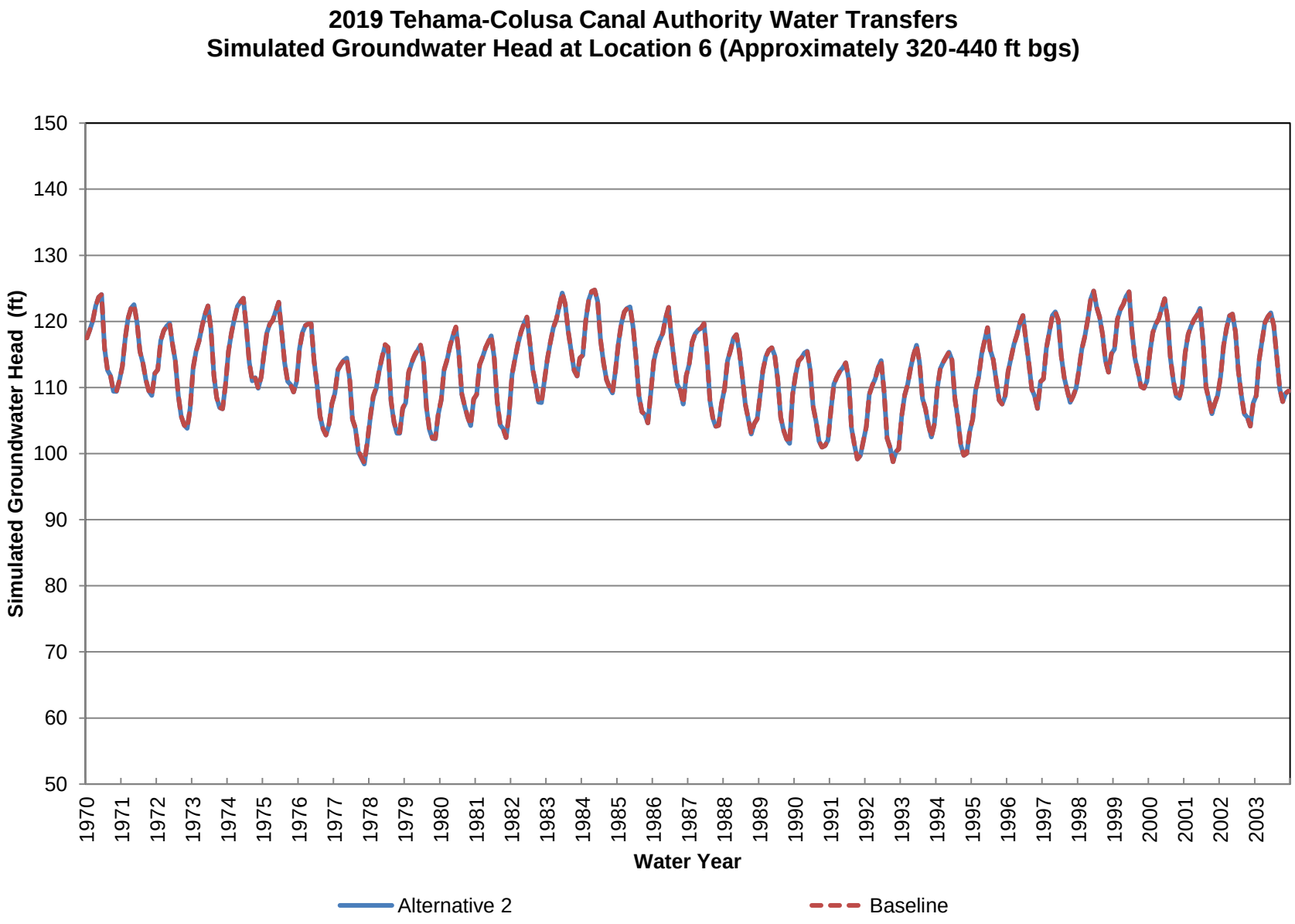
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 320-440 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
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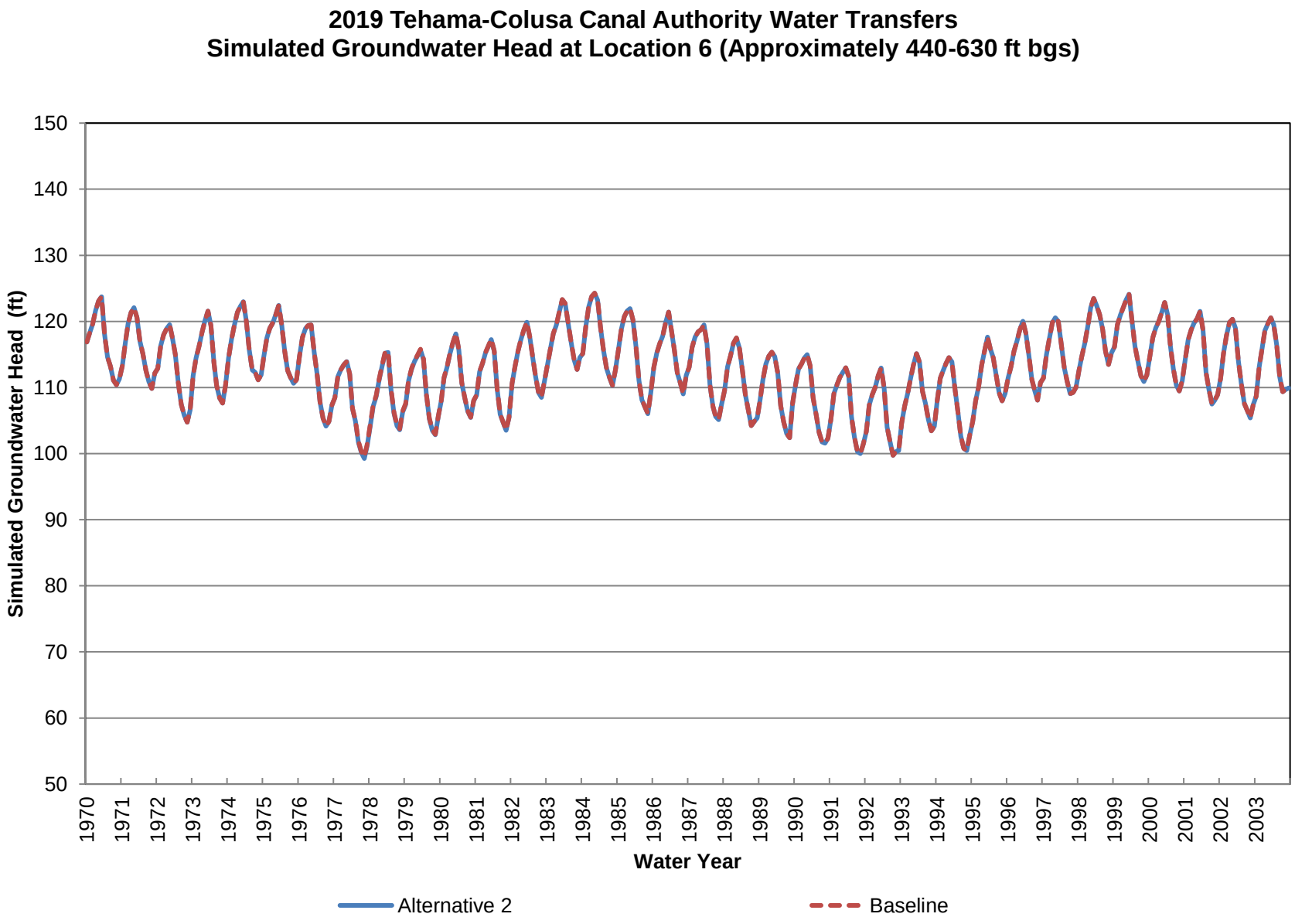
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 440-630 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
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100
90
80
70
60
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1970
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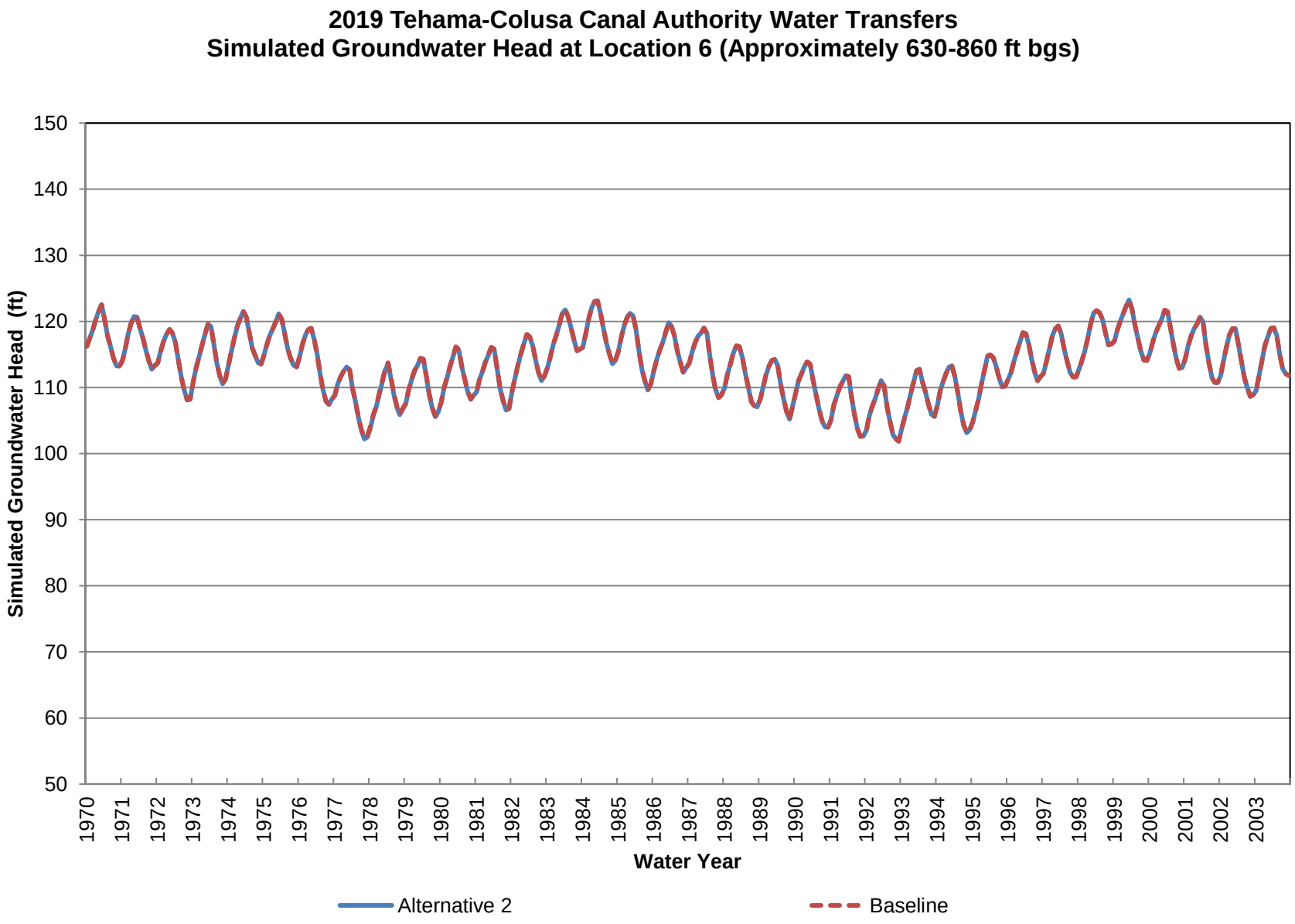
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 630-860 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
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100
90
80
70
60
50
1970
1971
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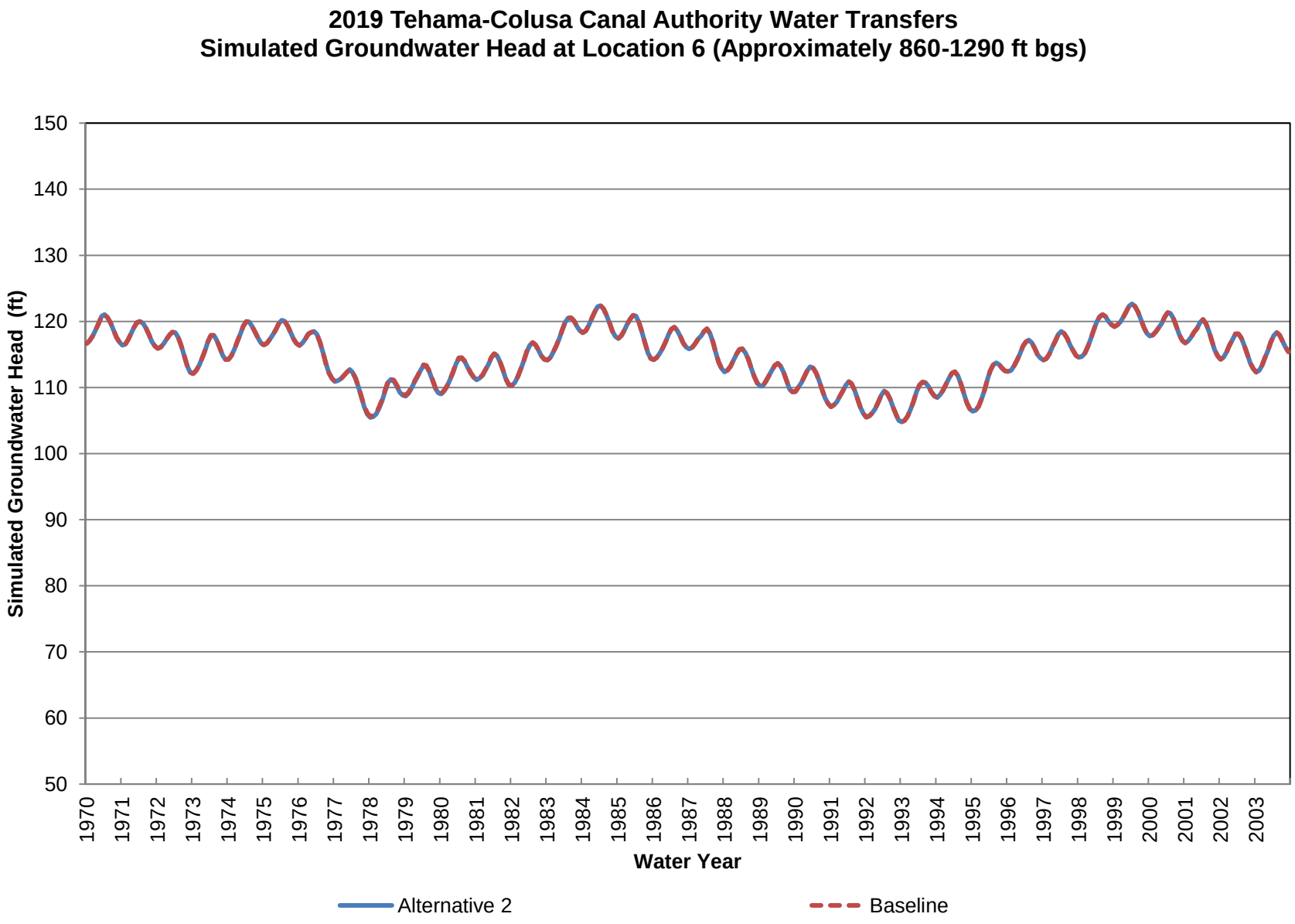
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 860-1290 ft bgs)
Simulated Groundwater Head (ft)
150
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130
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110
100
90
80
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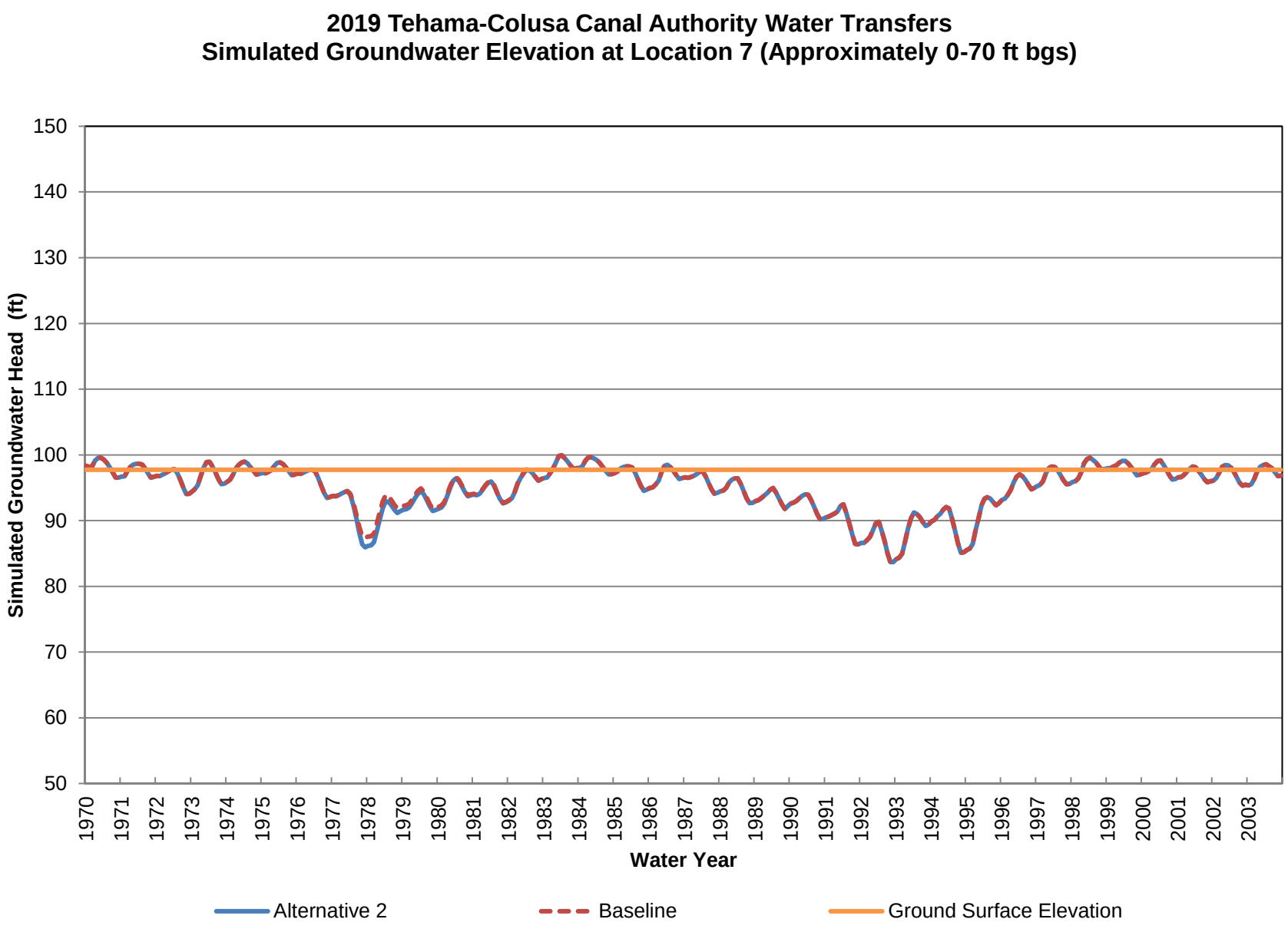
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 7 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
150
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100
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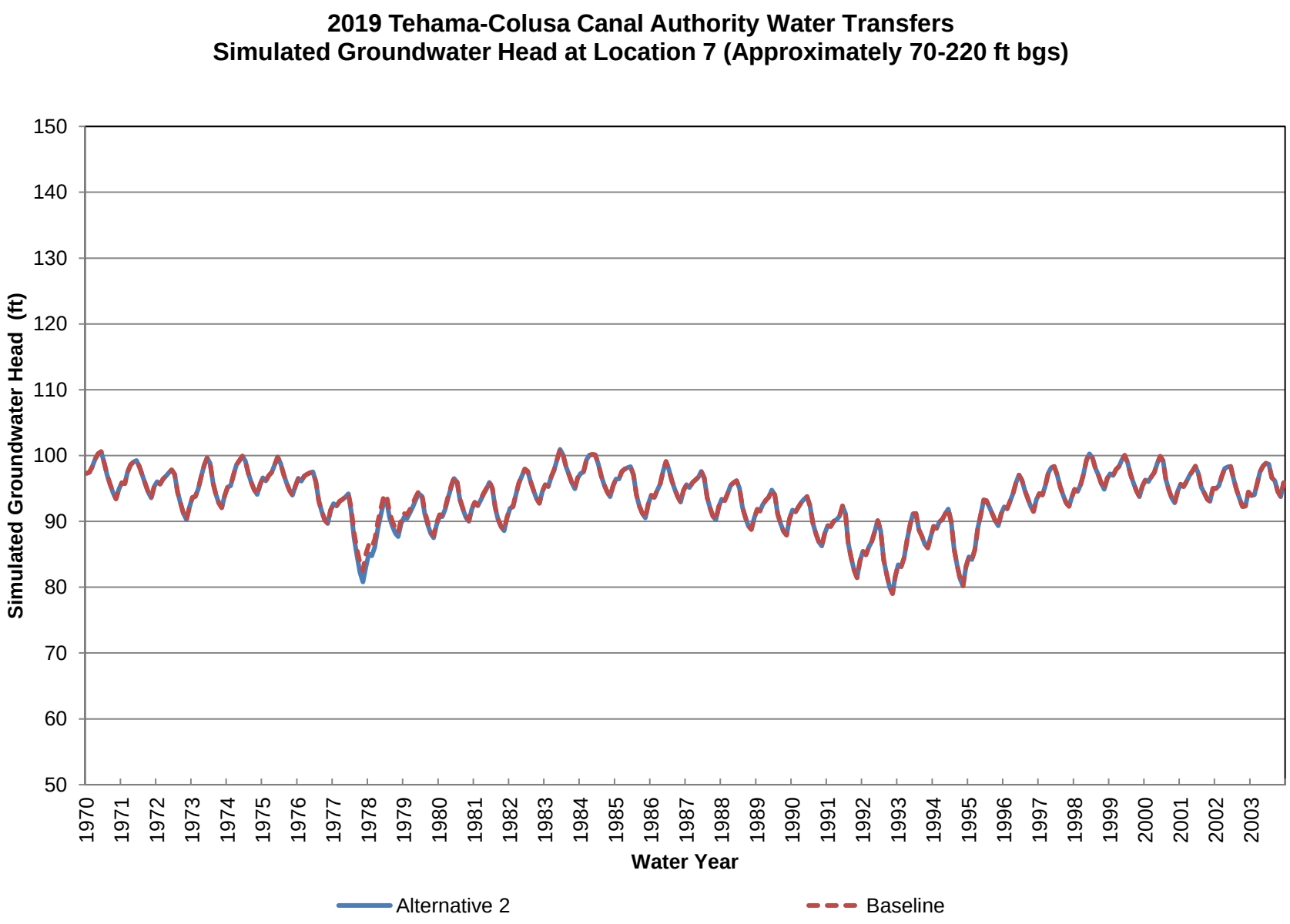
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 7 (Approximately 70-220 ft bgs)
Simulated Groundwater Head (ft)
150
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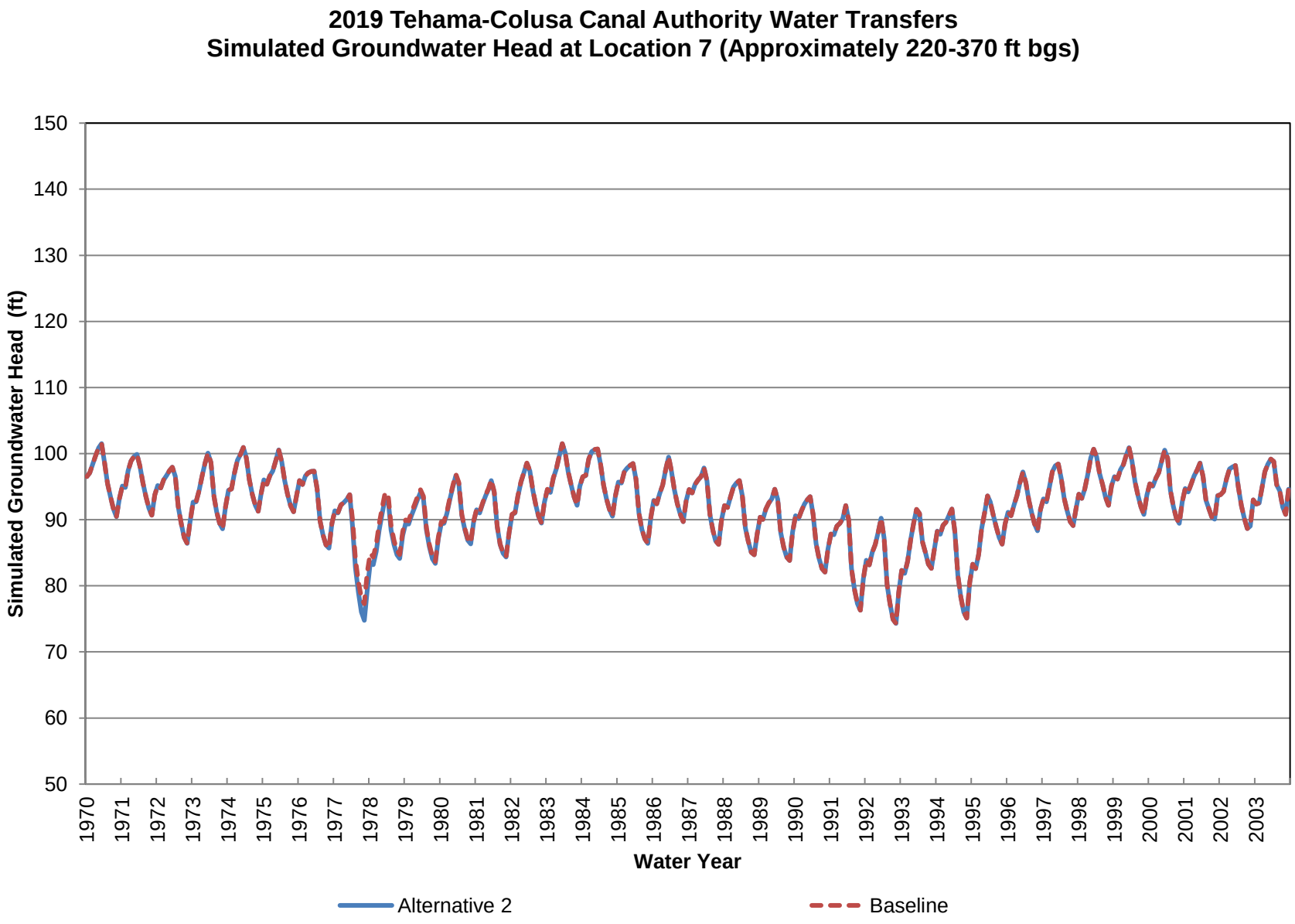
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 7 (Approximately 220-370 ft bgs)
Simulated Groundwater Head (ft)
150
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100
90
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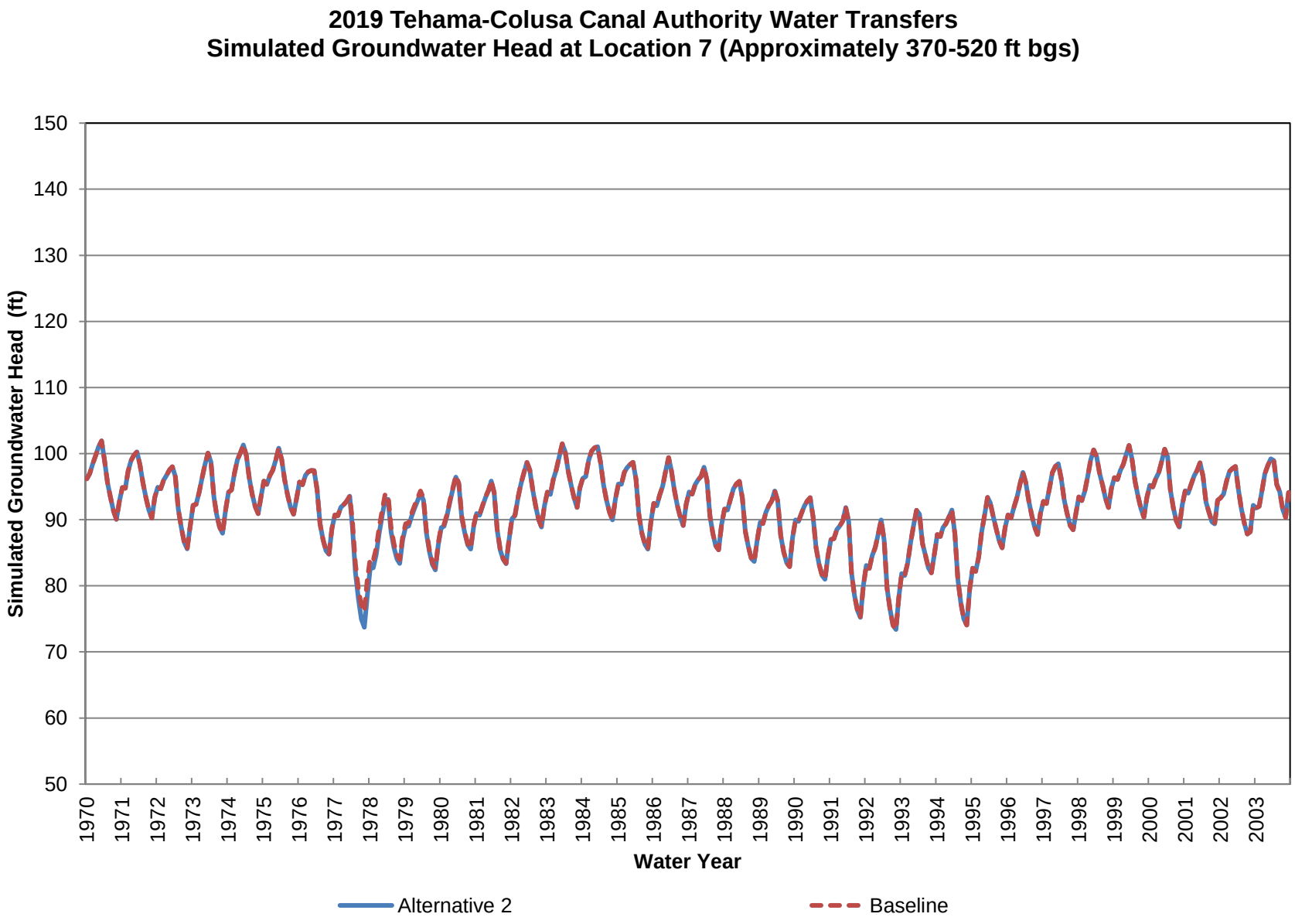
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 7 (Approximately 370-520 ft bgs)
Simulated Groundwater Head (ft)
150
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100
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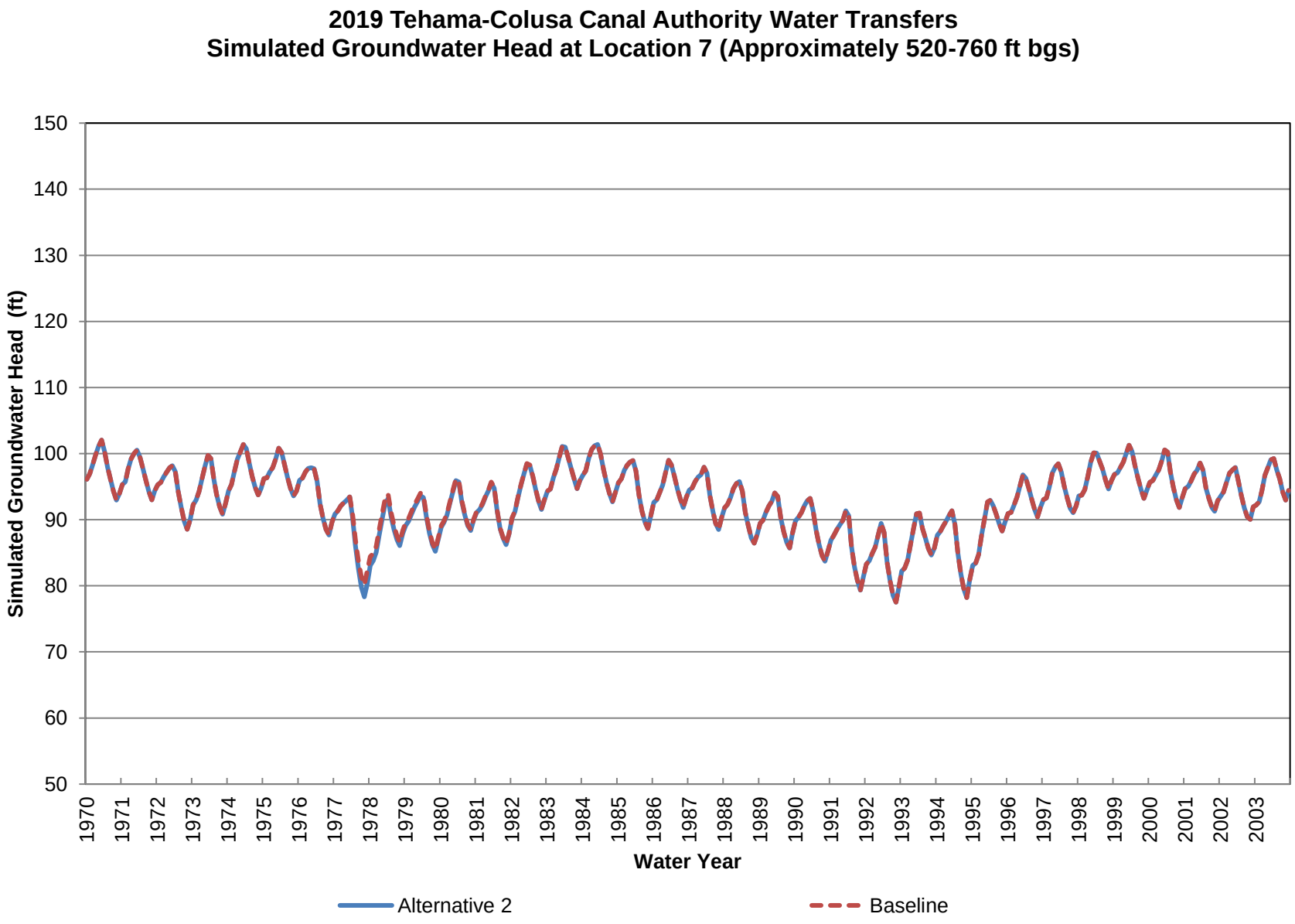
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 7 (Approximately 520-760 ft bgs)
Simulated Groundwater Head (ft)
150
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100
90
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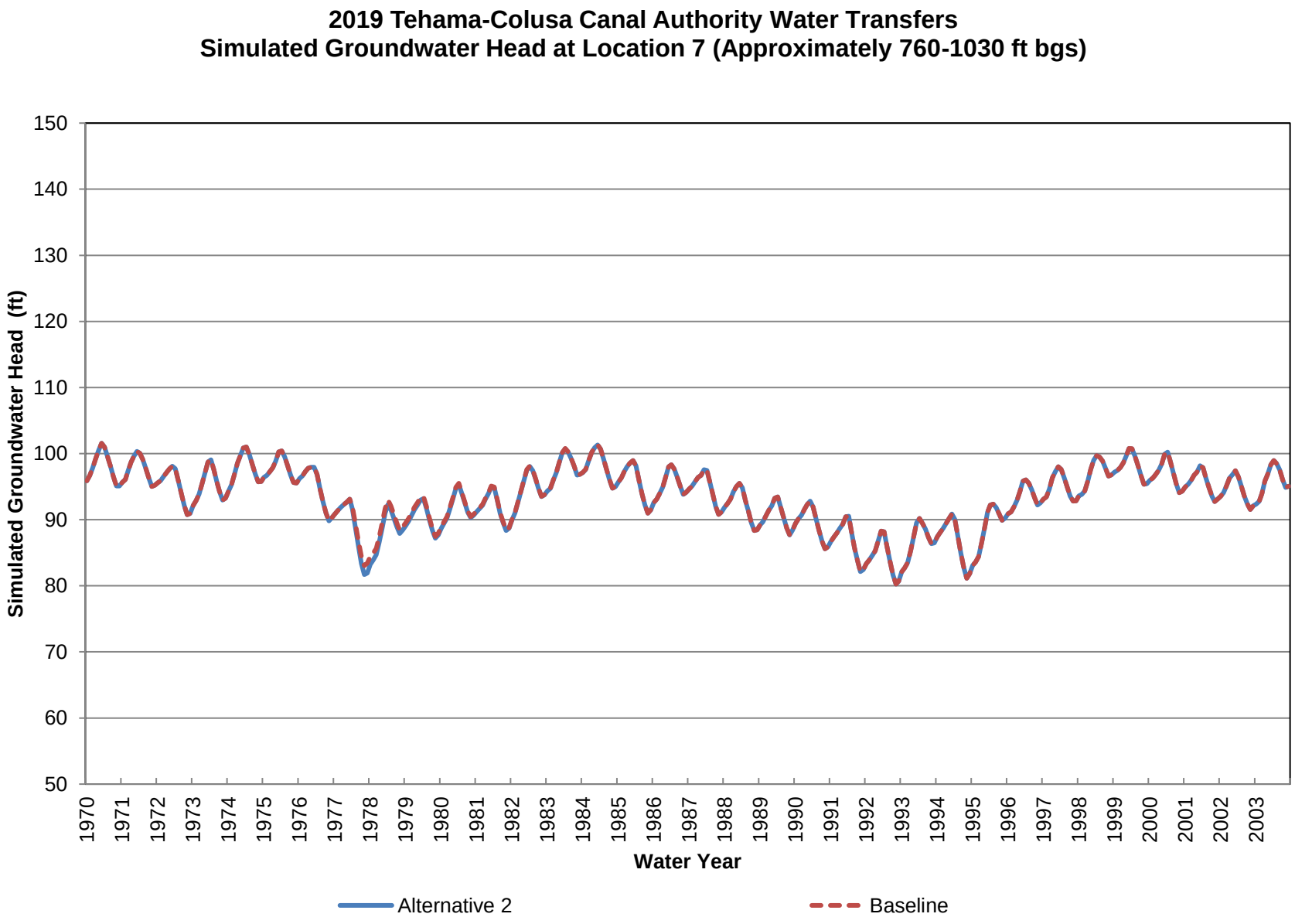
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 7 (Approximately 760-1030 ft bgs)
Simulated Groundwater Head (ft)
150
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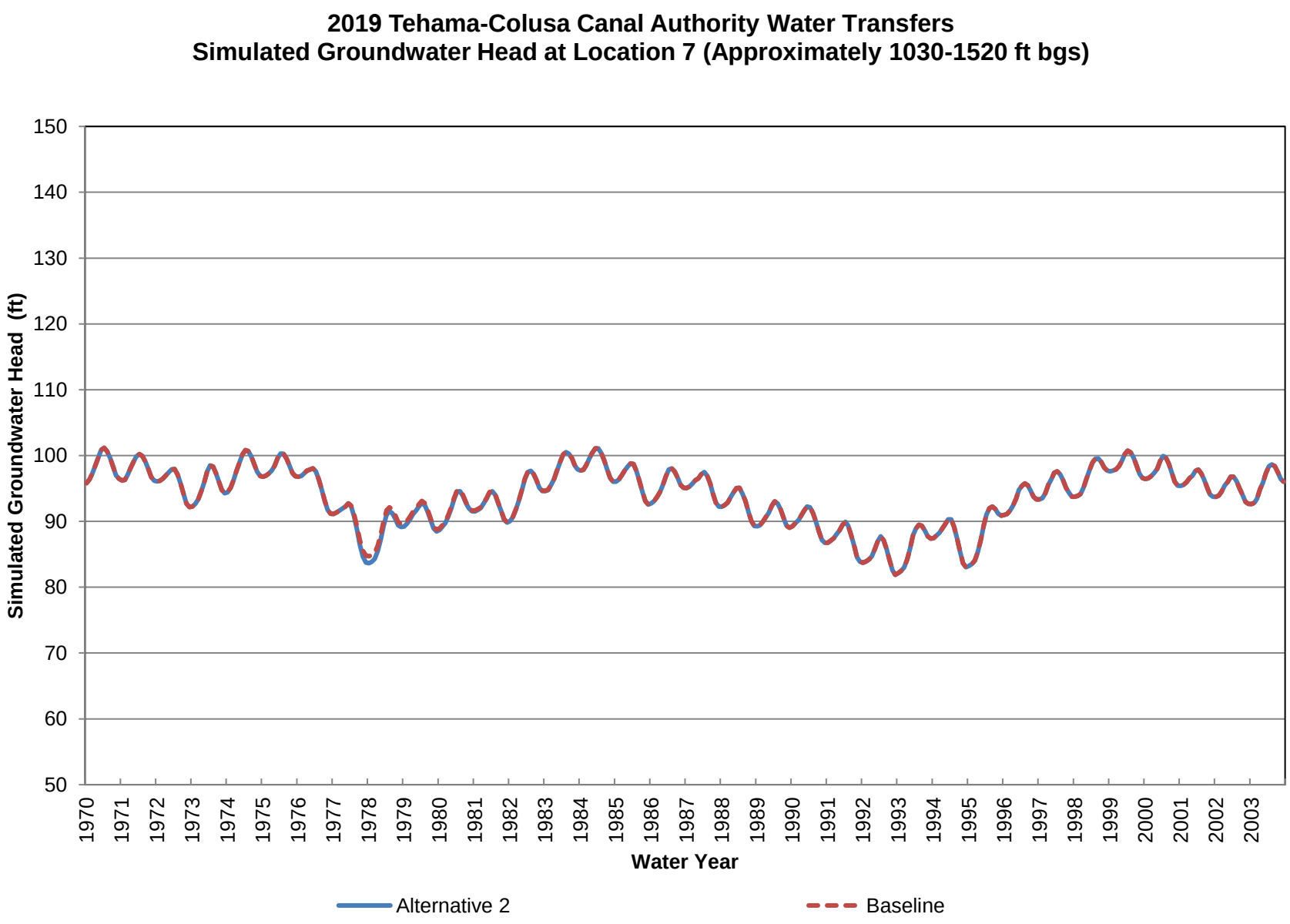
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 7 (Approximately 1030-1520 ft bgs)
Simulated Groundwater Head (ft)
150
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100
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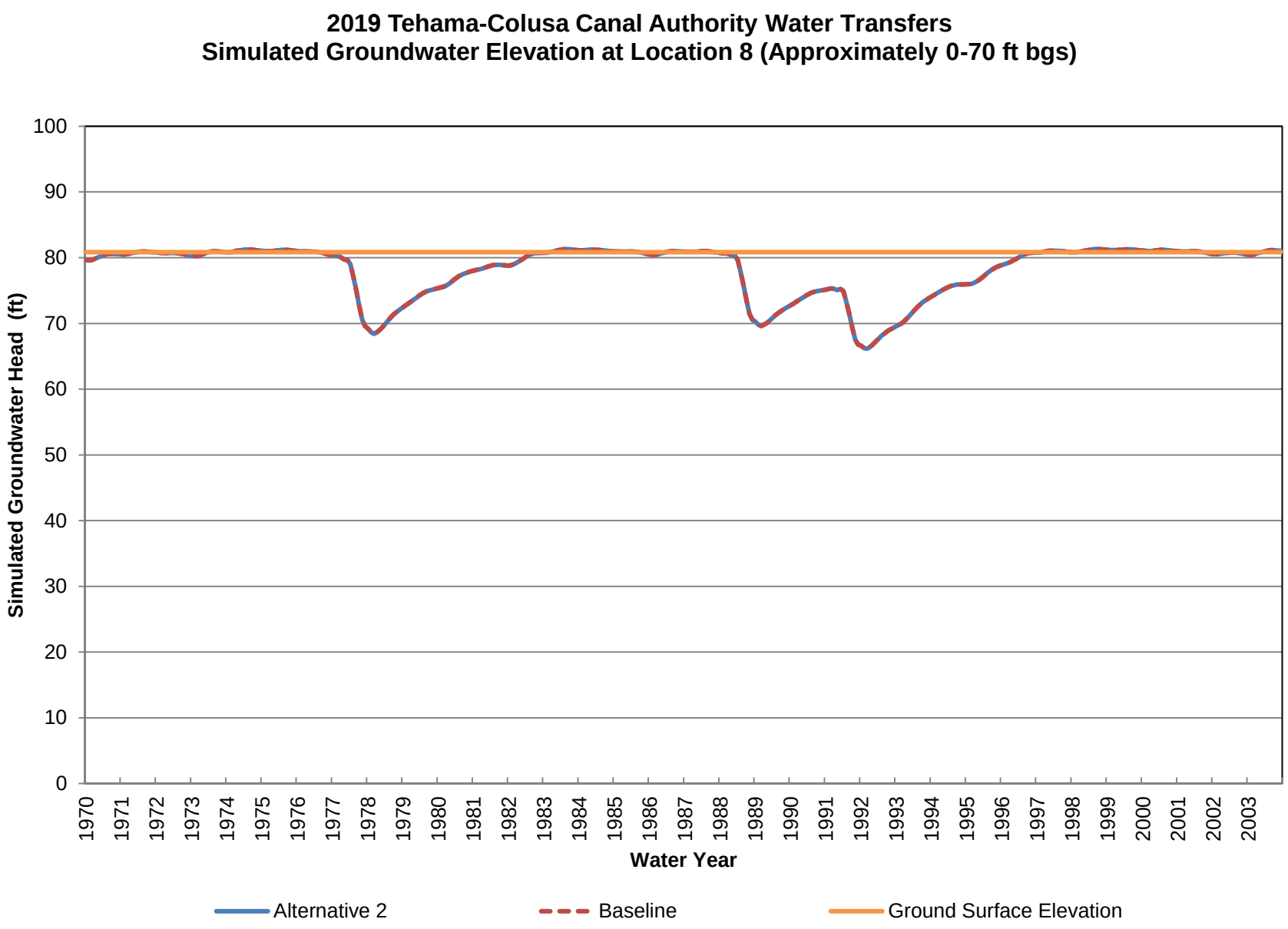
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 8 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
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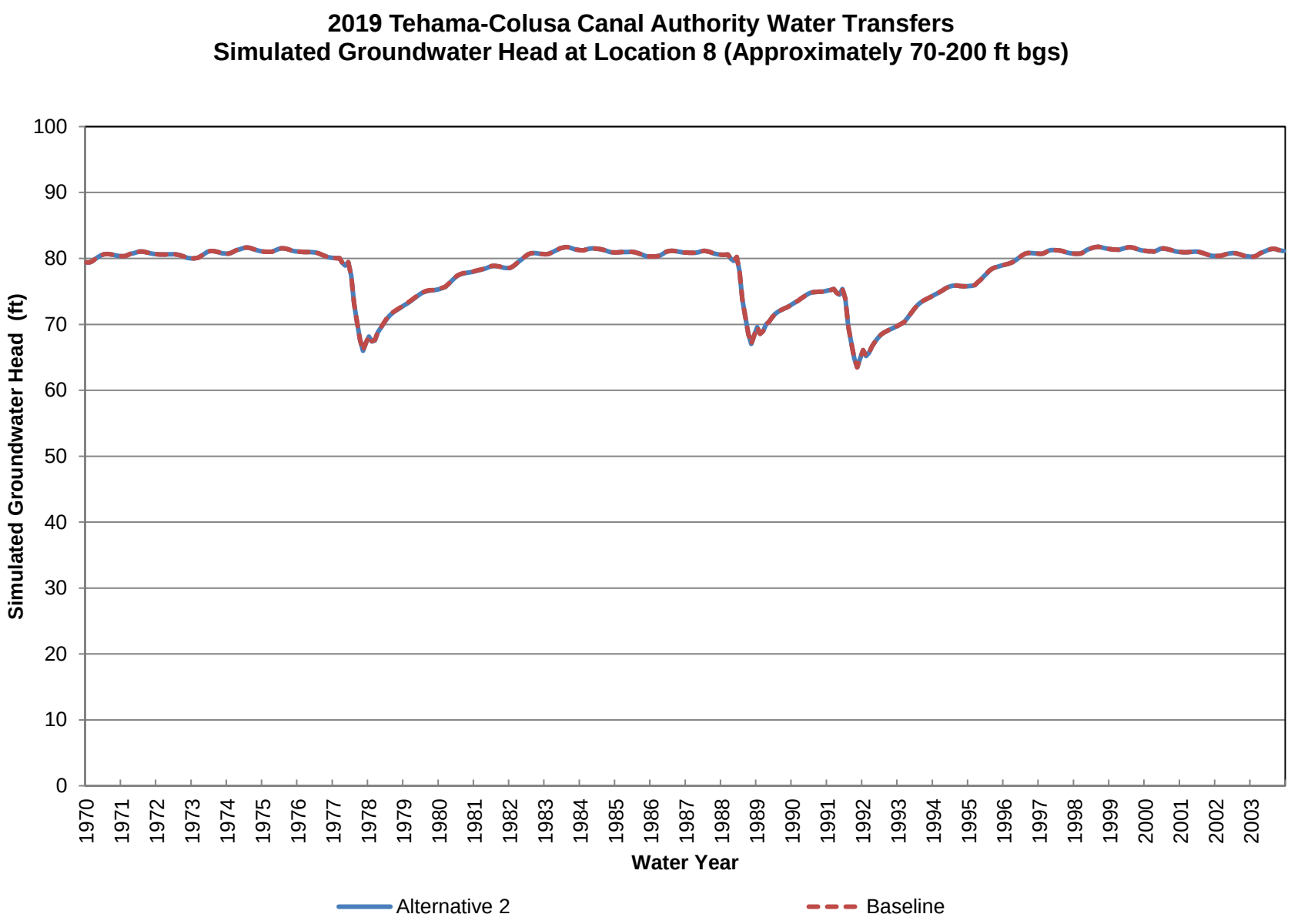
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 8 (Approximately 70-200 ft bgs)
Simulated Groundwater Head (ft)
100
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50
40
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1970
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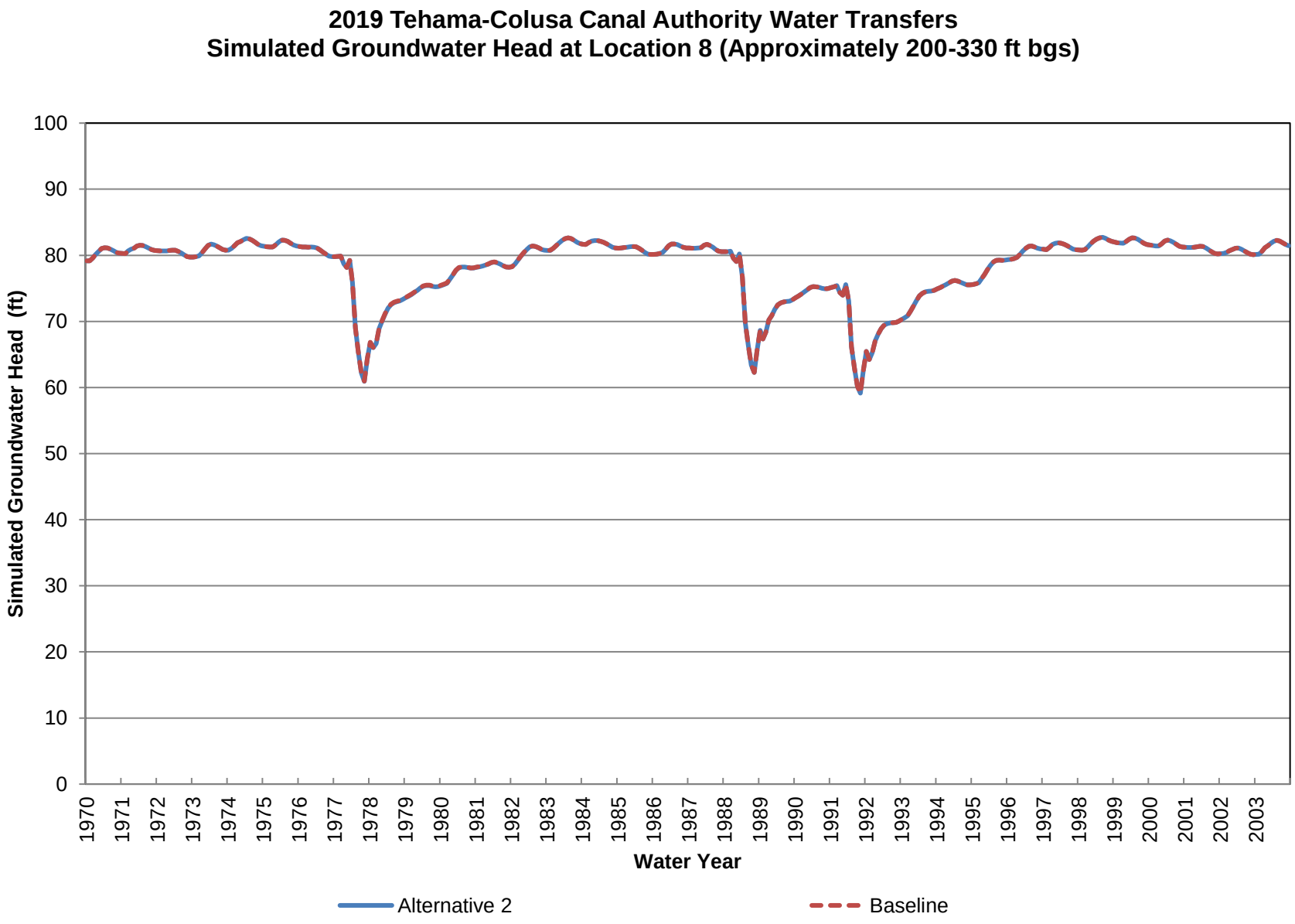
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 8 (Approximately 200-330 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
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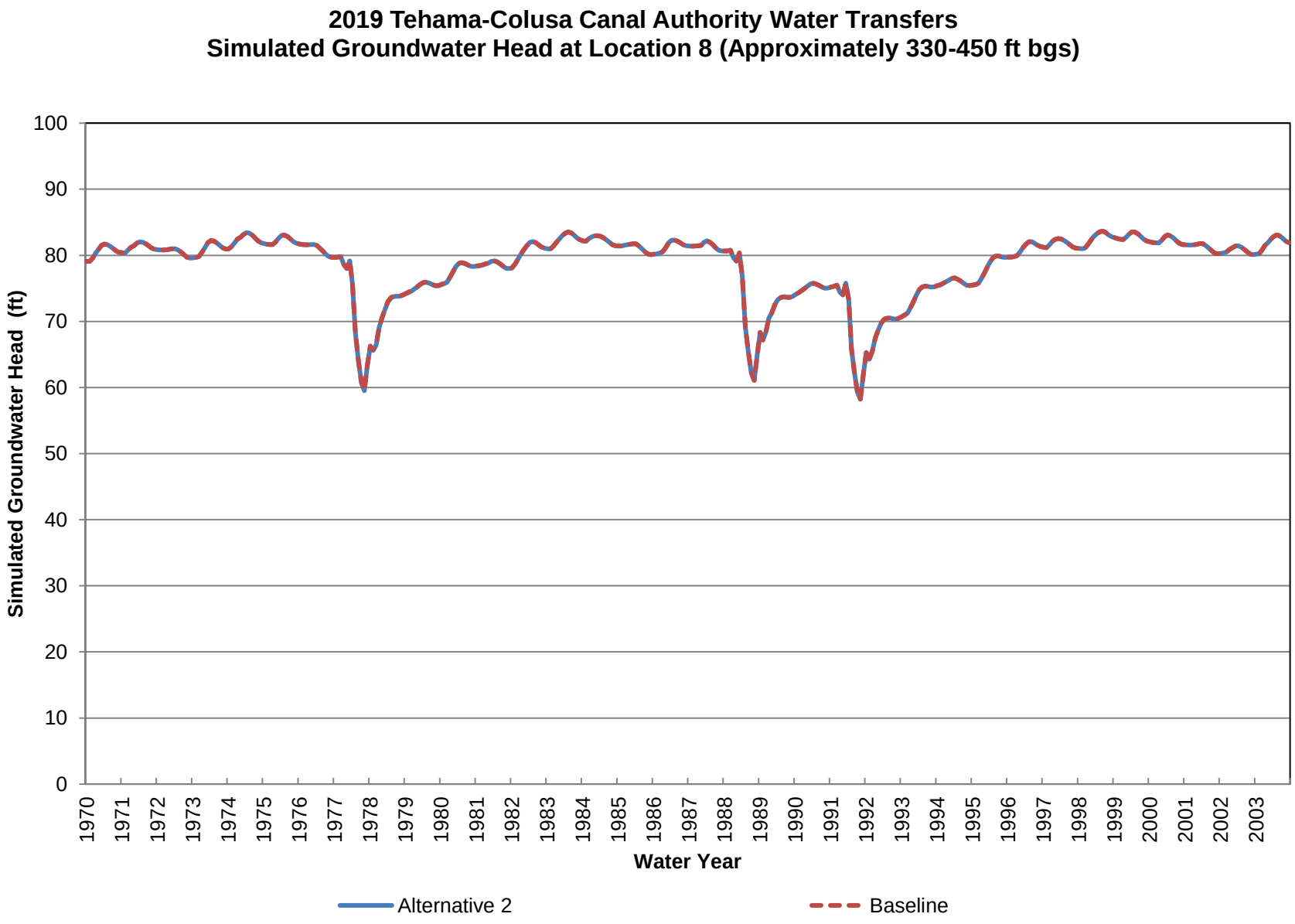
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 8 (Approximately 330-450 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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1998
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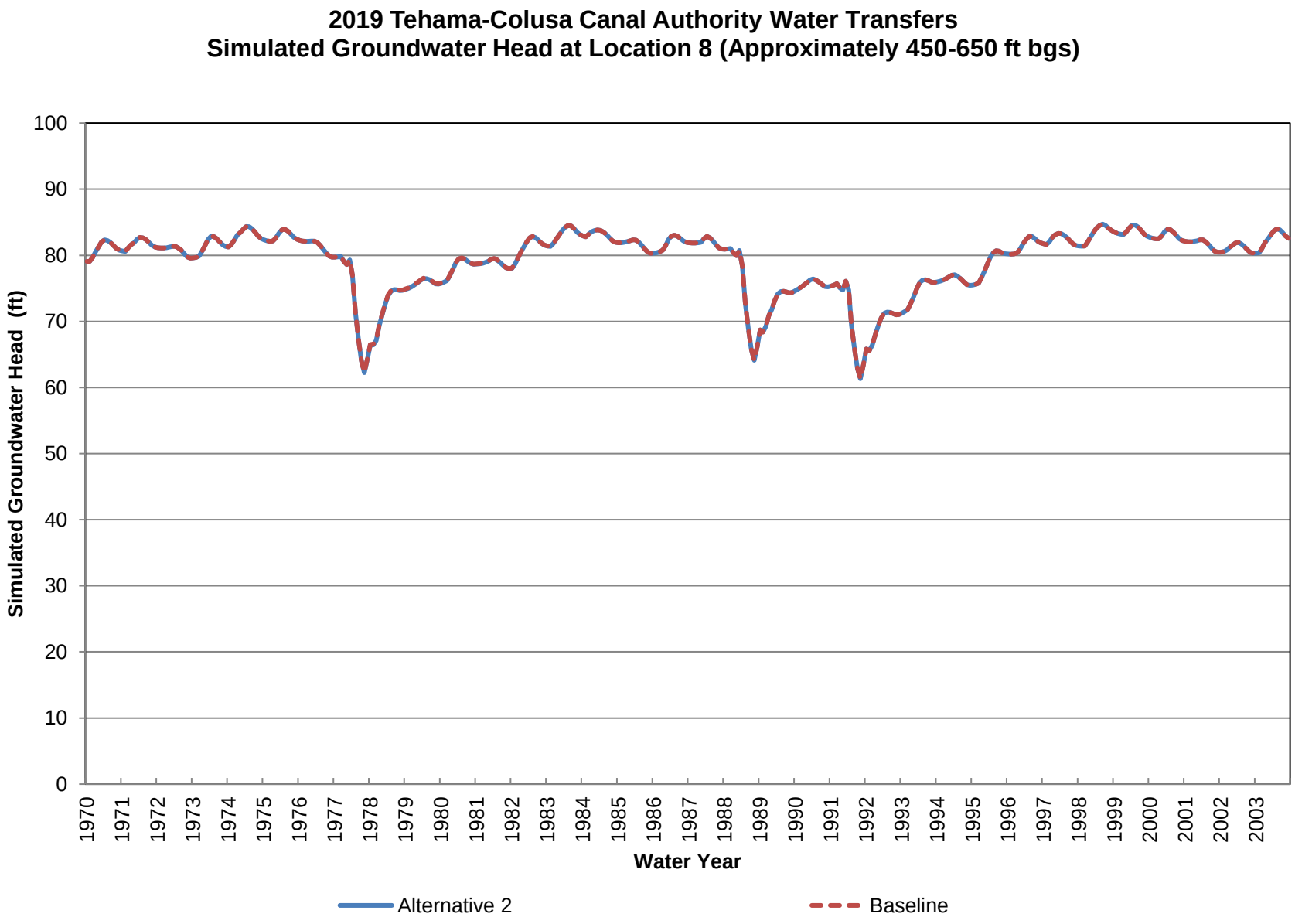
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 8 (Approximately 450-650 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
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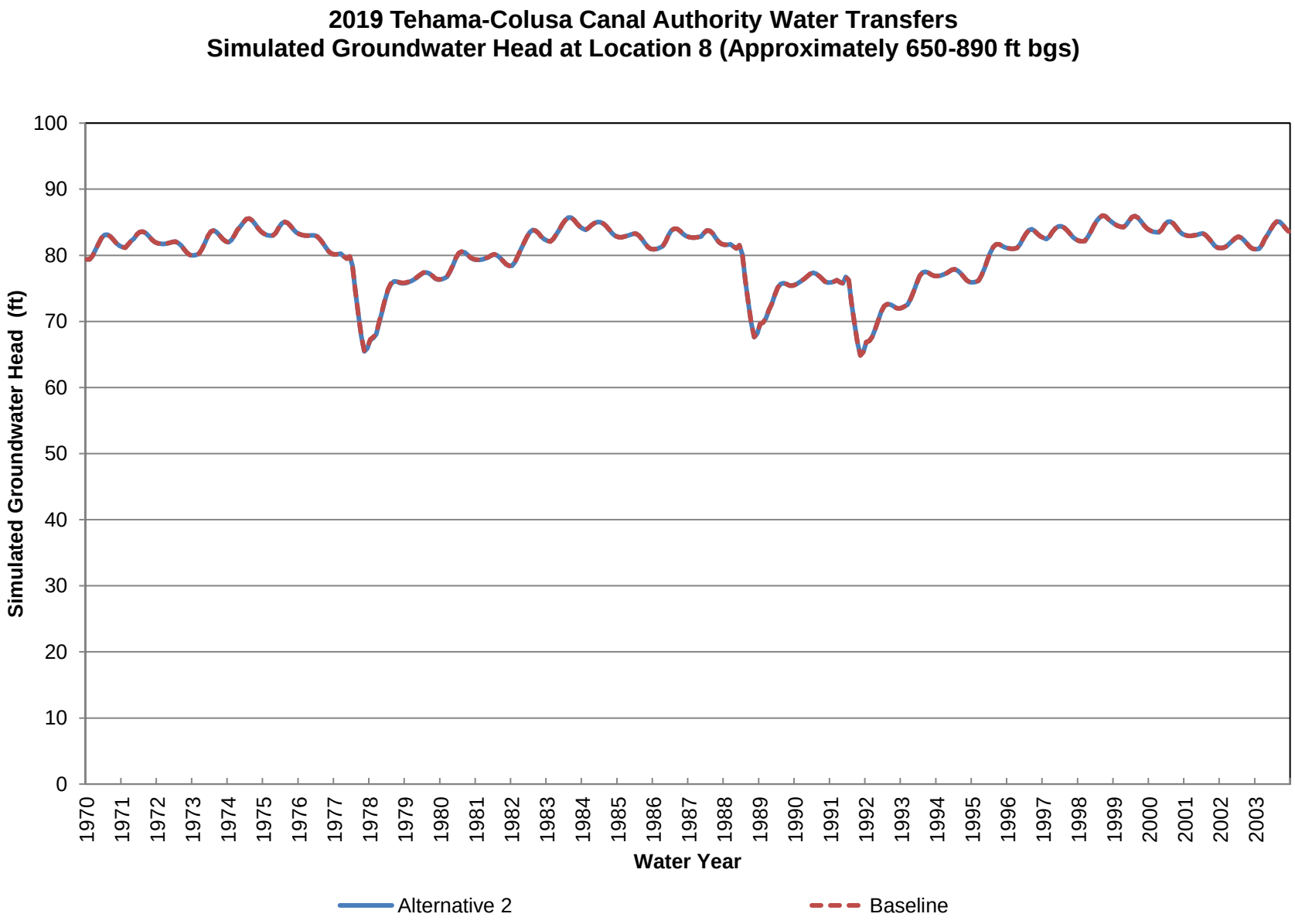
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 8 (Approximately 650-890 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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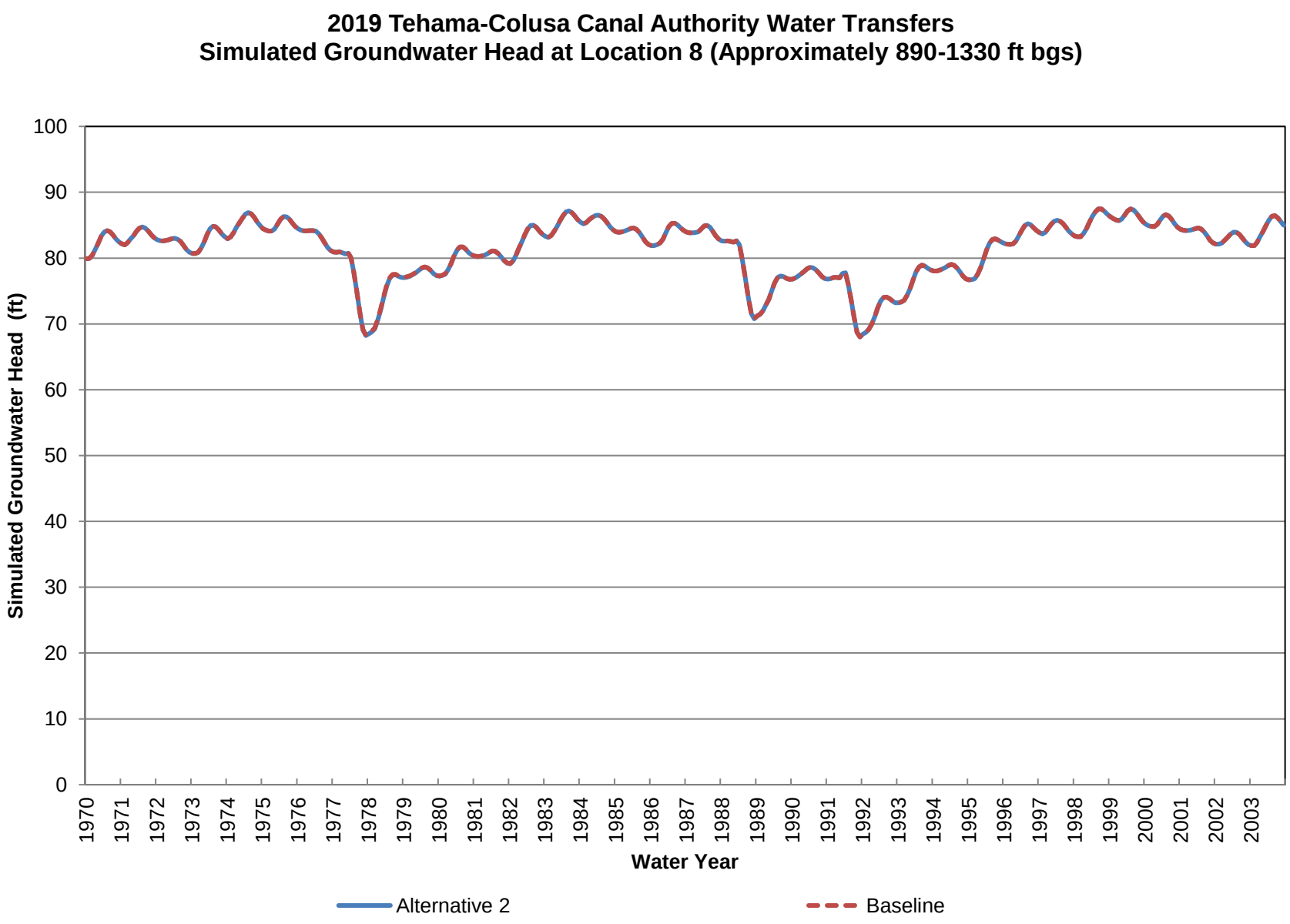
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 8 (Approximately 890-1330 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
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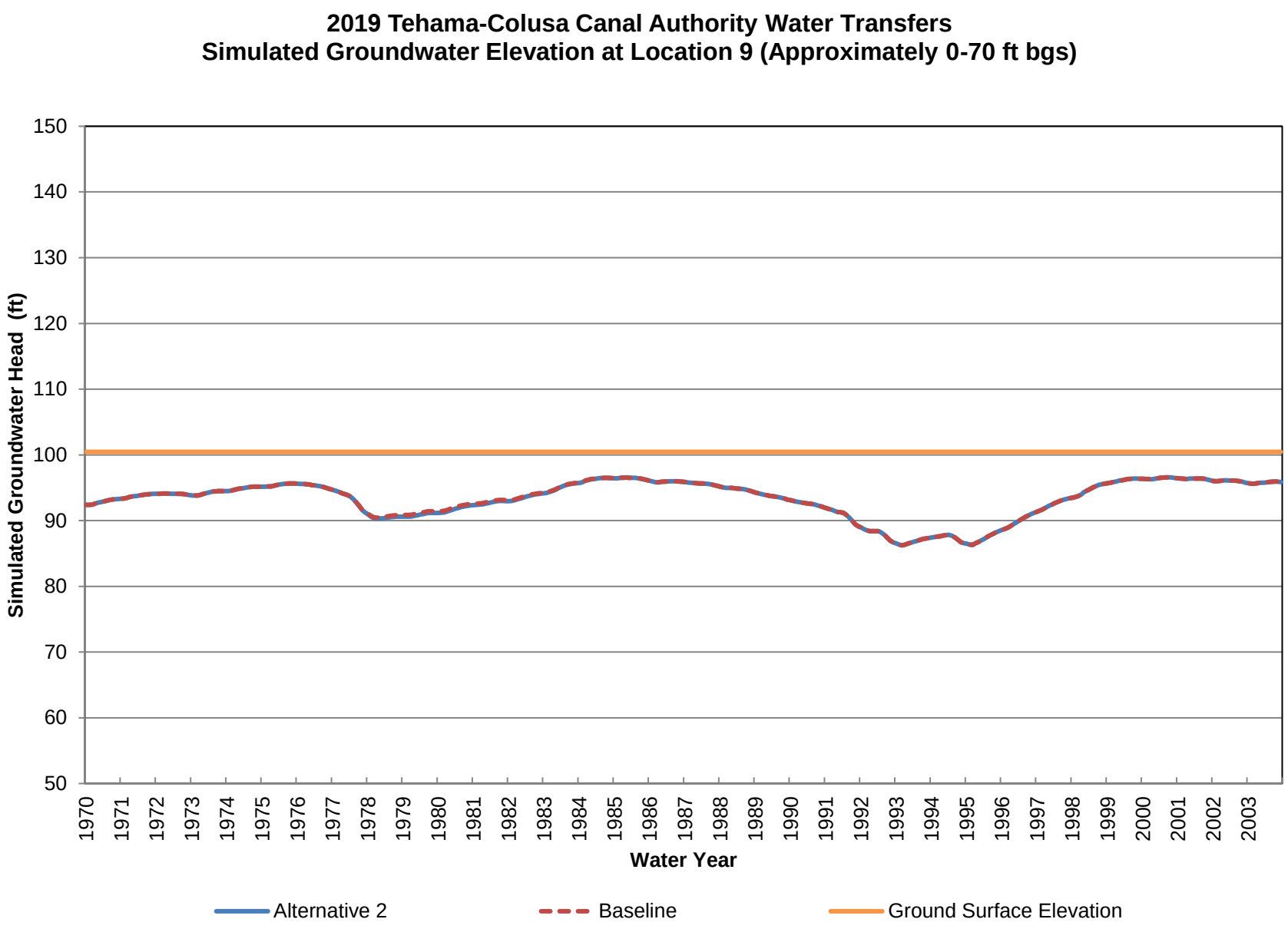
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 9 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
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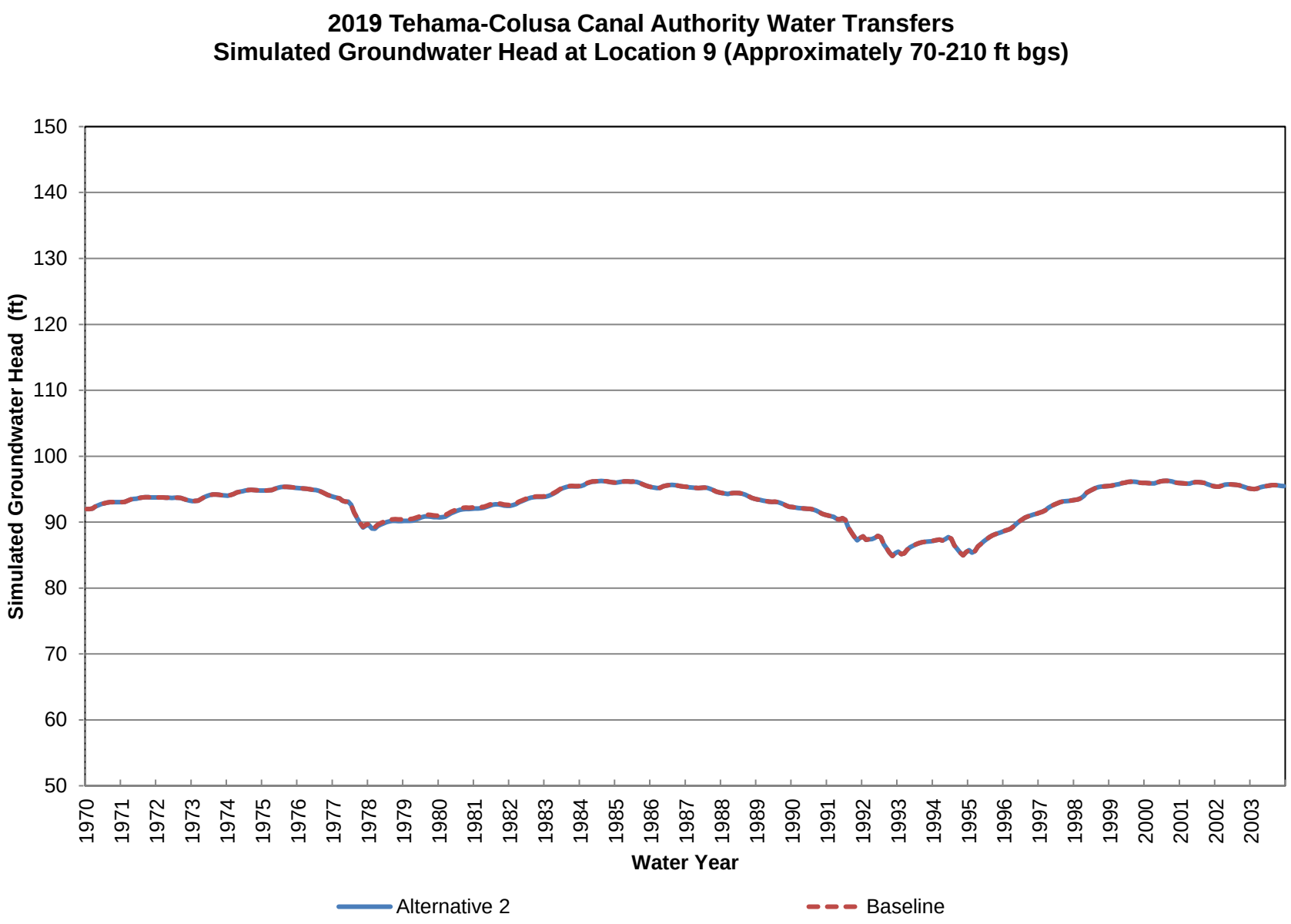
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 70-210 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
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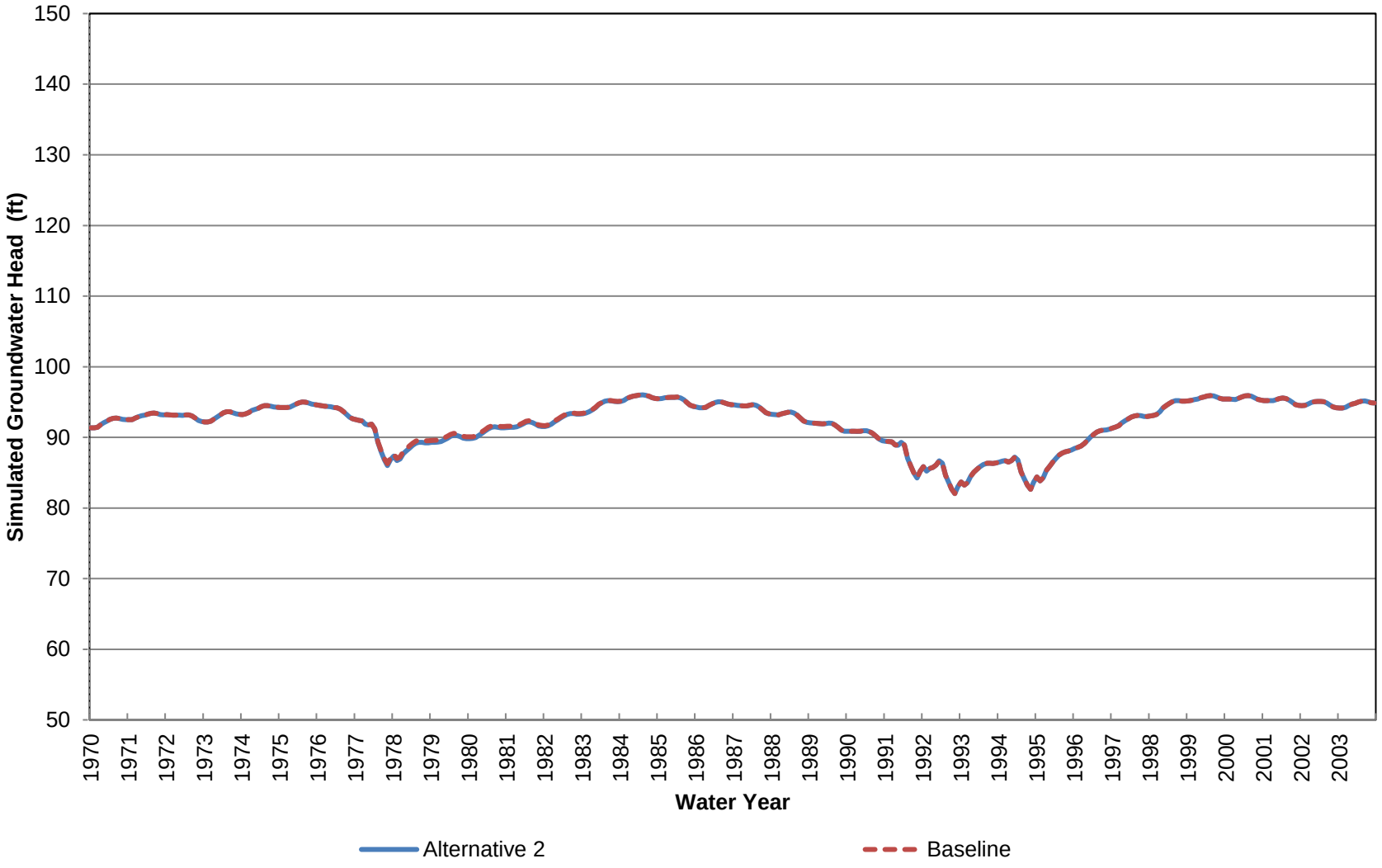
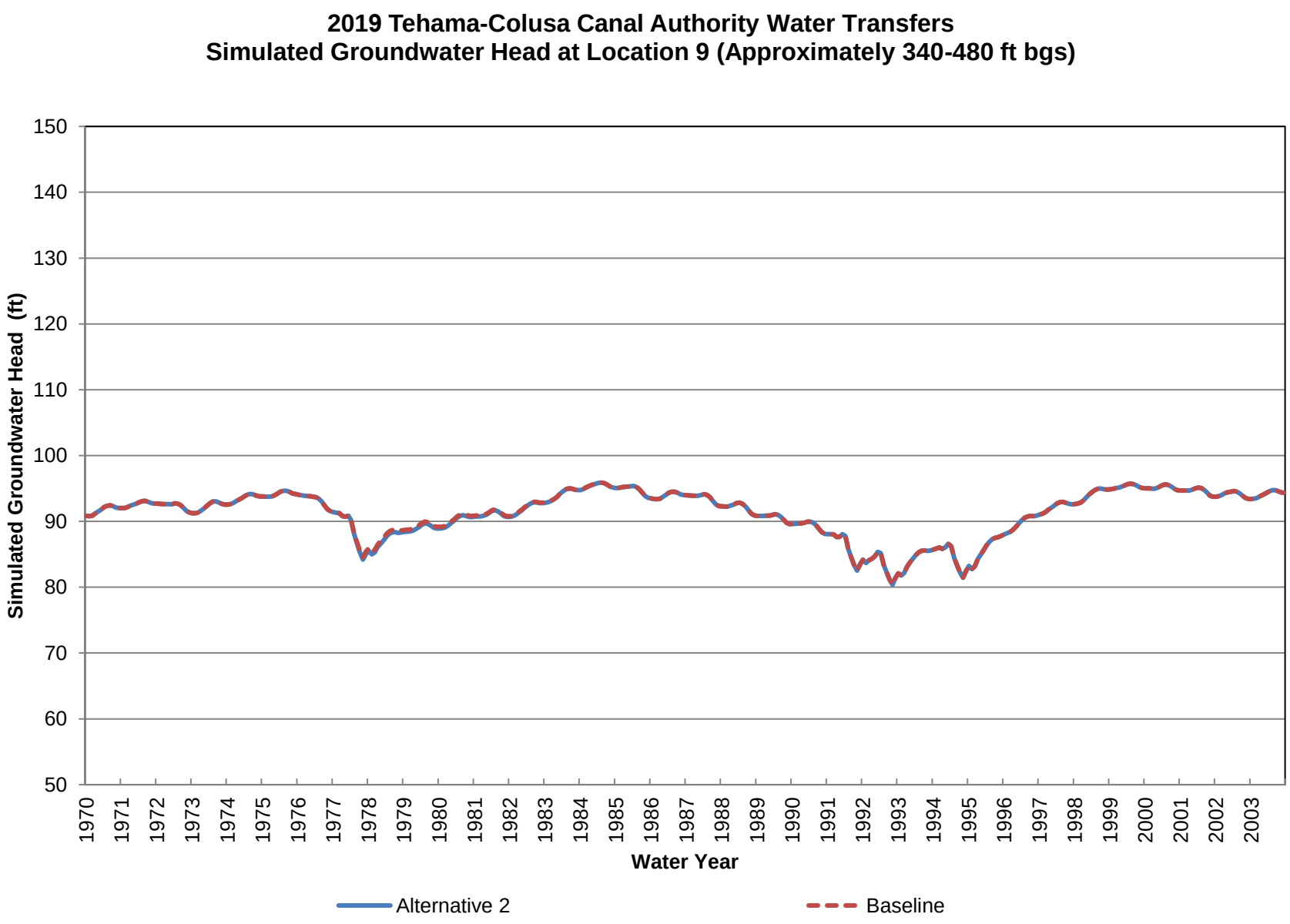
2003
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 210-340 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 340-480 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
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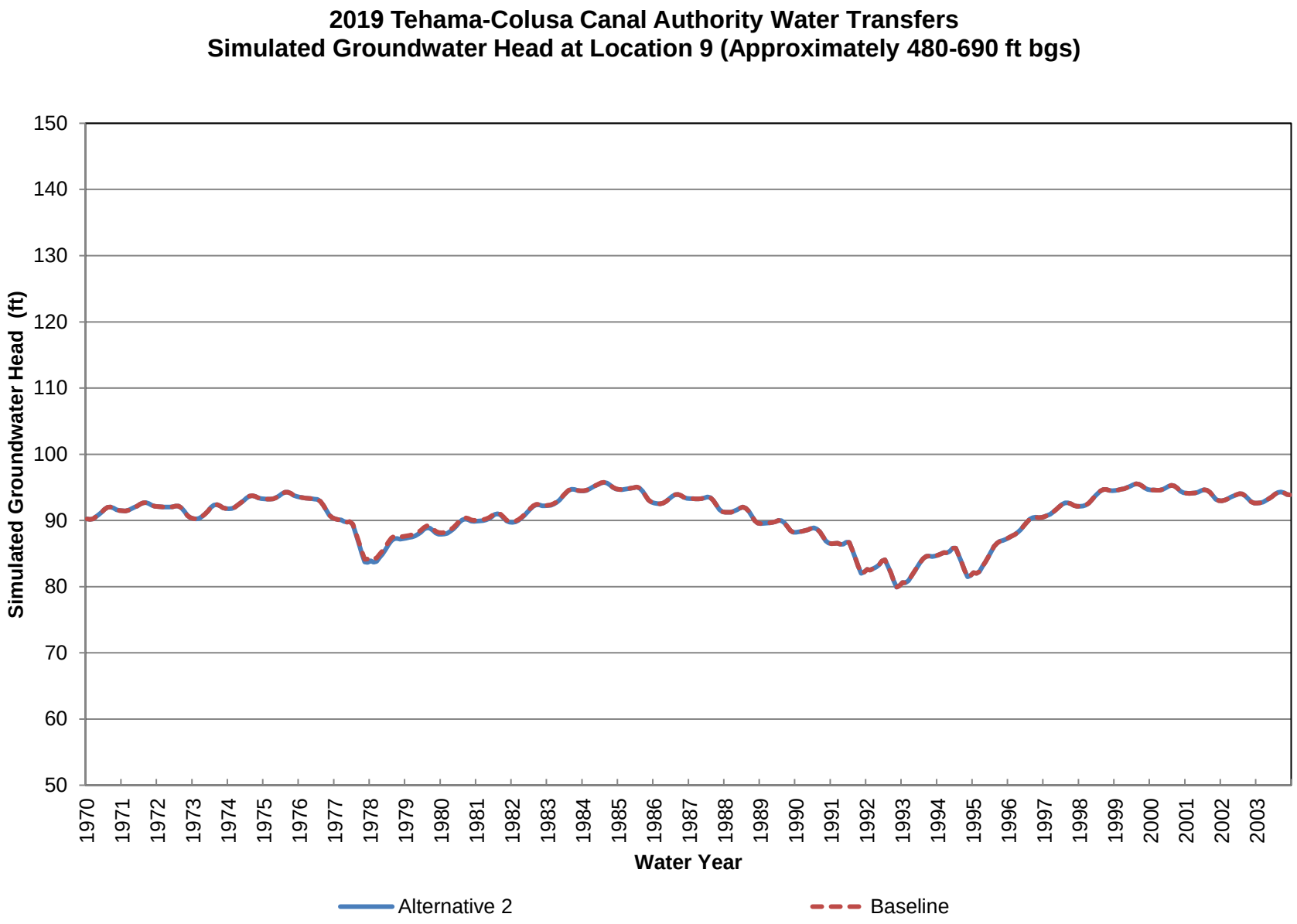
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 480-690 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
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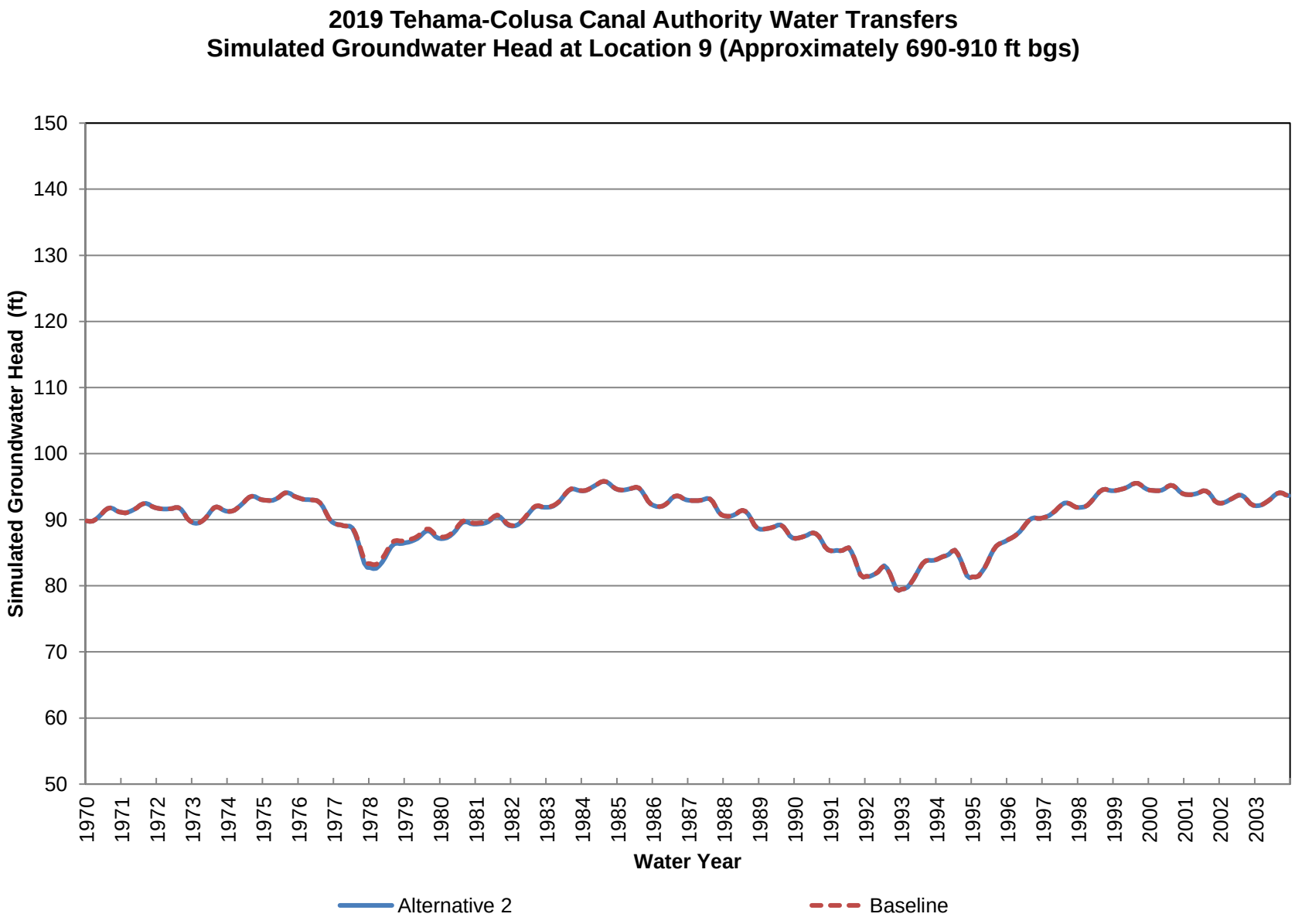
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 690-910 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
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1970
1971
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1975
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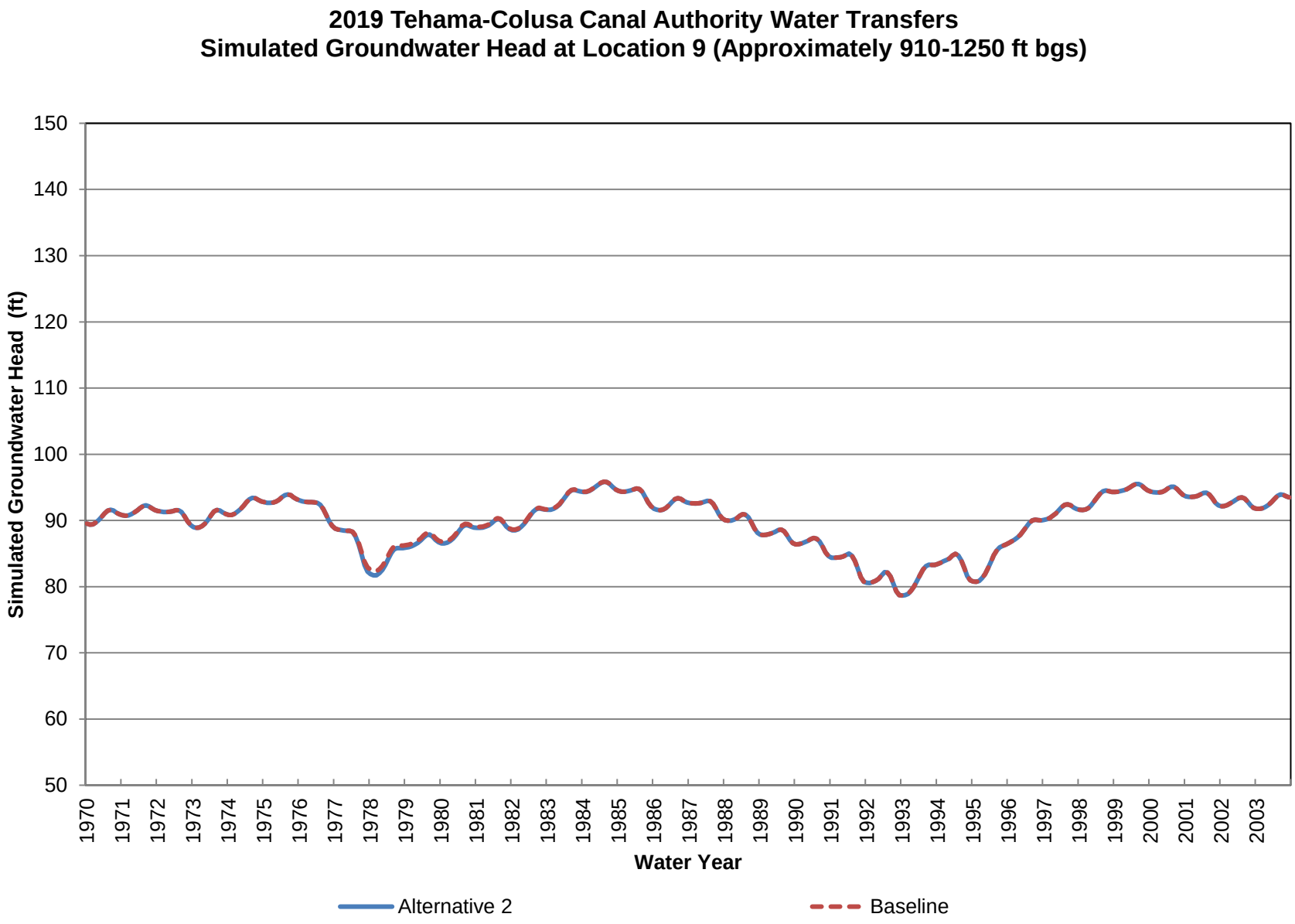
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 910-1250 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
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1970
1971
1972
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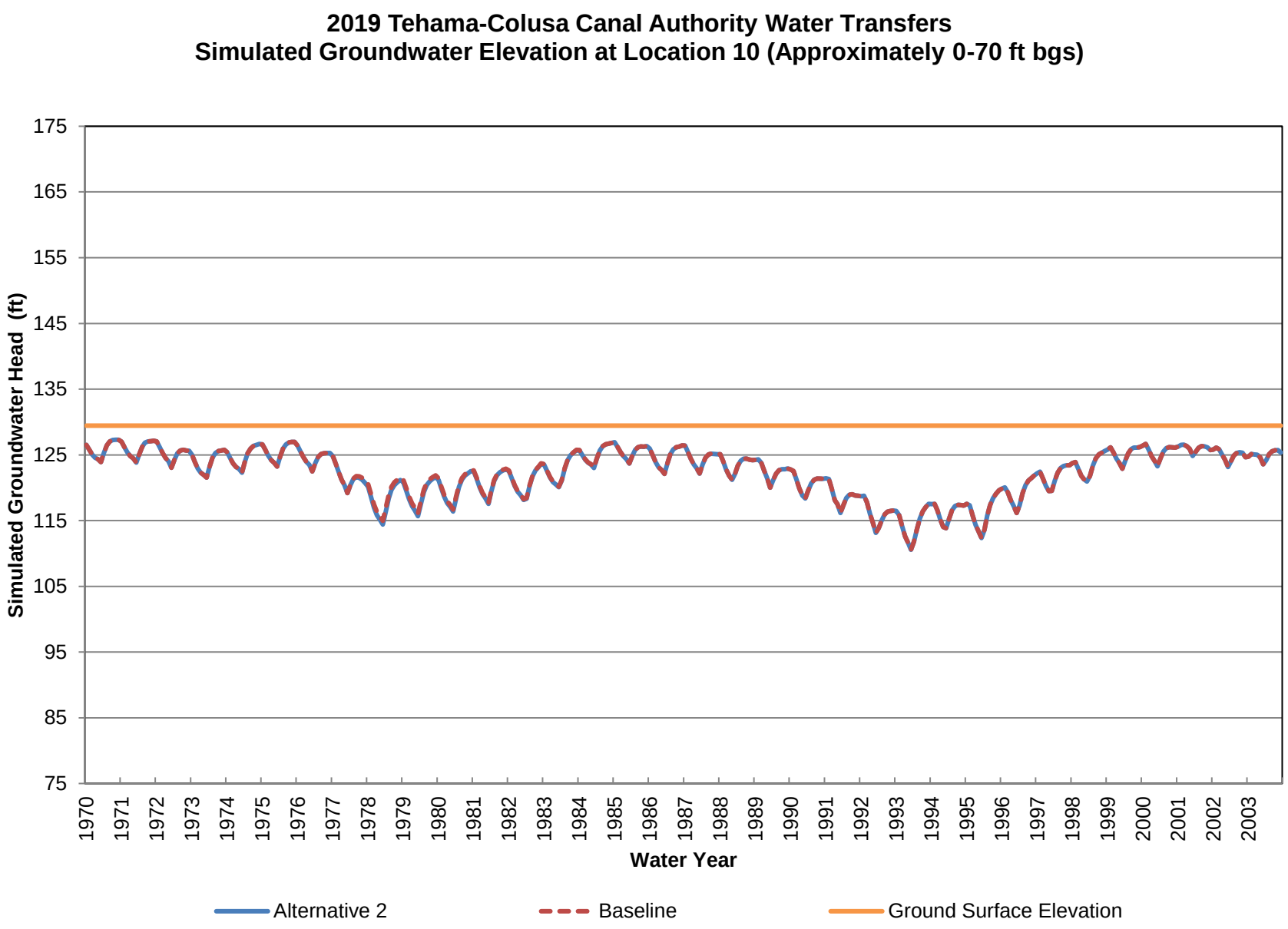
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 10 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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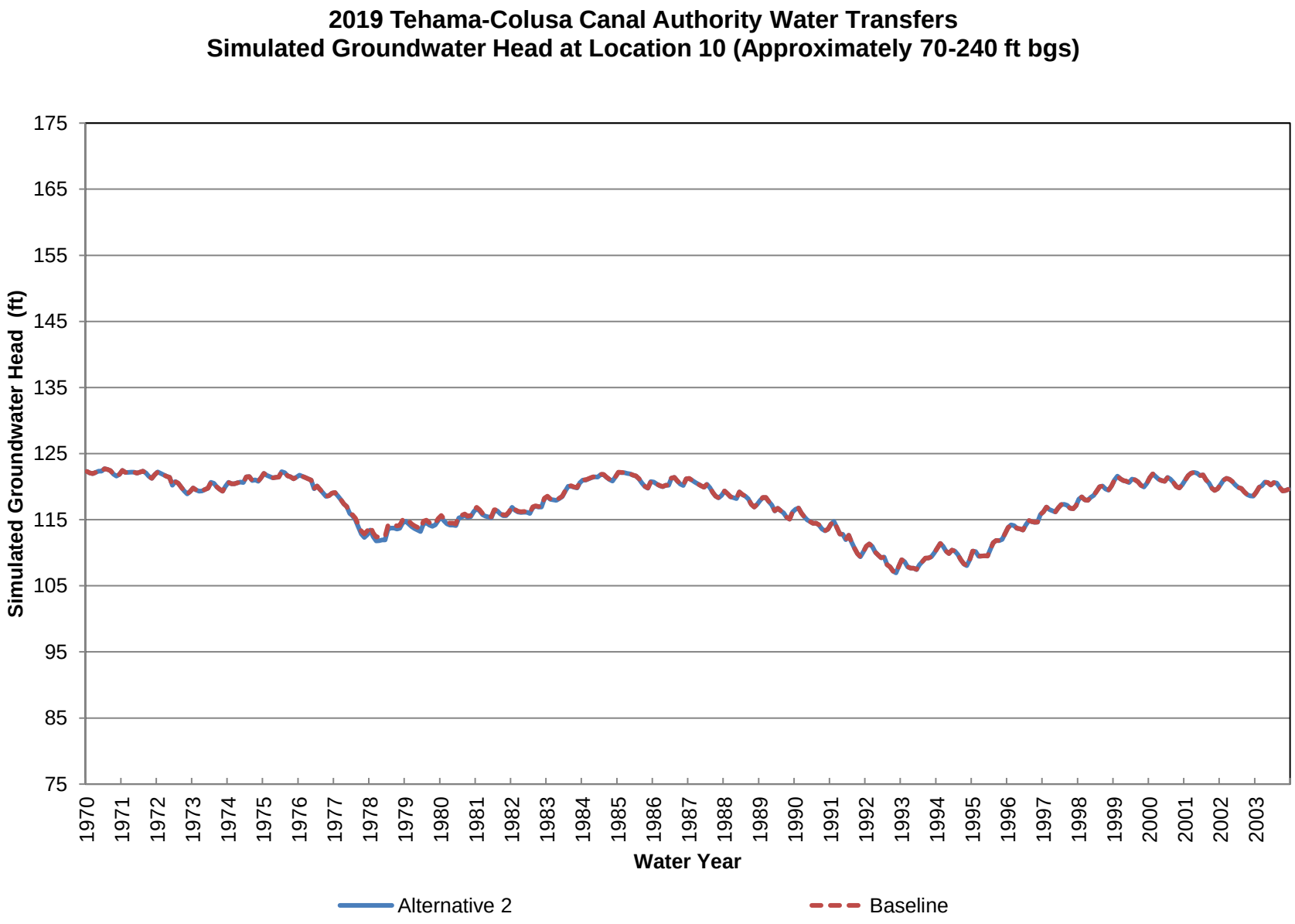
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 10 (Approximately 70-240 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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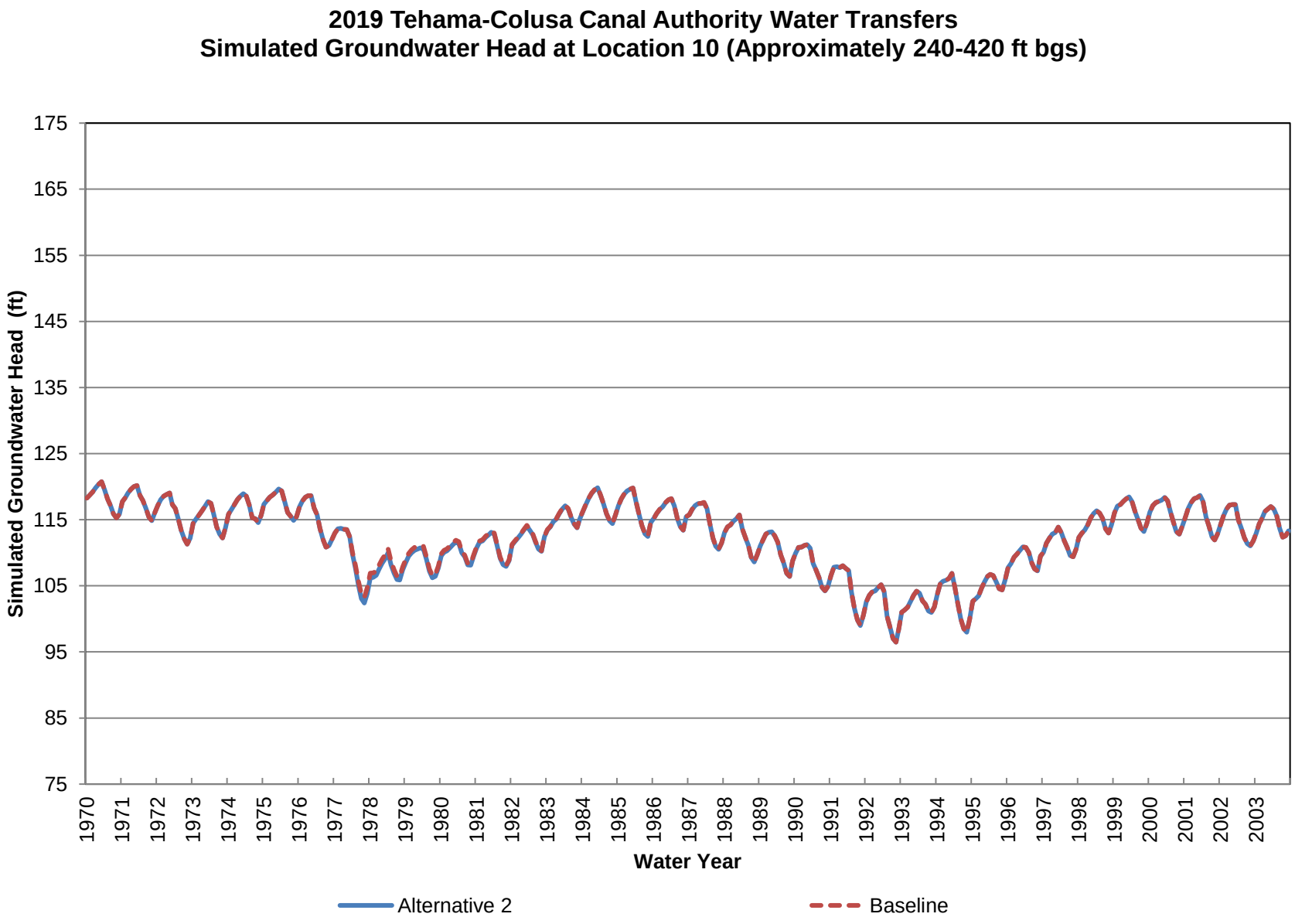
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 10 (Approximately 240-420 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
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1986
1987
1988
1989
1990
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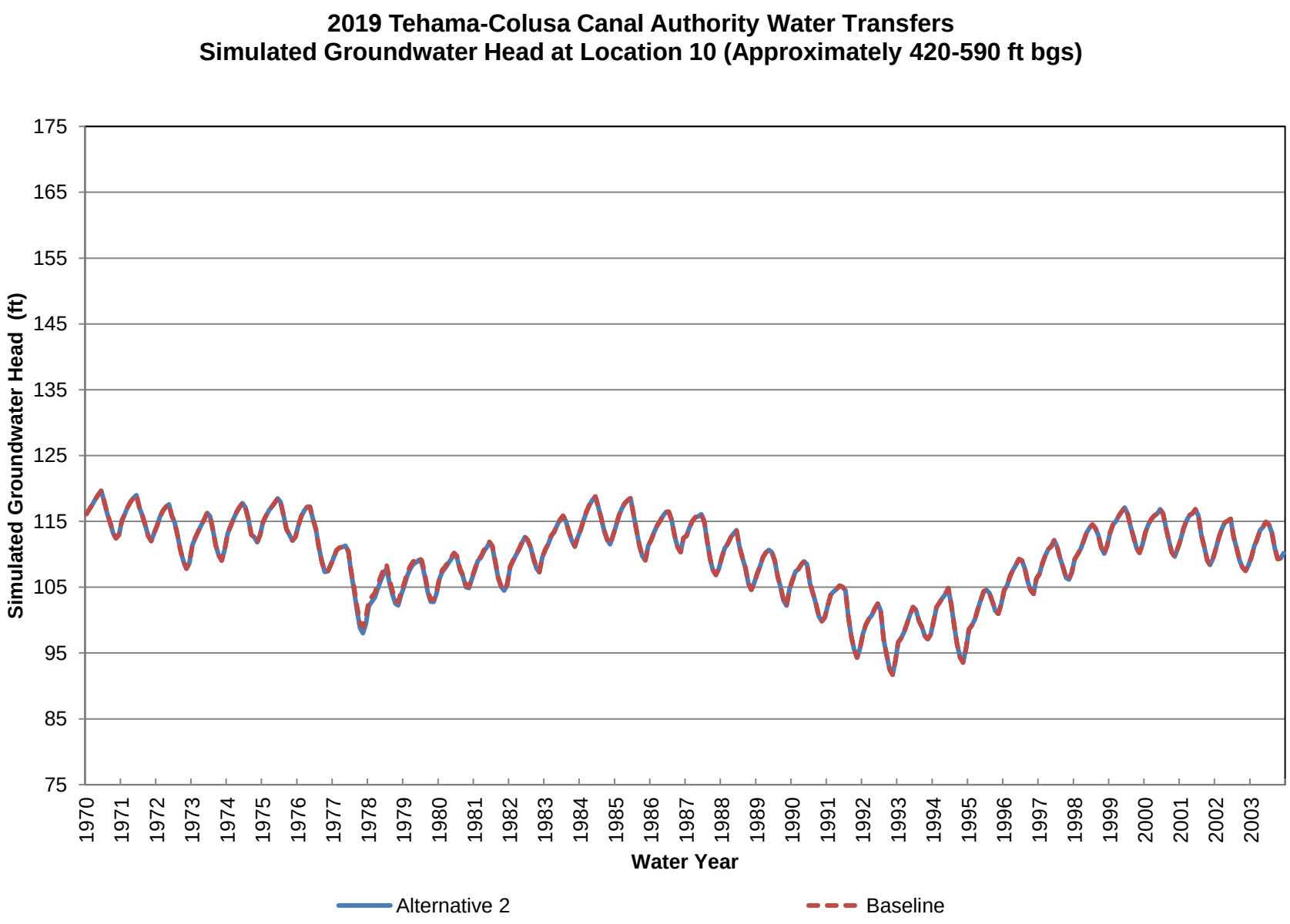
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 10 (Approximately 420-590 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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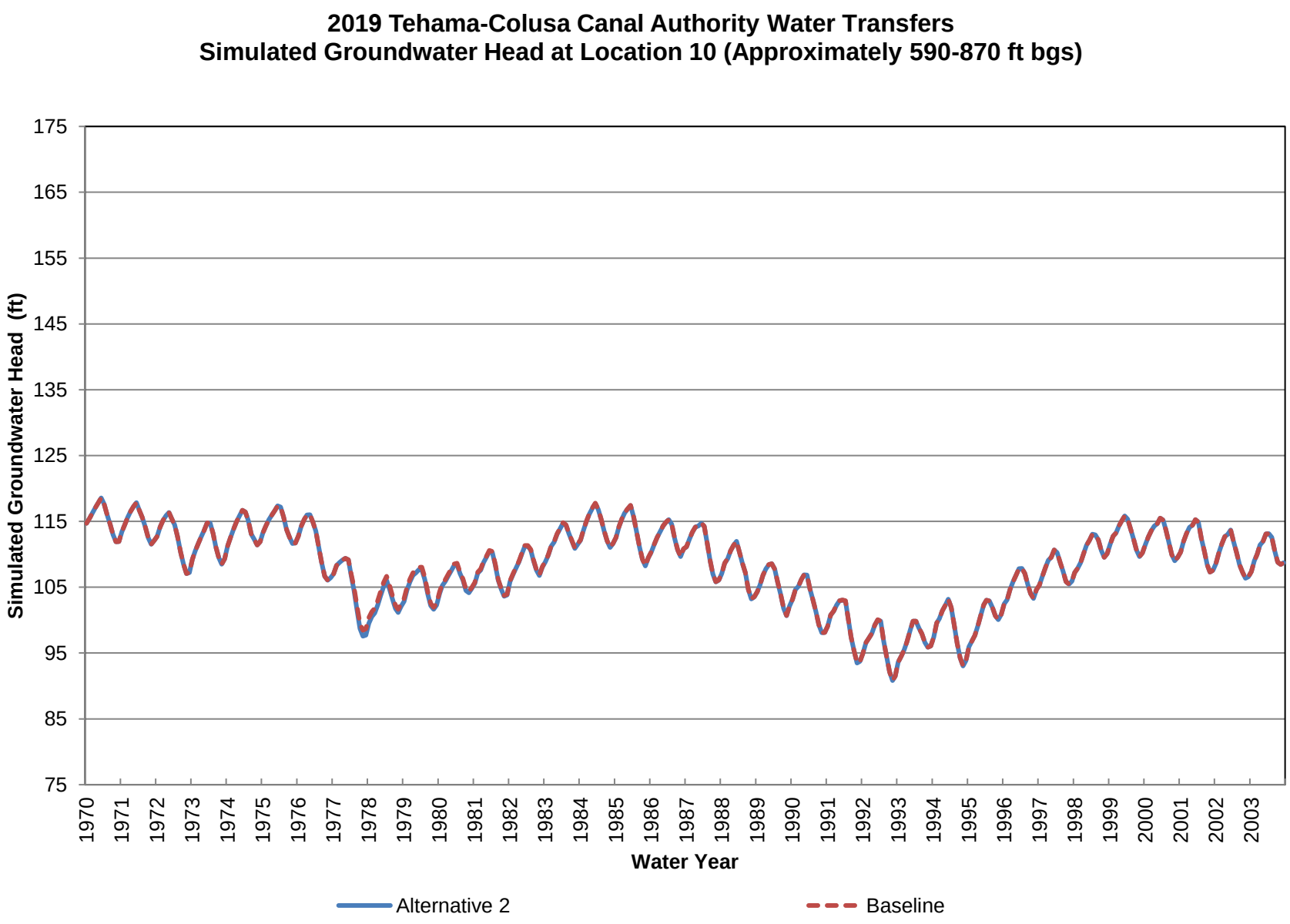
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 10 (Approximately 590-870 ft bgs)
Simulated Groundwater Head (ft)
175
165
155
145
135
125
115
105
95
85
75
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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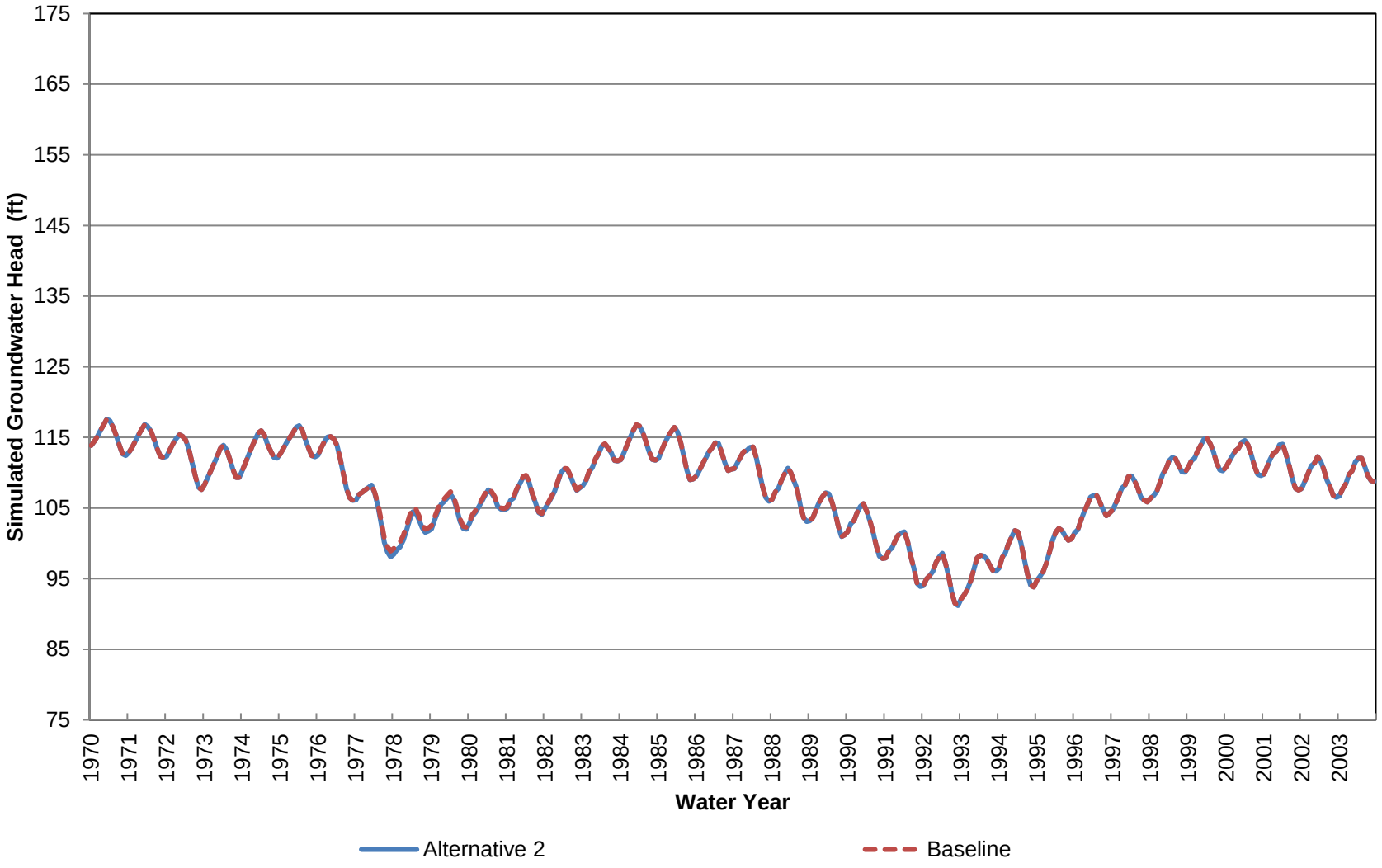
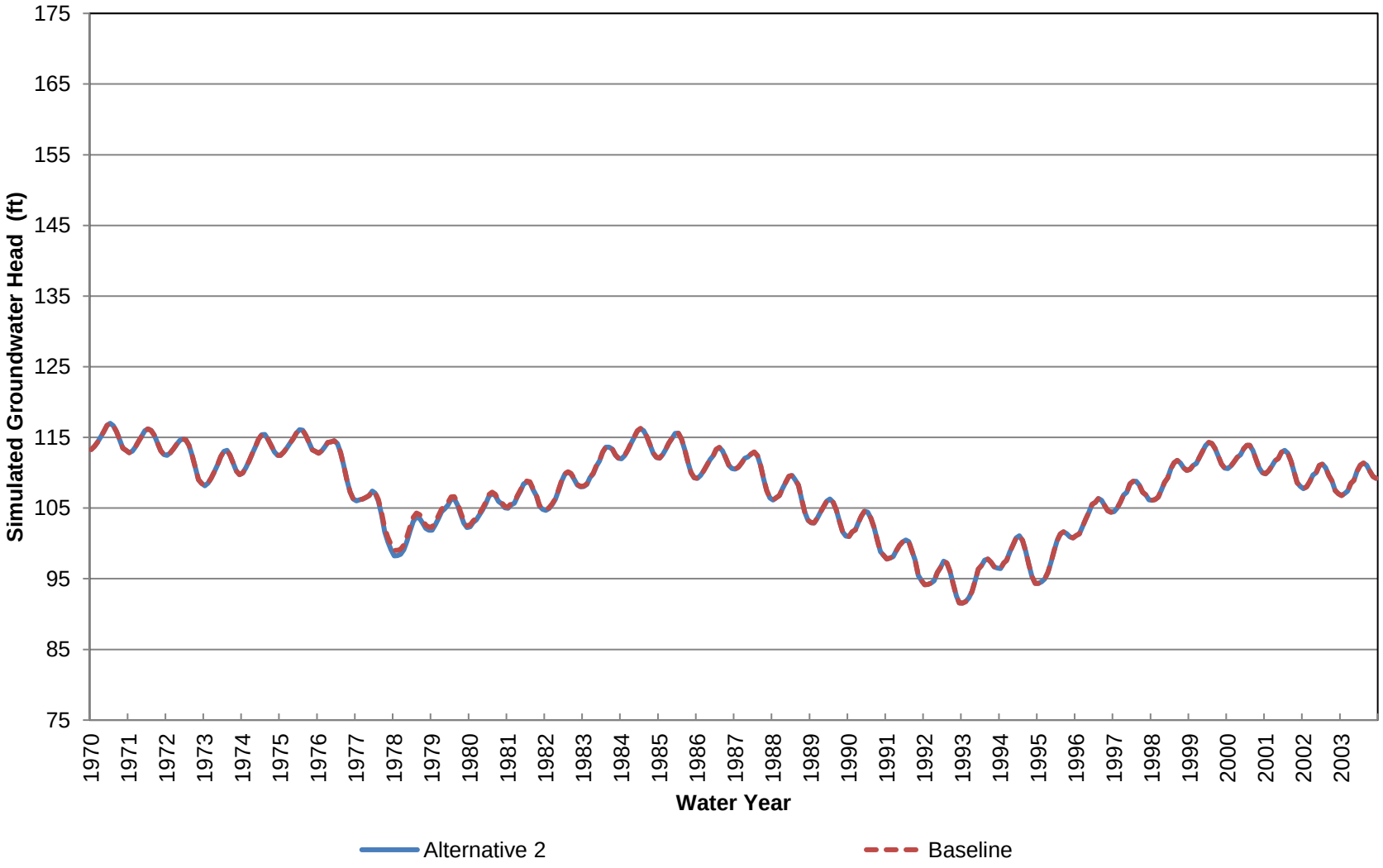
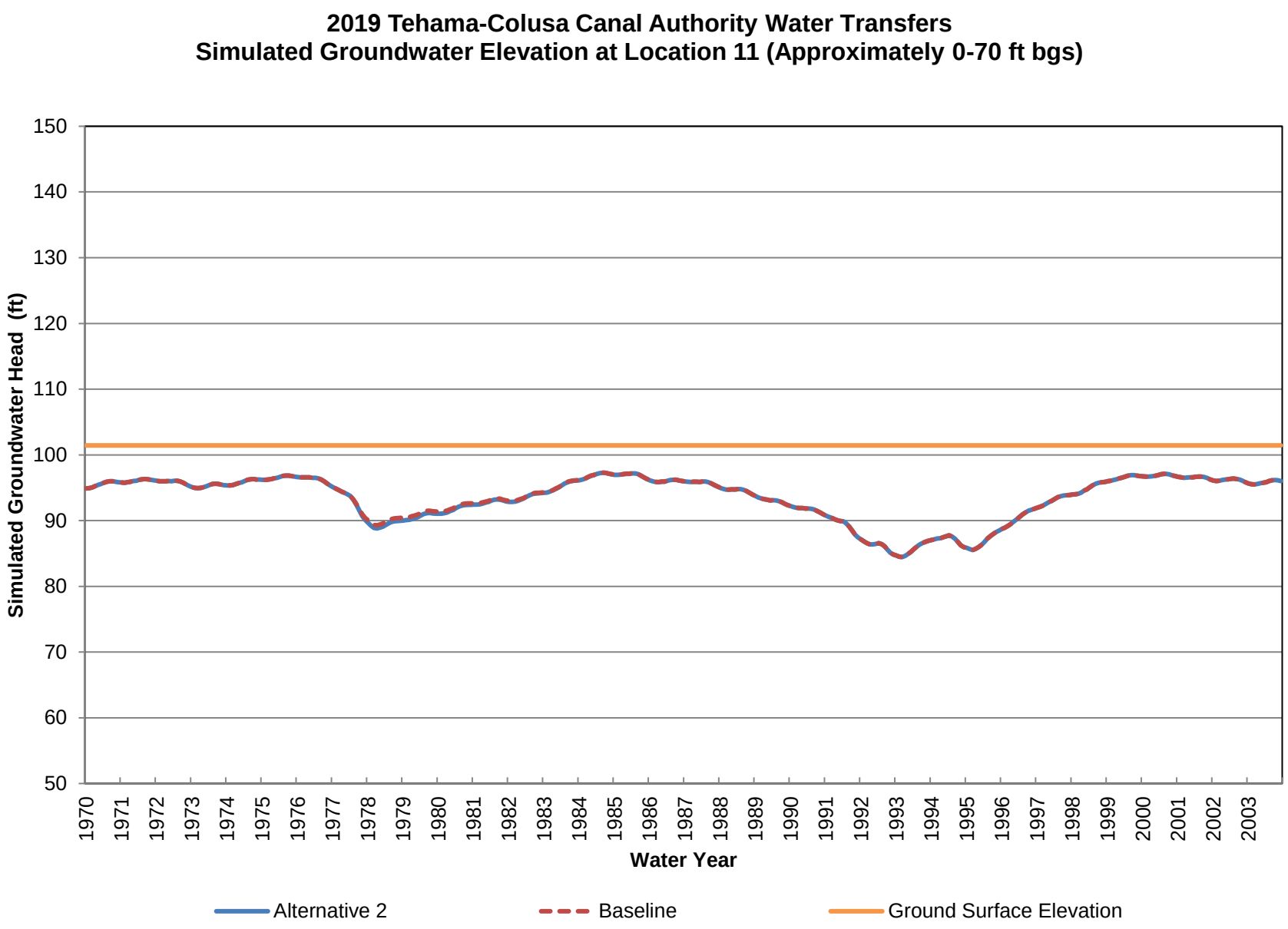
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 10 (Approximately 870-1160 ft bgs)



2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 10 (Approximately 1160-1590 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 11 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
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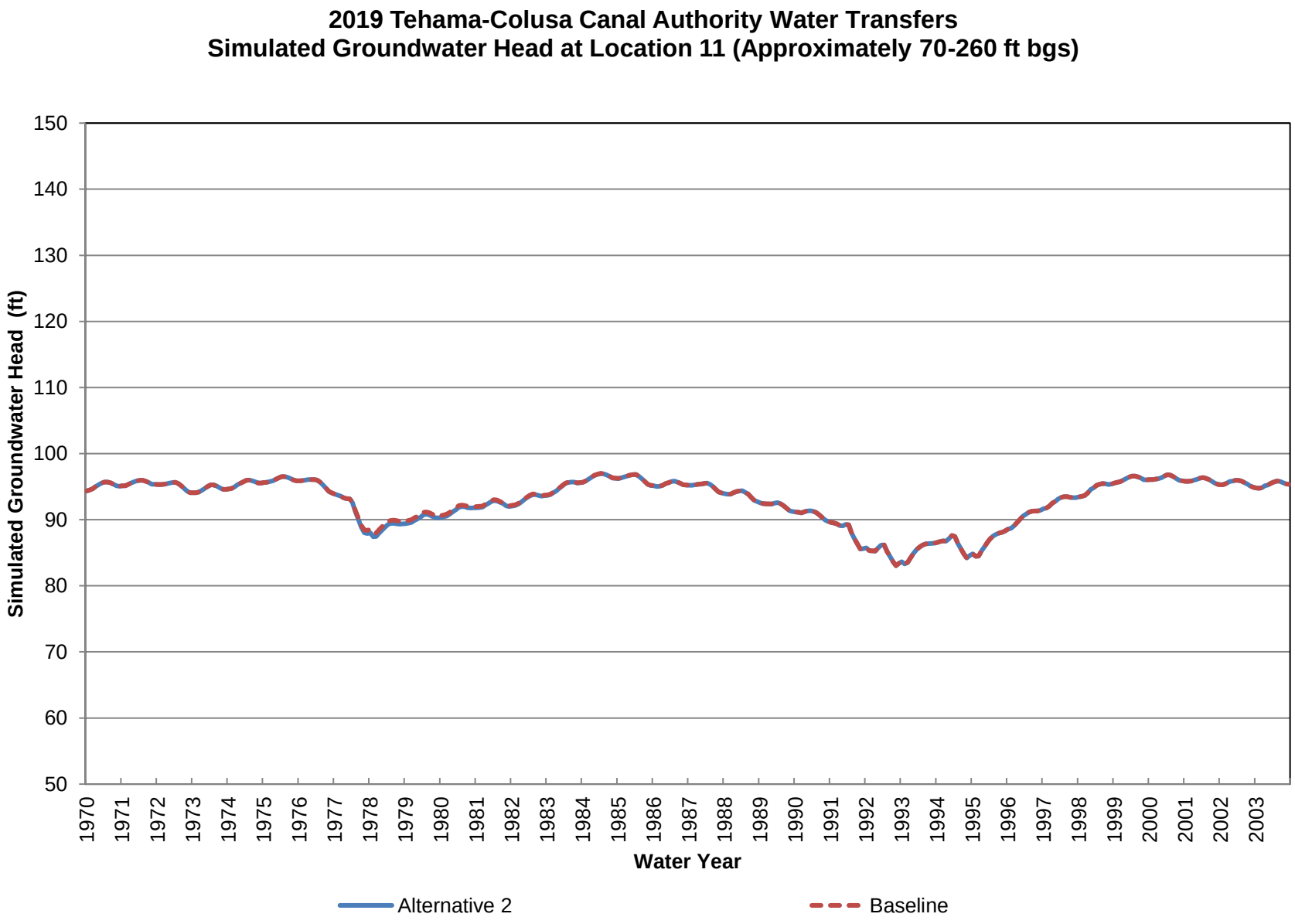
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 70-260 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
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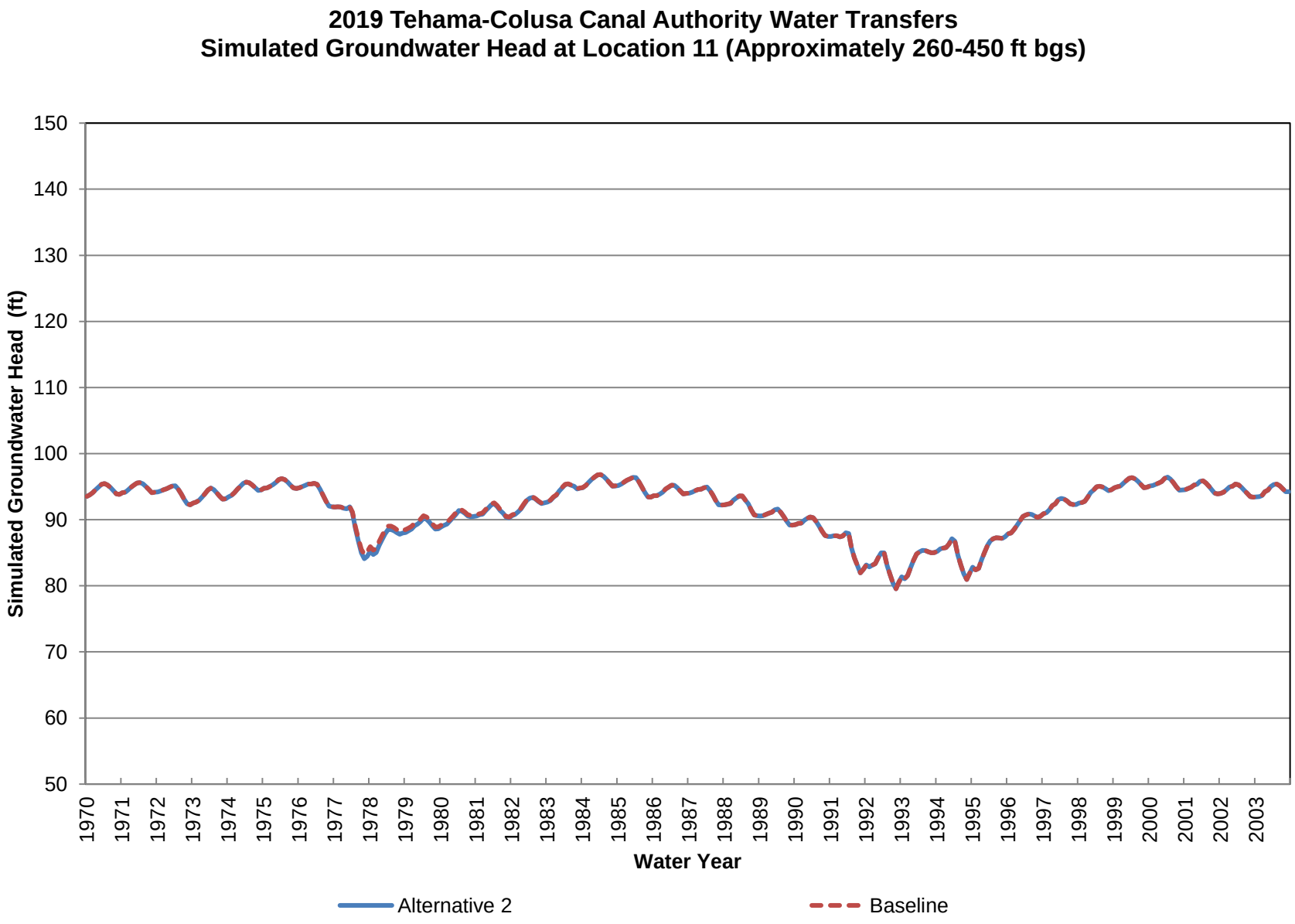
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 260-450 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
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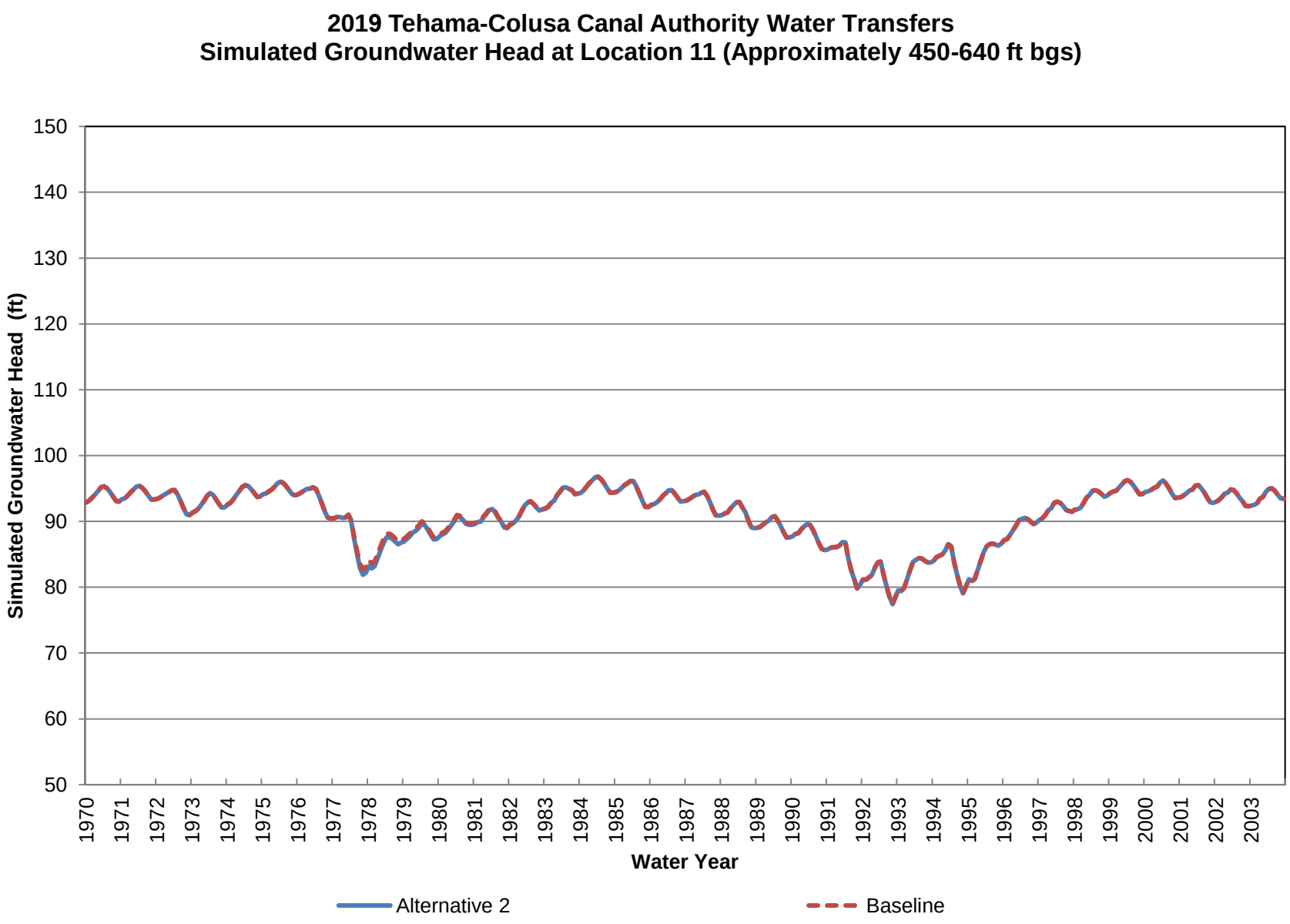
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 450-640 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
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1970
1971
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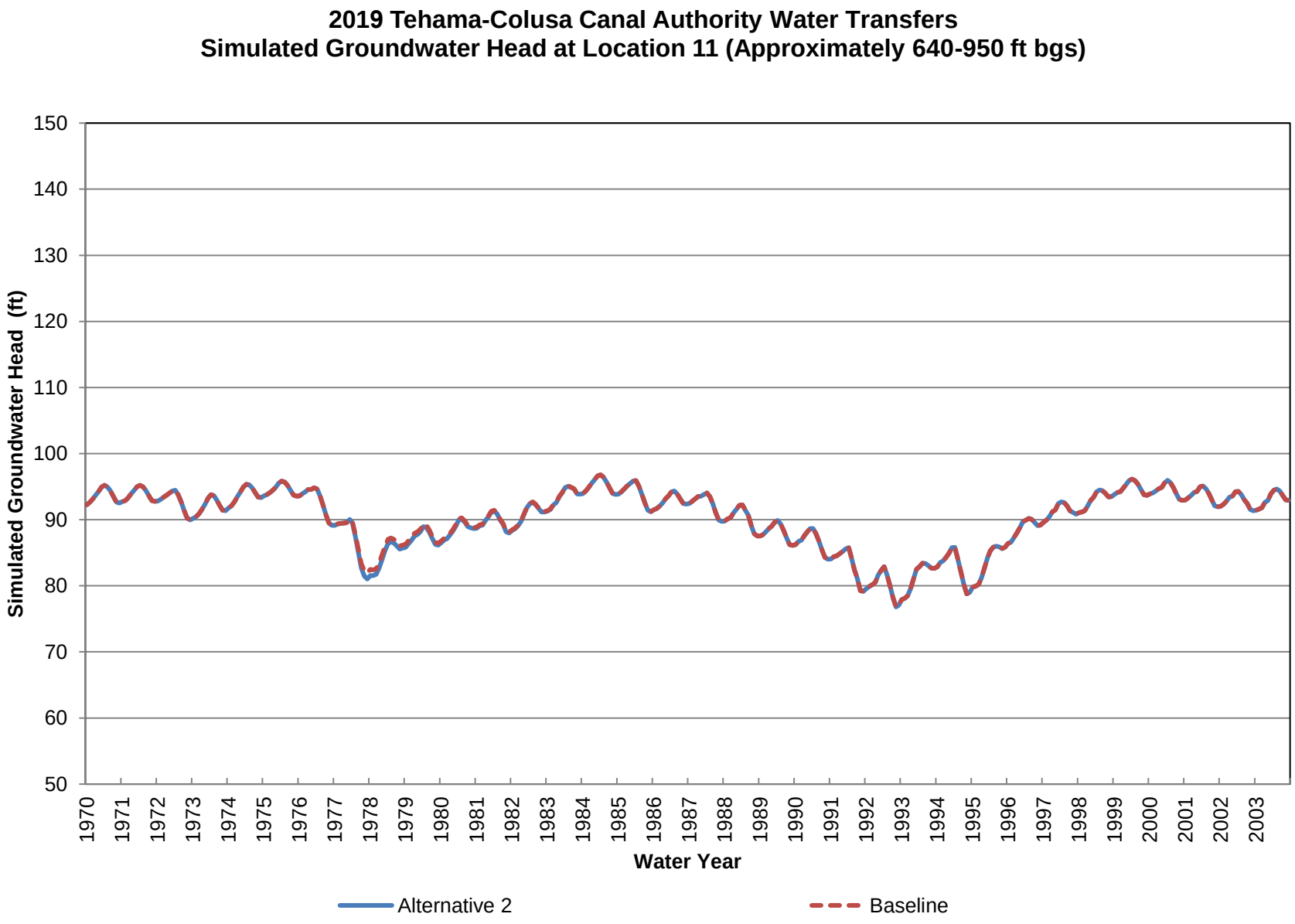
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 640-950 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
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100
90
80
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60
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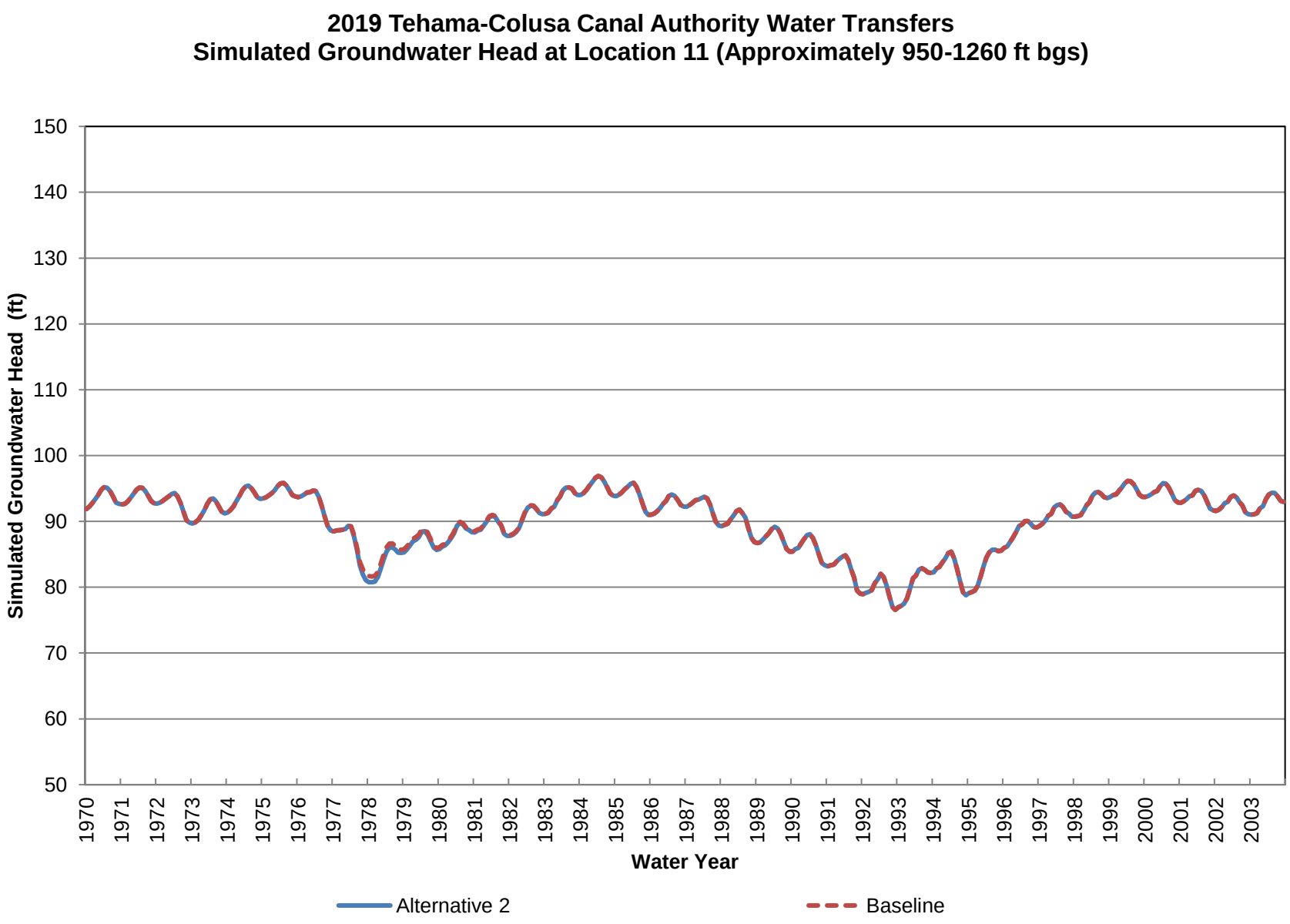
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 950-1260 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
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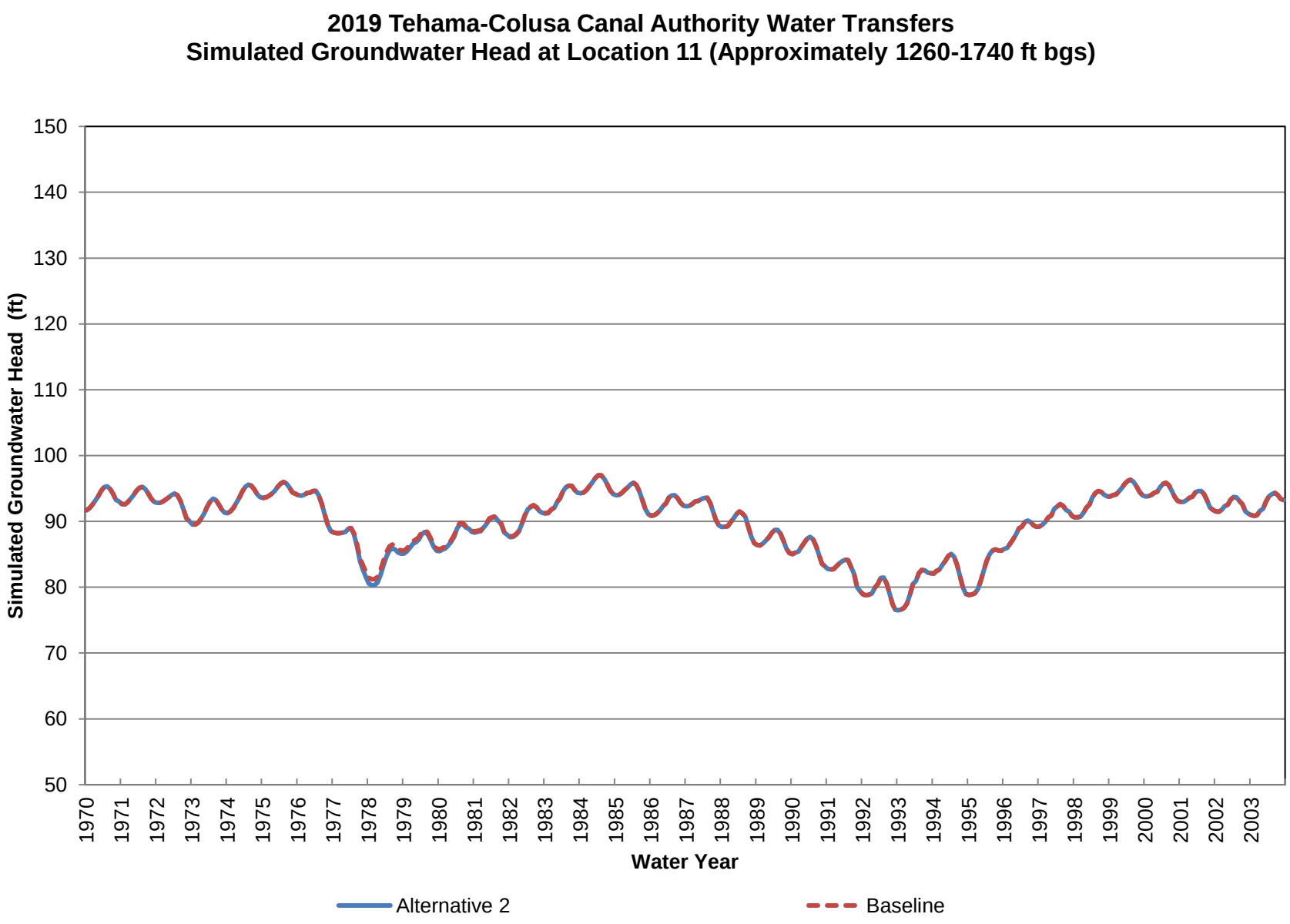
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 1260-1740 ft bgs)
Simulated Groundwater Head (ft)
150
140
130
120
110
100
90
80
70
60
50
1970
1971
1972
1973
1974
1975
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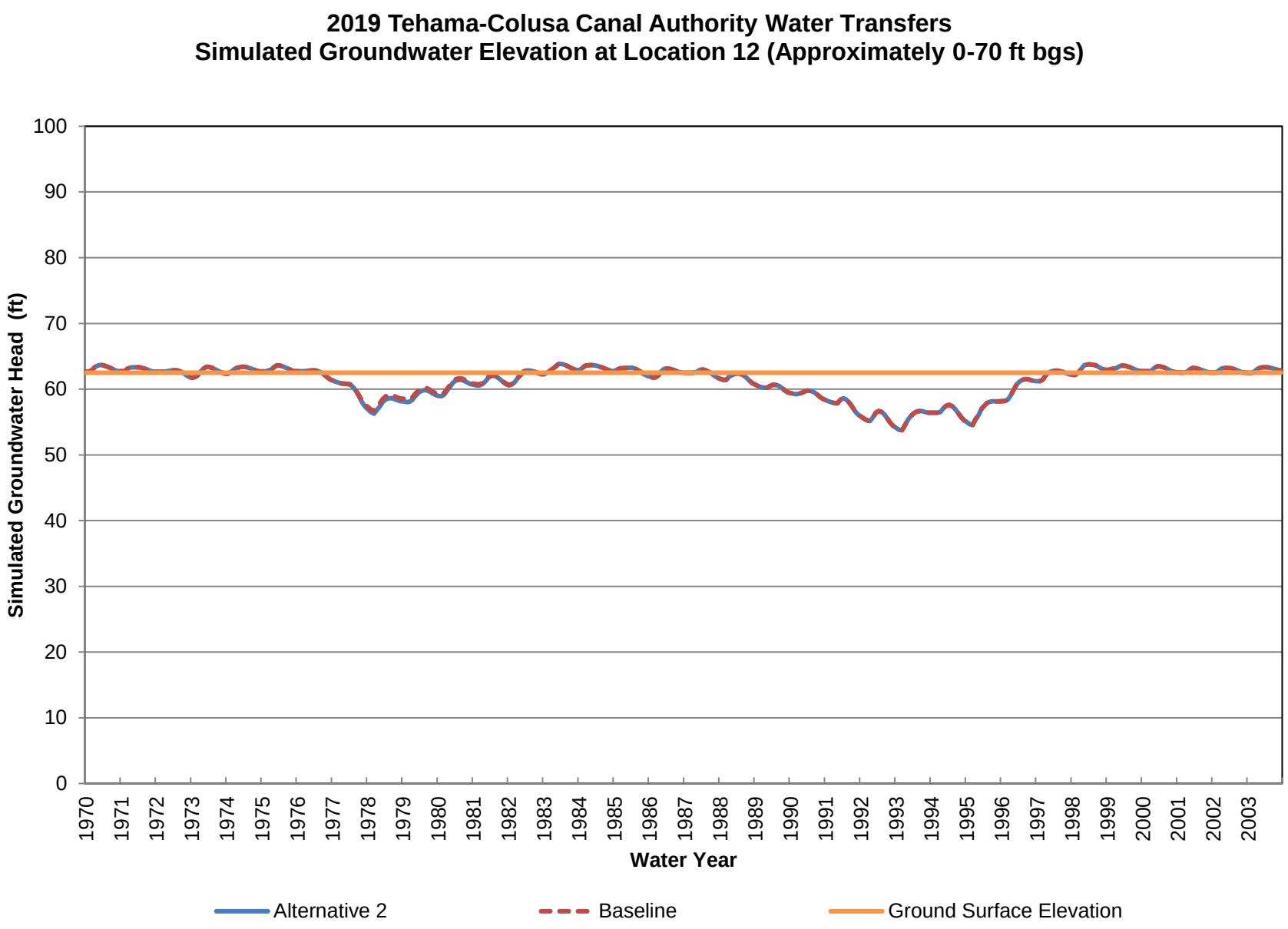
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 12 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
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1970
1971
1972
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1974
1975
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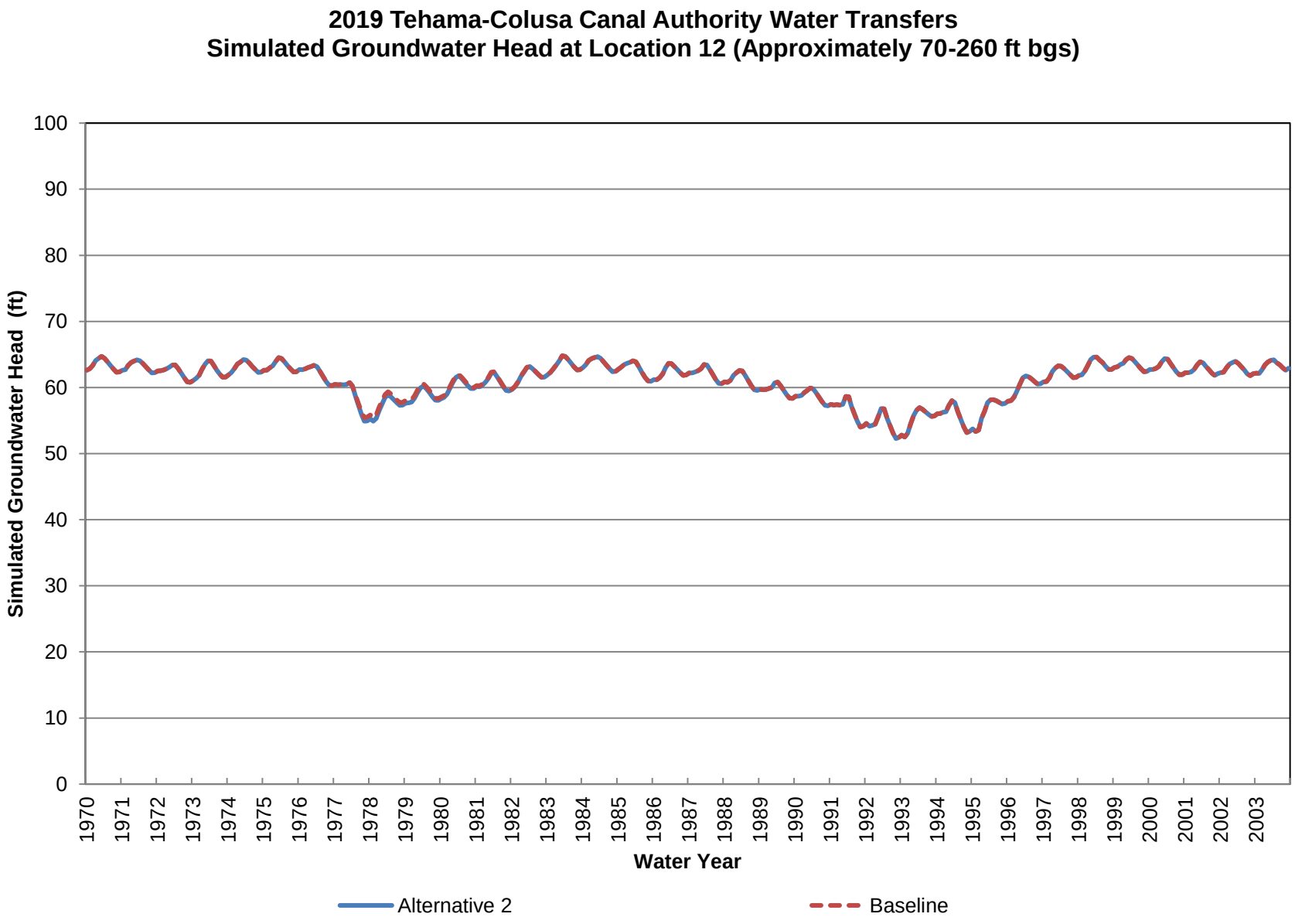
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 12 (Approximately 70-260 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
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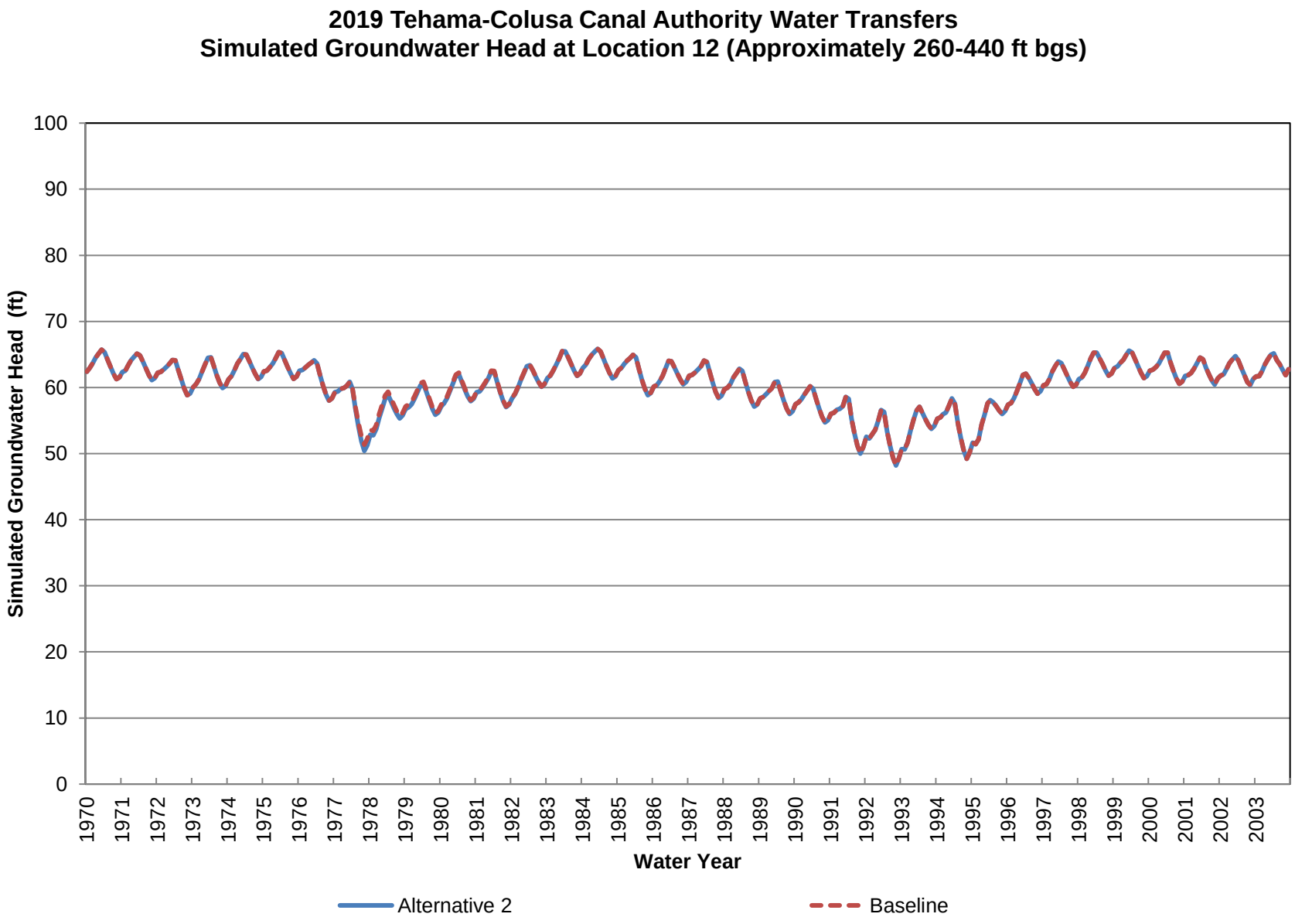
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 12 (Approximately 260-440 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
1977
1978
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1980
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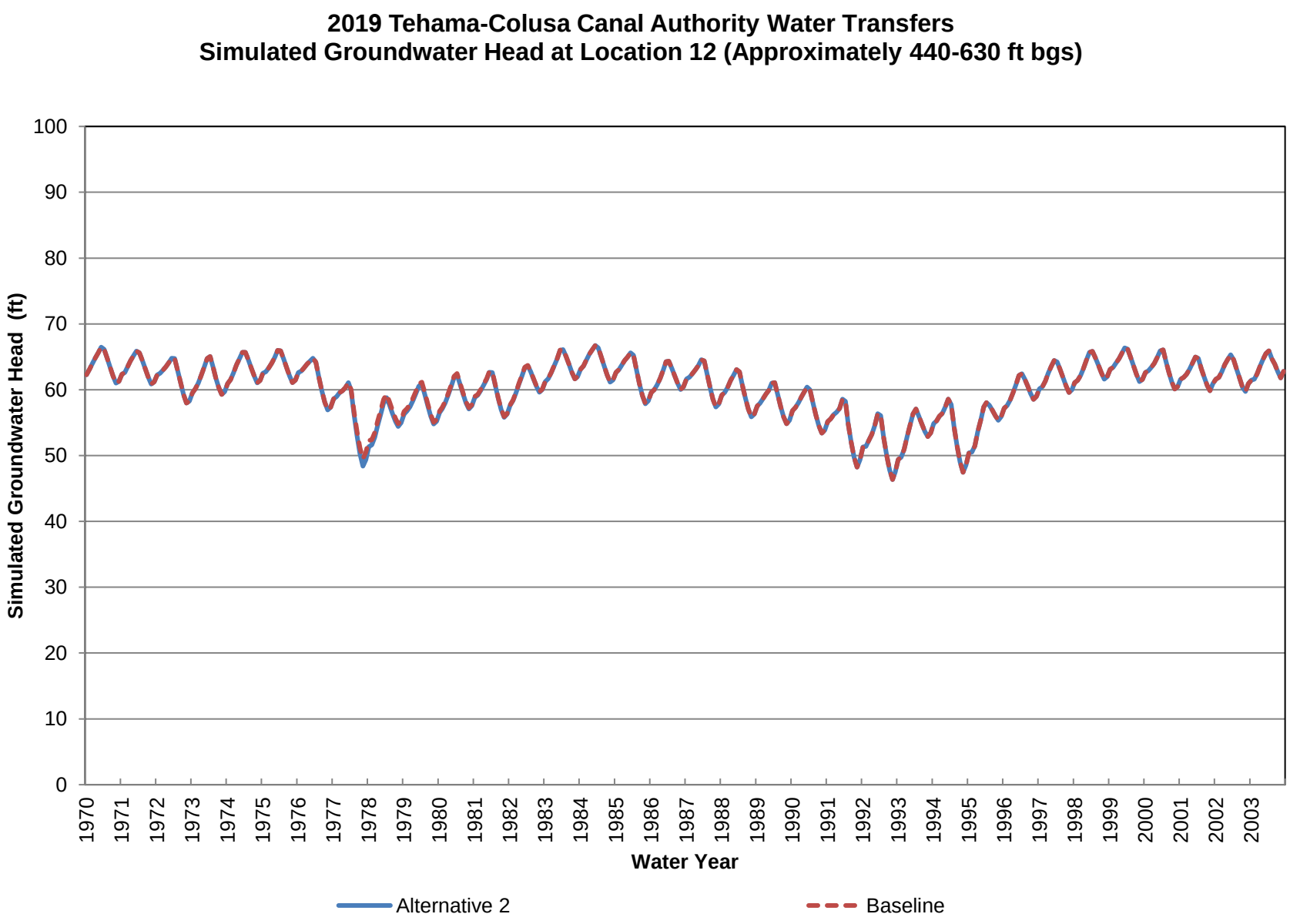
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 12 (Approximately 440-630 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
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1999
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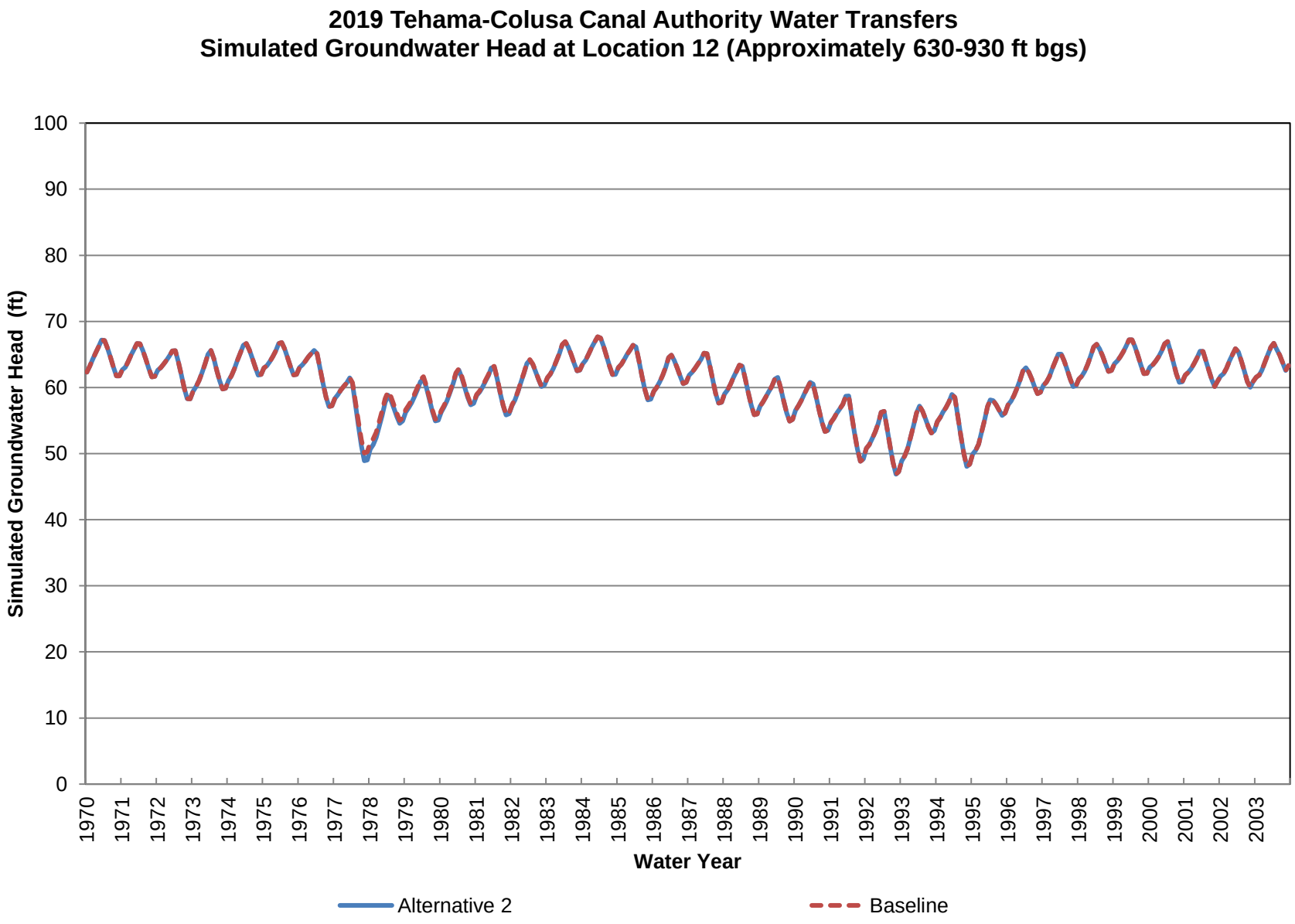
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 12 (Approximately 630-930 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
1975
1976
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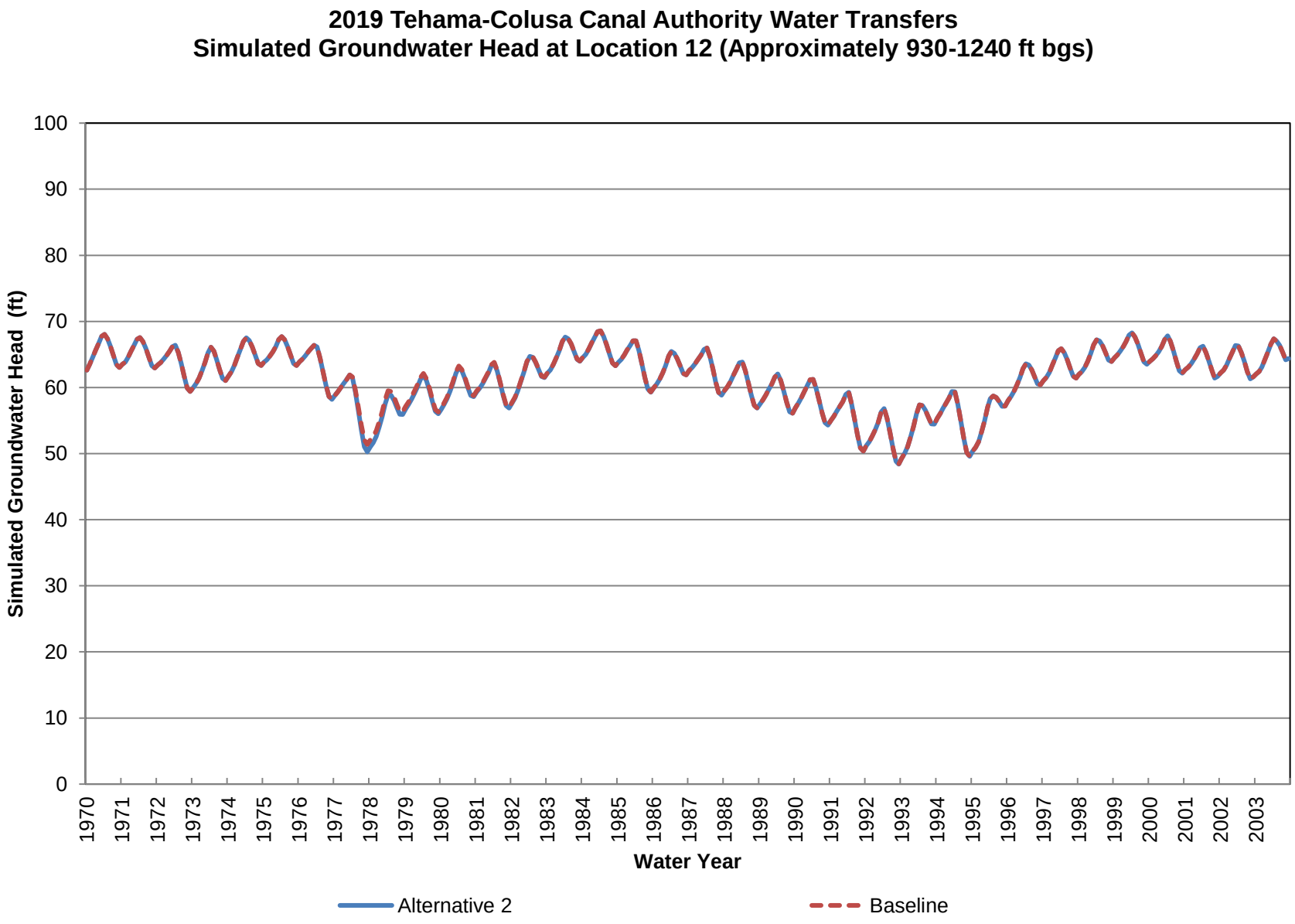
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 12 (Approximately 930-1240 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
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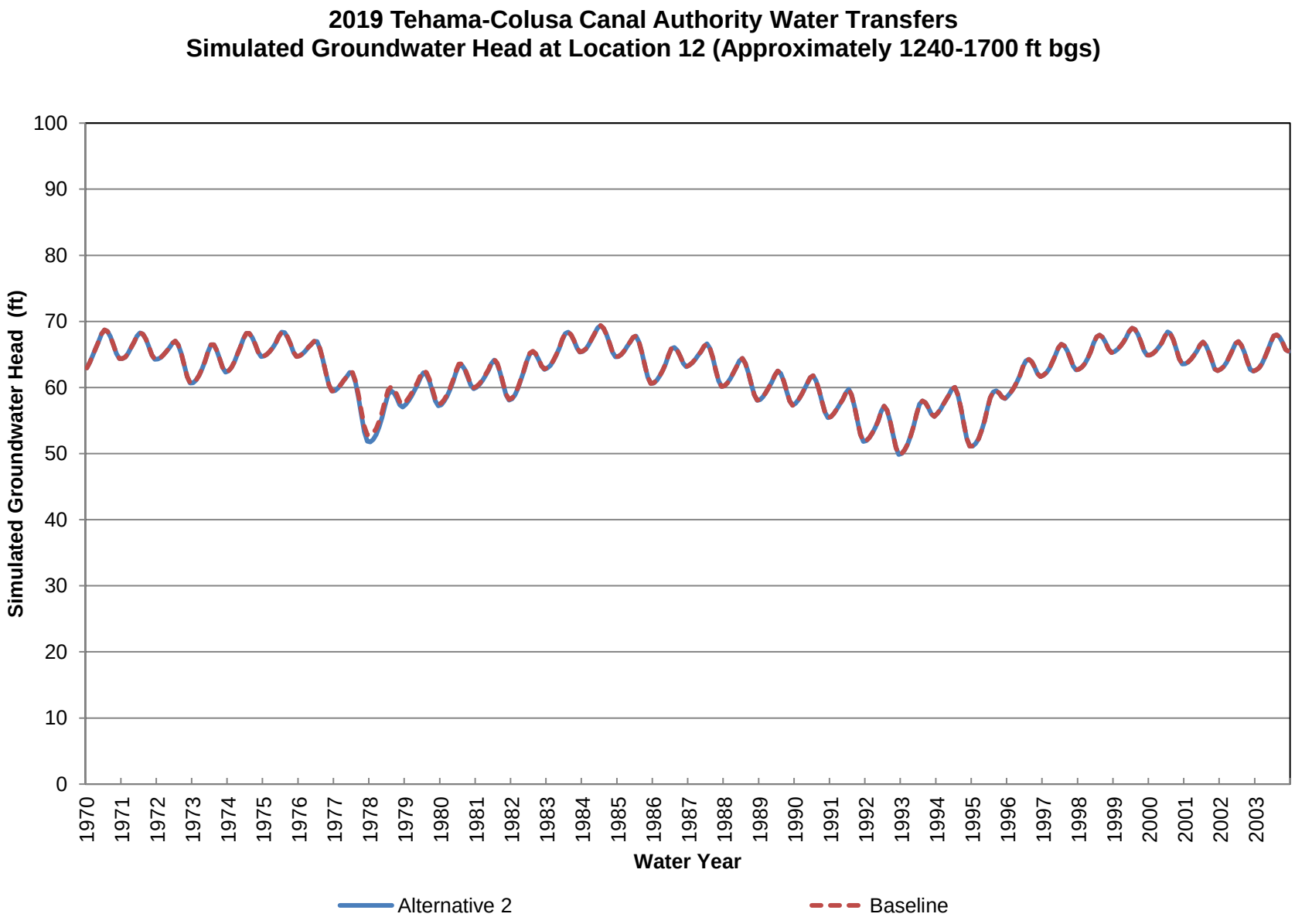
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 12 (Approximately 1240-1700 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
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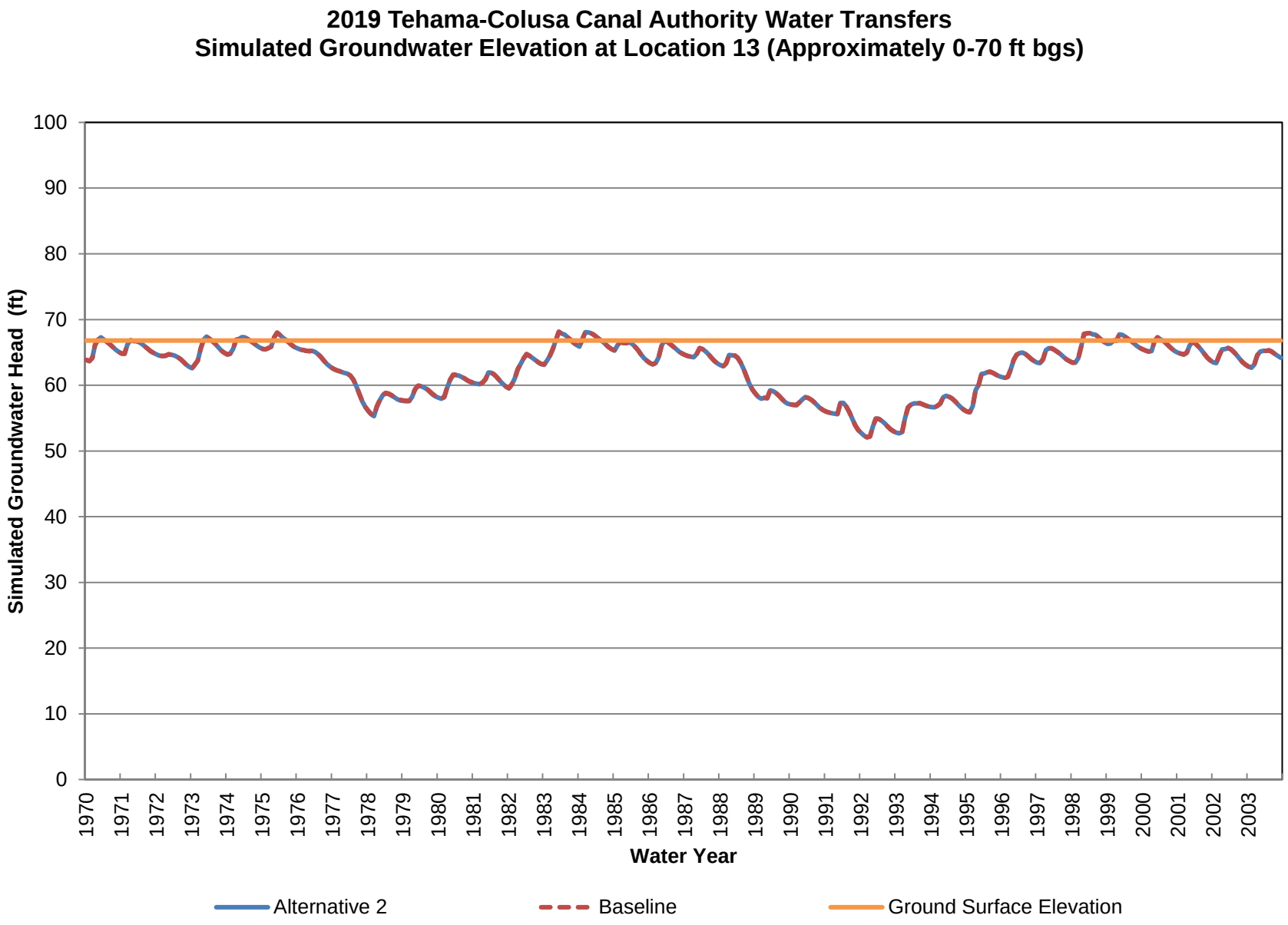
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 13 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
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0
1970
1971
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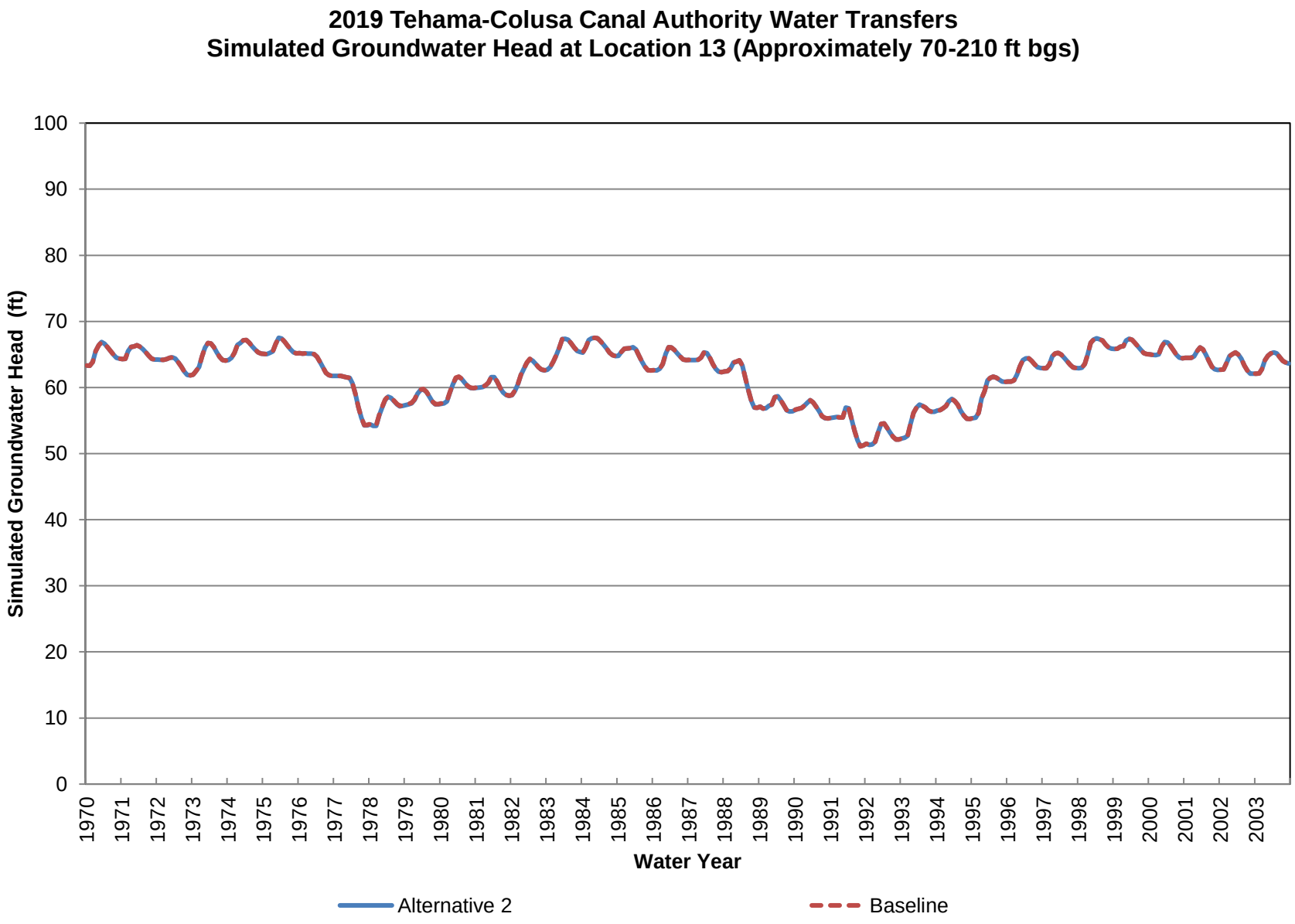
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 70-210 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
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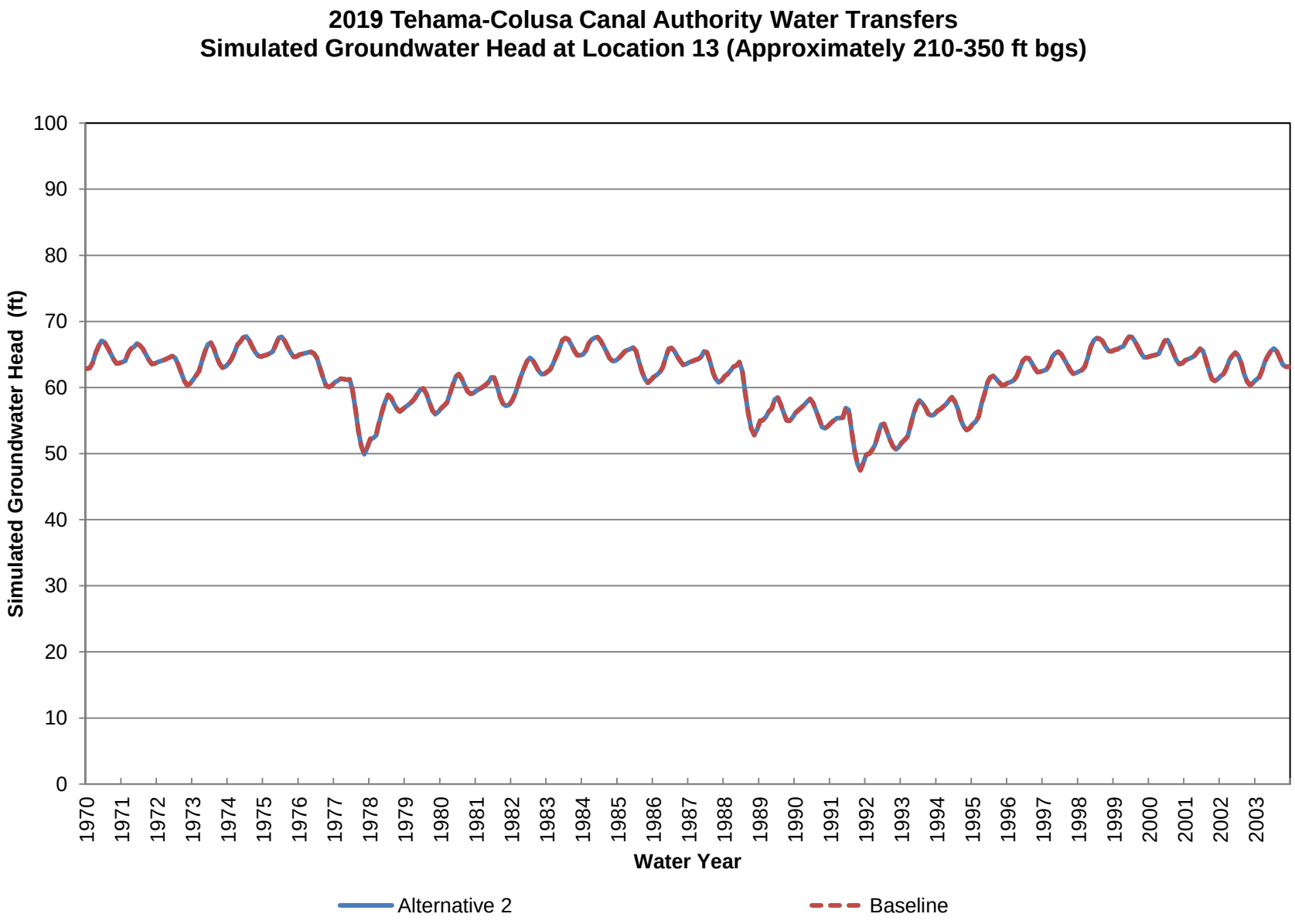
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 210-350 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
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0
1970
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1998
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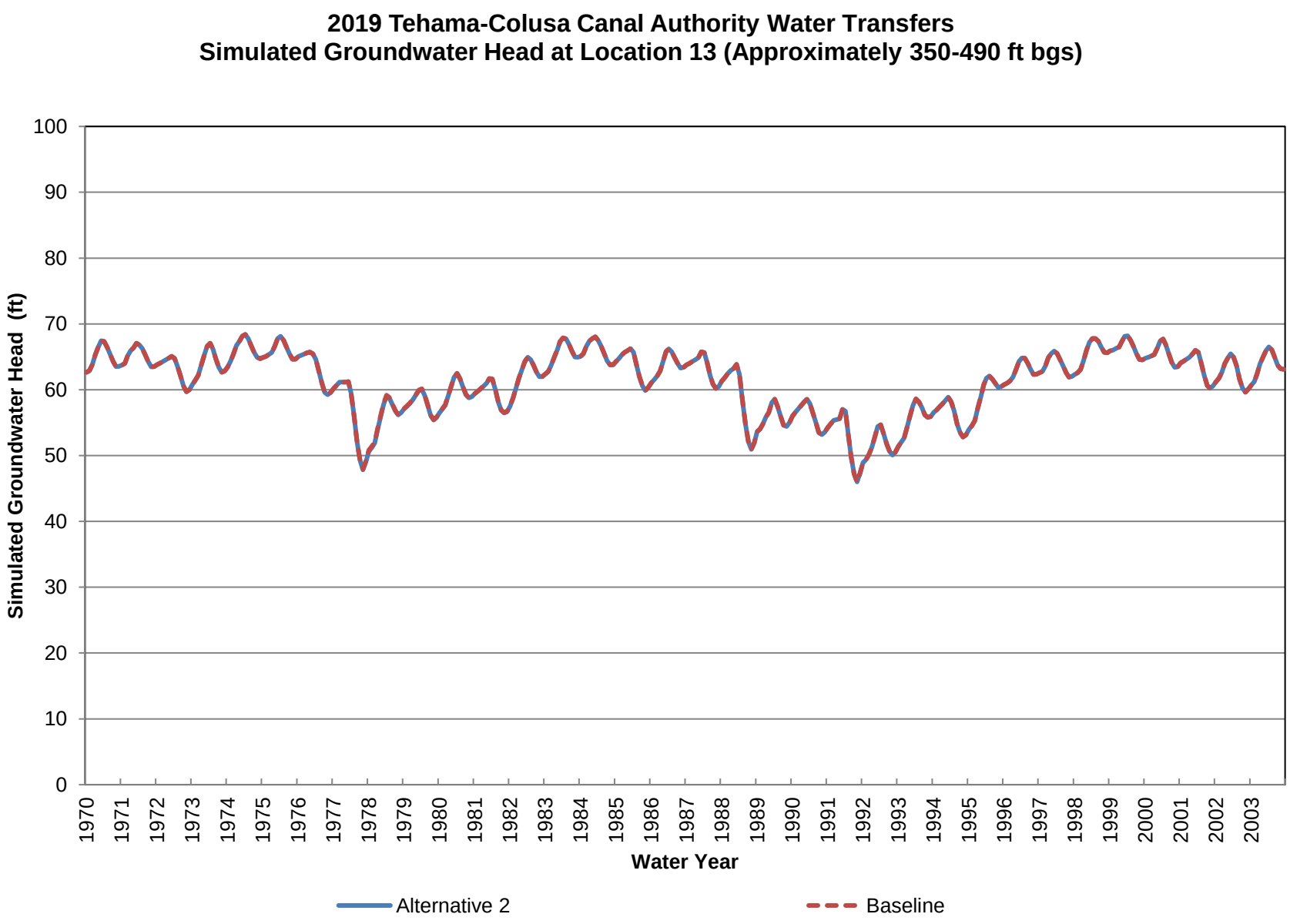
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 350-490 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
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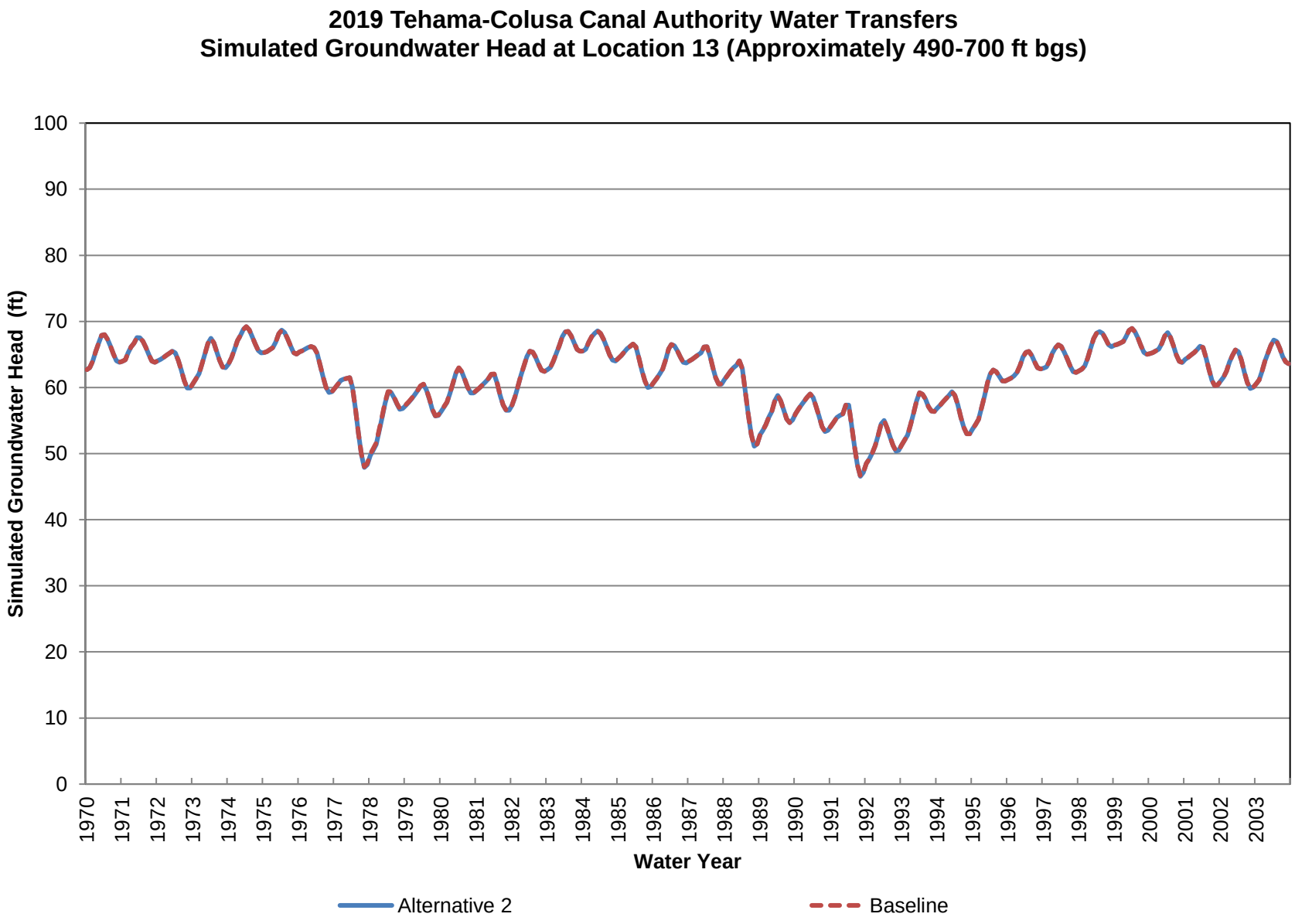
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 490-700 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
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20
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1970
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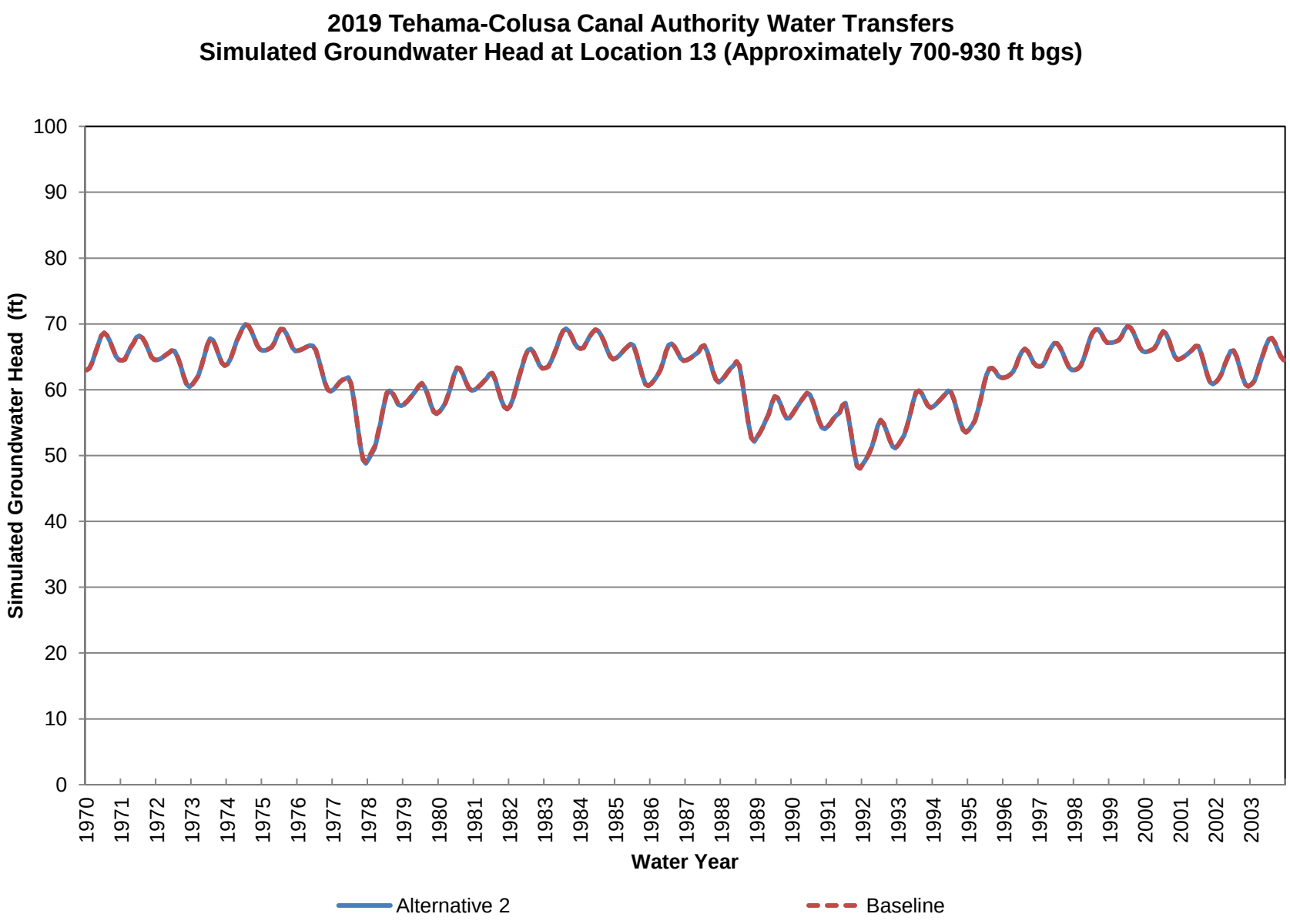
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 700-930 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
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1974
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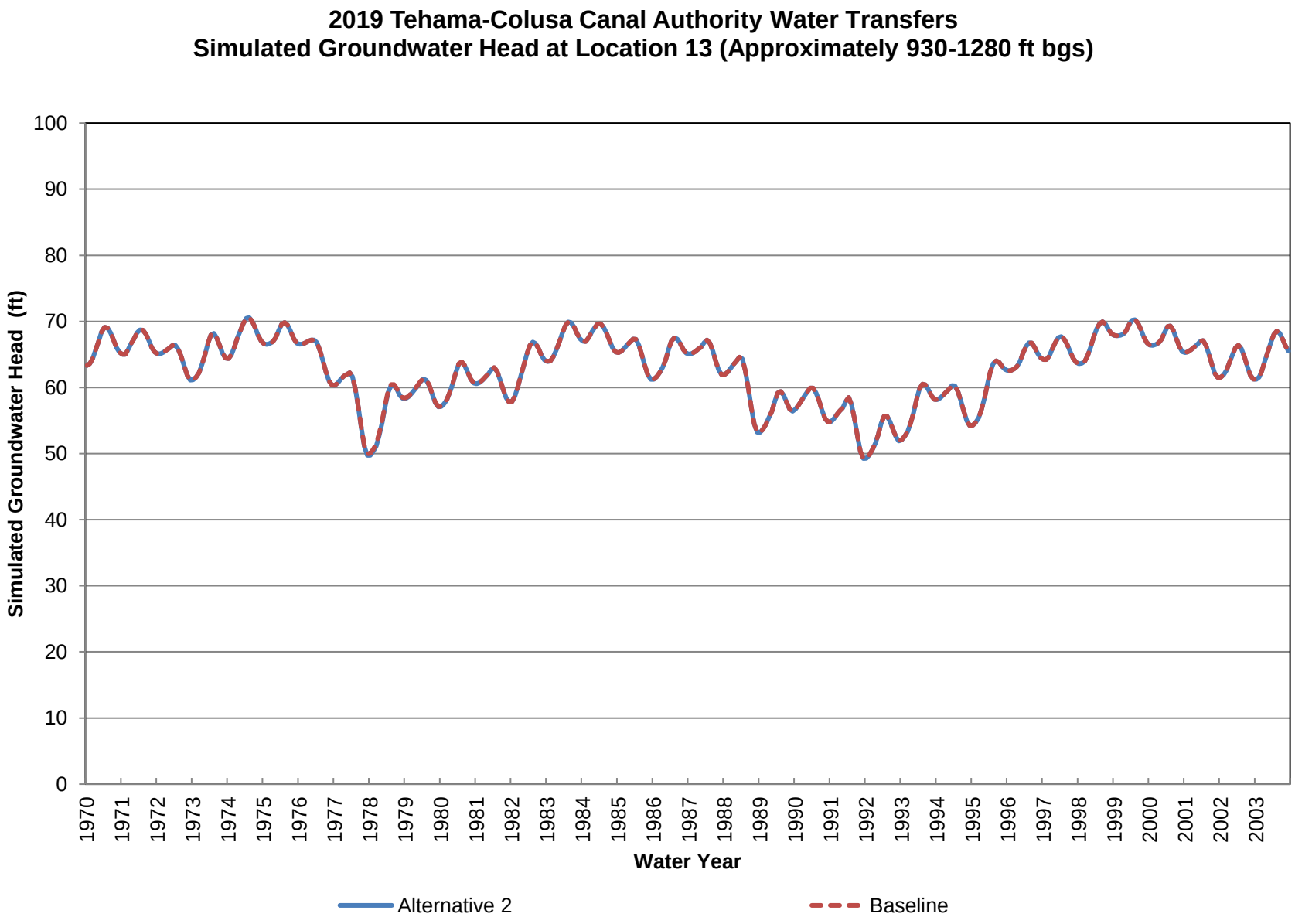
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 930-1280 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
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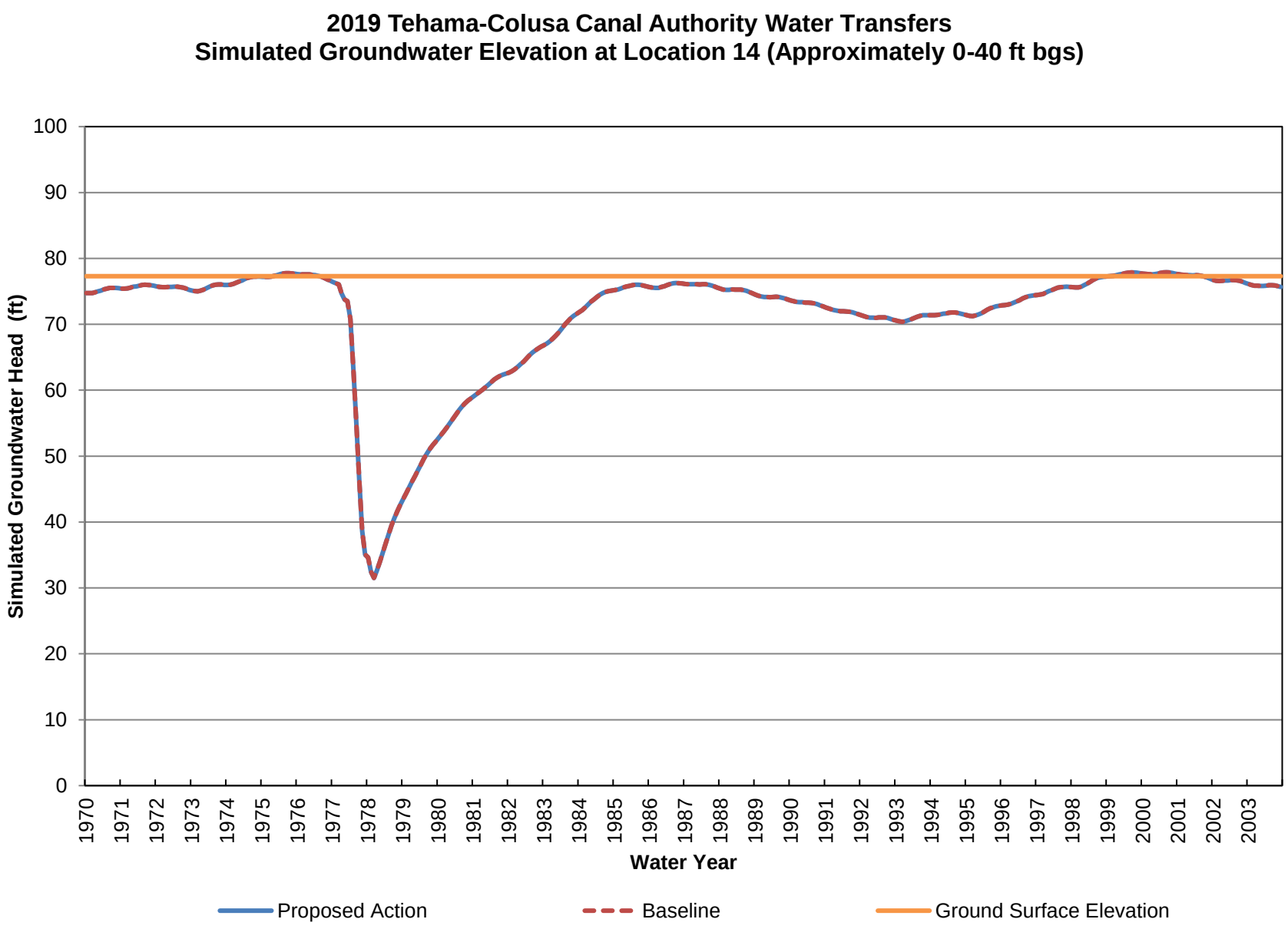
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 14 (Approximately 0-40 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
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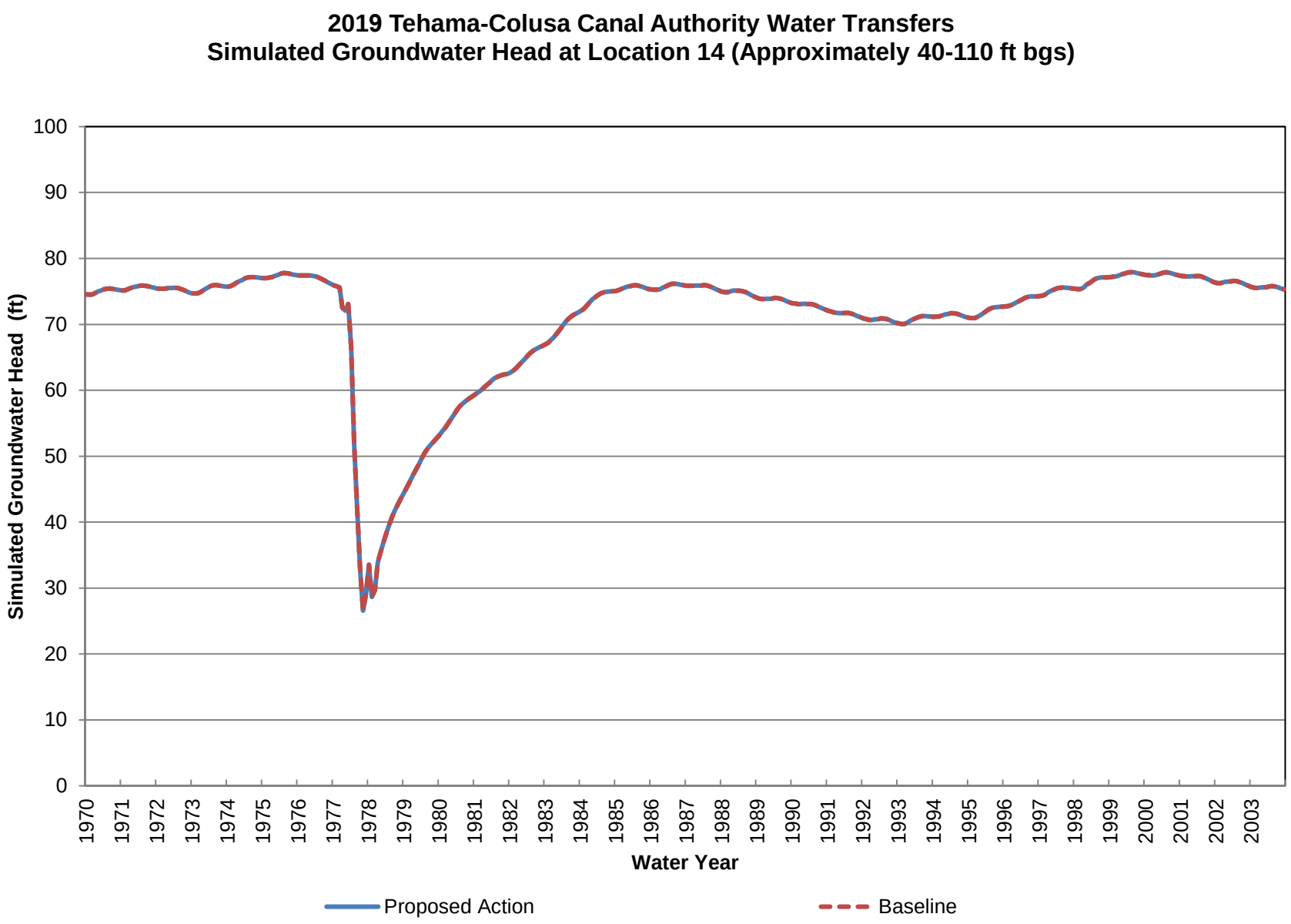
1998
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 40-110 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
1973
1974
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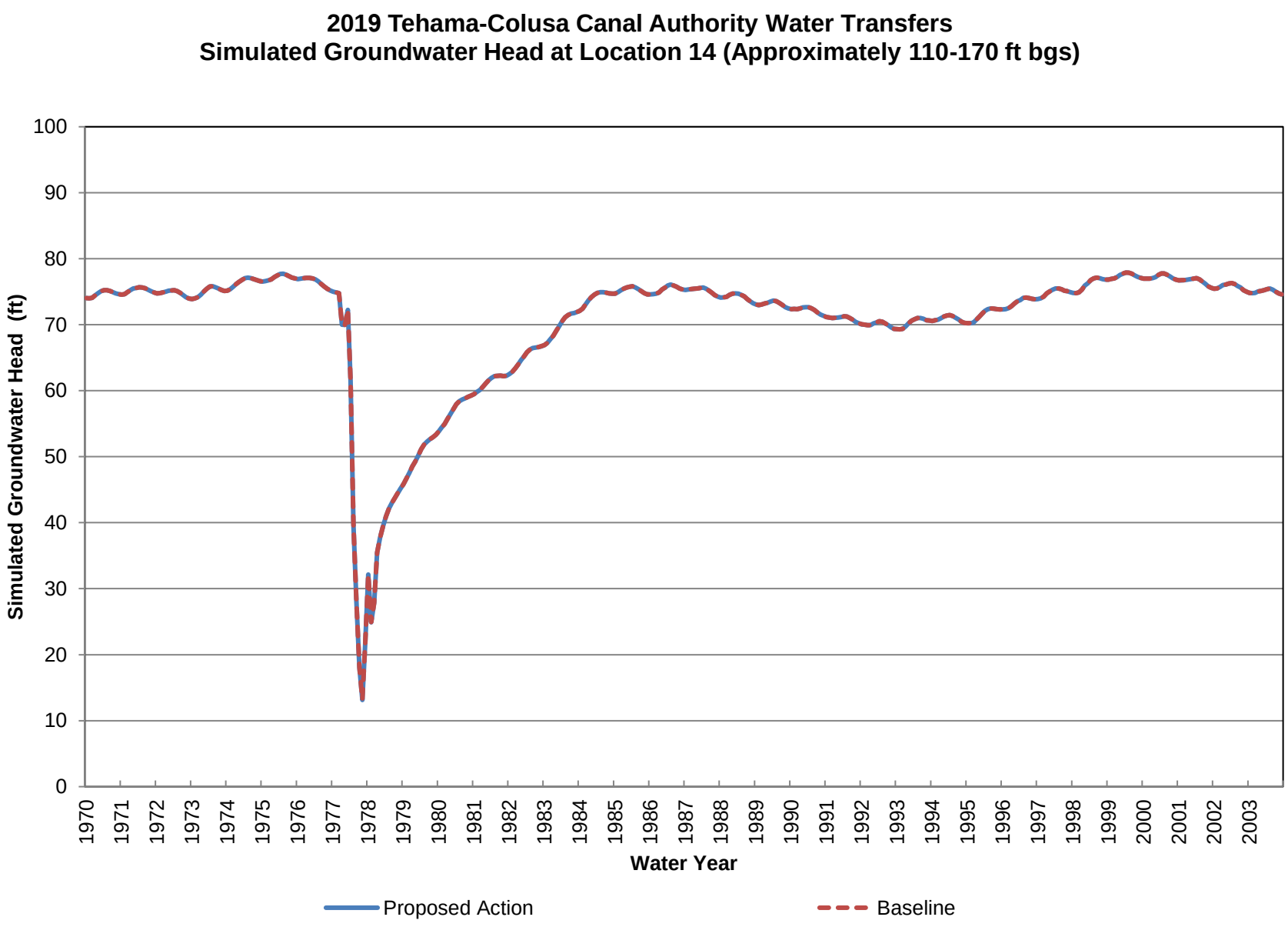
1997
1998
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 110-170 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
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1974
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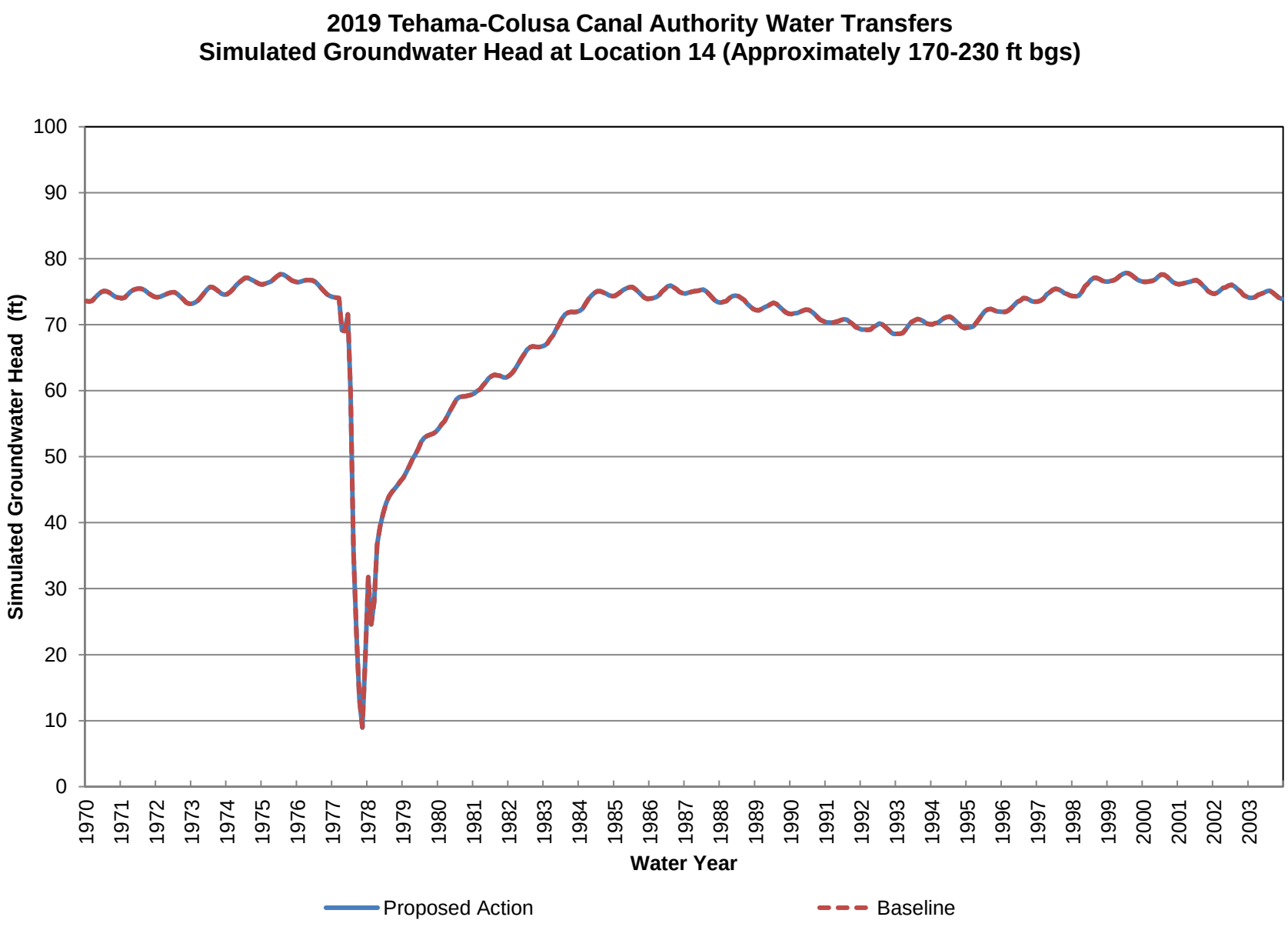
1997
1998
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 170-230 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
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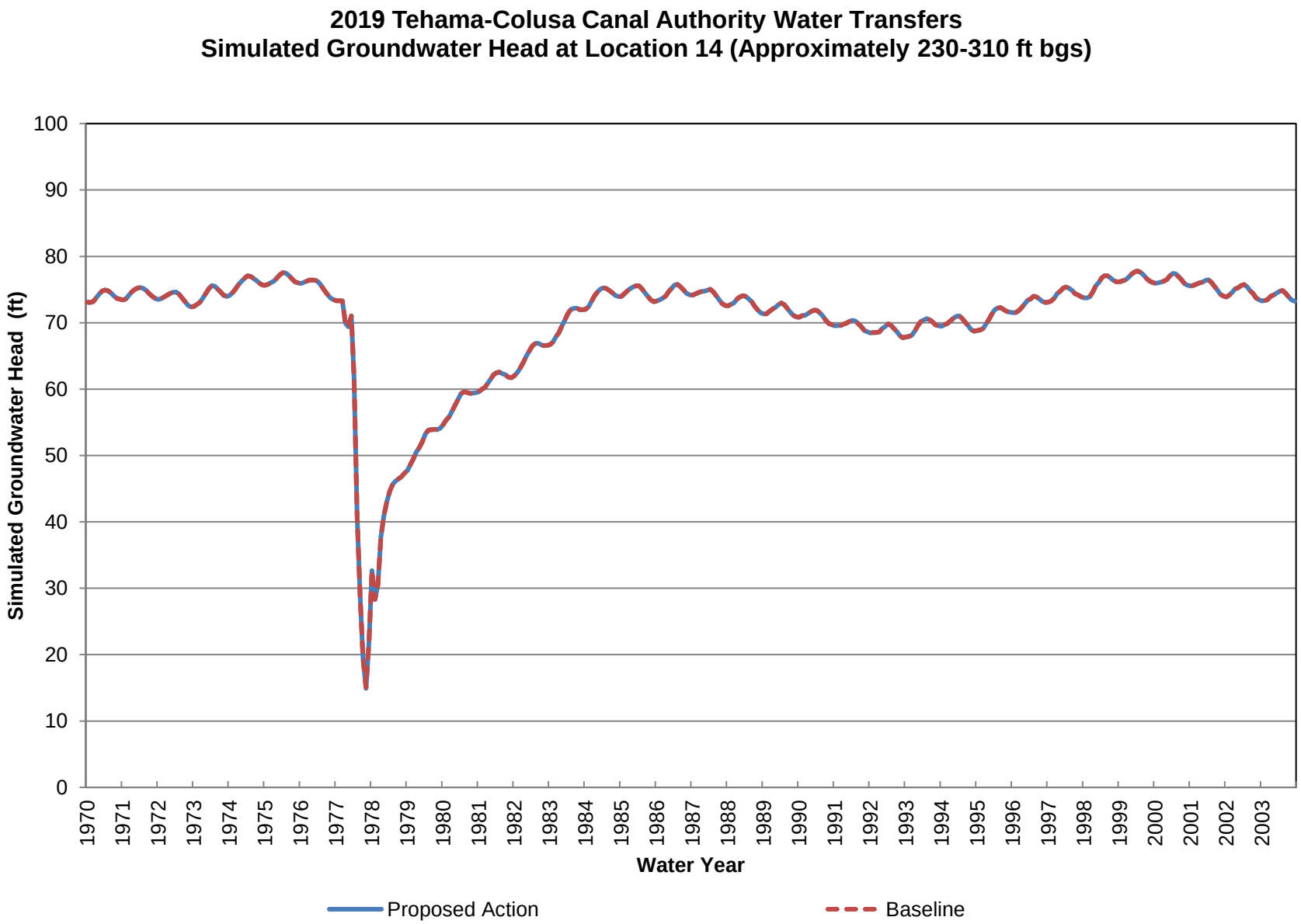
1998
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 230-310 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
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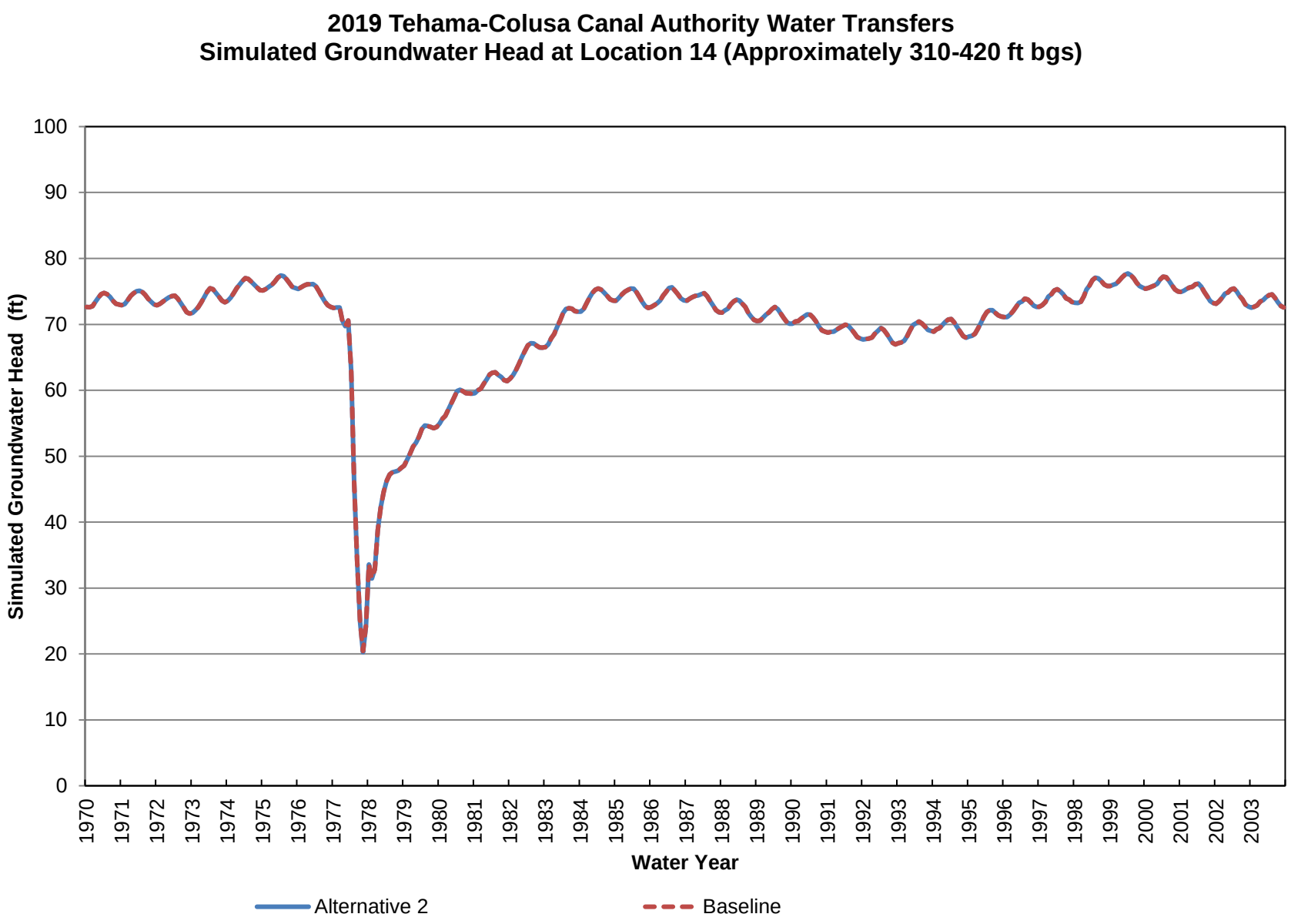
1998
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 310-420 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
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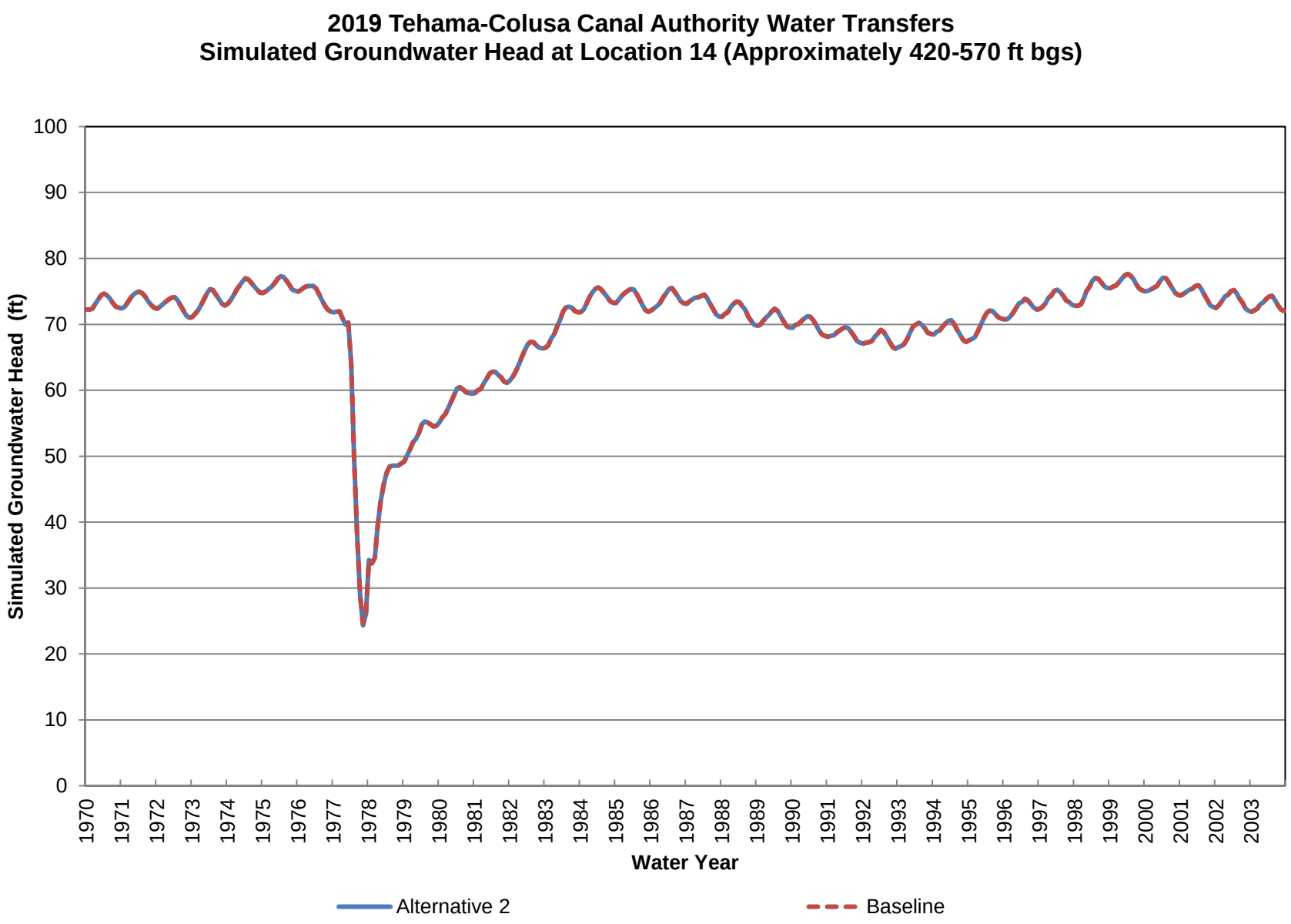
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 420-570 ft bgs)
Simulated Groundwater Head (ft)
100
90
80
70
60
50
40
30
20
10
0
1970
1971
1972
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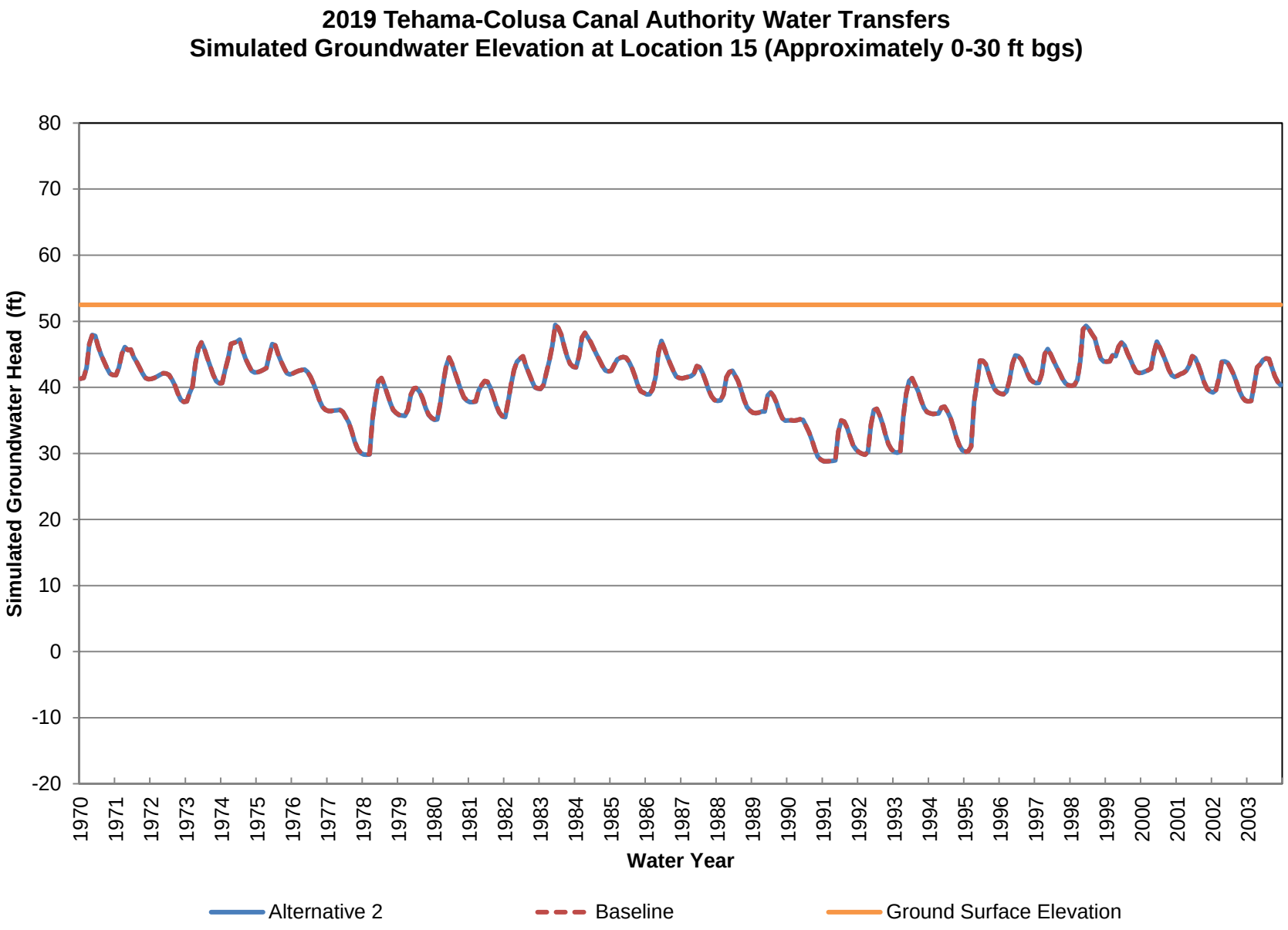
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 15 (Approximately 0-30 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
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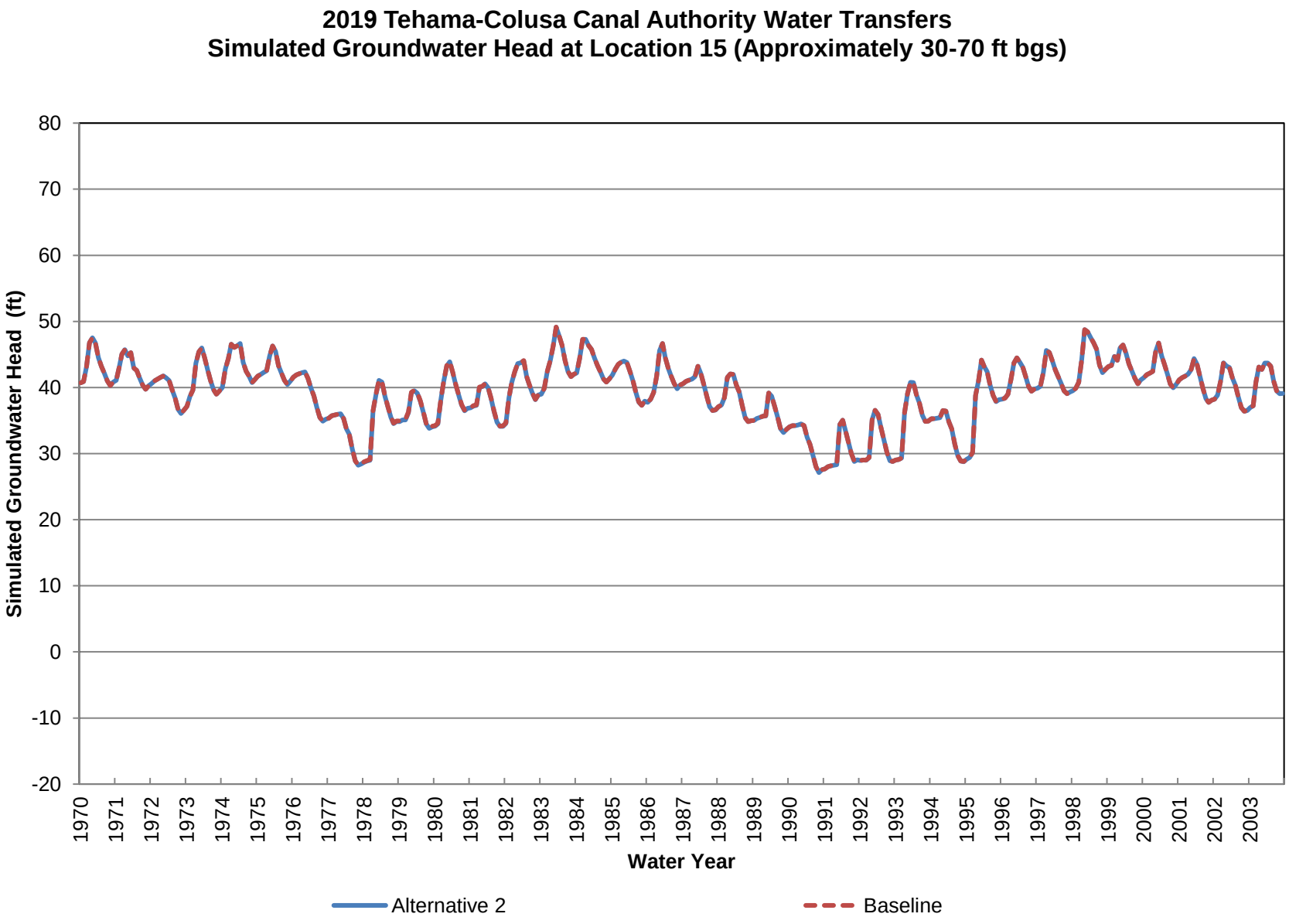
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 30-70 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
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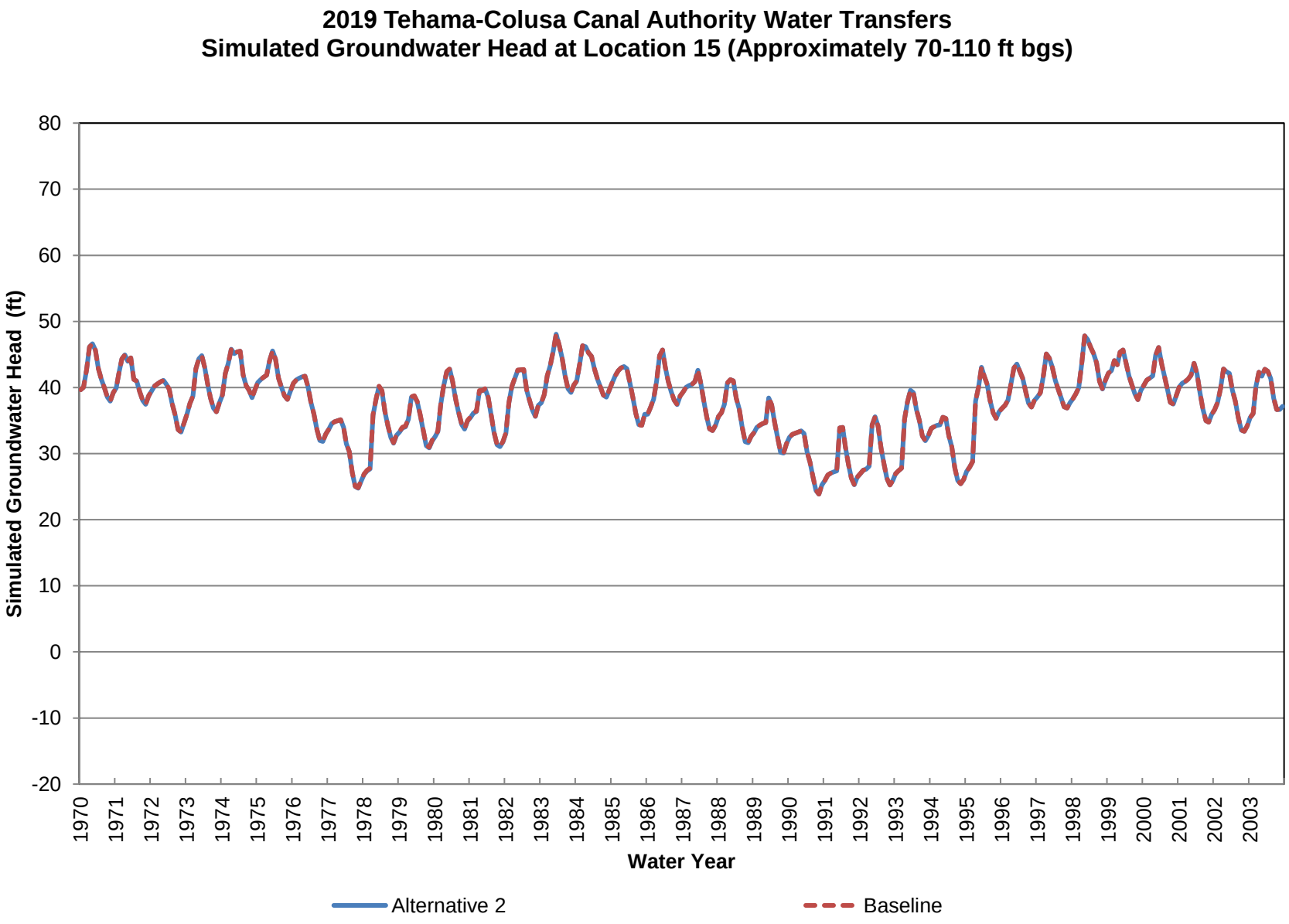
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 70-110 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
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30
20
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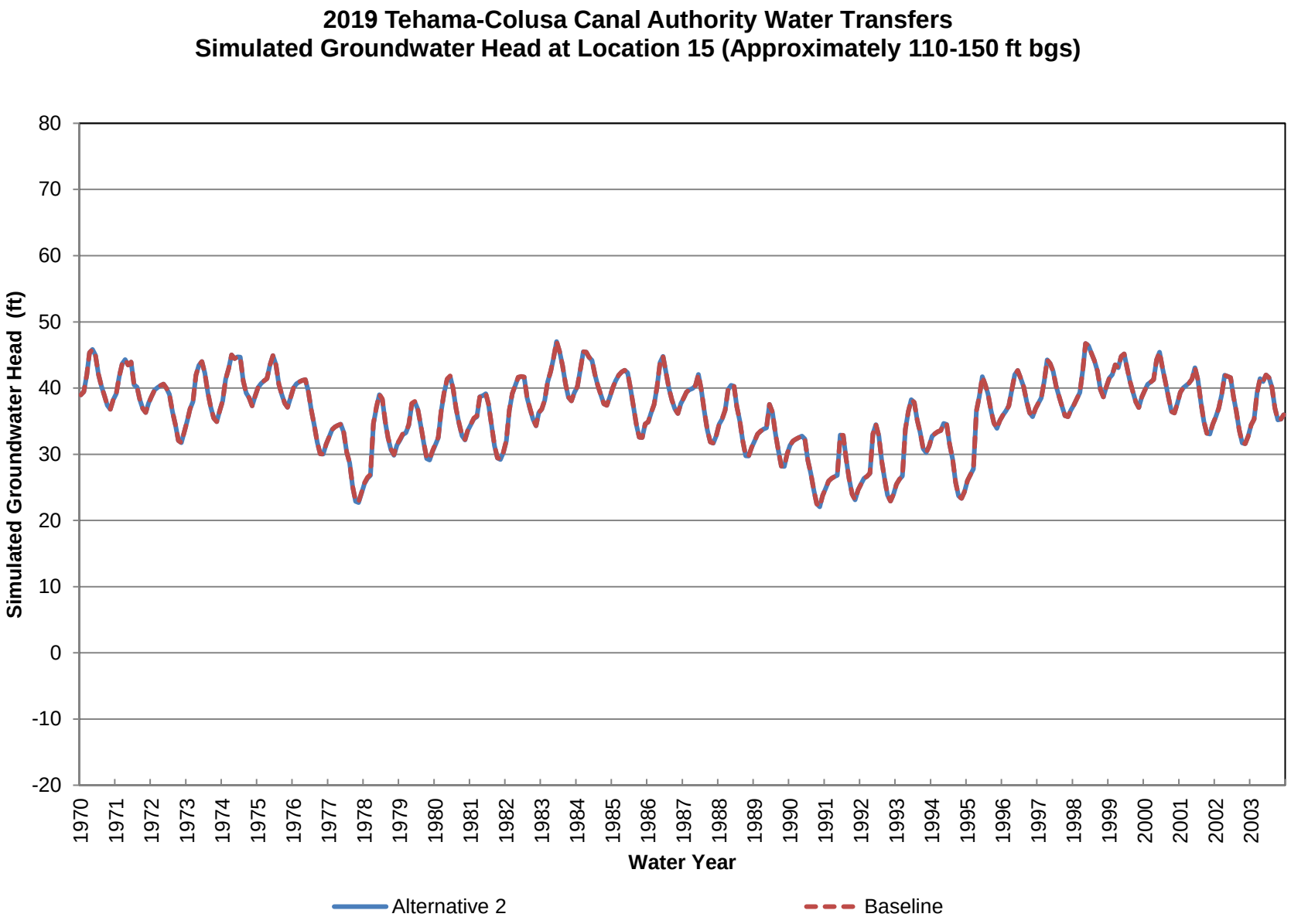
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 110-150 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
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1974
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1976
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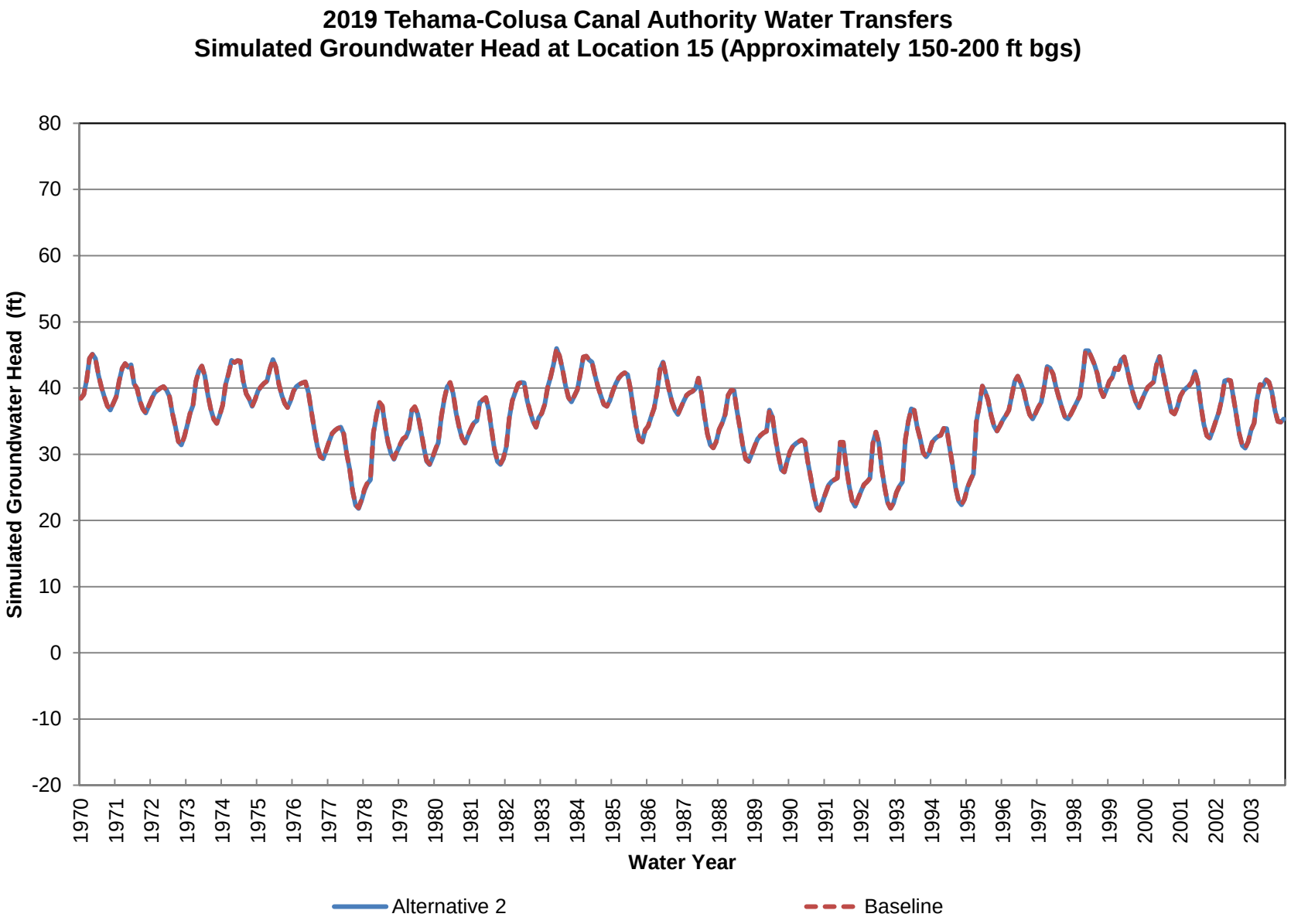
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 150-200 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
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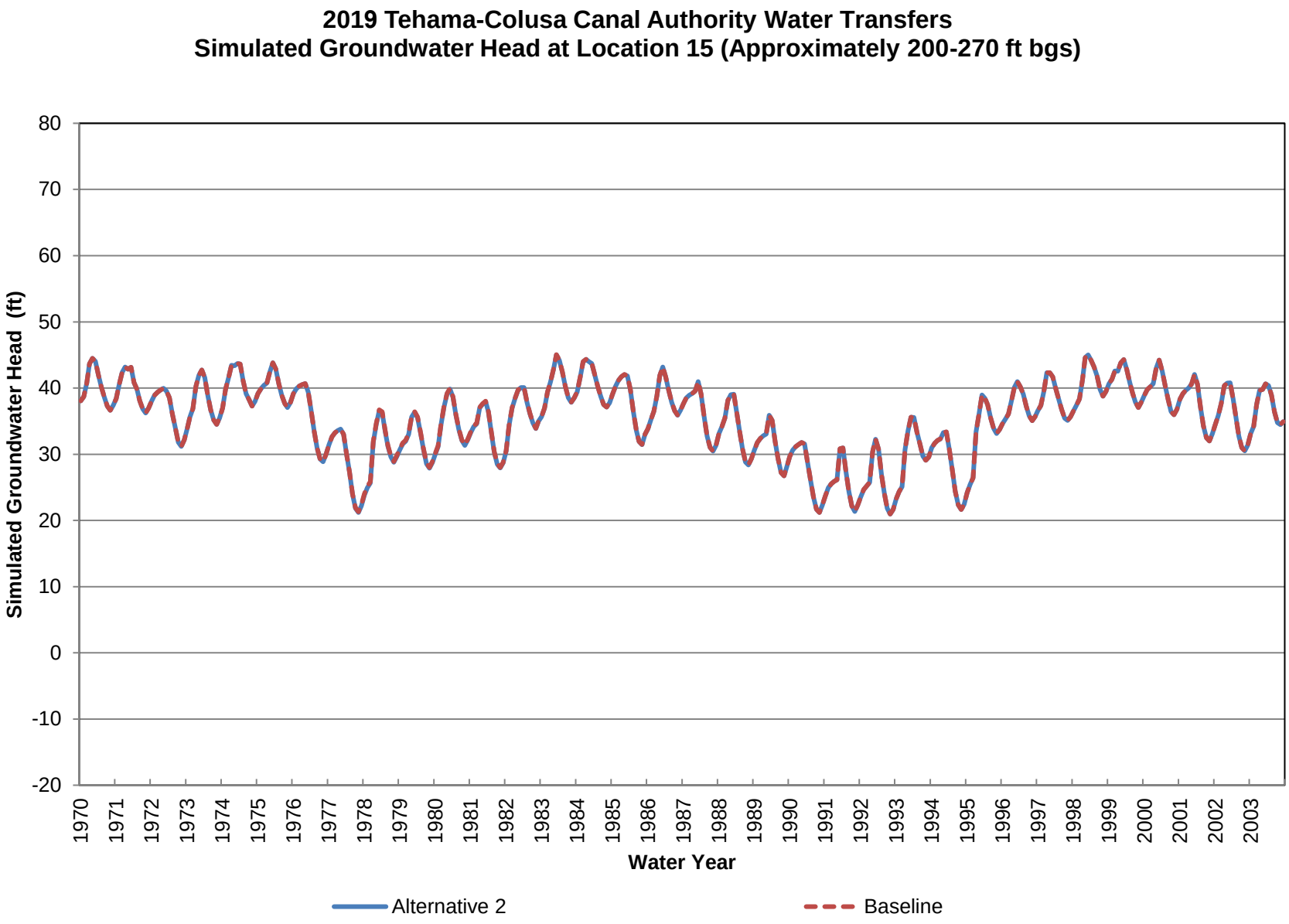
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 200-270 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
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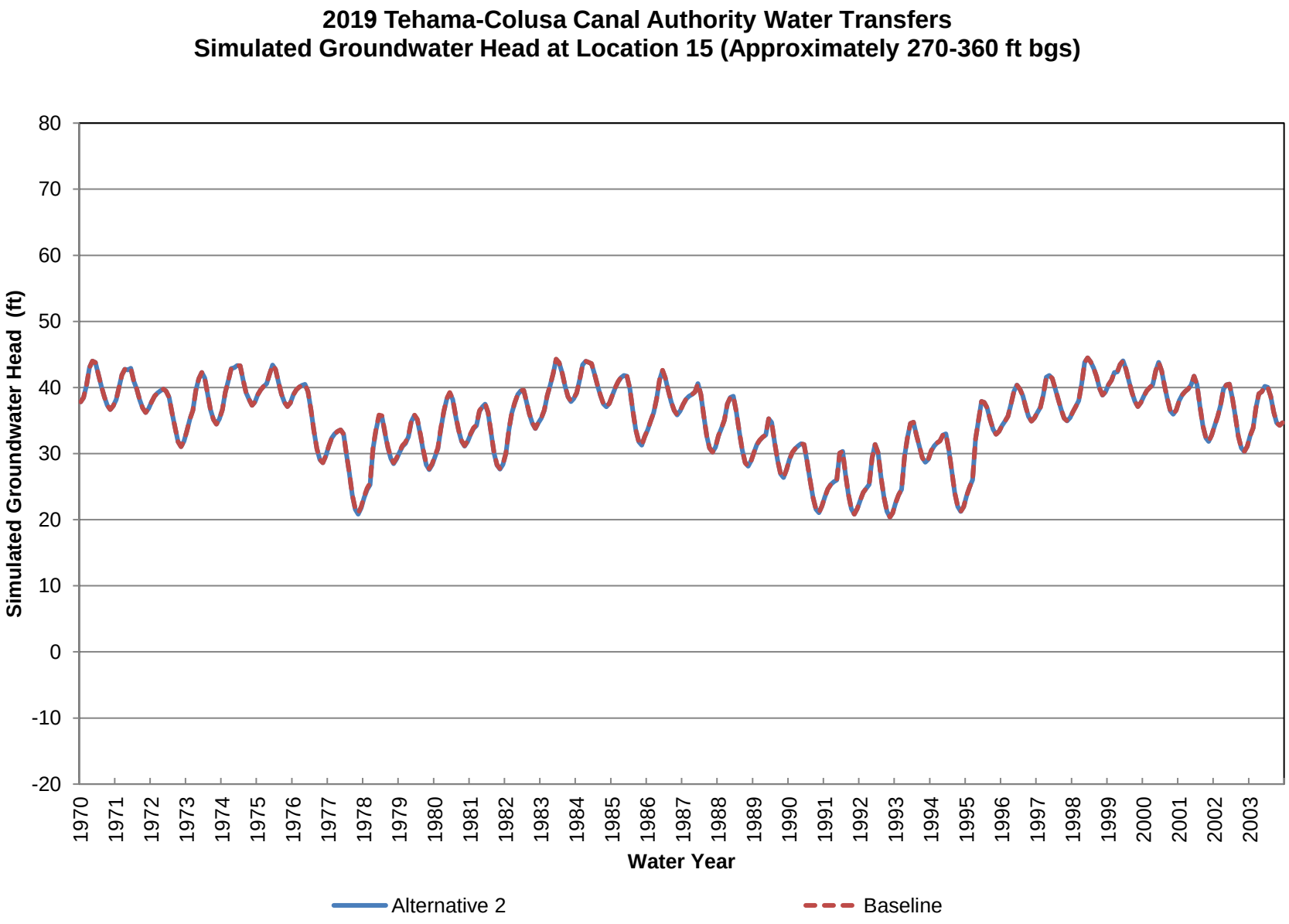
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 270-360 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
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1970
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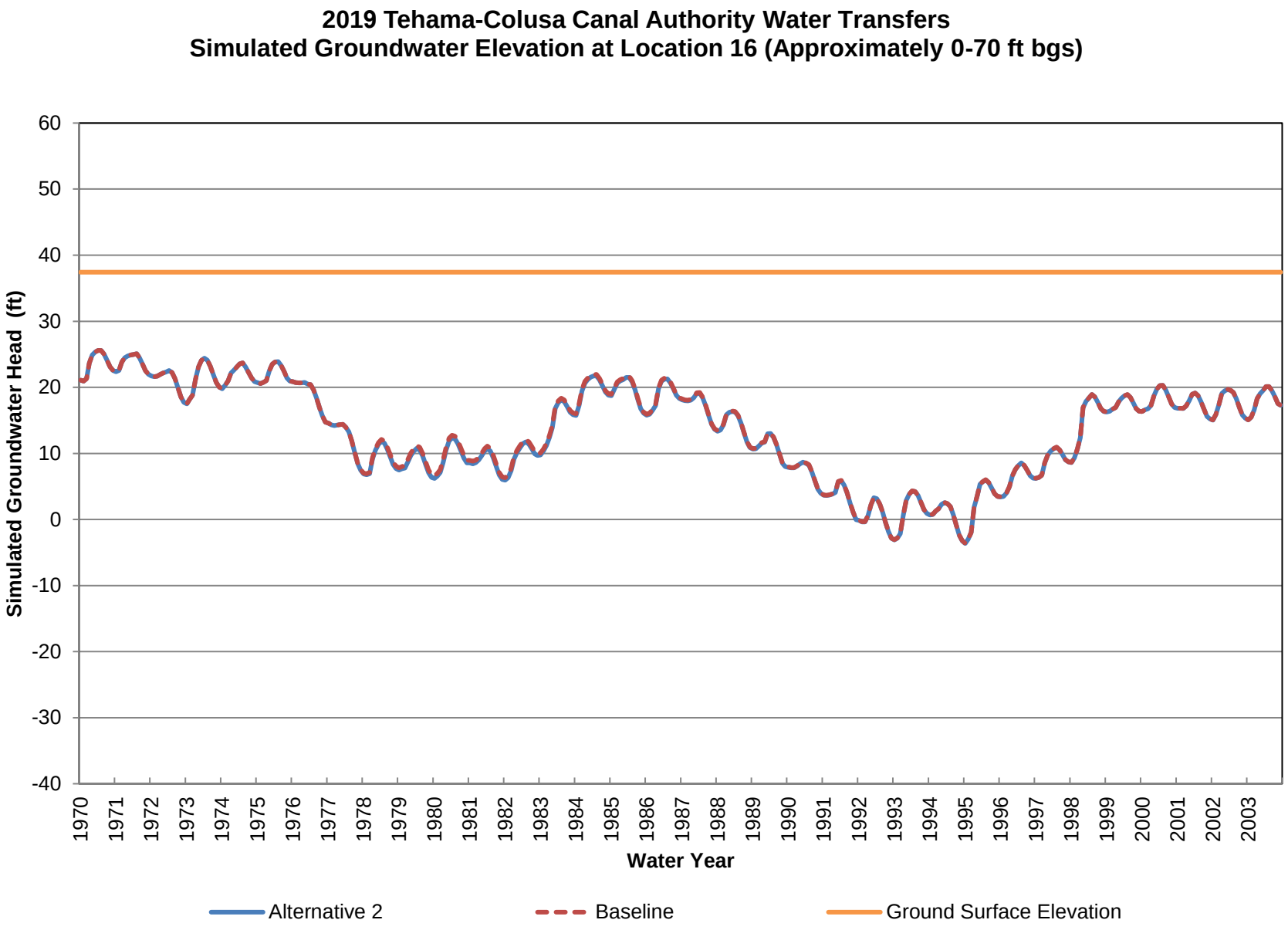
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 16 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
60
50
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20
10
0
-10
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1970
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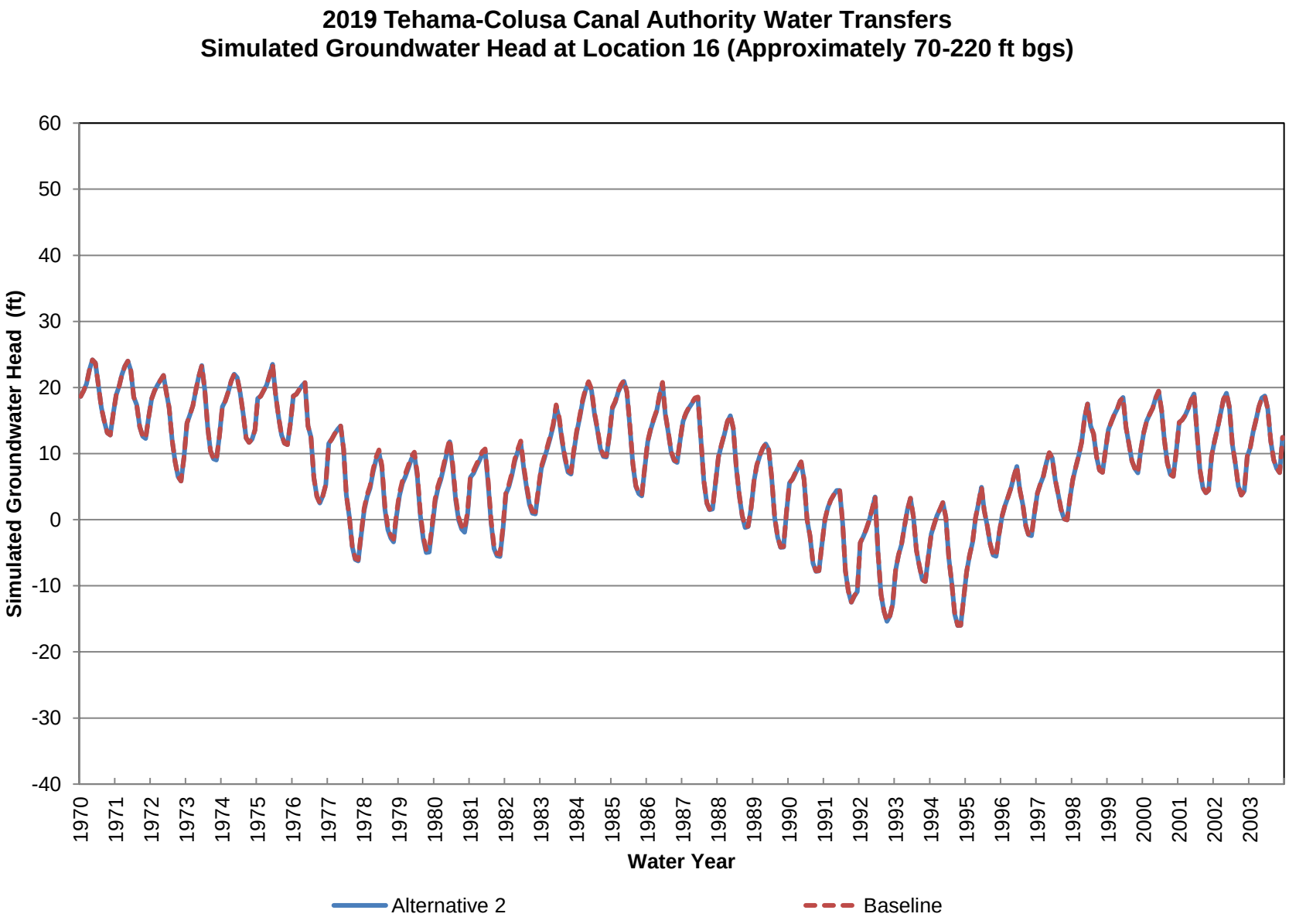
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 70-220 ft bgs)
Simulated Groundwater Head (ft)
60
50
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10
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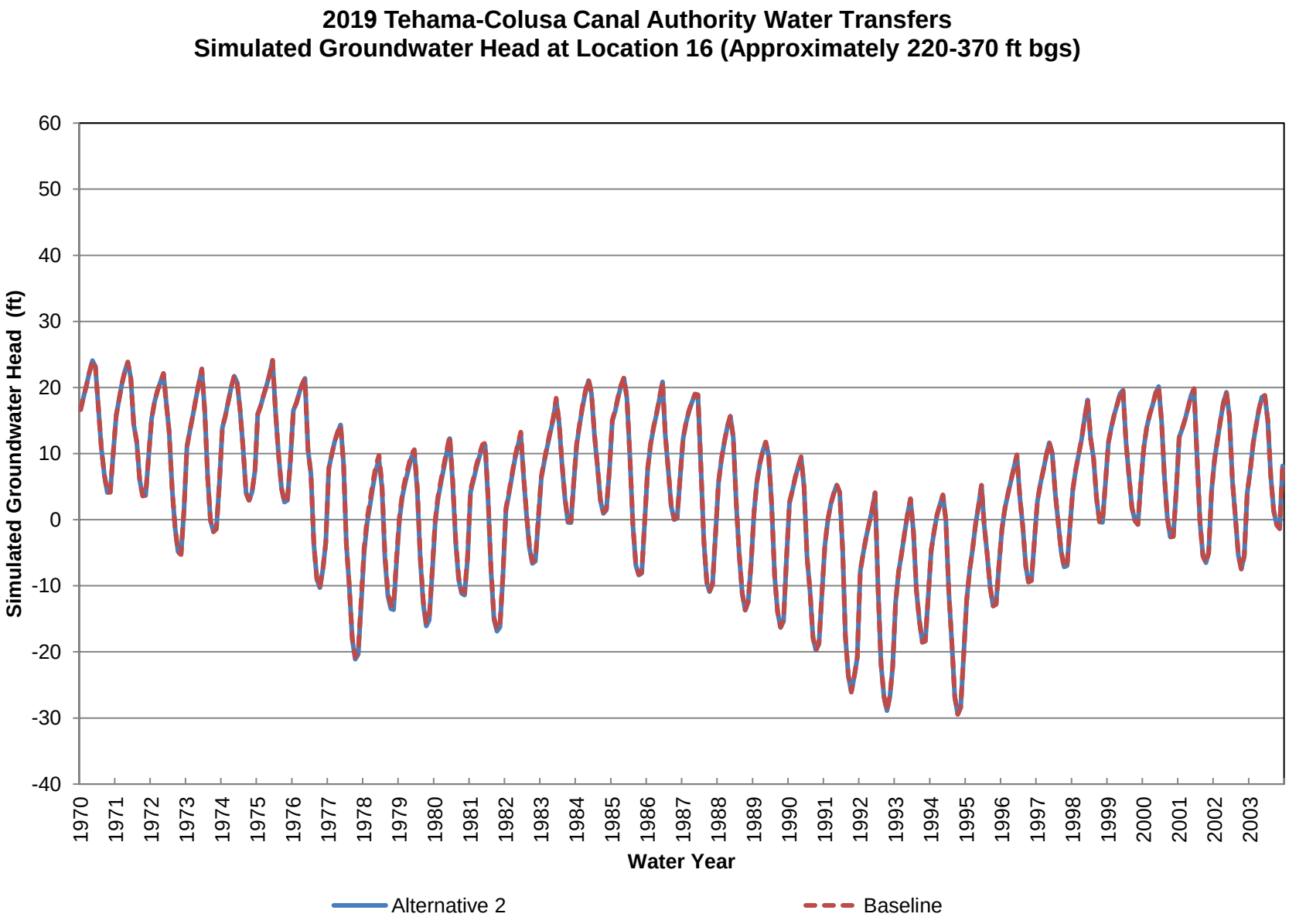
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 220-370 ft bgs)
Simulated Groundwater Head (ft)
60
50
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10
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-10
-20
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-40
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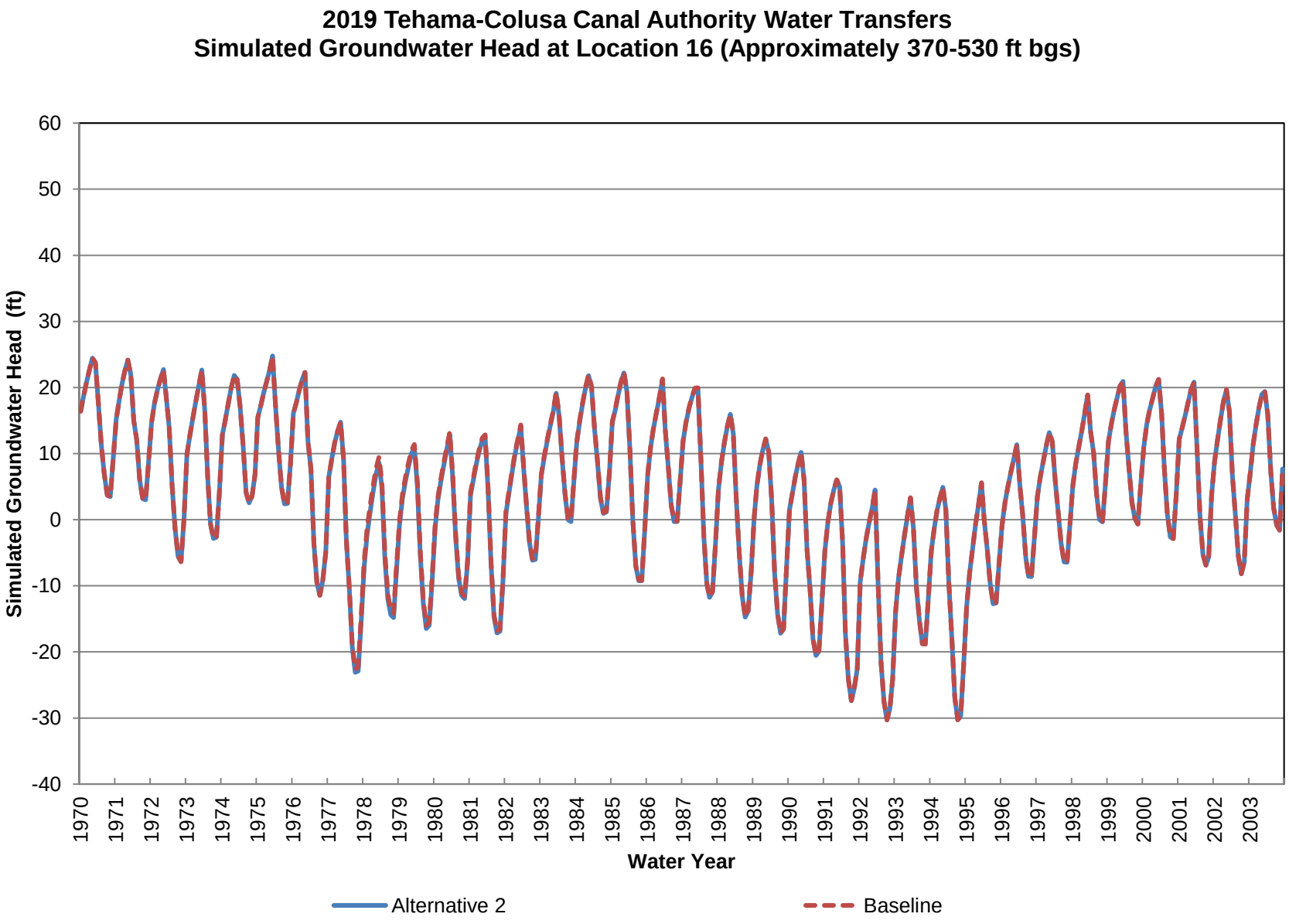
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 370-530 ft bgs)
Simulated Groundwater Head (ft)
60
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10
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-10
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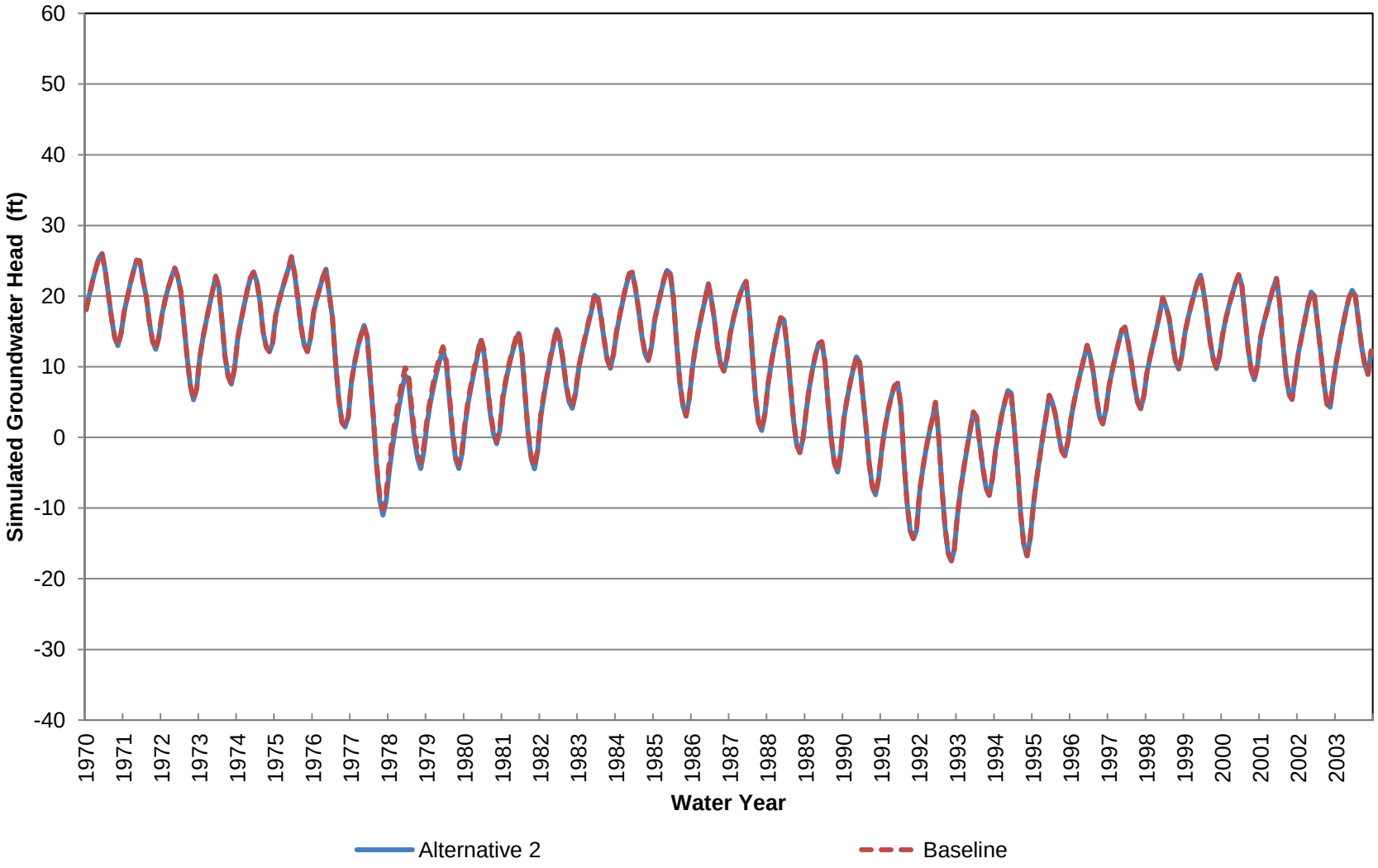
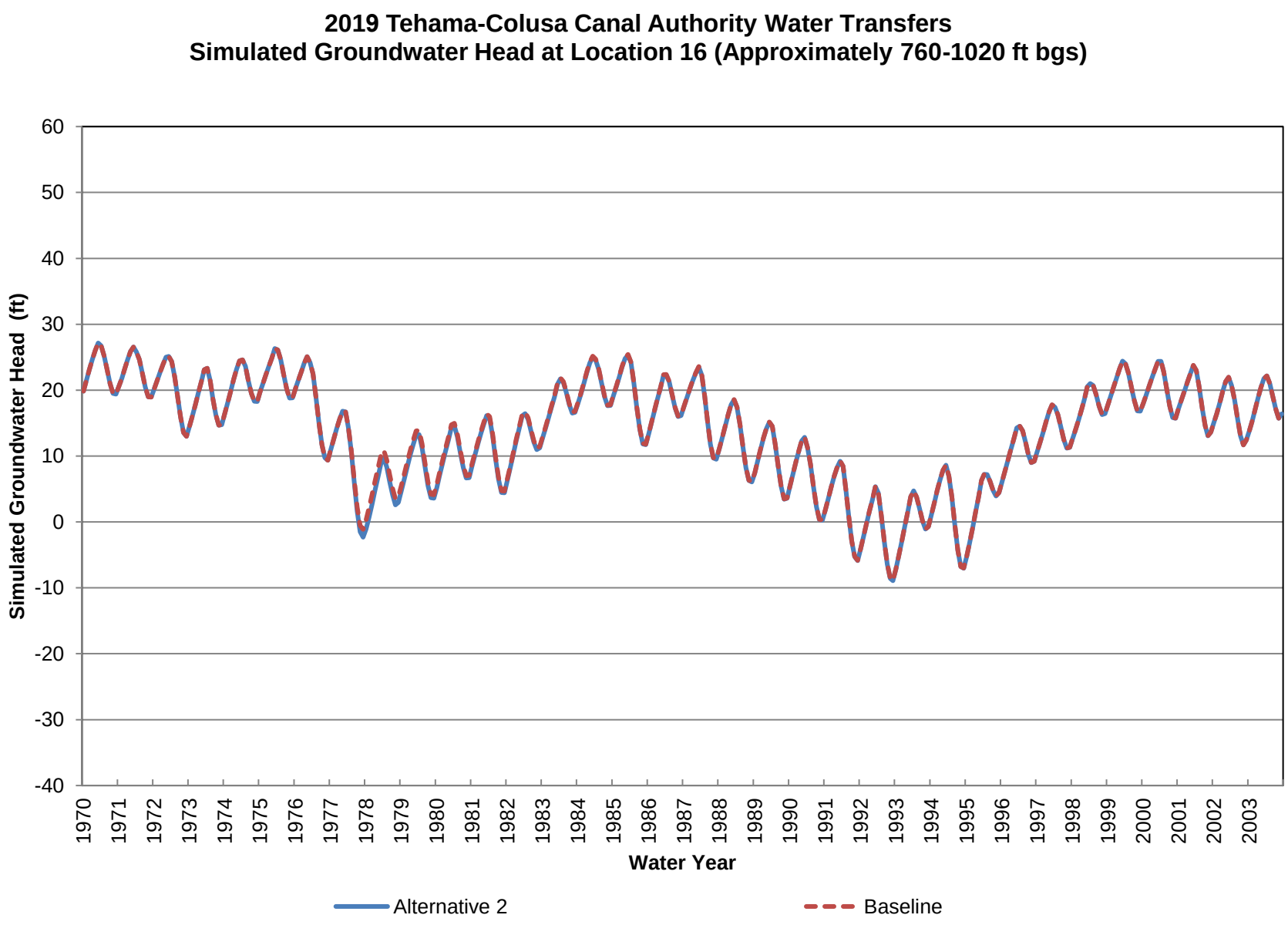
2002
2003
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 530-760 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 760-1020 ft bgs)
Simulated Groundwater Head (ft)
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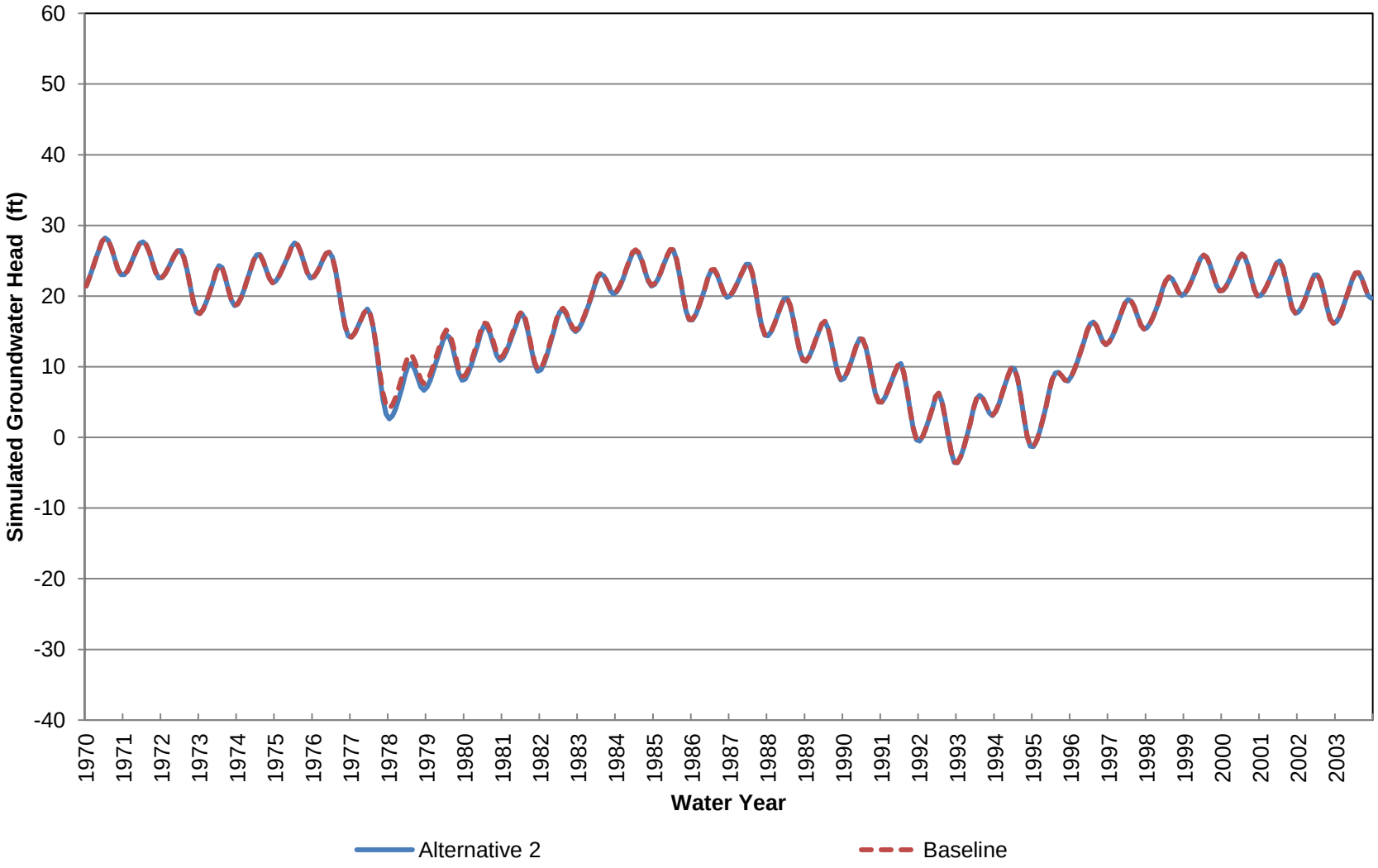
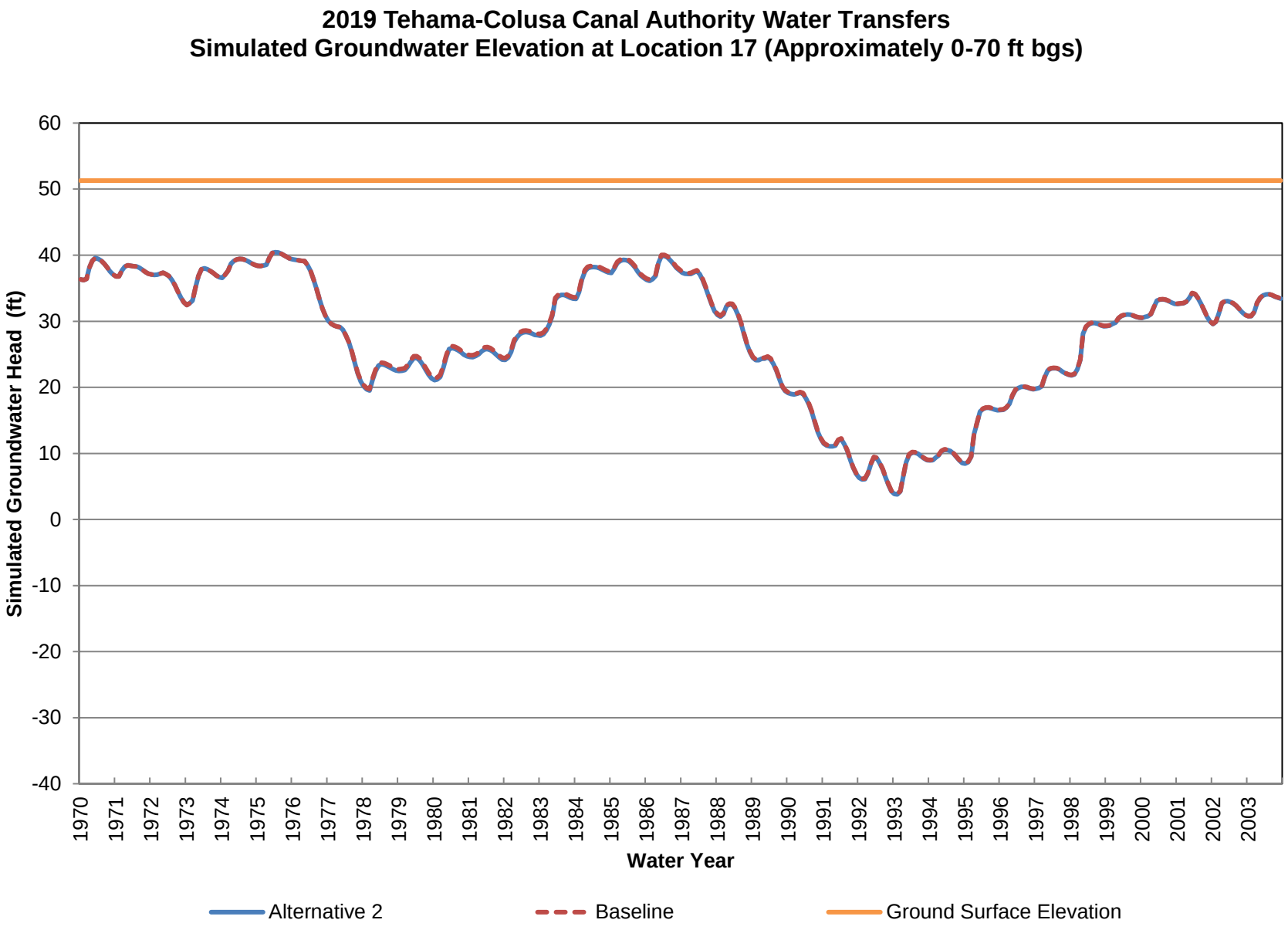
2003
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 1020-1390 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 17 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
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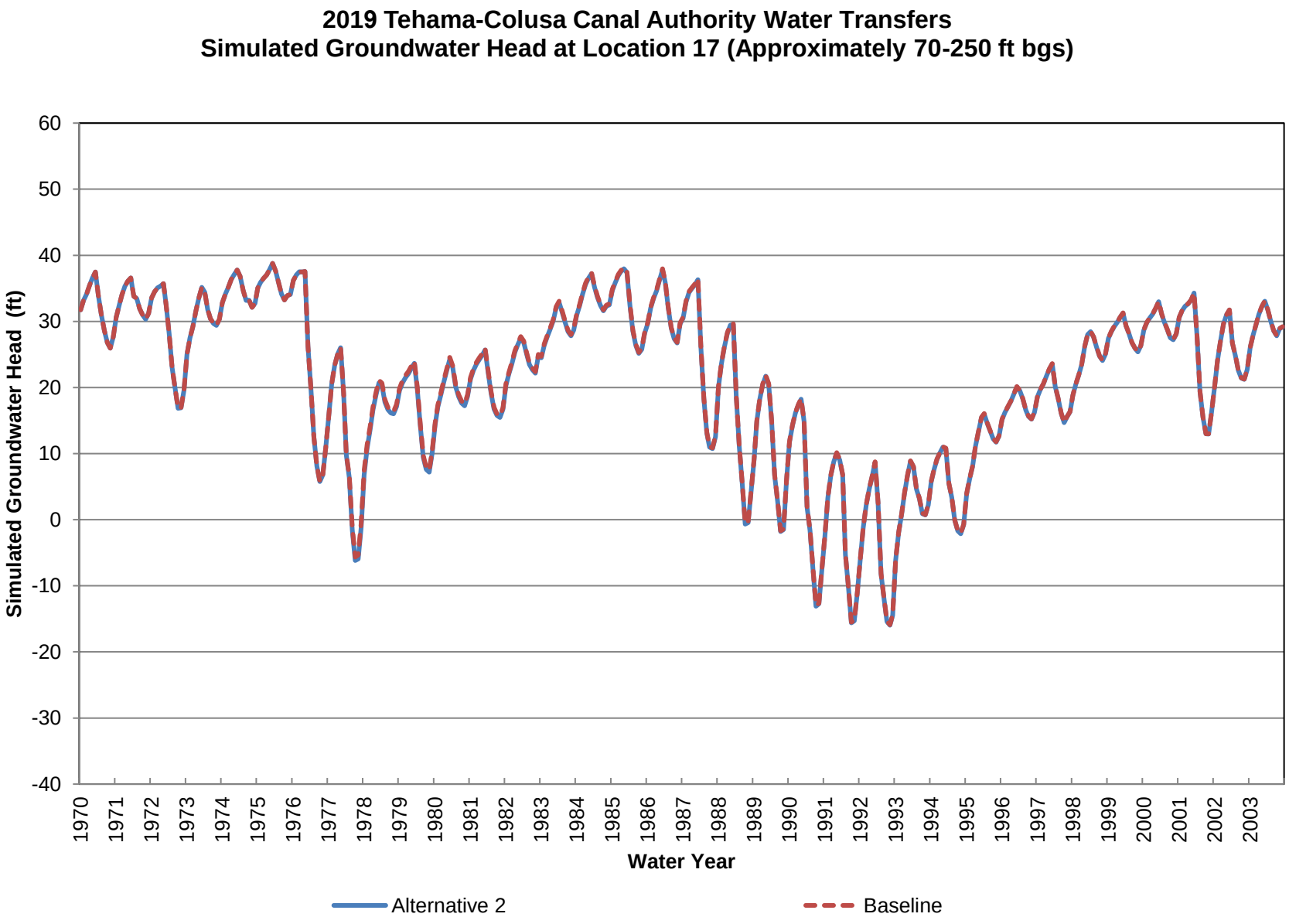
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 70-250 ft bgs)
Simulated Groundwater Head (ft)
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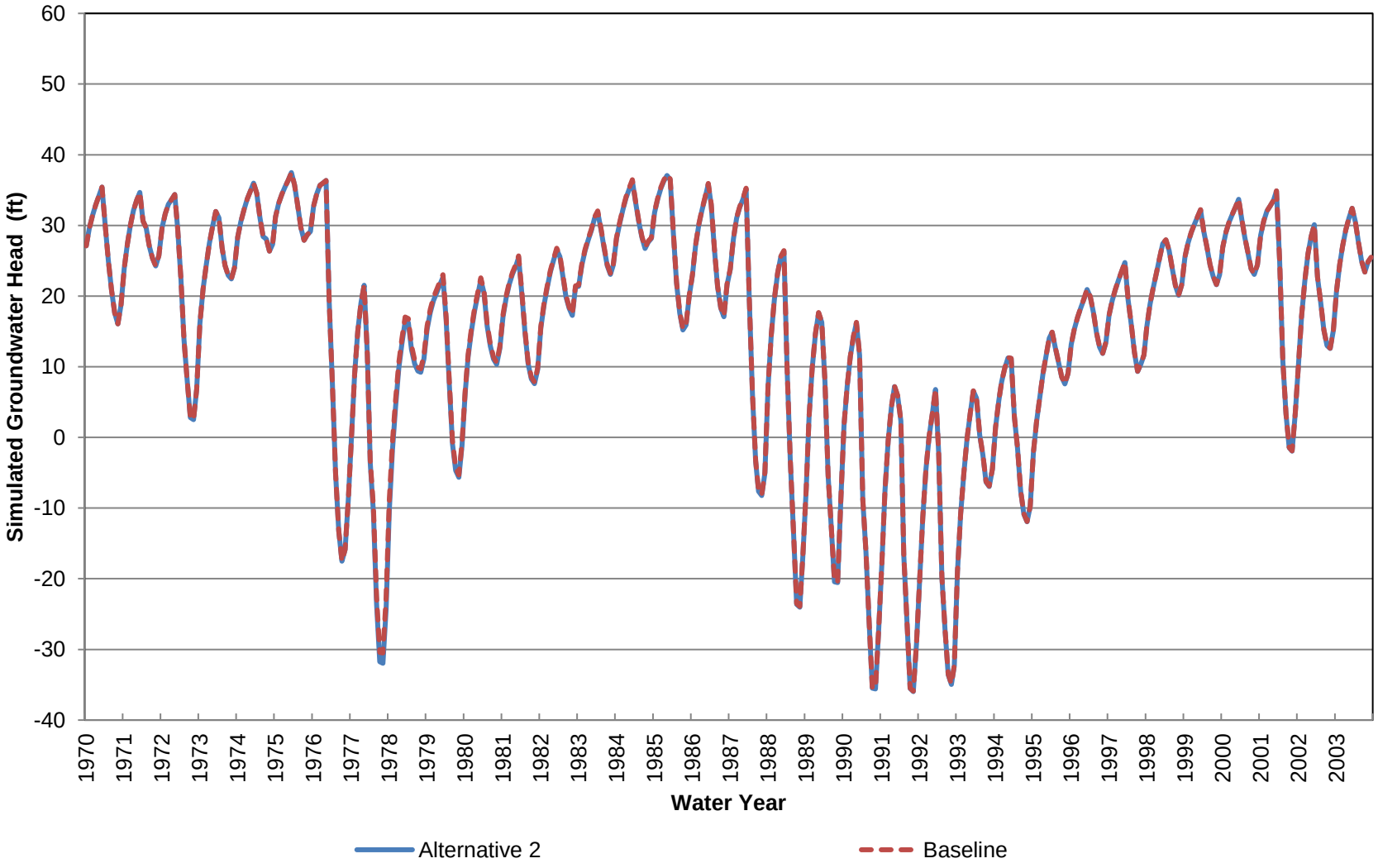
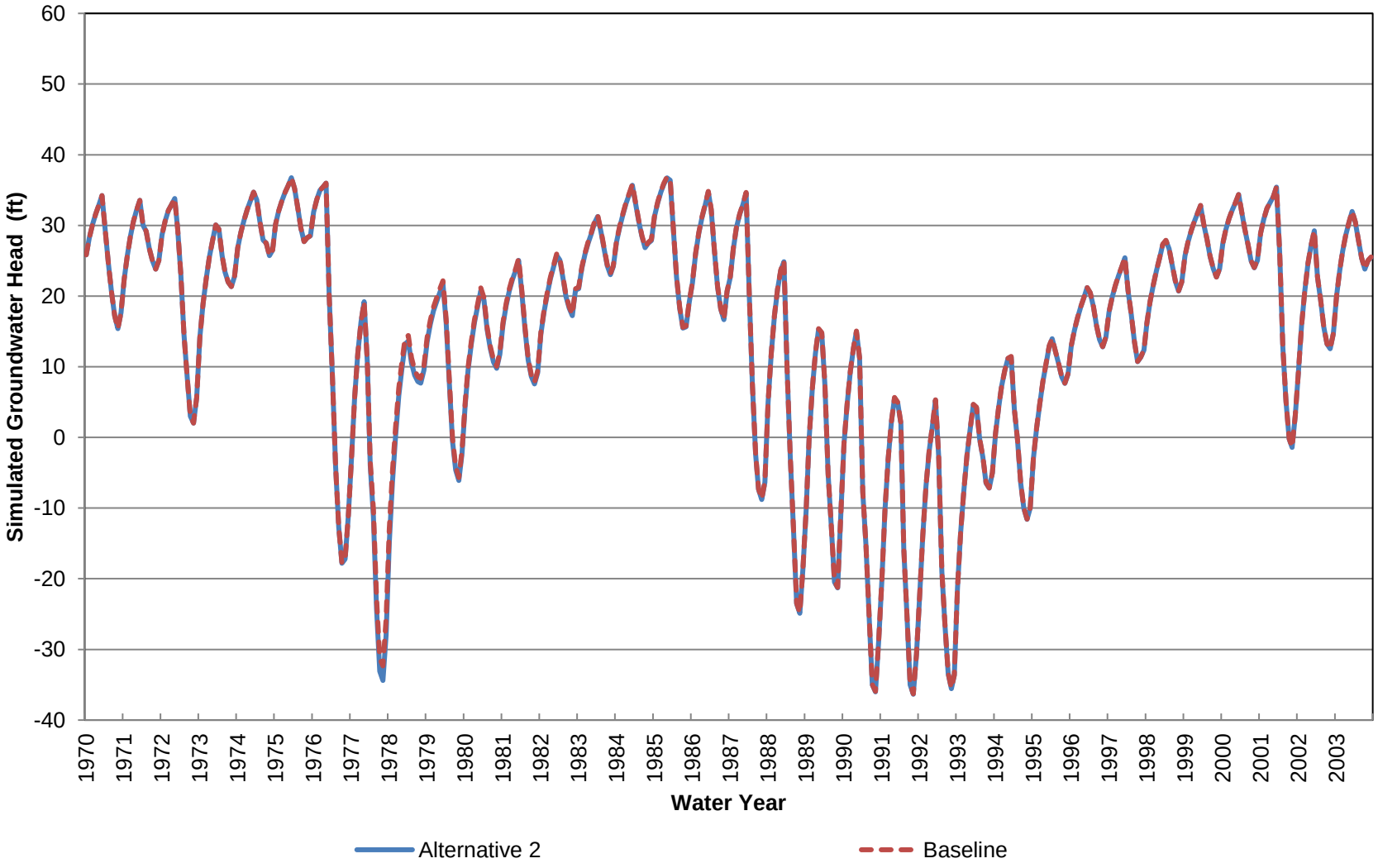
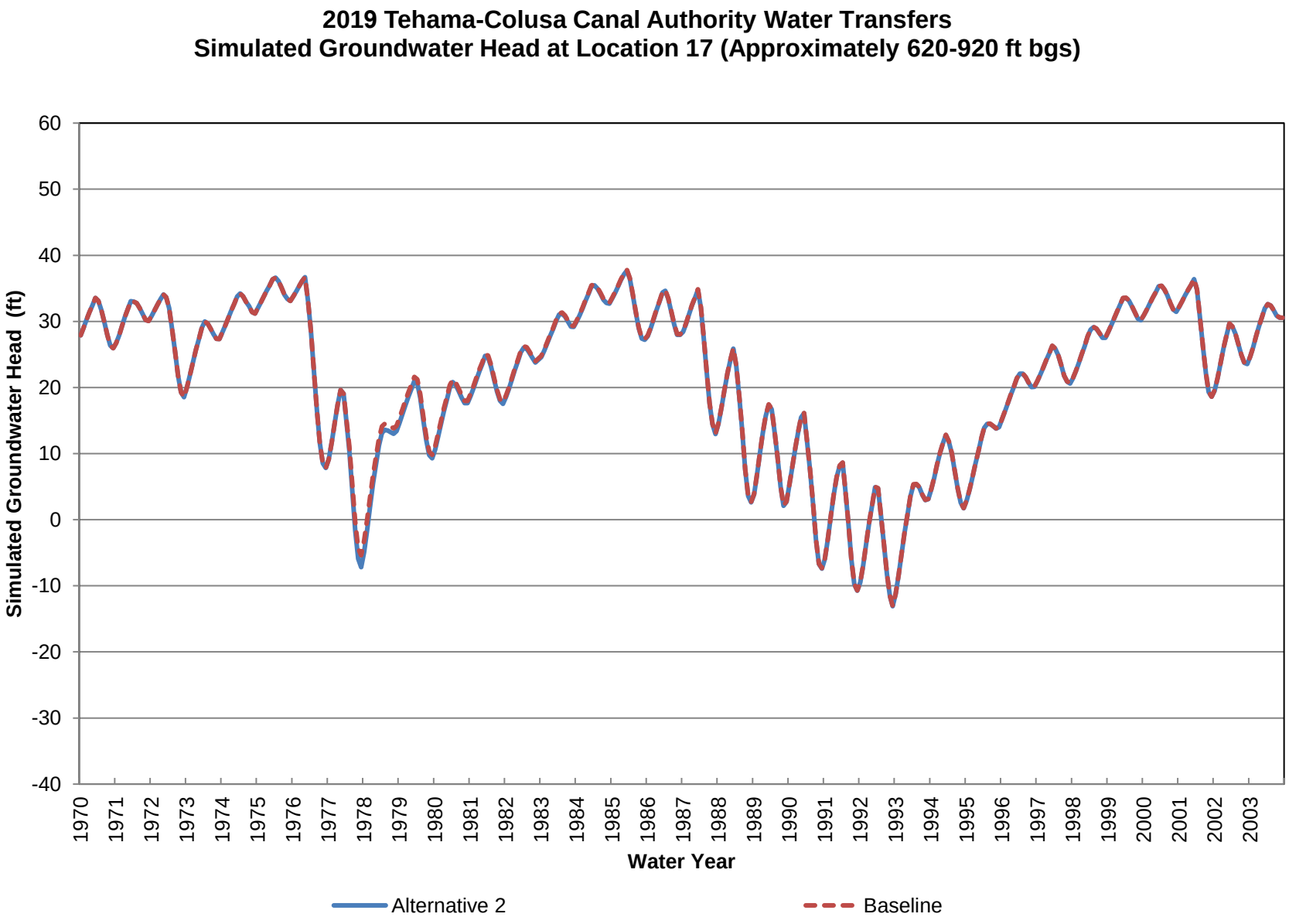
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 250-440 ft bgs)



2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 440-620 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 620-920 ft bgs)
Simulated Groundwater Head (ft)
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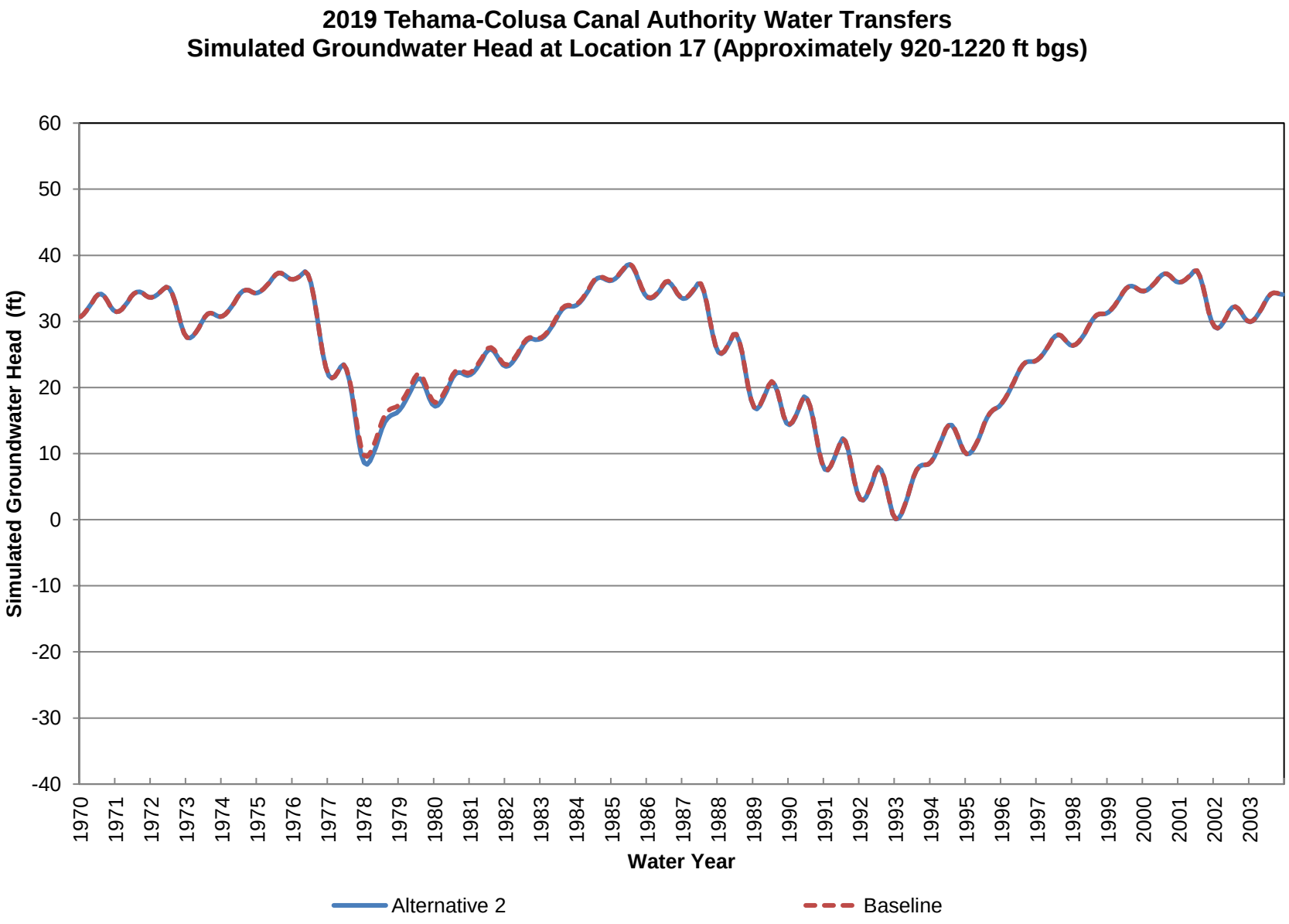
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 920-1220 ft bgs)
Simulated Groundwater Head (ft)
60
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10
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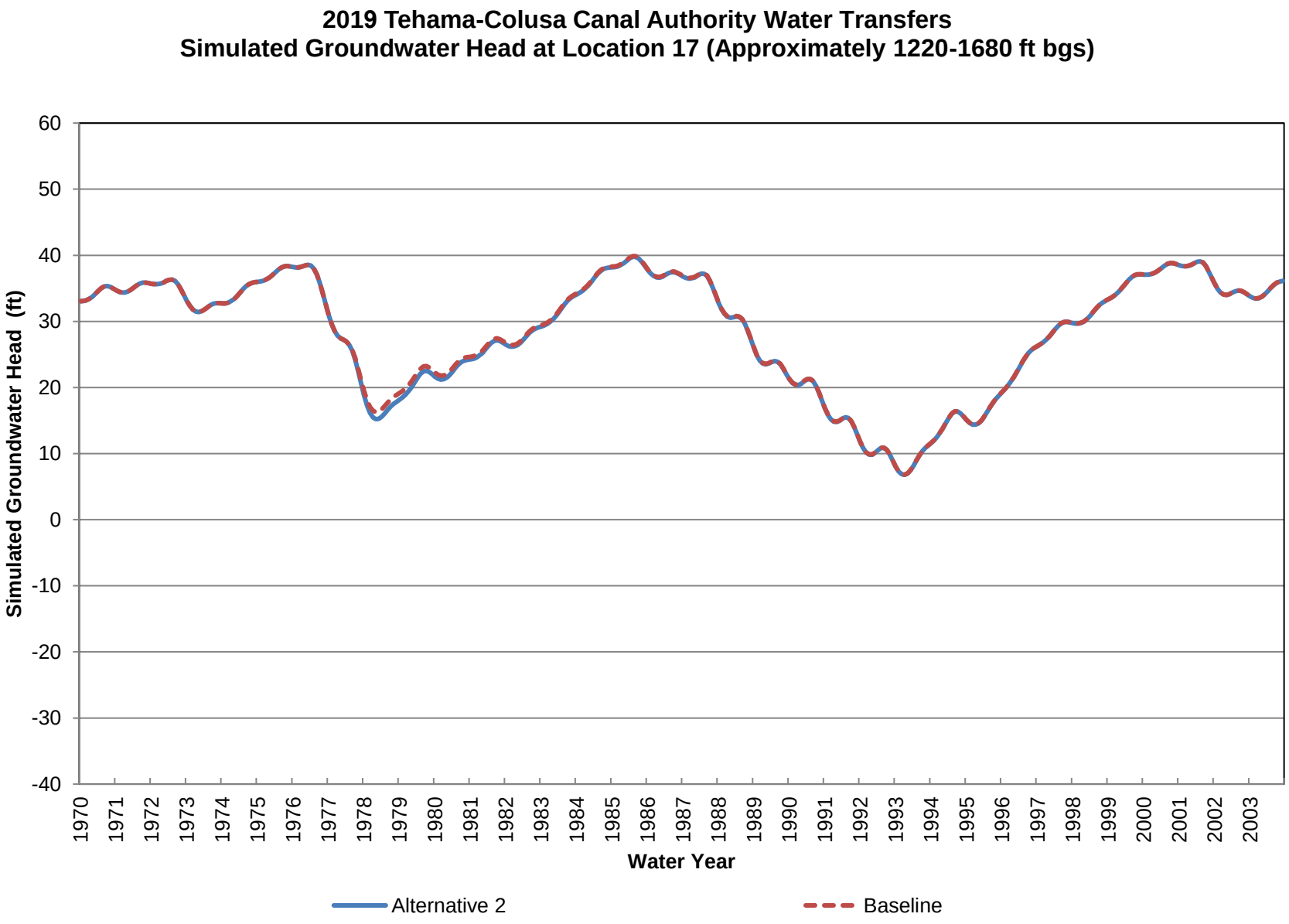
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 1220-1680 ft bgs)
Simulated Groundwater Head (ft)
60
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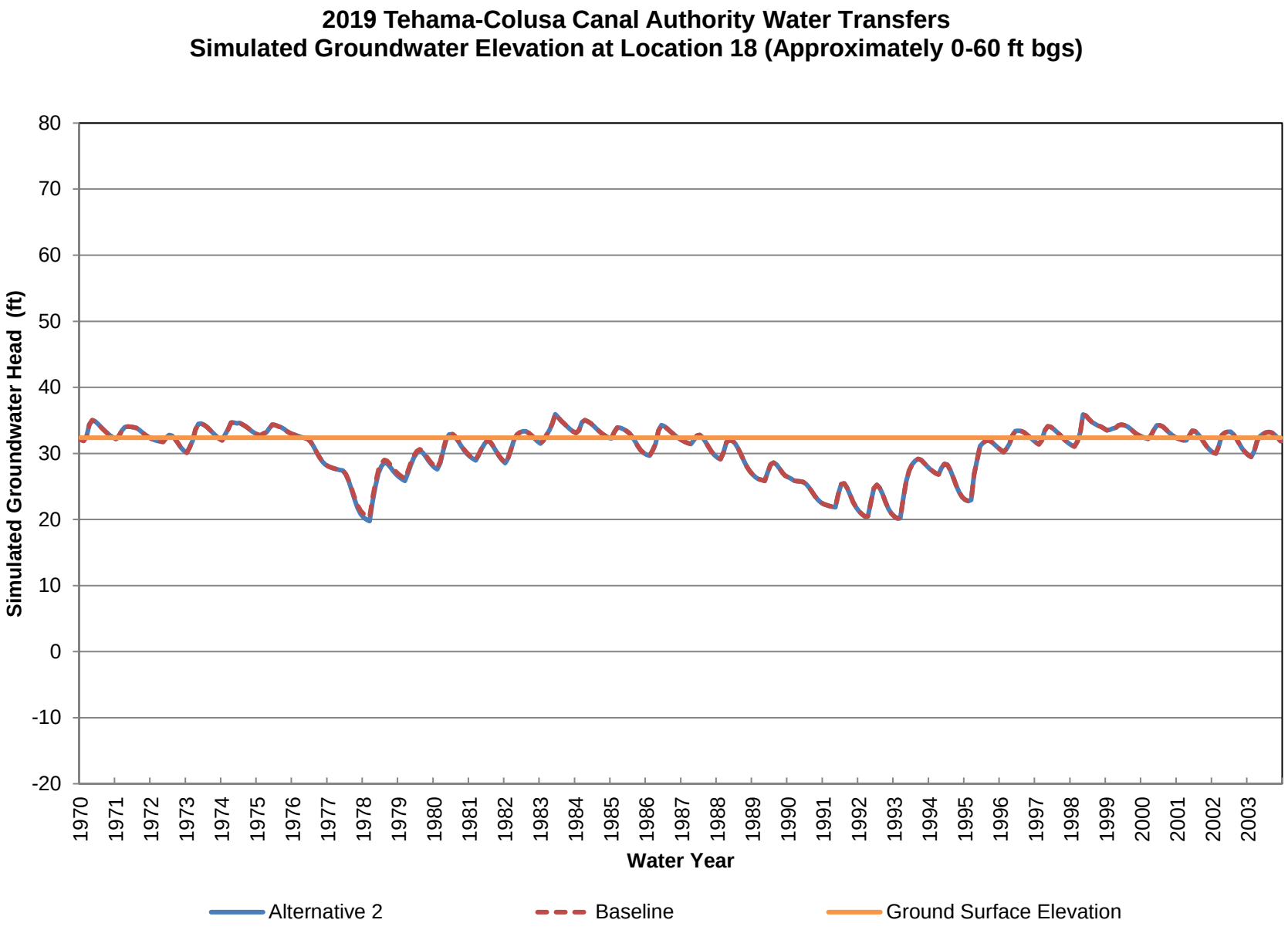
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 18 (Approximately 0-60 ft bgs)
Simulated Groundwater Head (ft)
80
70
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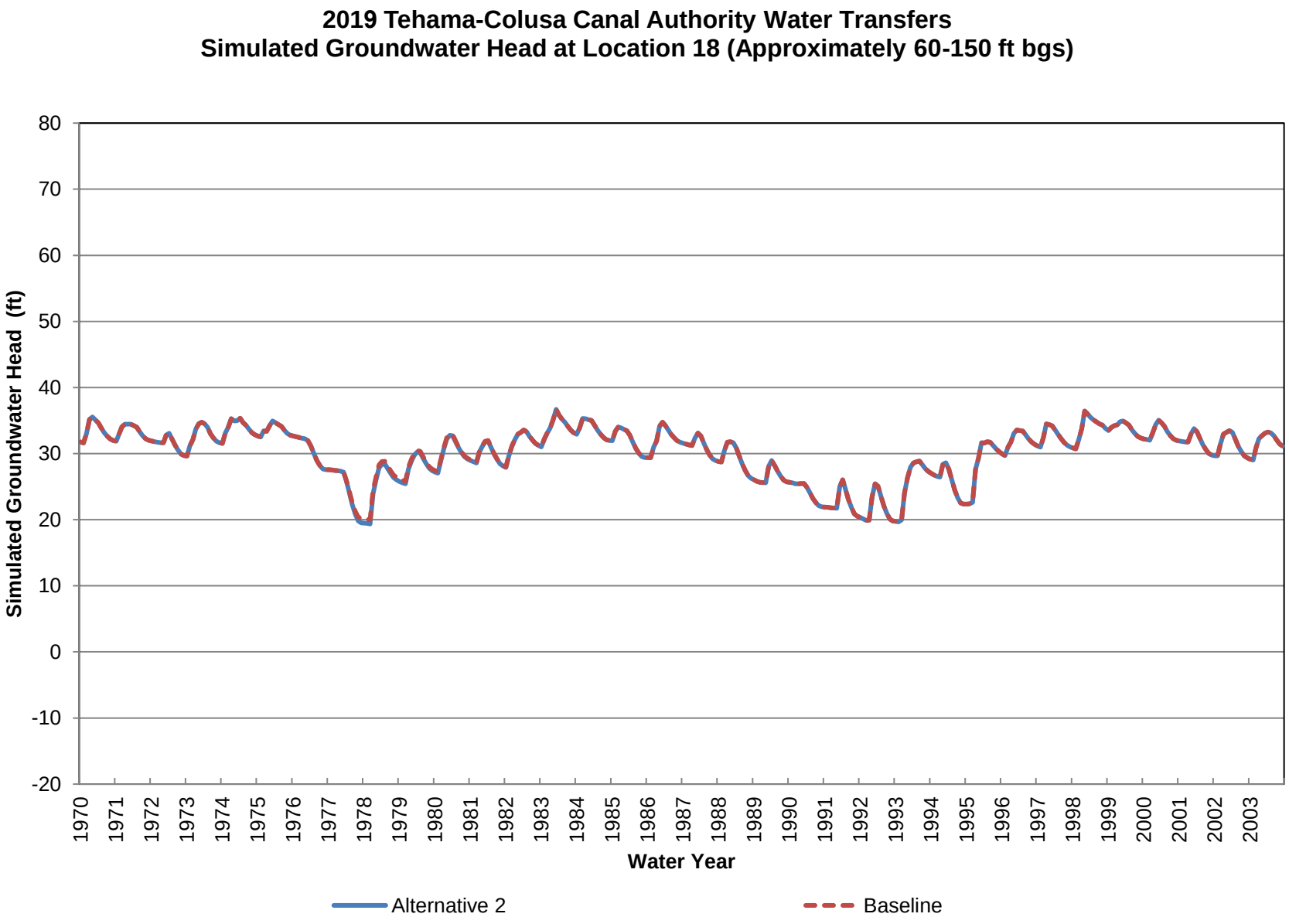
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 60-150 ft bgs)
Simulated Groundwater Head (ft)
80
70
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30
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10
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-10
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1970
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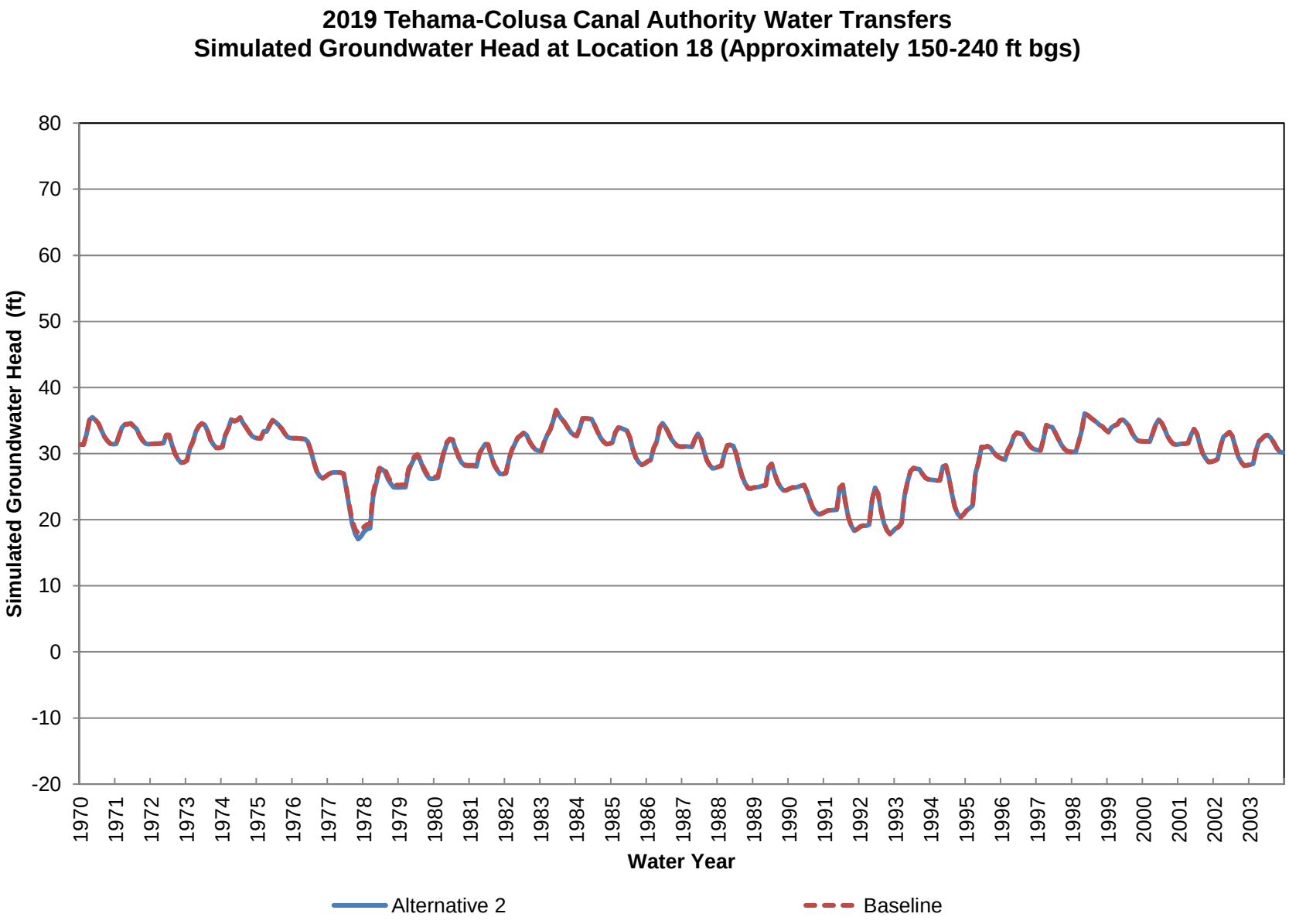
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 150-240 ft bgs)
Simulated Groundwater Head (ft)
80
70
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-10
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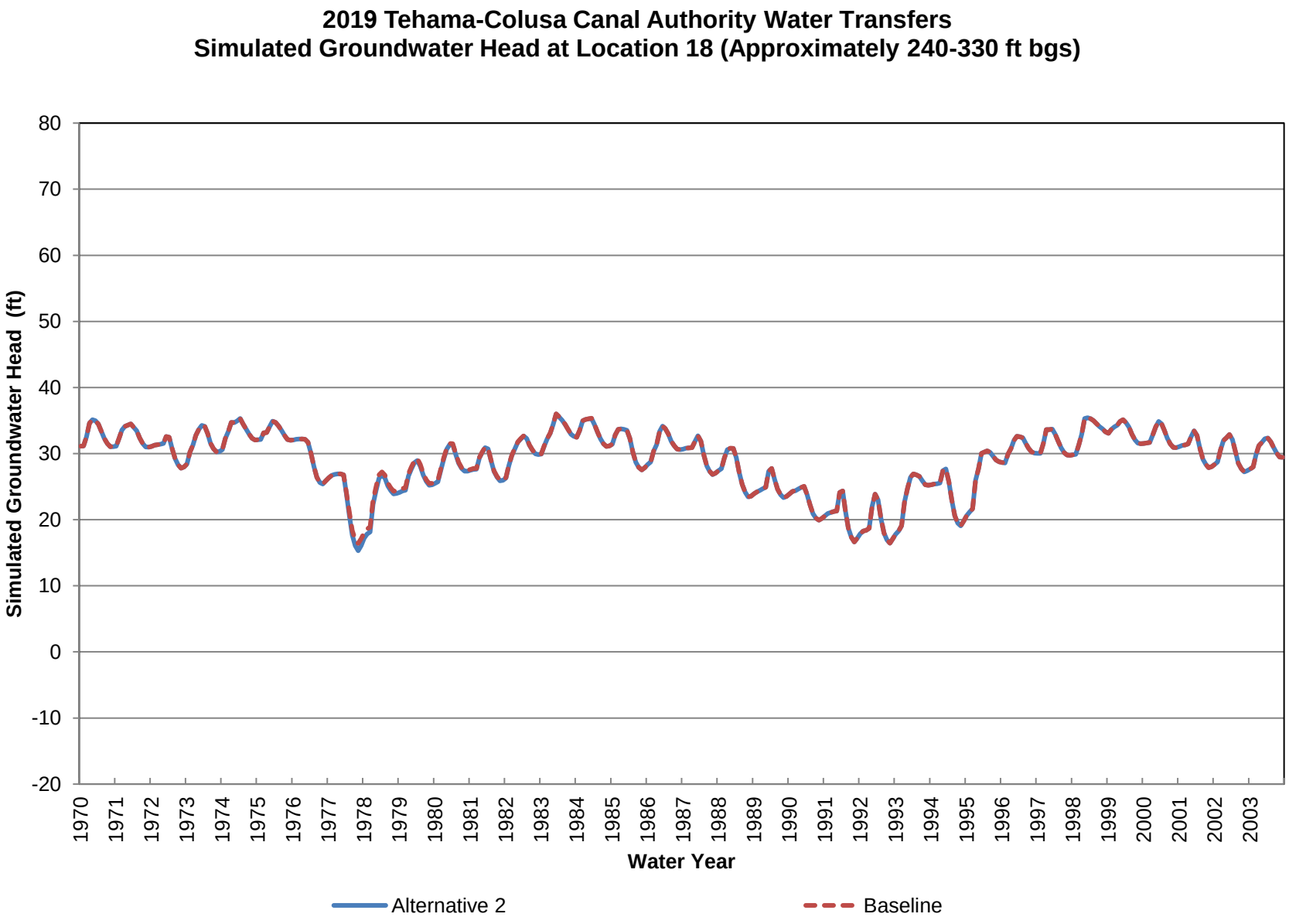
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 240-330 ft bgs)
Simulated Groundwater Head (ft)
80
70
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20
10
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-10
-20
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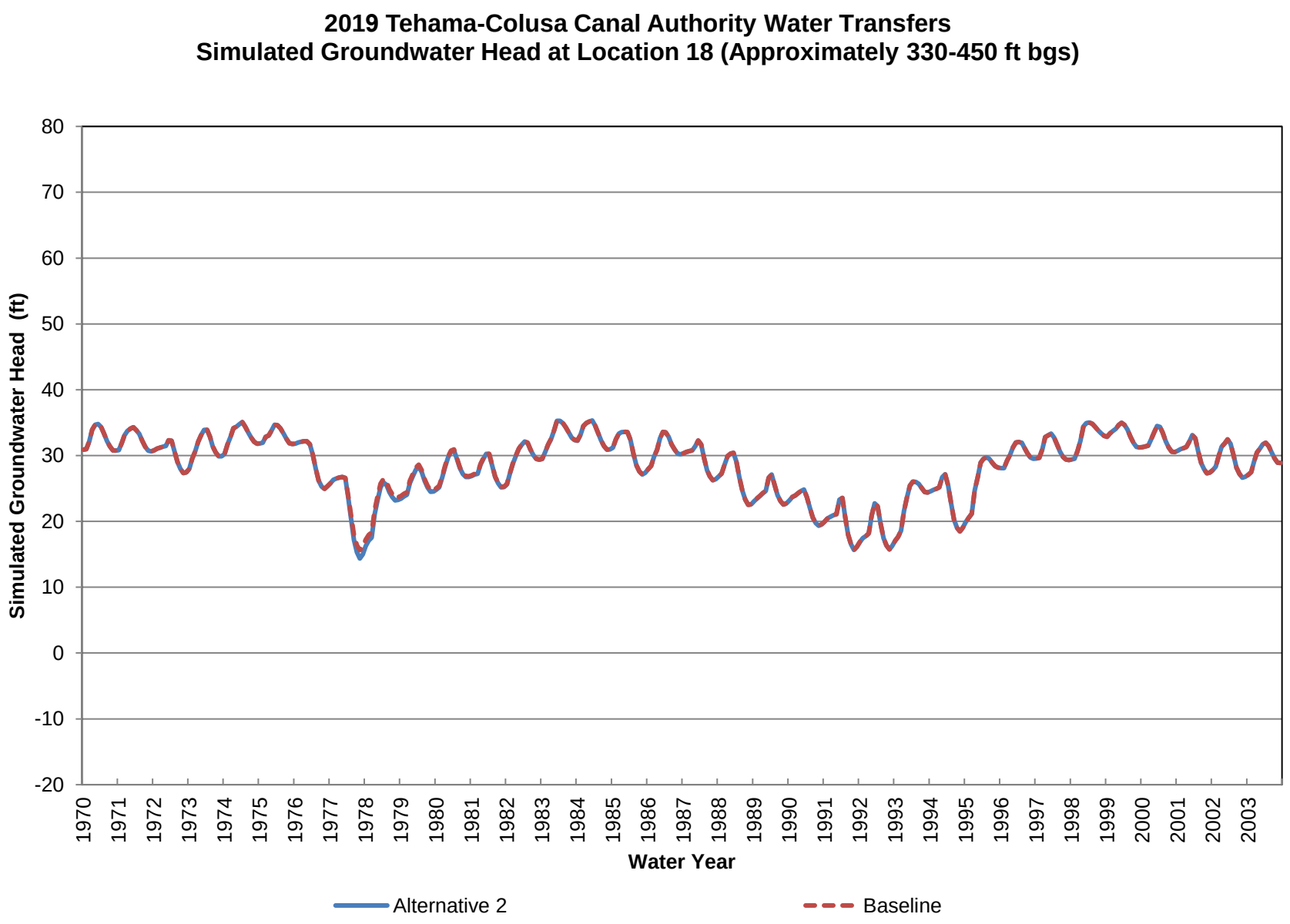
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 330-450 ft bgs)
Simulated Groundwater Head (ft)
80
70
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-10
-20
1970
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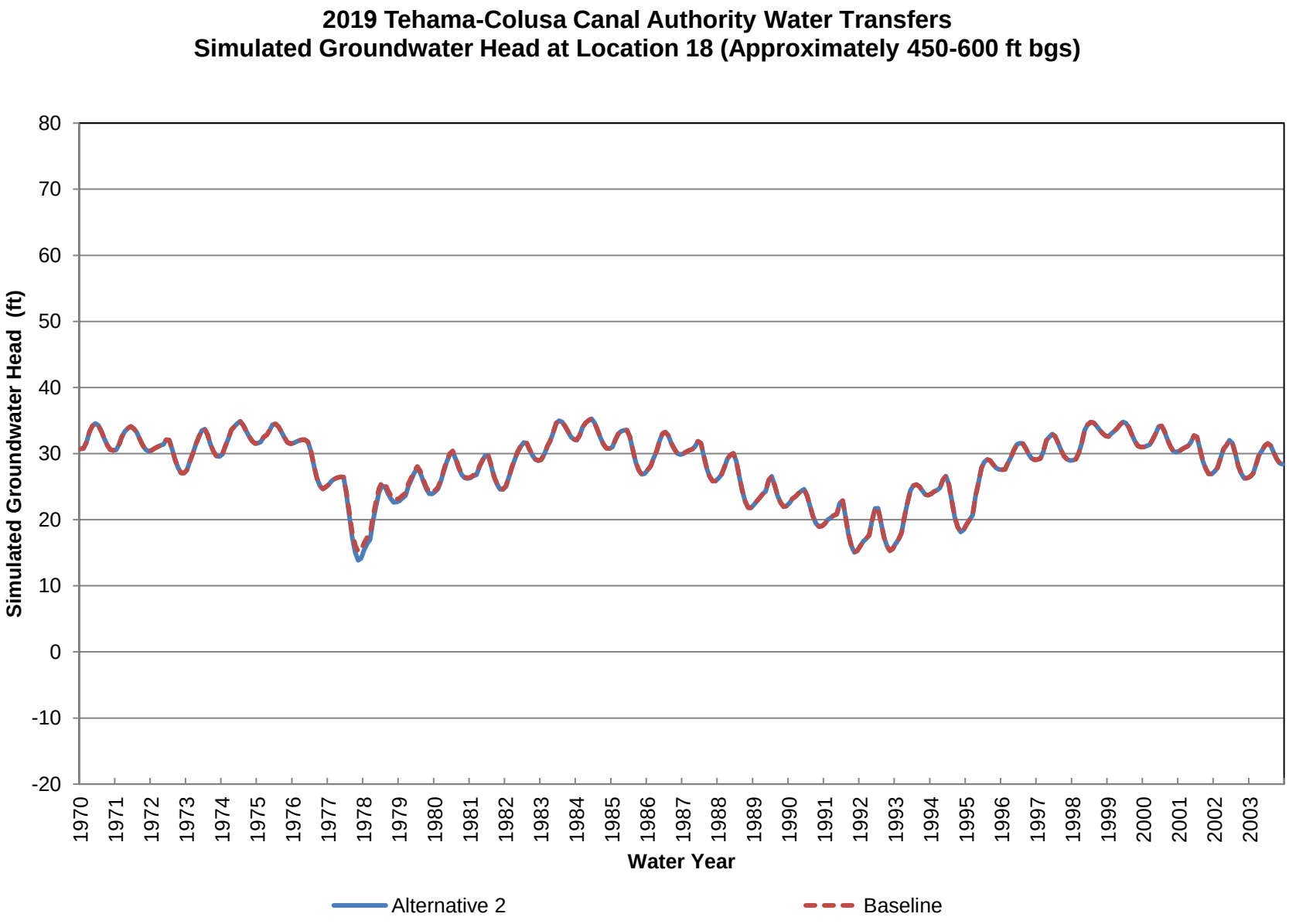
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 450-600 ft bgs)
Simulated Groundwater Head (ft)
80
70
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30
20
10
0
-10
-20
1970
1971
1972
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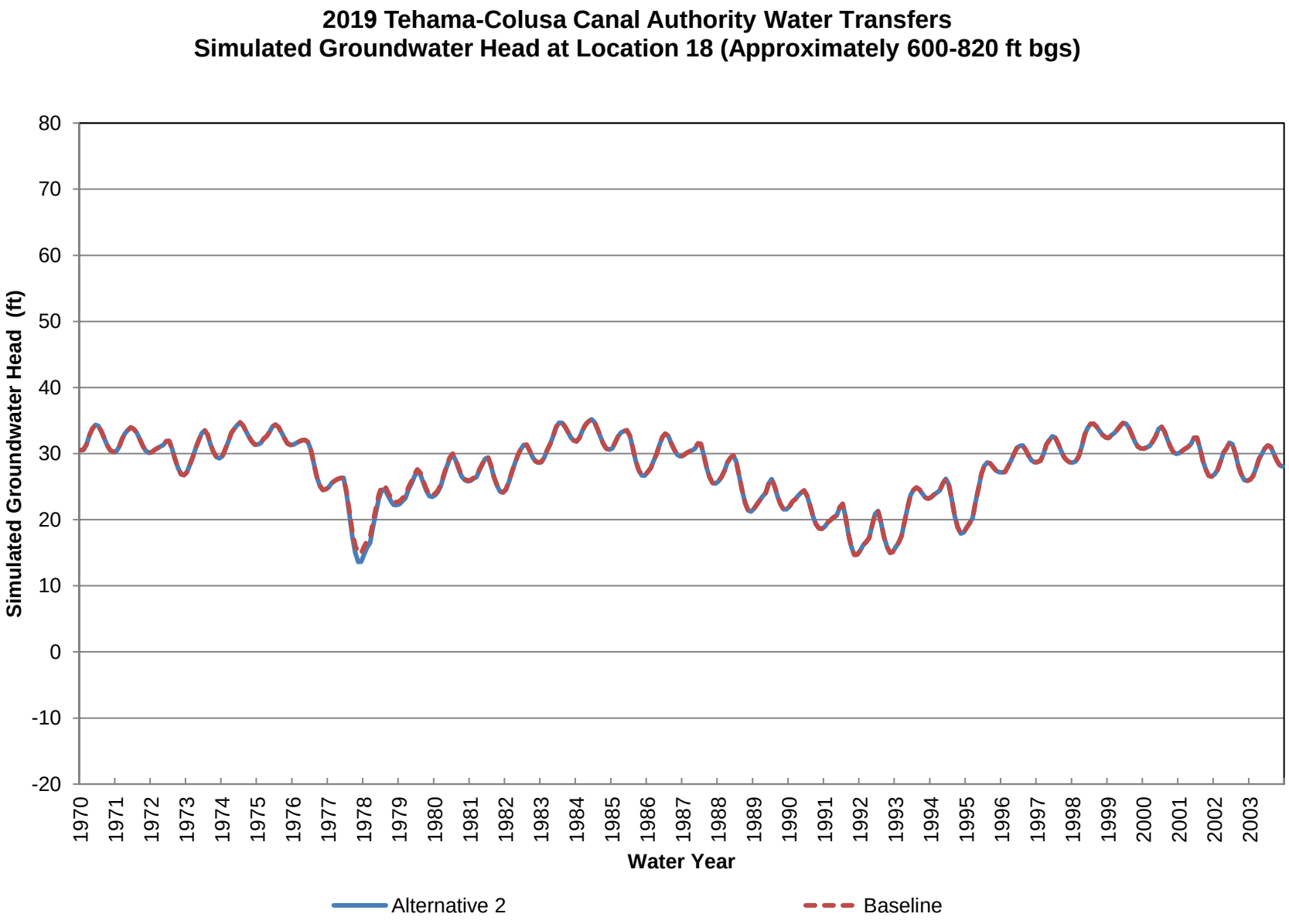
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 600-820 ft bgs)
Simulated Groundwater Head (ft)
80
70
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-10
-20
1970
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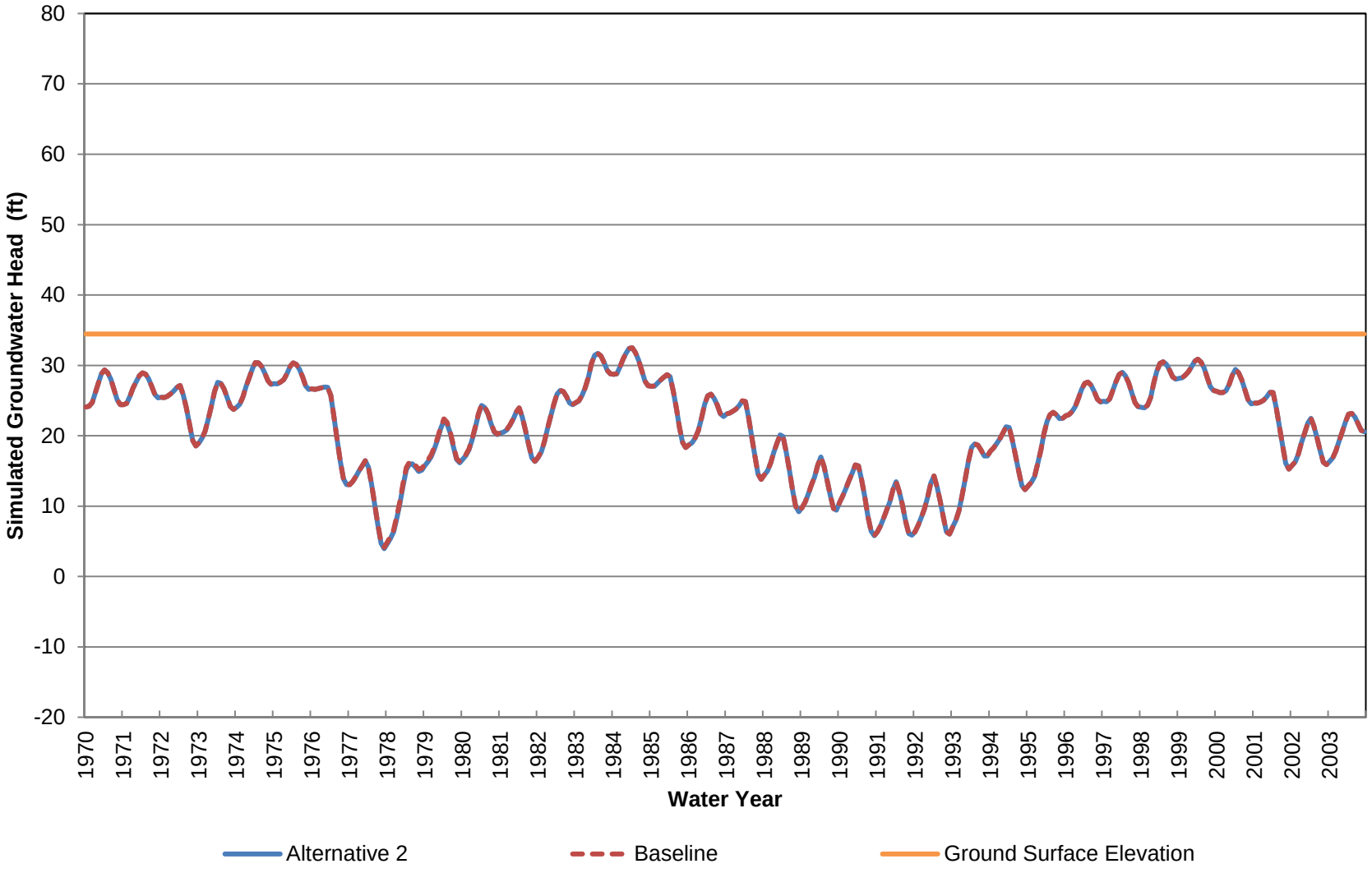
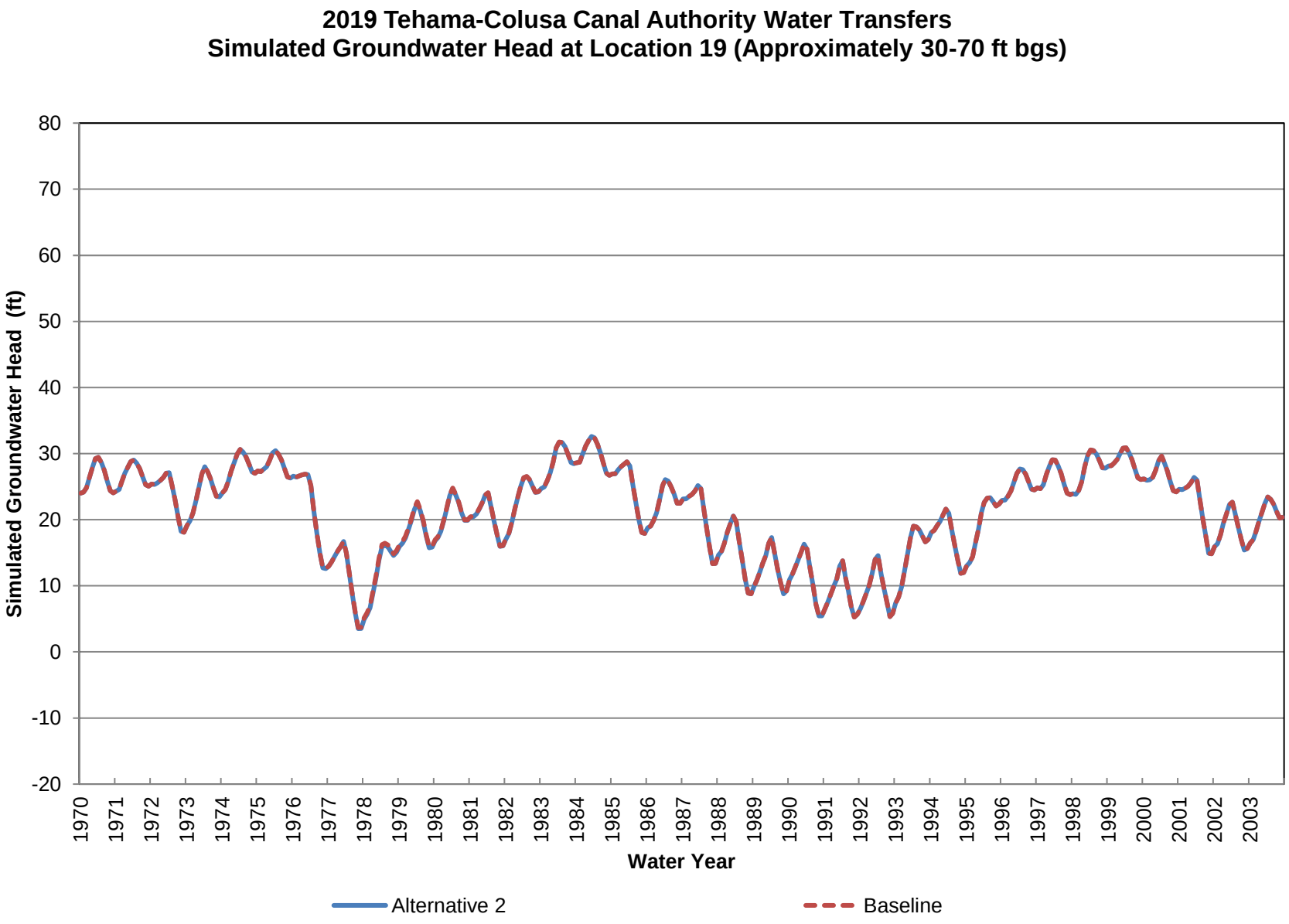
2003
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 19 (Approximately 0-30 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 19 (Approximately 30-70 ft bgs)
Simulated Groundwater Head (ft)
80
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-10
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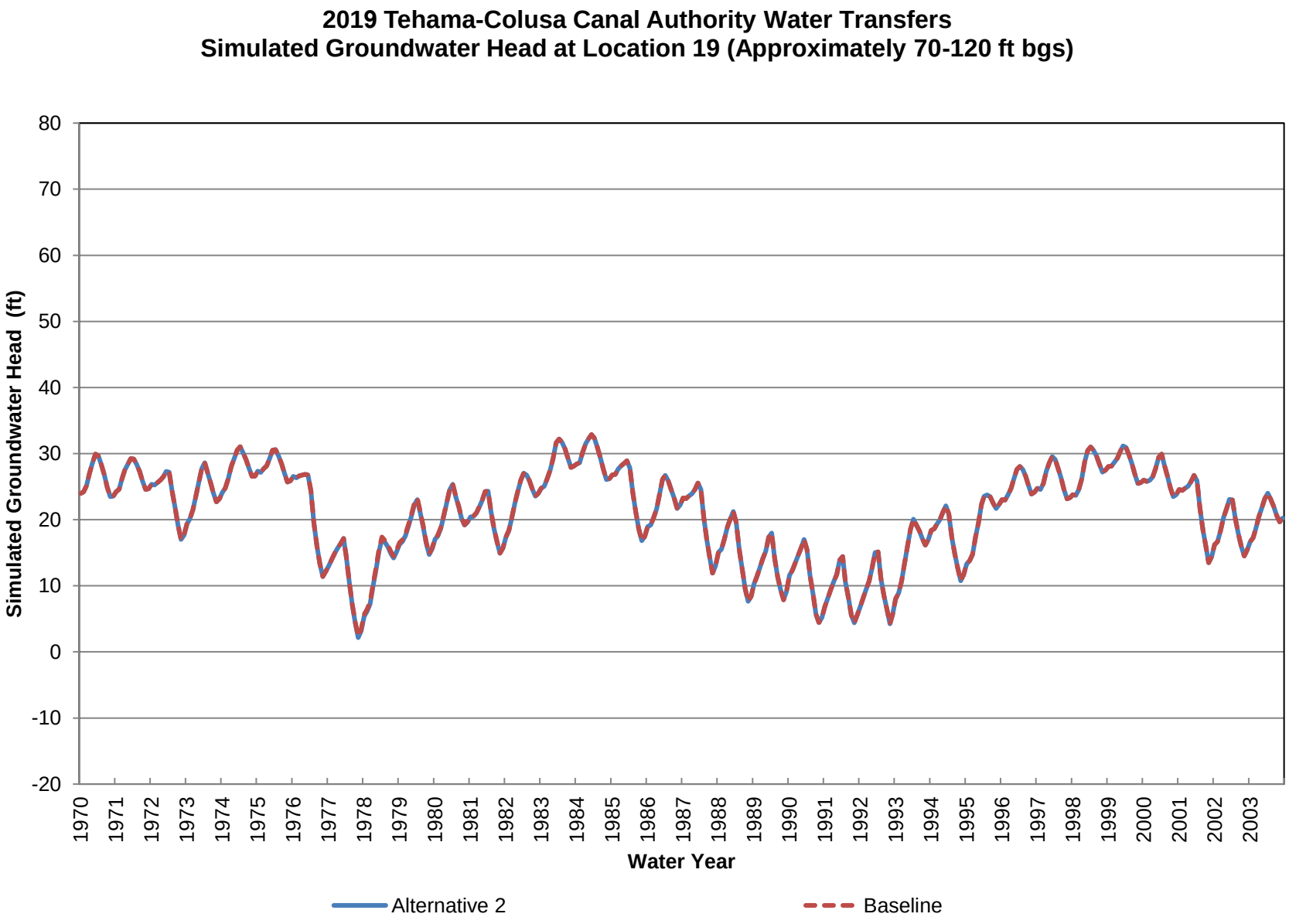
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 19 (Approximately 70-120 ft bgs)
Simulated Groundwater Head (ft)
80
70
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30
20
10
0
-10
-20
1970
1971
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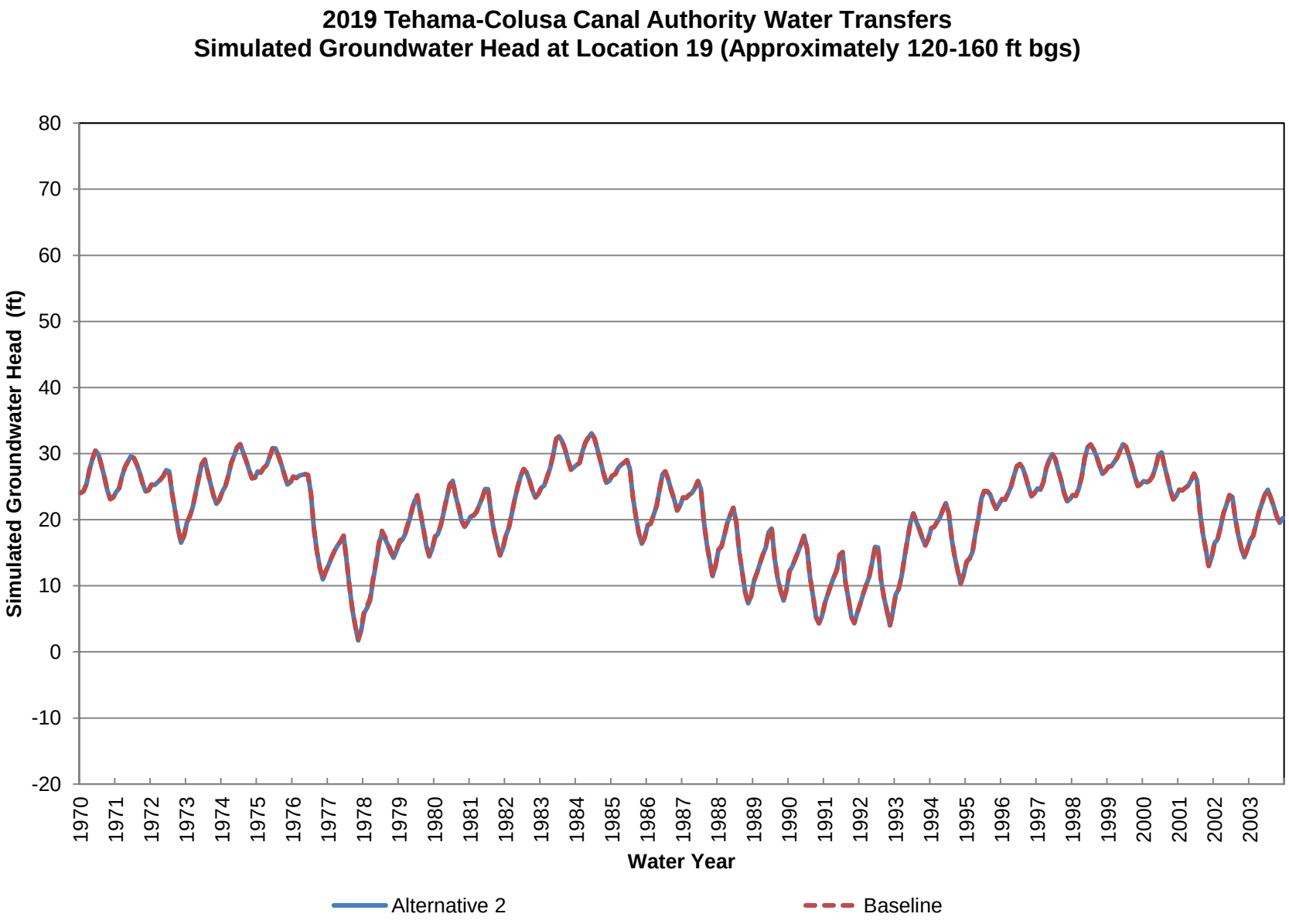
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 19 (Approximately 120-160 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
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30
20
10
0
-10
-20
1970
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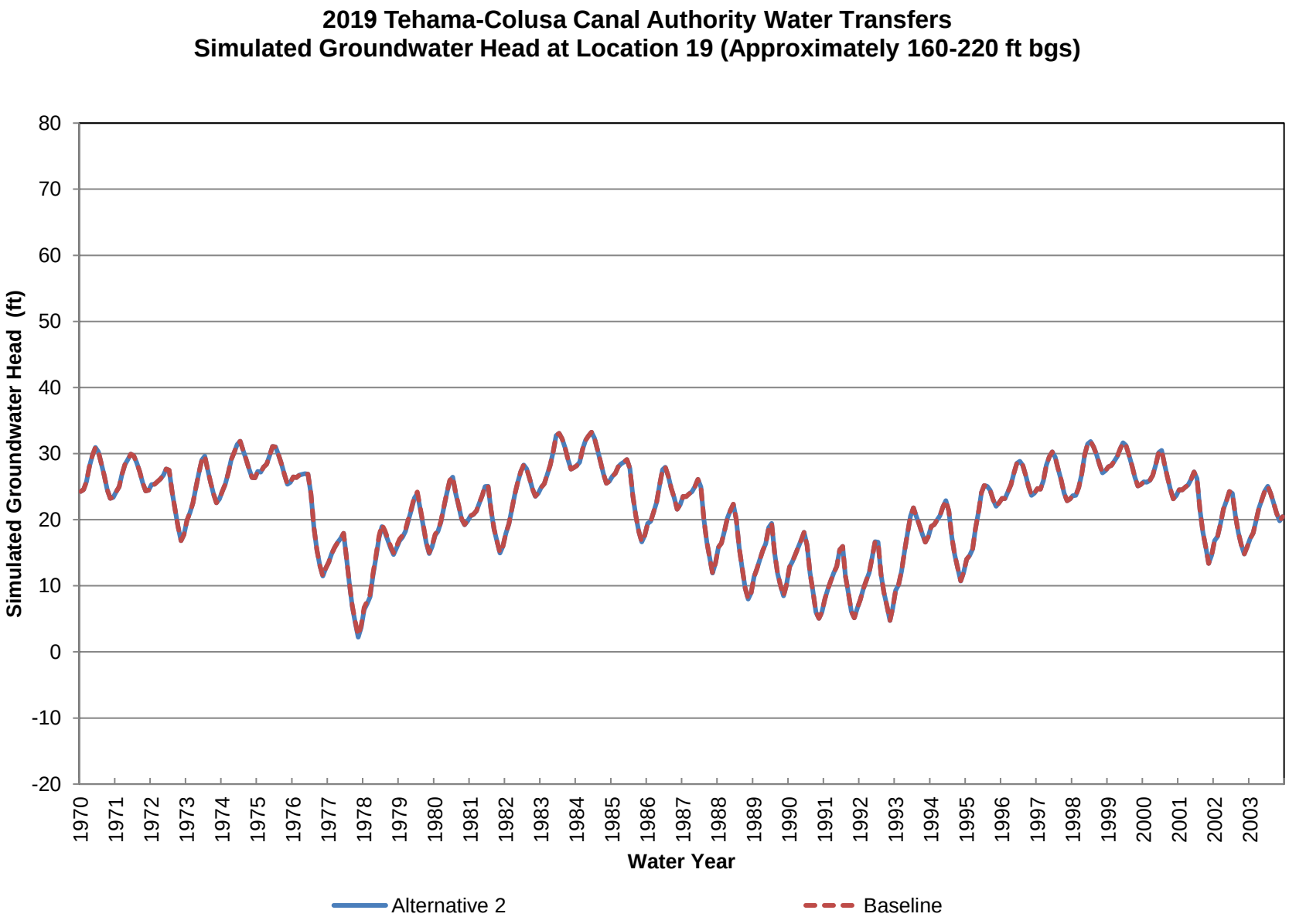
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 19 (Approximately 160-220 ft bgs)
Simulated Groundwater Head (ft)
80
70
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30
20
10
0
-10
-20
1970
1971
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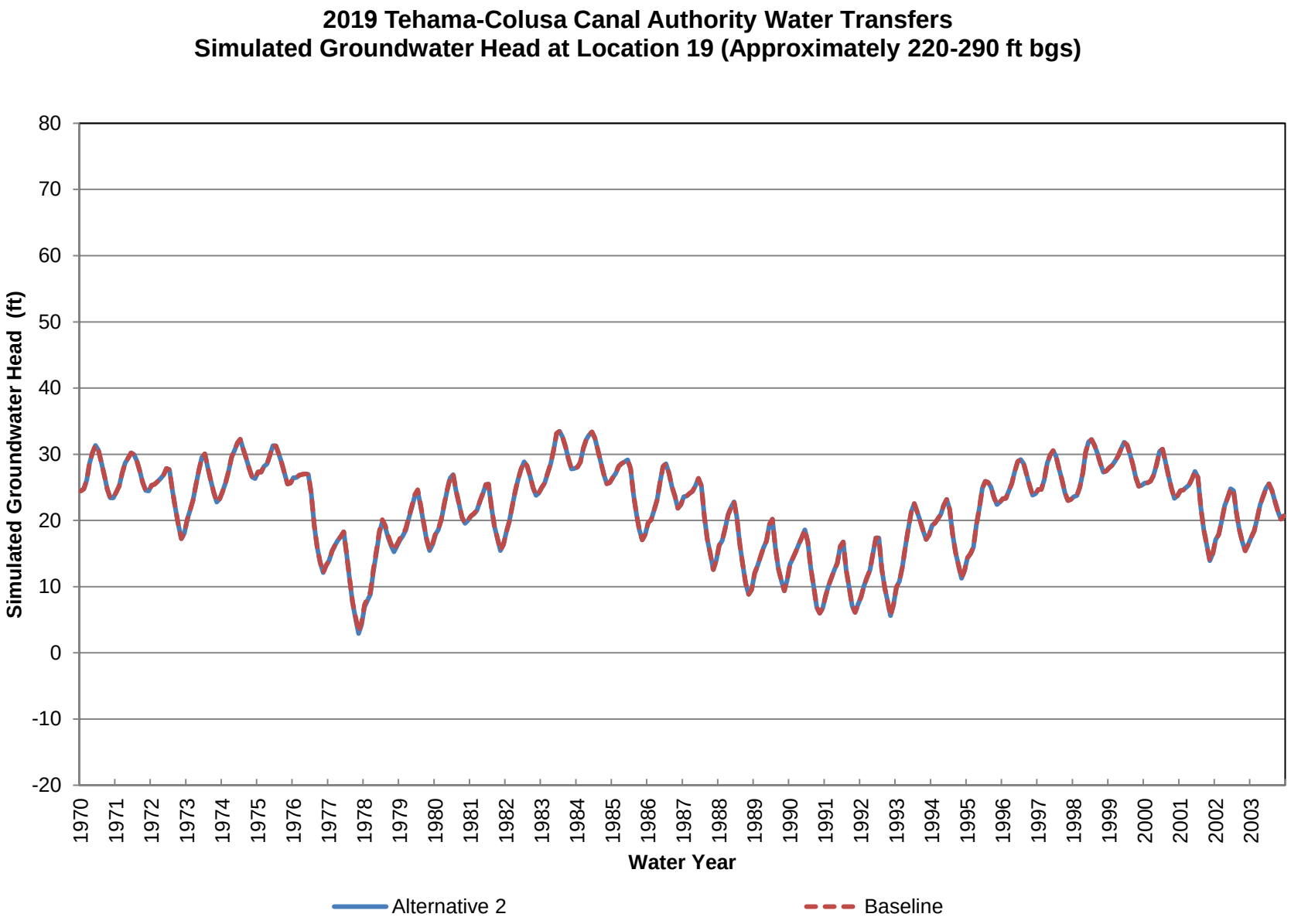
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
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
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1976
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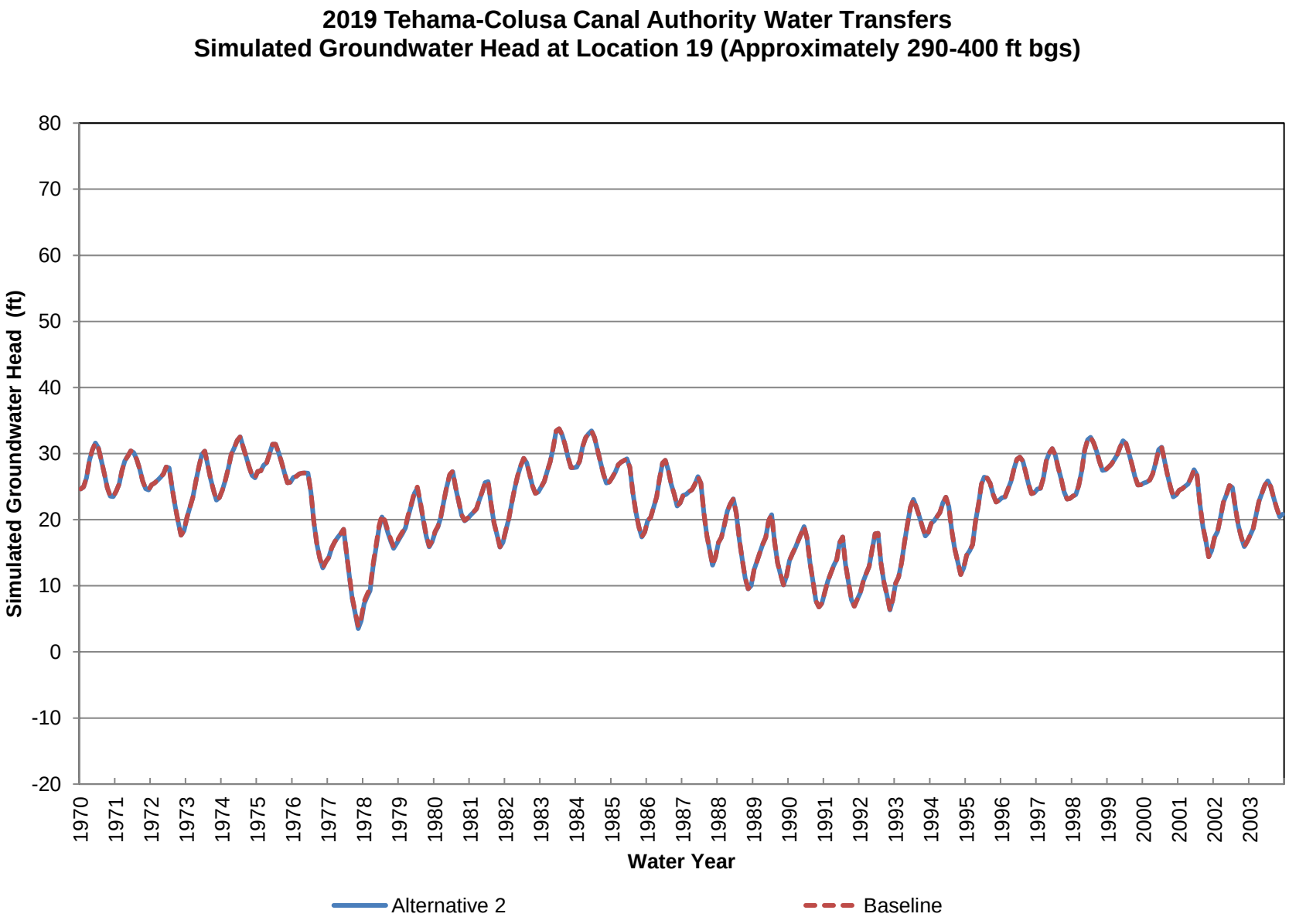
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 19 (Approximately 290-400 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
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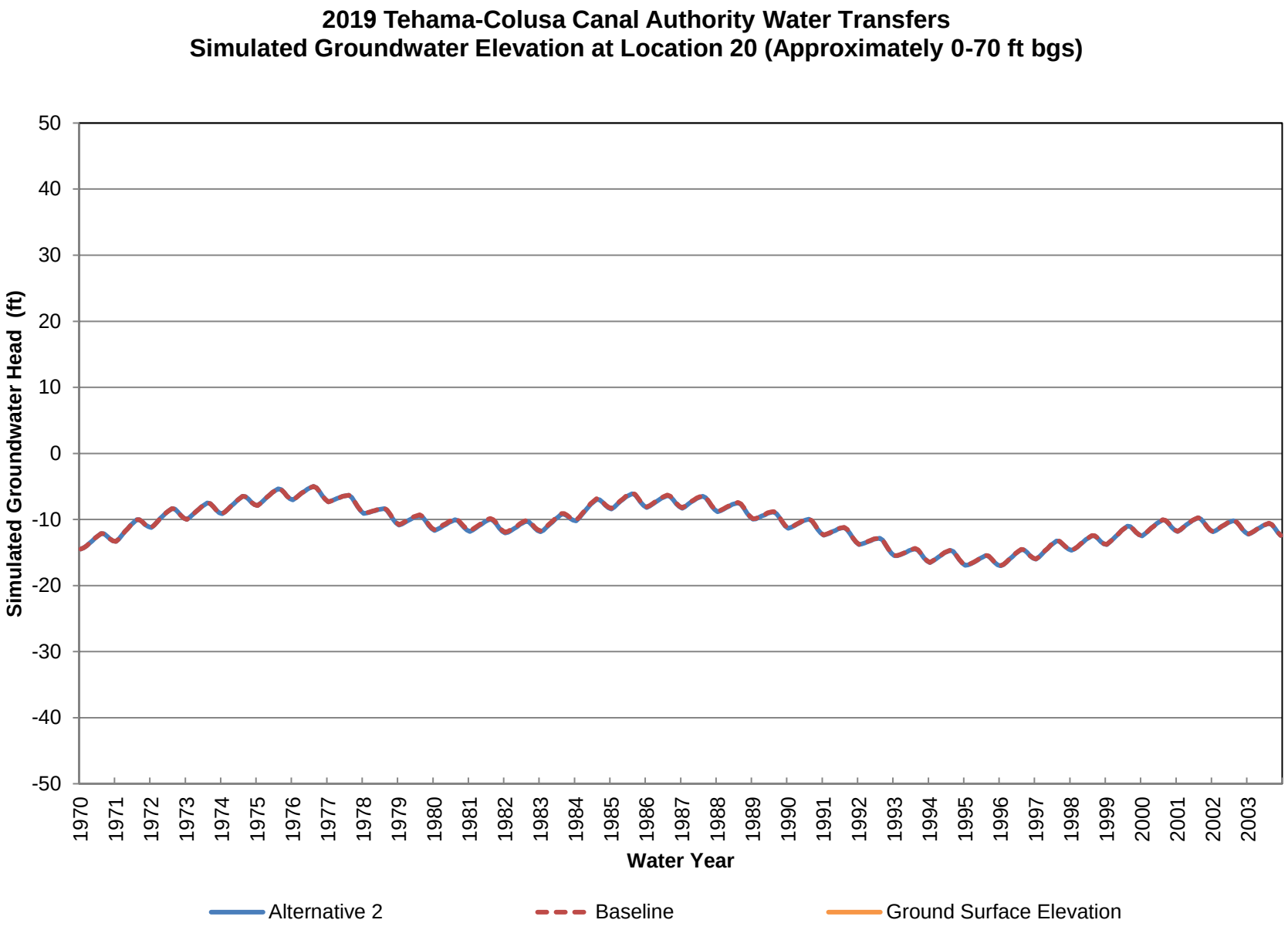
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 20 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
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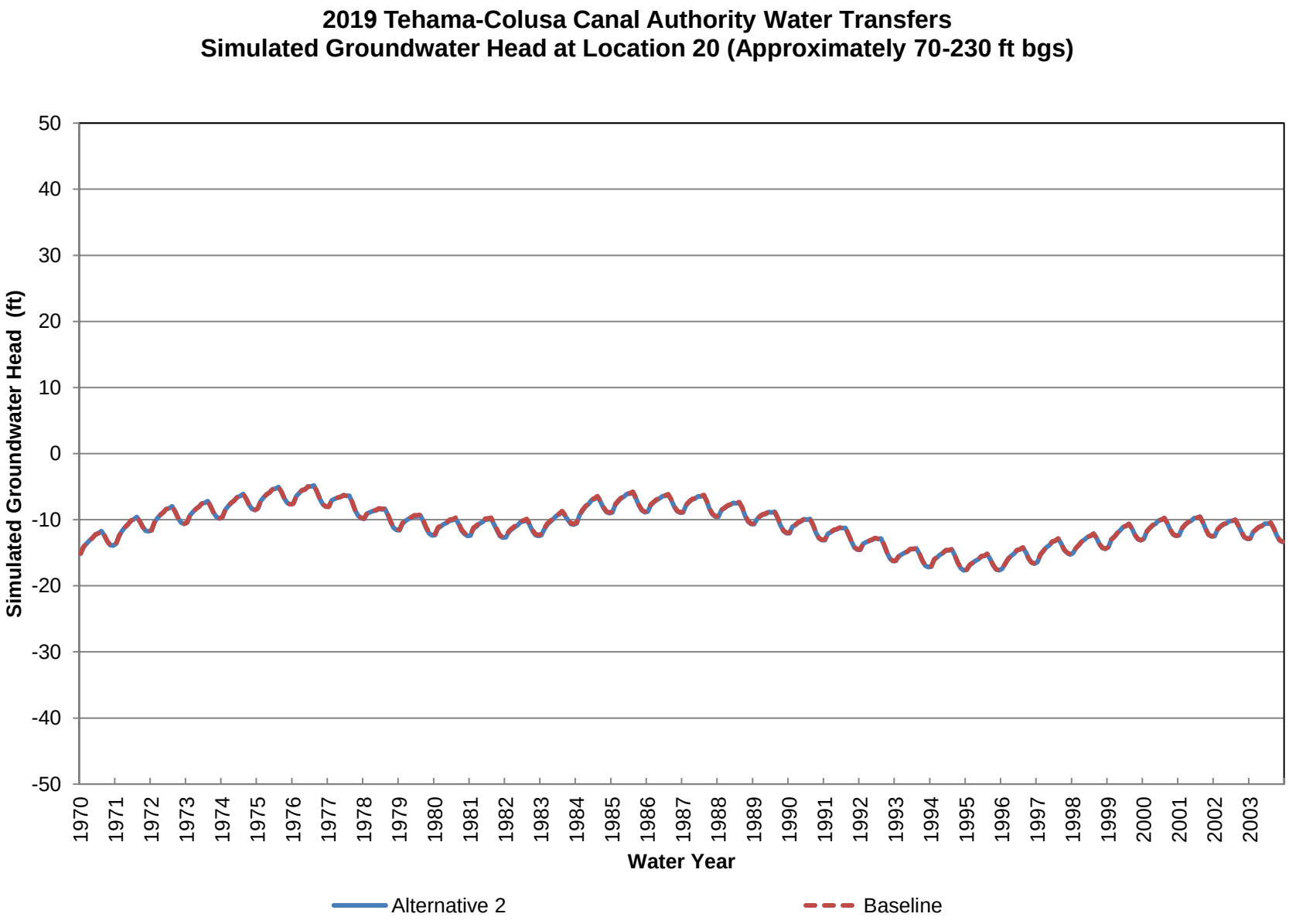
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 70-230 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
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1998
1999
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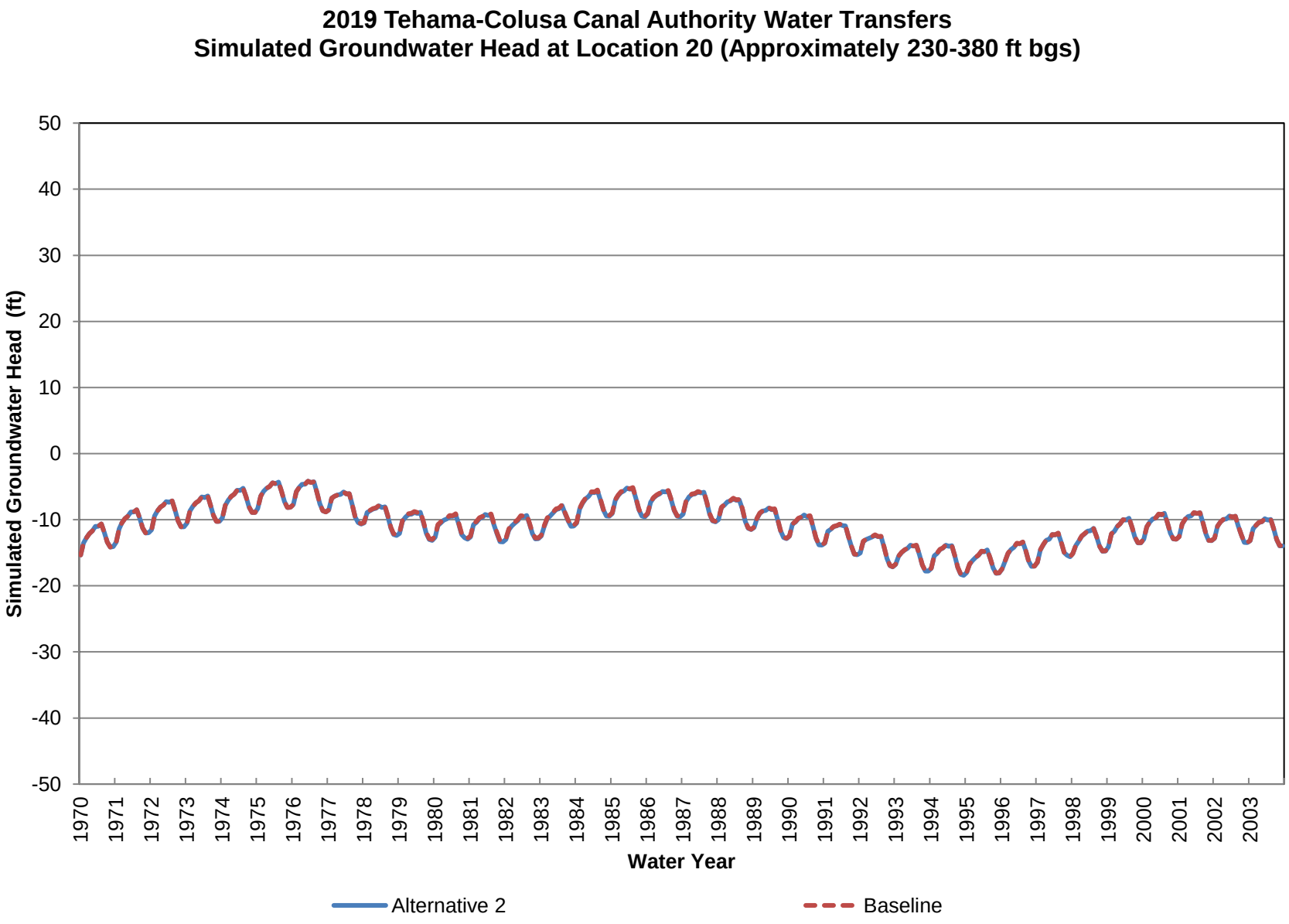
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 230-380 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
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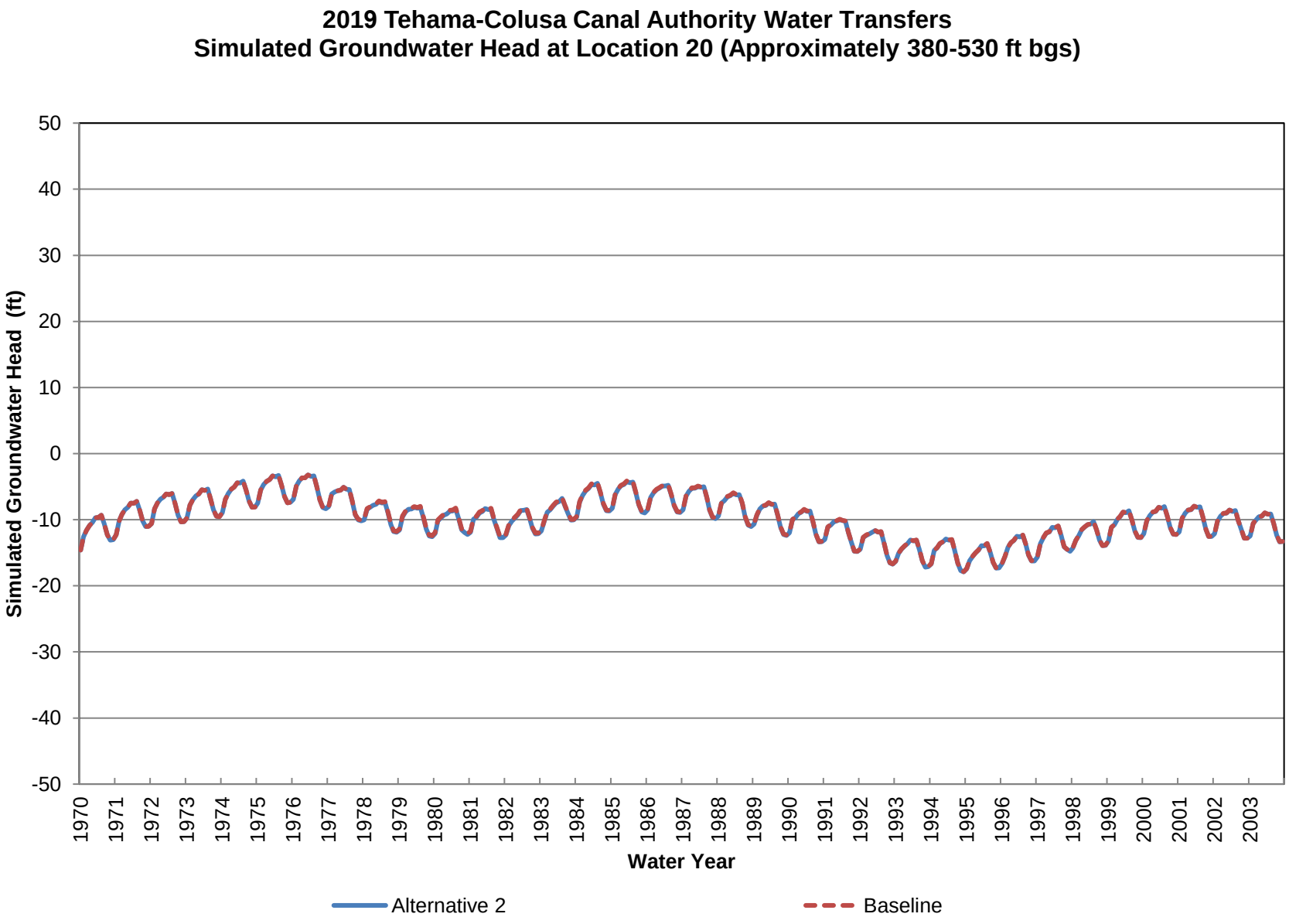
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 380-530 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
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1991
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1994
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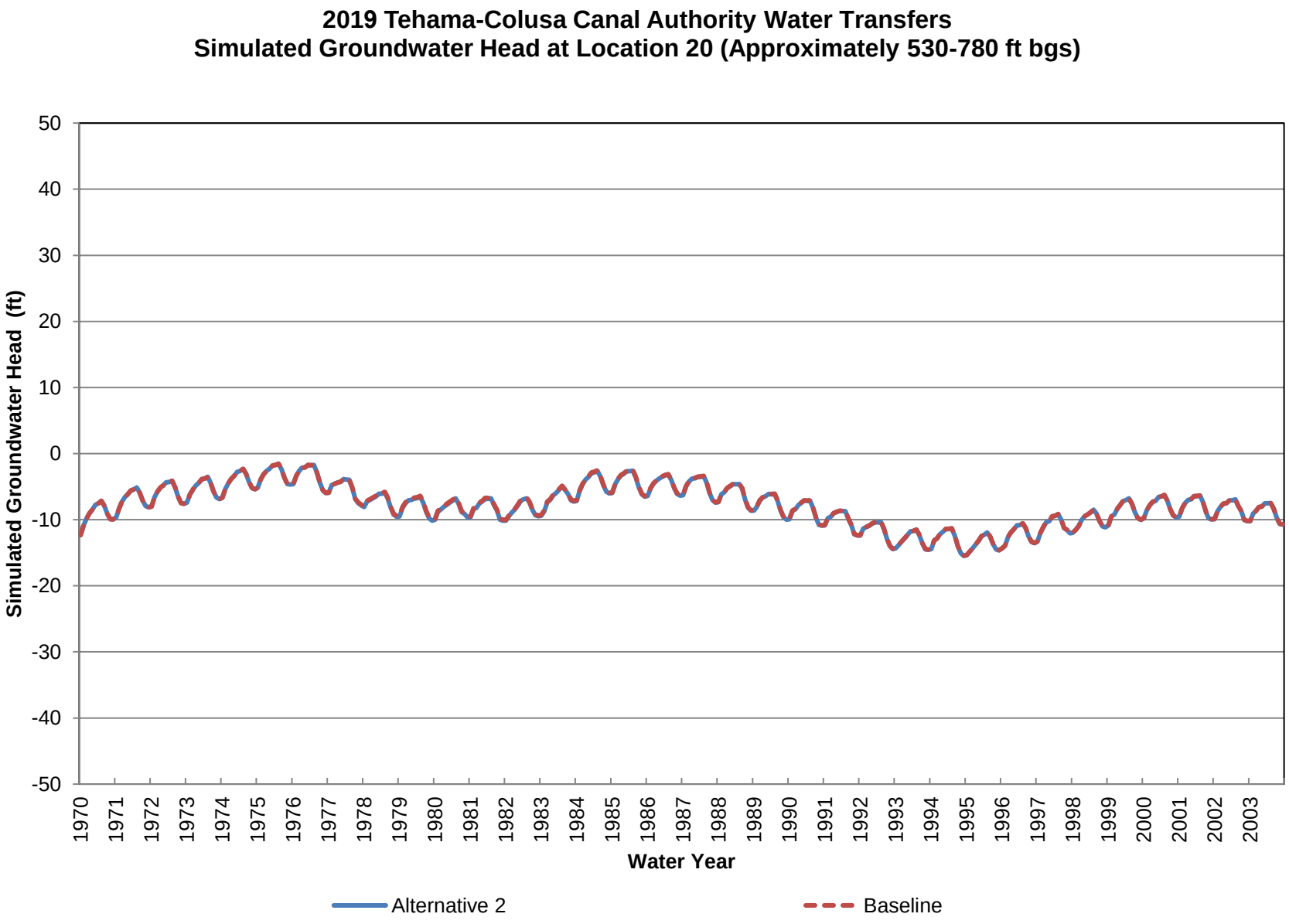
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 530-780 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
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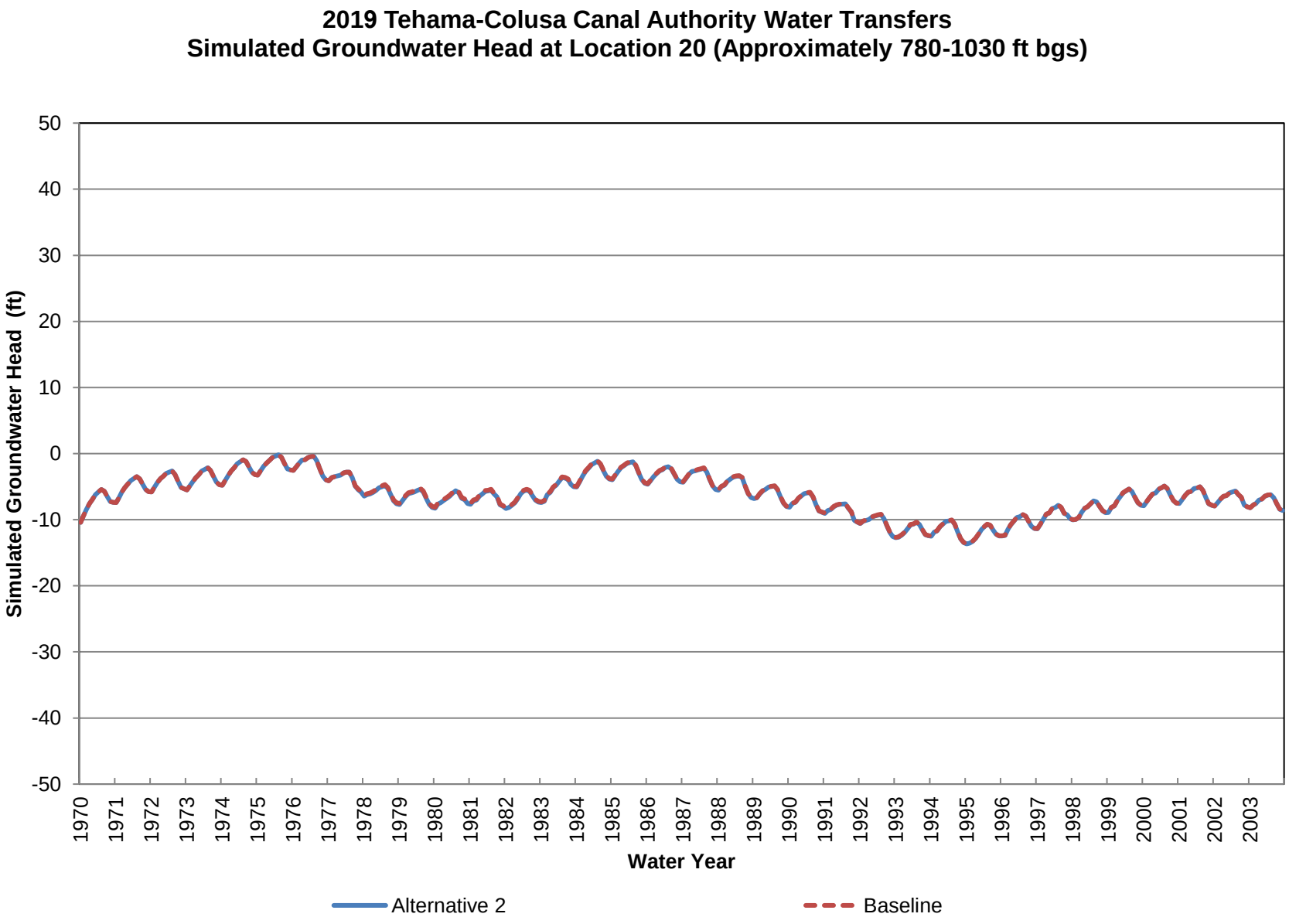
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 780-1030 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
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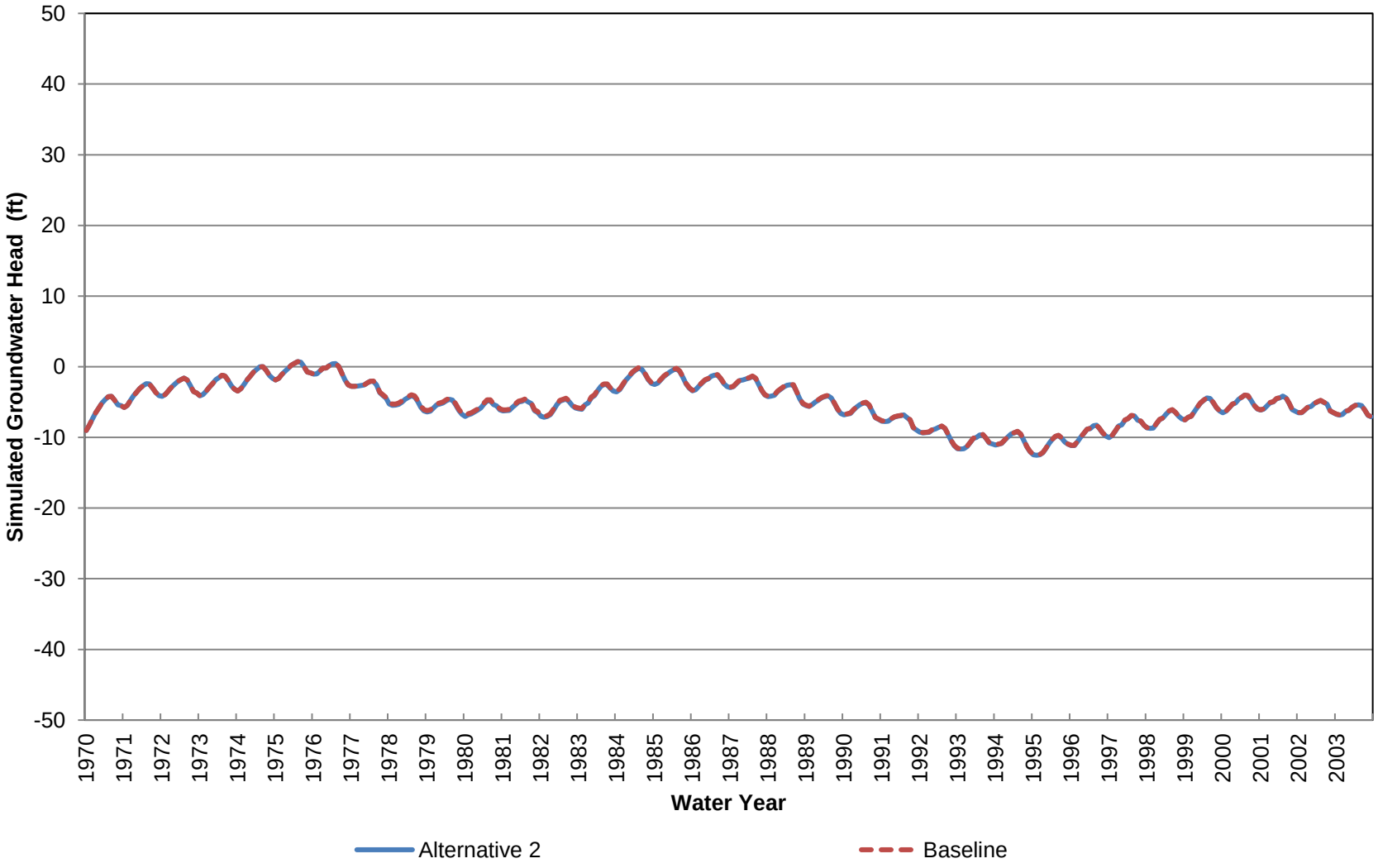
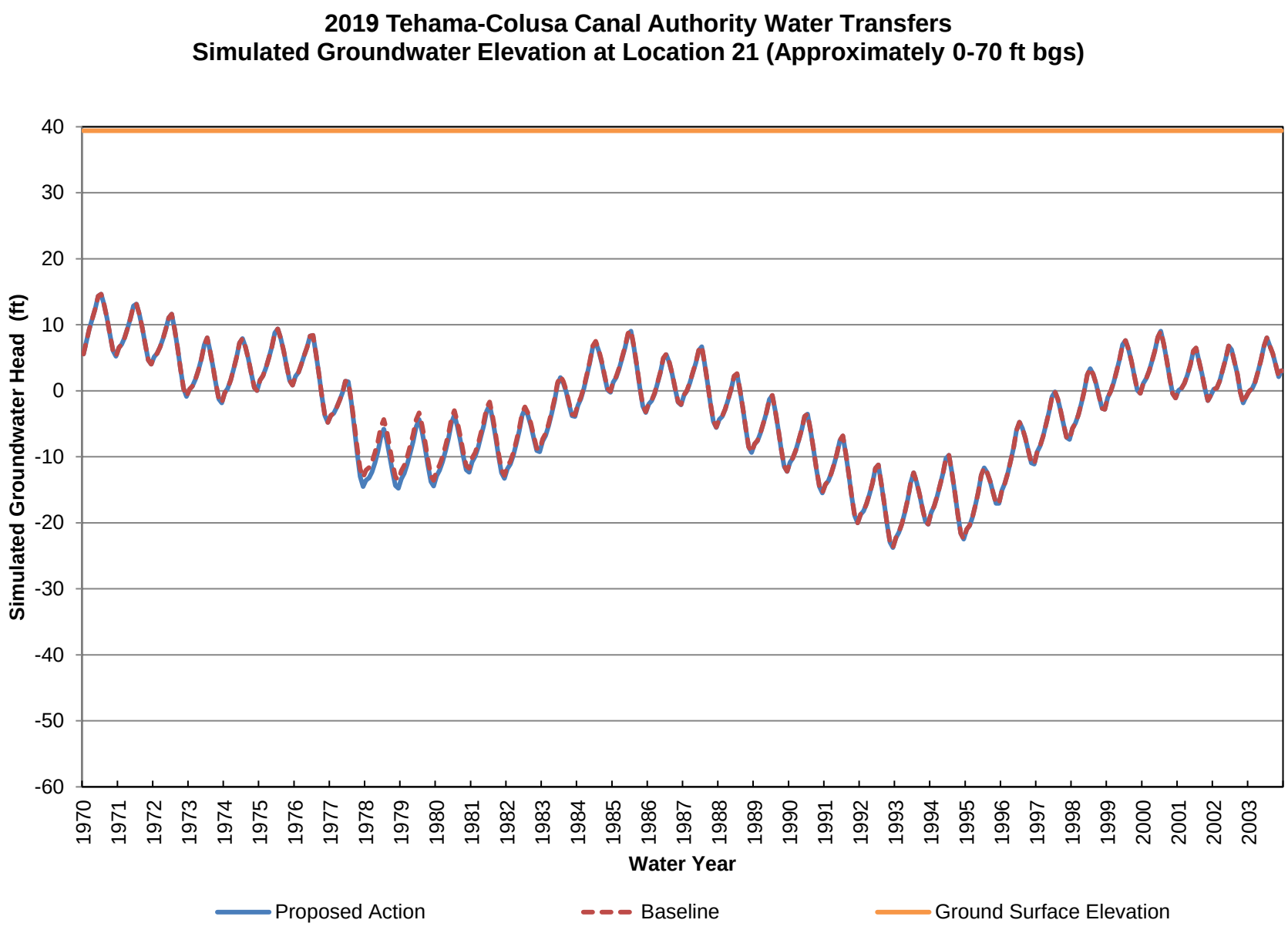
2001
2002
2003
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 1030-1420 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 21 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1970
1971
1972
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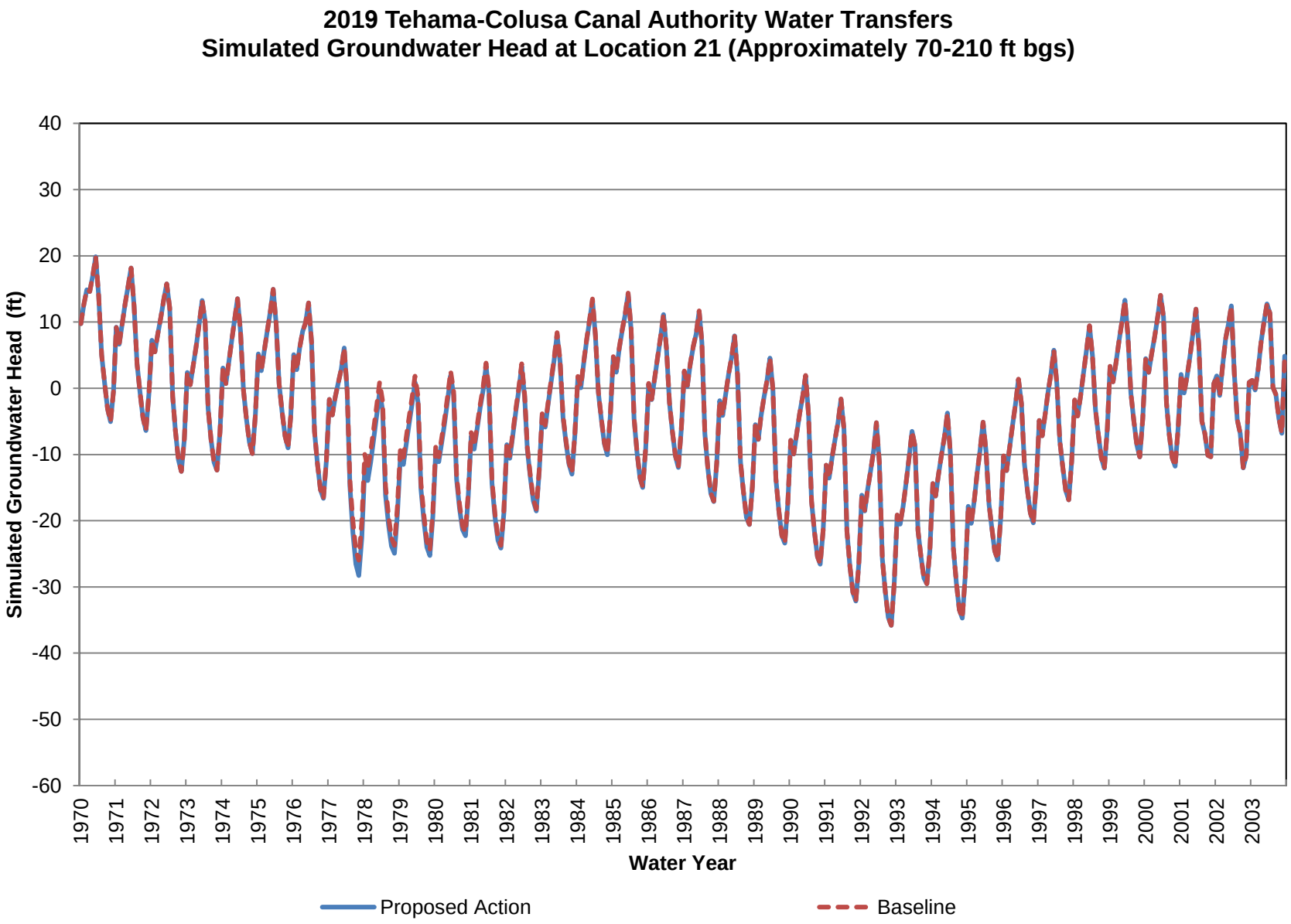
2002
2003
Water Year
Proposed Action
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 70-210 ft bgs)
Simulated Groundwater Head (ft)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1970
1971
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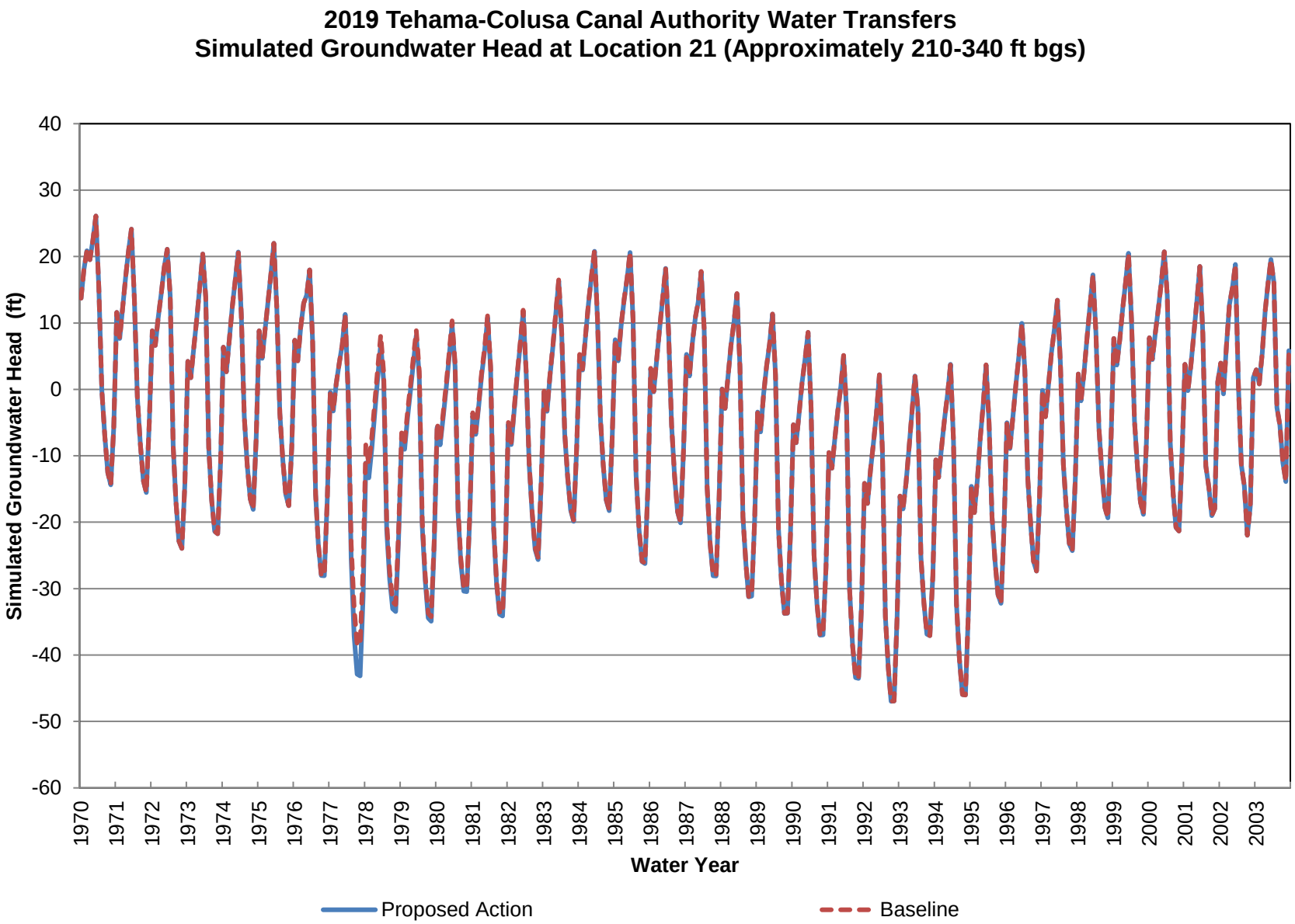
2002
2003
Water Year
Proposed Action
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 210-340 ft bgs)
Simulated Groundwater Head (ft)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1970
1971
1972
1973
1974
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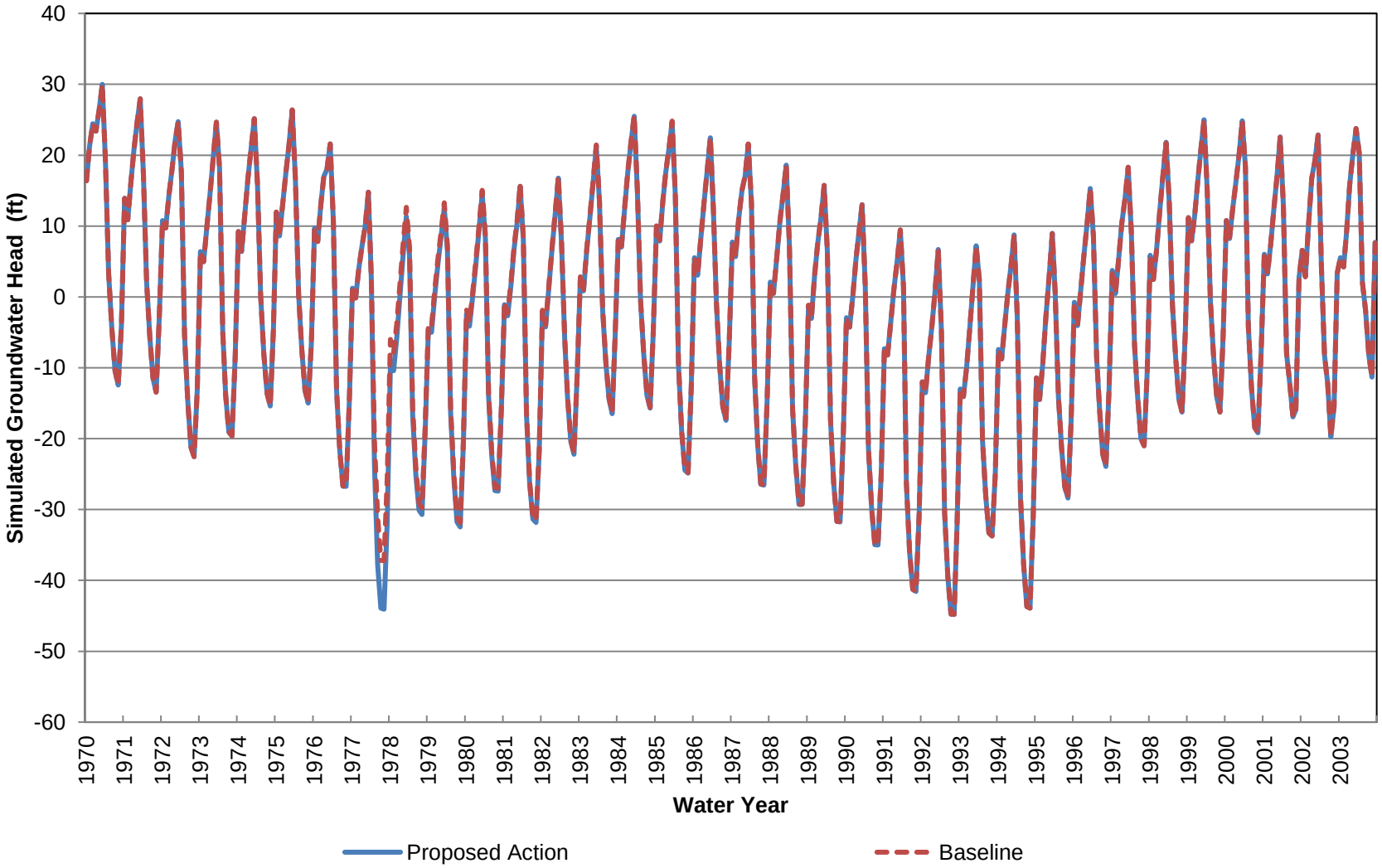
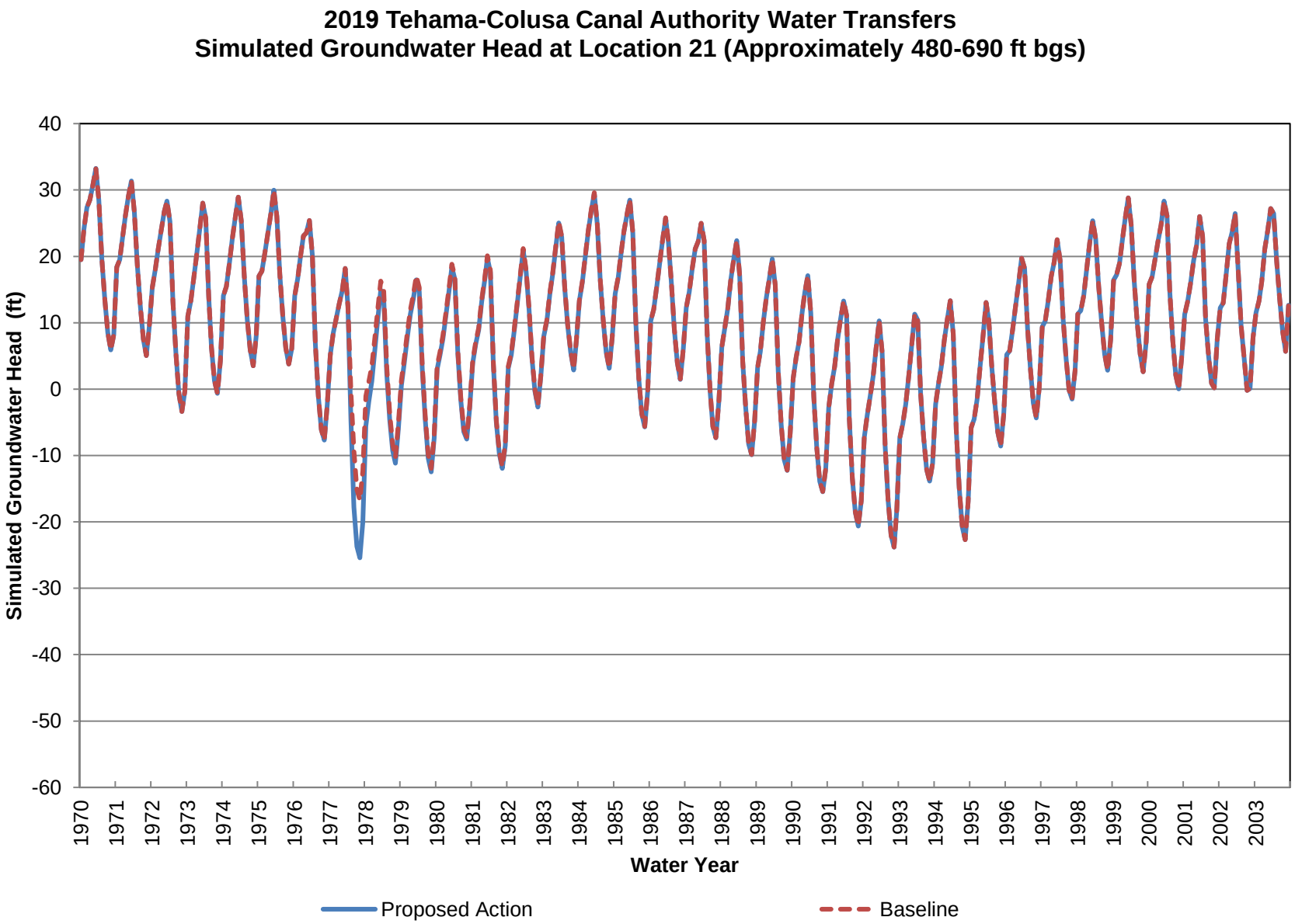
2001
2002
2003
Water Year
Proposed Action
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 340-480 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 480-690 ft bgs)
Simulated Groundwater Head (ft)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1970
1971
1972
1973
1974
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1998
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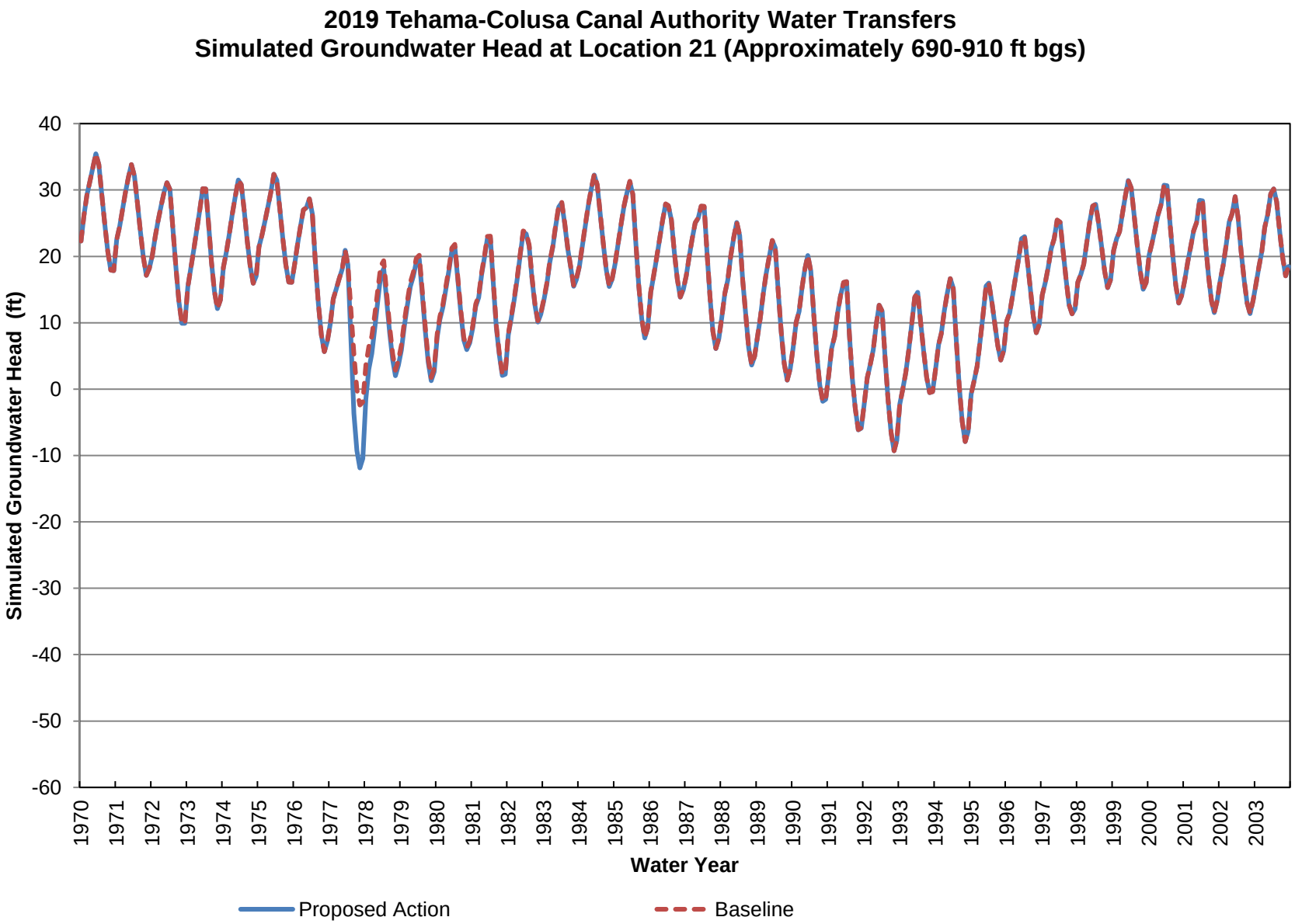
2001
2002
2003
Water Year
Proposed Action
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 690-910 ft bgs)
Simulated Groundwater Head (ft)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1970
1971
1972
1973
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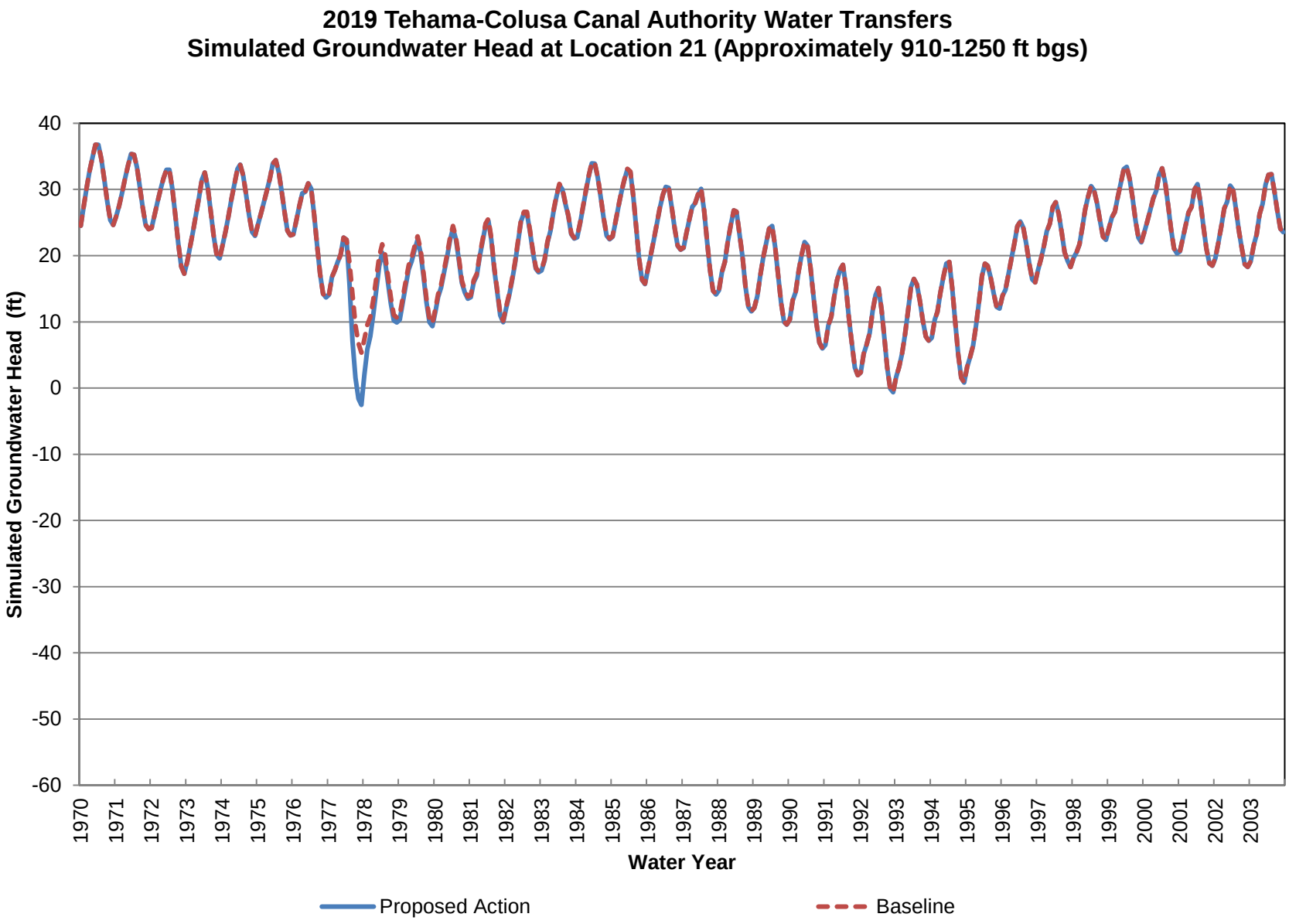
1998
1999
2000
2001
2002
2003
Water Year
Proposed Action
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 910-1250 ft bgs)
Simulated Groundwater Head (ft)
40
30
20
10
0
-10
-20
-30
-40
-50
-60
1970
1971
1972
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1998
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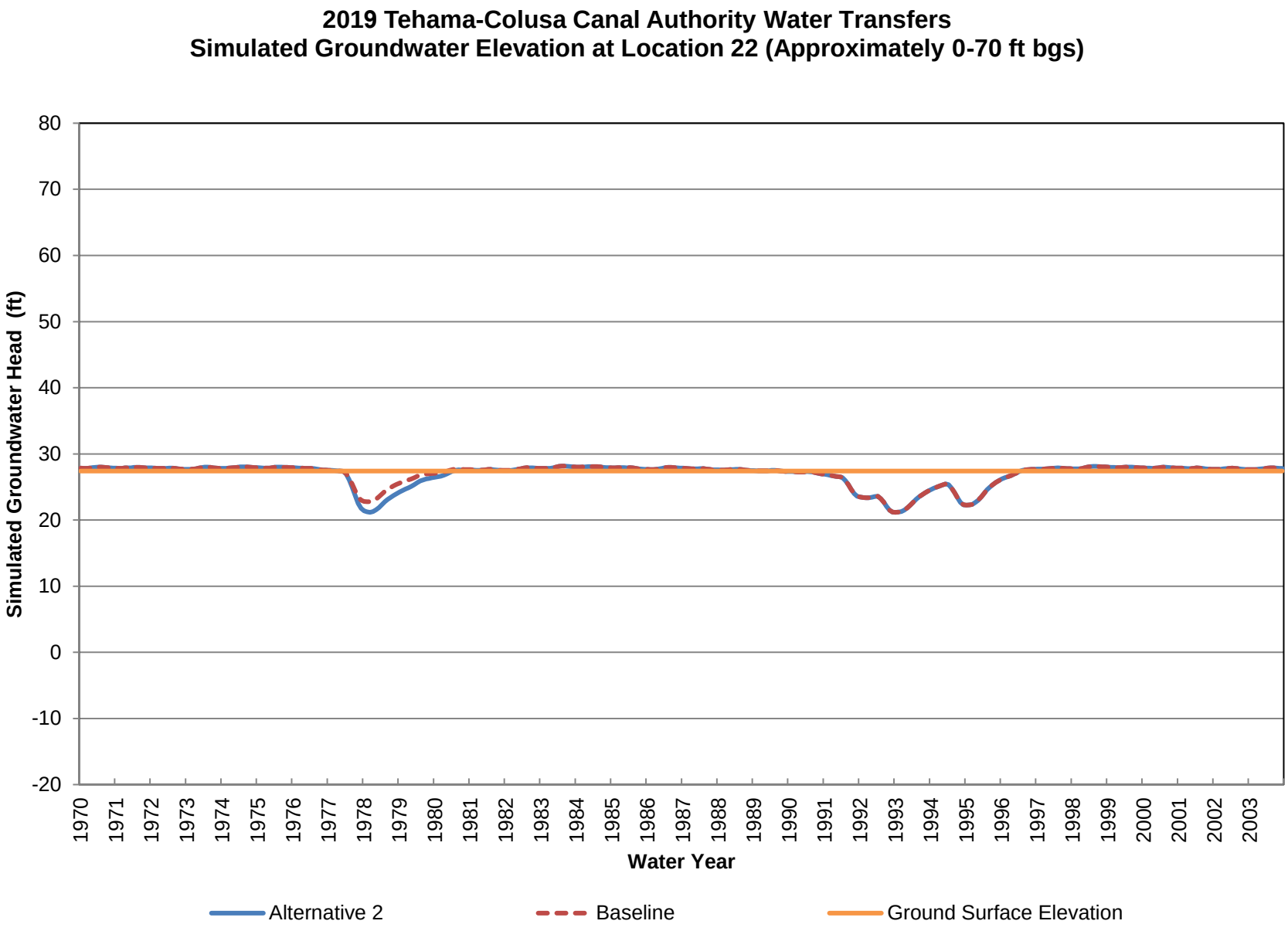
2001
2002
2003
Water Year
Proposed Action
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 22 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
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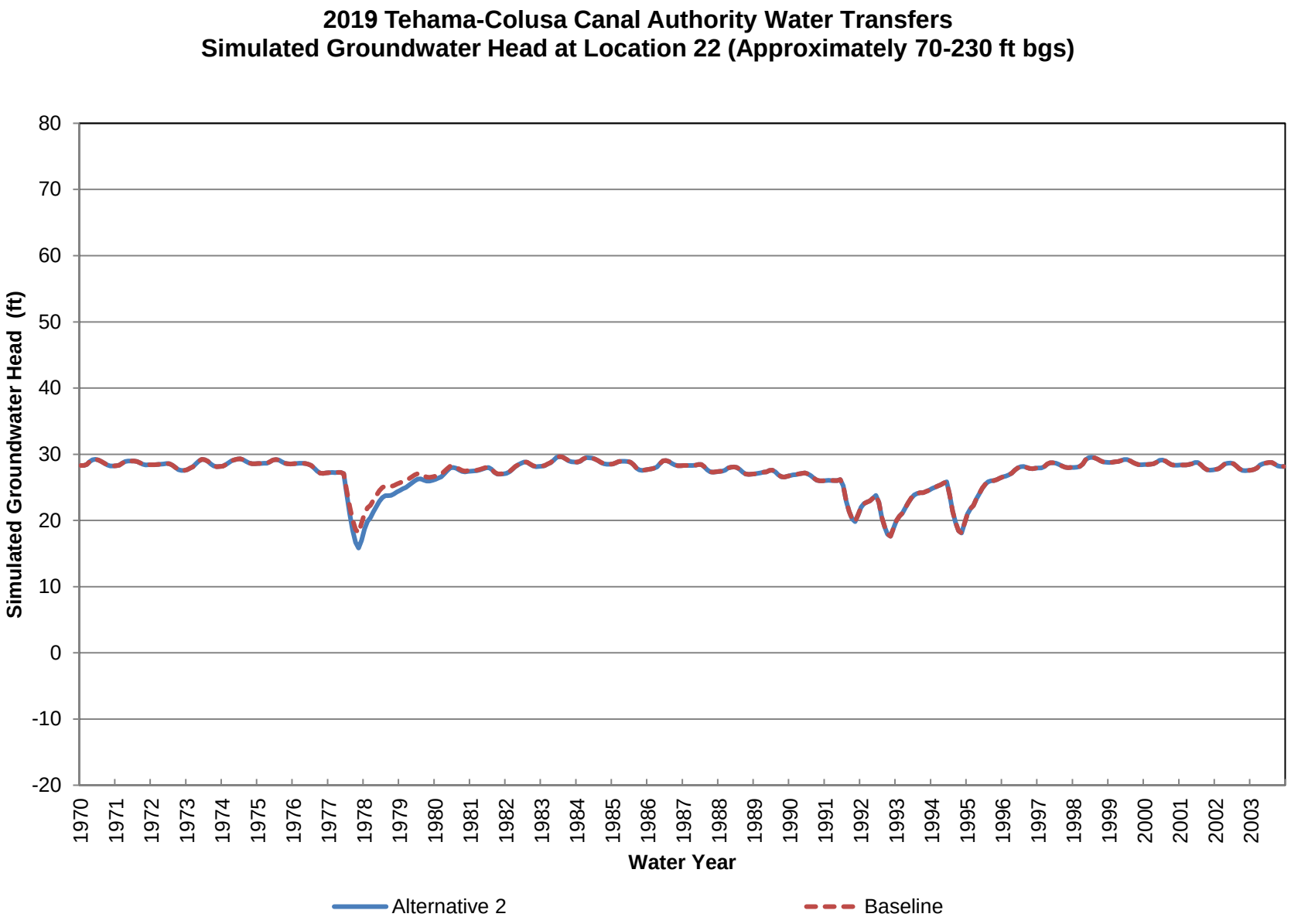
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 70-230 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
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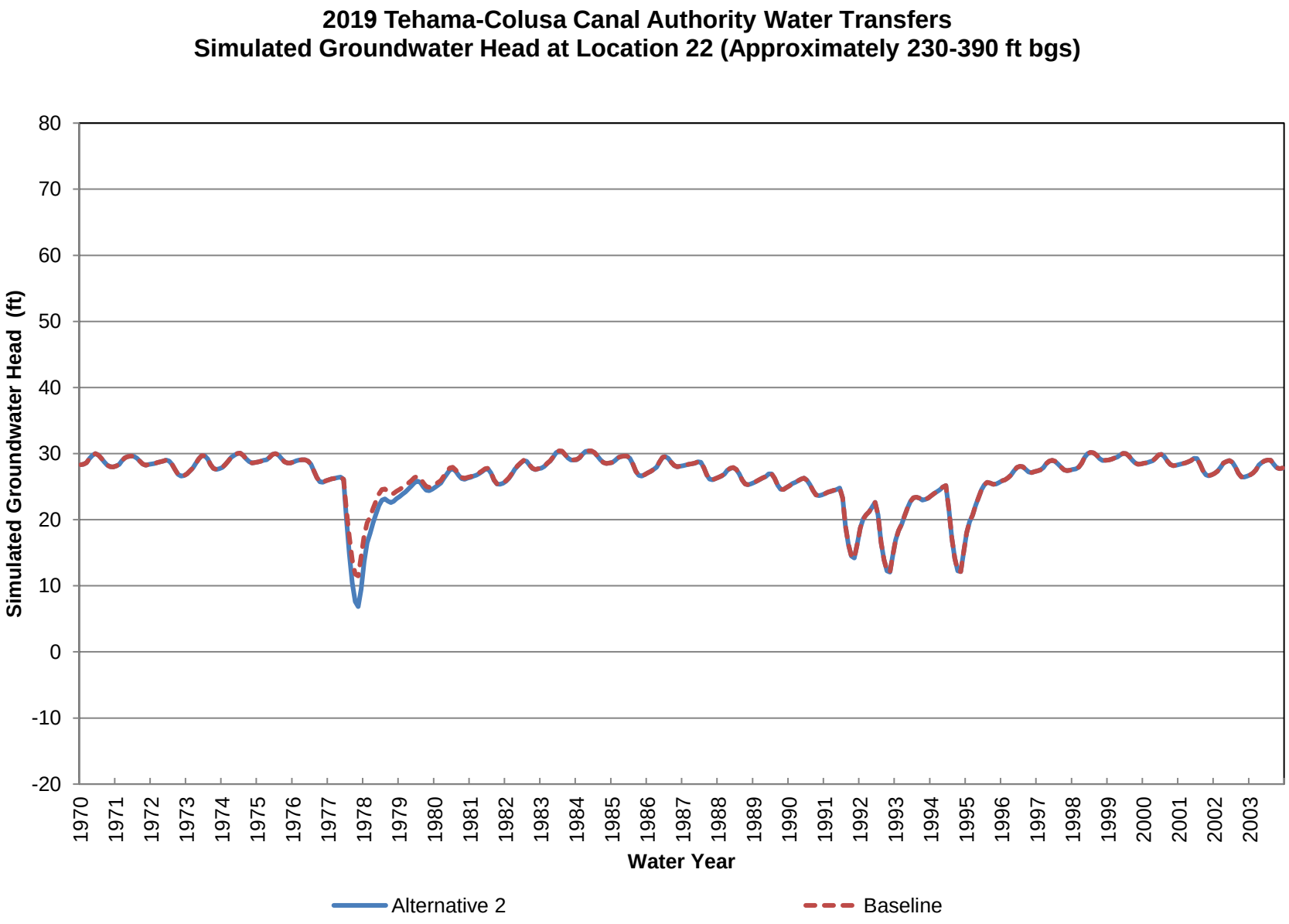
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 230-390 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
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1974
1975
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1978
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1980
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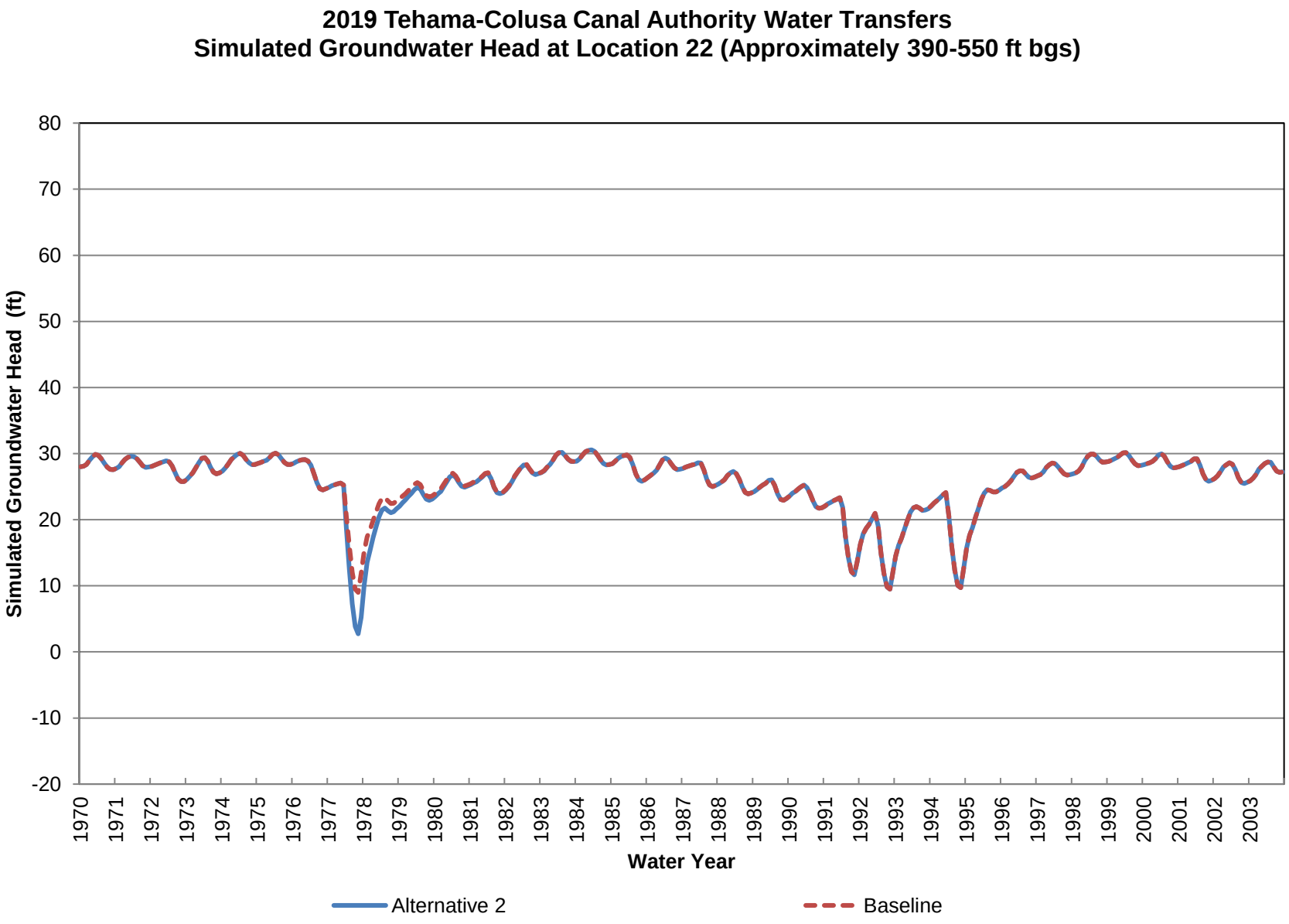
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 390-550 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
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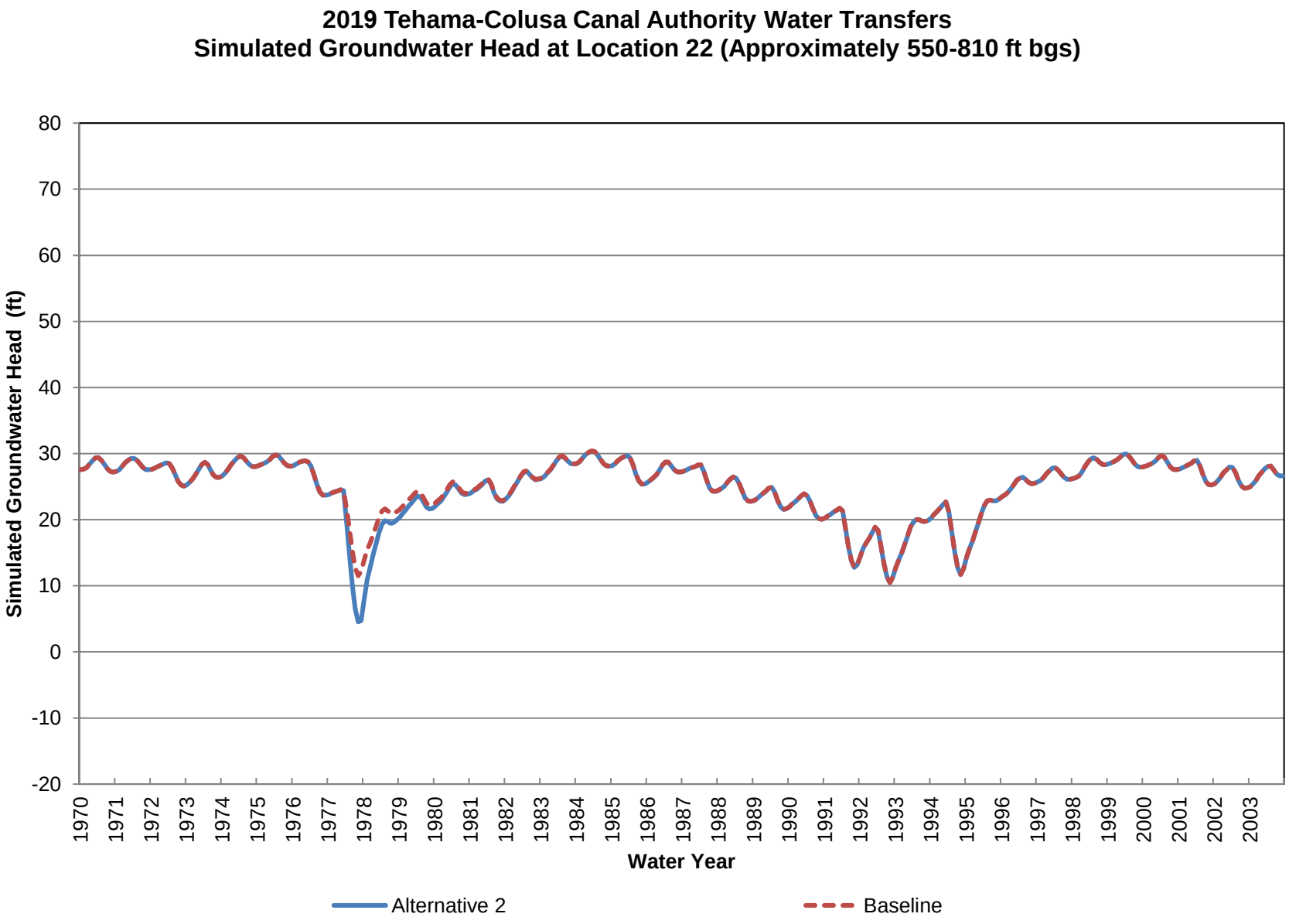
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 550-810 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
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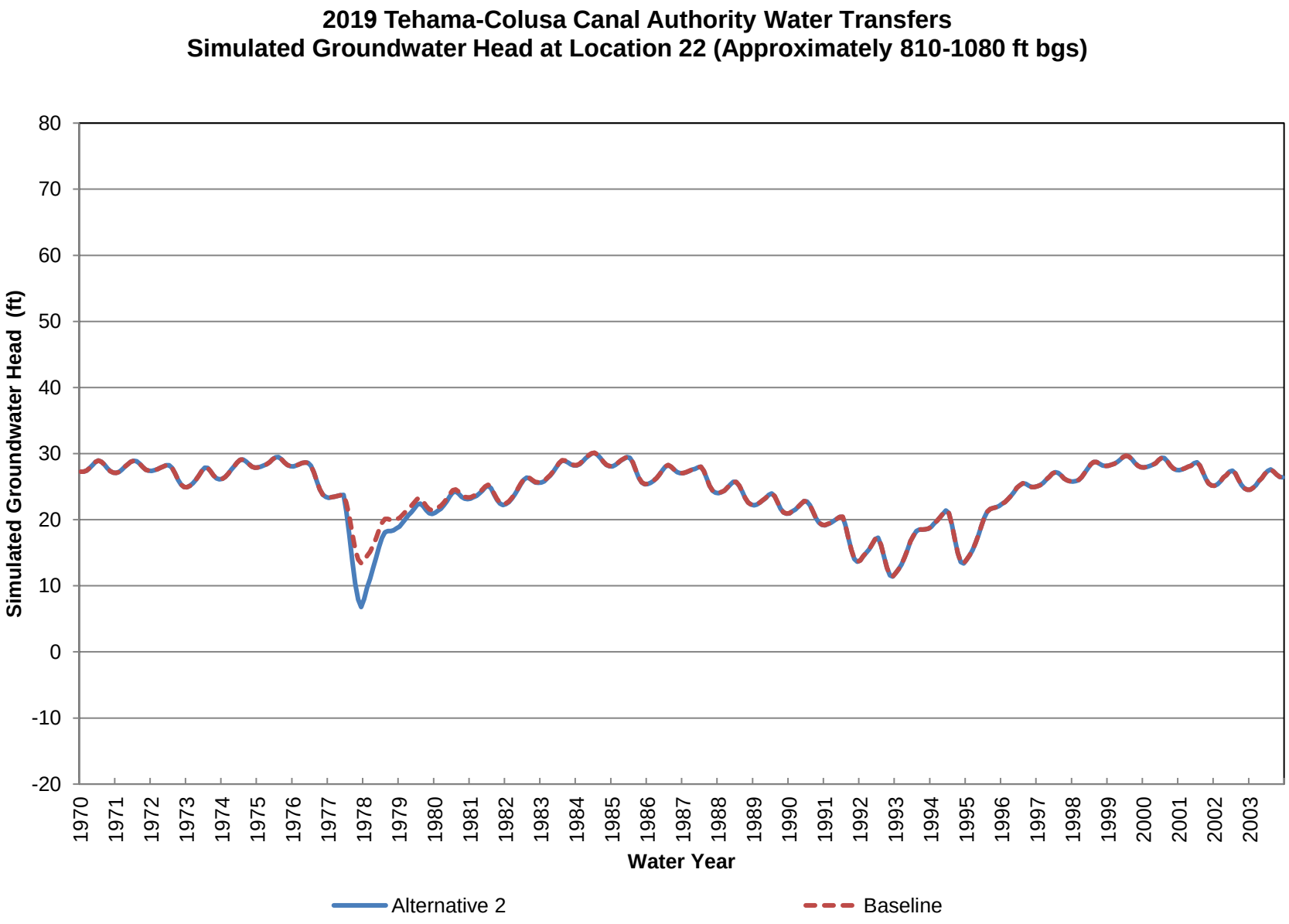
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 810-1080 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
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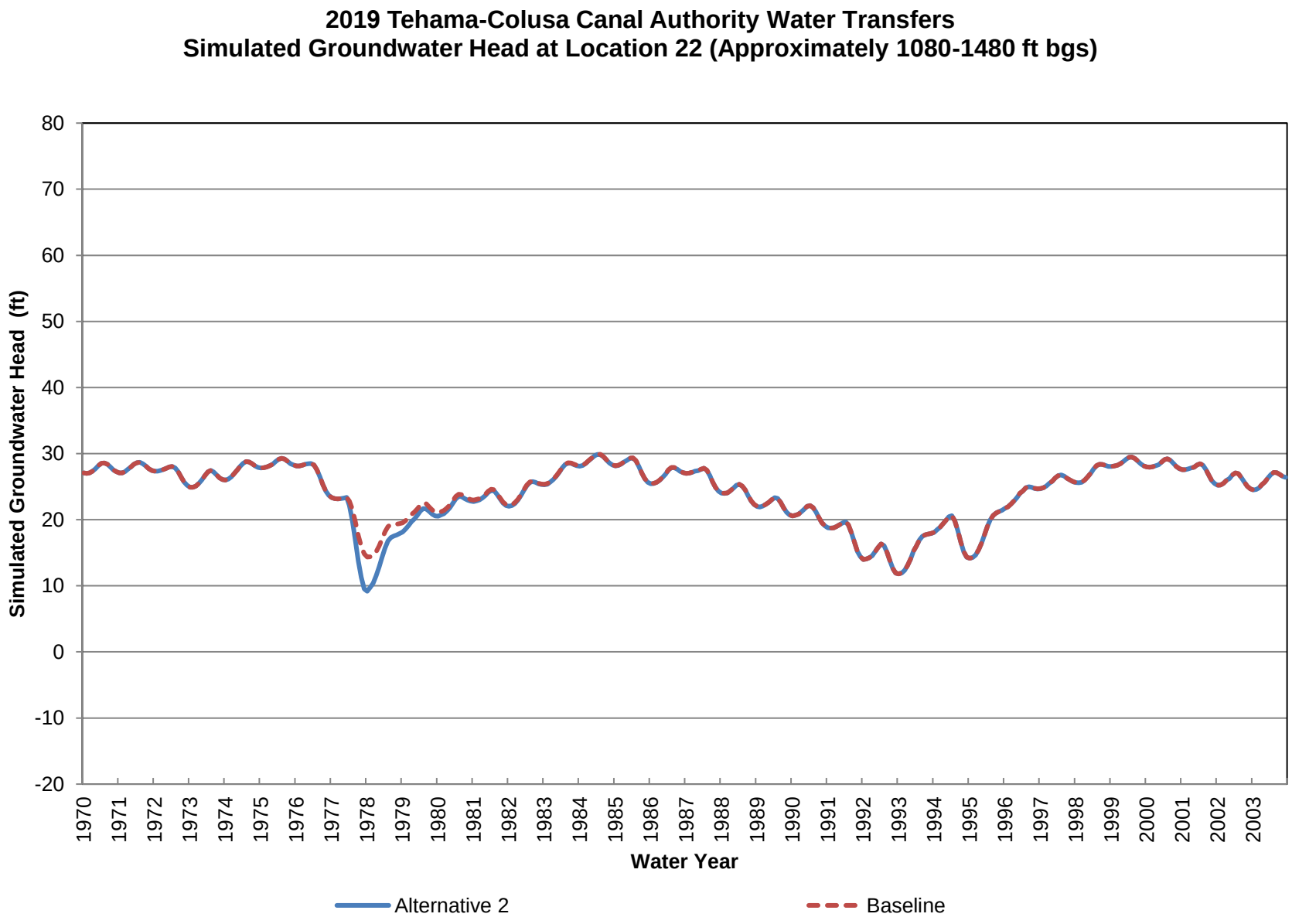
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 1080-1480 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
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1974
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1976
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1998
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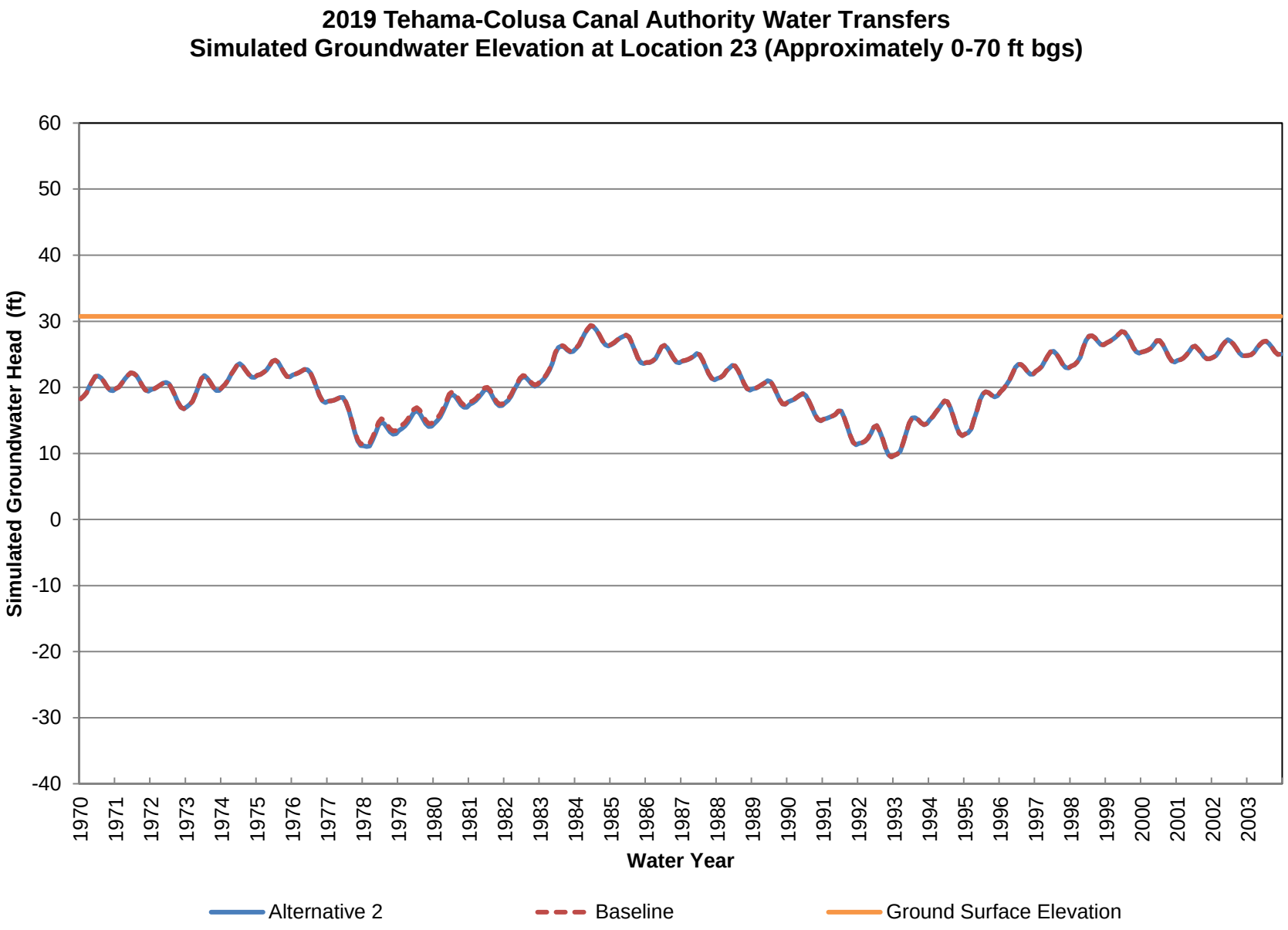
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 23 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
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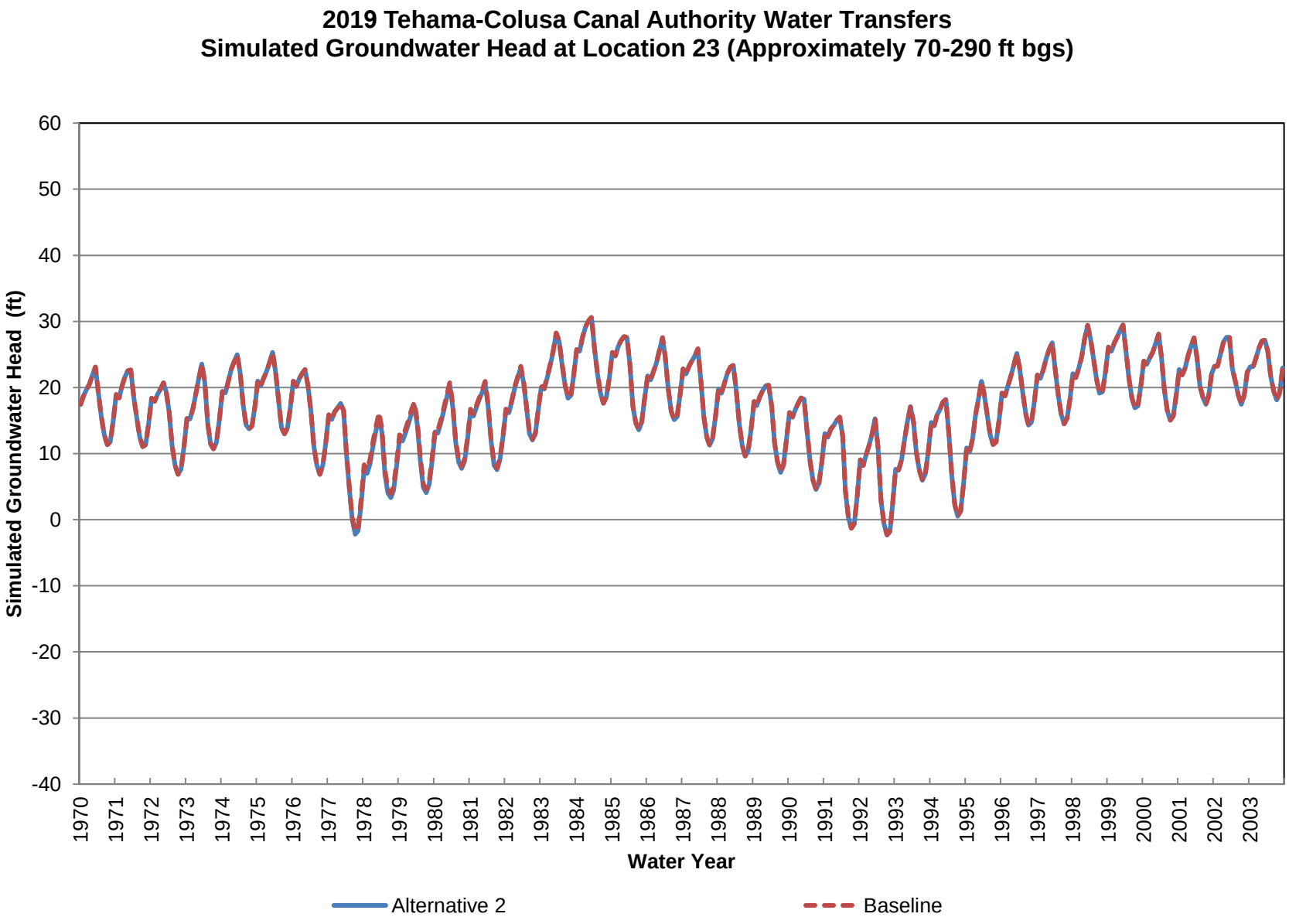
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 70-290 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
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20
10
0
-10
-20
-30
-40
1970
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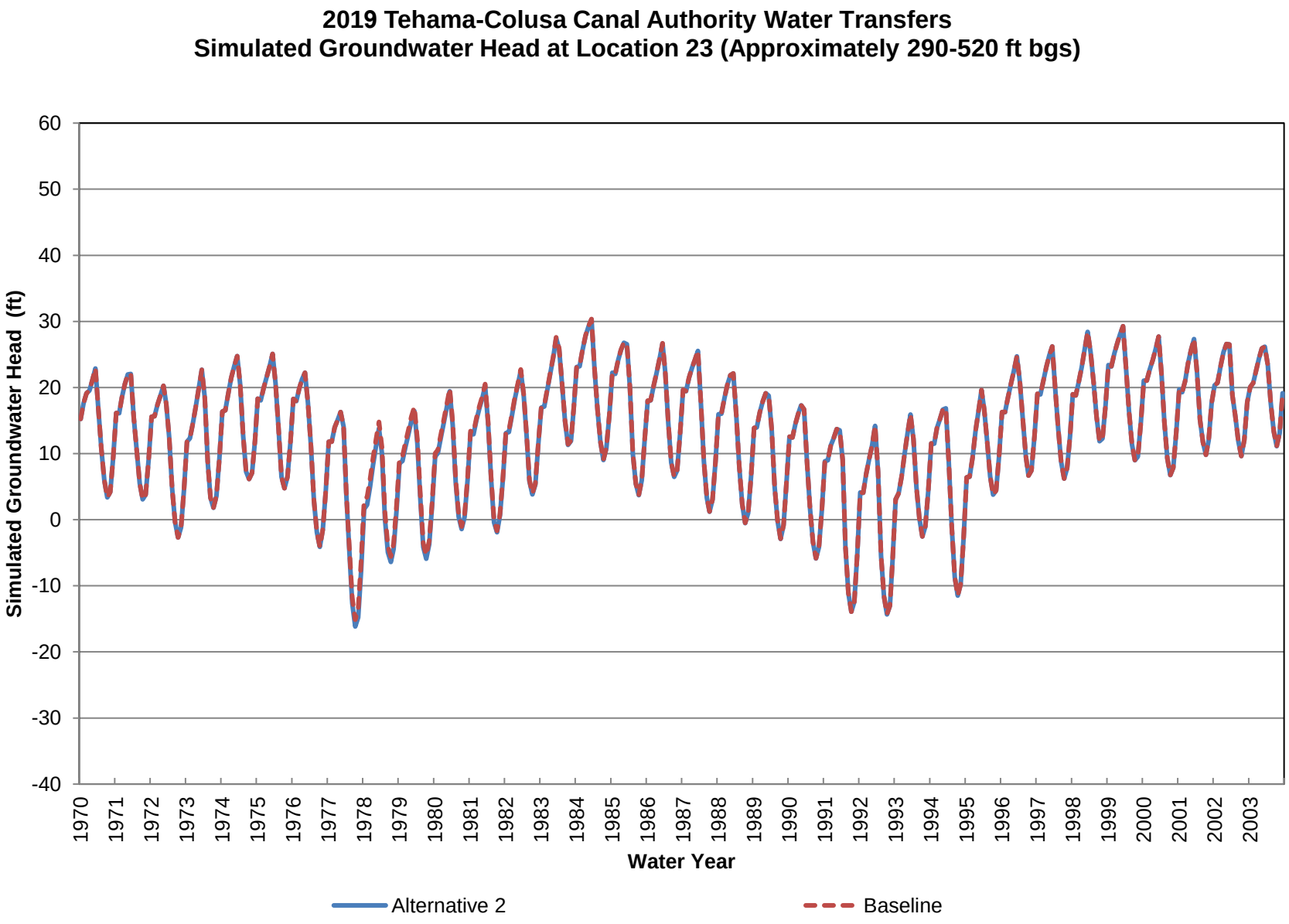
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 290-520 ft bgs)
Simulated Groundwater Head (ft)
60
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-10
-20
-30
-40
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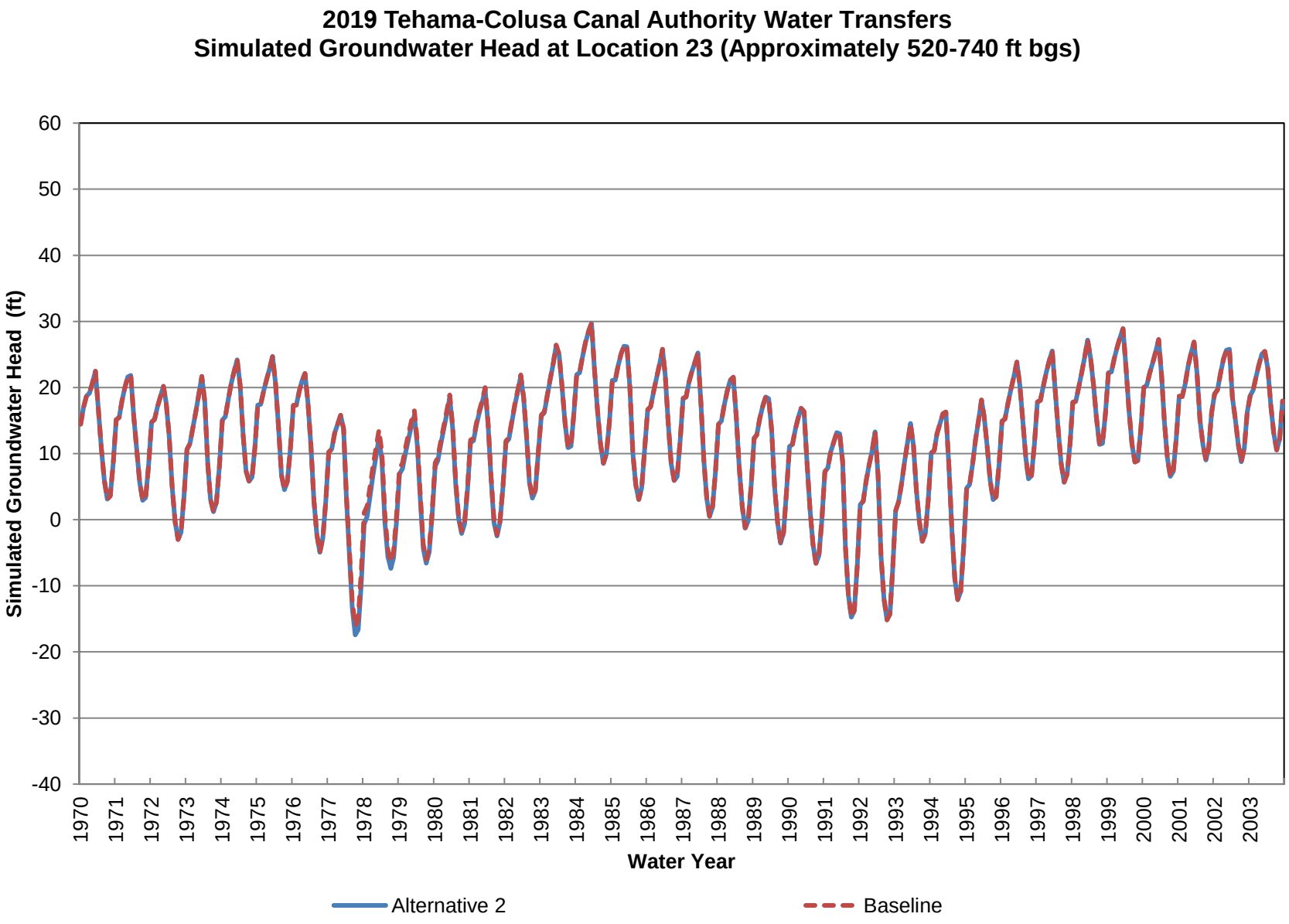
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 520-740 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
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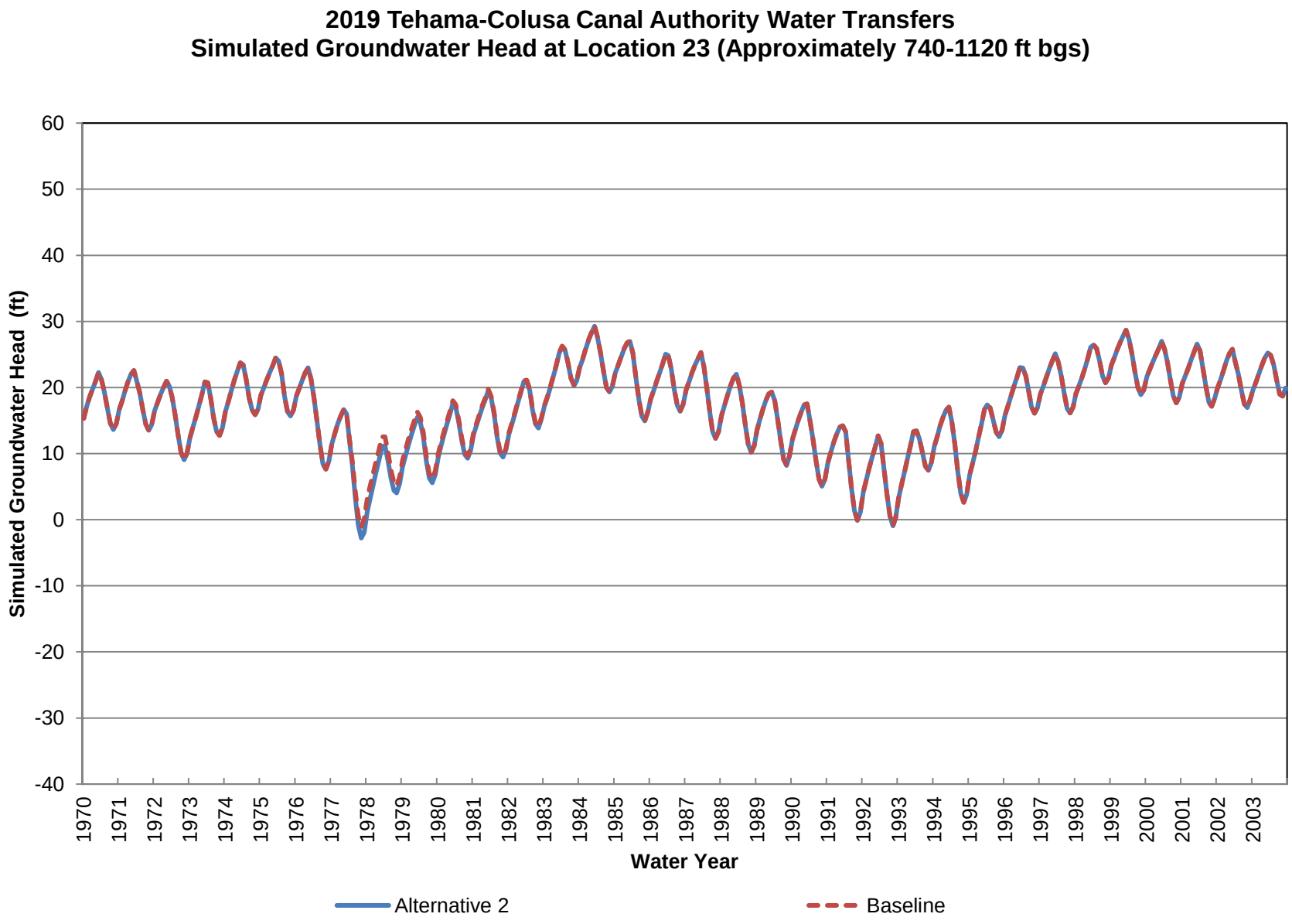
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 740-1120 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
1976
1977
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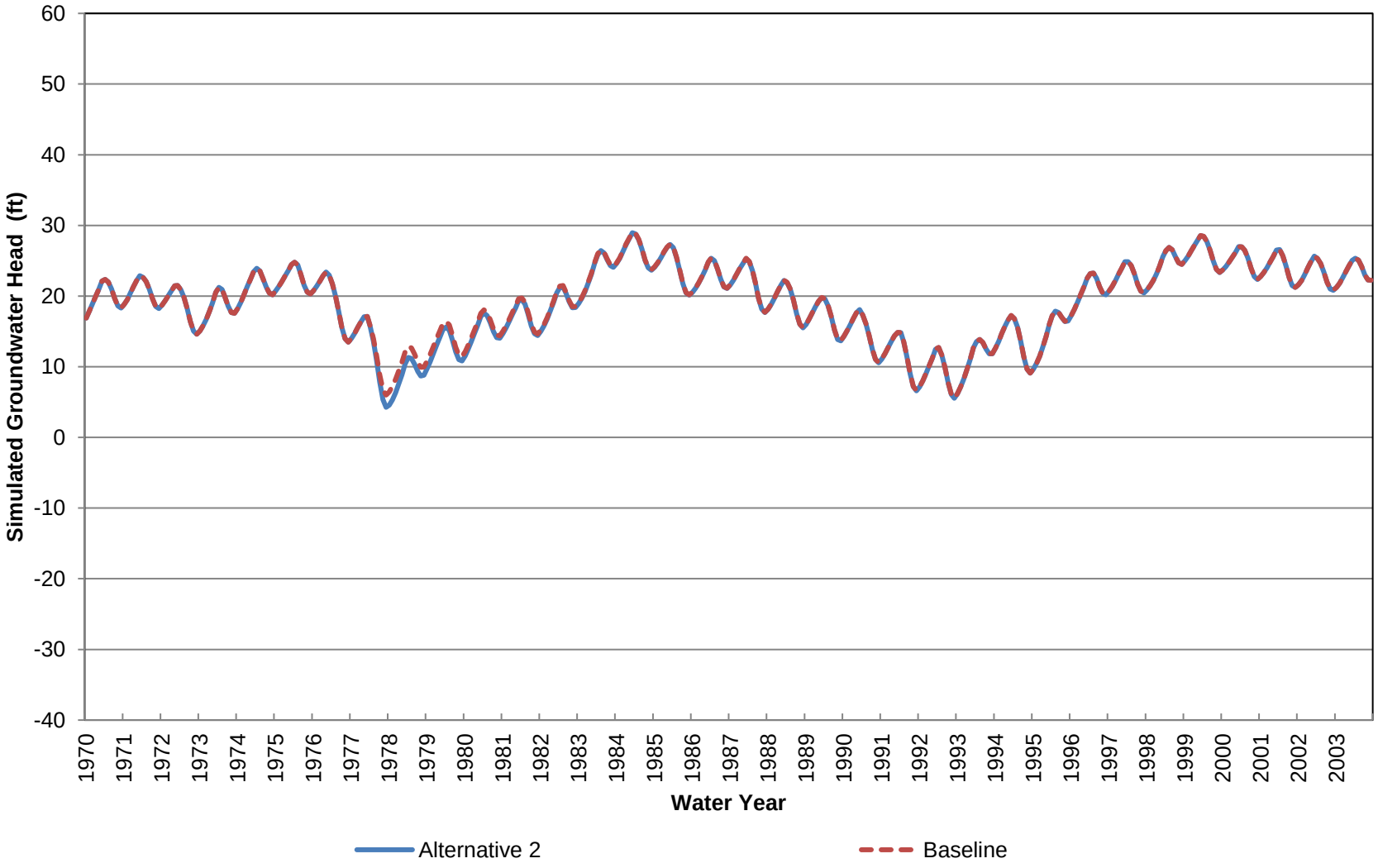
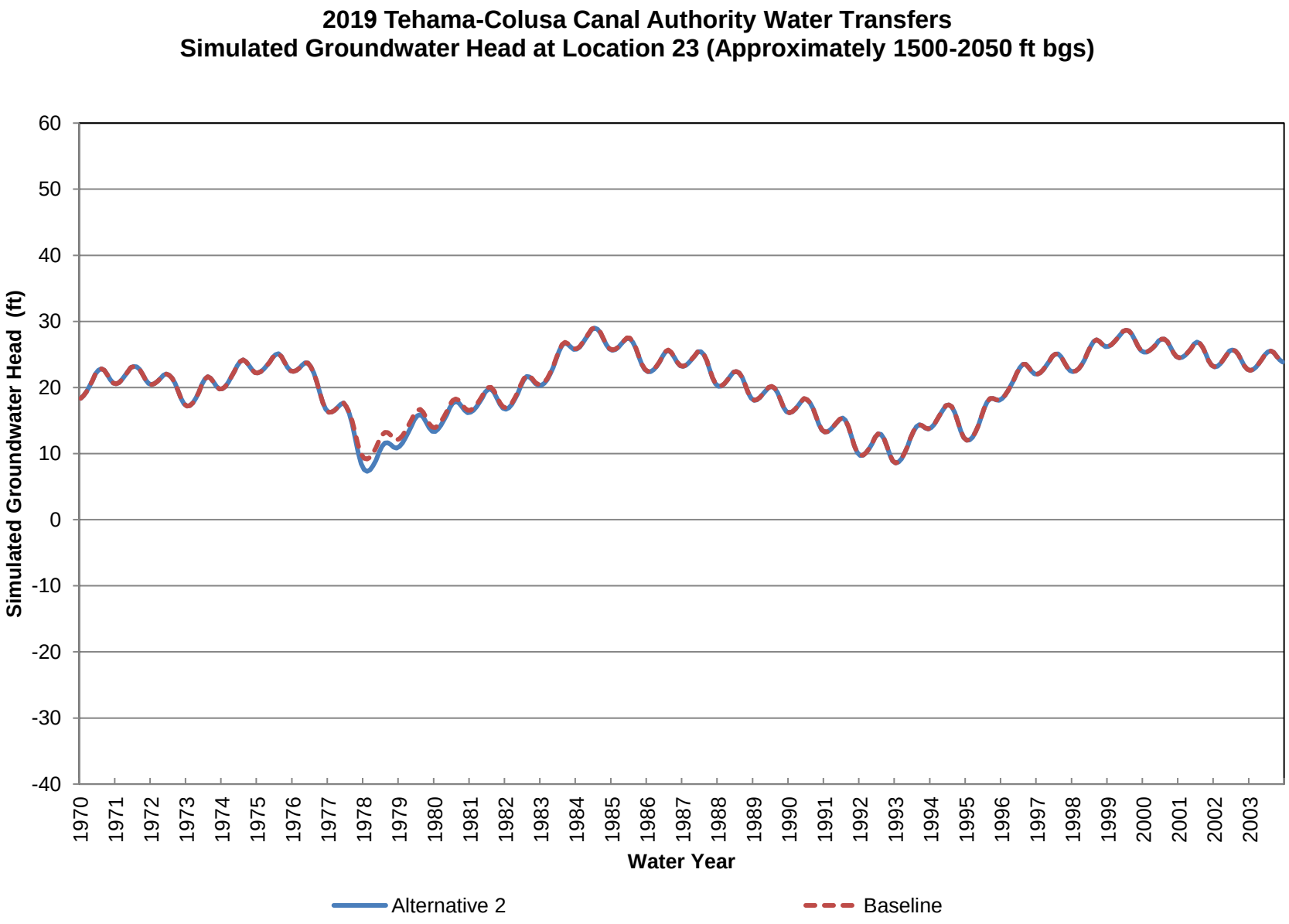
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 1120-1500 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 1500-2050 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
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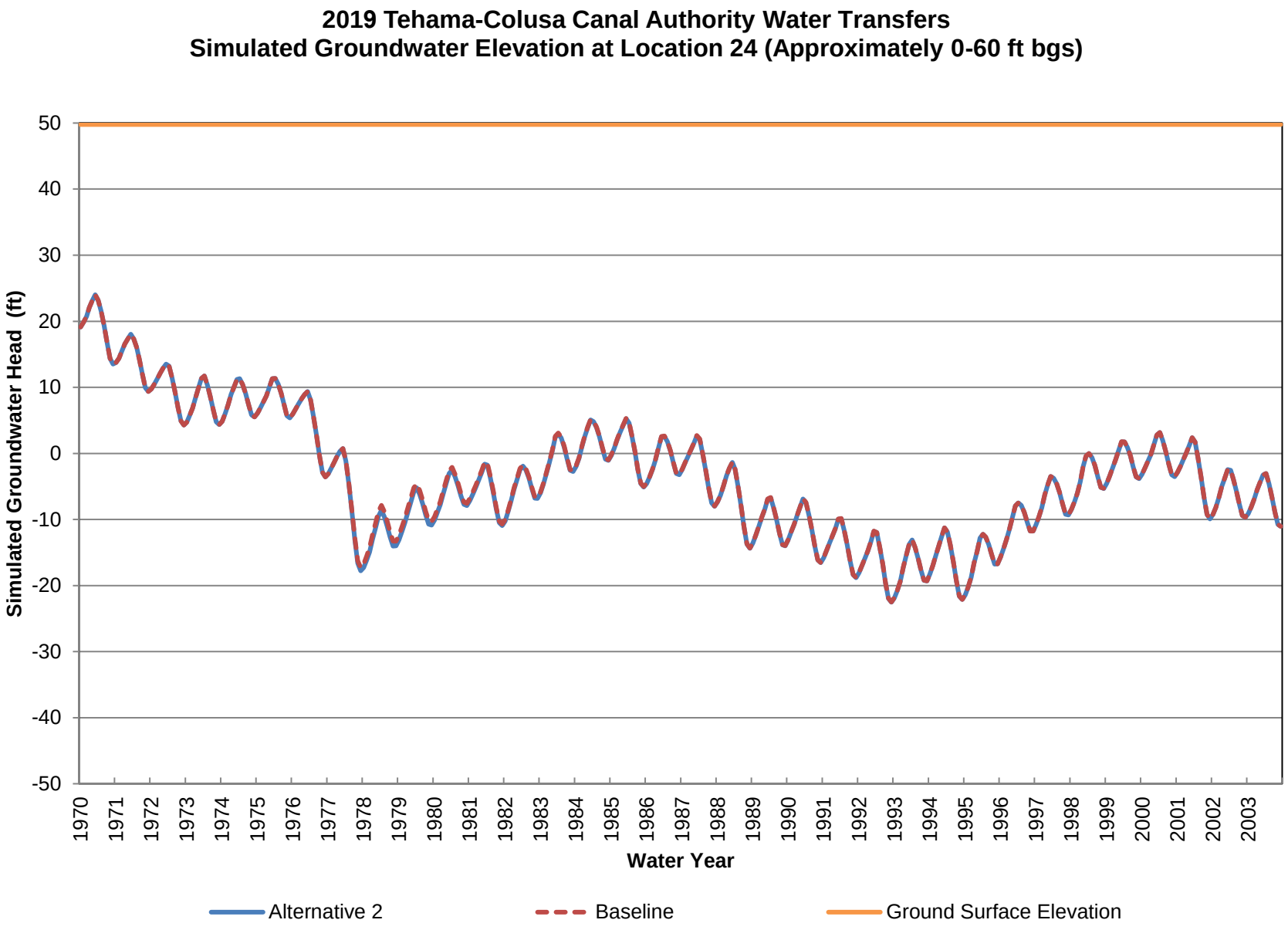
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 24 (Approximately 0-60 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
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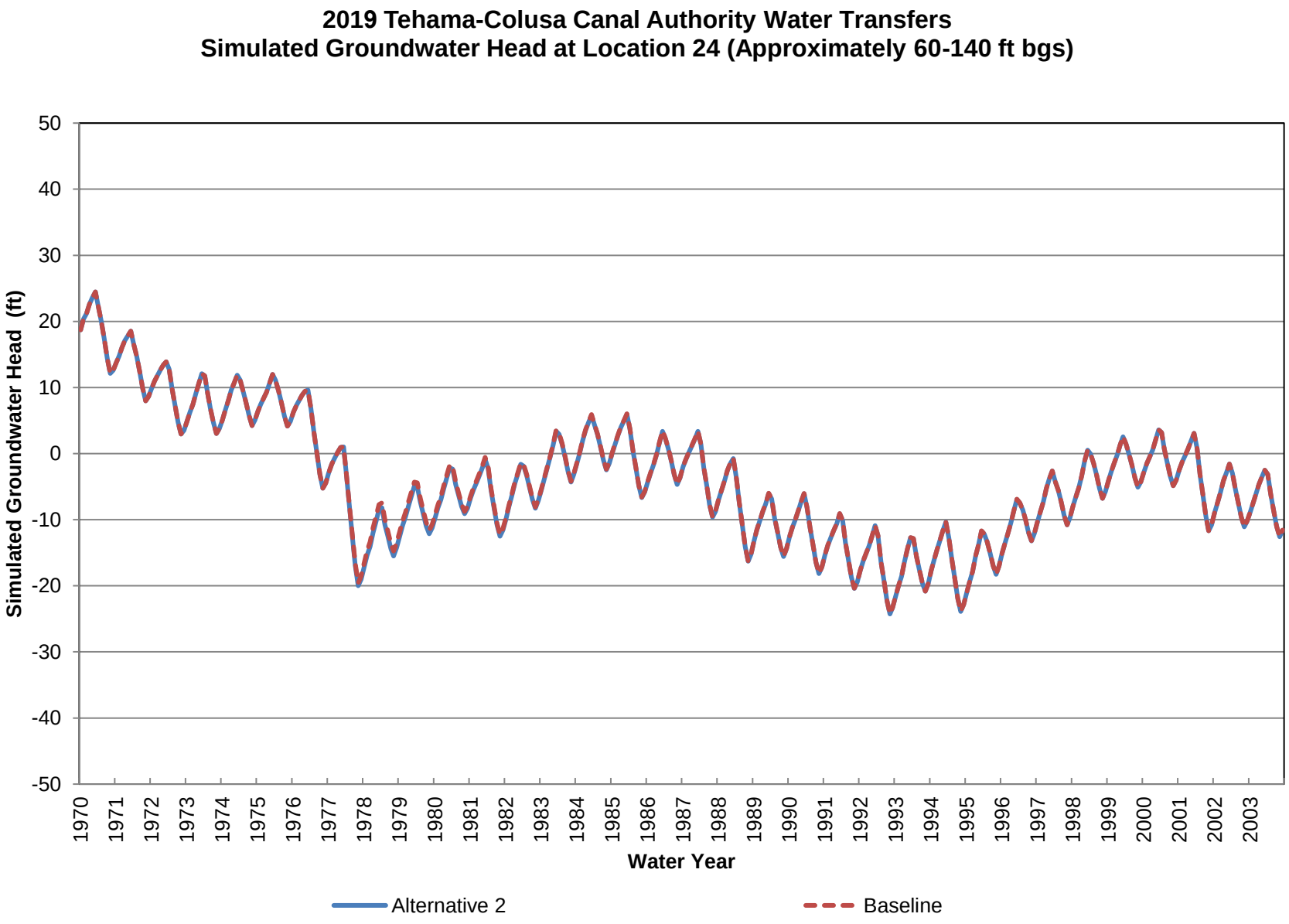
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 60-140 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
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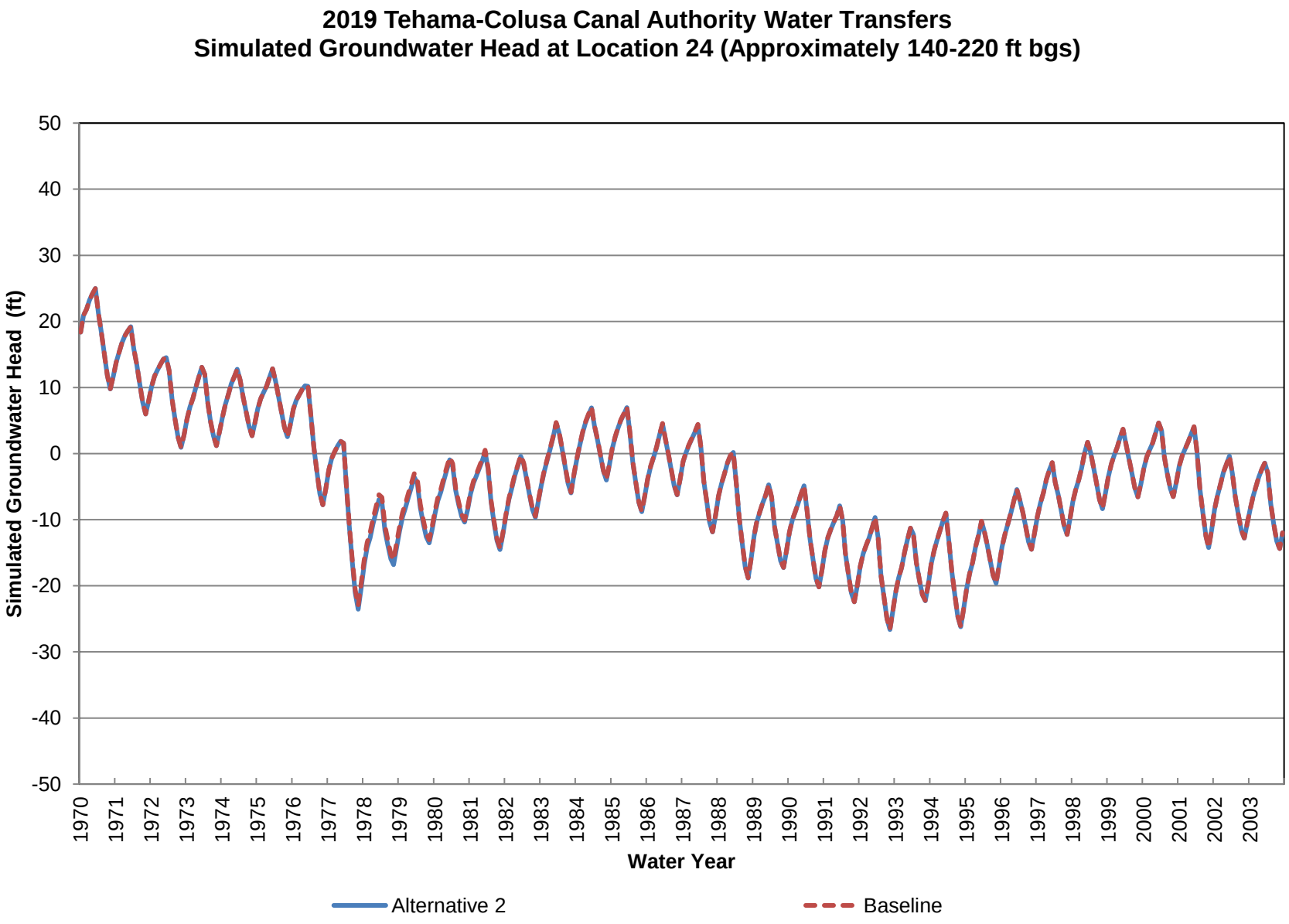
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 140-220 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
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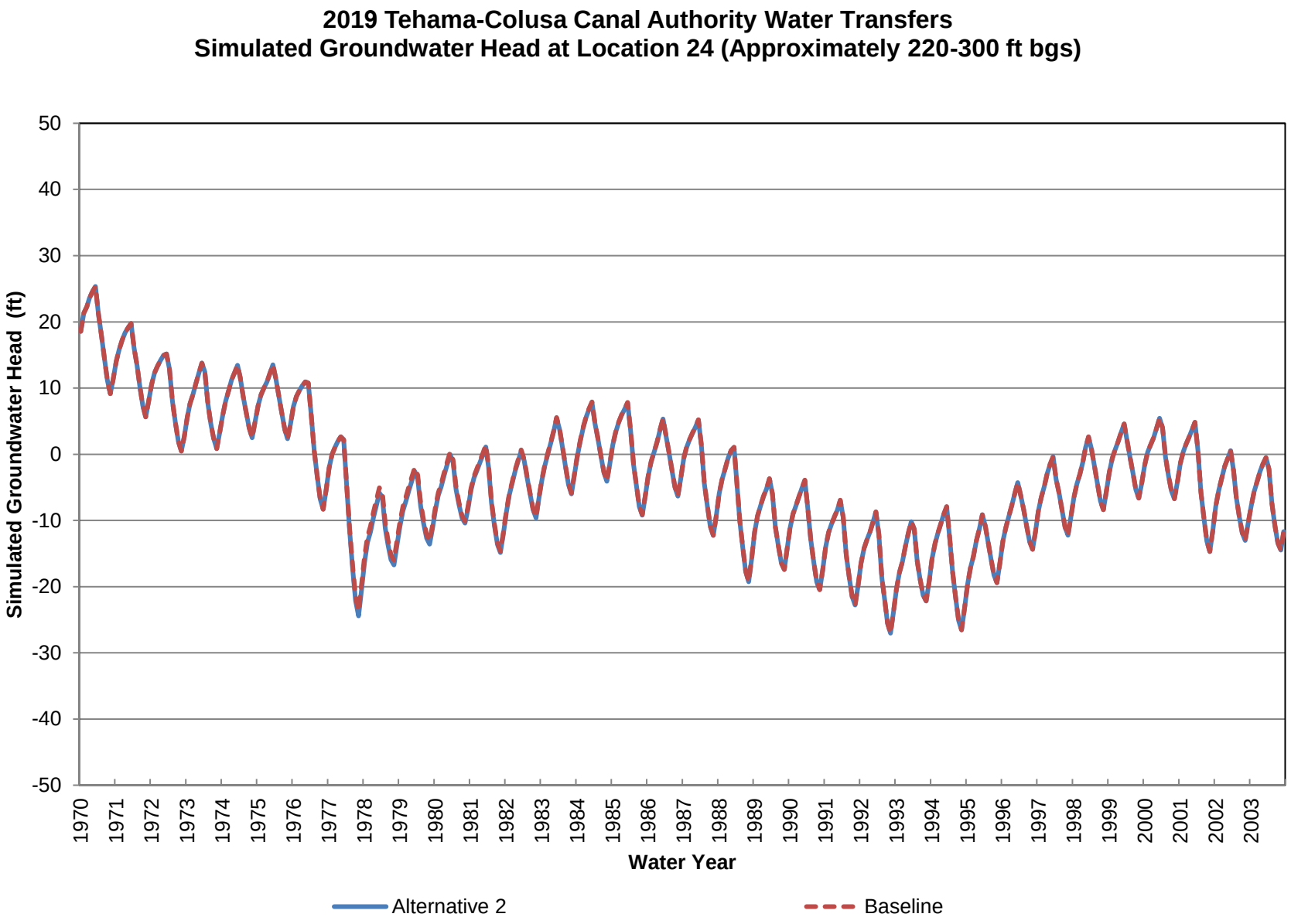
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 220-300 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
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1998
1999
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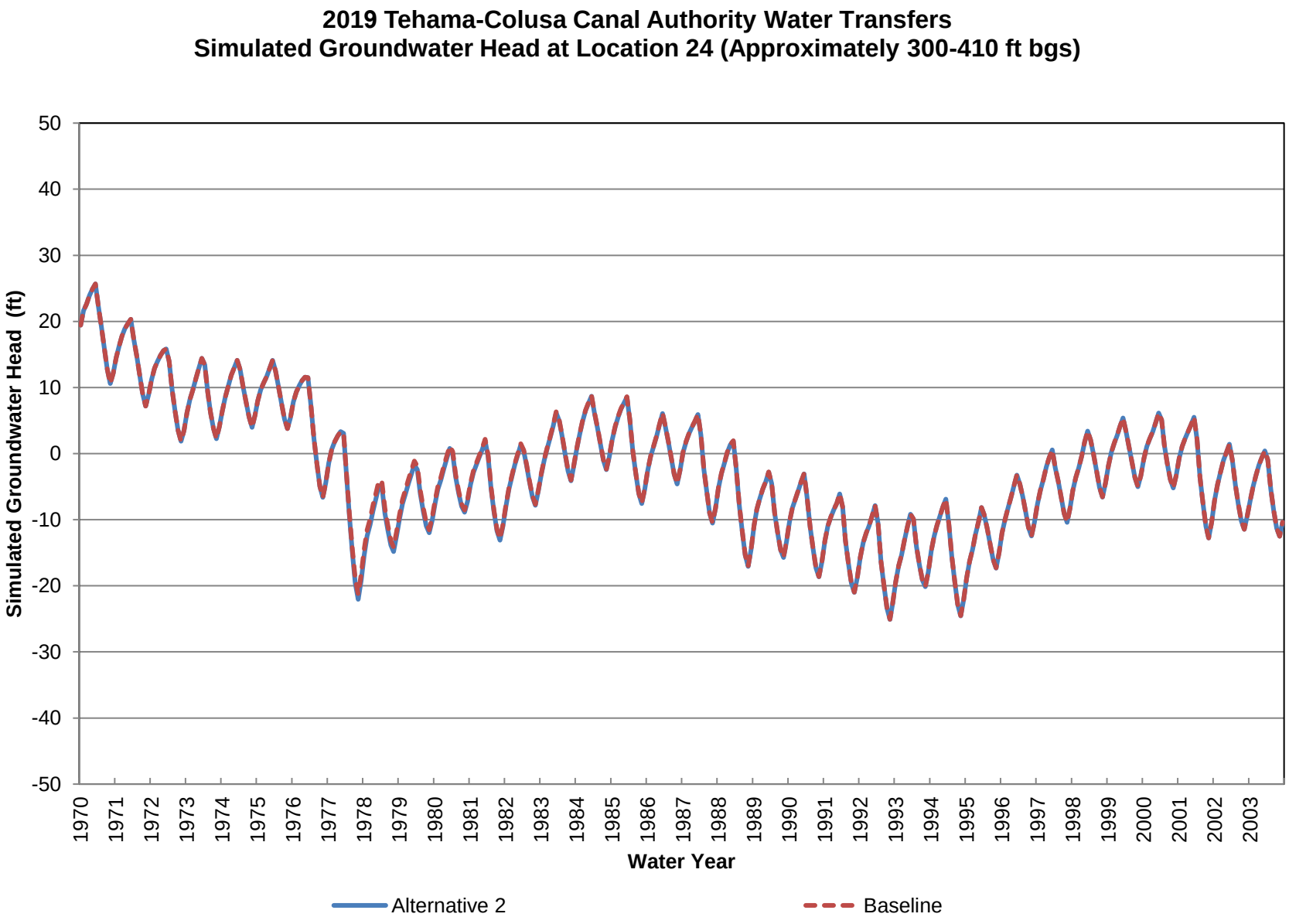
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 300-410 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
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1978
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1998
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2000
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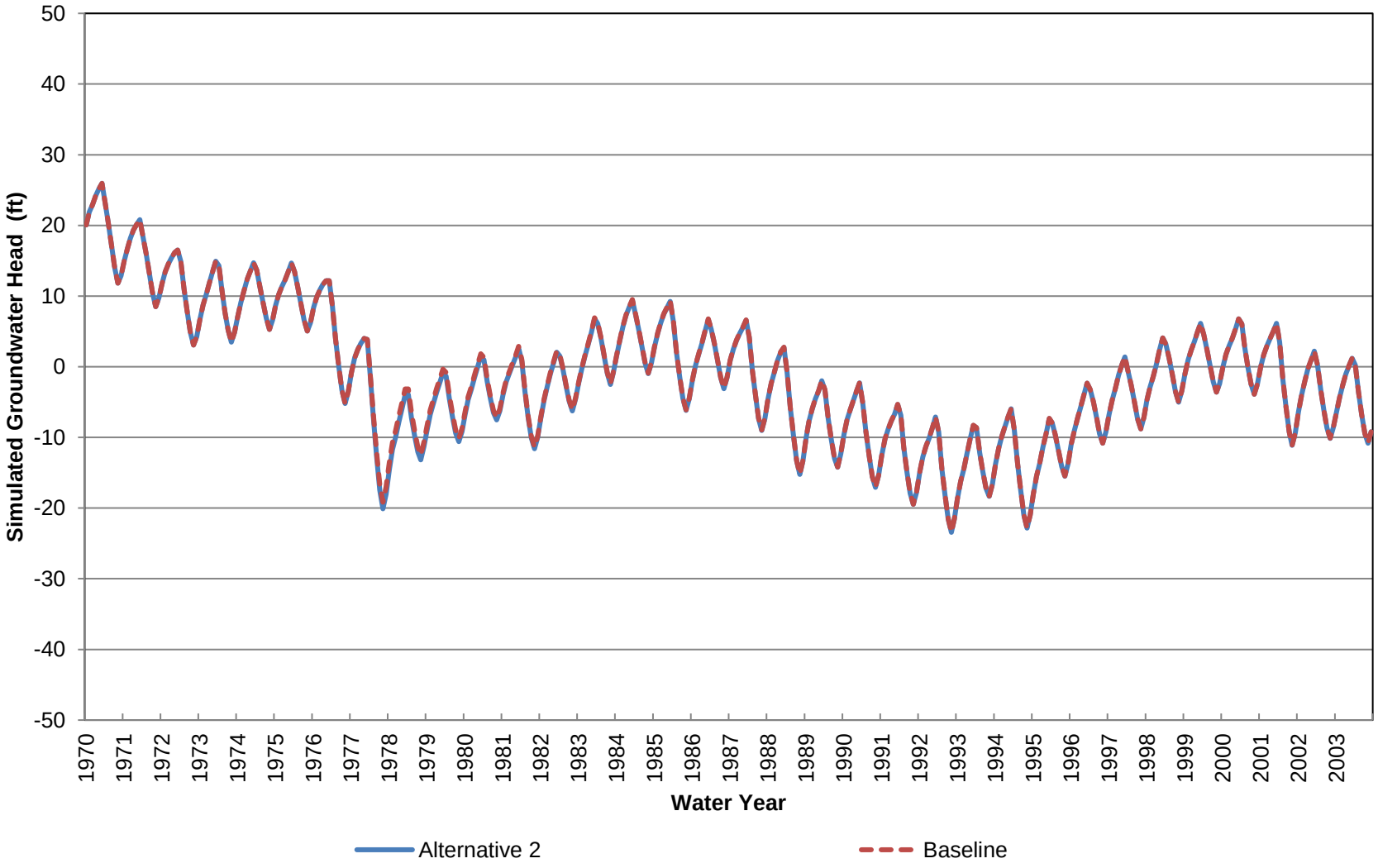
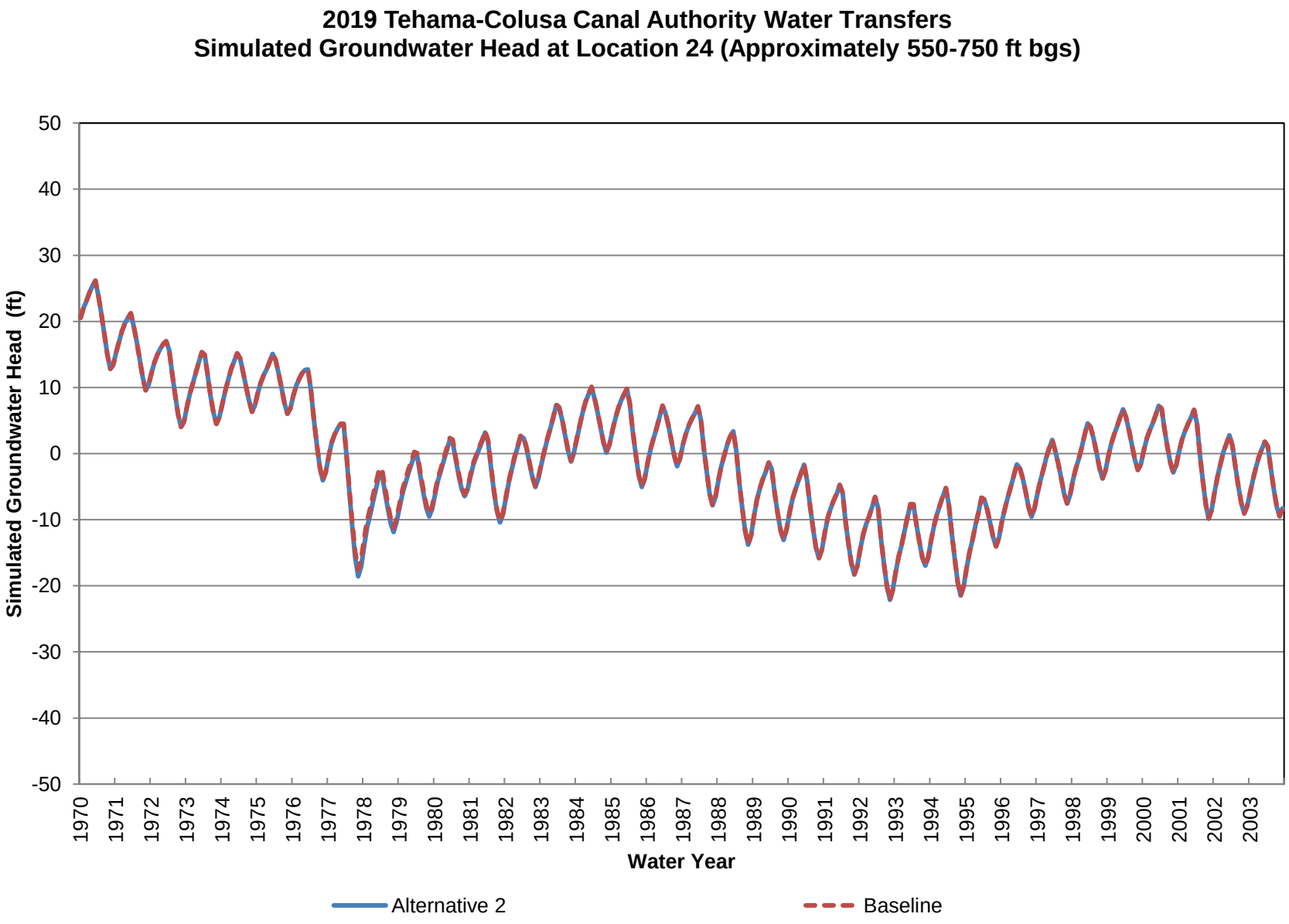
2002
2003
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 410-550 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 550-750 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
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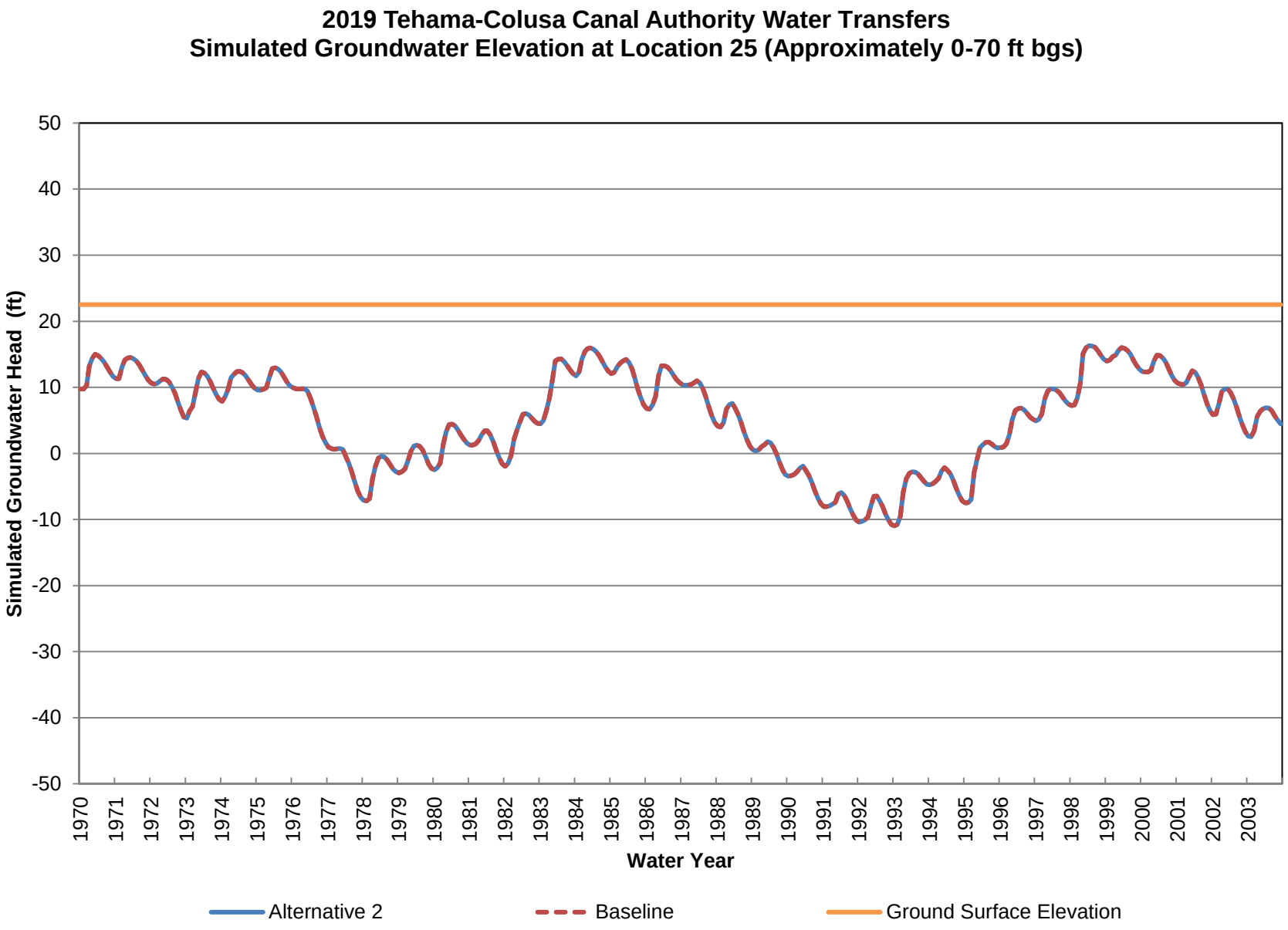
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 25 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
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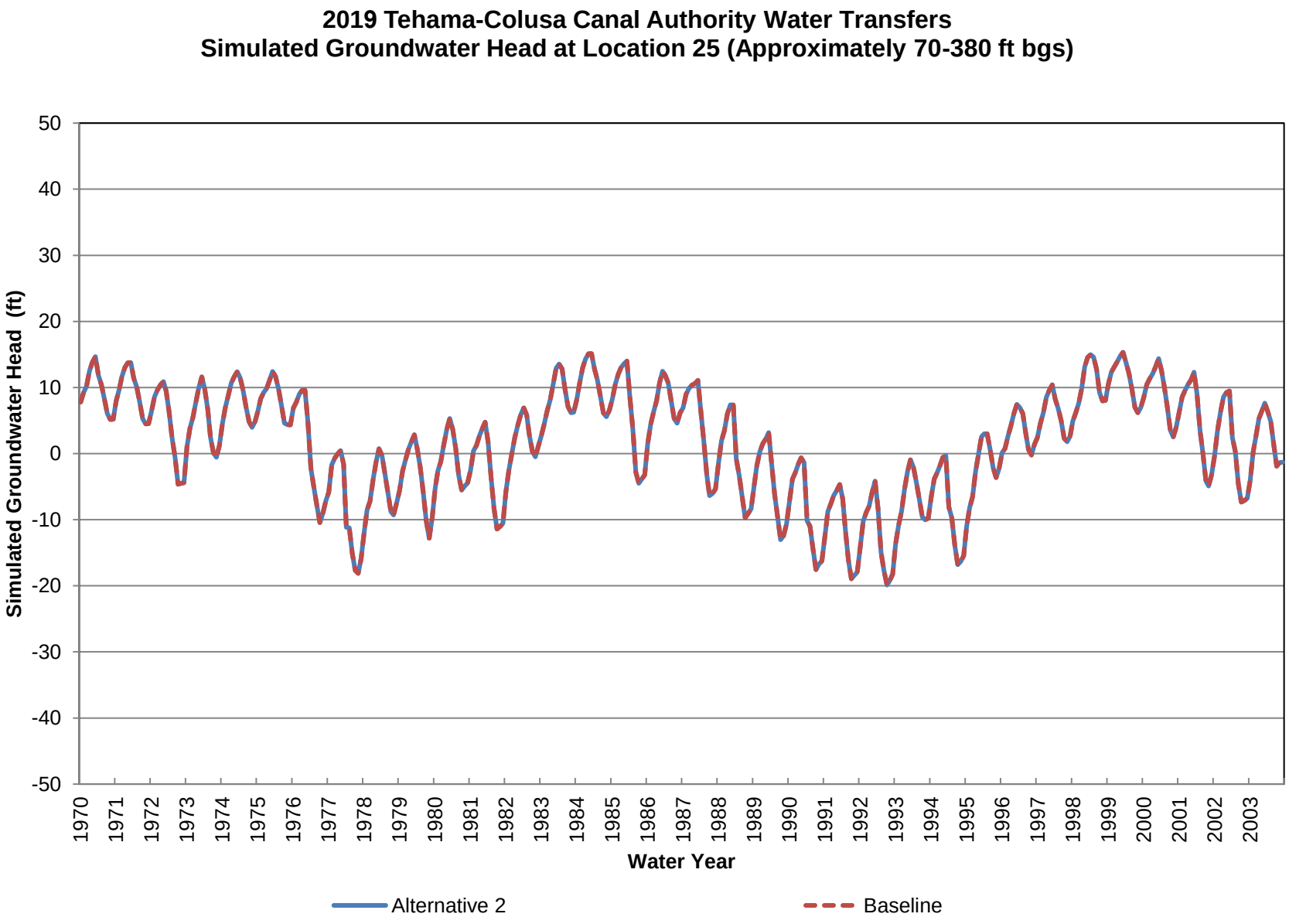
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 70-380 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
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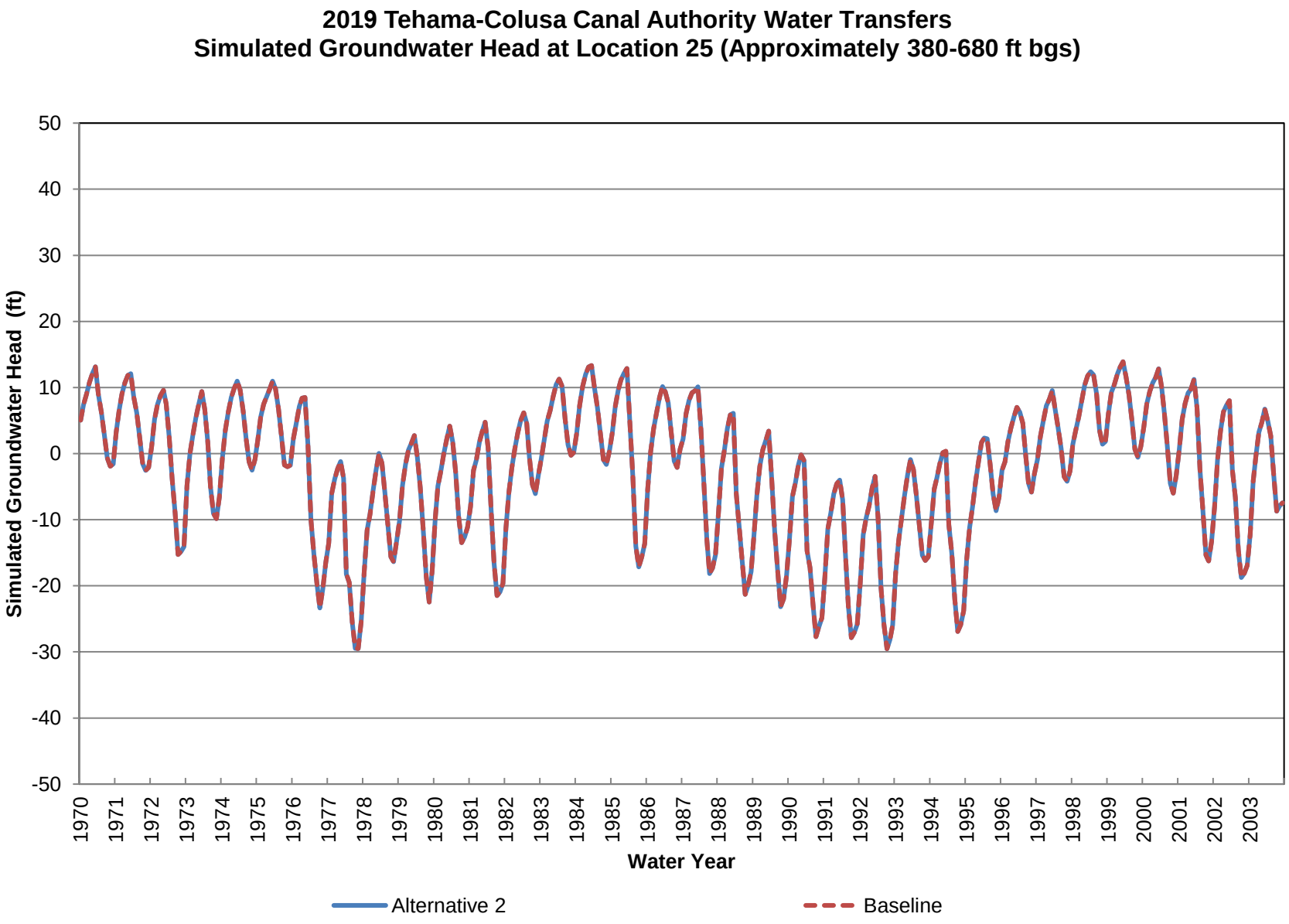
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 380-680 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
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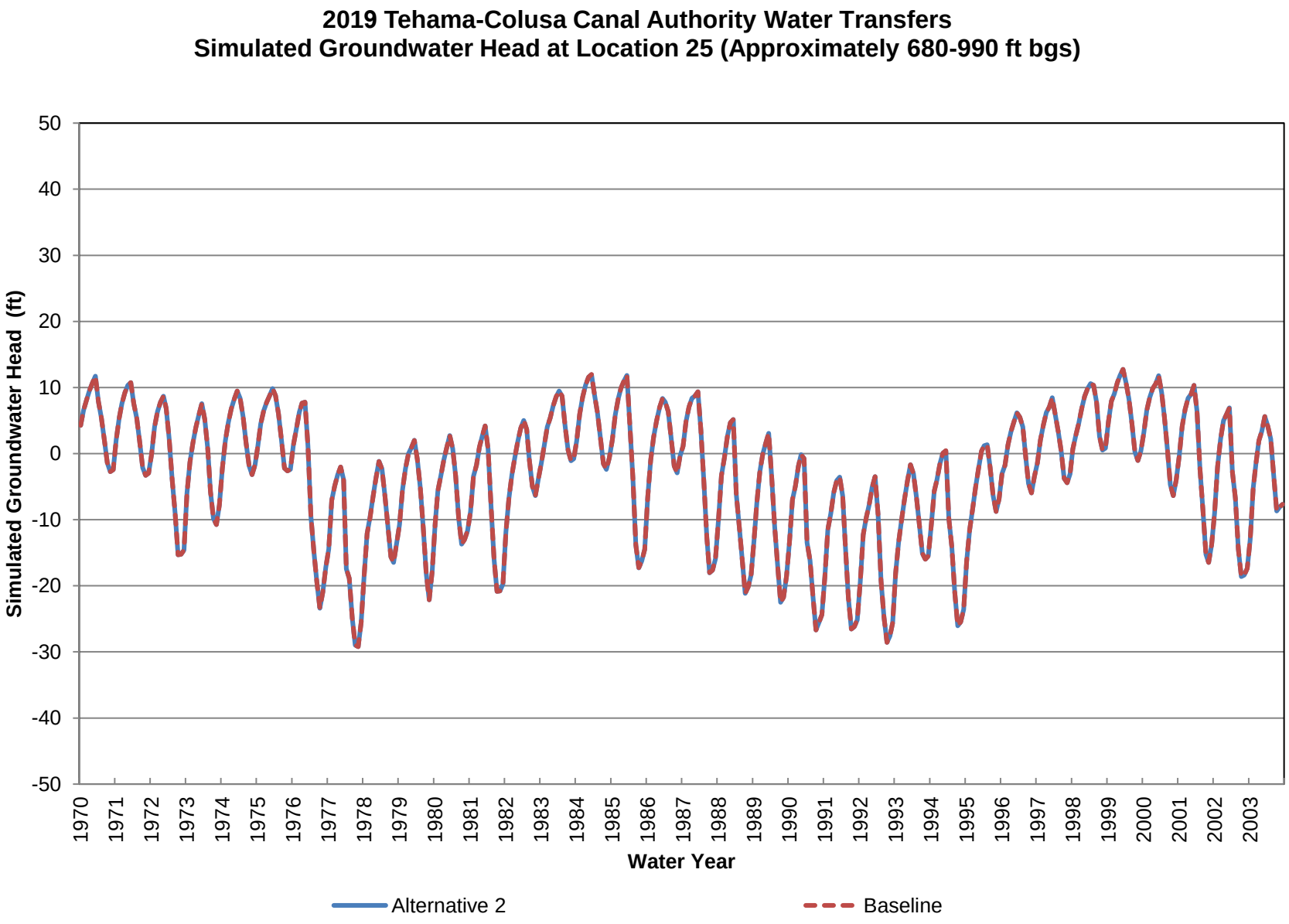
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 680-990 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
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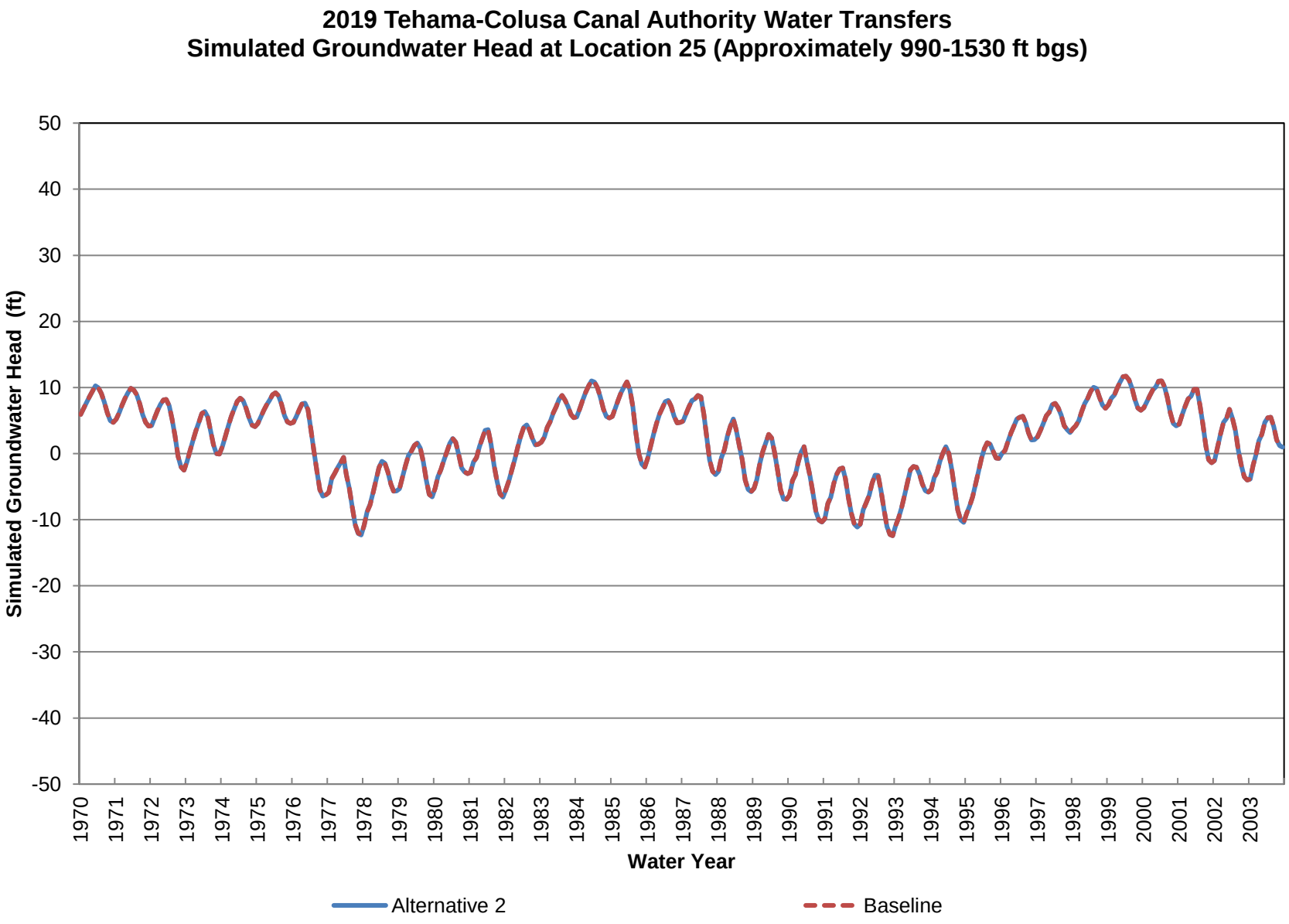
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 990-1530 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
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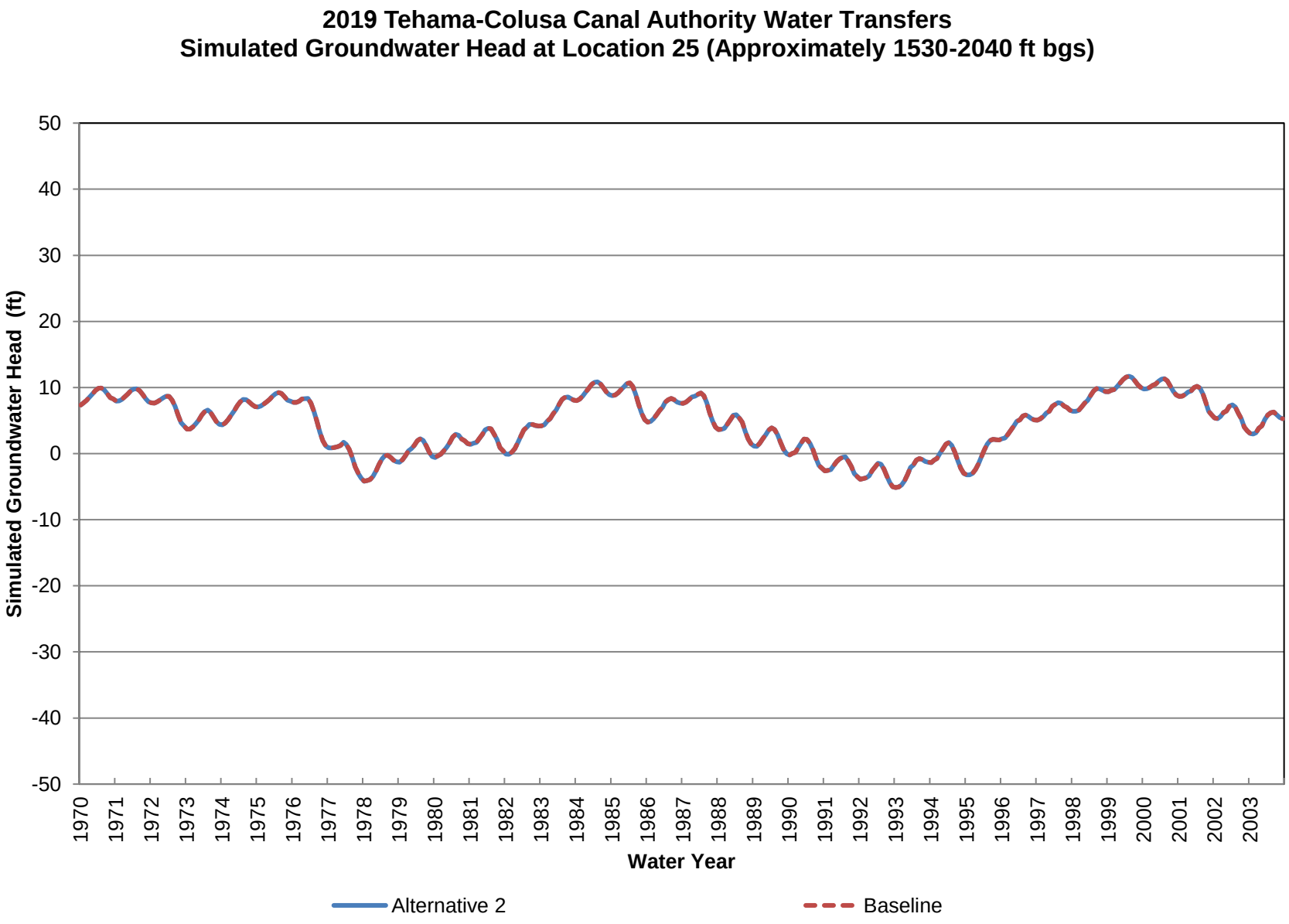
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 1530-2040 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
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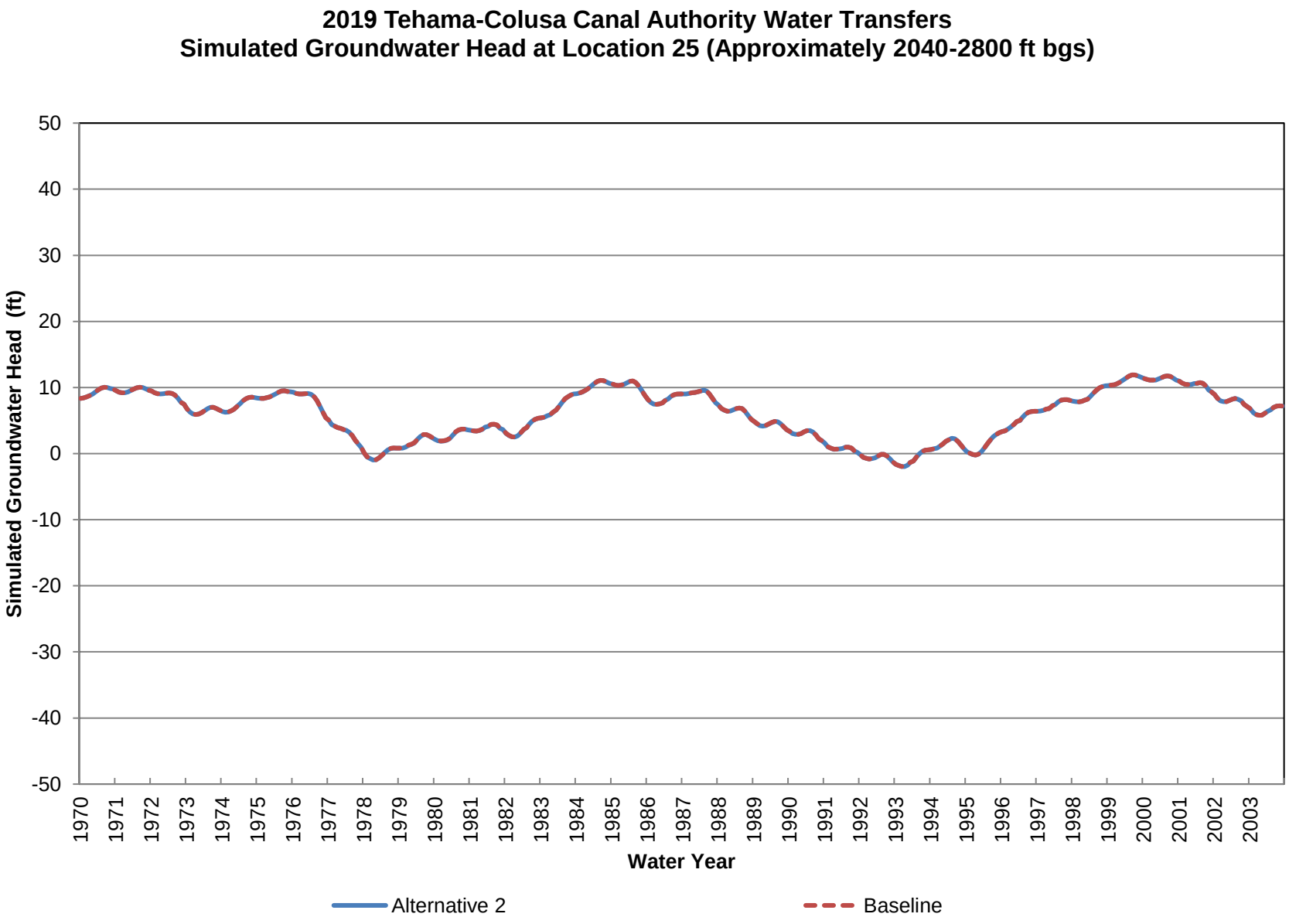
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 2040-2800 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
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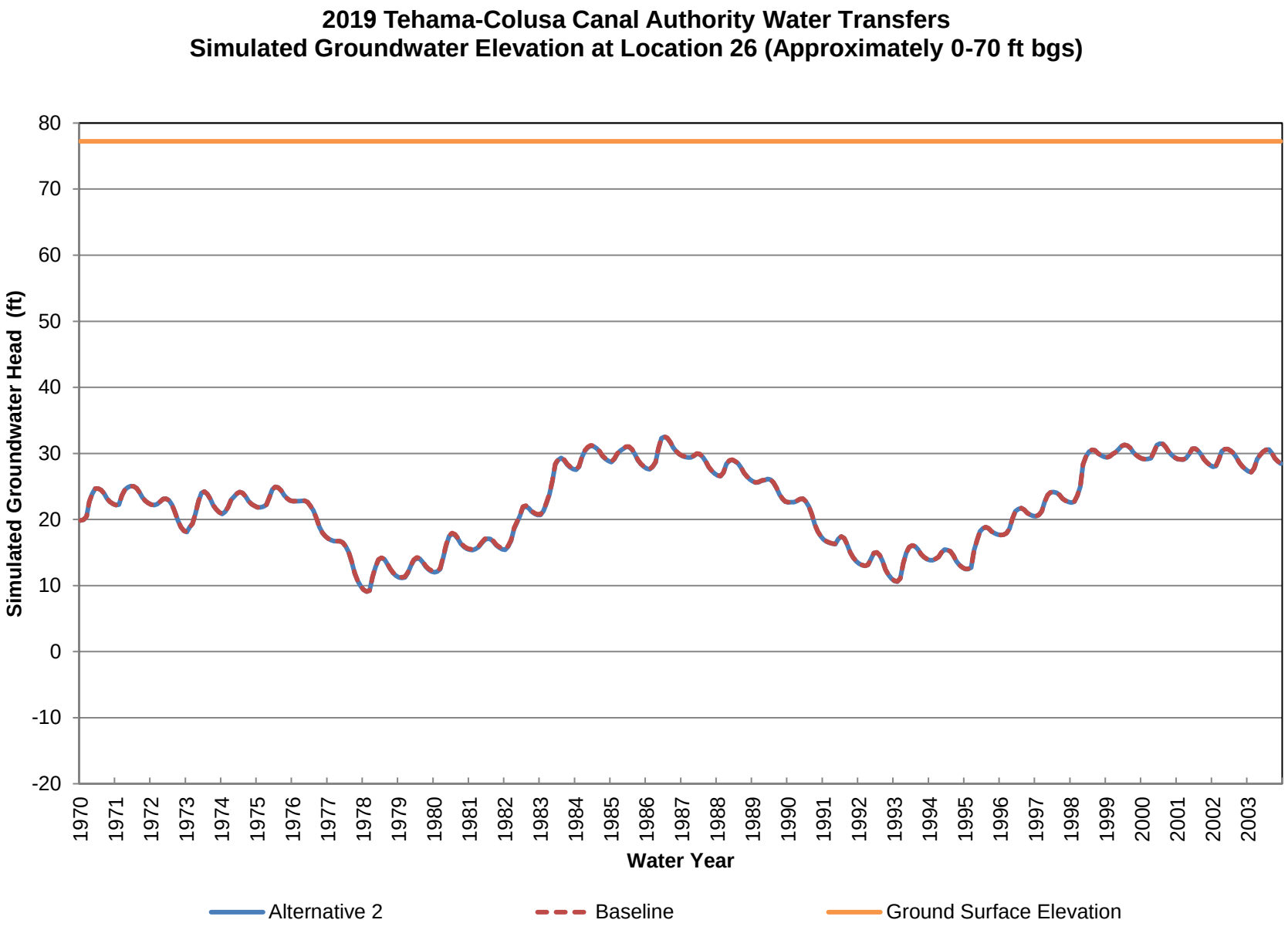
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 26 (Approximately 0-70 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
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1986
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1989
1990
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1994
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1996
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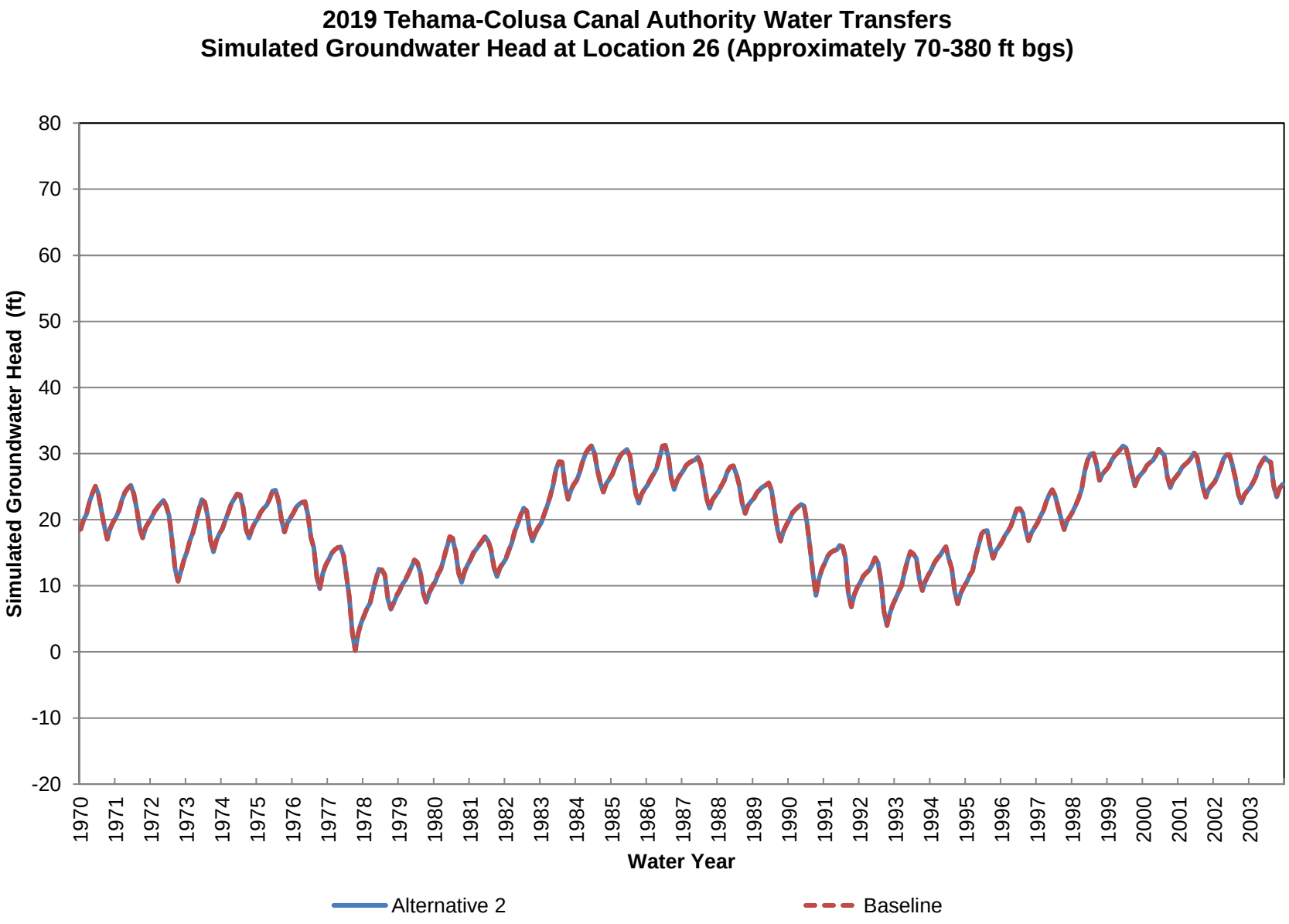
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 70-380 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
1970
1971
1972
1973
1974
1975
1976
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1978
1979
1980
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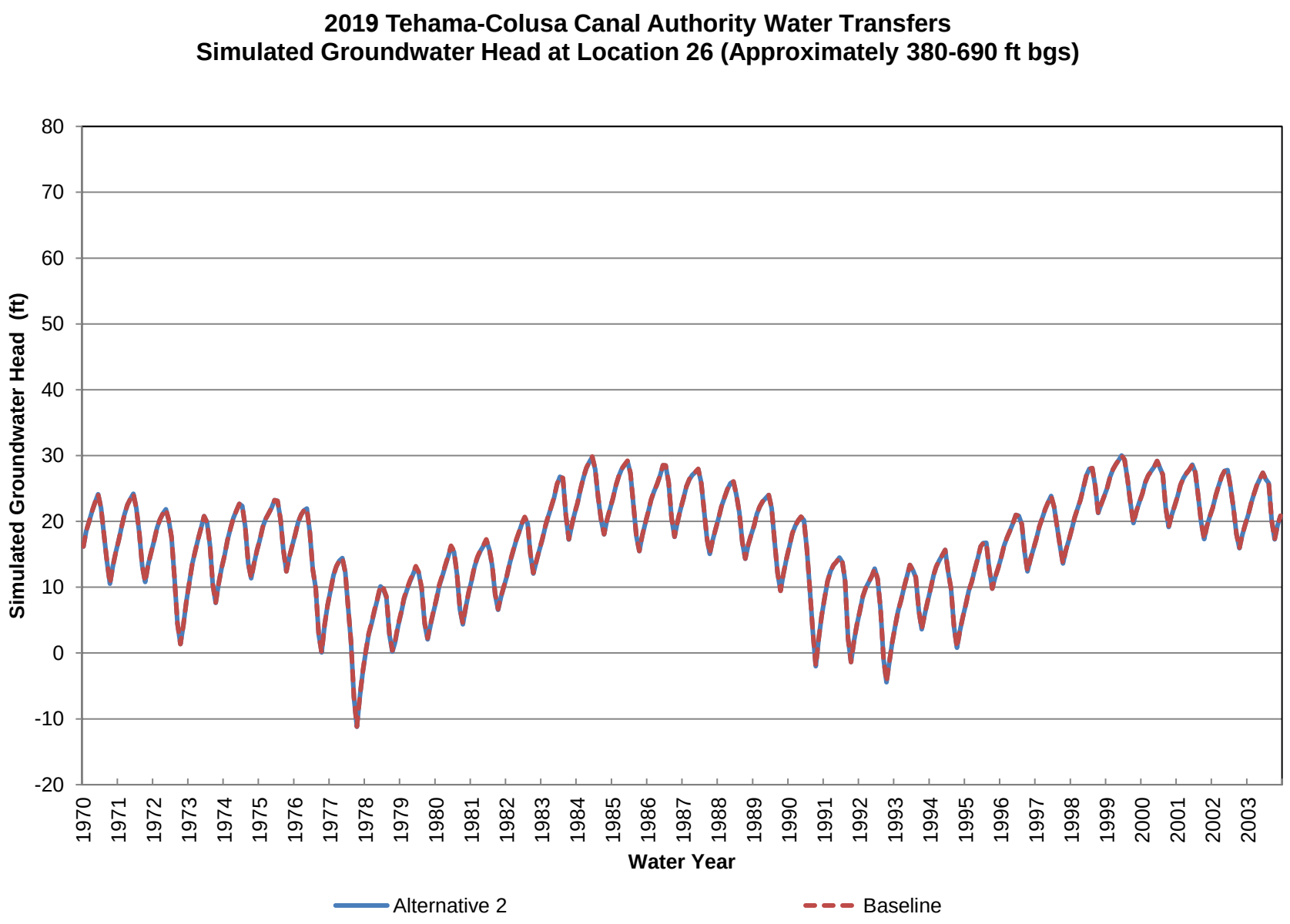
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 380-690 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
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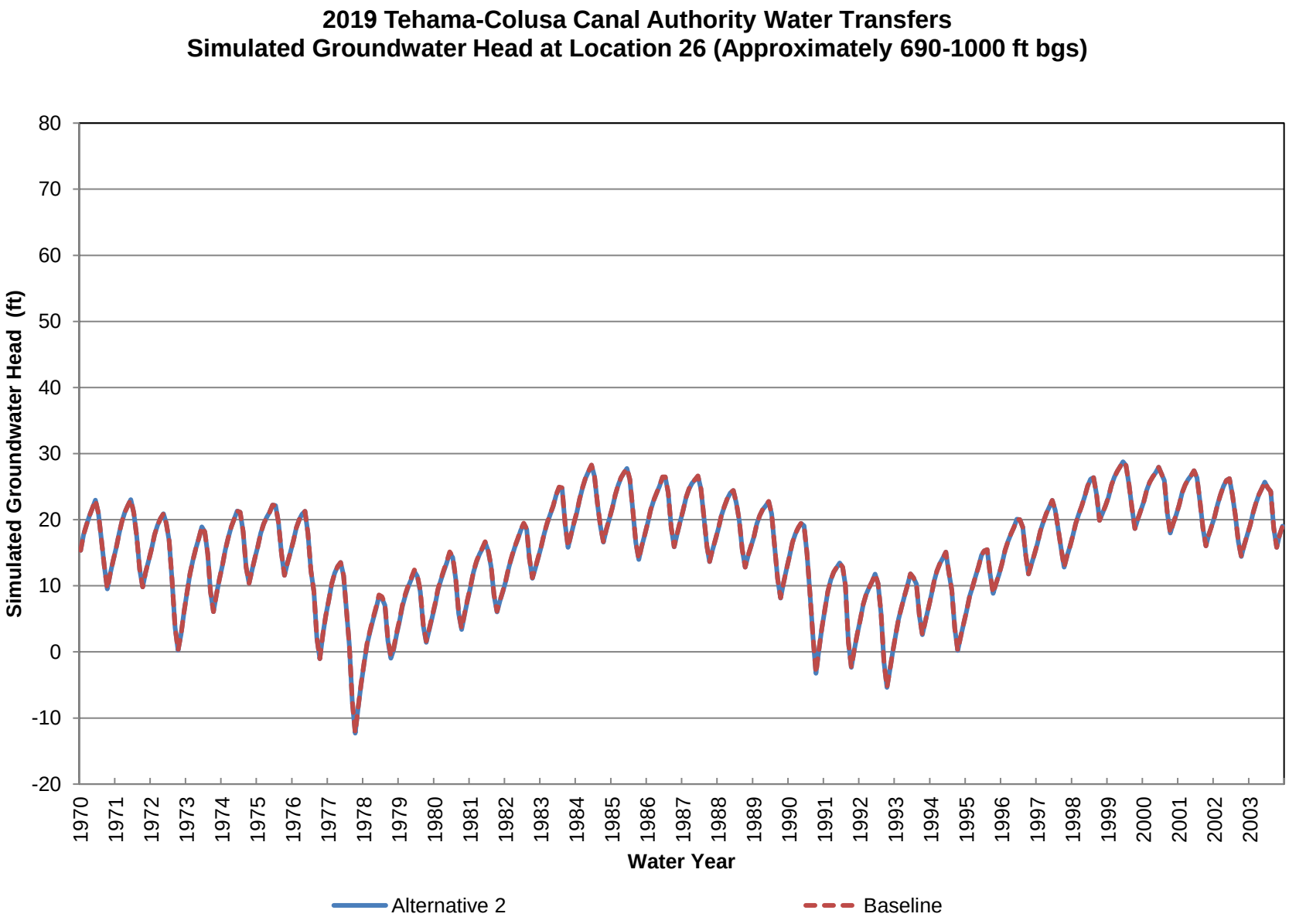
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 690-1000 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
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1998
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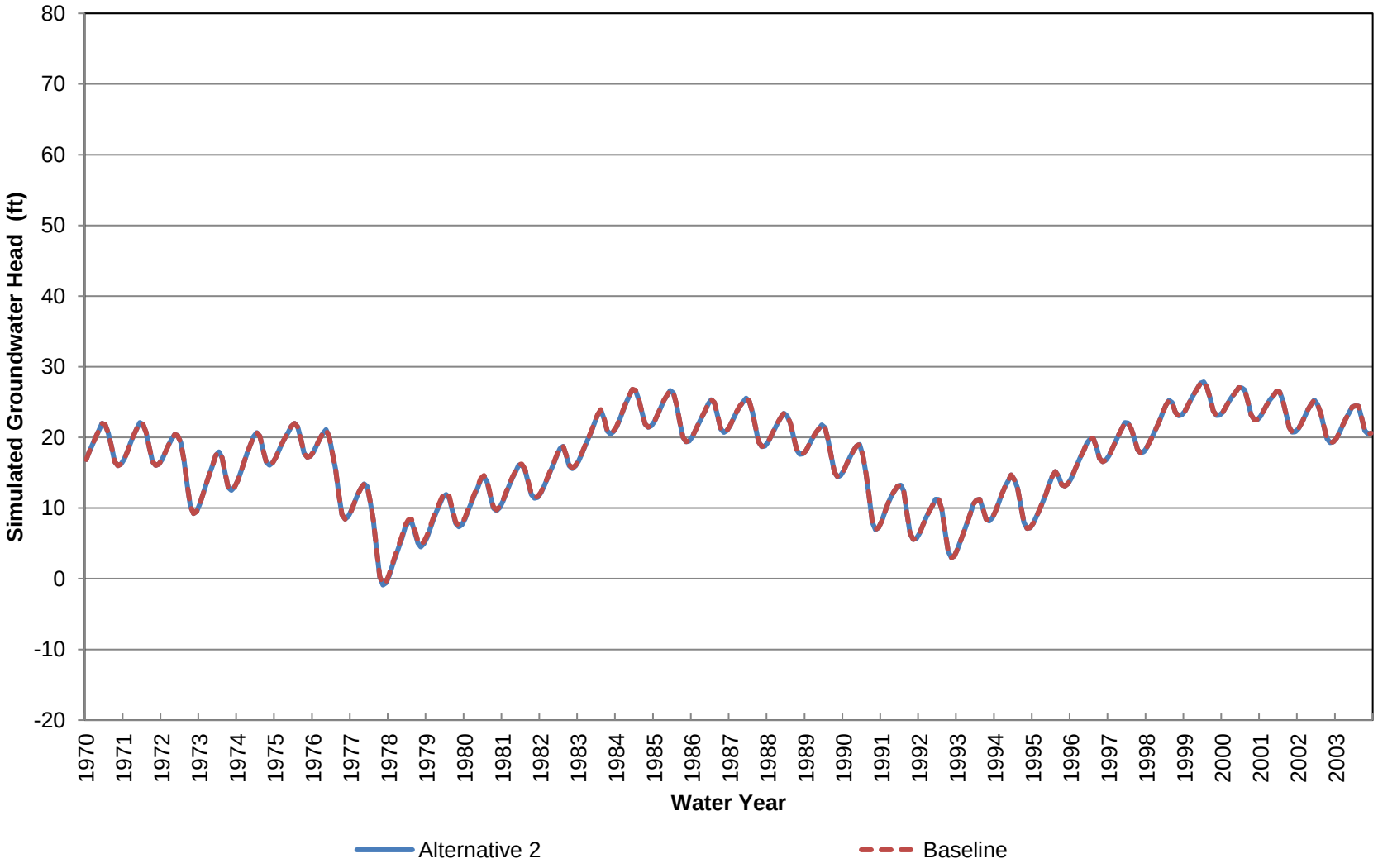
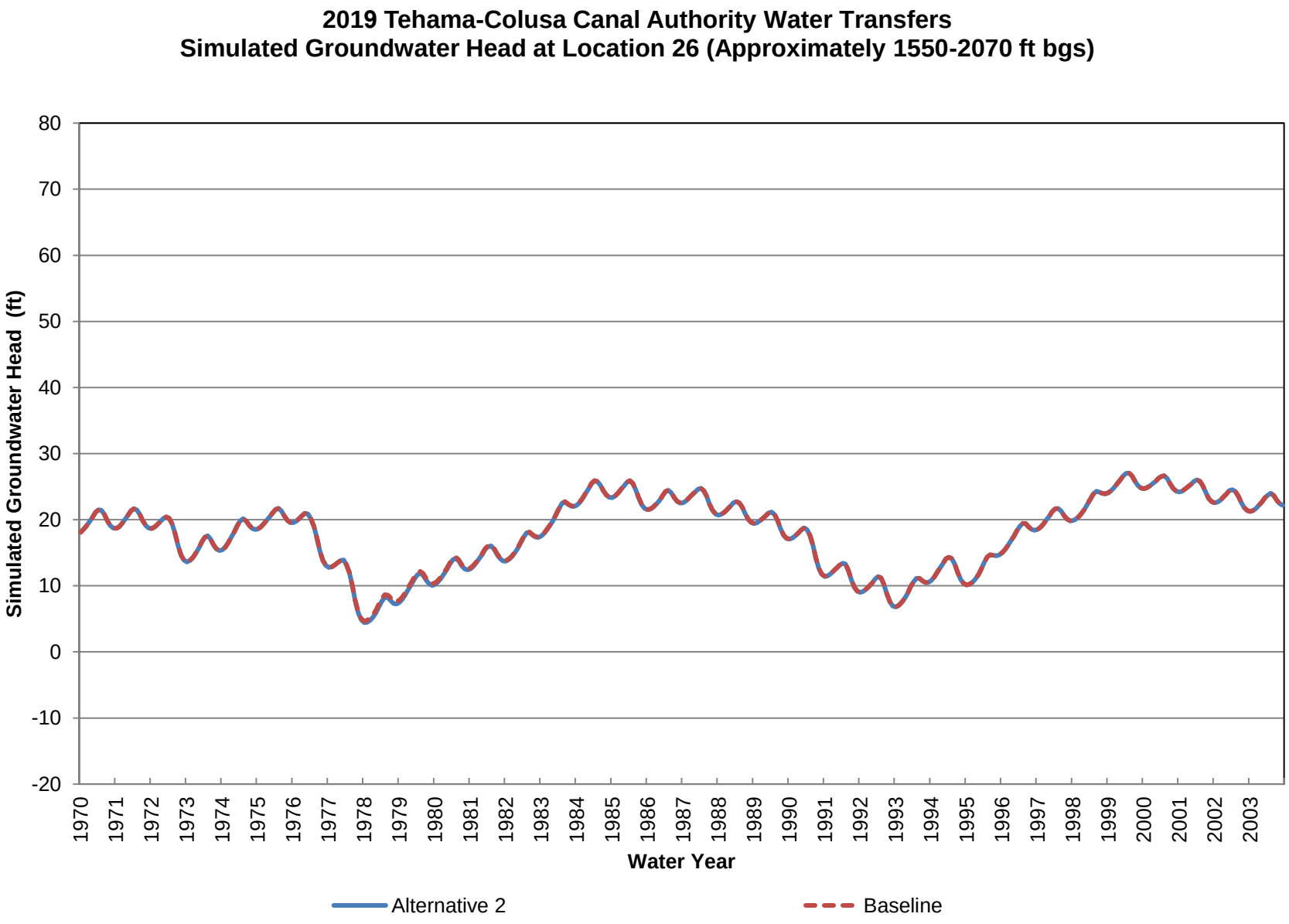
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 1000-1550 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 1550-2070 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
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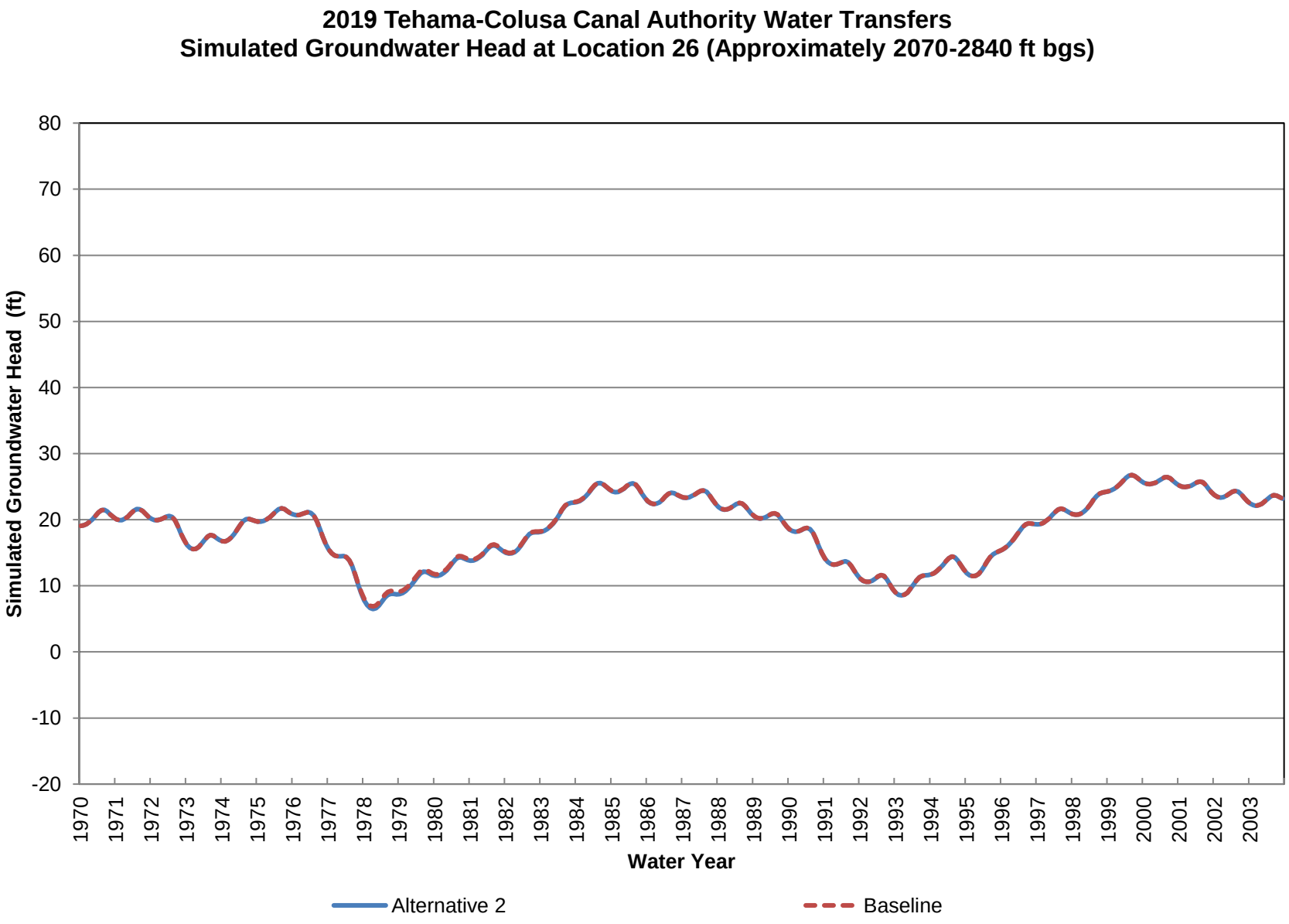
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 2070-2840 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
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1989
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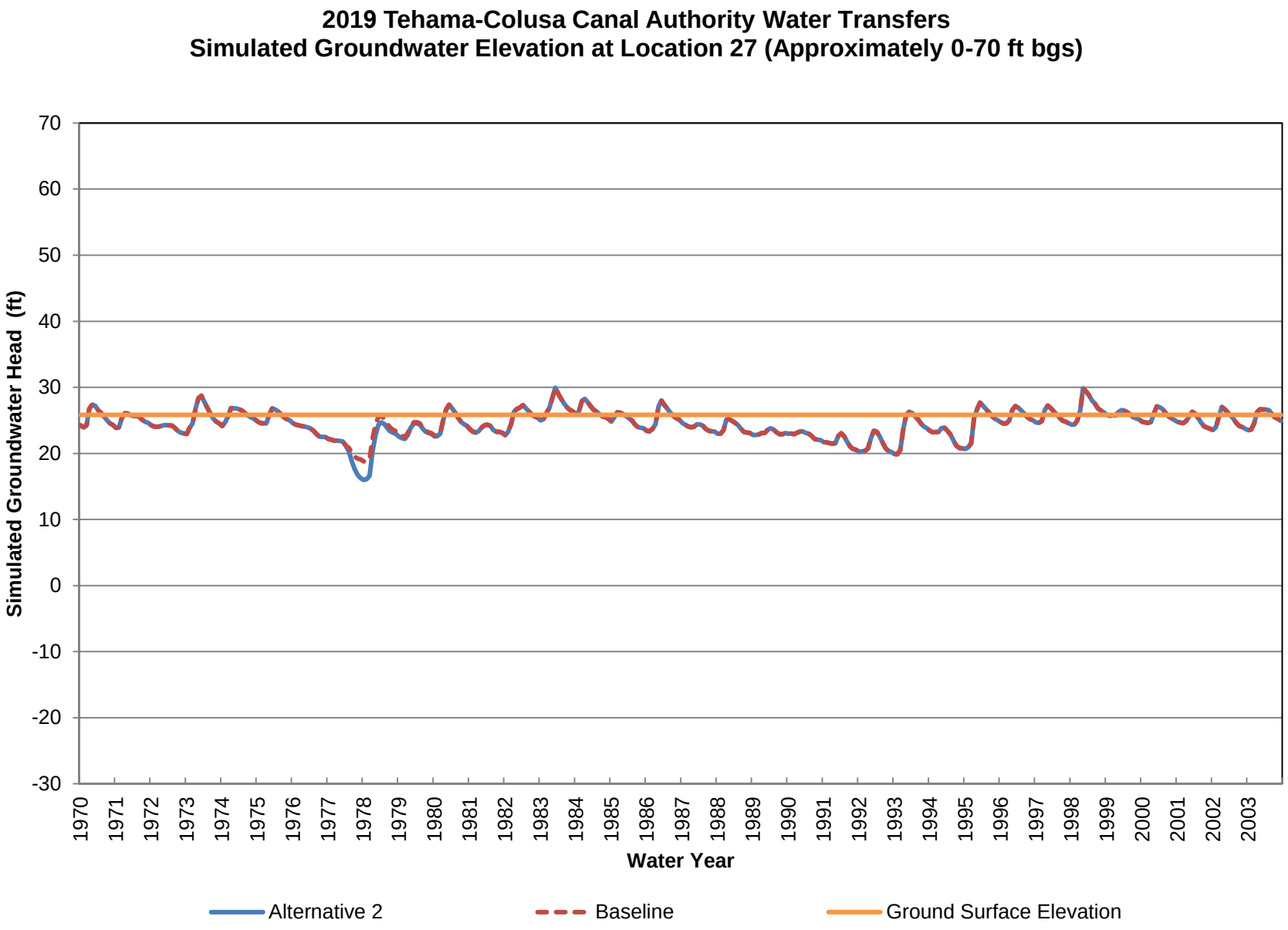
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 27 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
70
60
50
40
30
20
10
0
-10
-20
-30
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
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1986
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1988
1989
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1991
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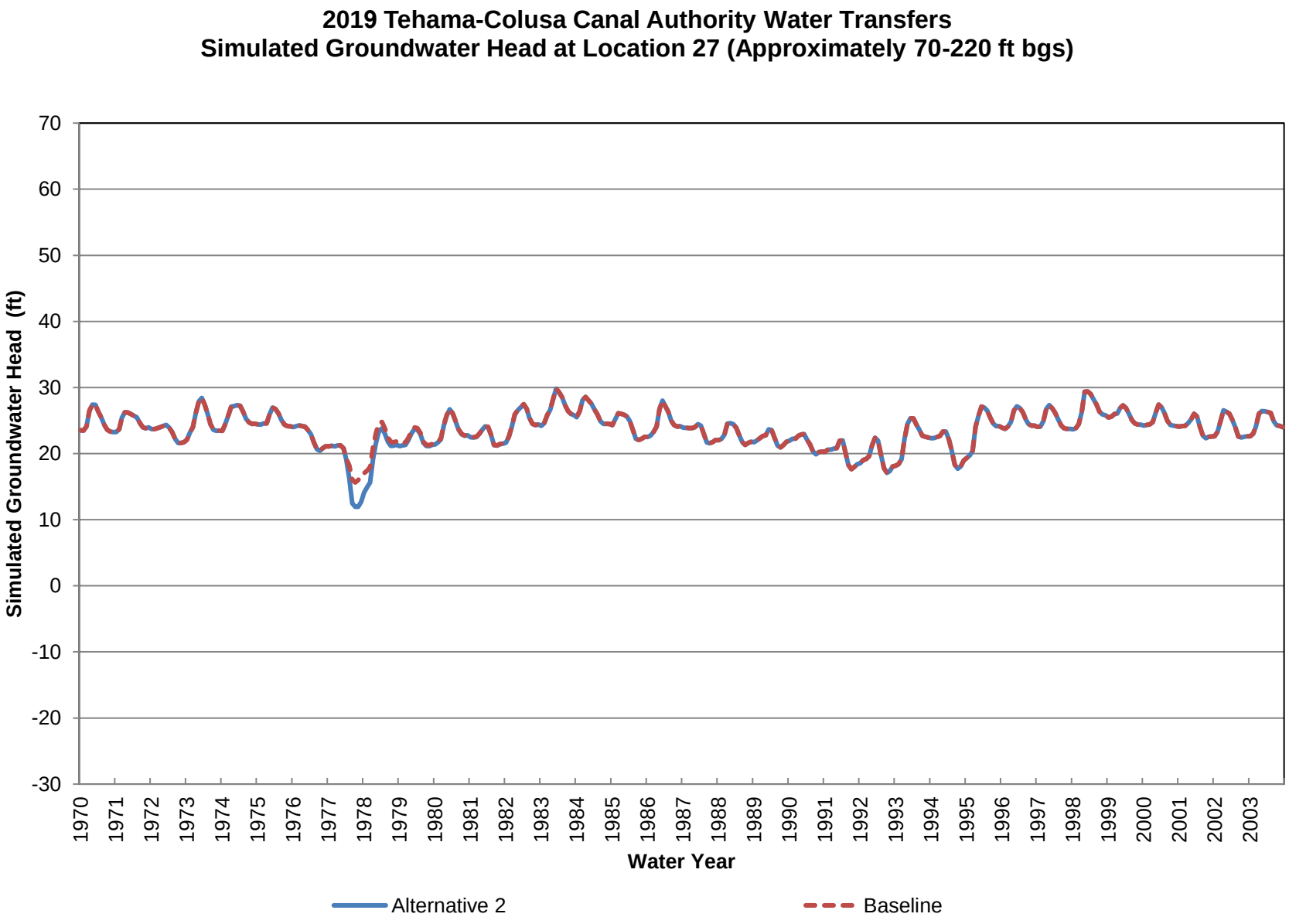
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 70-220 ft bgs)
Simulated Groundwater Head (ft)
70
60
50
40
30
20
10
0
-10
-20
-30
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
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1984
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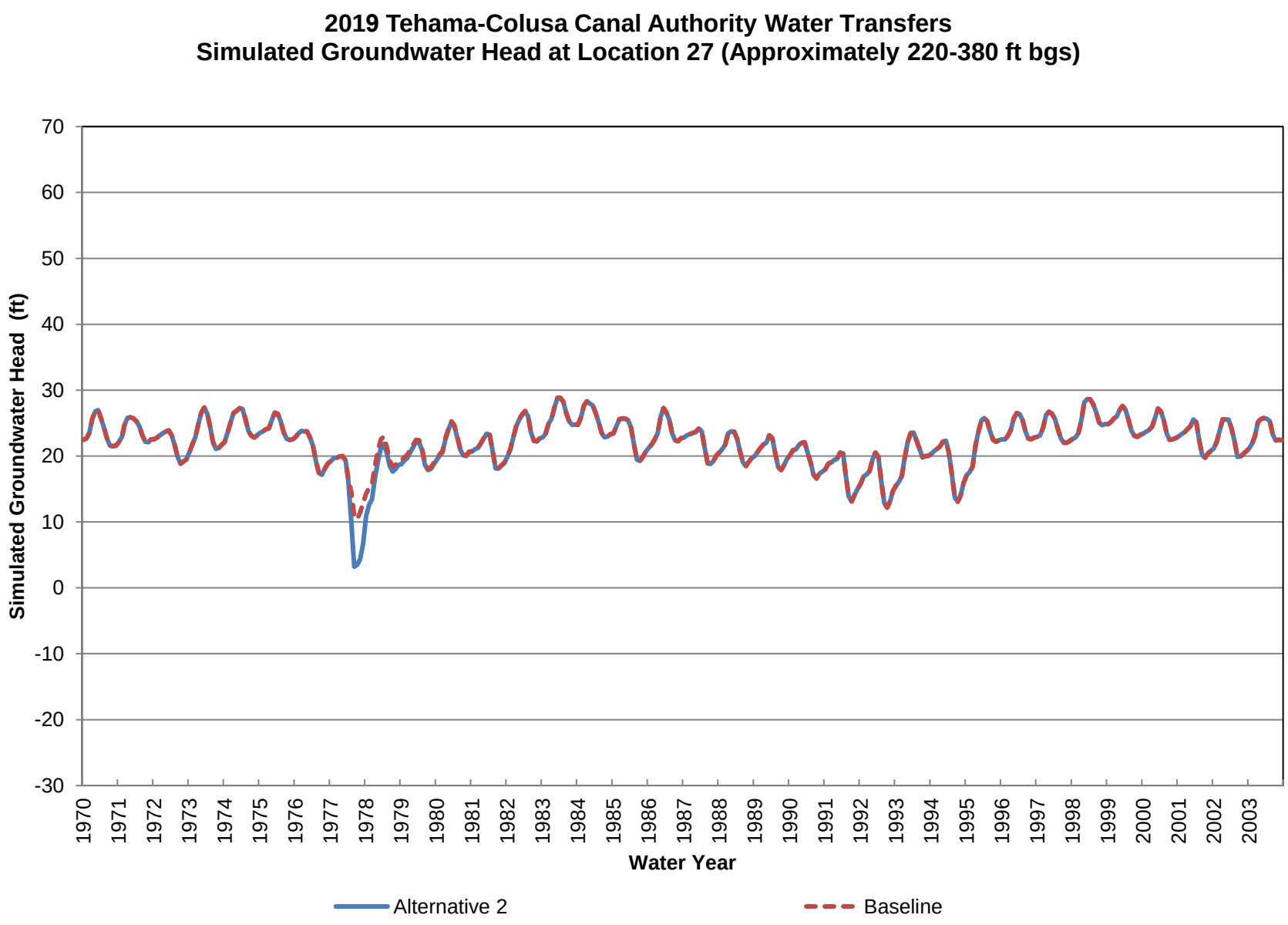
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 220-380 ft bgs)
Simulated Groundwater Head (ft)
70
60
50
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10
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-30
1970
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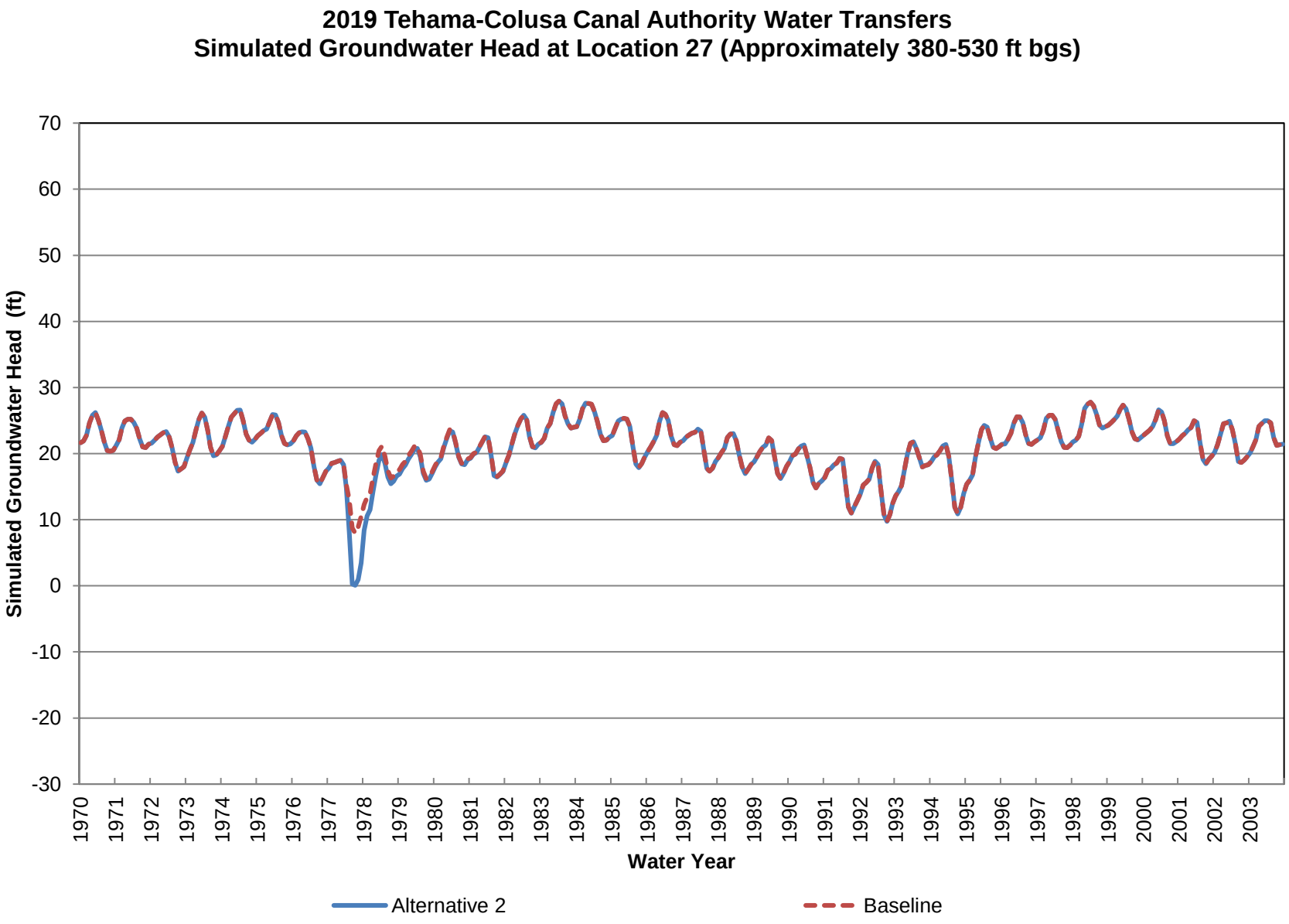
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 380-530 ft bgs)
Simulated Groundwater Head (ft)
70
60
50
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20
10
0
-10
-20
-30
1970
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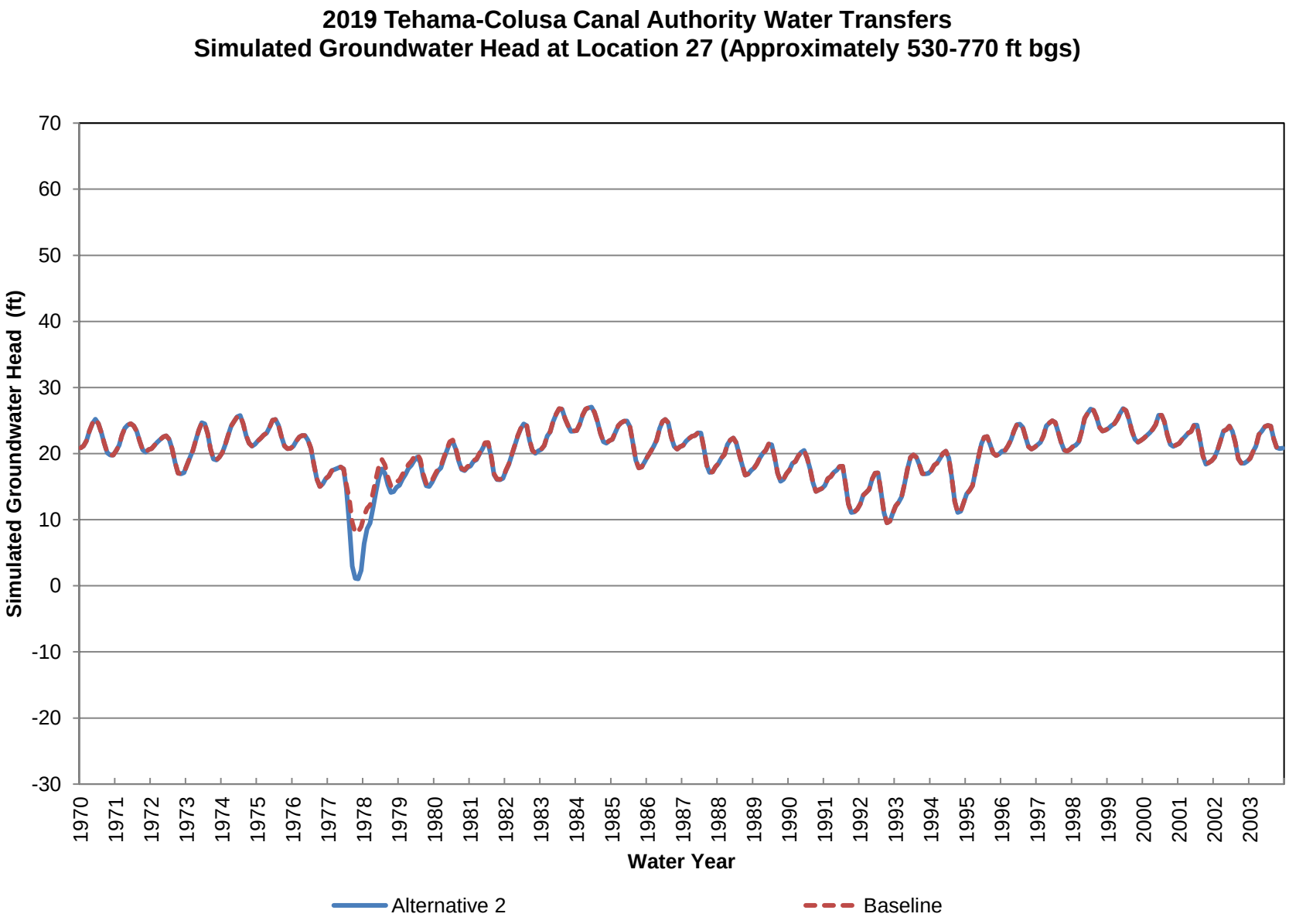
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 530-770 ft bgs)
Simulated Groundwater Head (ft)
70
60
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20
10
0
-10
-20
-30
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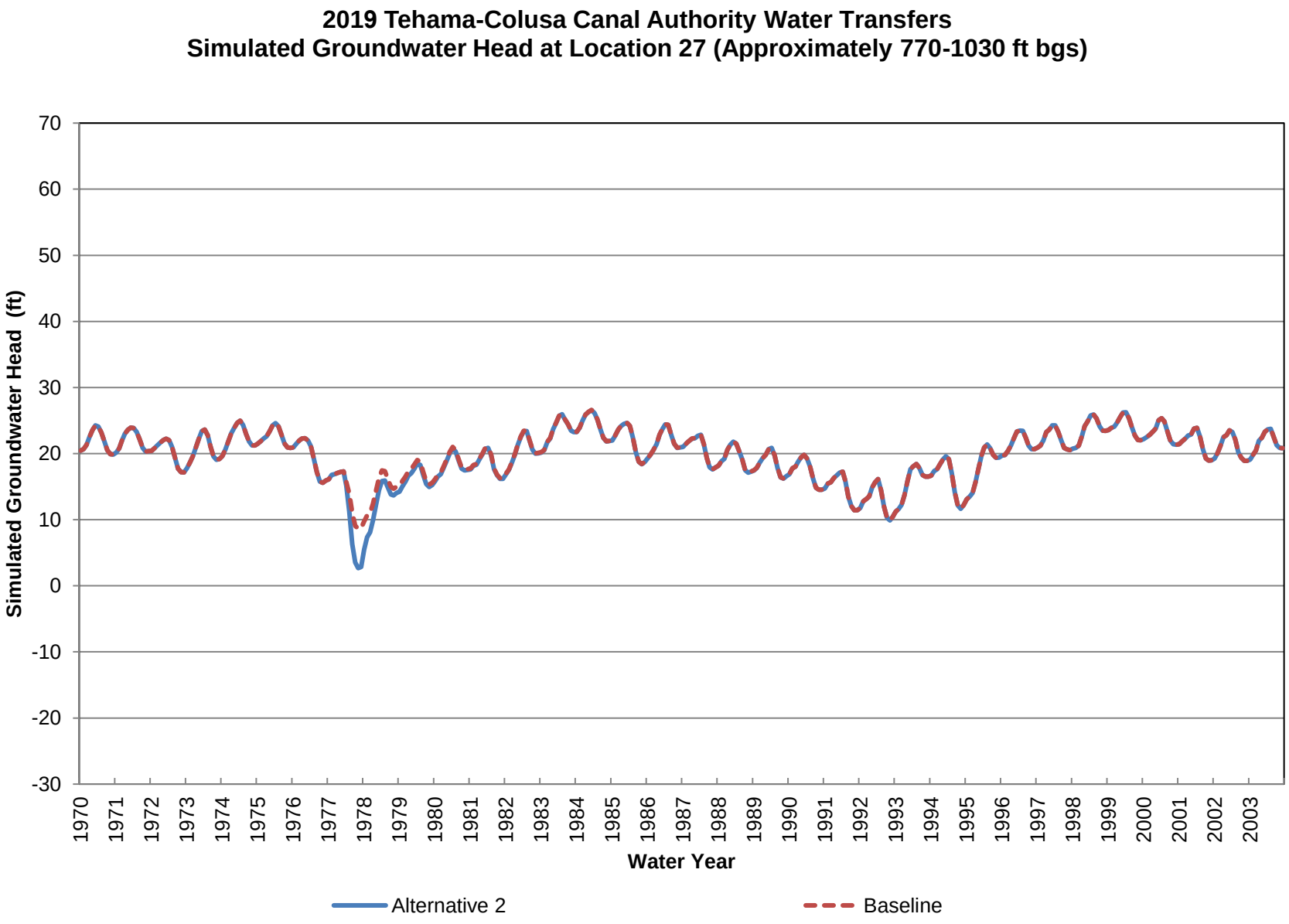
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 770-1030 ft bgs)
Simulated Groundwater Head (ft)
70
60
50
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20
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0
-10
-20
-30
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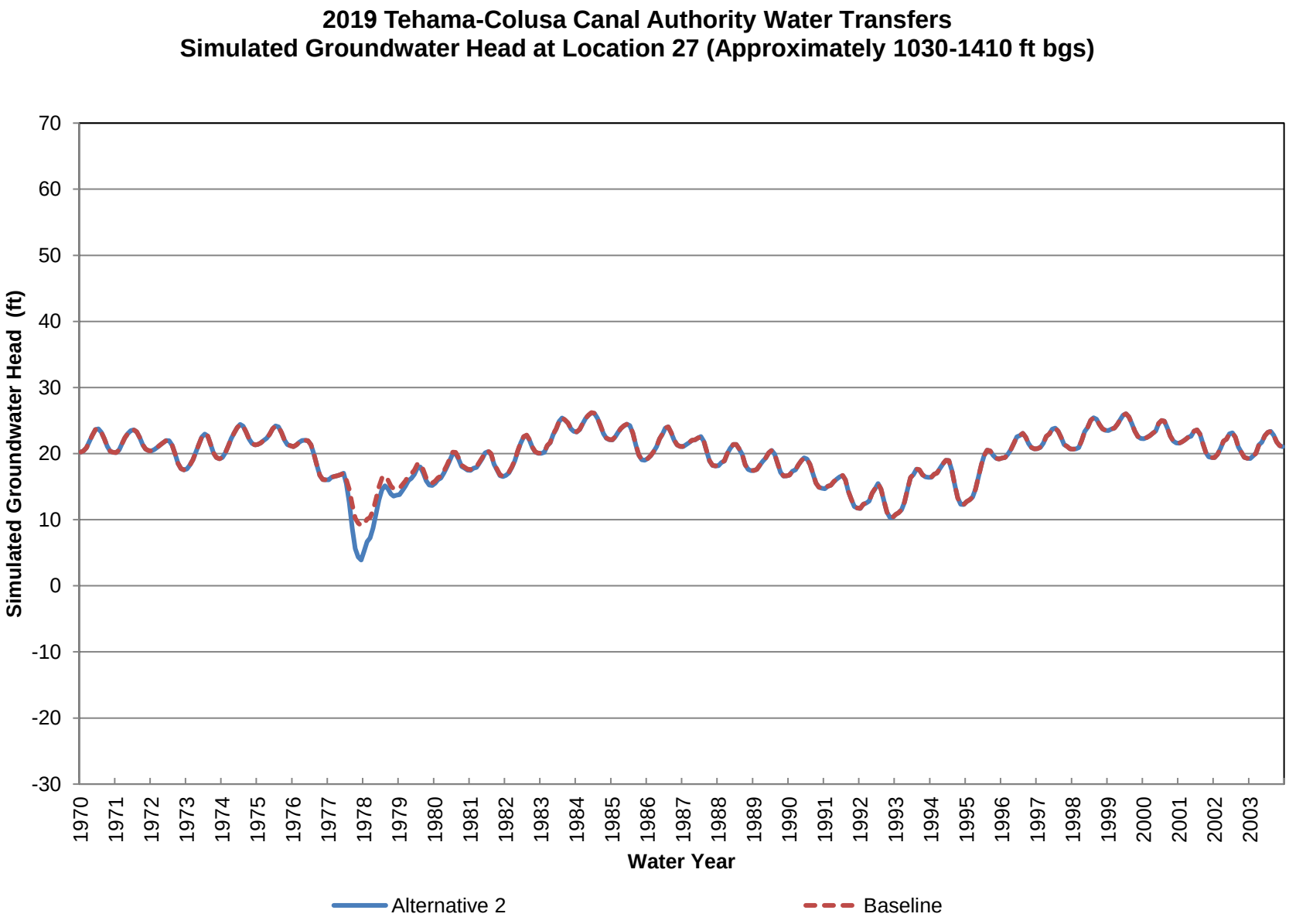
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 1030-1410 ft bgs)
Simulated Groundwater Head (ft)
70
60
50
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30
20
10
0
-10
-20
-30
1970
1971
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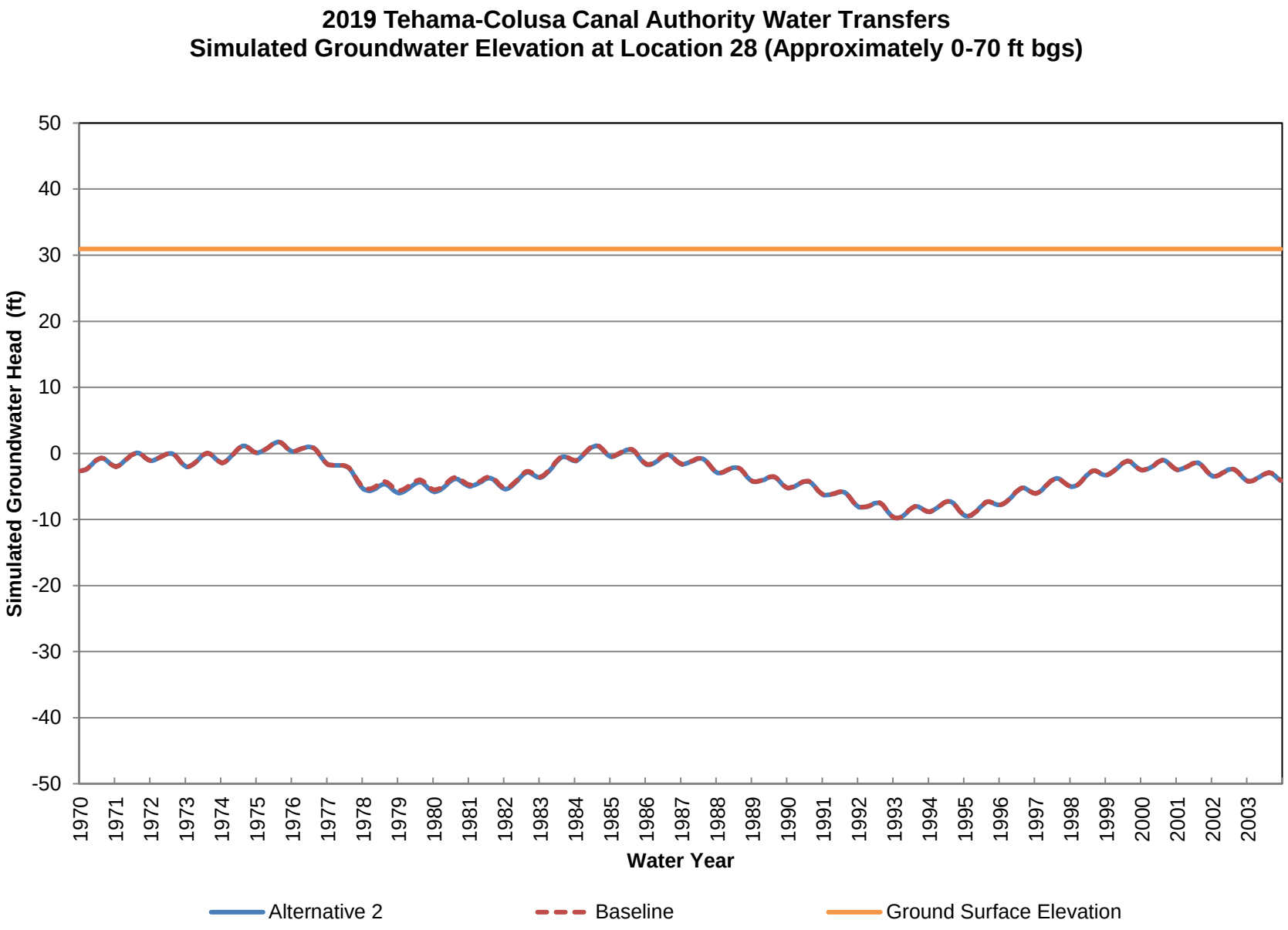
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 28 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
50
40
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0
-10
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-50
1970
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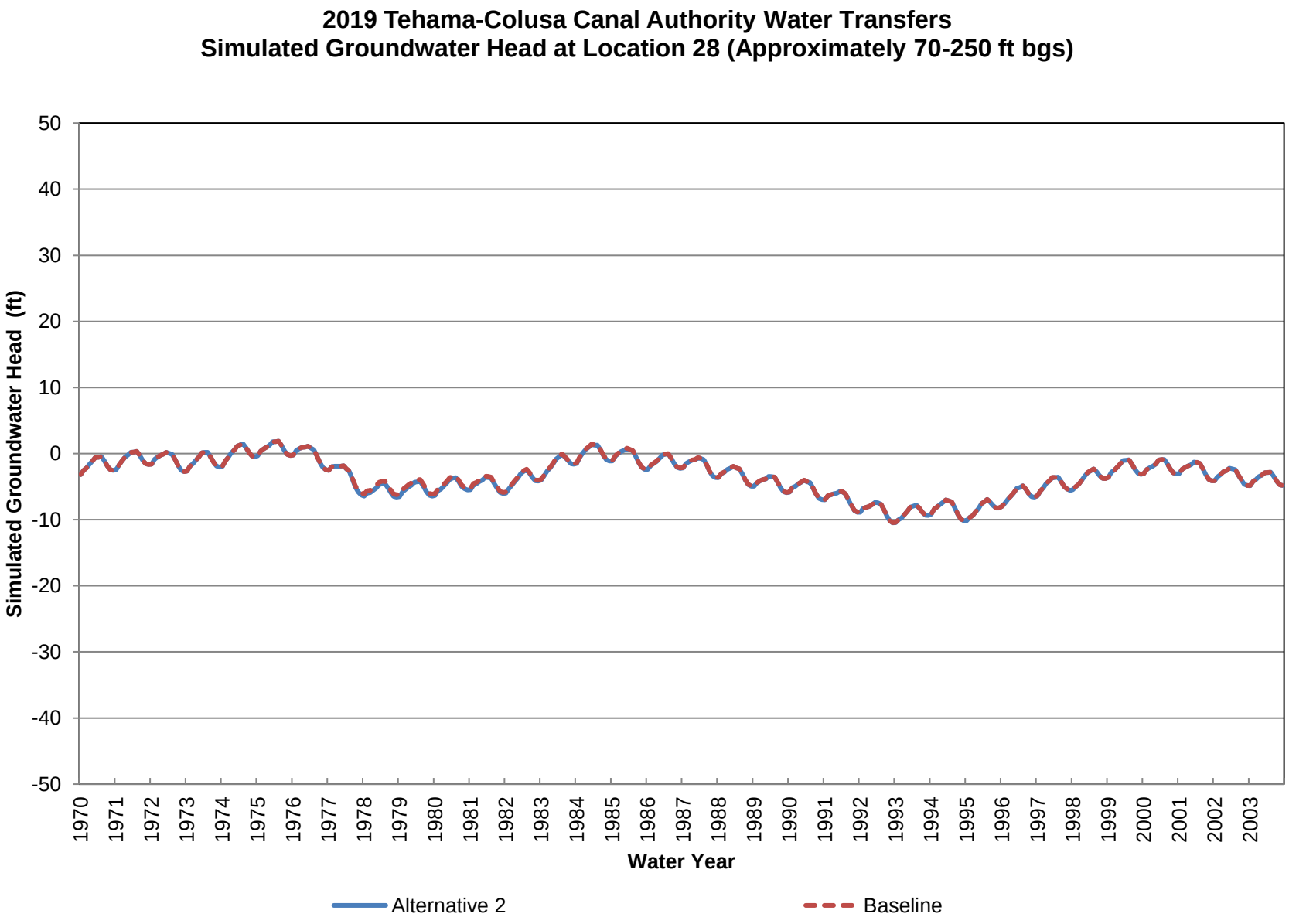
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 70-250 ft bgs)
Simulated Groundwater Head (ft)
50
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0
-10
-20
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-40
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1970
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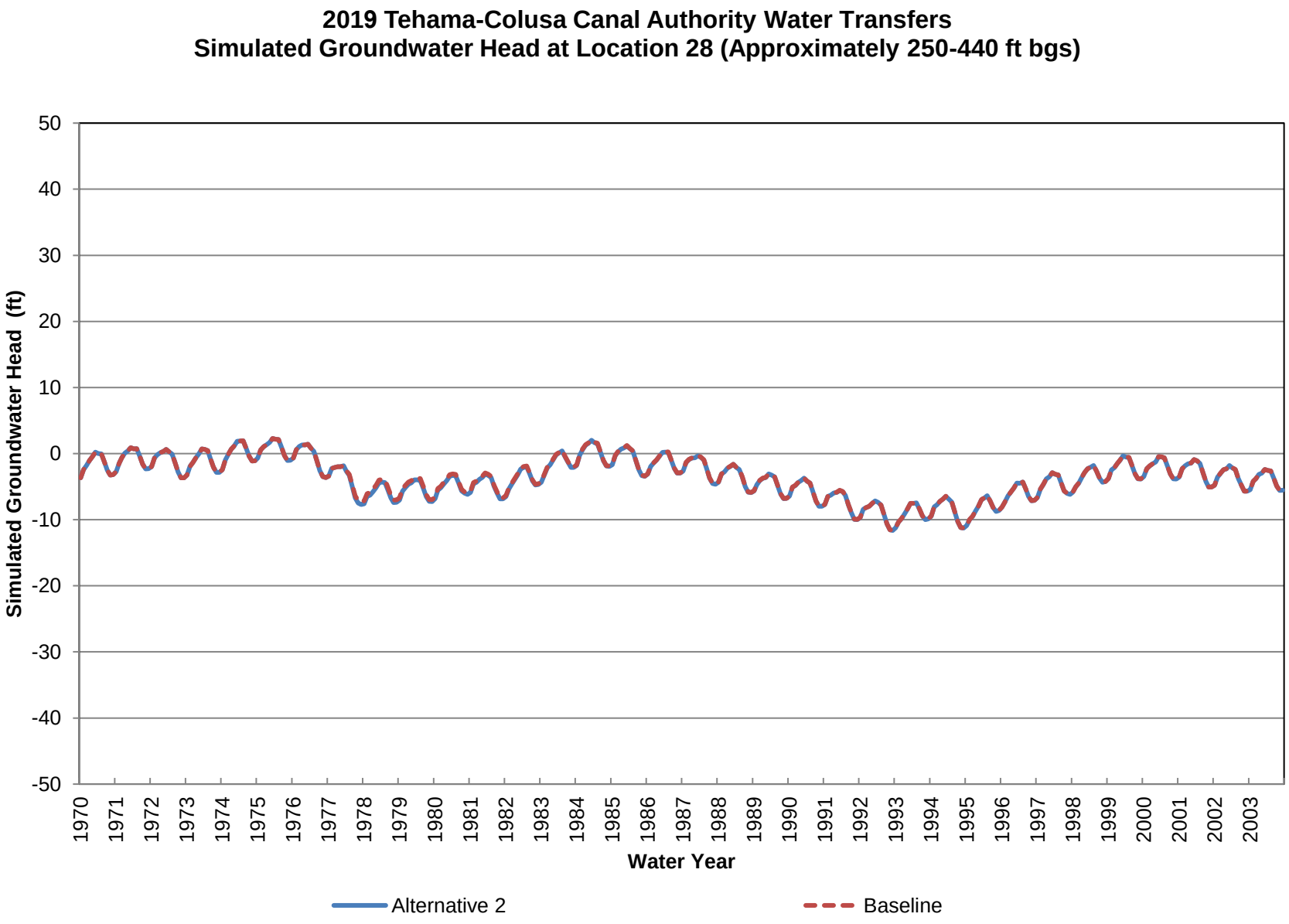
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 250-440 ft bgs)
Simulated Groundwater Head (ft)
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1970
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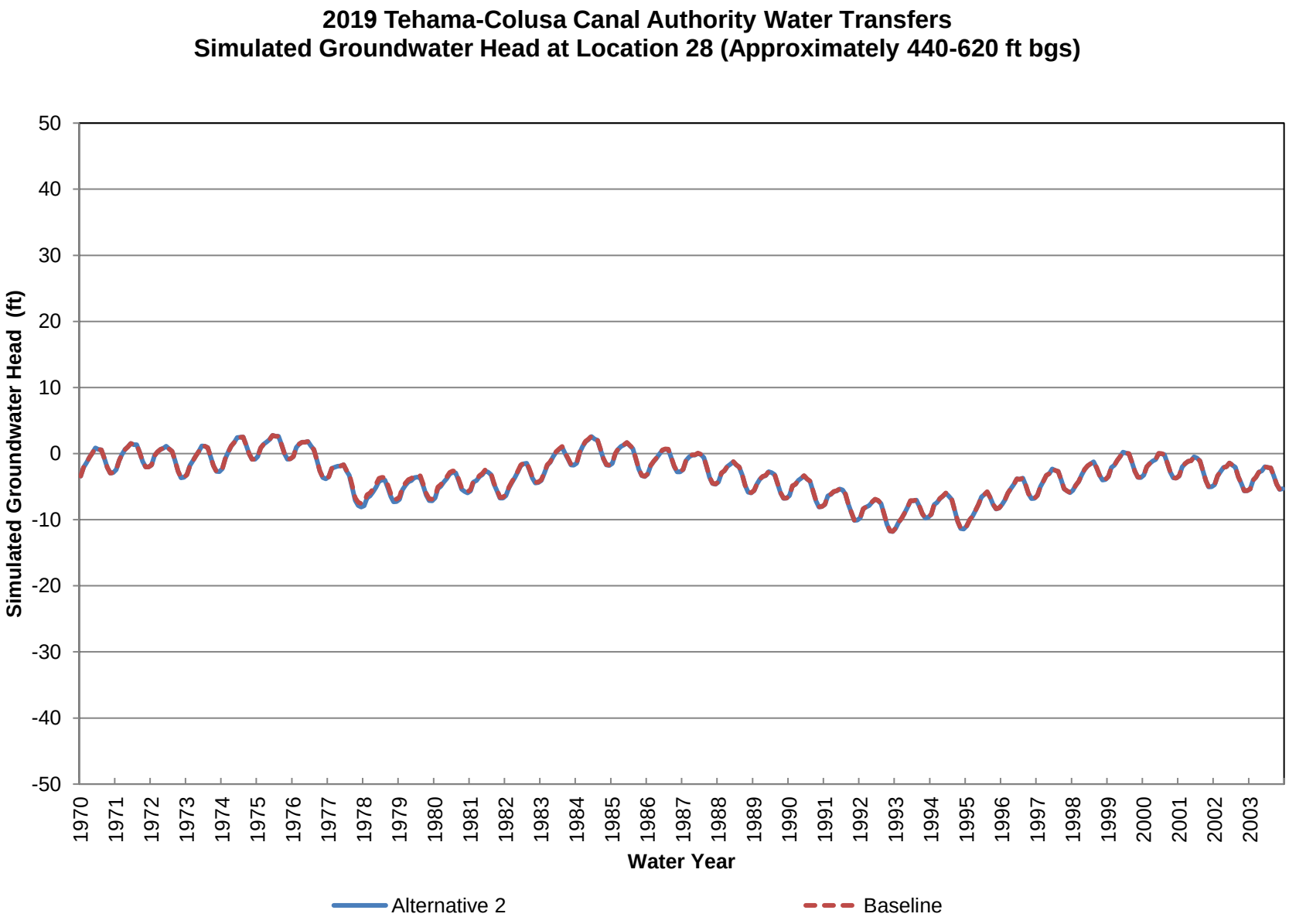
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 440-620 ft bgs)
Simulated Groundwater Head (ft)
50
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0
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-20
-30
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-50
1970
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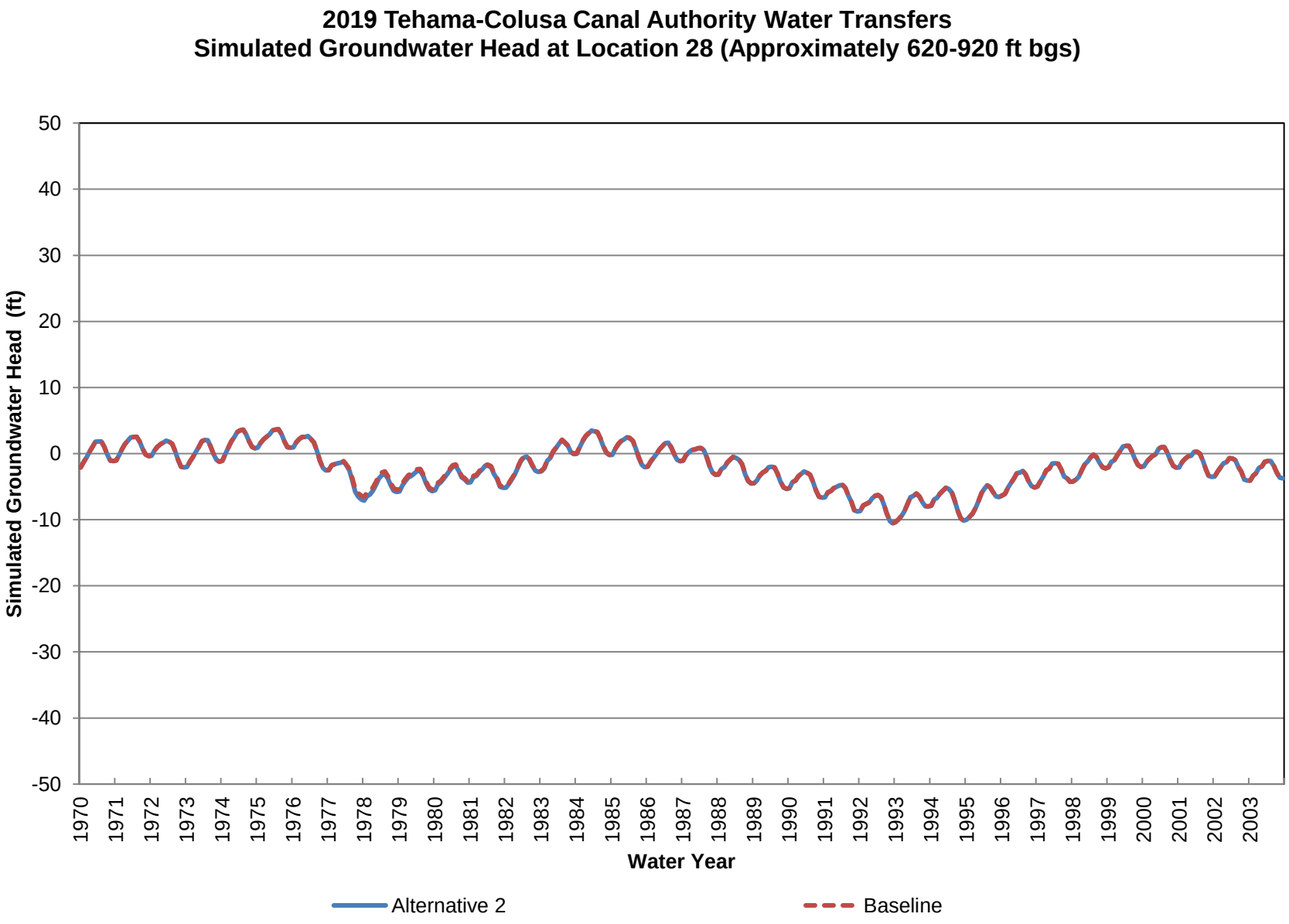
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 620-920 ft bgs)
Simulated Groundwater Head (ft)
50
40
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0
-10
-20
-30
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1970
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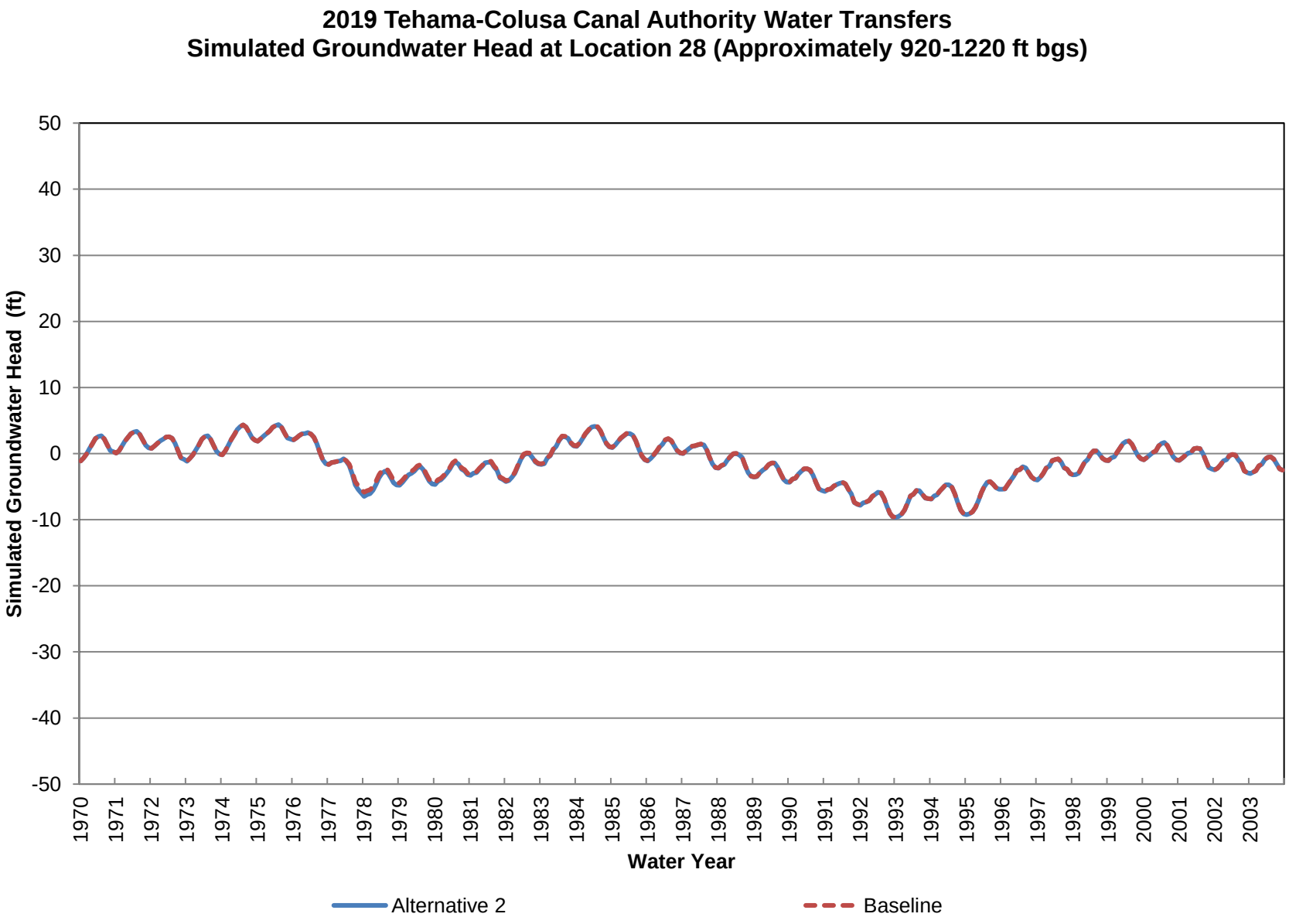
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 920-1220 ft bgs)
Simulated Groundwater Head (ft)
50
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30
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0
-10
-20
-30
-40
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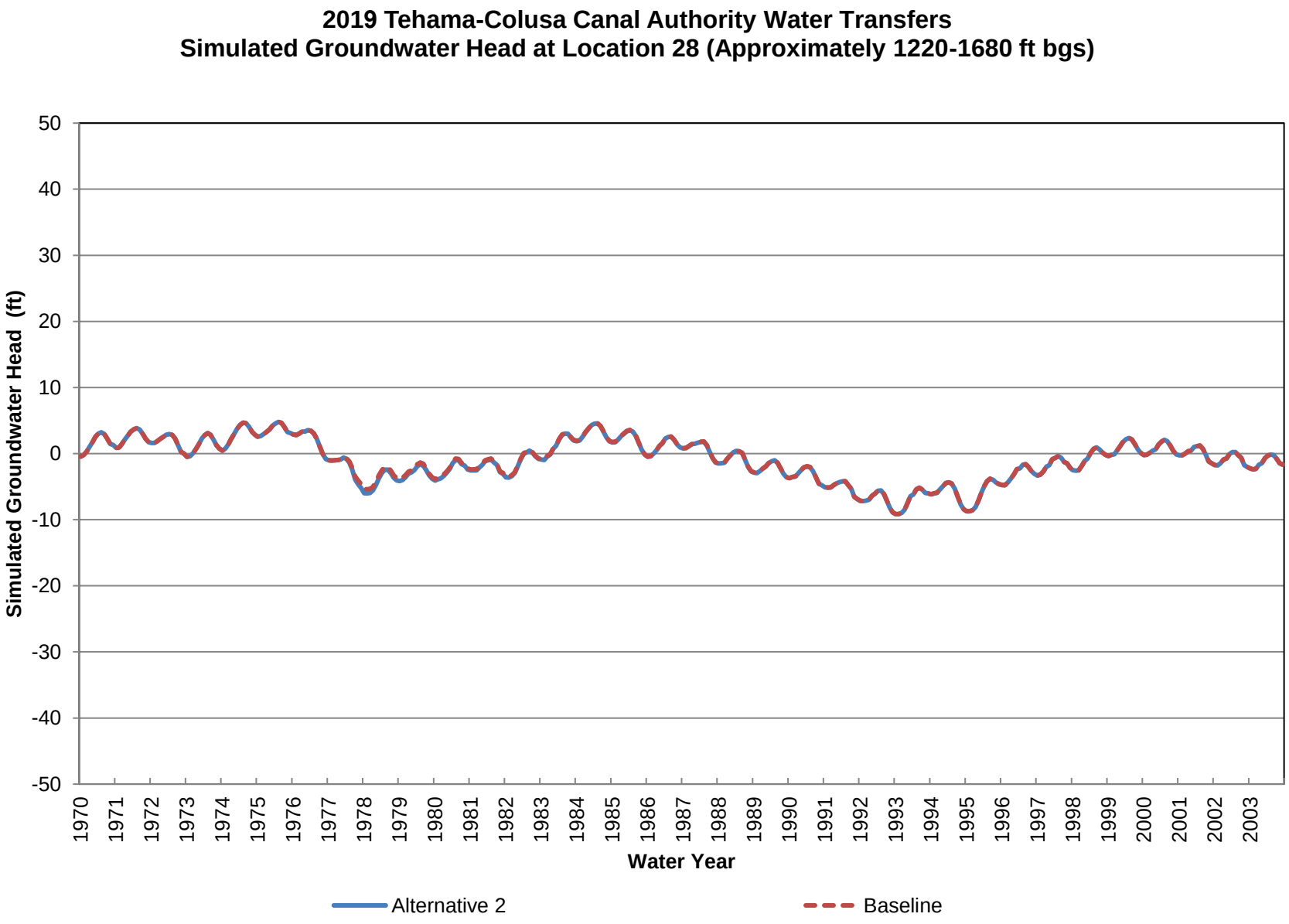
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 1220-1680 ft bgs)
Simulated Groundwater Head (ft)
50
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0
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1970
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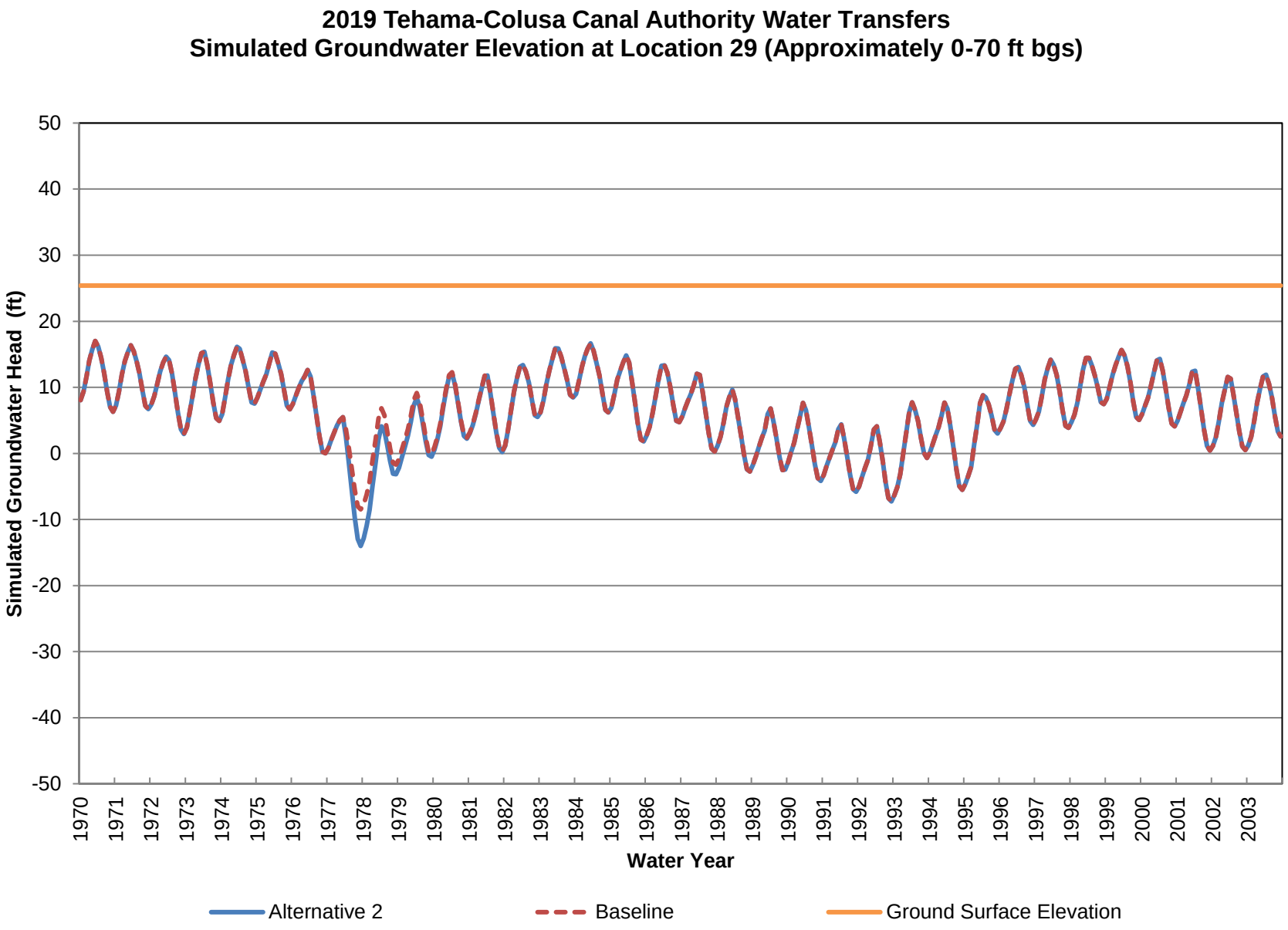
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 29 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
50
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30
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0
-10
-20
-30
-40
-50
1970
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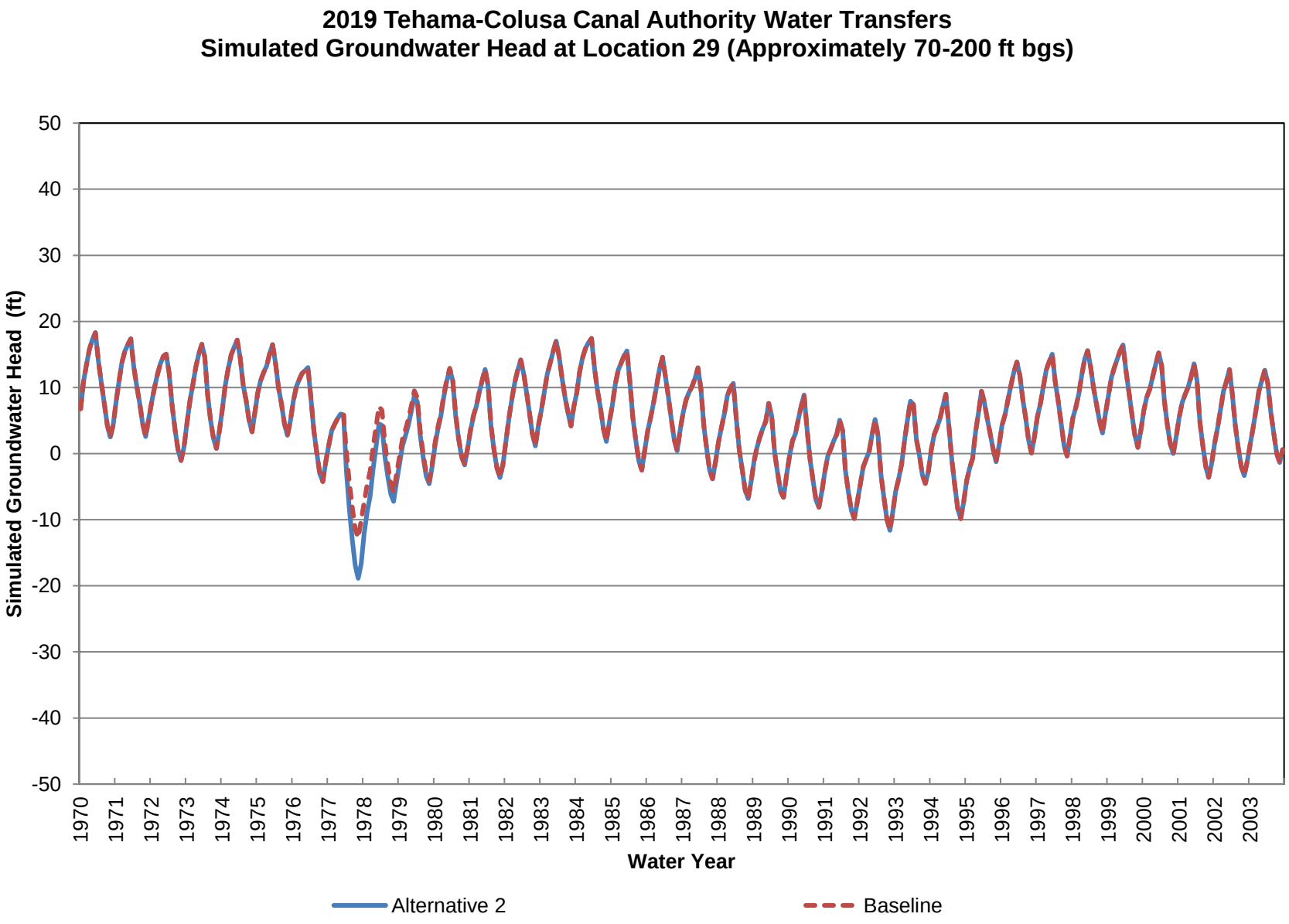
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 70-200 ft bgs)
Simulated Groundwater Head (ft)
50
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0
-10
-20
-30
-40
-50
1970
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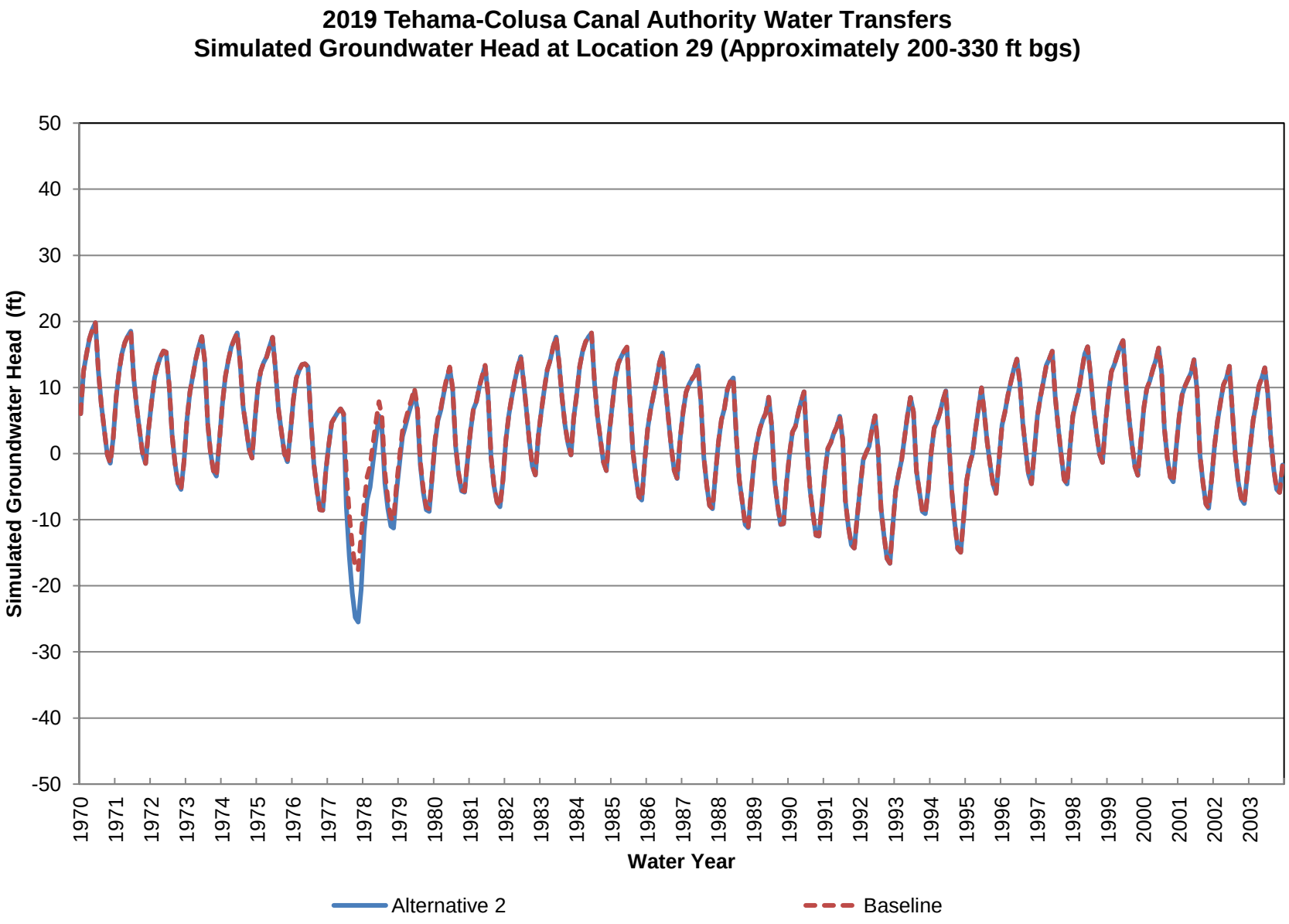
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 200-330 ft bgs)
Simulated Groundwater Head (ft)
50
40
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10
0
-10
-20
-30
-40
-50
1970
1971
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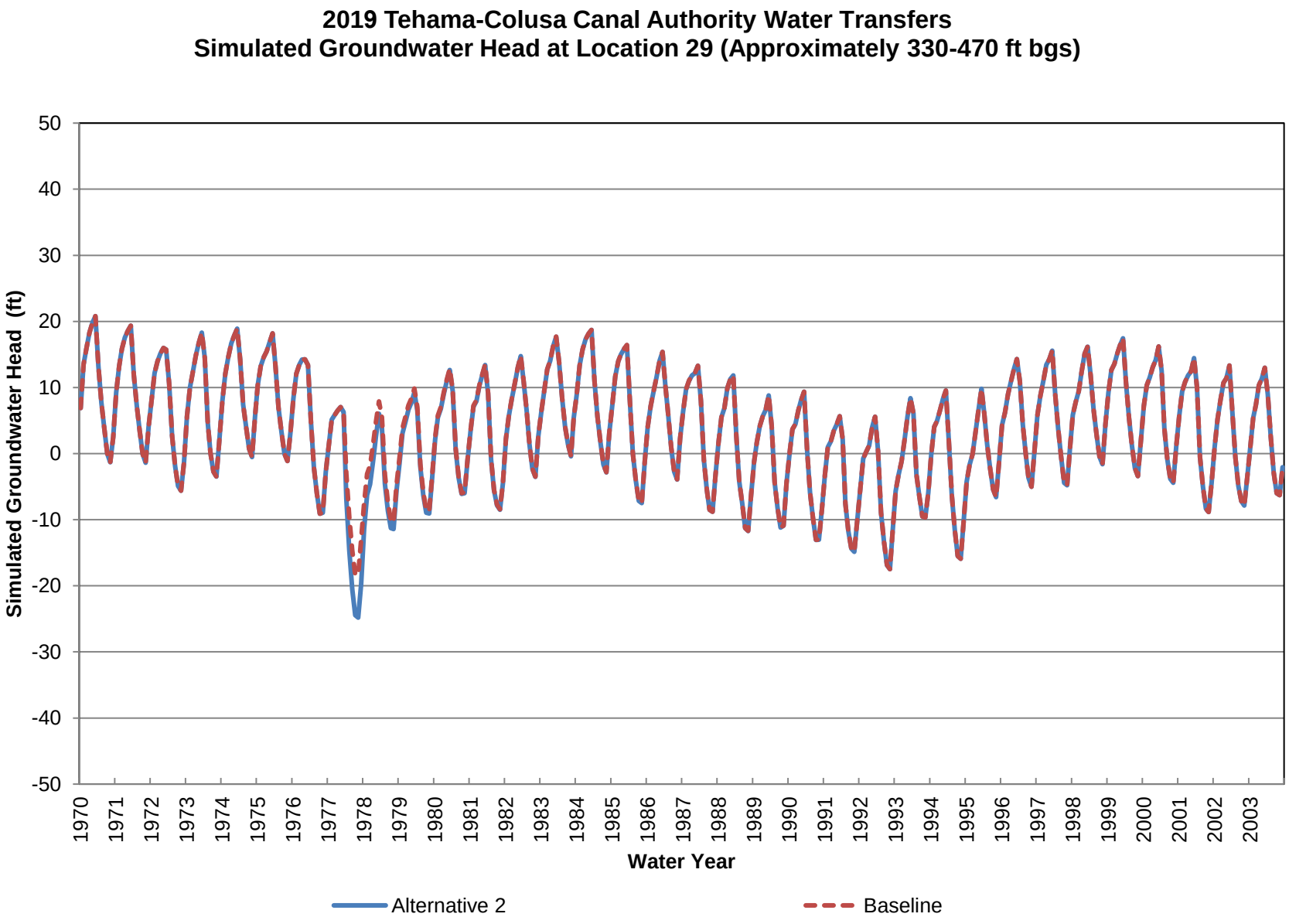
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 330-470 ft bgs)
Simulated Groundwater Head (ft)
50
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0
-10
-20
-30
-40
-50
1970
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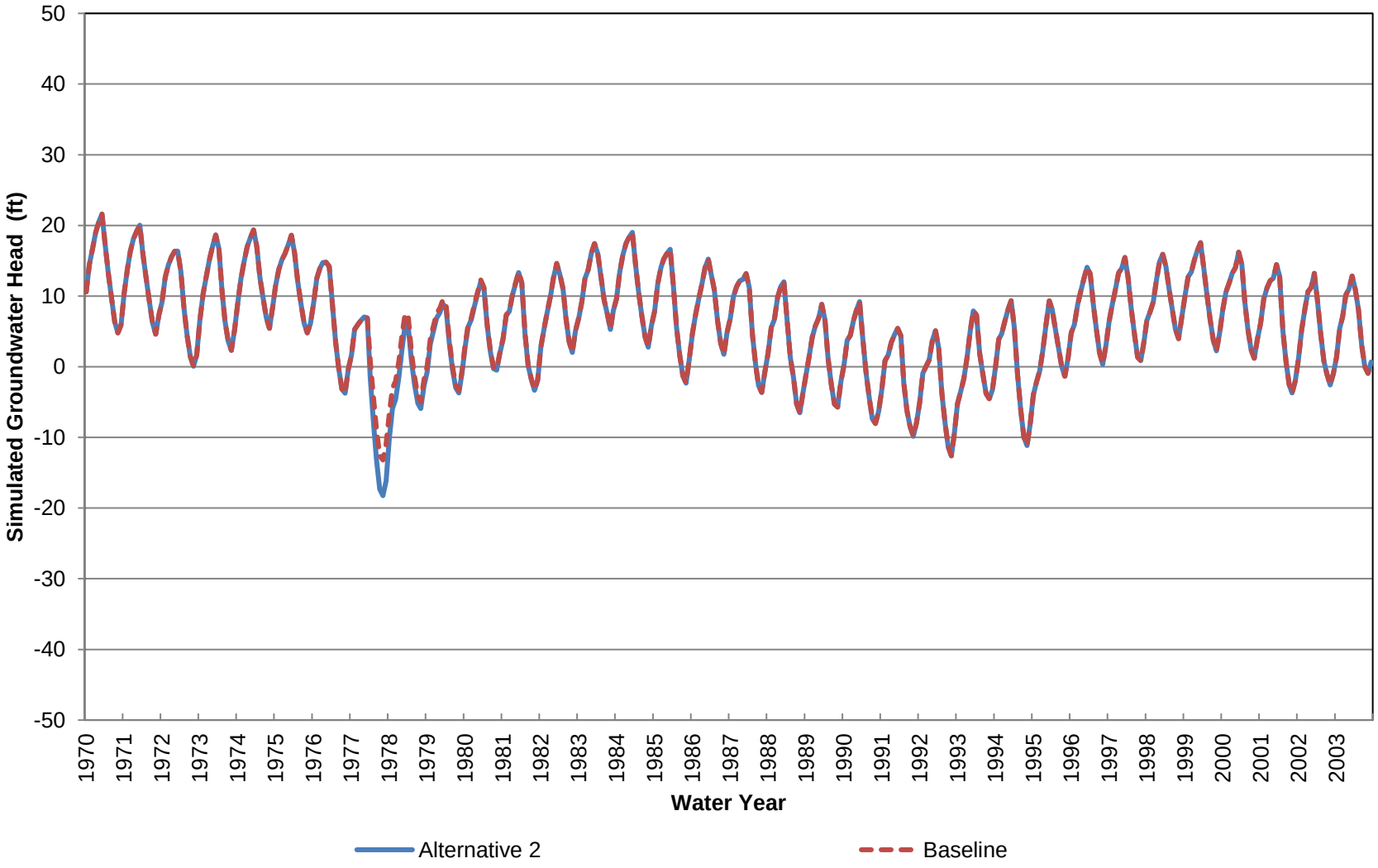
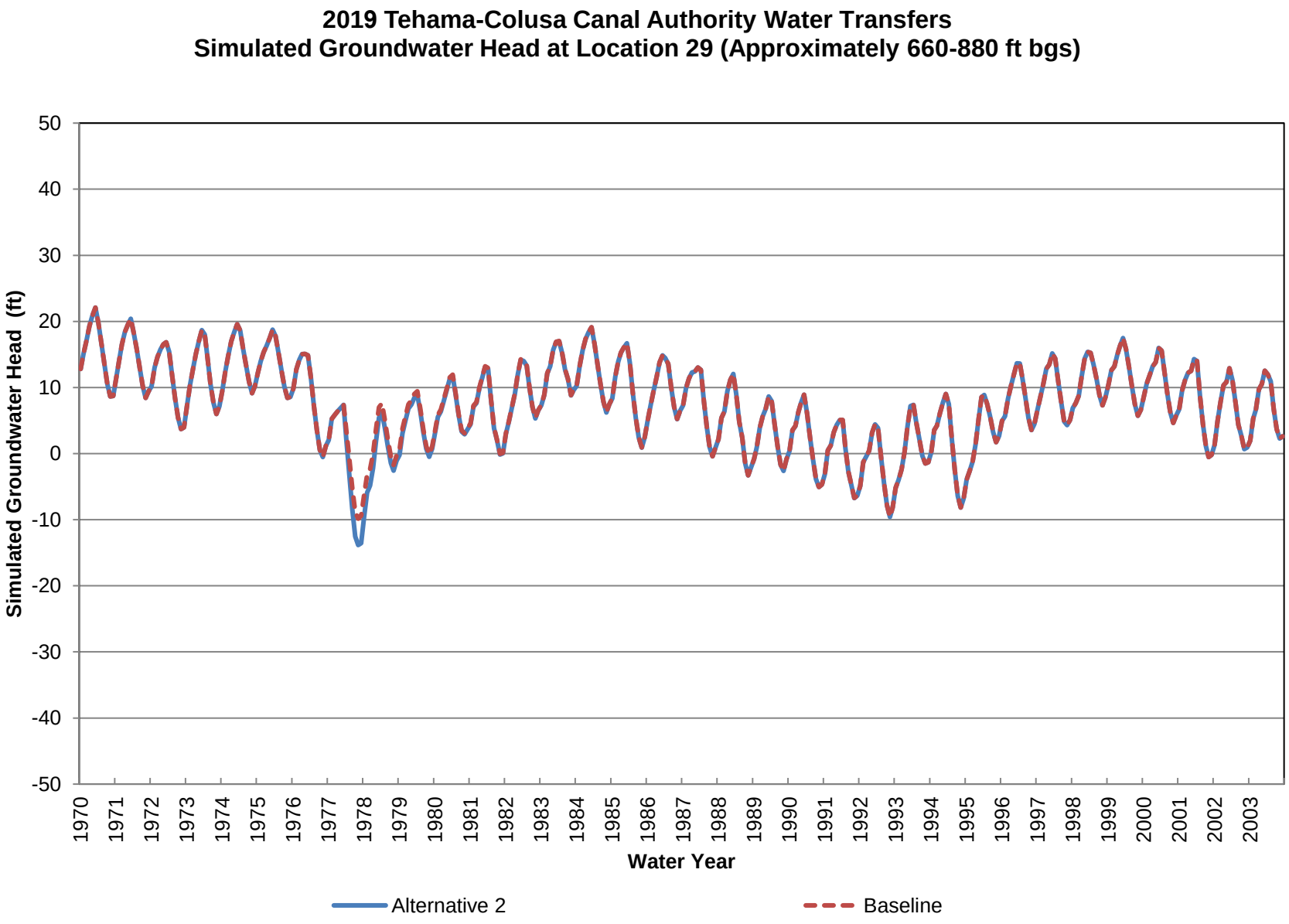
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 470-660 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 660-880 ft bgs)
Simulated Groundwater Head (ft)
50
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0
-10
-20
-30
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-50
1970
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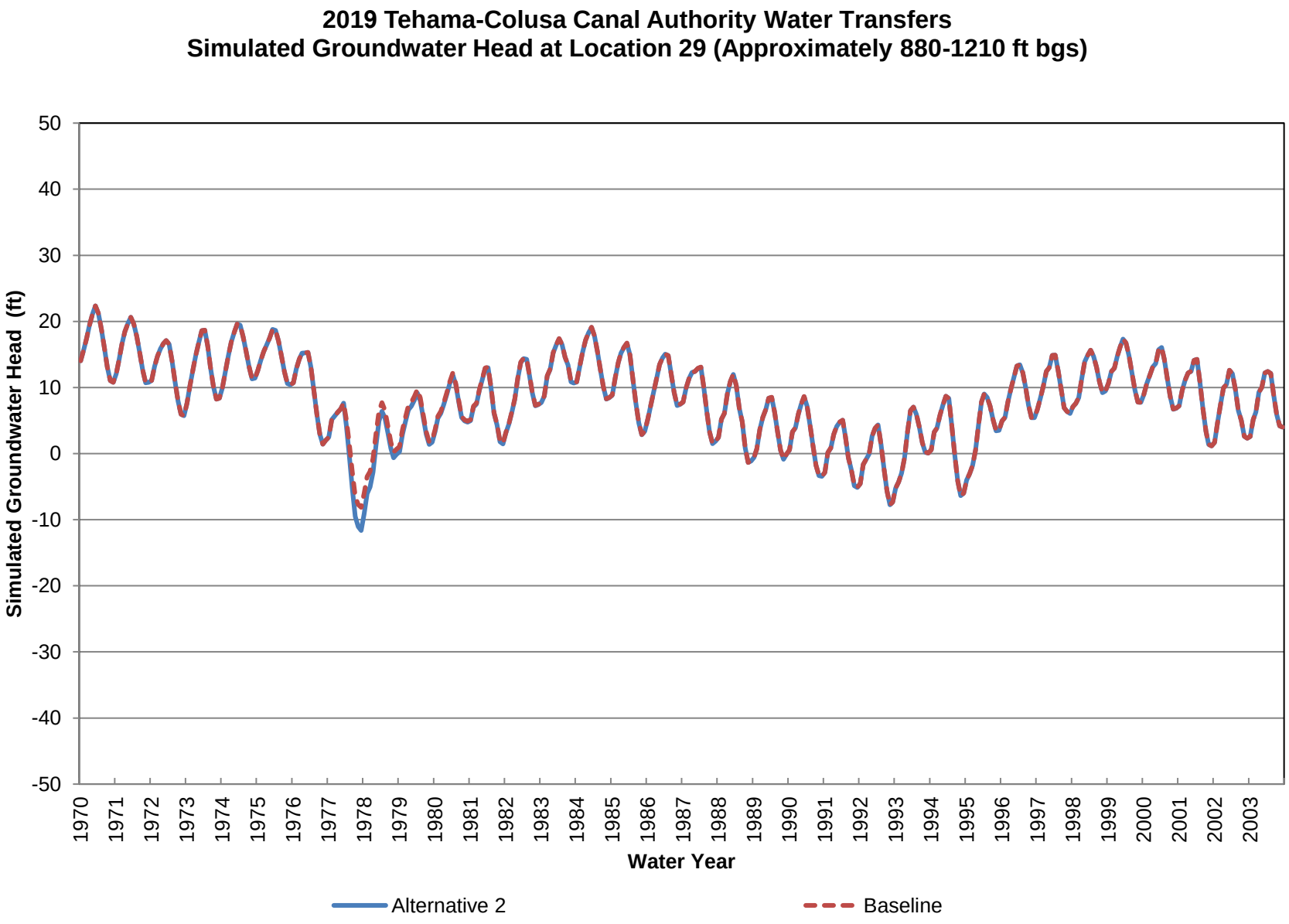
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 880-1210 ft bgs)
Simulated Groundwater Head (ft)
50
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10
0
-10
-20
-30
-40
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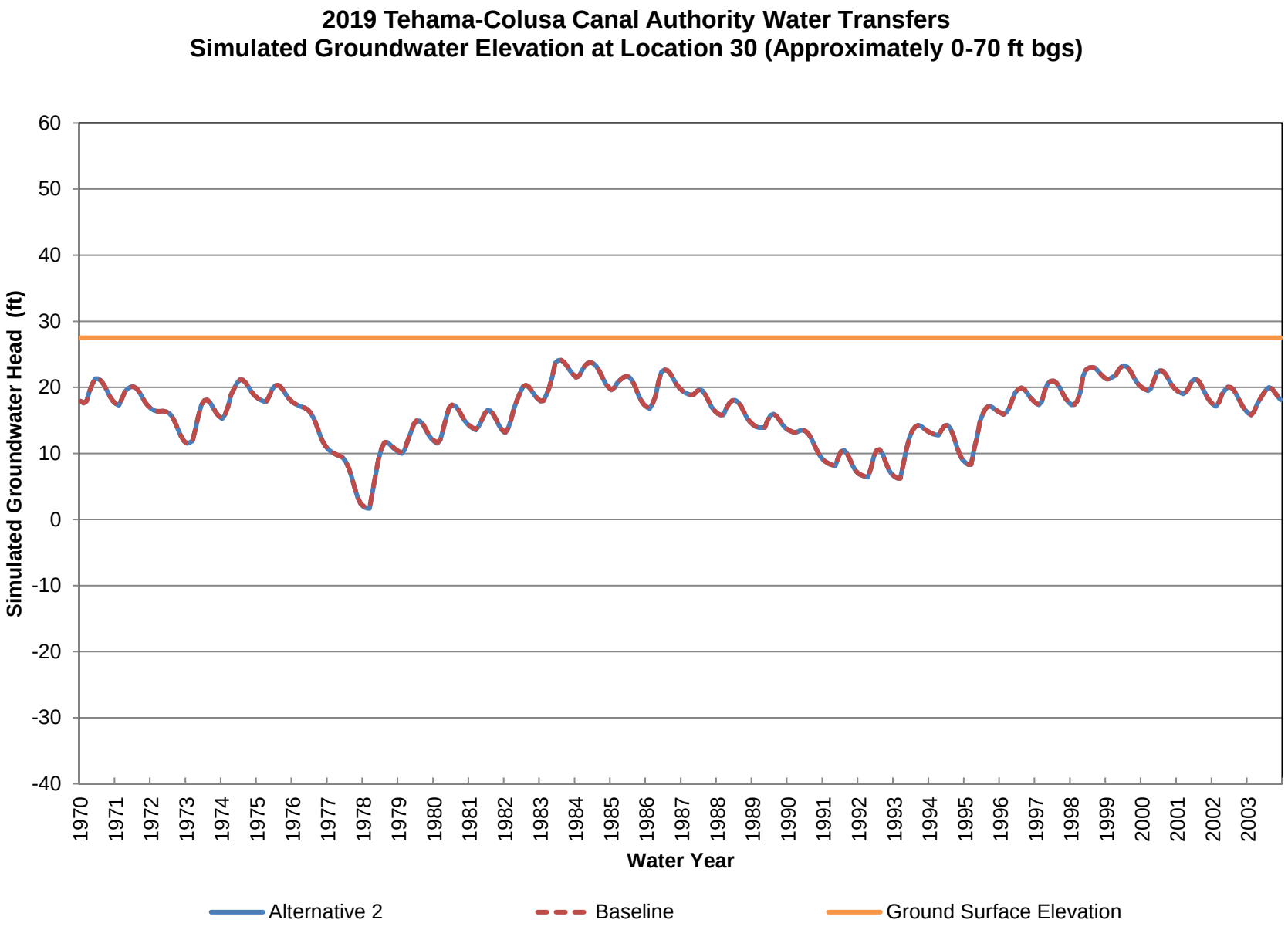
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 30 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
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10
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-10
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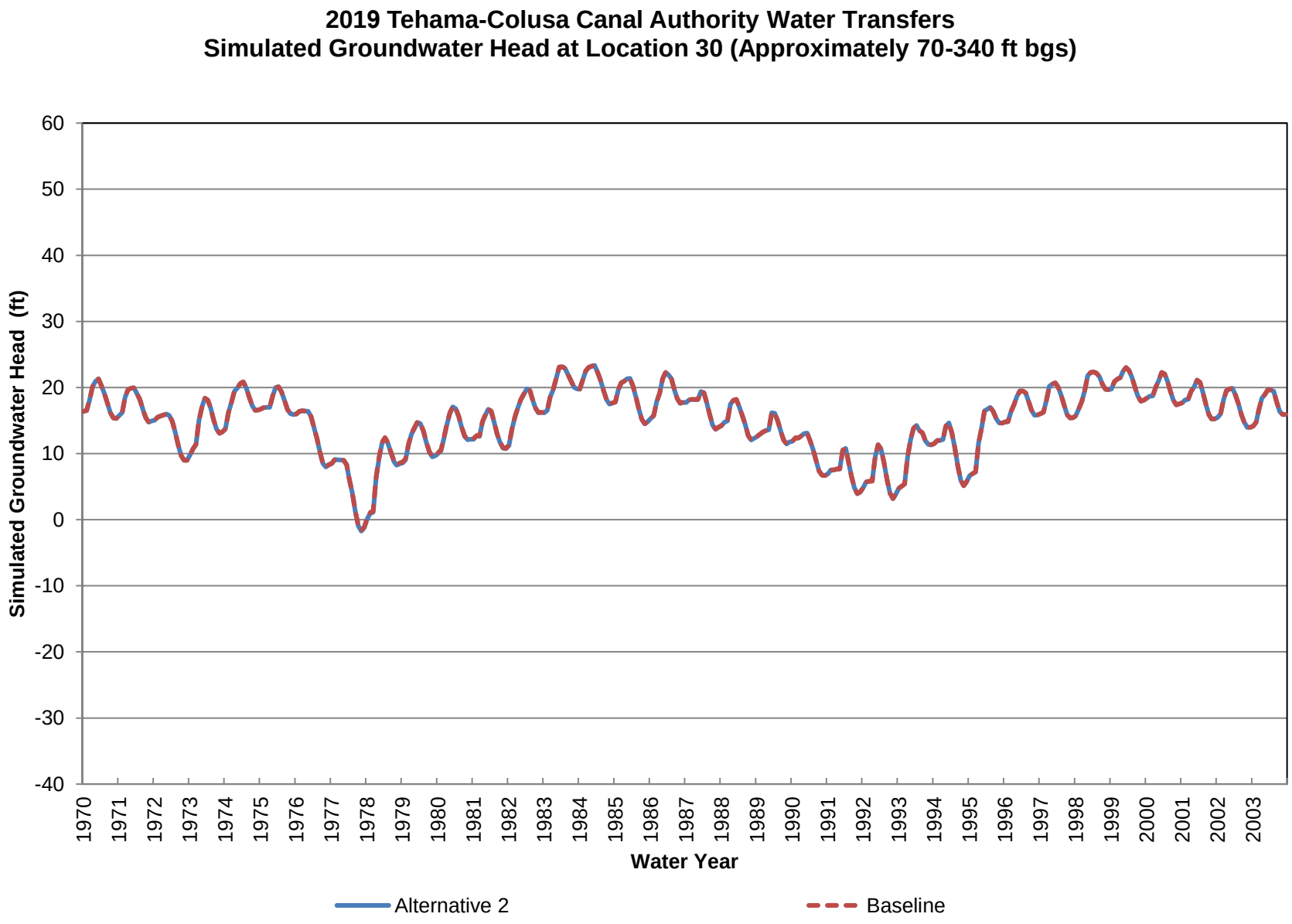
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 70-340 ft bgs)
Simulated Groundwater Head (ft)
60
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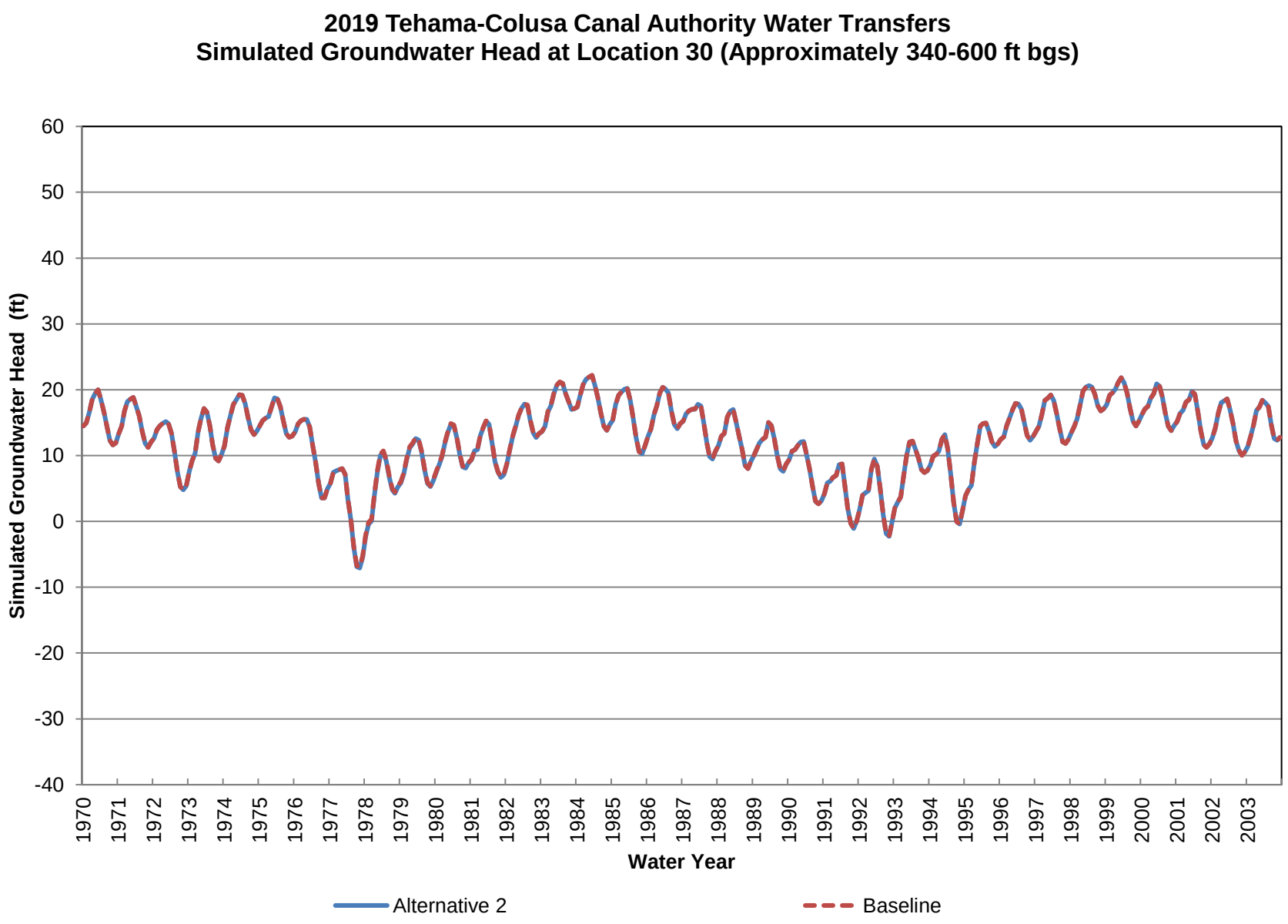
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 340-600 ft bgs)
Simulated Groundwater Head (ft)
60
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10
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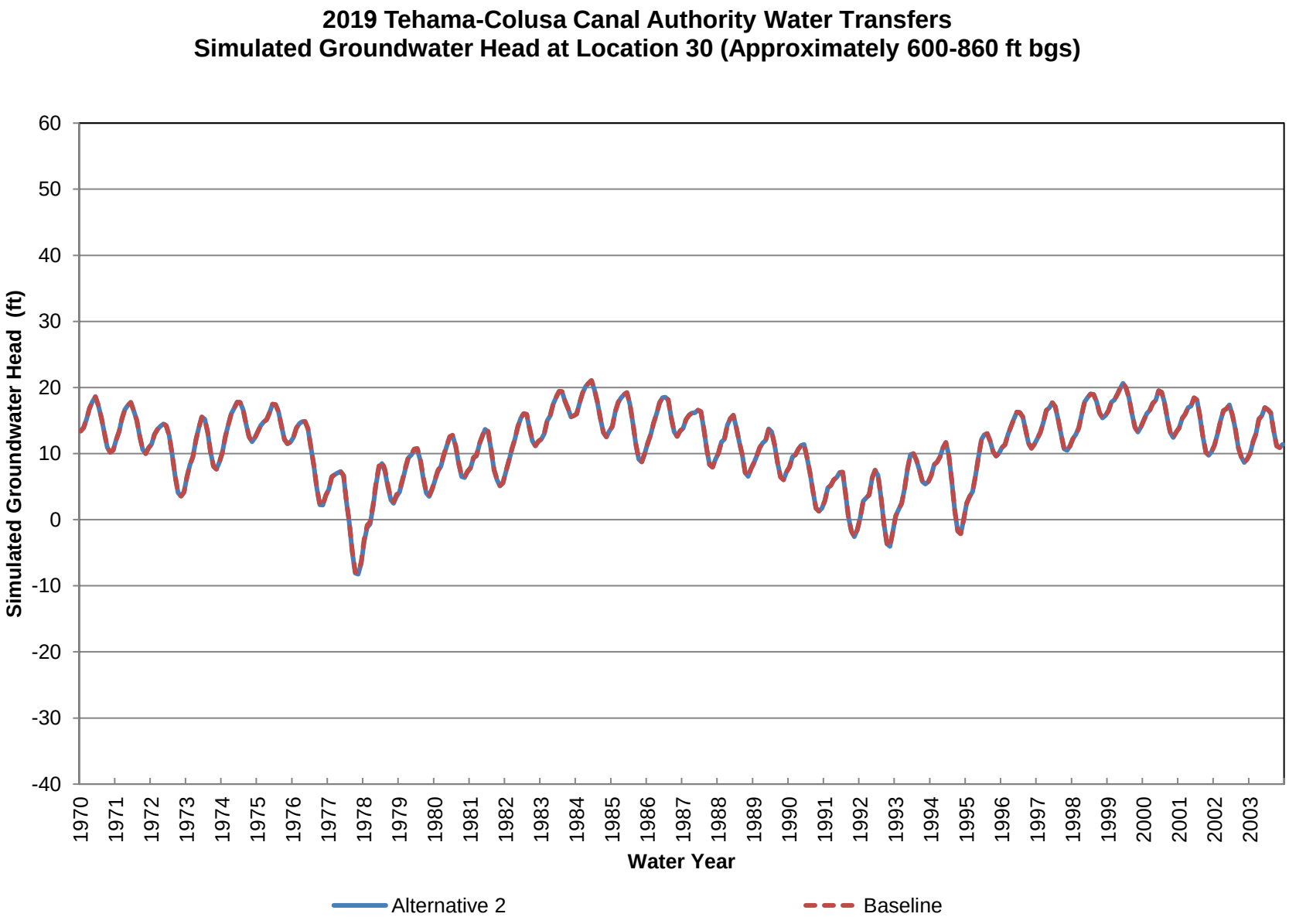
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 600-860 ft bgs)
Simulated Groundwater Head (ft)
60
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10
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-10
-20
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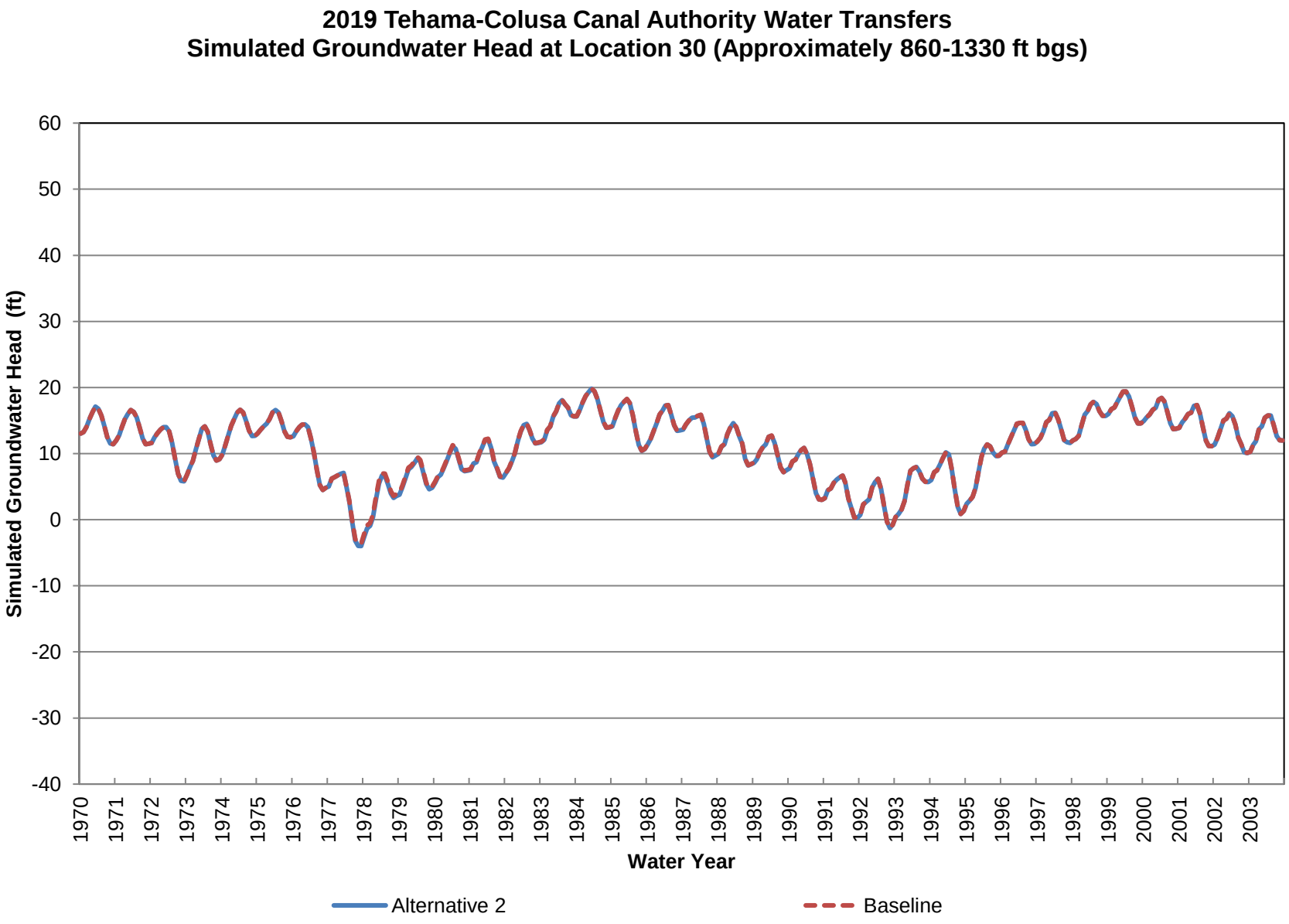
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 860-1330 ft bgs)
Simulated Groundwater Head (ft)
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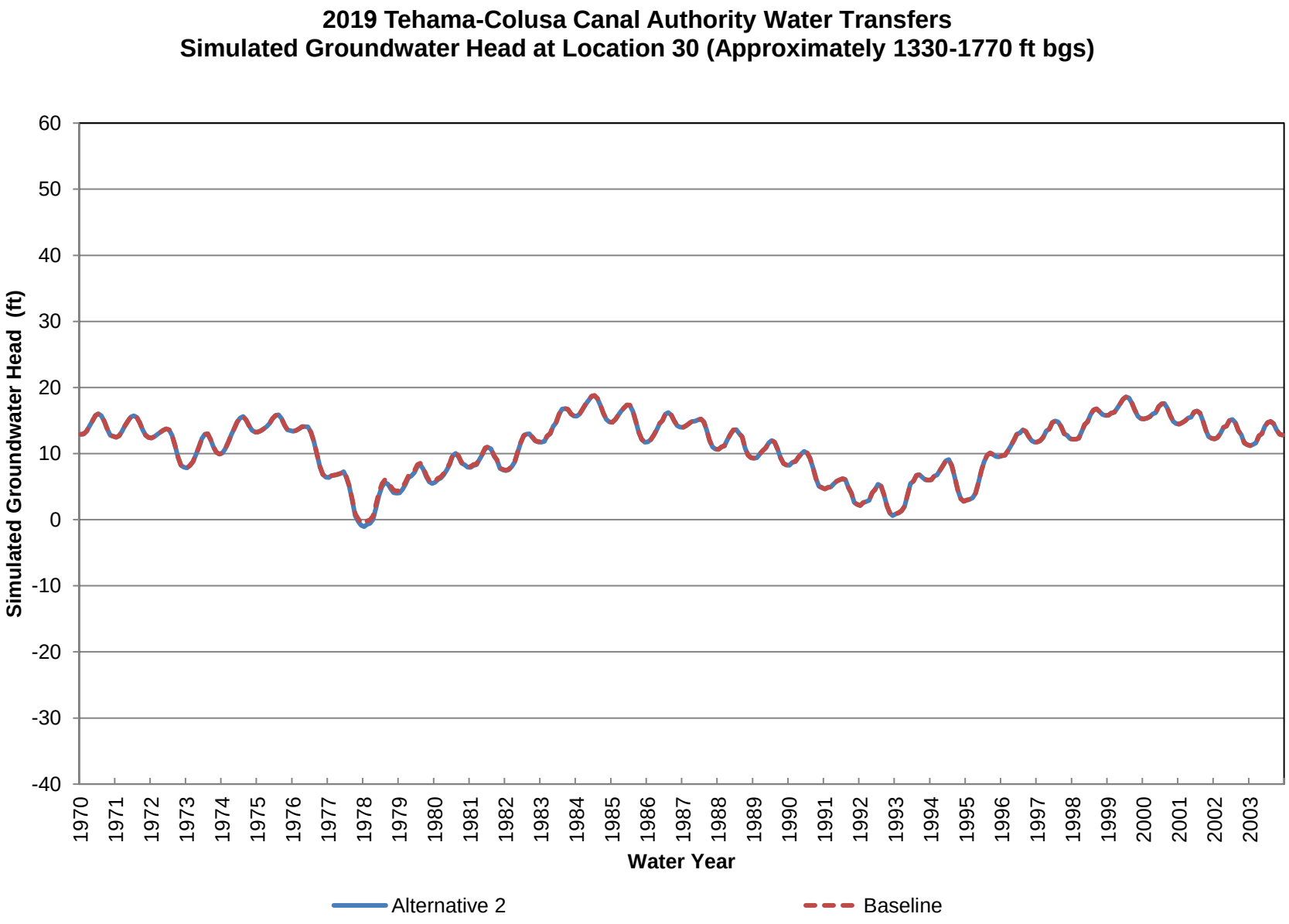
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 1330-1770 ft bgs)
Simulated Groundwater Head (ft)
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-10
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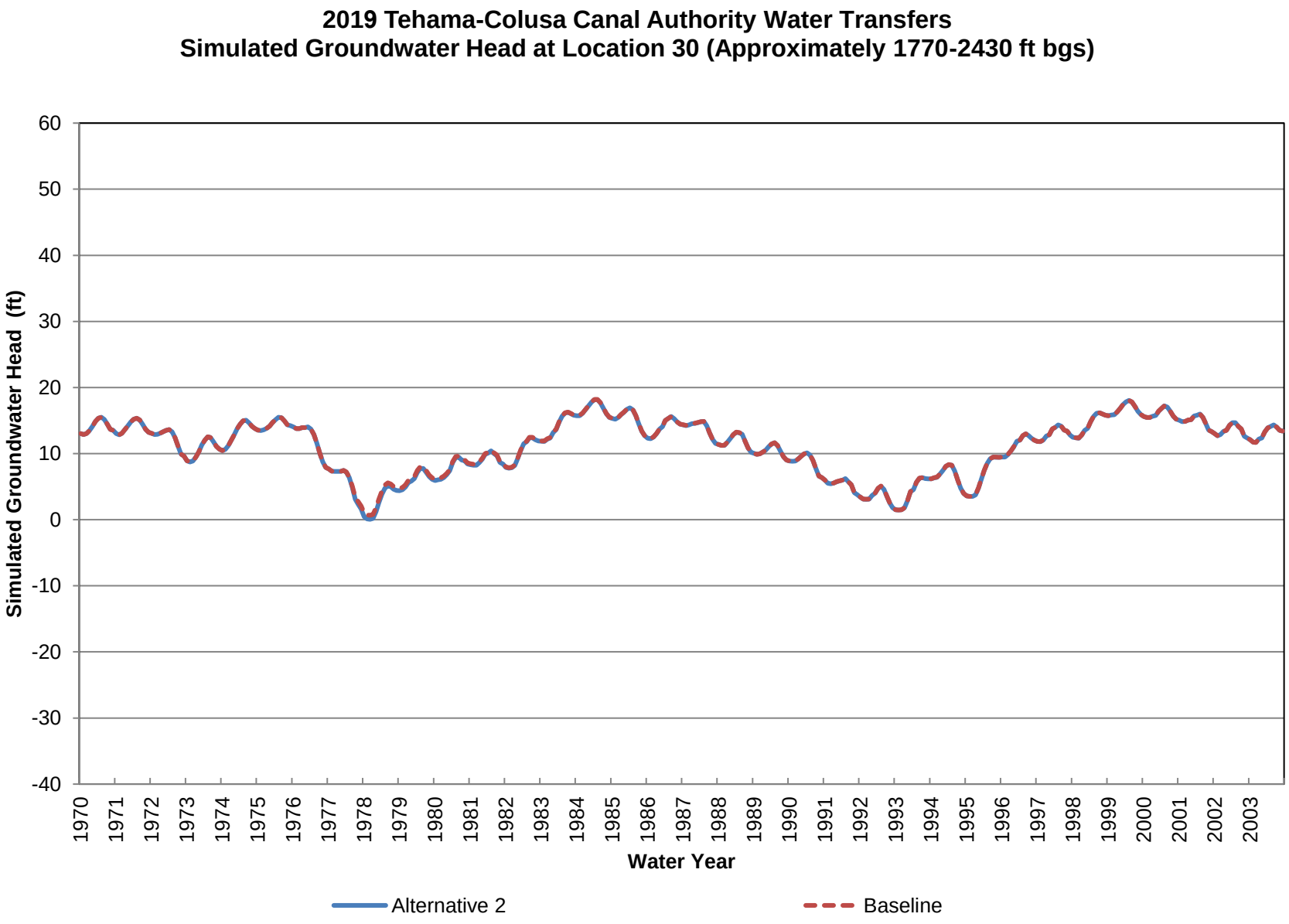
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 1770-2430 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
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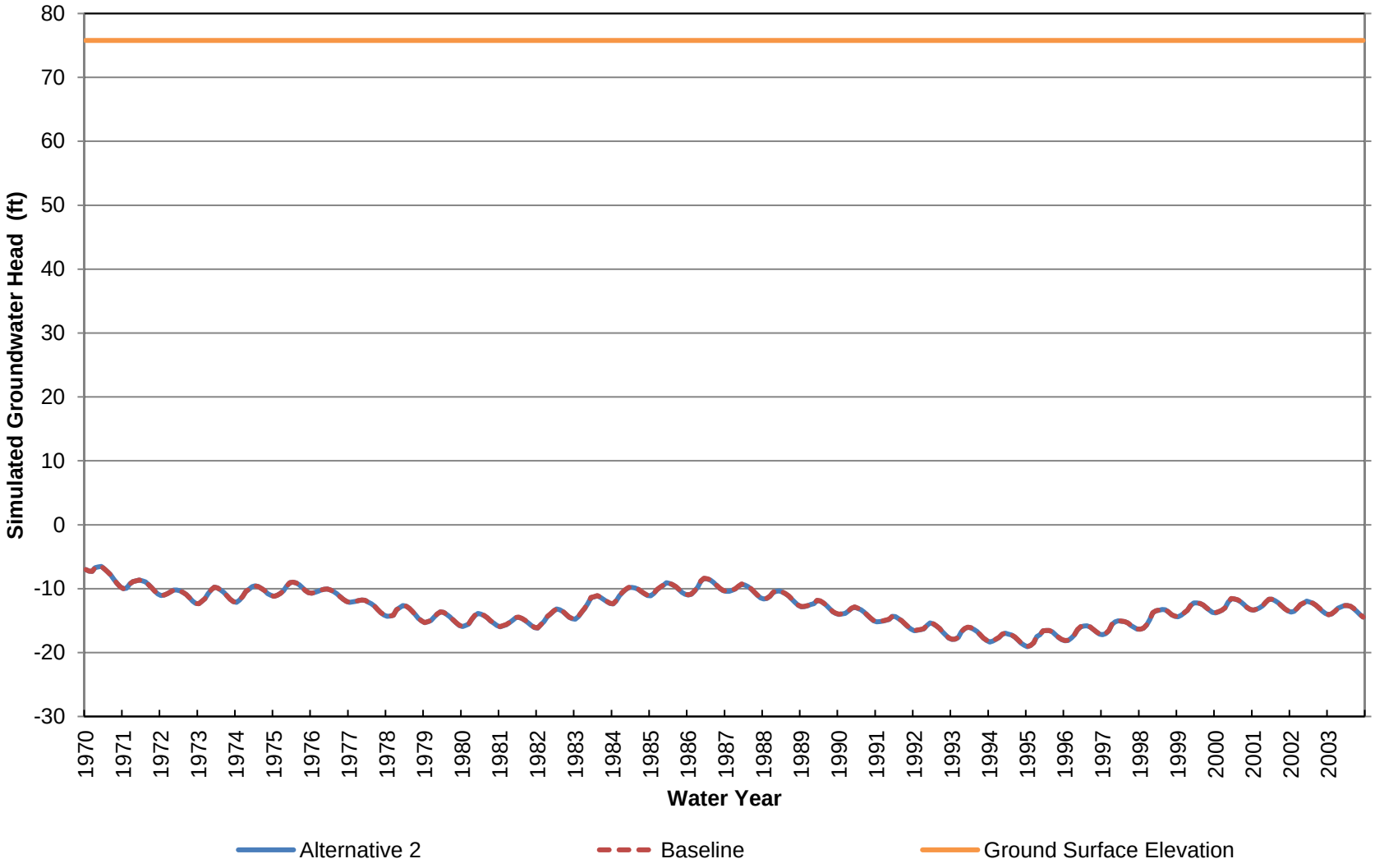
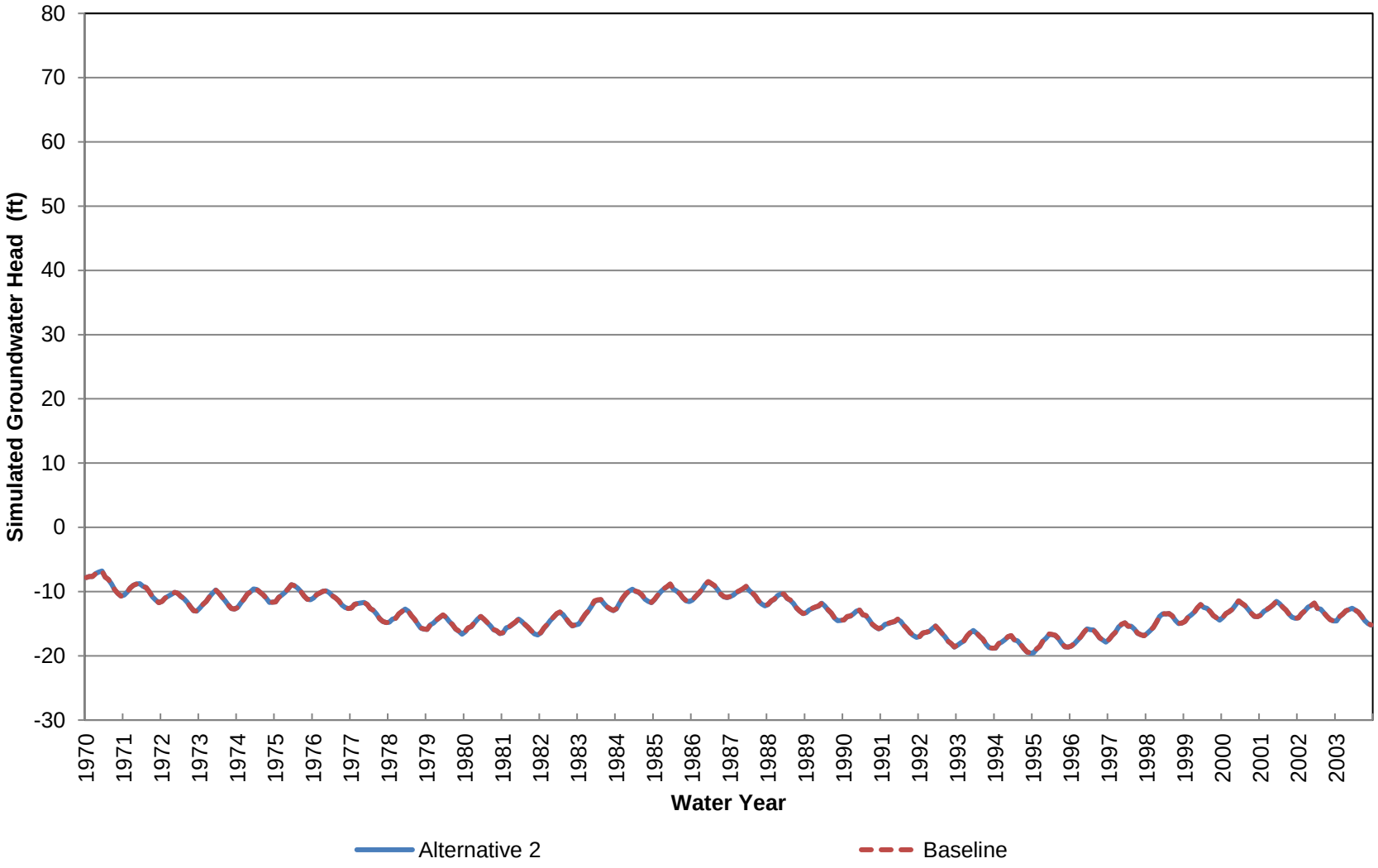
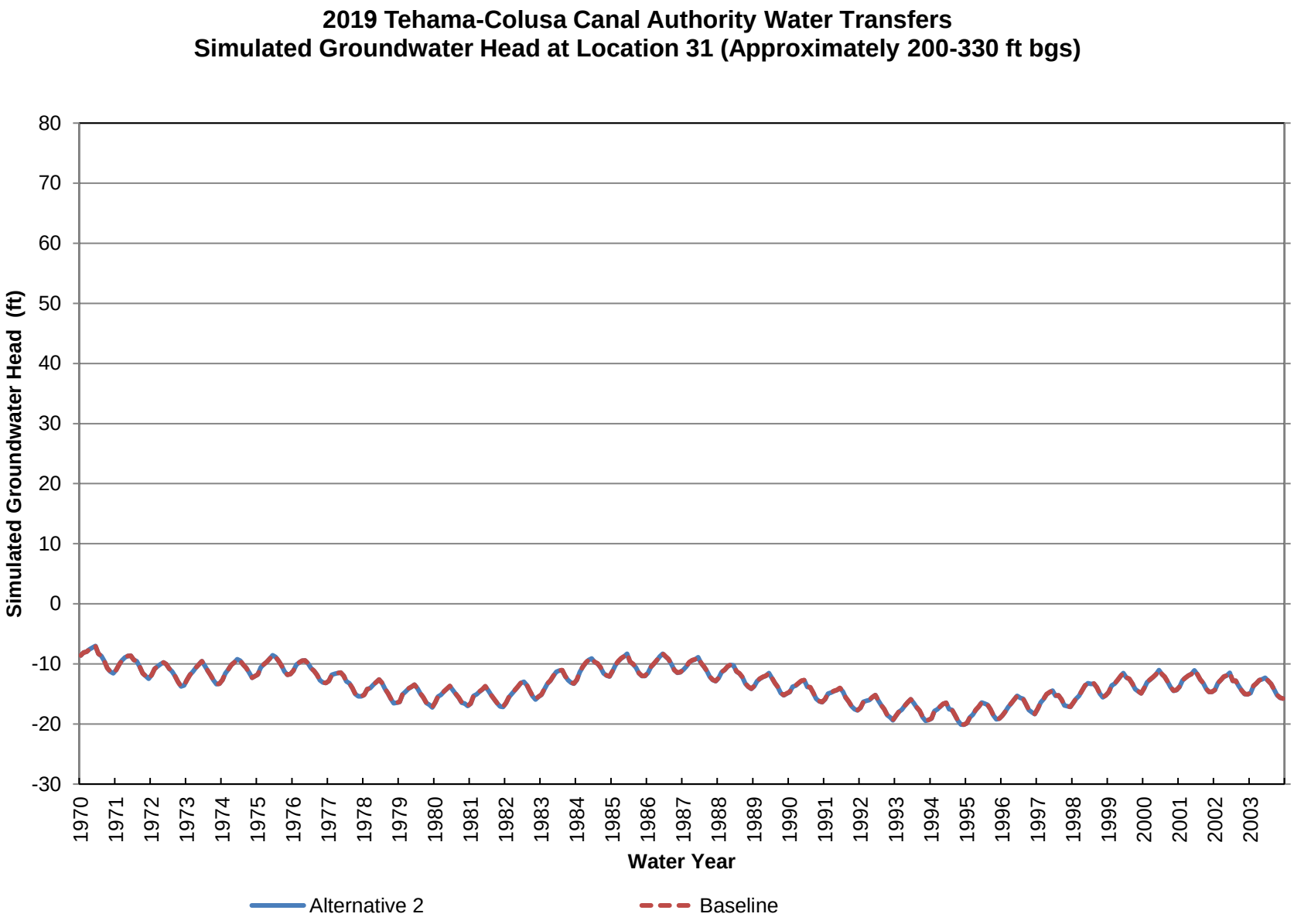
2002
2003
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 31 (Approximately 0-70 ft bgs)



2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 70-200 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 200-330 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
-30
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
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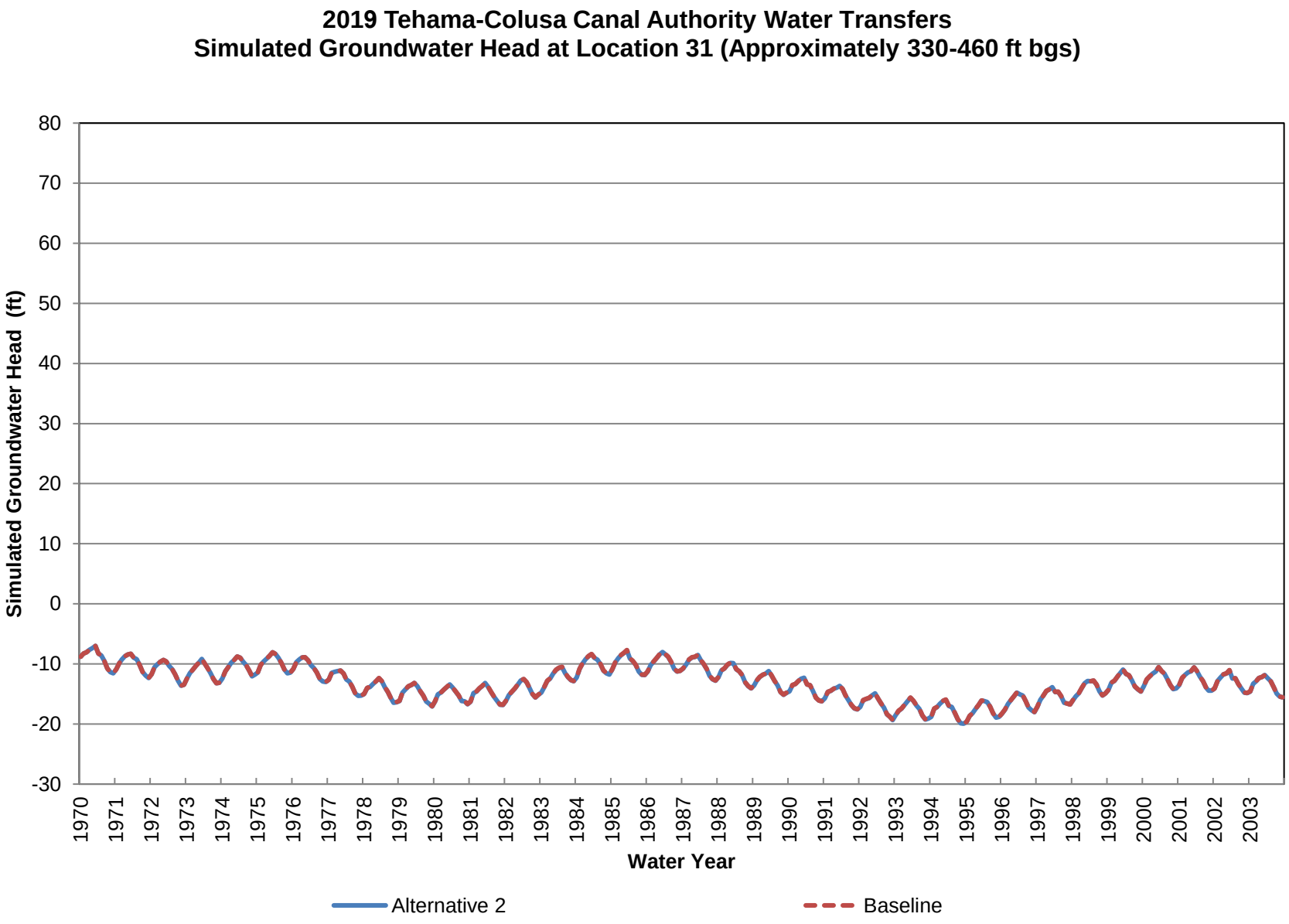
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 330-460 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
-30
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
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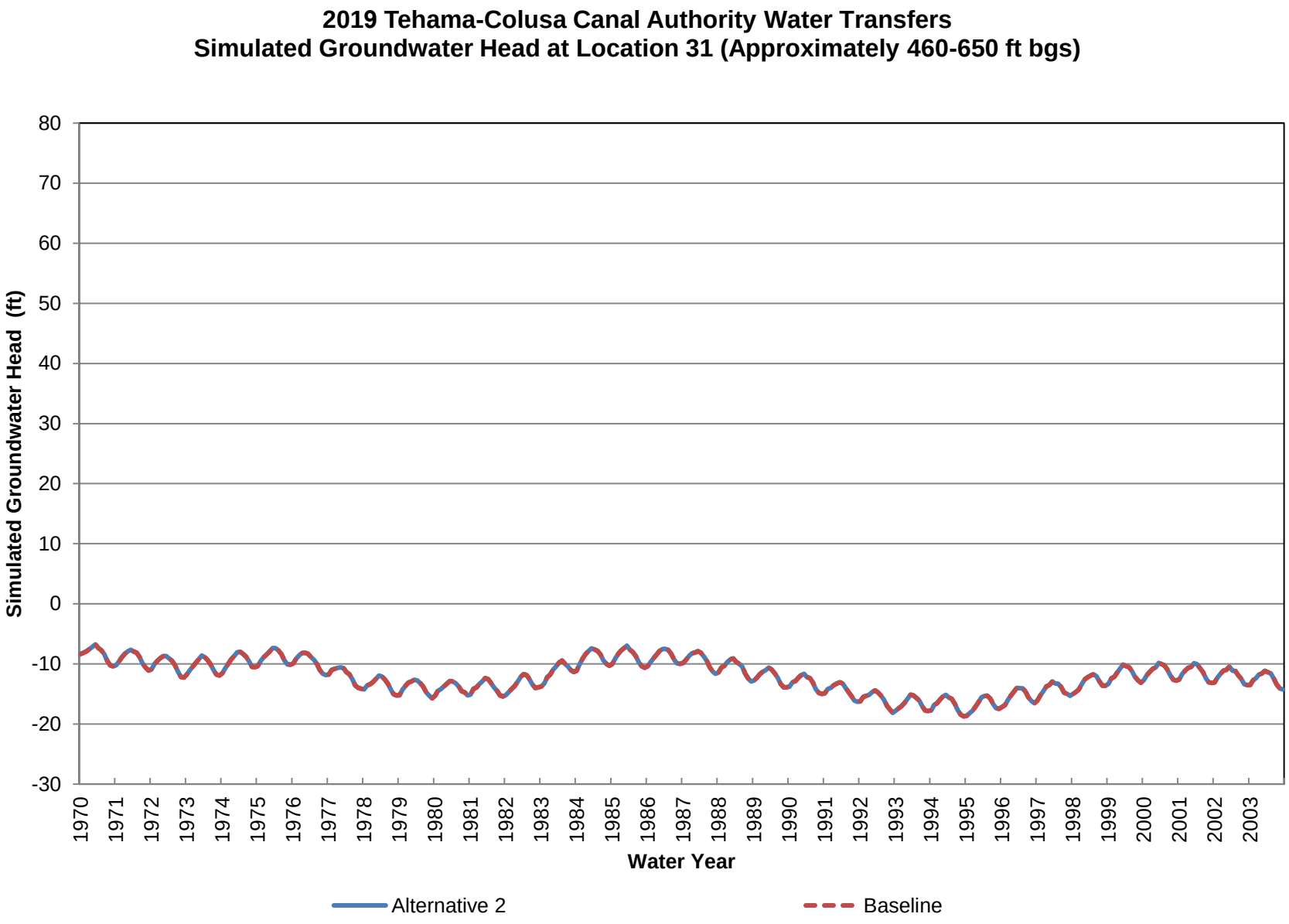
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 460-650 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
-30
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
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1983
1984
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1989
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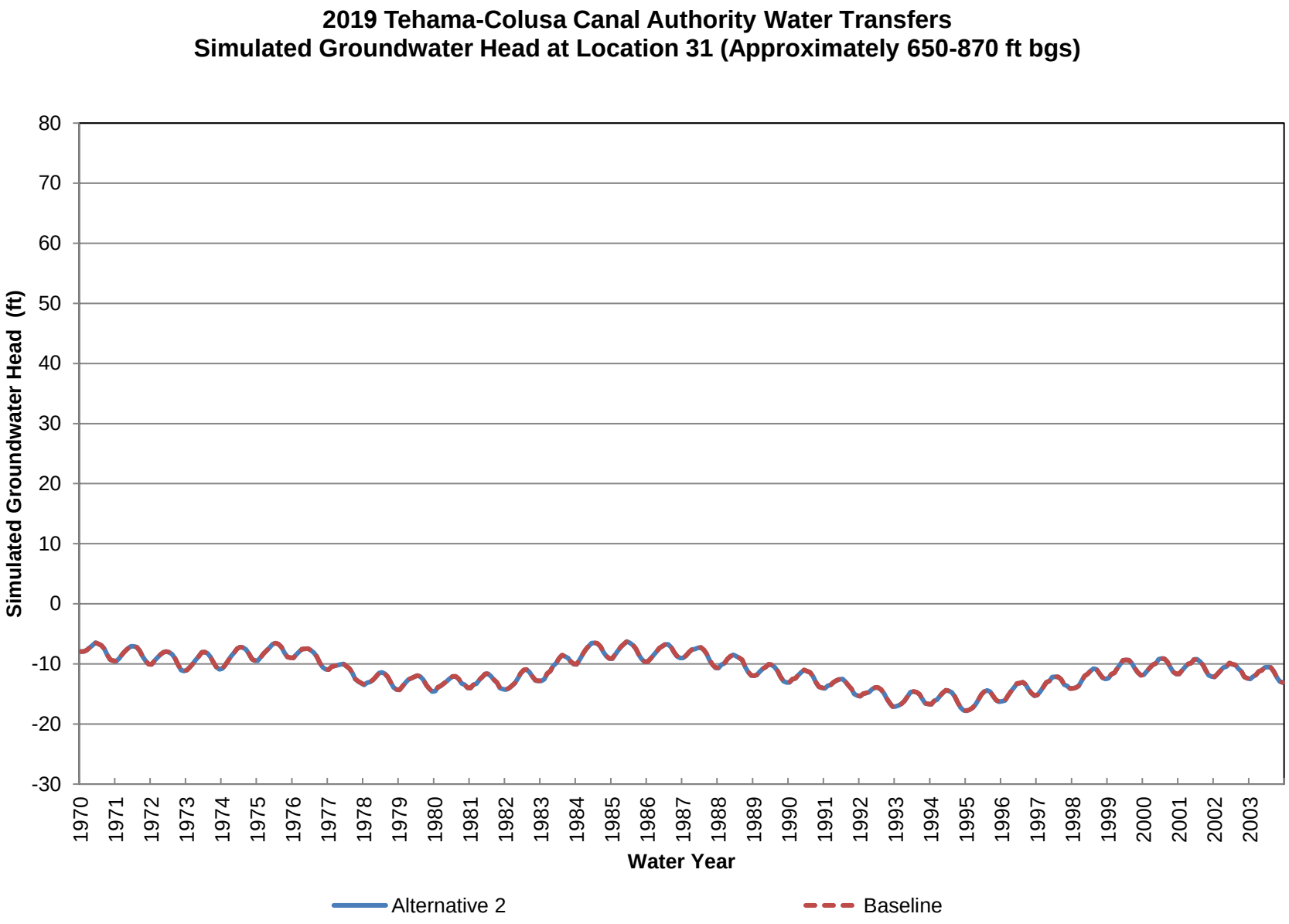
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 650-870 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
-30
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
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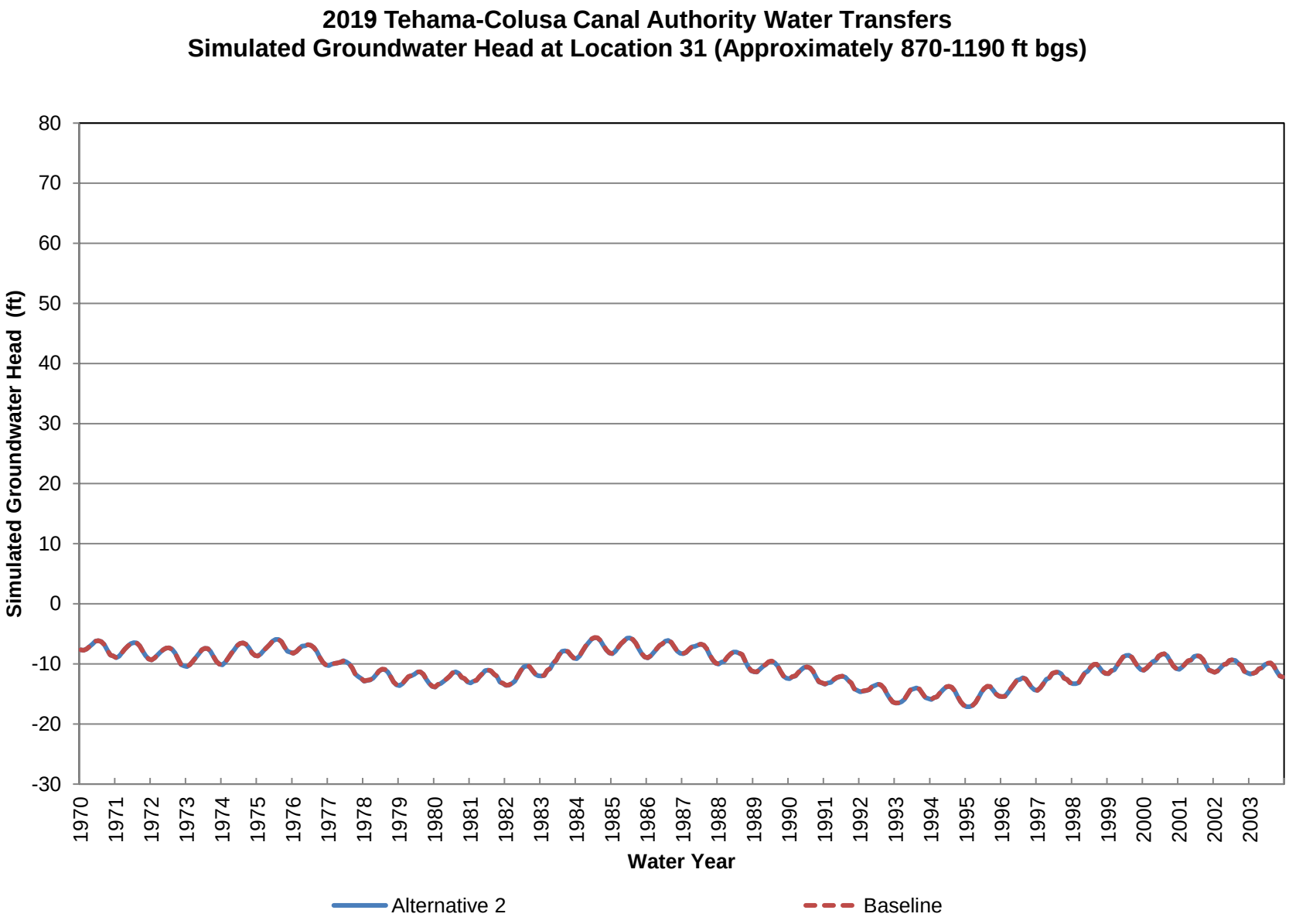
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 870-1190 ft bgs)
Simulated Groundwater Head (ft)
80
70
60
50
40
30
20
10
0
-10
-20
-30
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
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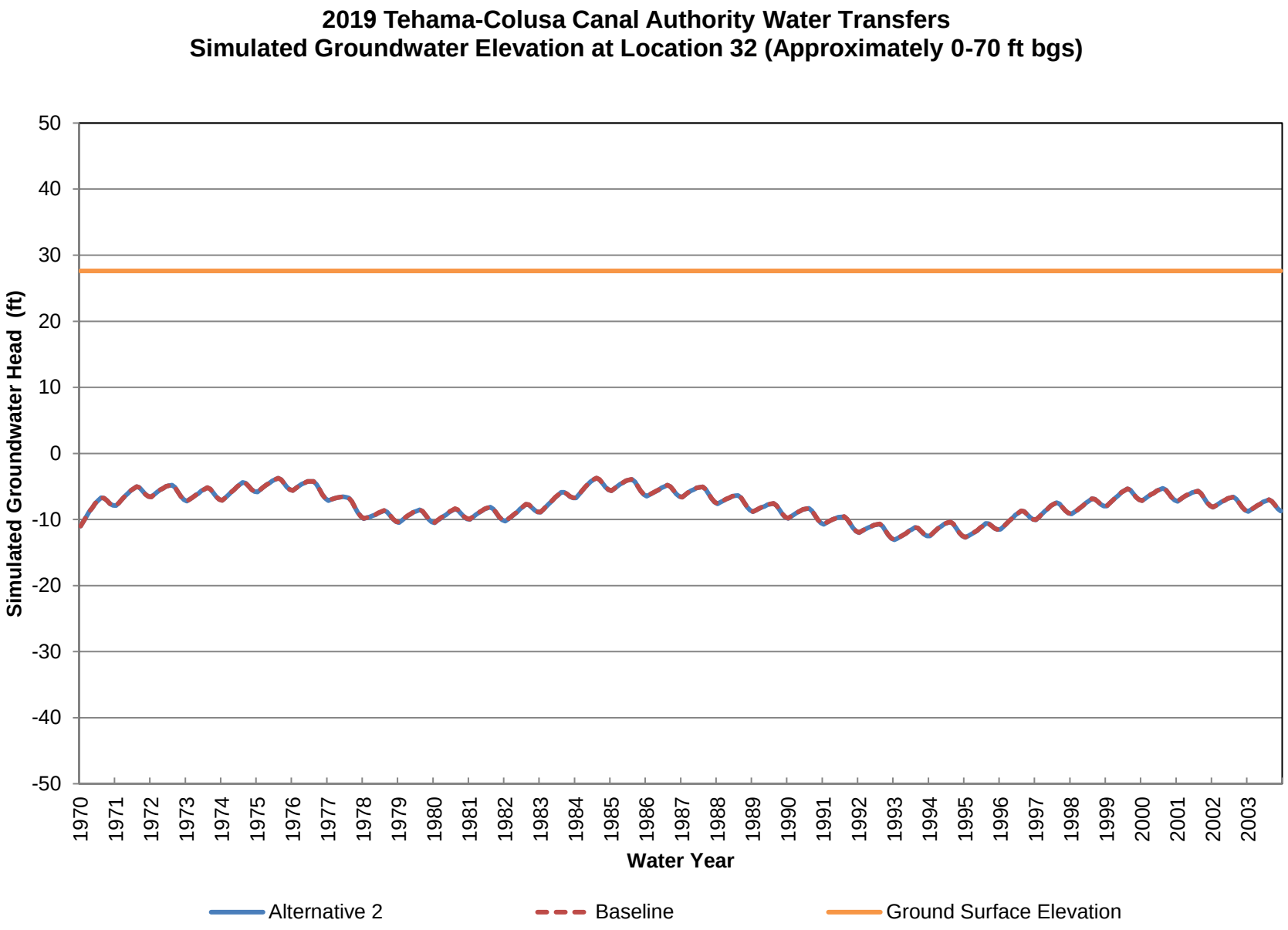
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 32 (Approximately 0-70 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
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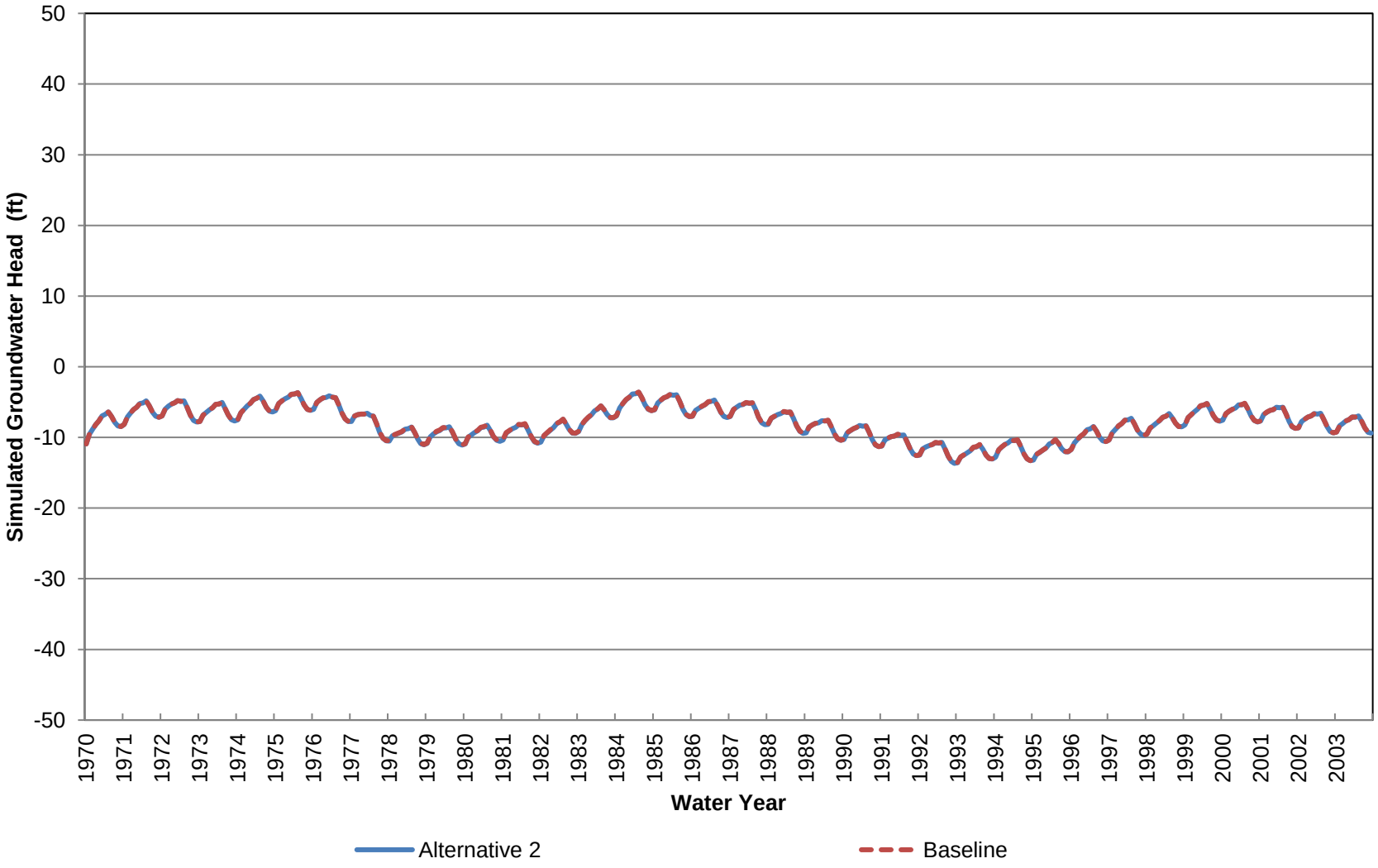
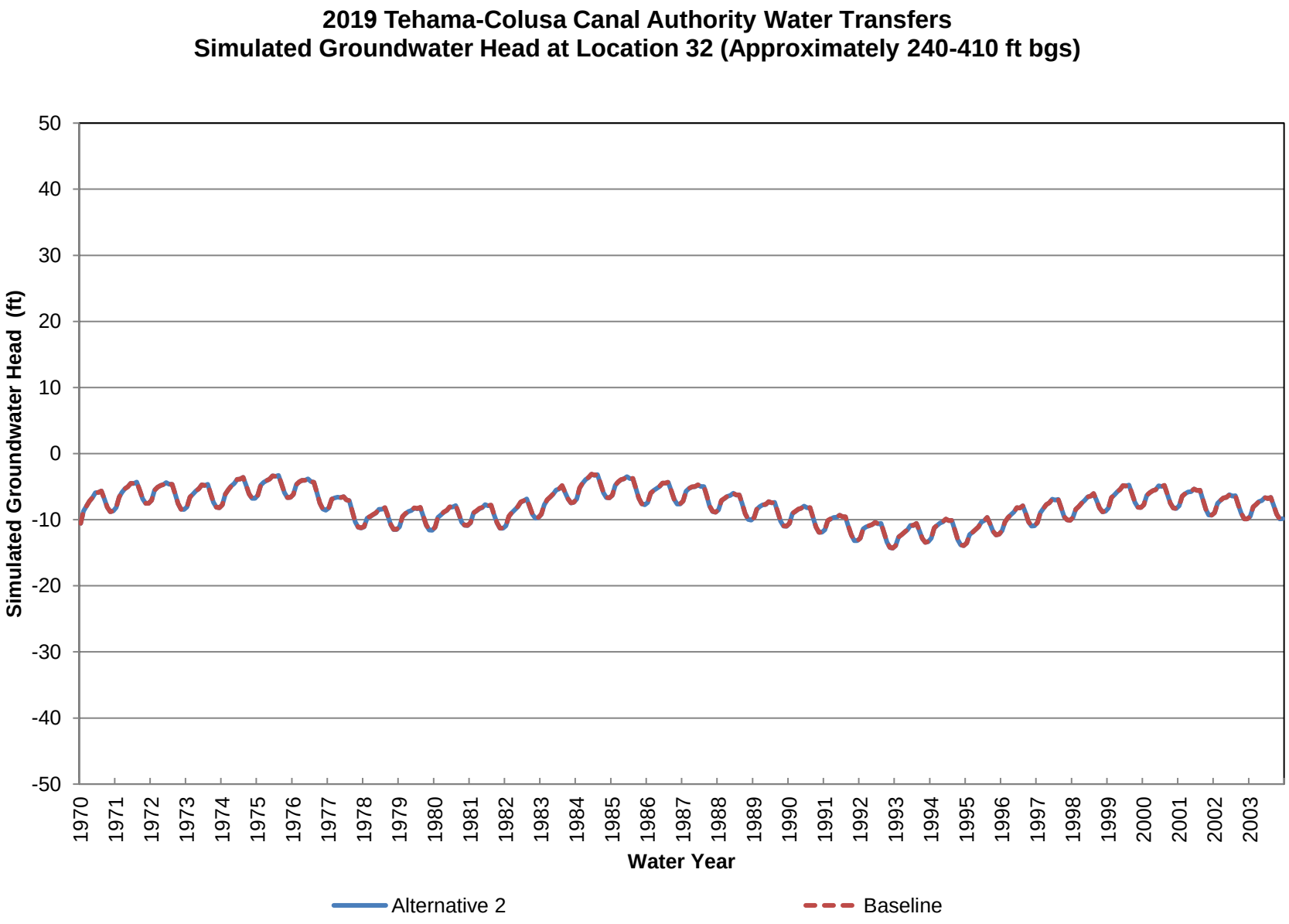
2000
2001
2002
2003
Water Year
Alternative 2
Baseline
Ground Surface Elevation

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 70-240 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 240-410 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
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1998
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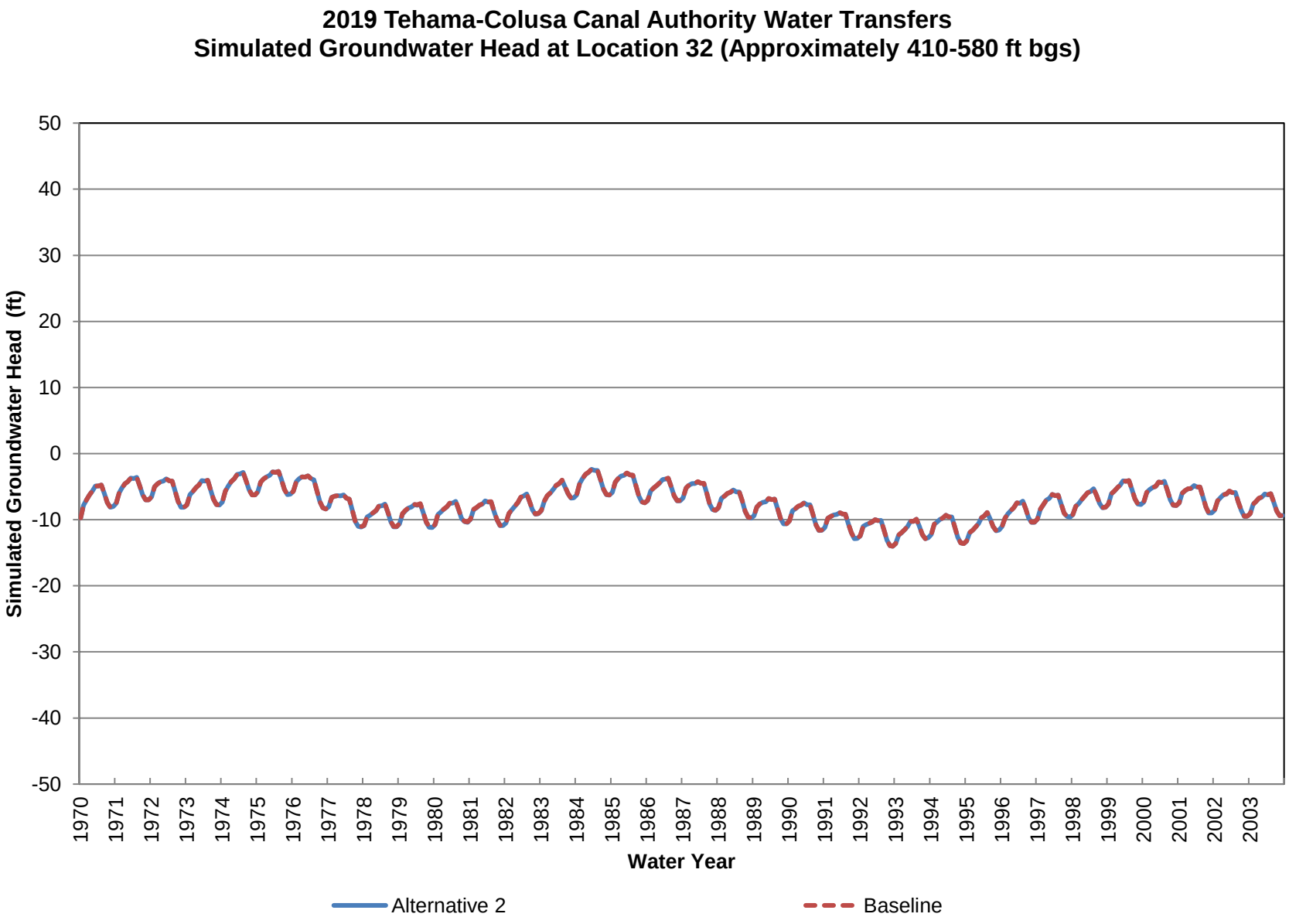
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 410-580 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
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1990
1991
1992
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1994
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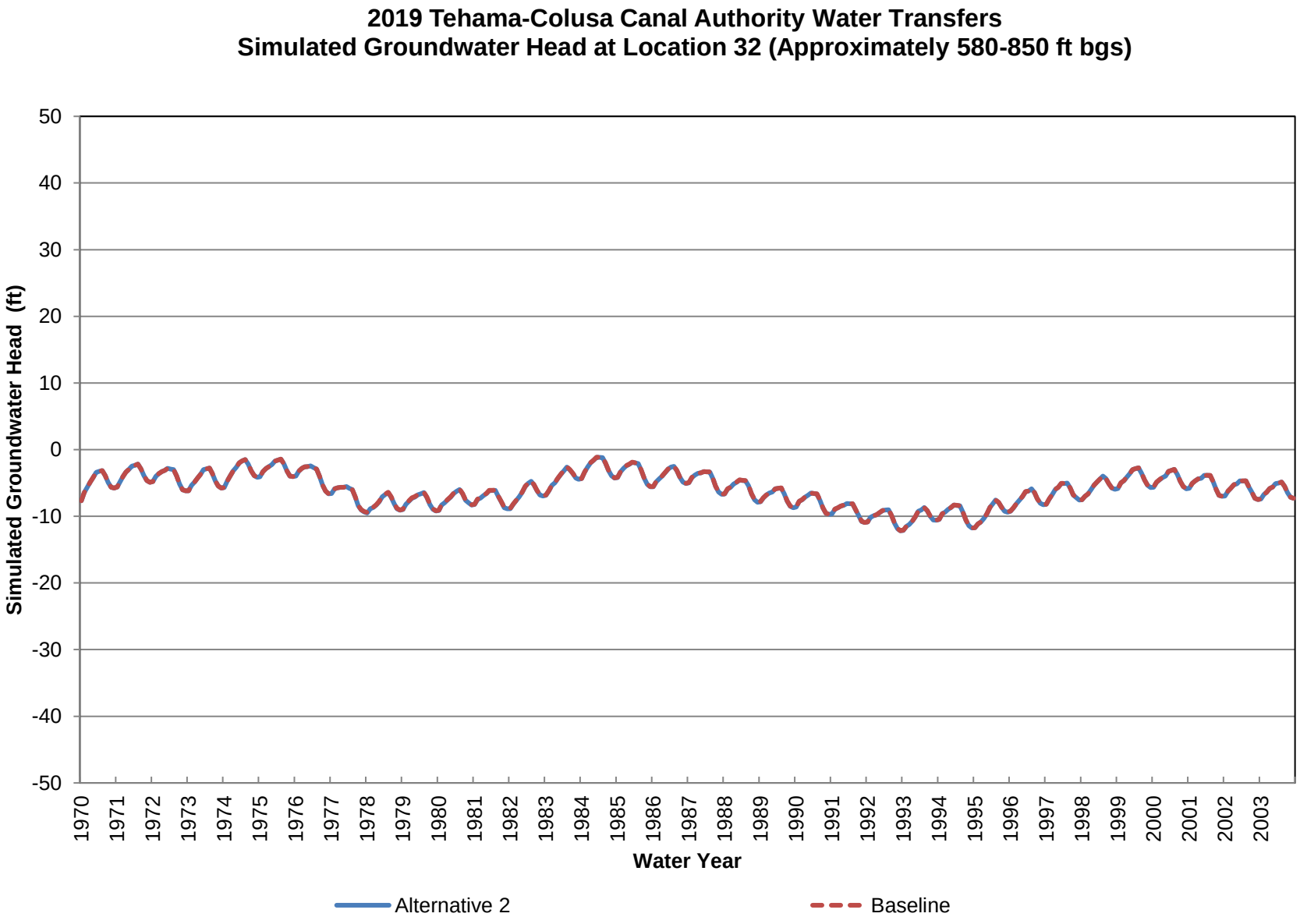
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 580-850 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
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1978
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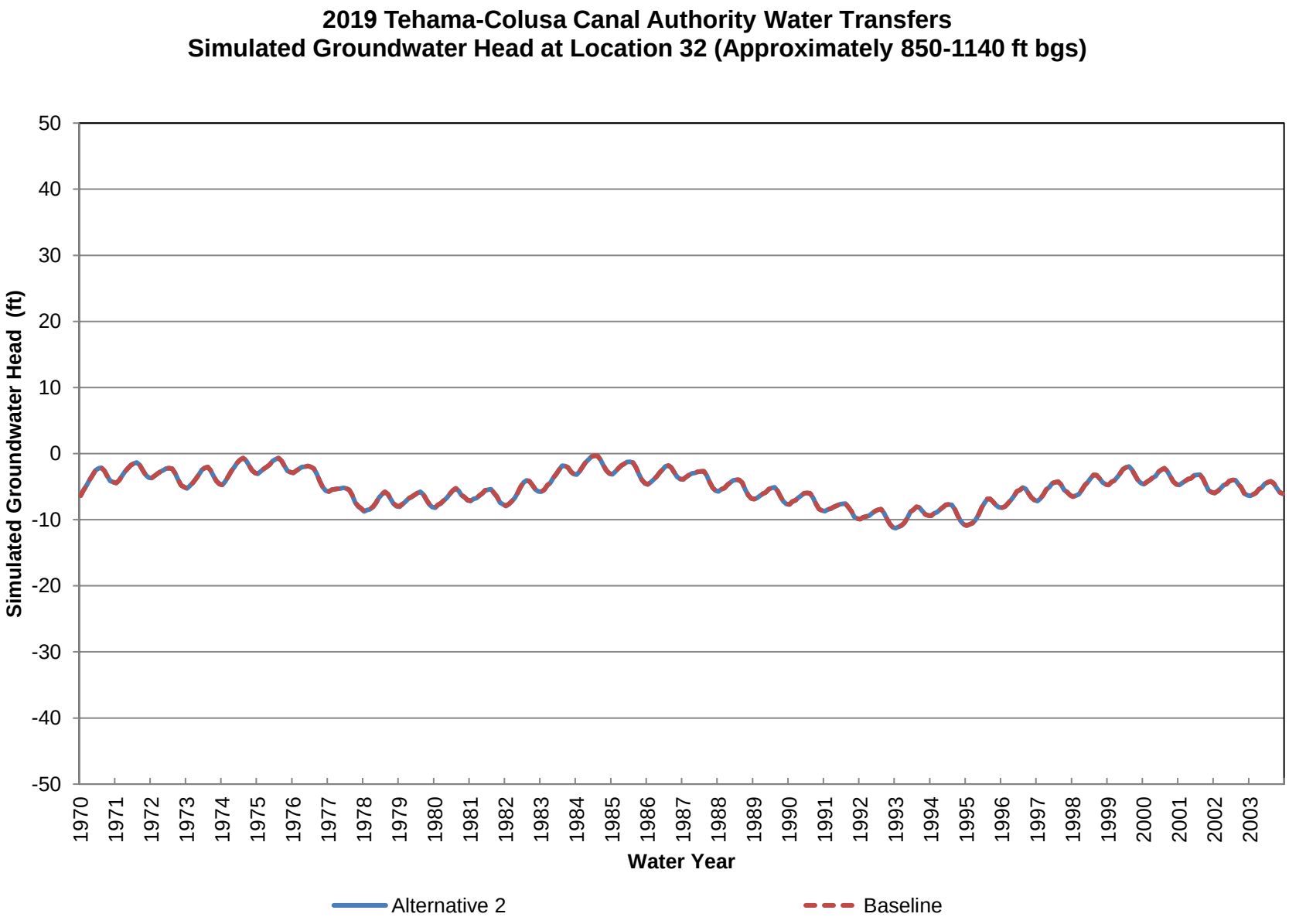
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 850-1140 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
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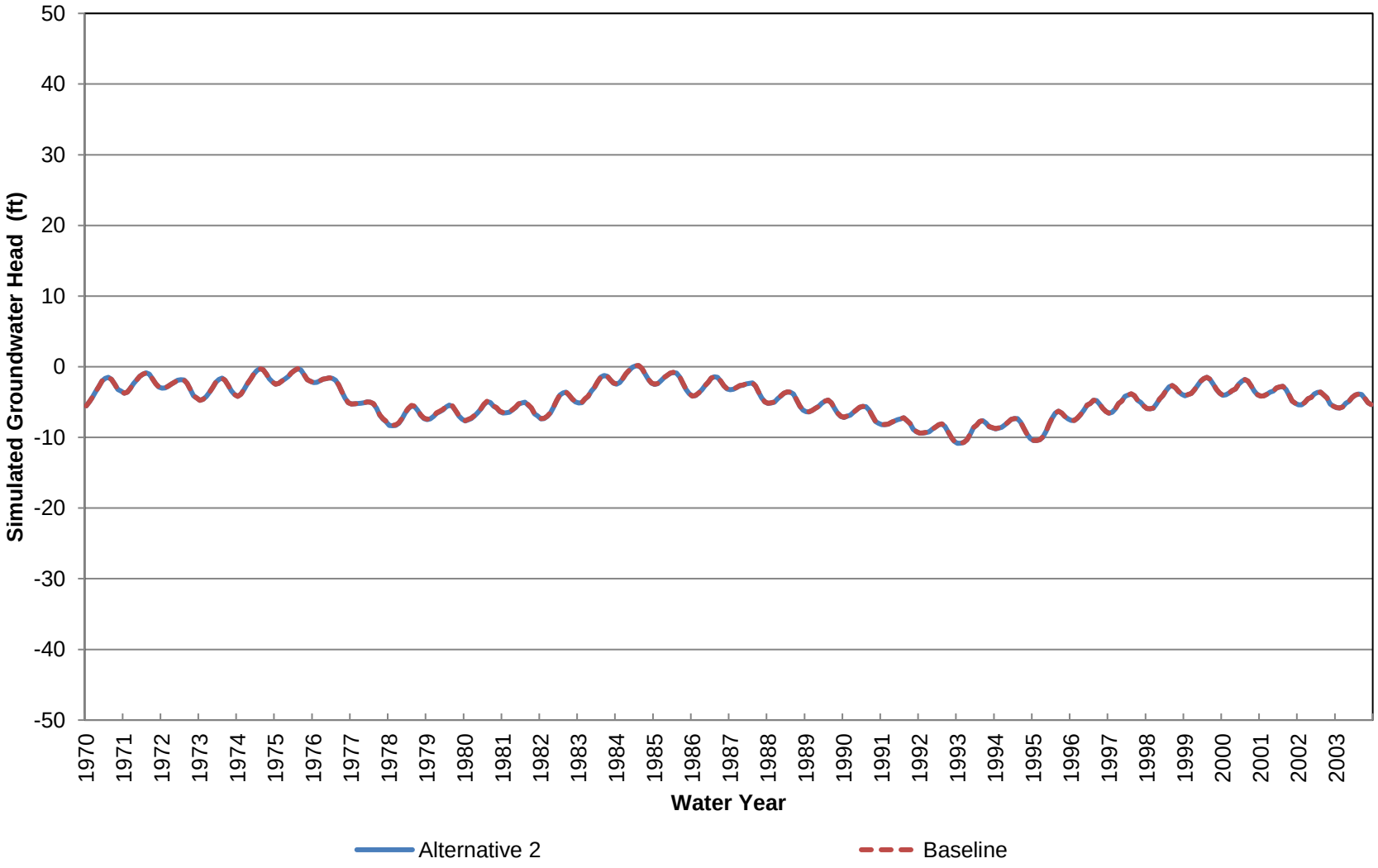
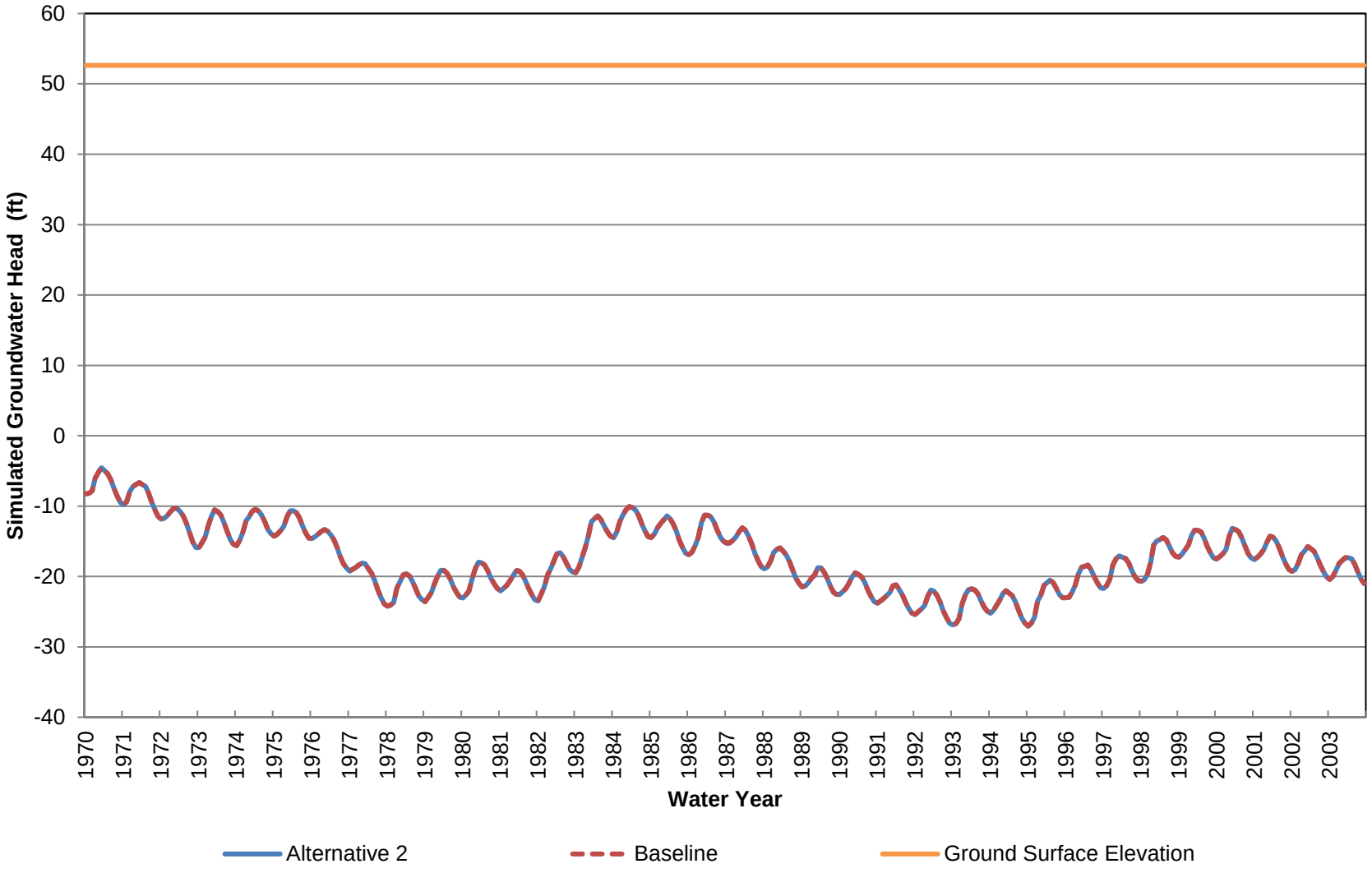
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

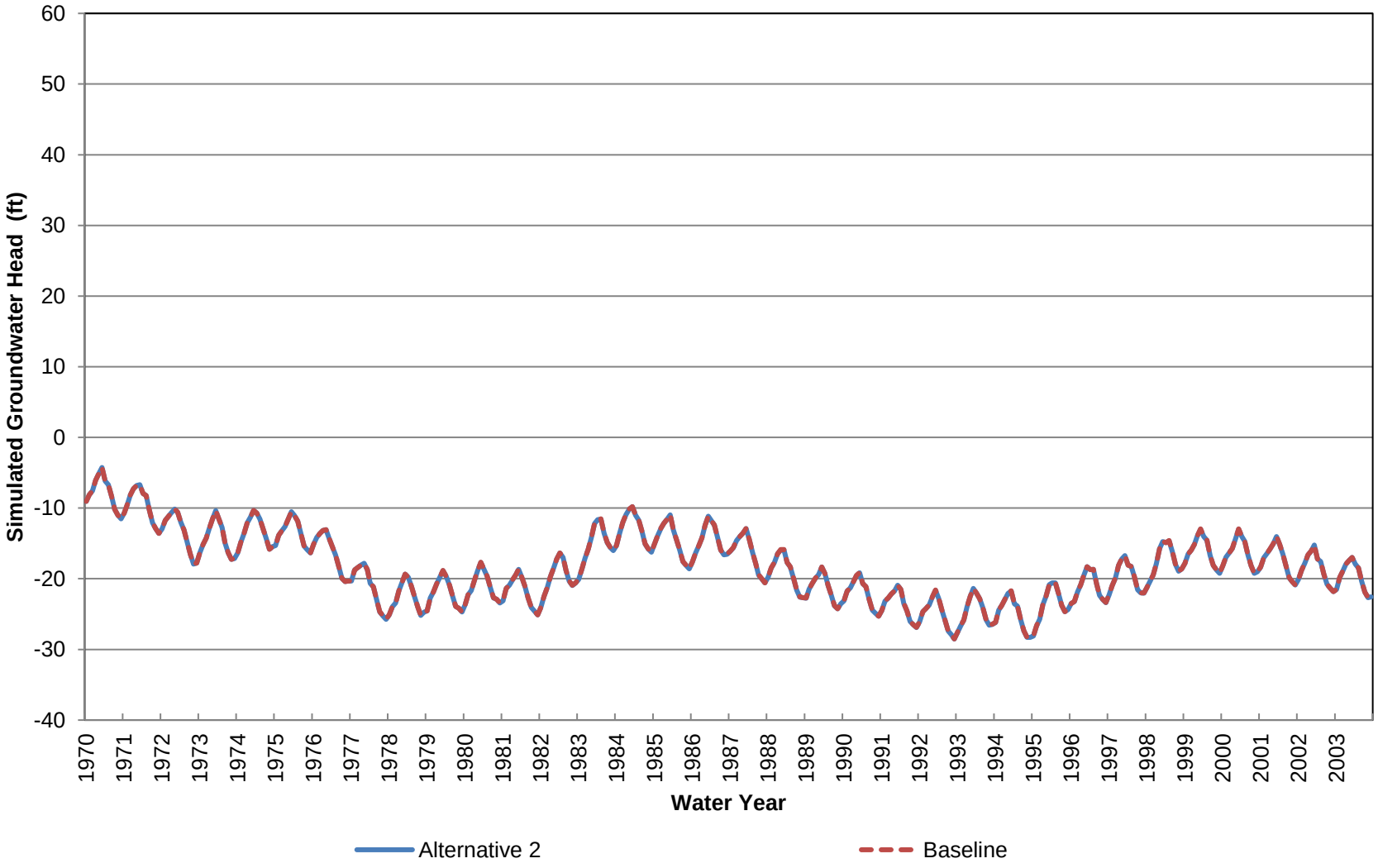
2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 1140-1560 ft bgs)

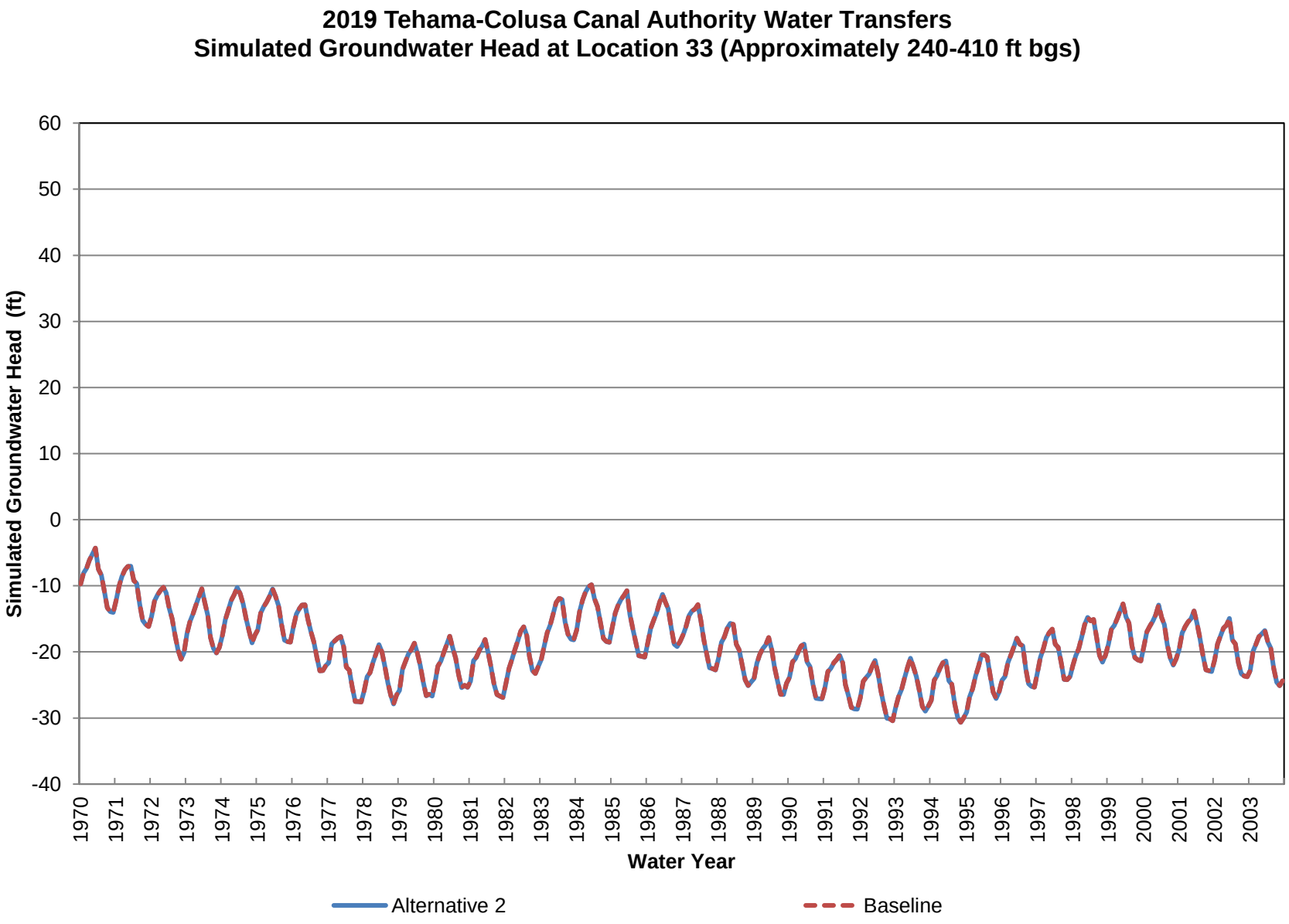


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 33 (Approximately 0-70 ft bgs)



2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 70-240 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 240-410 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
1975
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1992
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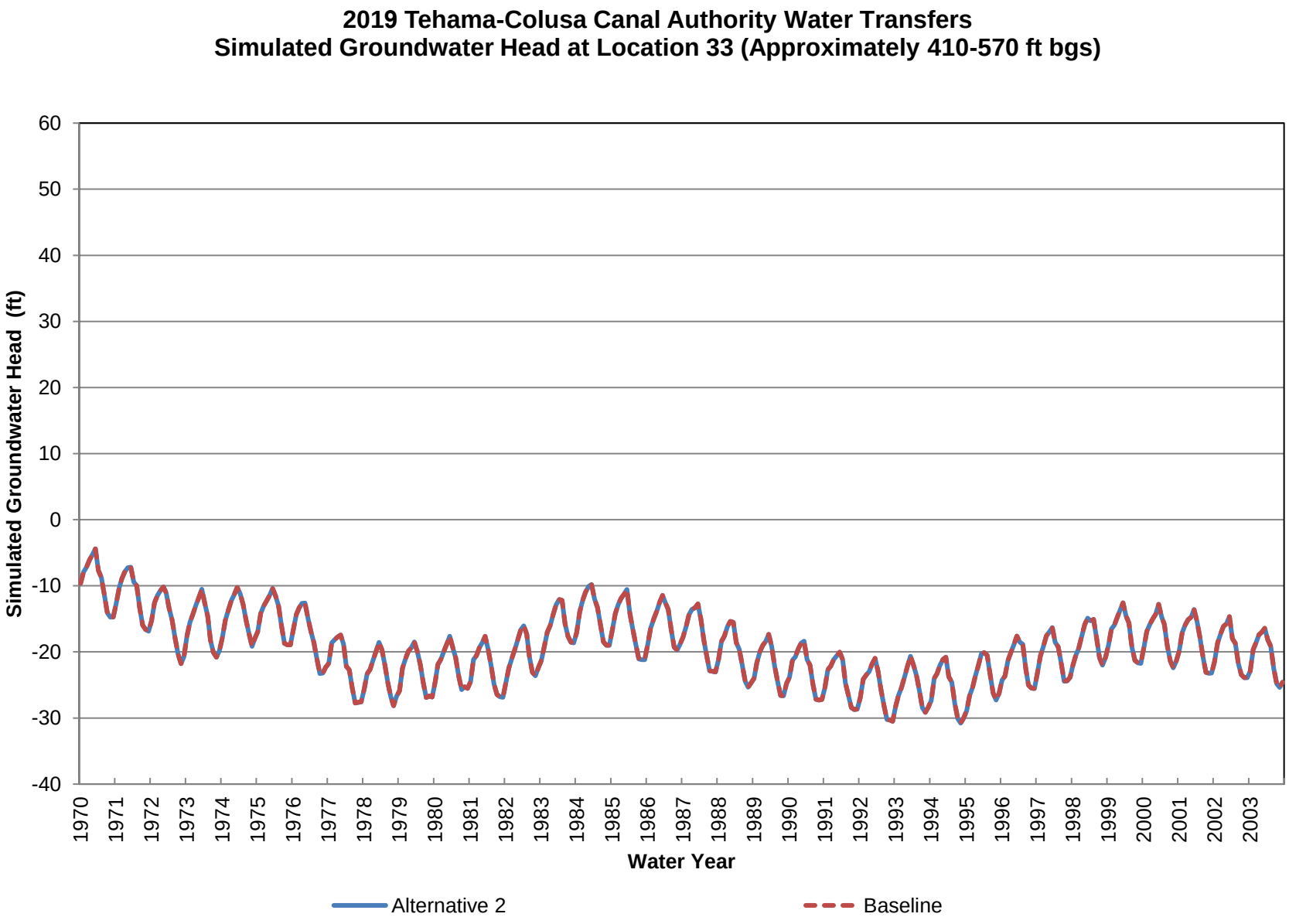
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 410-570 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
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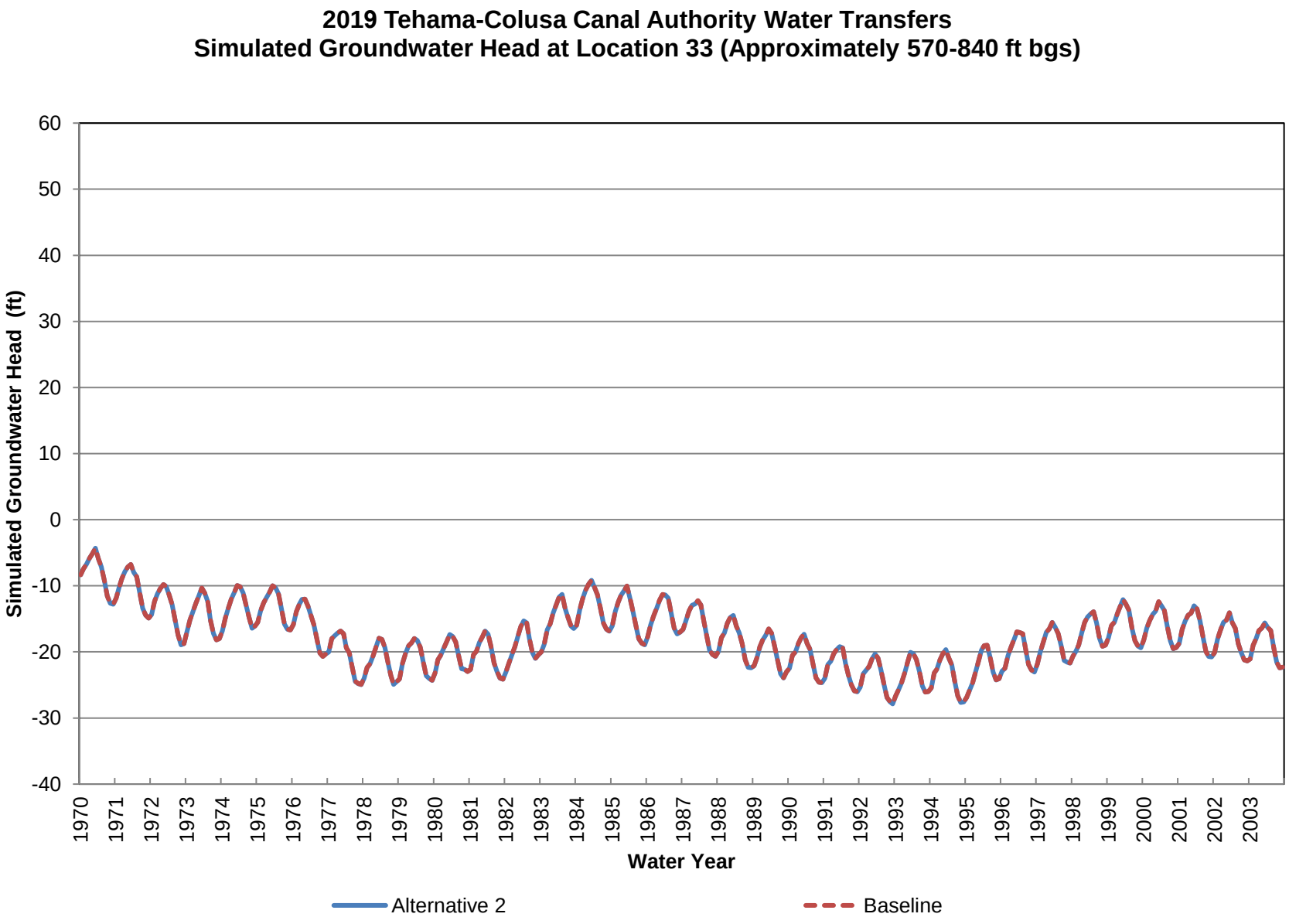
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 570-840 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
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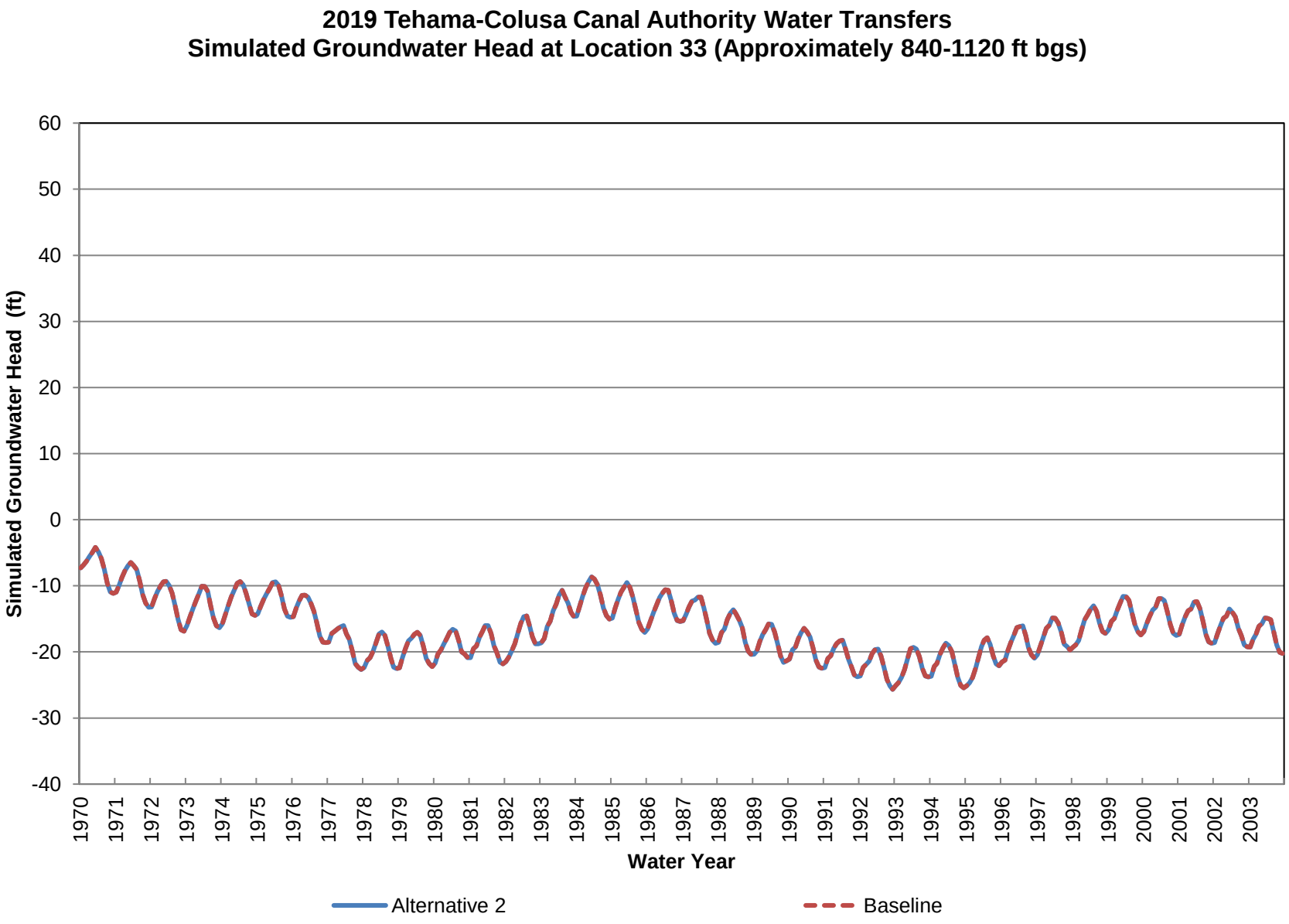
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 840-1120 ft bgs)
Simulated Groundwater Head (ft)
60
50
40
30
20
10
0
-10
-20
-30
-40
1970
1971
1972
1973
1974
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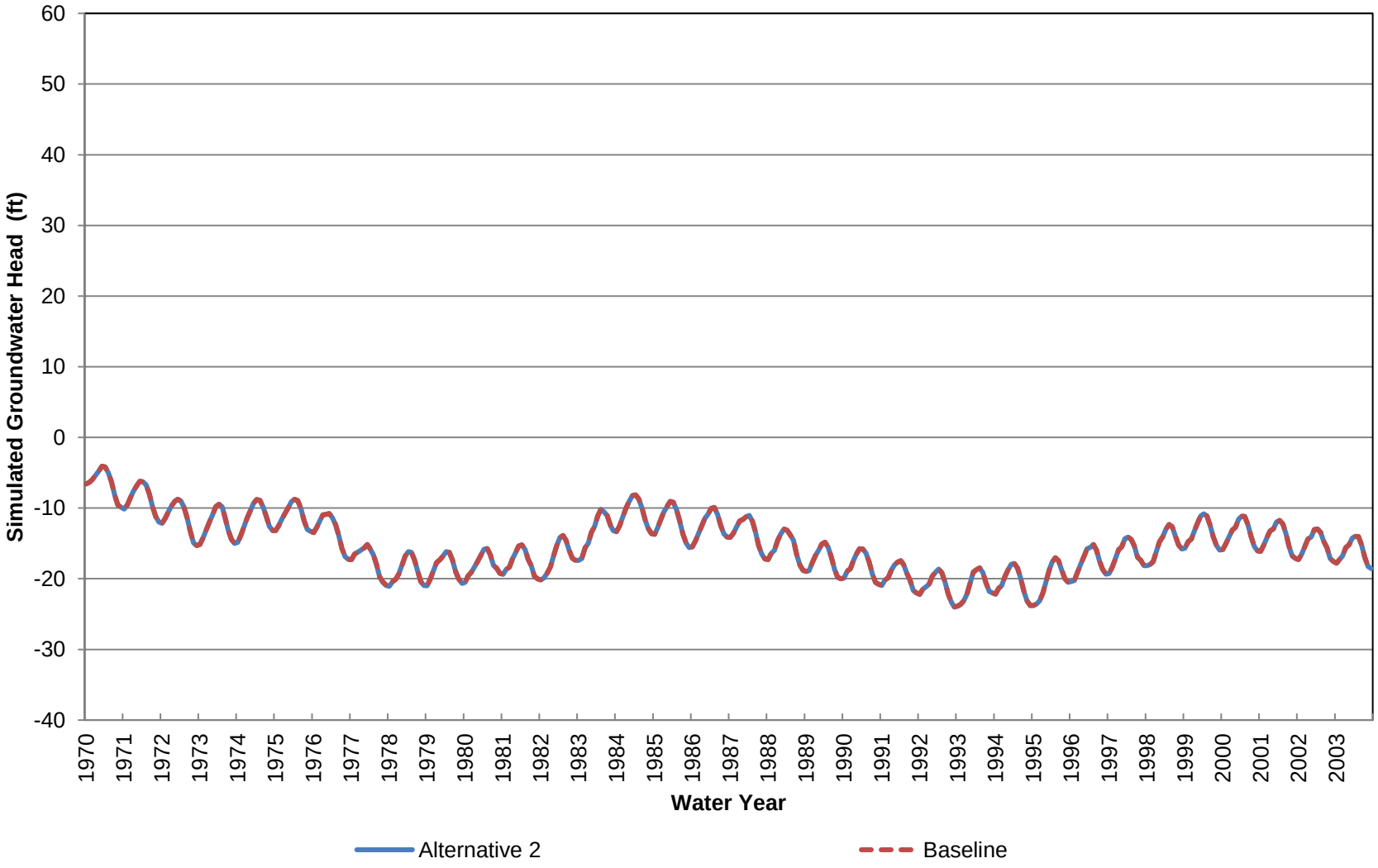
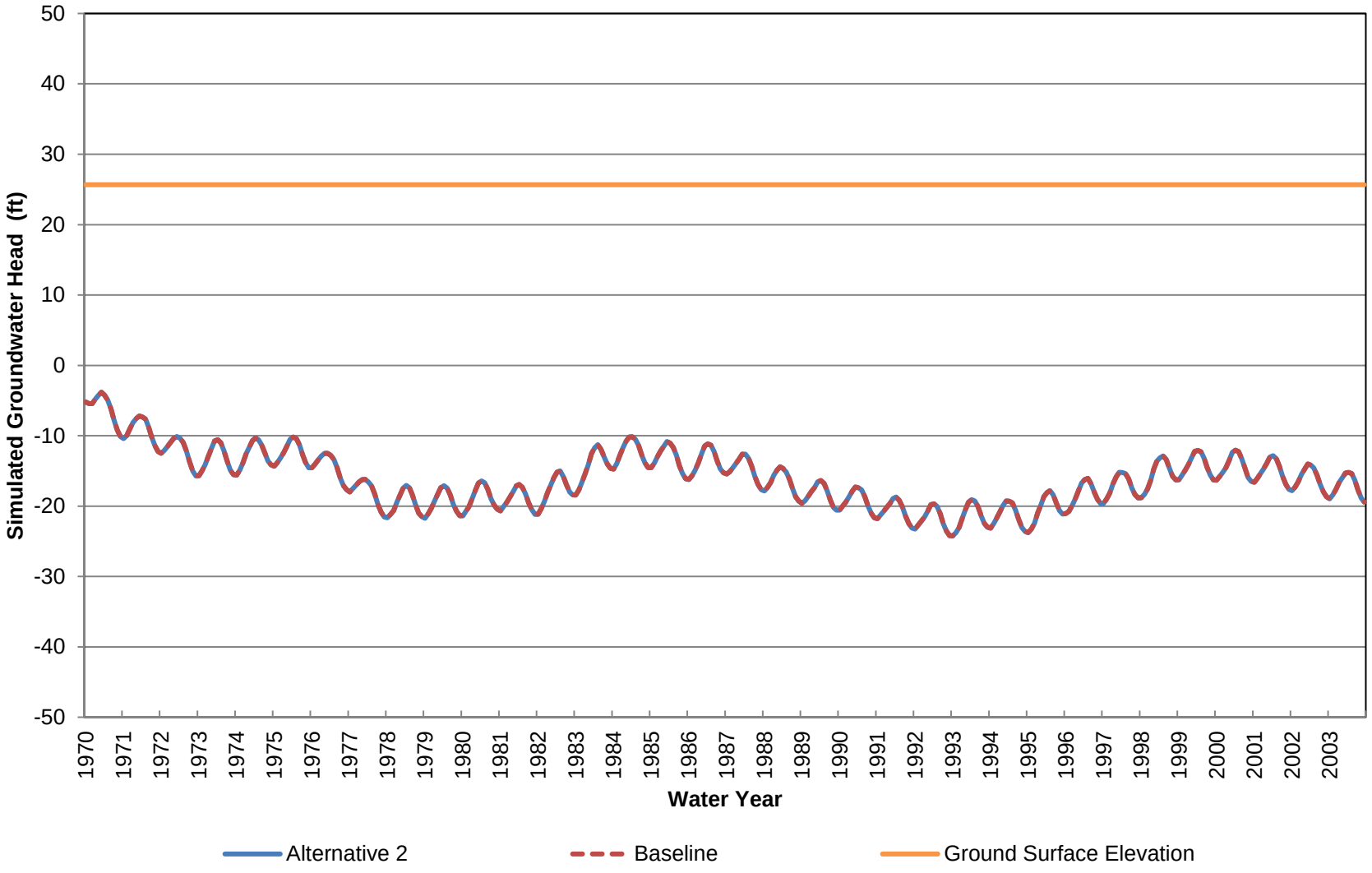
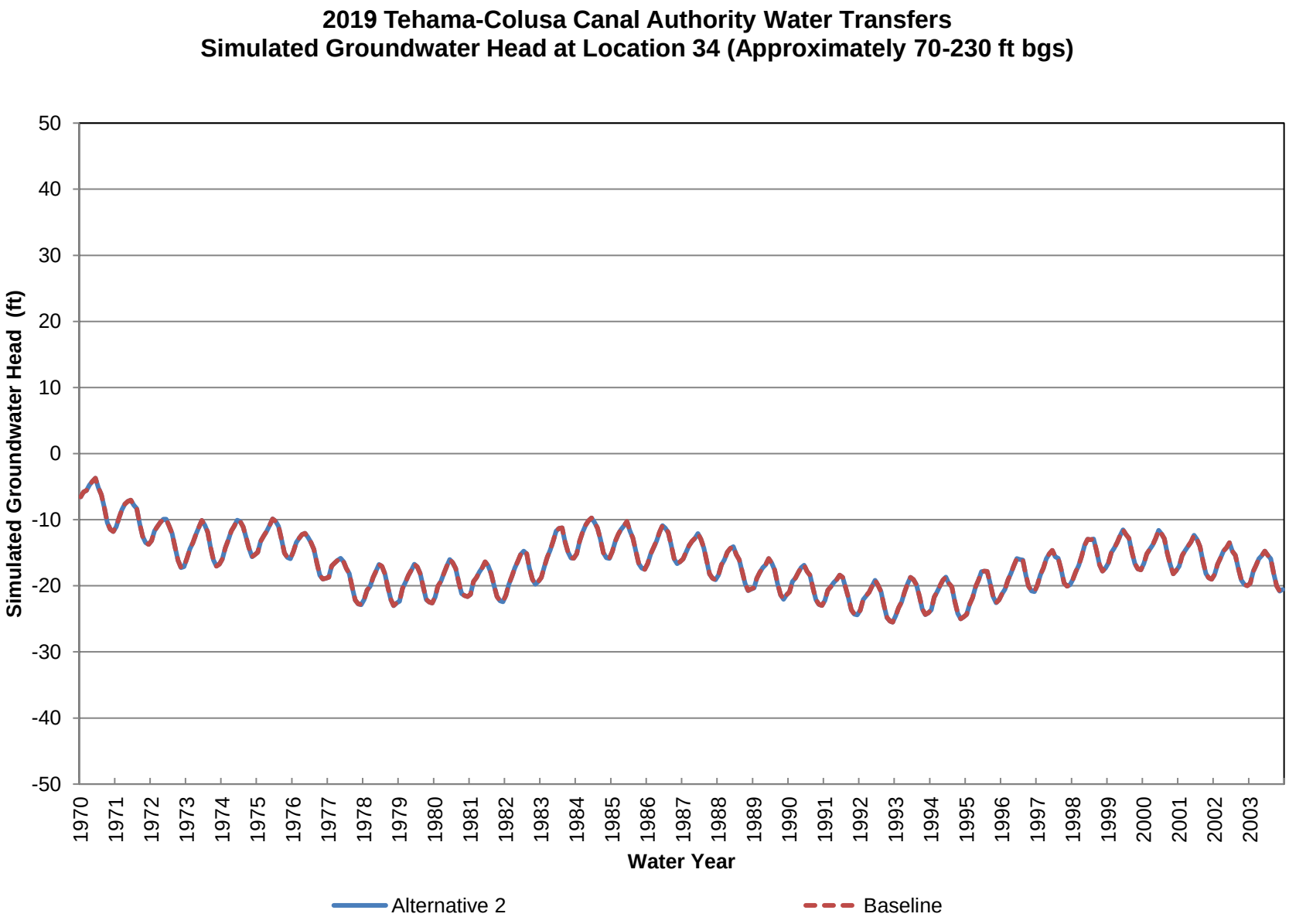
2001
2002
2003
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 1120-1540 ft bgs)



2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 34 (Approximately 0-70 ft bgs)




2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 70-230 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
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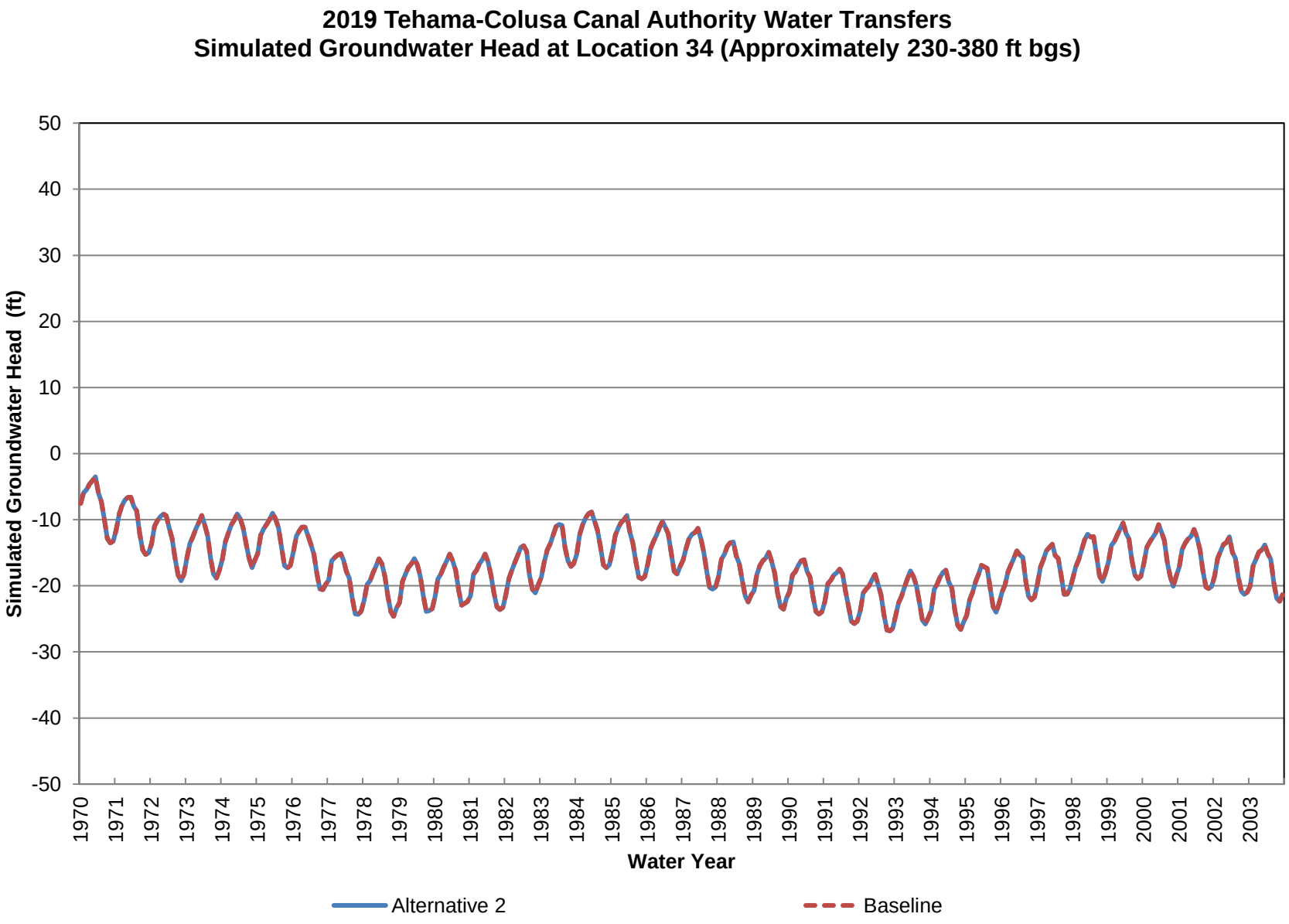
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 230-380 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
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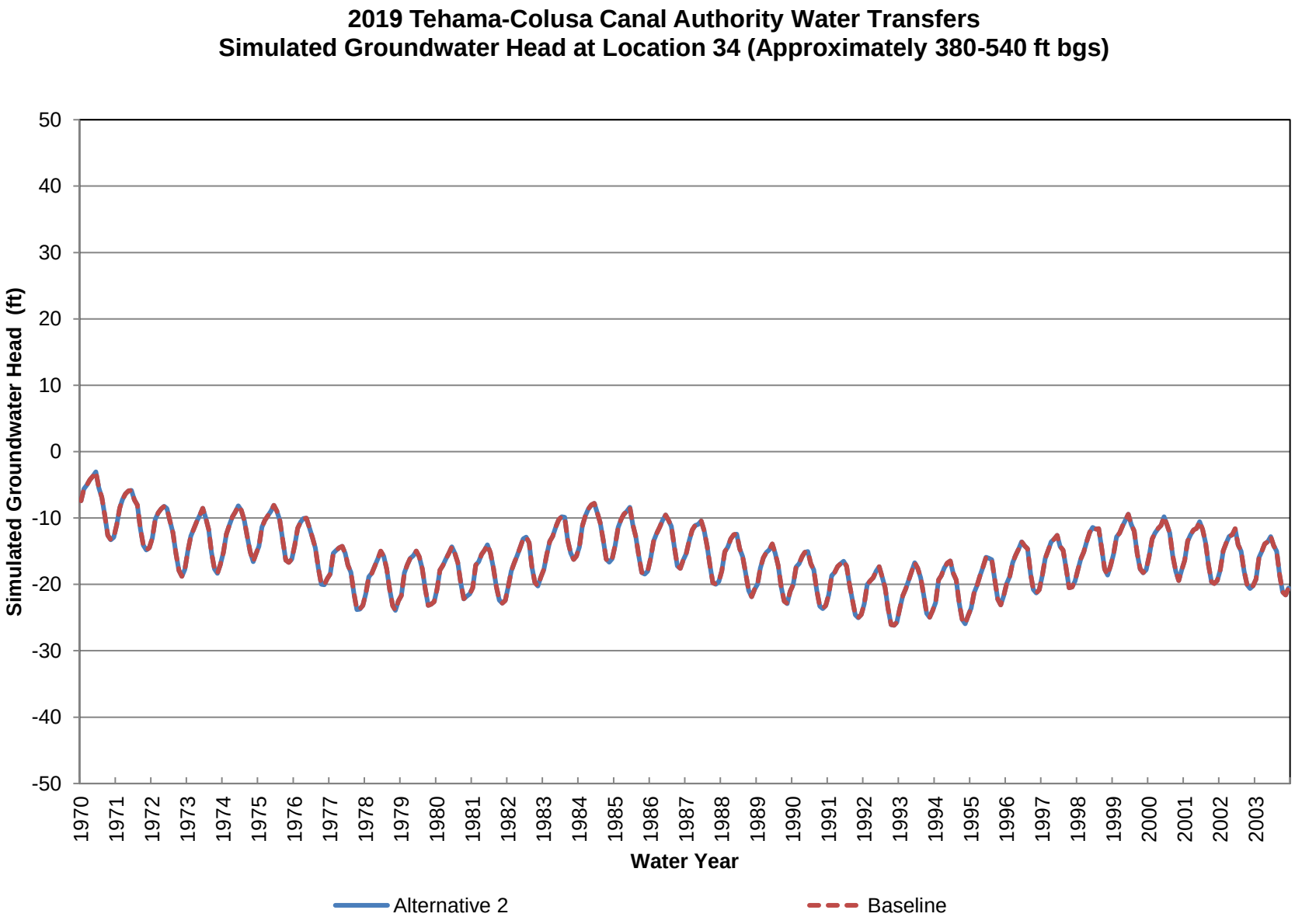
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 380-540 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
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1977
1978
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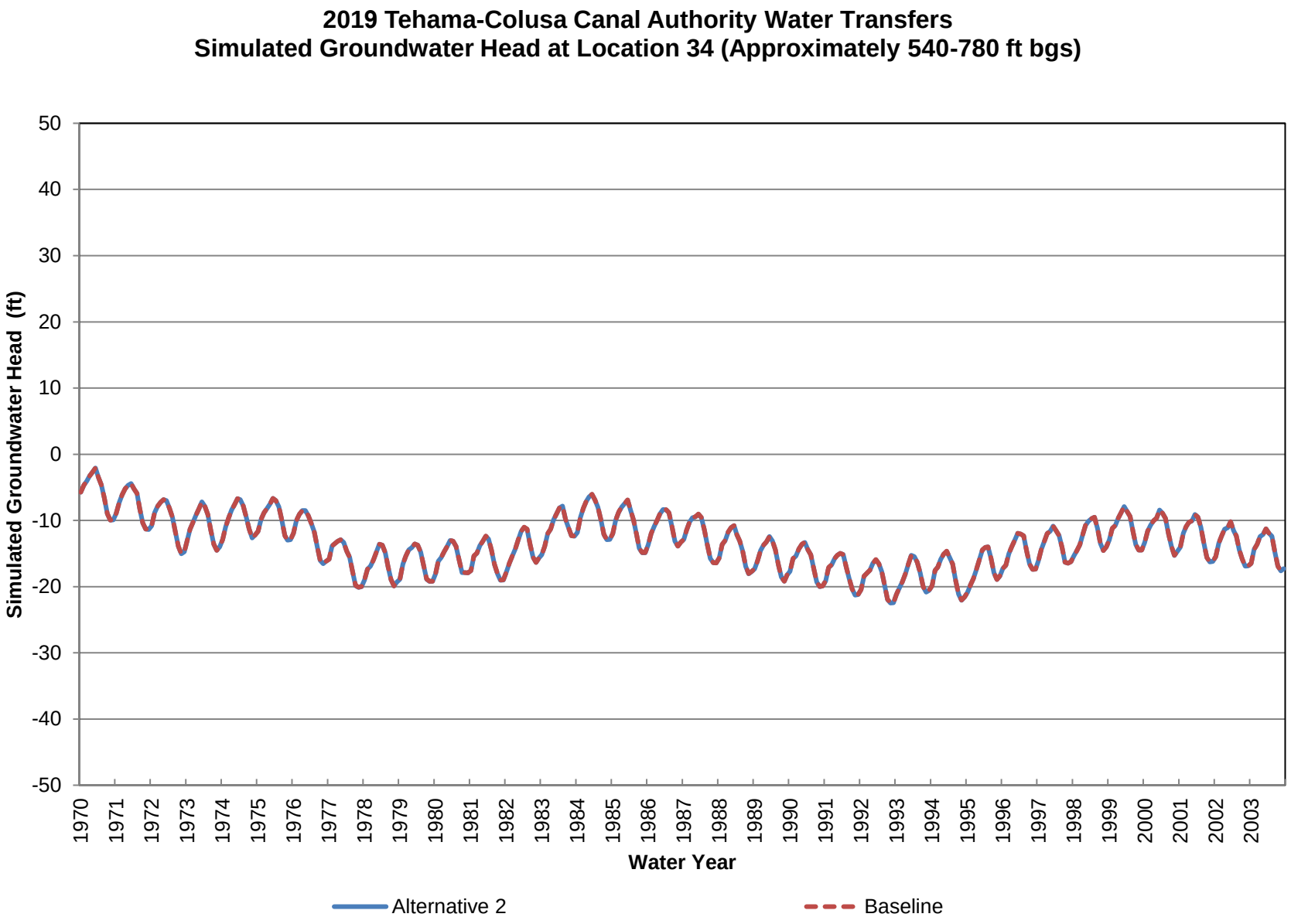
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 540-780 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
1976
1977
1978
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1980
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1991
1992
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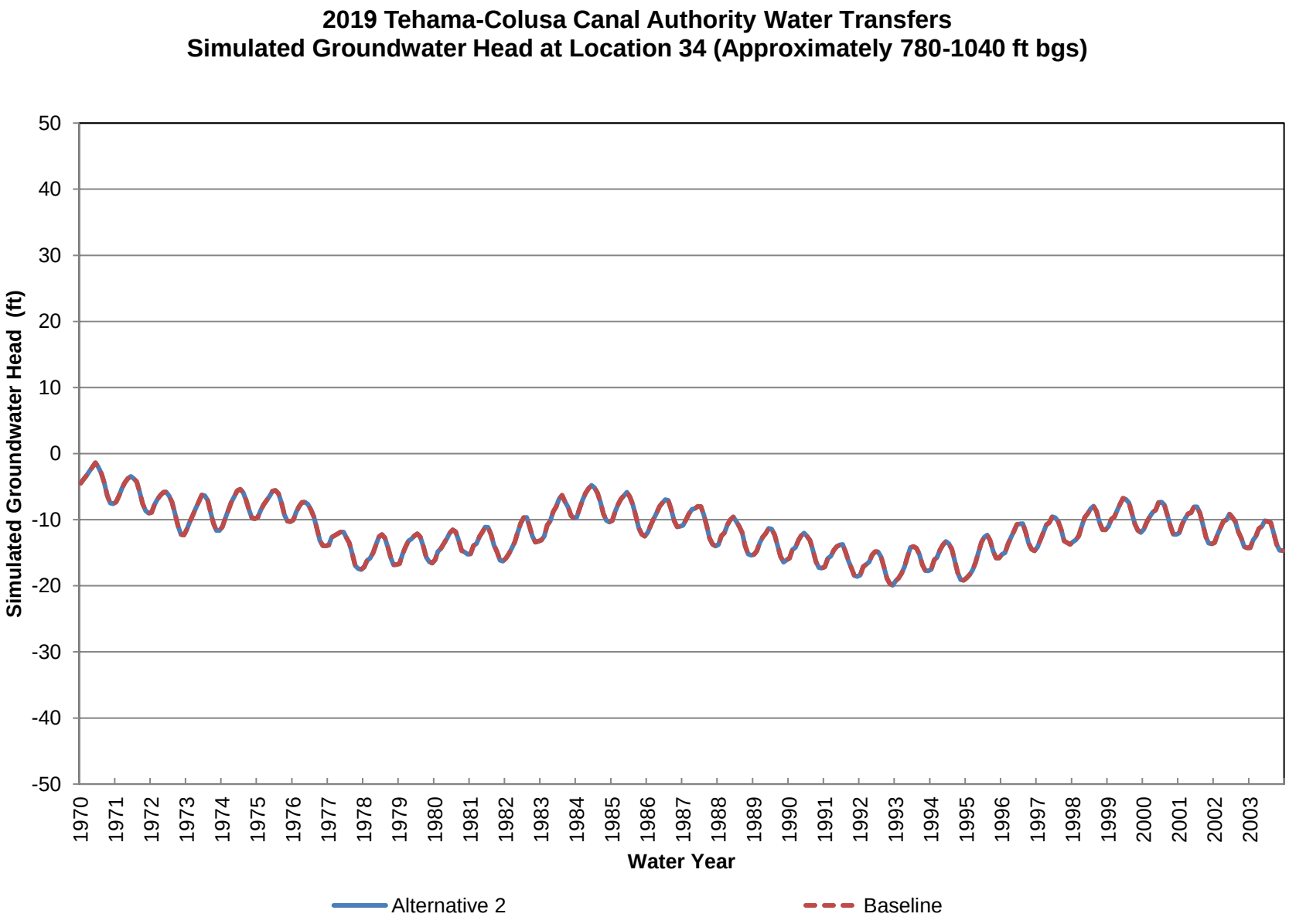
1996
1997
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline


2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 780-1040 ft bgs)
Simulated Groundwater Head (ft)
50
40
30
20
10
0
-10
-20
-30
-40
-50
1970
1971
1972
1973
1974
1975
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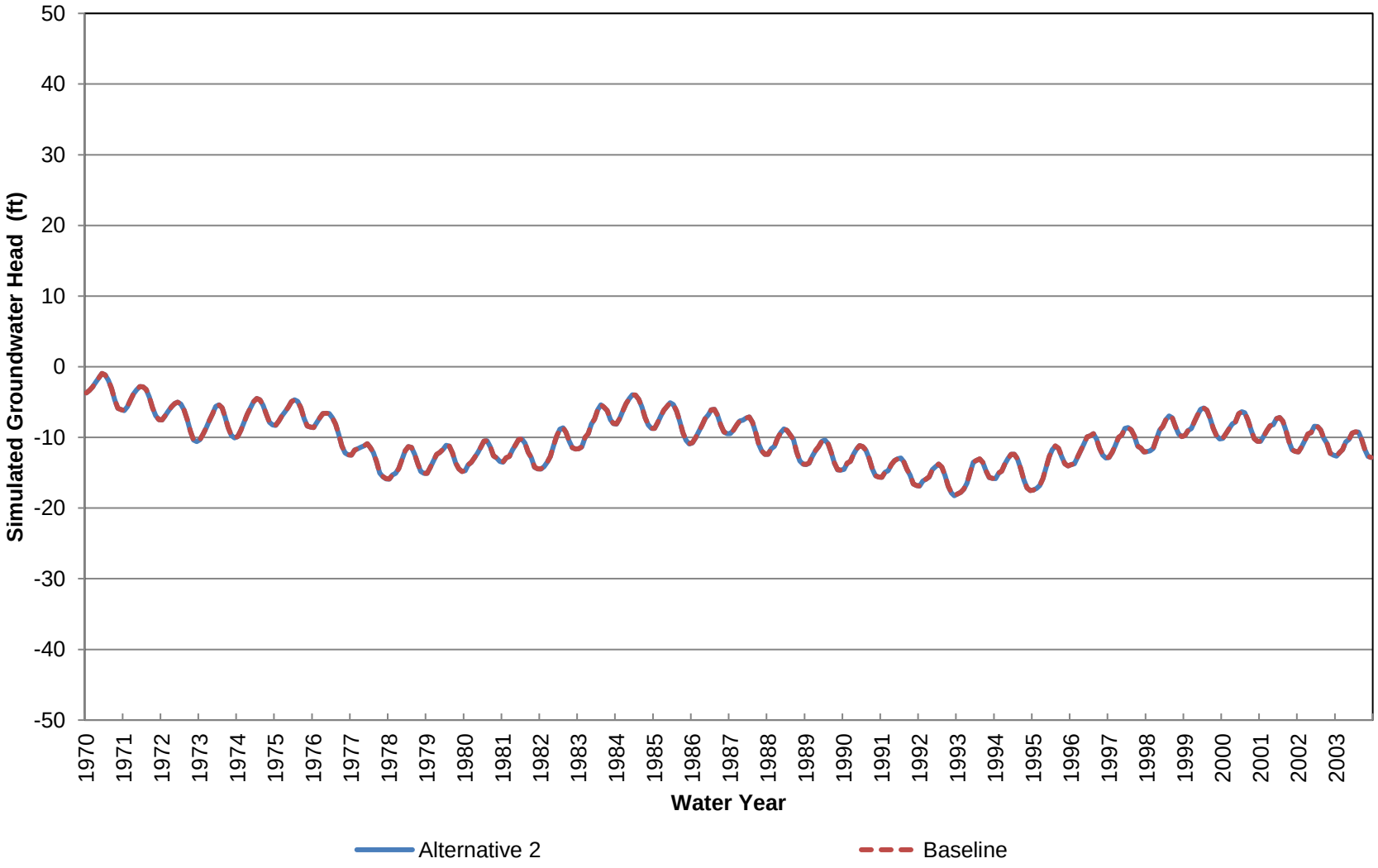
1998
1999
2000
2001
2002
2003
Water Year
Alternative 2
Baseline

2019 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 1040-1430 ft bgs)



Appendix I

2015 Water Transfers Data Reports

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Anderson-Cottonwood Irrigation District

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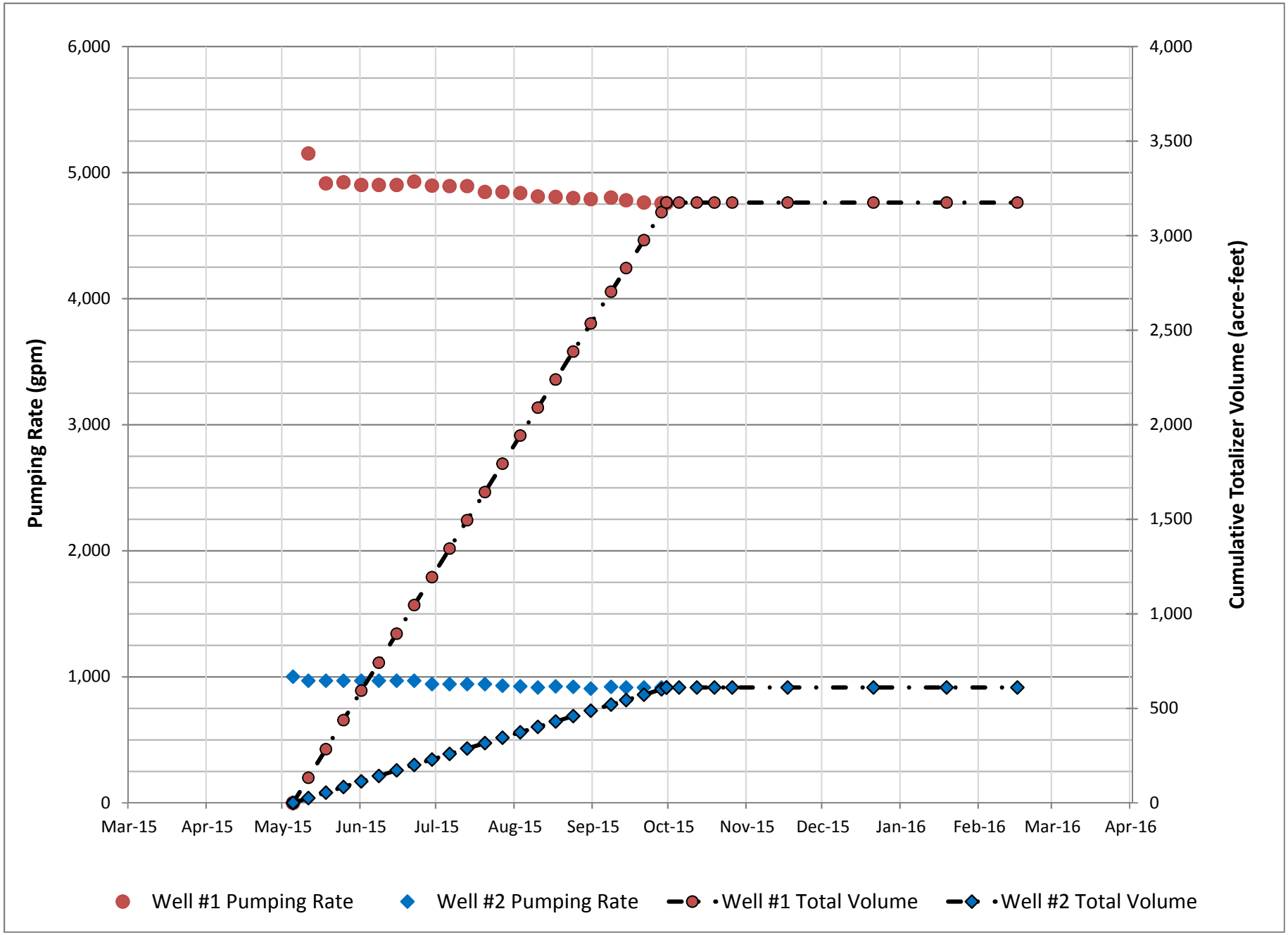
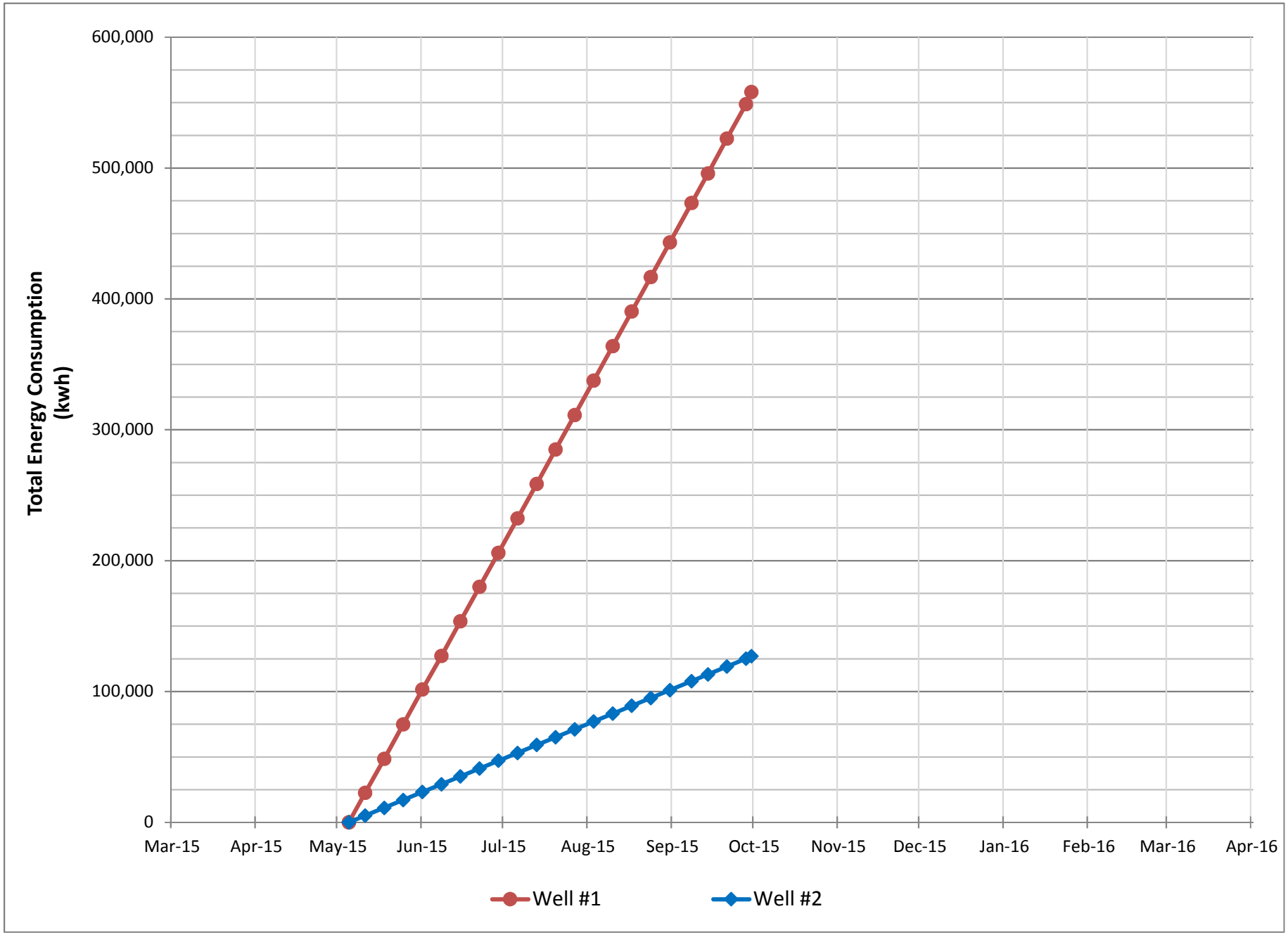
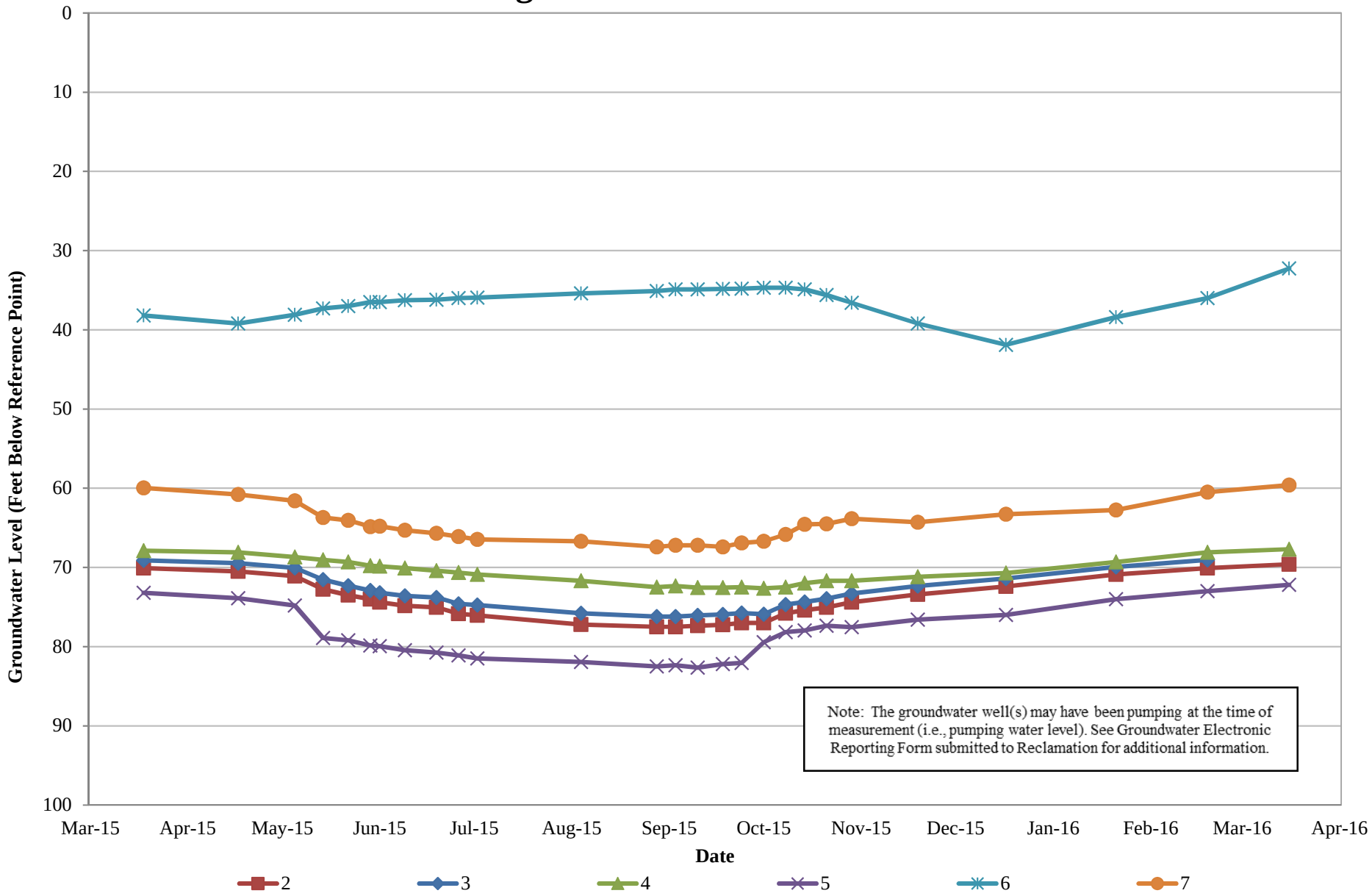
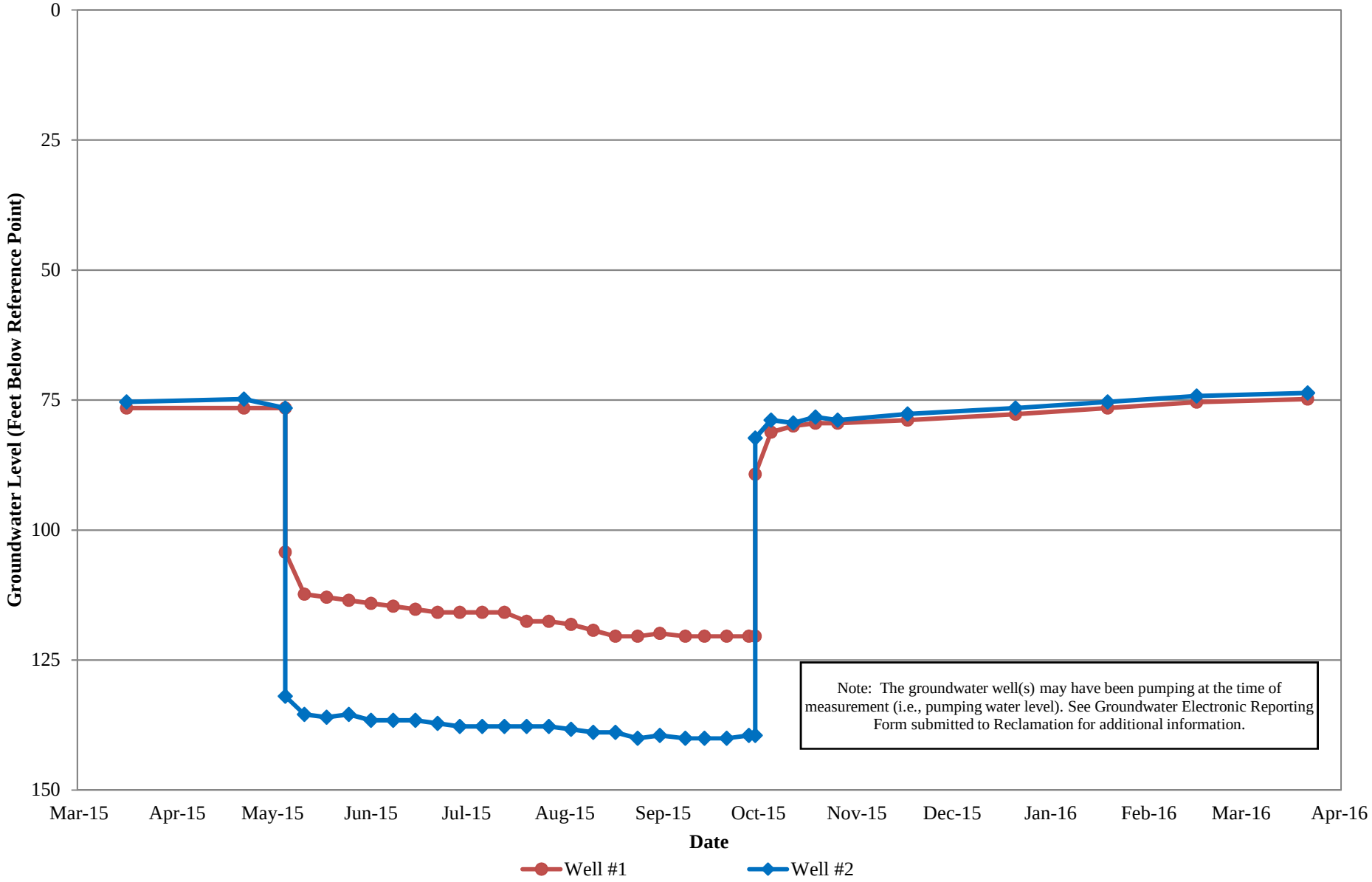

6,000
5,000
4,000
3,000
2,000
1,000
0
Pumping Rate (gpm)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Cumulative Totalizer Volume (acre-feet)
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Well #1 Pumping Rate
Well #2 Pumping Rate
Well #1 Total Volume
Well #2 Total Volume

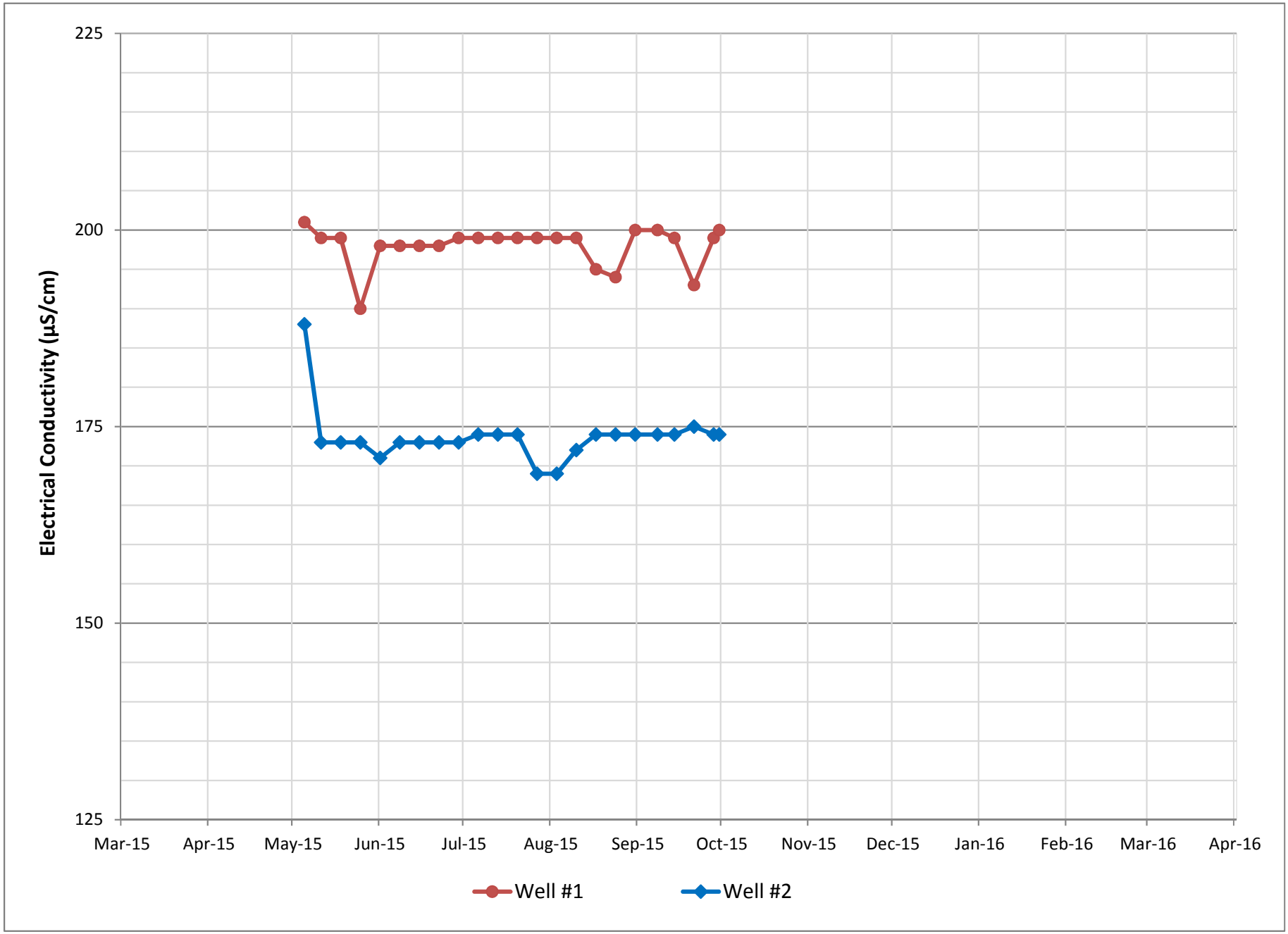

Total Energy Consumption (kwh)
600,000
500,000
400,000
300,000
200,000
100,000
0
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Well #1
Well #2

Anderson-Cottonwood Irrigation District
Monitoring Well Groundwater Level Data

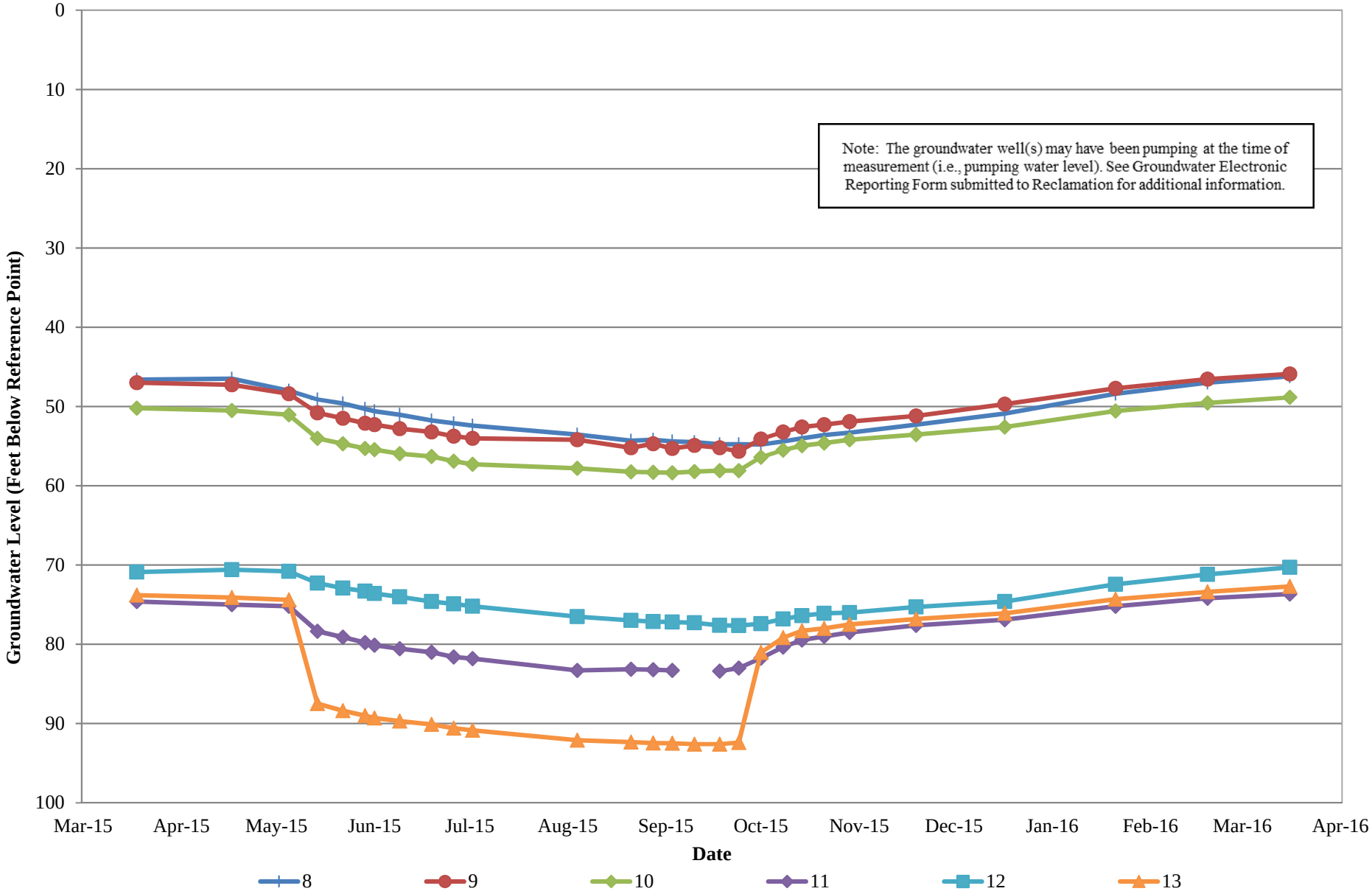


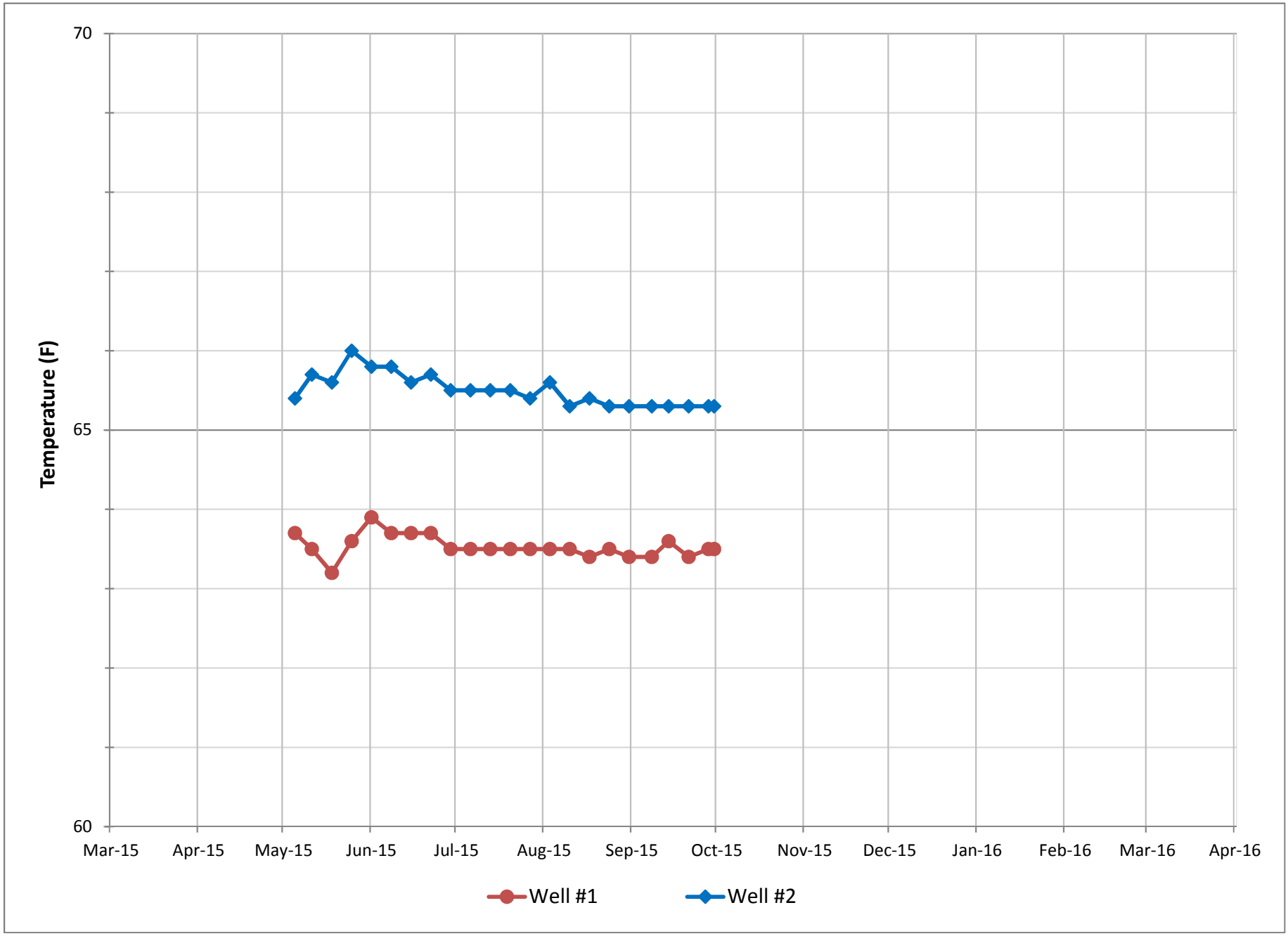
Anderson-Cottonwood Irrigation District
Production Well Groundwater Level Data




225
200
175
150
125
Electrical Conductivity (µS/cm)
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Well #1
Well #2

Anderson-Cottonwood Irrigation District
Monitoring Well Groundwater Level Data




70
65
60
Temperature (F)
Mar-15
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Well #1
Well #2

Canal Farms

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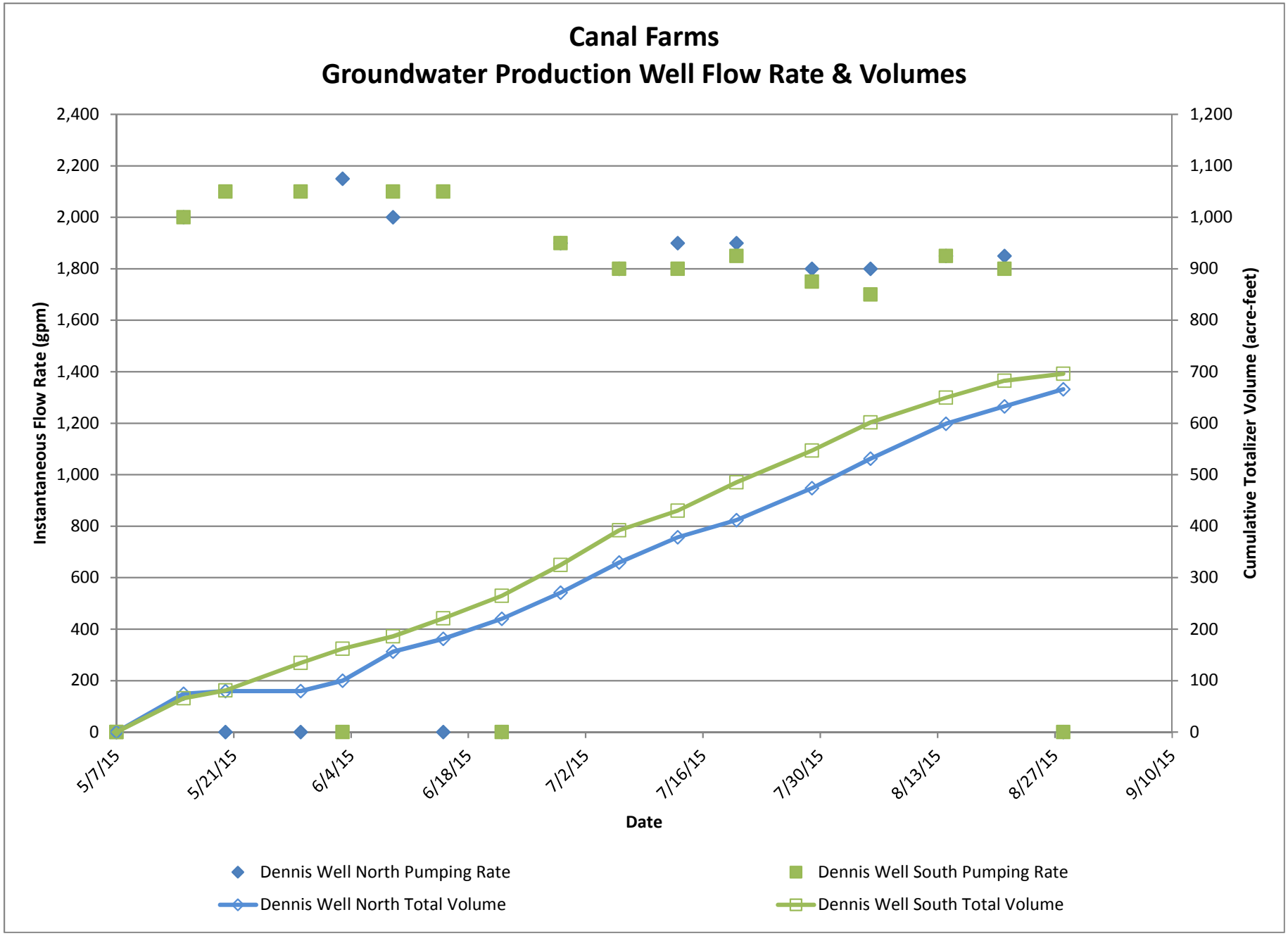
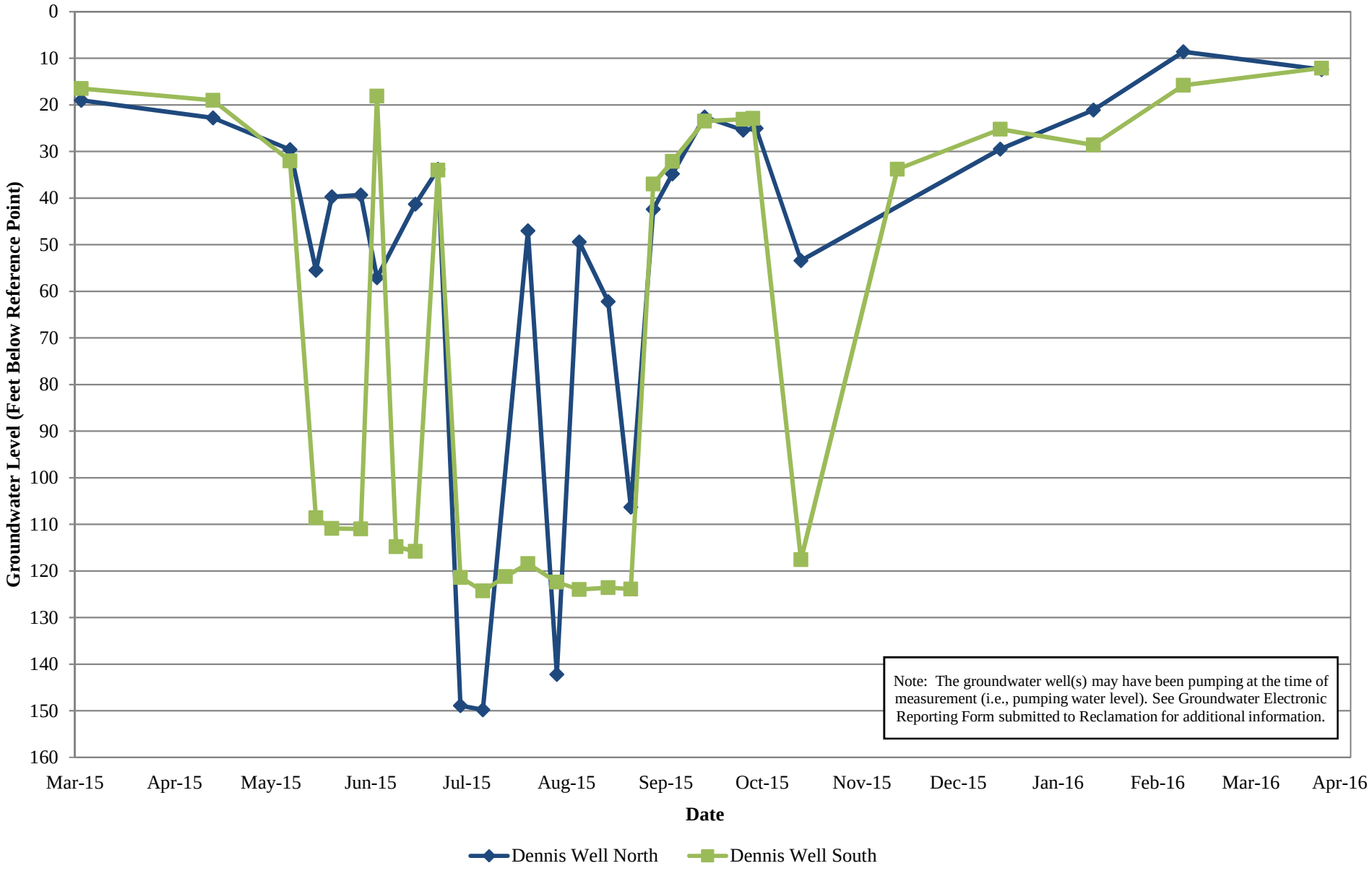
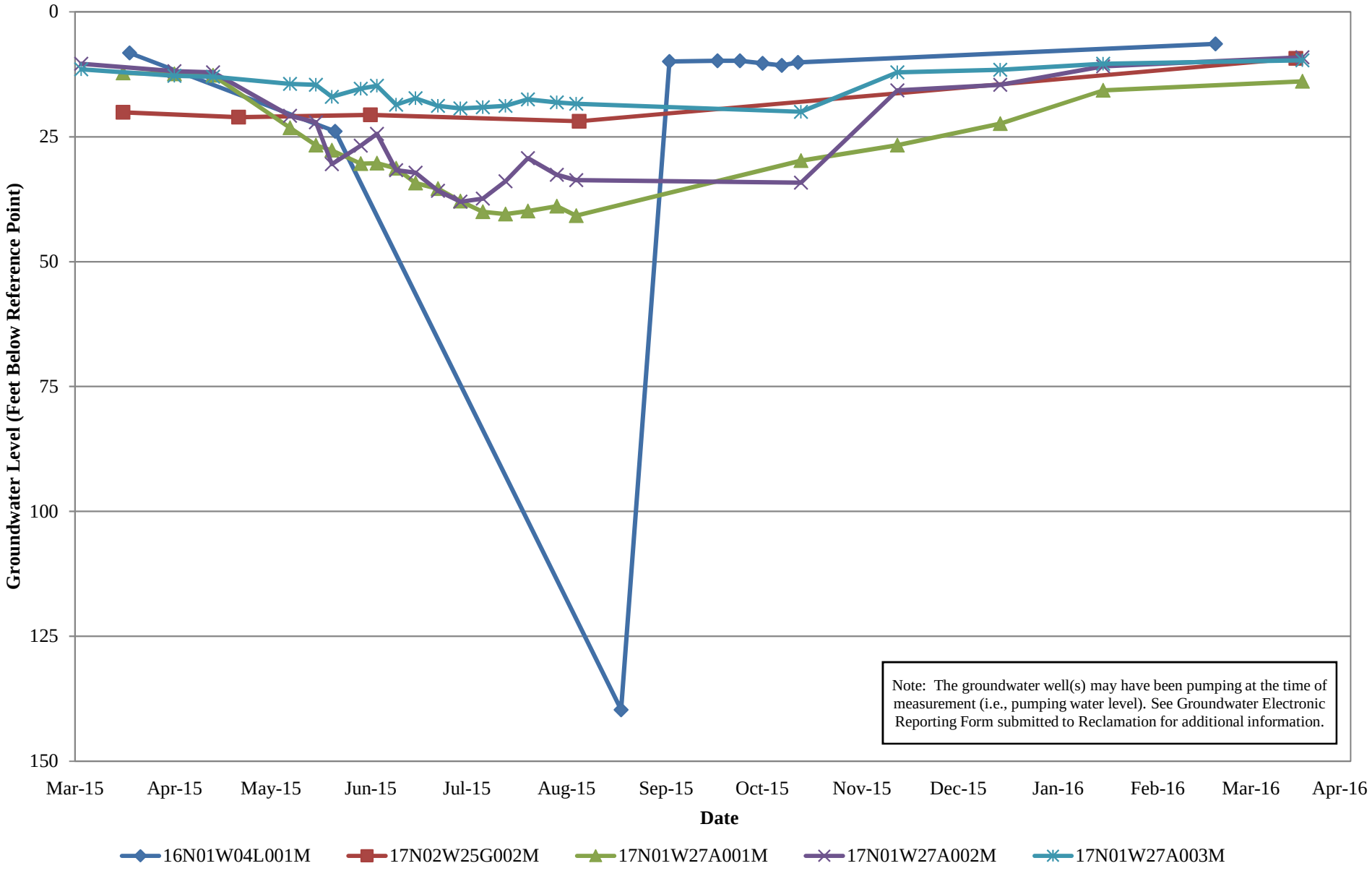

Canal Farms
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/7/15
5/21/15
6/4/15
6/18/15
7/2/15
7/16/15
7/30/15
8/13/15
8/27/15
9/10/15
Date
Dennis Well North Pumping Rate
Dennis Well South Pumping Rate
Dennis Well North Total Volume
Dennis Well South Total Volume

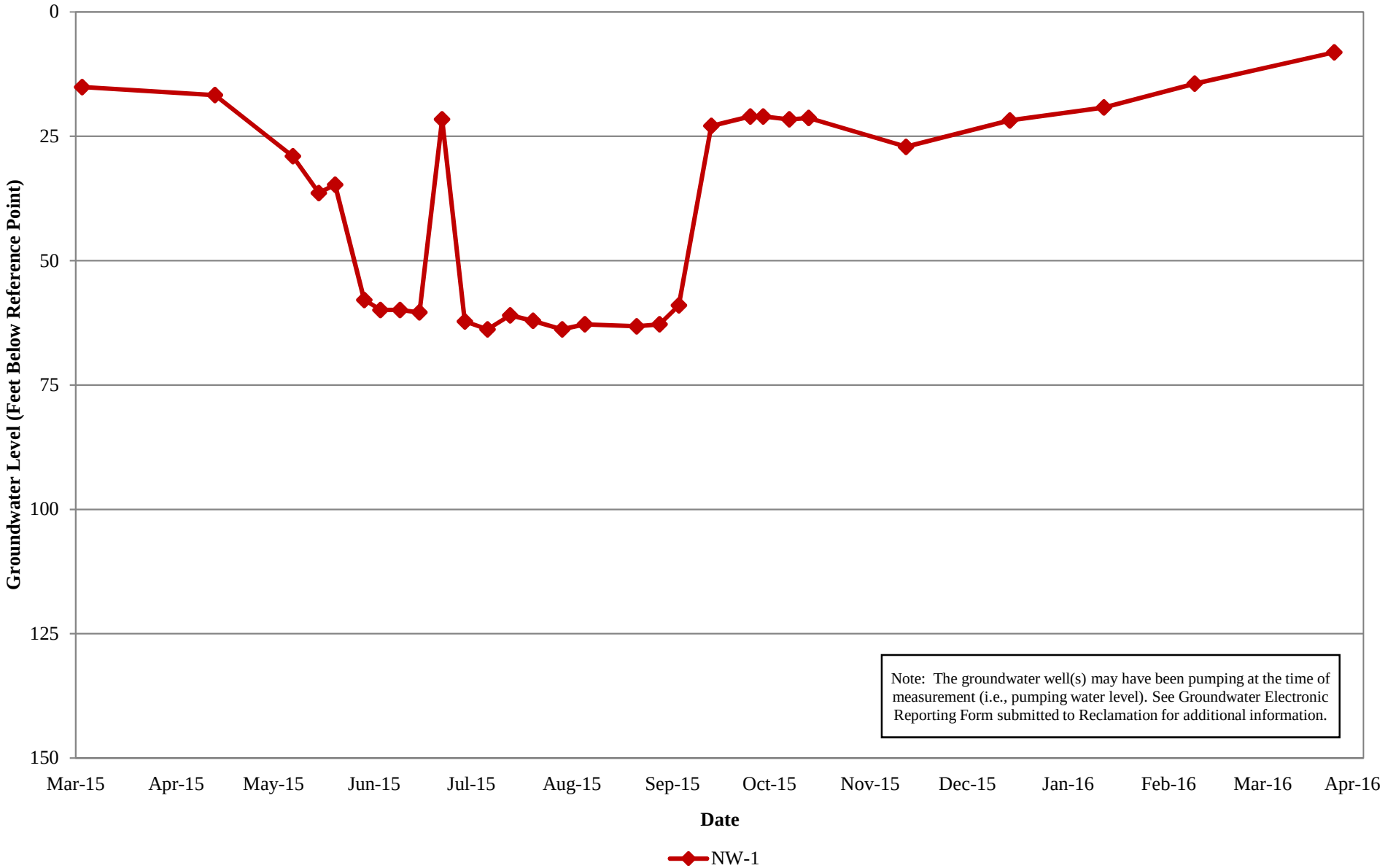
Canal Farms
Production Well Groundwater Level Data

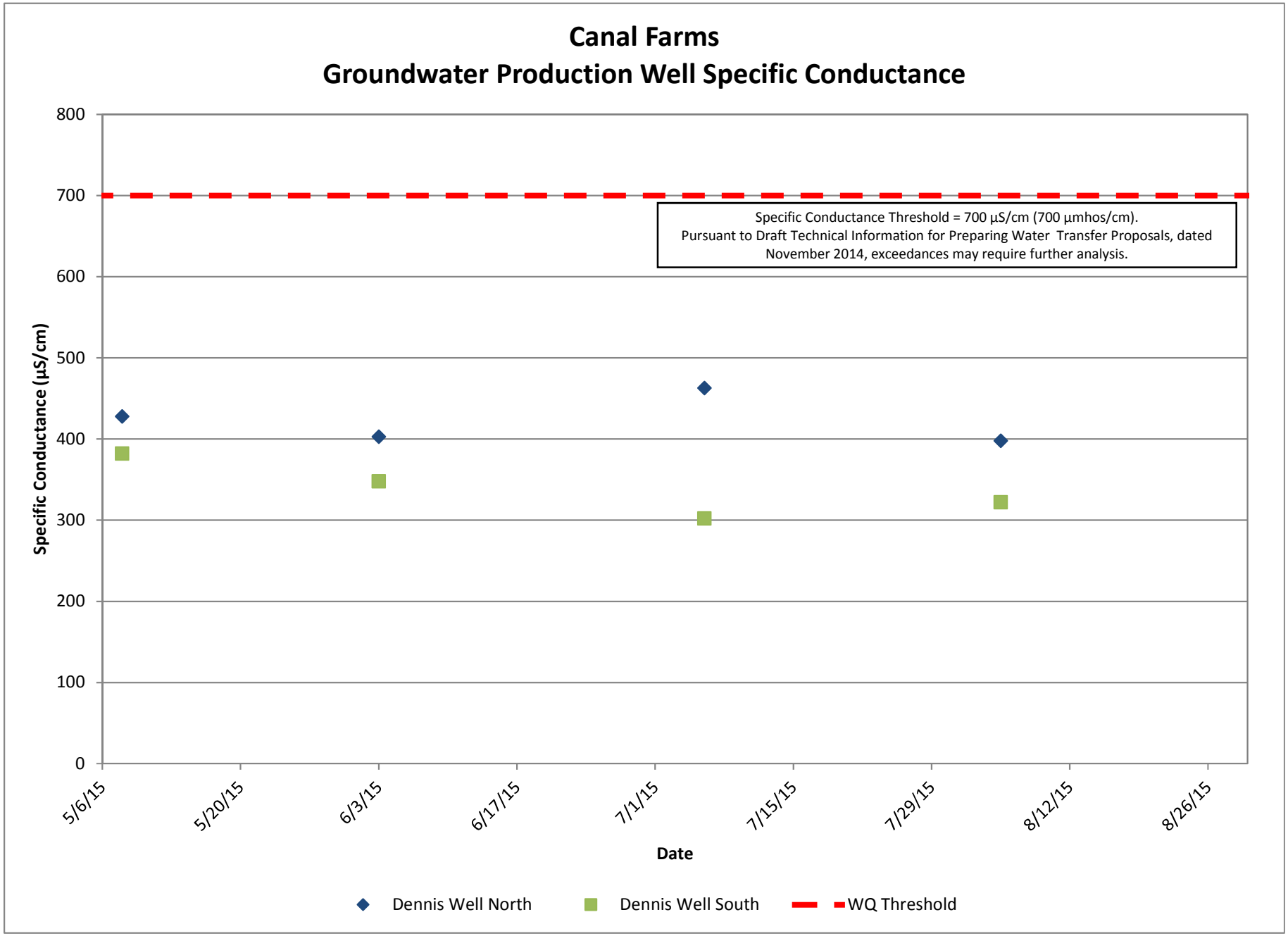


Canal Farms
DWR Monitoring Well Groundwater Level Data



Canal Farms
Monitoring Well Groundwater Level Data




Canal Farms
Groundwater Production Well Specific Conductance
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for Preparing Water Transfer Proposals, dated November 2014, exceedances may require further analysis.
Specific Conductance (µS/cm)
800
700
600
500
400
300
200
100
0
5/6/15
5/20/15
6/3/15
6/17/15
7/1/15
7/15/15
7/29/15
8/12/15
8/26/15
Date
Dennis Well North
Dennis Well South
WQ Threshold

Conaway Preservation Group

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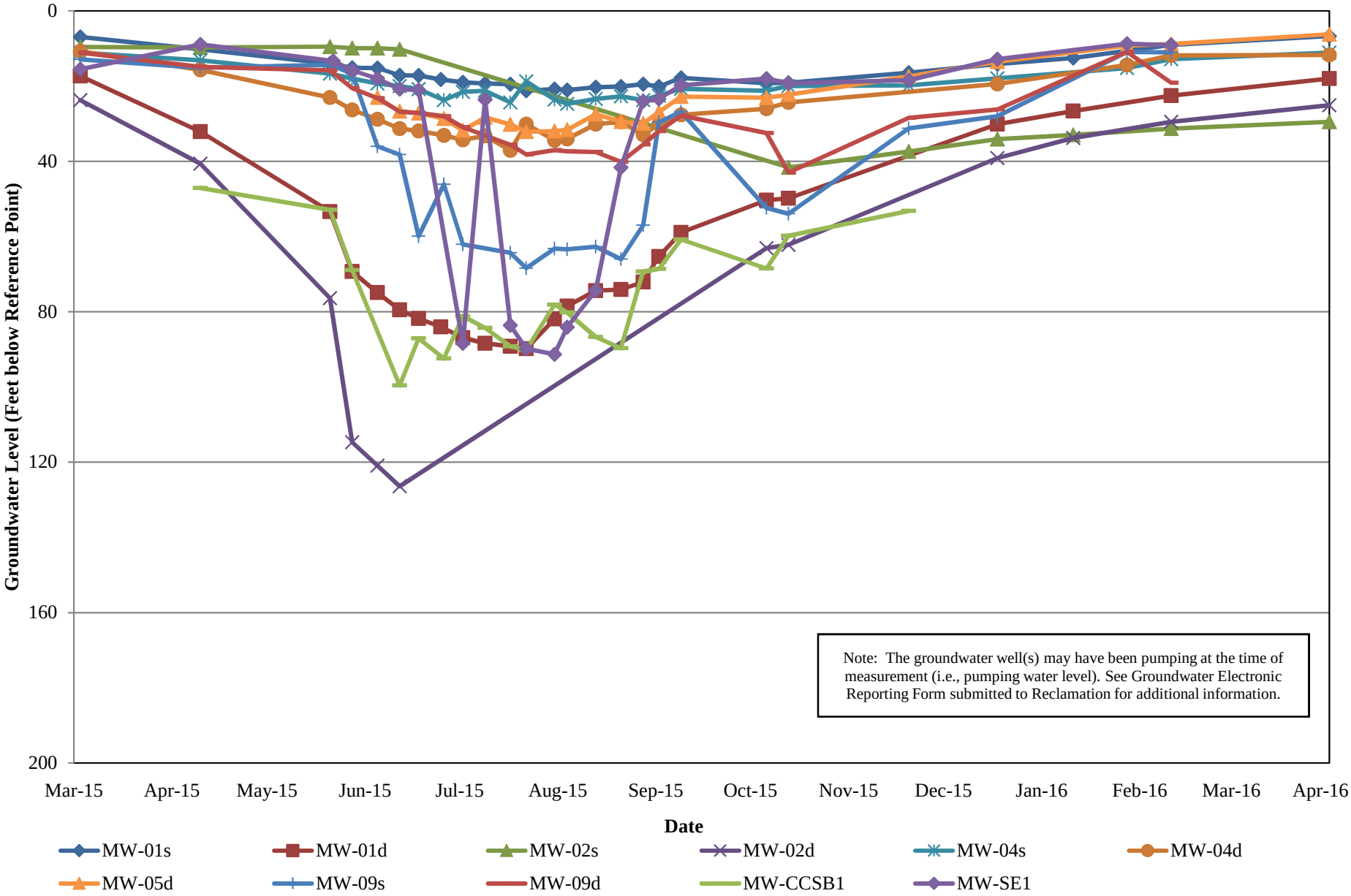
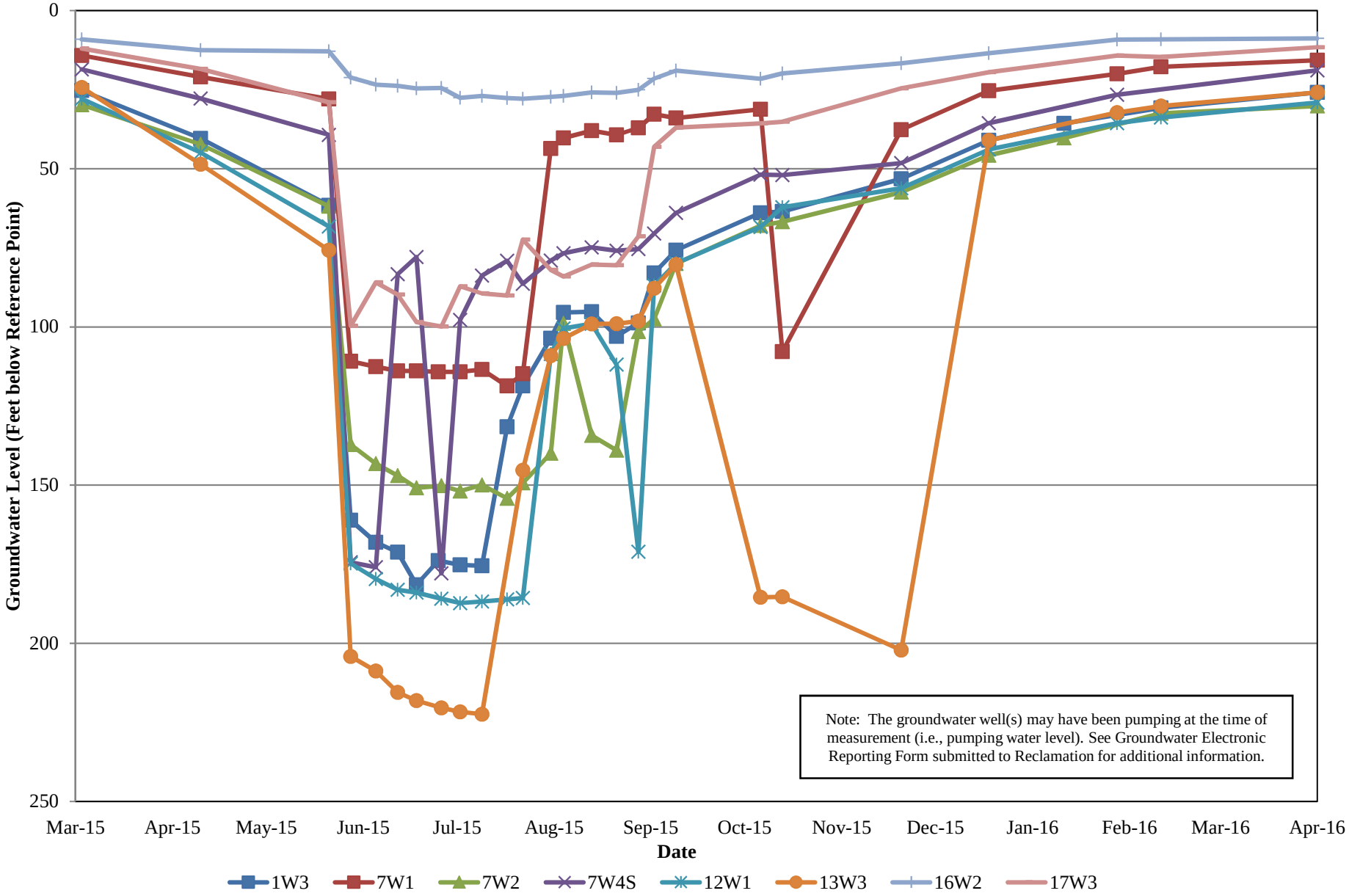
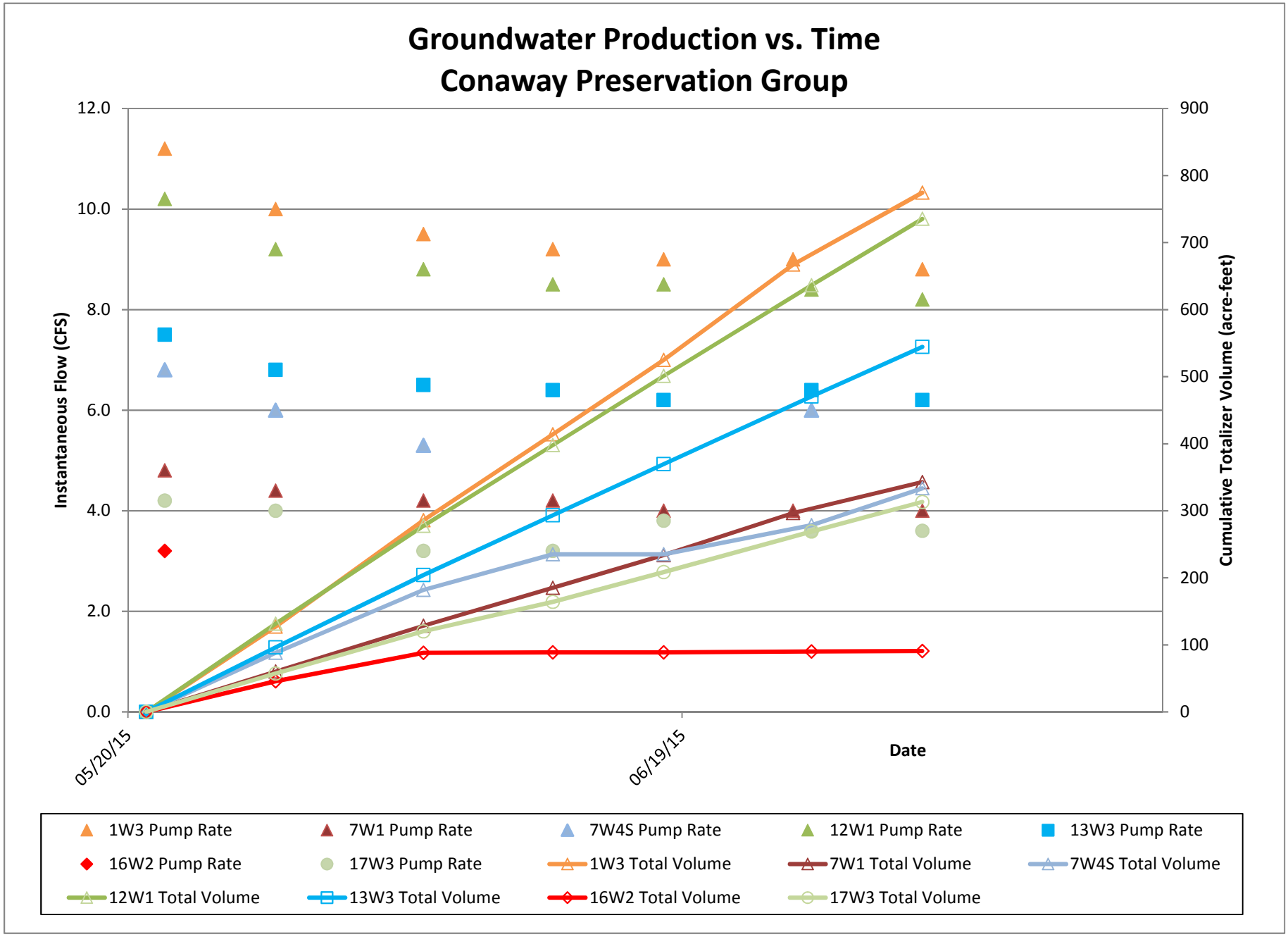
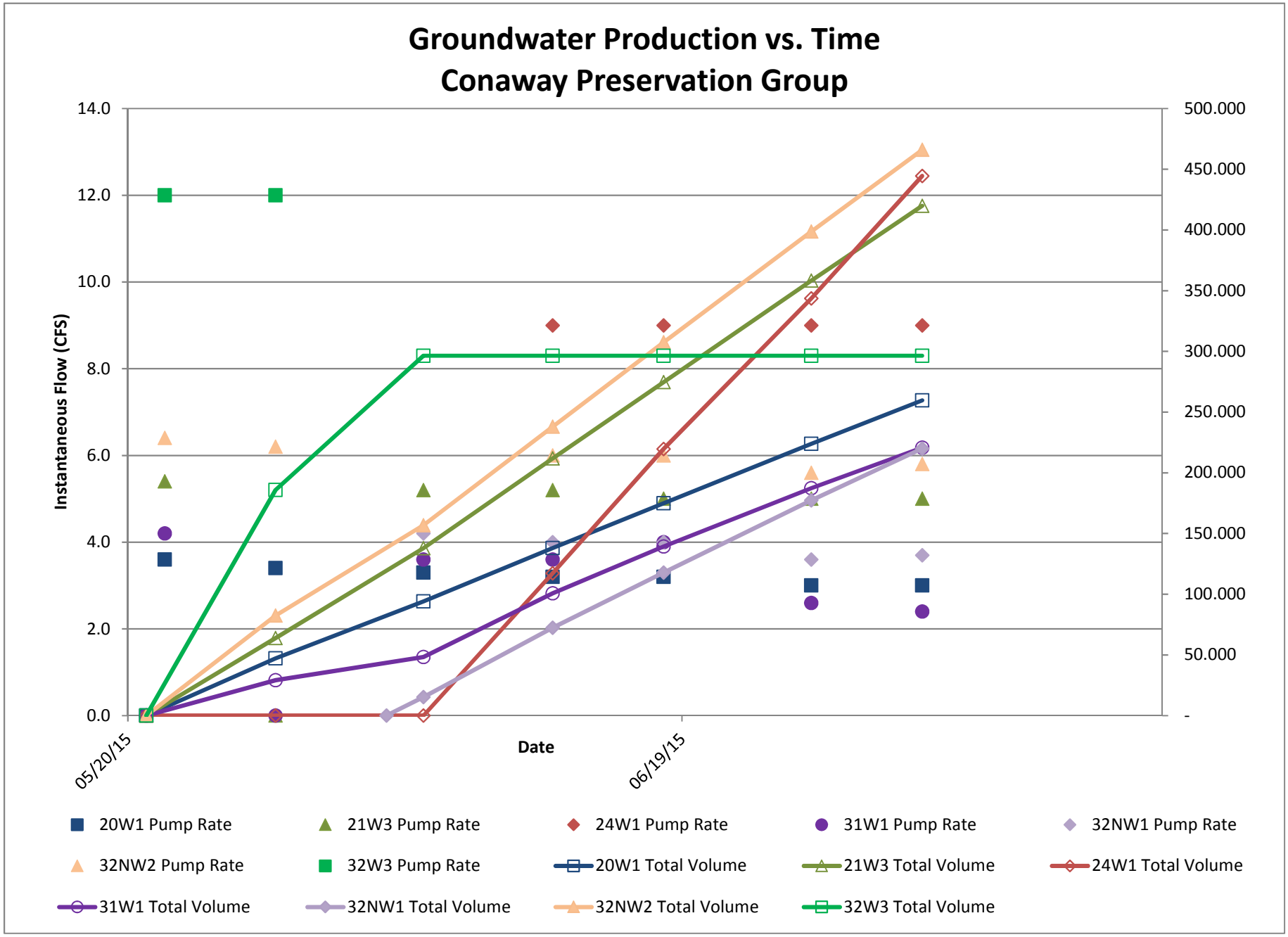
Conaway Preservation Group
Monitoring Well Groundwater Level Data

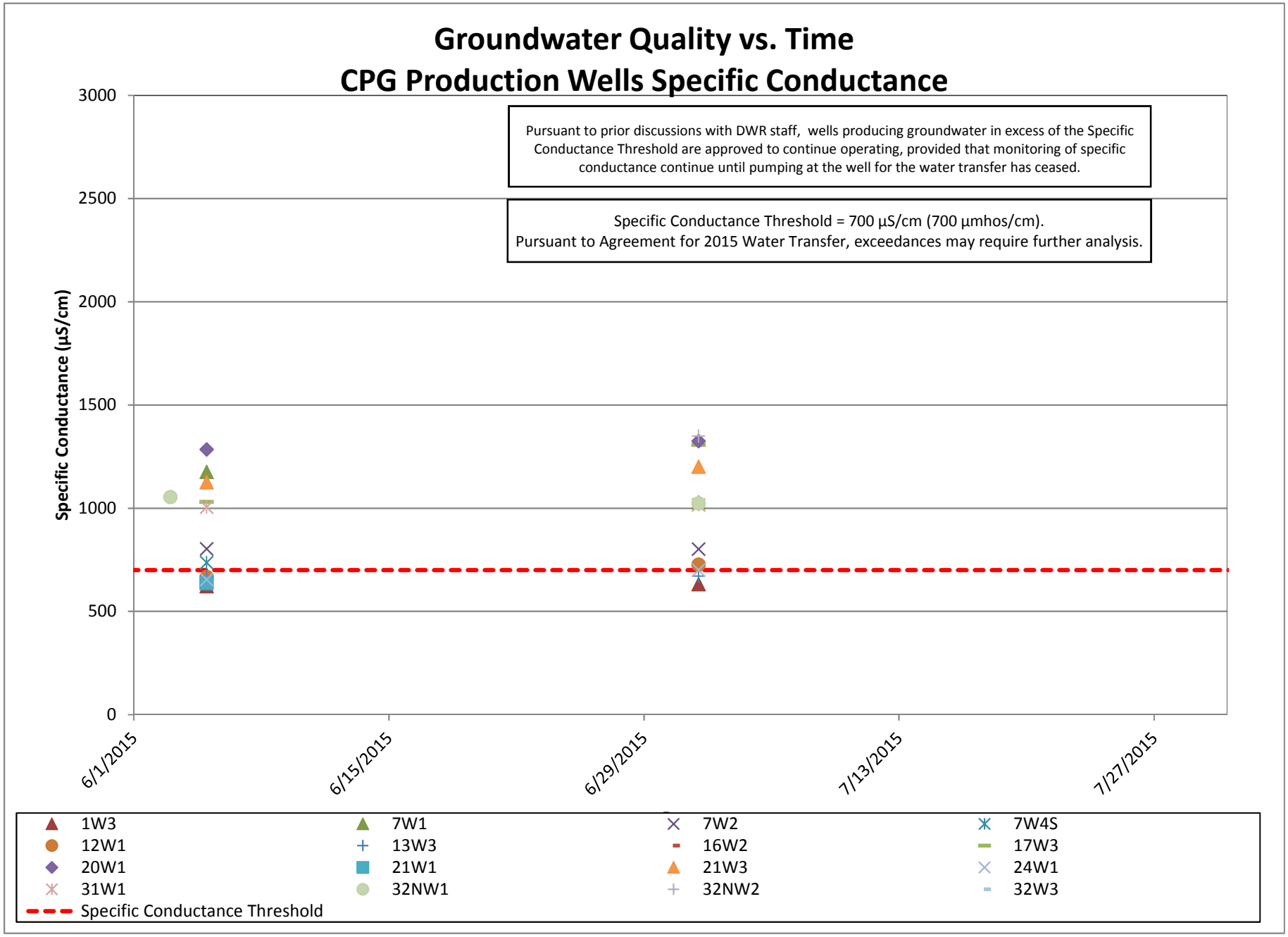


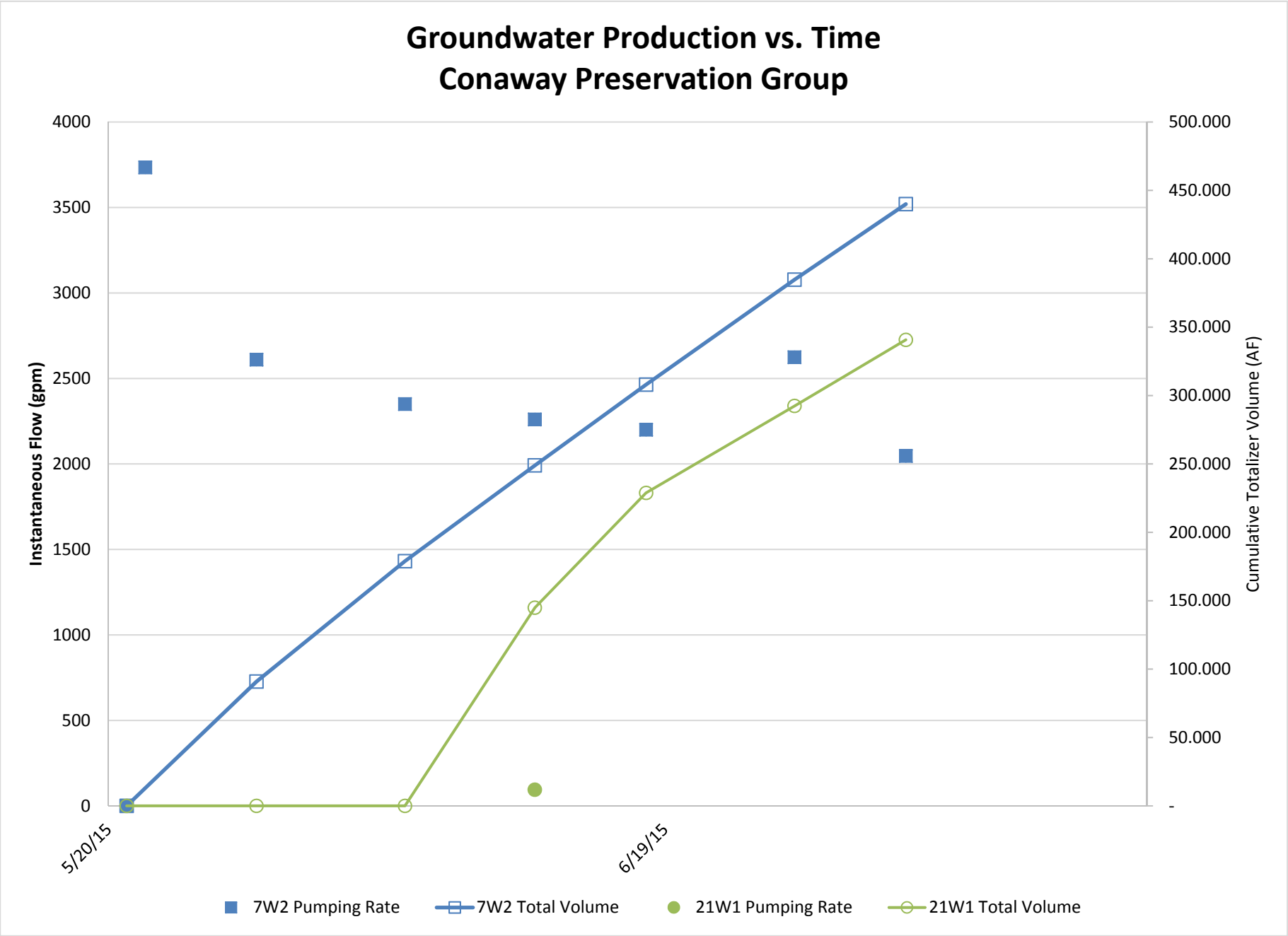
Conaway Preservation Group
Production Well Groundwater Level Data



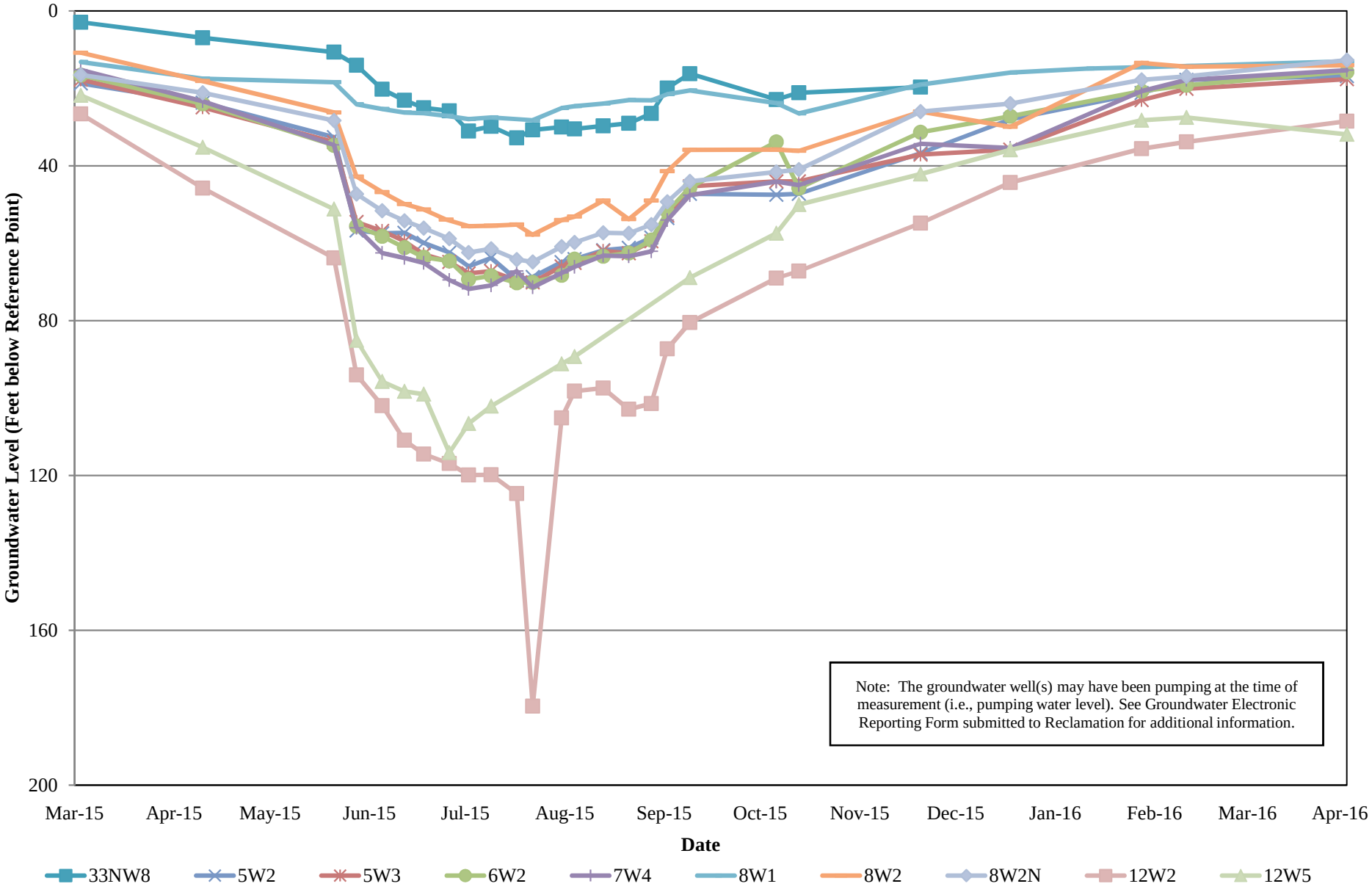

Groundwater Production vs. Time
Conaway Preservation Group
Instantaneous Flow (CFS)
Cumulative Totalizer Volume (acre-feet)
Date
12.0
10.0
8.0
6.0
4.0
2.0
0.0
900
800
700
600
500
400
300
200
100
0
05/20/15
06/19/15
1W3 Pump Rate
7W1 Pump Rate
7W4S Pump Rate
12W1 Pump Rate
13W3 Pump Rate
16W2 Pump Rate
17W3 Pump Rate
1W3 Total Volume
7W1 Total Volume
7W4S Total Volume
12W1 Total Volume
13W3 Total Volume
16W2 Total Volume
17W3 Total Volume


Groundwater Production vs. Time
Conaway Preservation Group
Instantaneous Flow (CFS)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
500.000
450.000
400.000
350.000
300.000
250.000
200.000
150.000
100.000
50.000
-
05/20/15
06/19/15
Date
20W1 Pump Rate
21W3 Pump Rate
24W1 Pump Rate
31W1 Pump Rate
32NW1 Pump Rate
32NW2 Pump Rate
32W3 Pump Rate
20W1 Total Volume
21W3 Total Volume
24W1 Total Volume
31W1 Total Volume
32NW1 Total Volume
32NW2 Total Volume
32W3 Total Volume

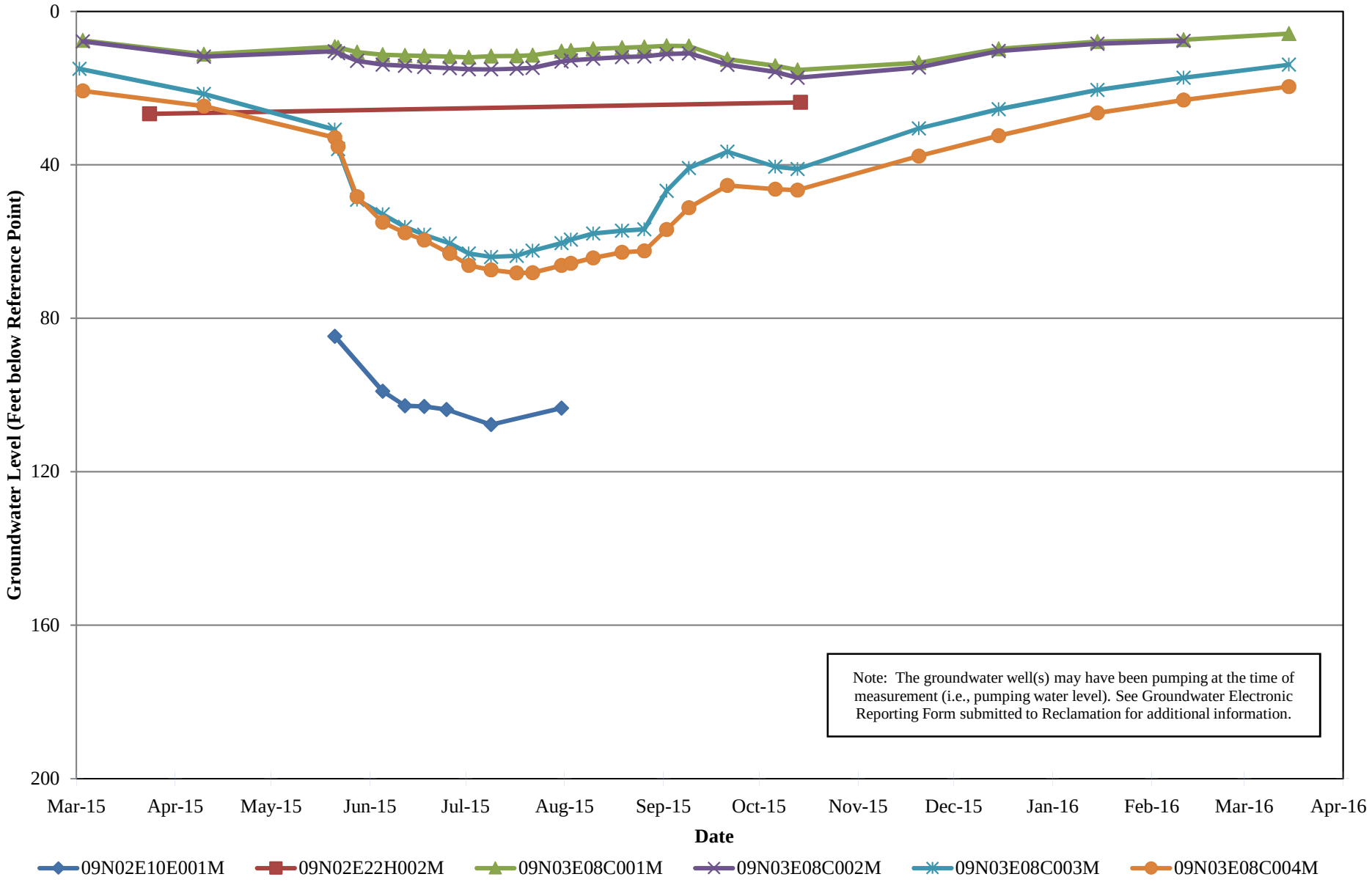

Groundwater Quality vs. Time
CPG Production Wells Specific Conductance
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Agreement for 2015 Water Transfer, exceedances may require further analysis.
Specific Conductance (µS/cm)
3000
2500
2000
1500
1000
500
0
6/1/2015
6/15/2015
6/29/2015
7/13/2015
7/27/2015
1W3
7W1
7W2
7W4S
12W1
13W3
16W2
17W3
20W1
21W1
21W3
24W1
31W1
32NW1
32NW2
32W3
Specific Conductance Threshold


Groundwater Production vs. Time
Conaway Preservation Group
Instantaneous Flow (gpm)
Cumulative Totalizer Volume (AF)
4000
3500
3000
2500
2000
1500
1000
500
0
500.000
450.000
400.000
350.000
300.000
250.000
200.000
150.000
100.000
50.000
-
5/20/15
6/19/15
7W2 Pumping Rate
7W2 Total Volume
21W1 Pumping Rate
21W1 Total Volume

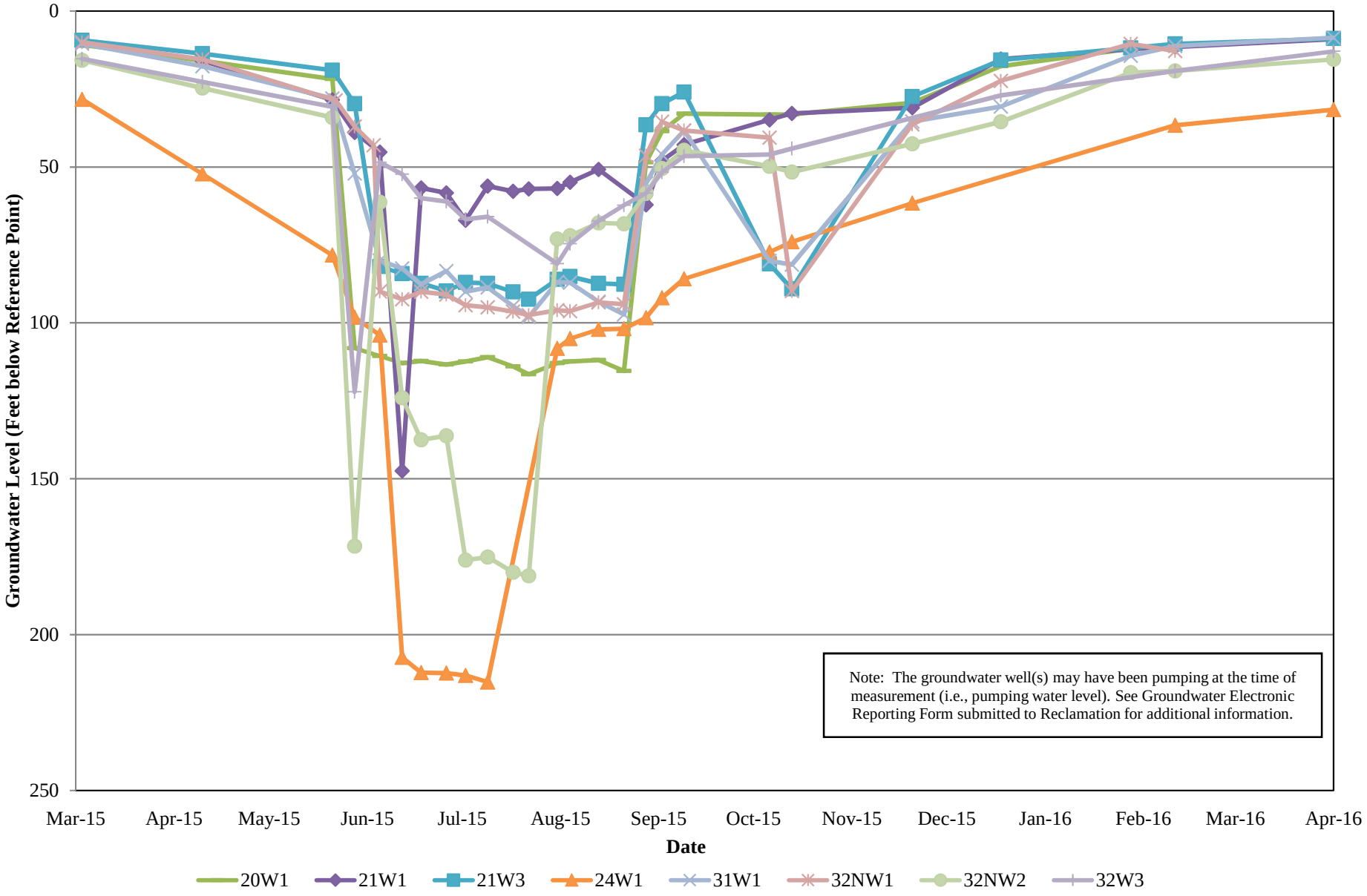
Conaway Preservation Group
Monitoring Well Groundwater Level Data



Conaway Preservation Group
DWR and YCFFWCD Monitoring Well Groundwater Level Data



Conaway Preservation Group
Production Well Groundwater Level Data



Eastside Mutual Water Company

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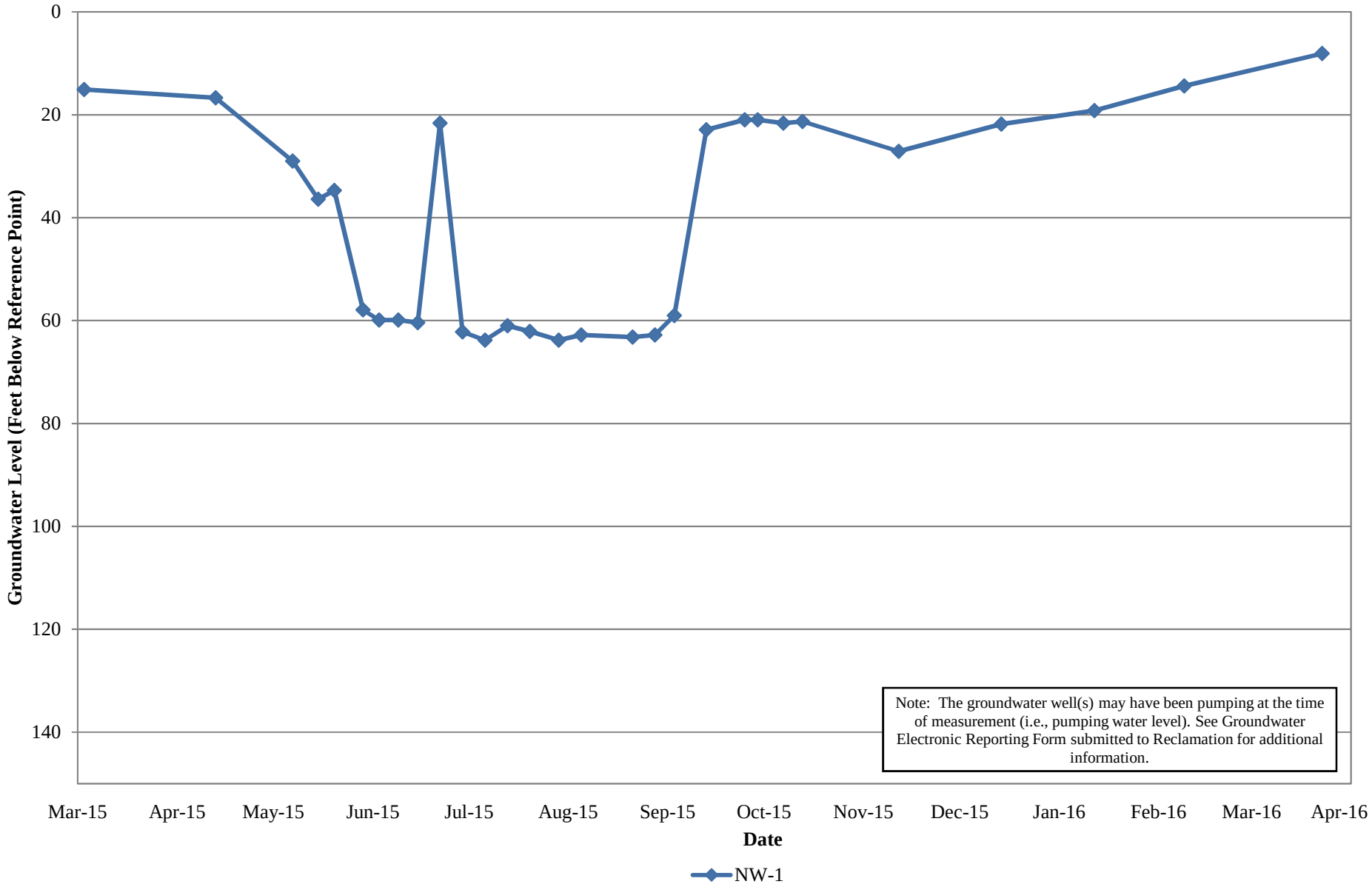
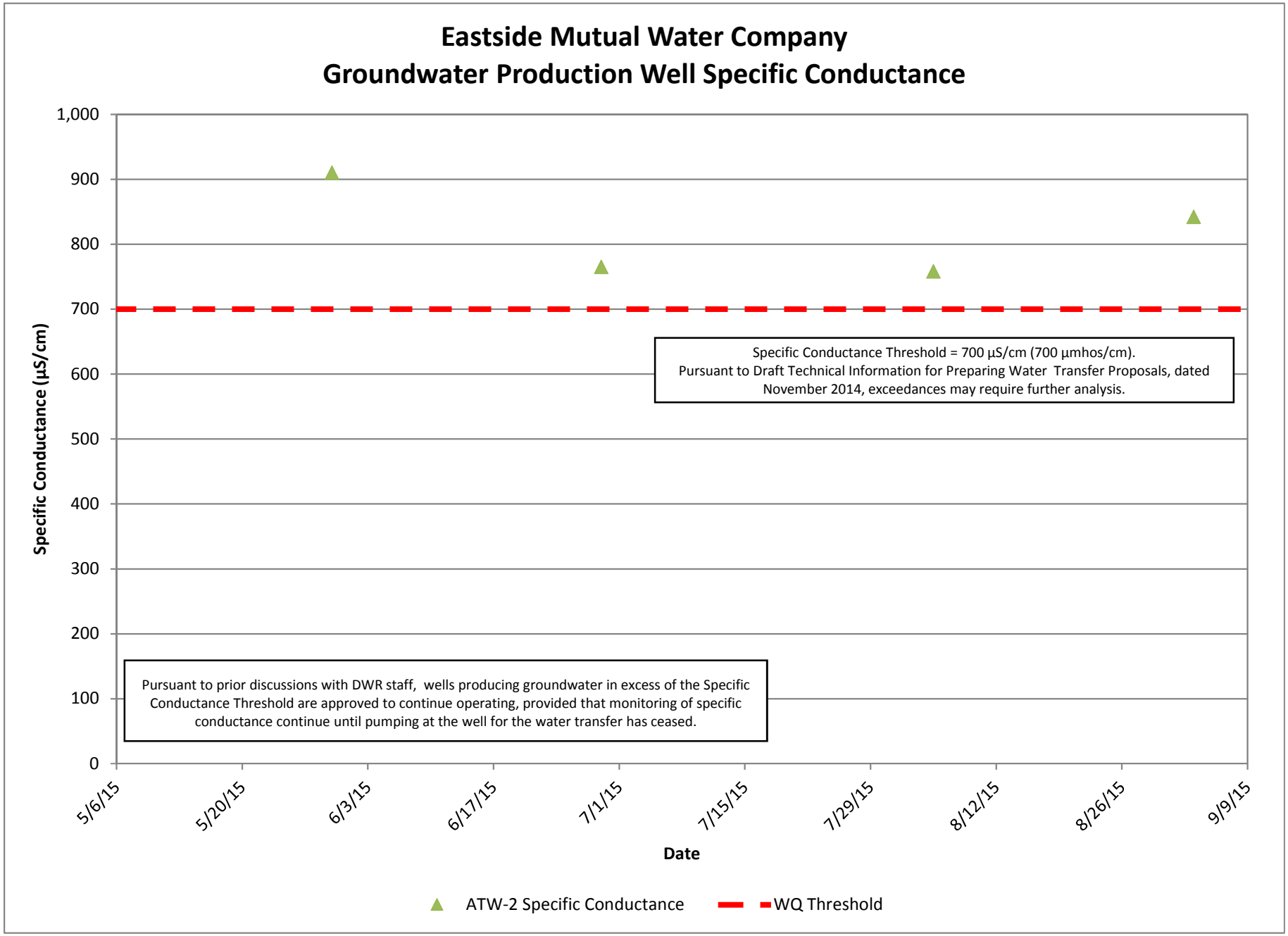
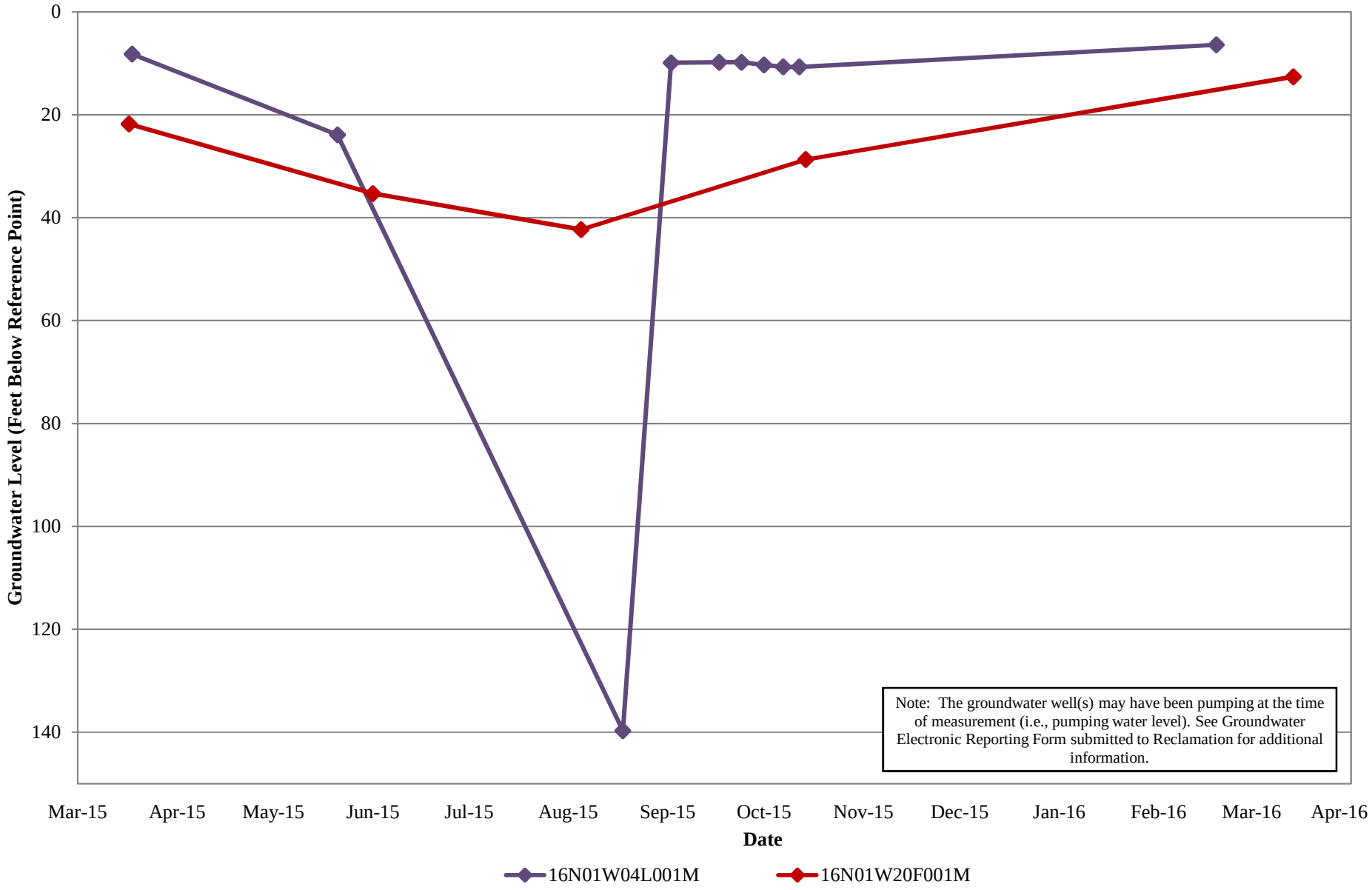
Eastside Mutual Water Company
Monitoring Well Groundwater Level Data

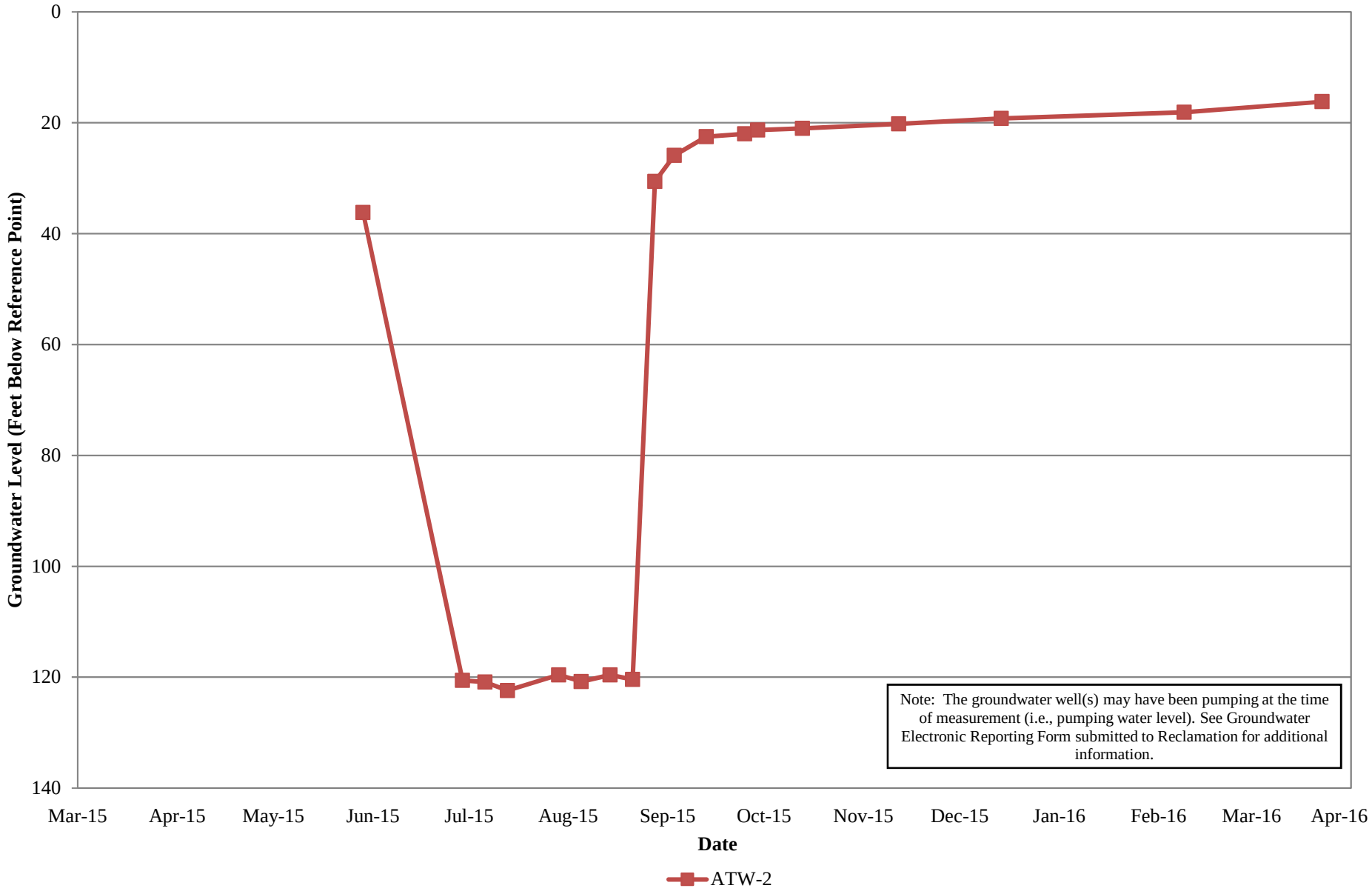


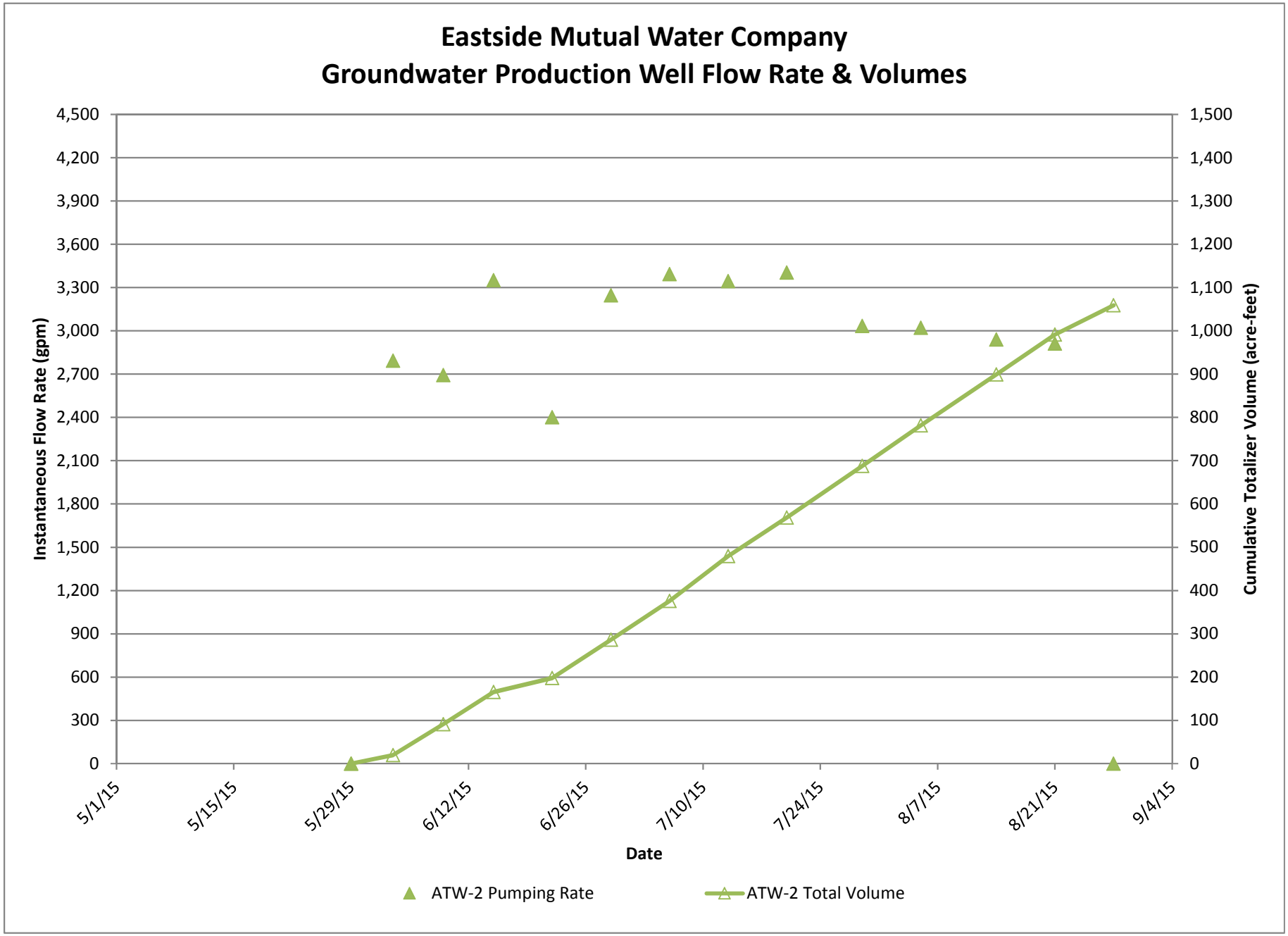

Eastside Mutual Water Company
Groundwater Production Well Specific Conductance
Specific Conductance (µS/cm)
1,000
900
800
700
600
500
400
300
200
100
0
5/6/15
5/20/15
6/3/15
6/17/15
7/1/15
7/15/15
7/29/15
8/12/15
8/26/15
9/9/15
Date
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for Preparing Water Transfer Proposals, dated November 2014, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
ATW-2 Specific Conductance
WQ Threshold

Eastside Mutual Water Company
DWR Monitoring Well Groundwater Level Data



Eastside Mutual Water Company
Production Well Groundwater Collection Data




Eastside Mutual Water Company
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
4,500
4,200
3,900
3,600
3,300
3,000
2,700
2,400
2,100
1,800
1,500
1,200
900
600
300
0
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
8/21/15
9/4/15
Date
ATW-2 Pumping Rate
ATW-2 Total Volume

Glenn-Colusa Irrigation District

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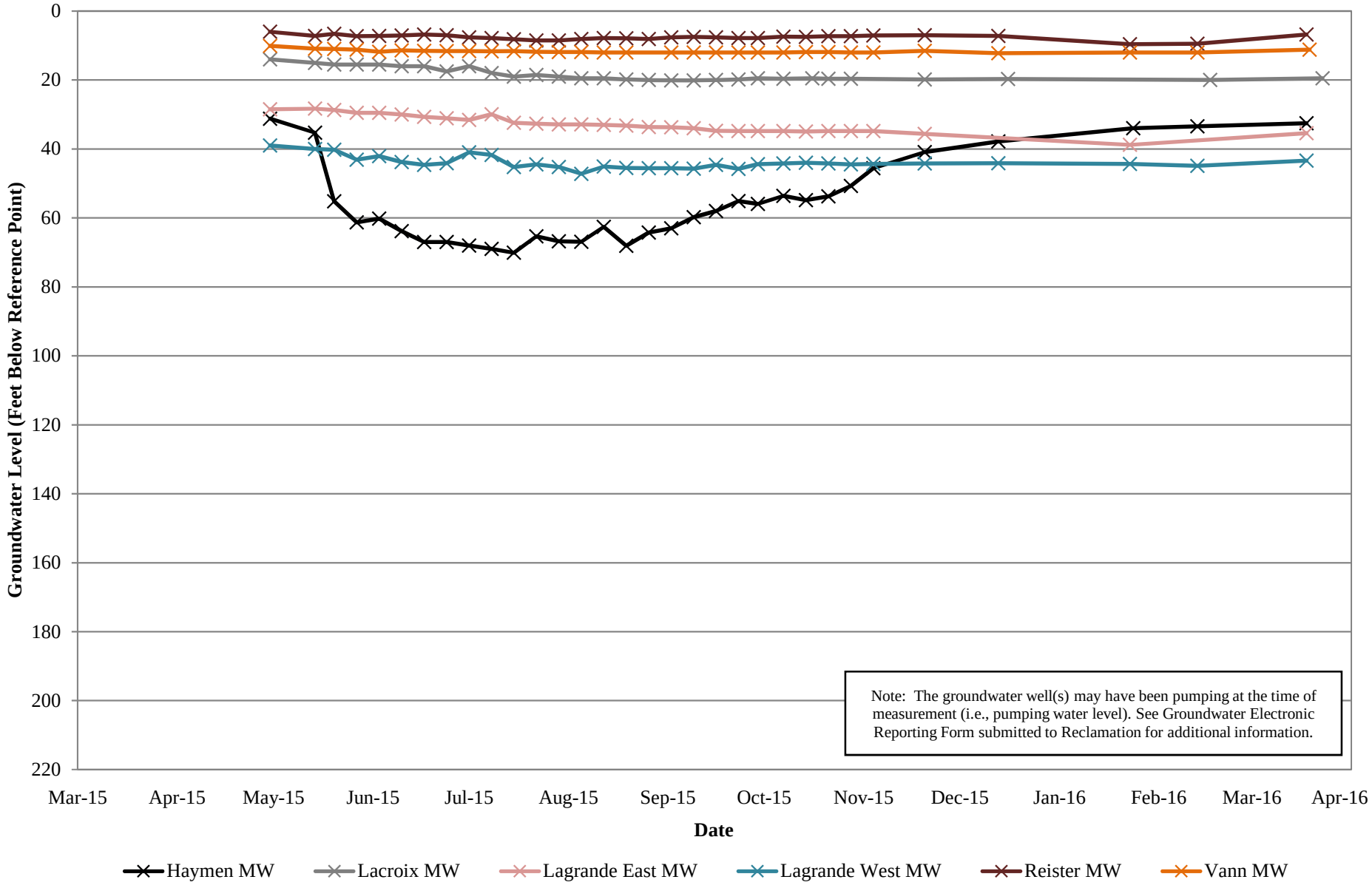
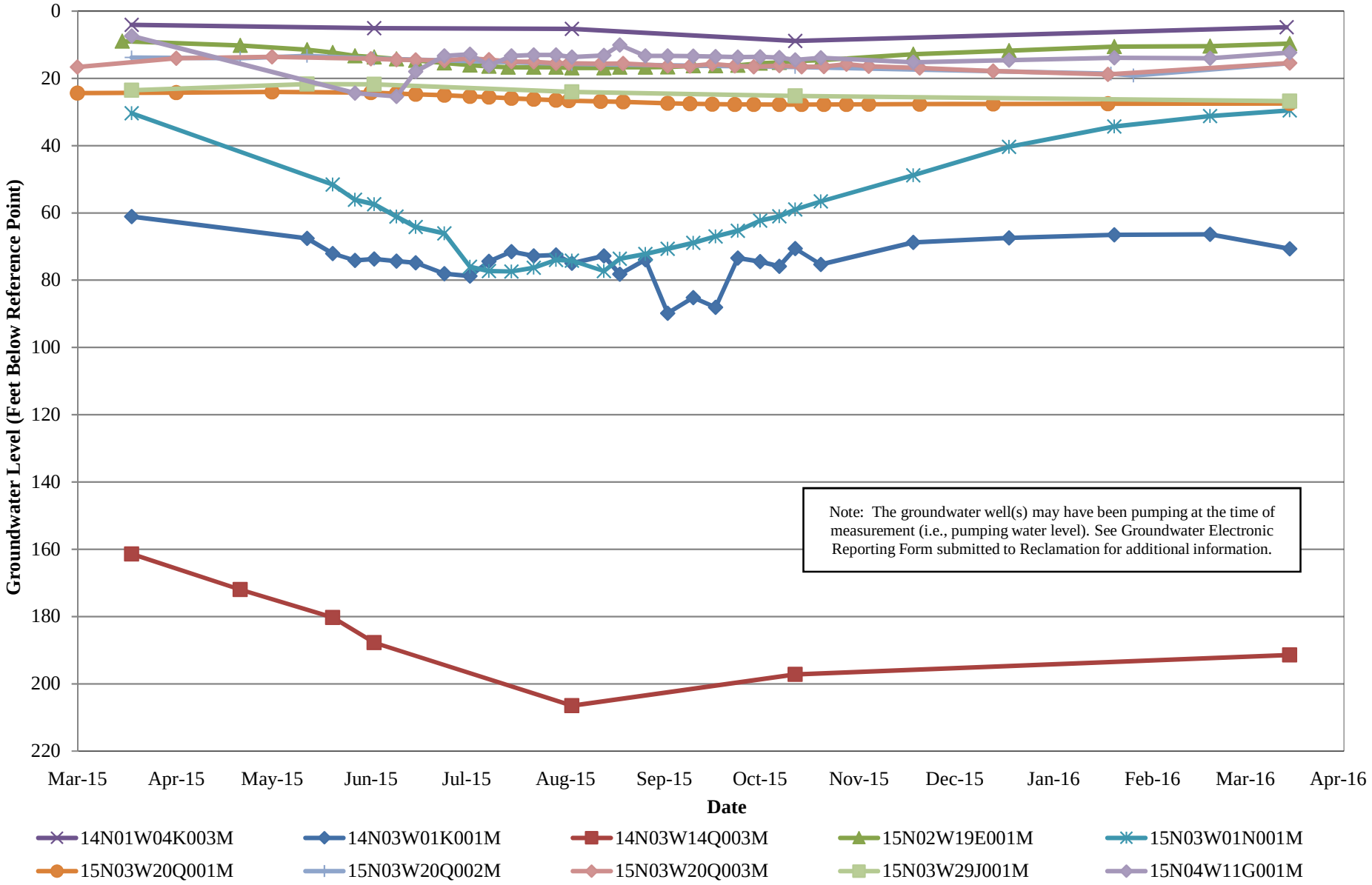
Glenn-Colusa Irrigation District
Monitoring Well Groundwater Level Data

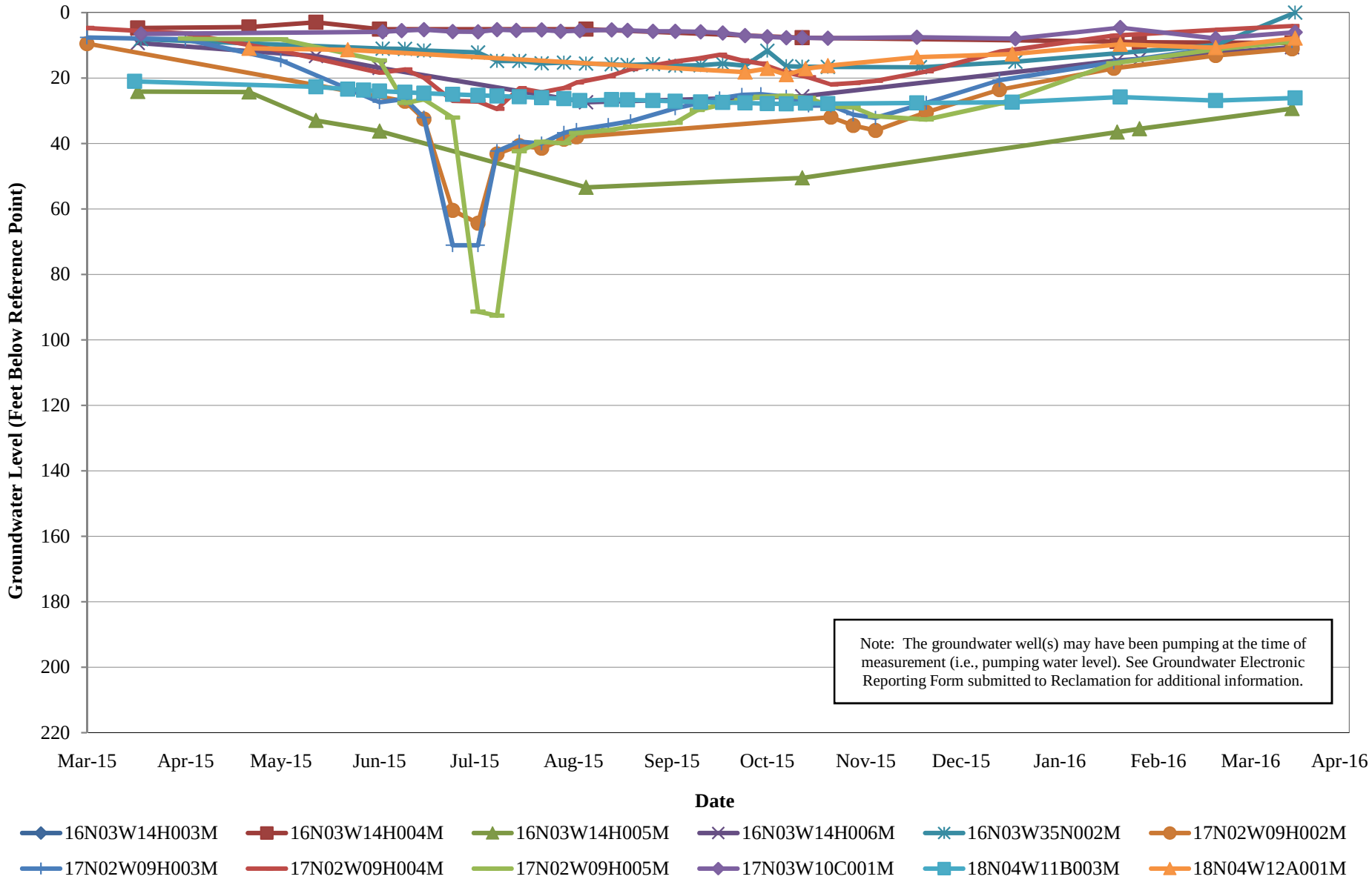


Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.

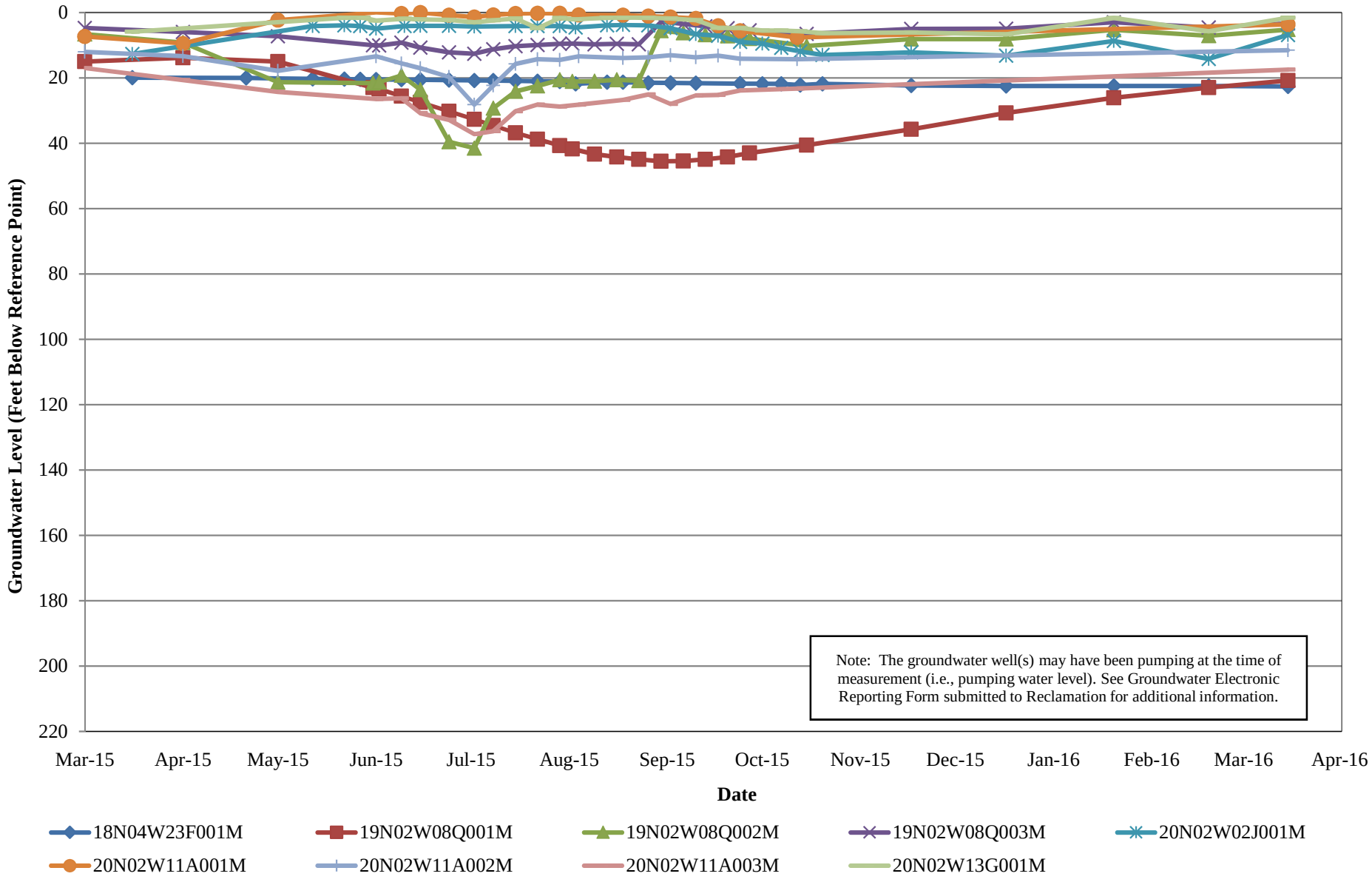
Glenn-Colusa Irrigation District
DWR Monitoring Well Groundwater Level Data



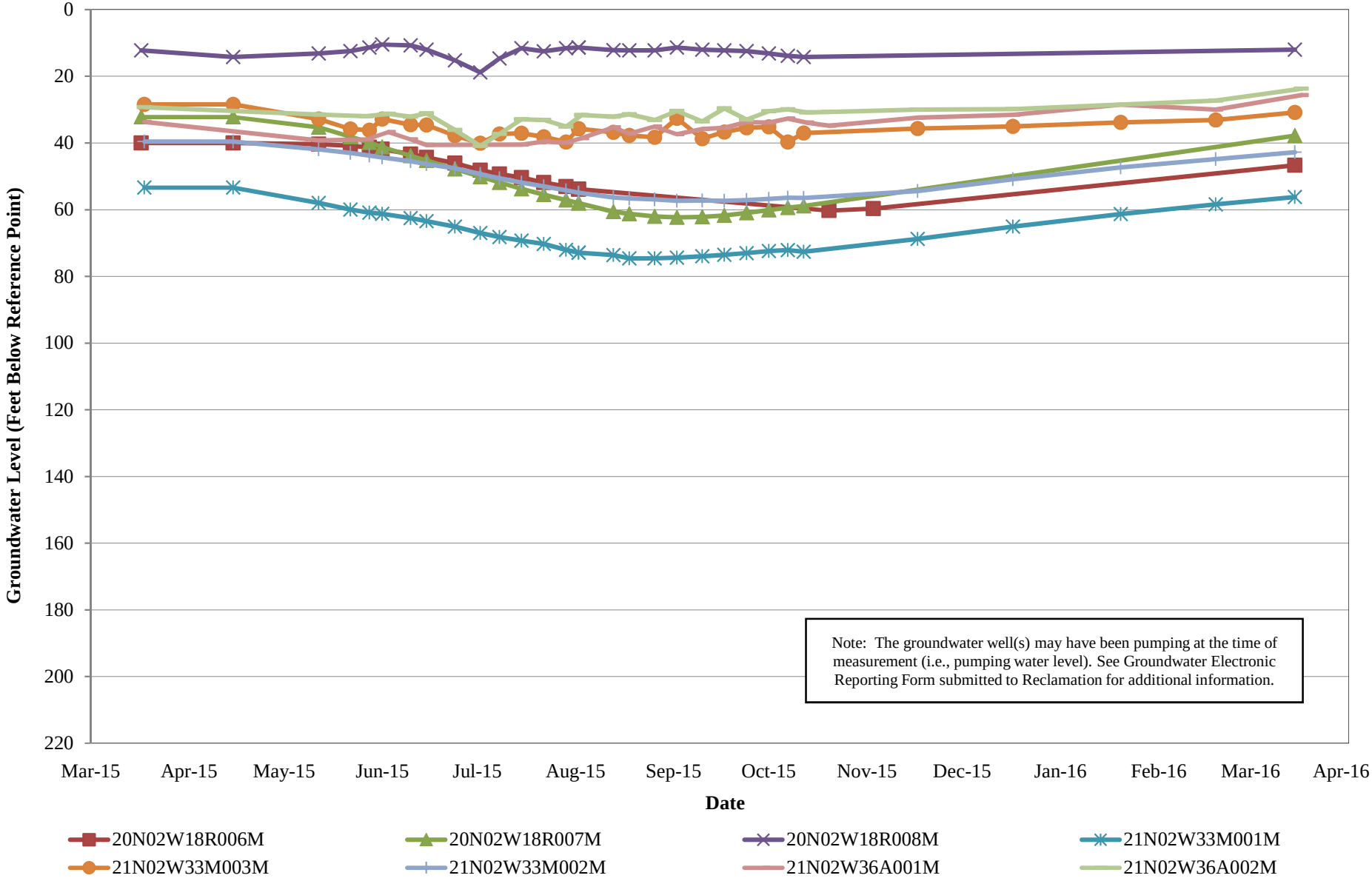
Glenn-Colusa Irrigation District
DWR Monitoring Well Groundwater Level Data

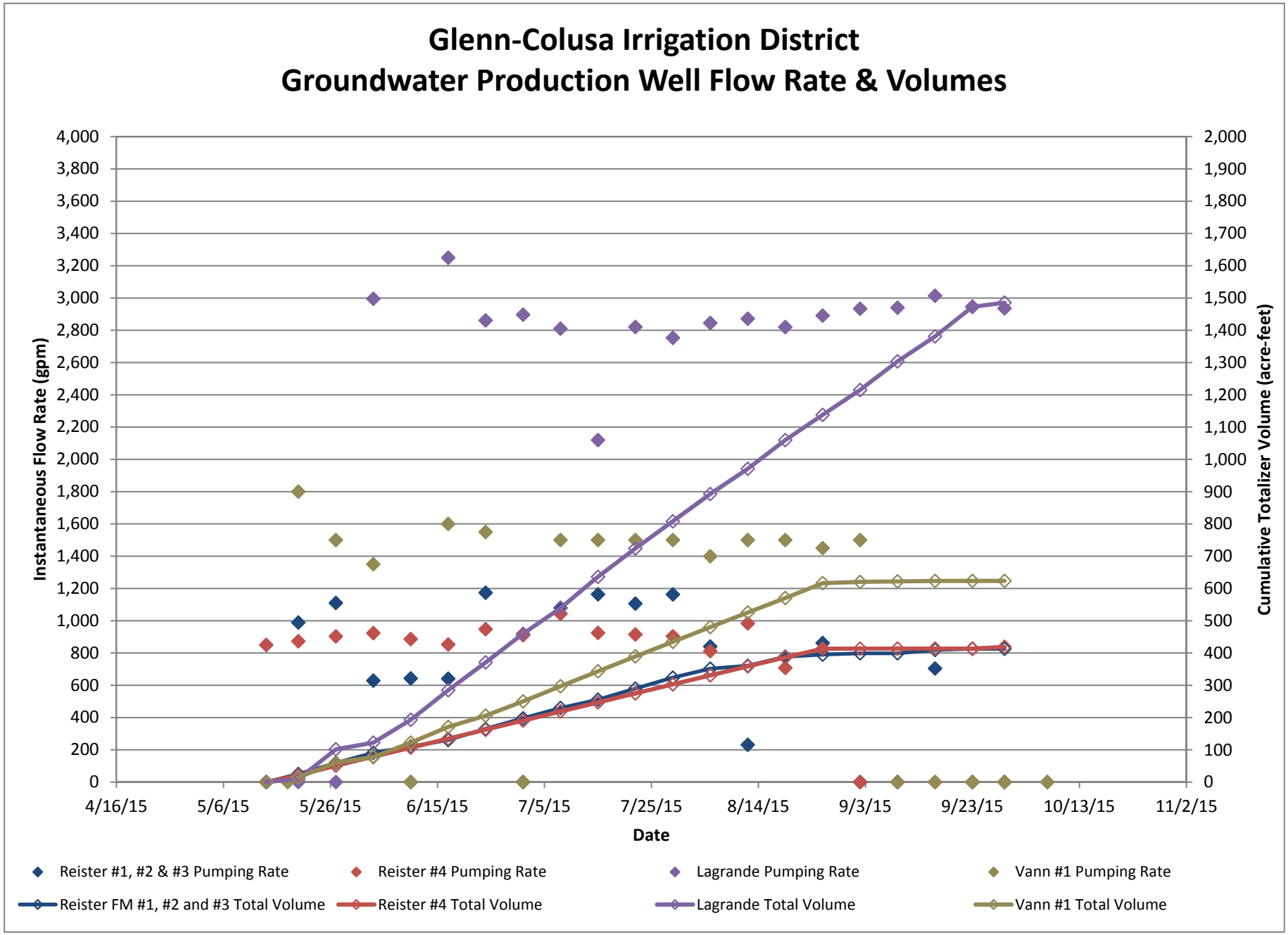


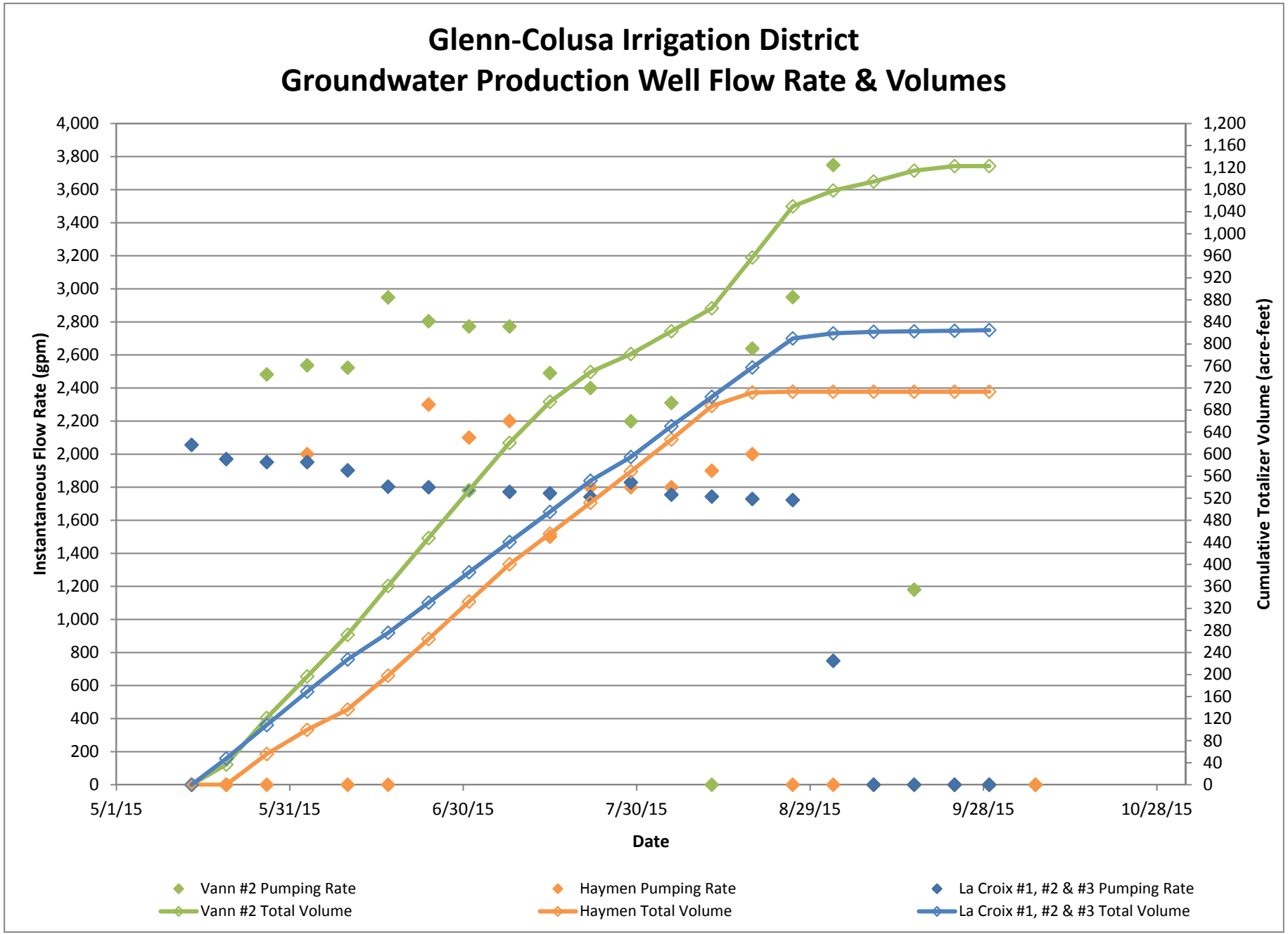
Glenn-Colusa Irrigation District
DWR Monitoring Well Groundwater Level Data

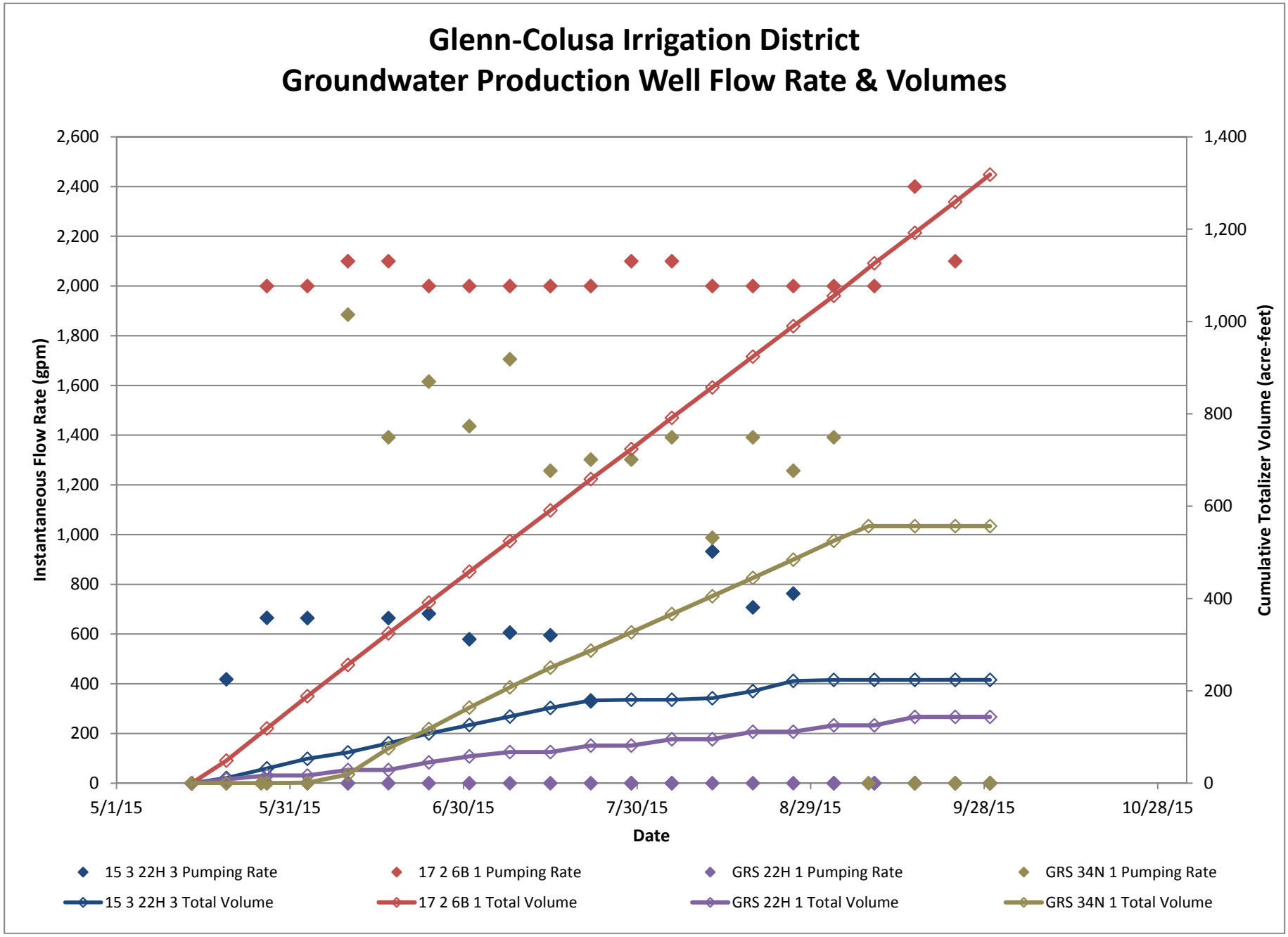


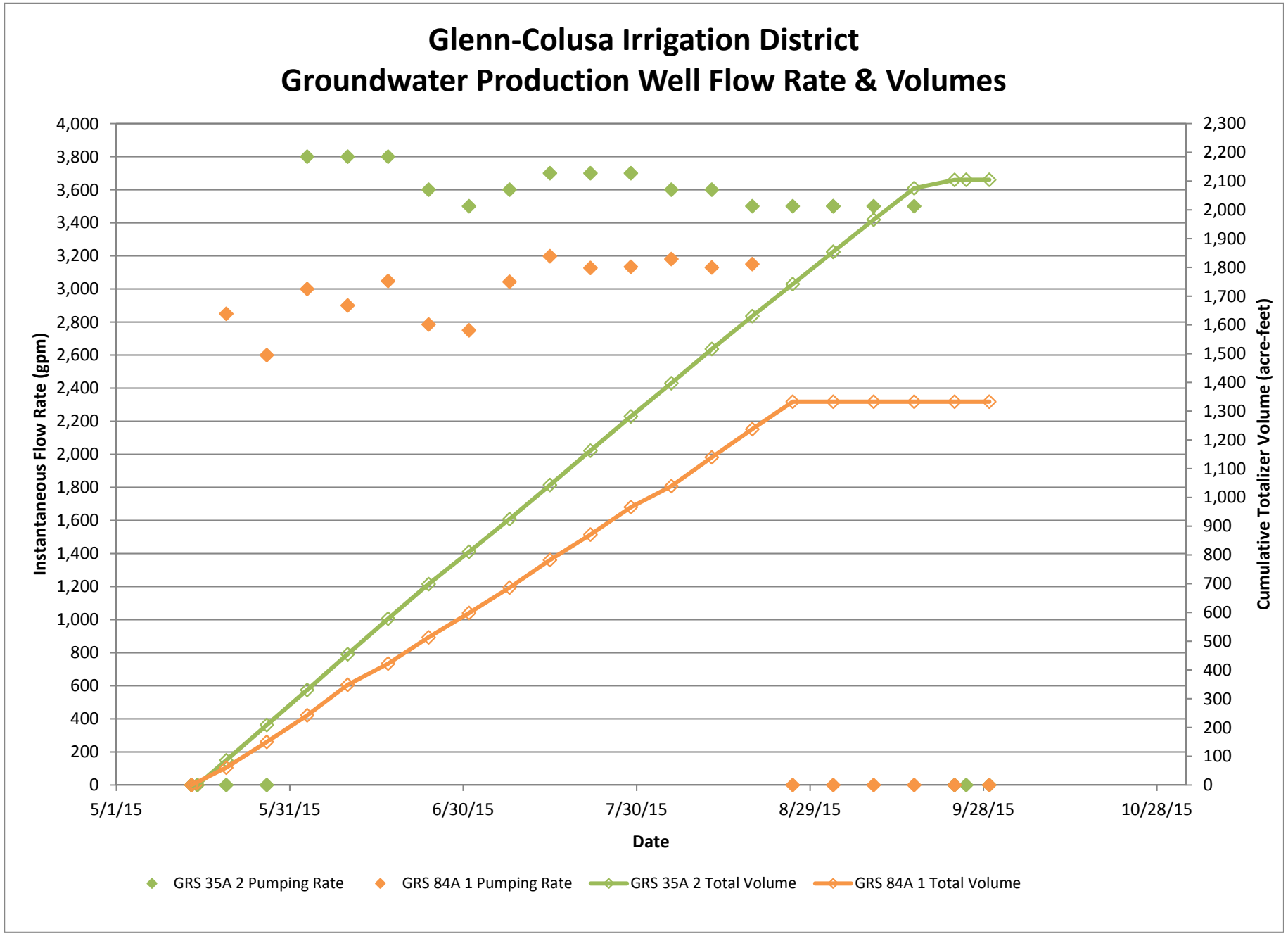
Glenn-Colusa Irrigation District
DWR Monitoring Well Groundwater Level Data



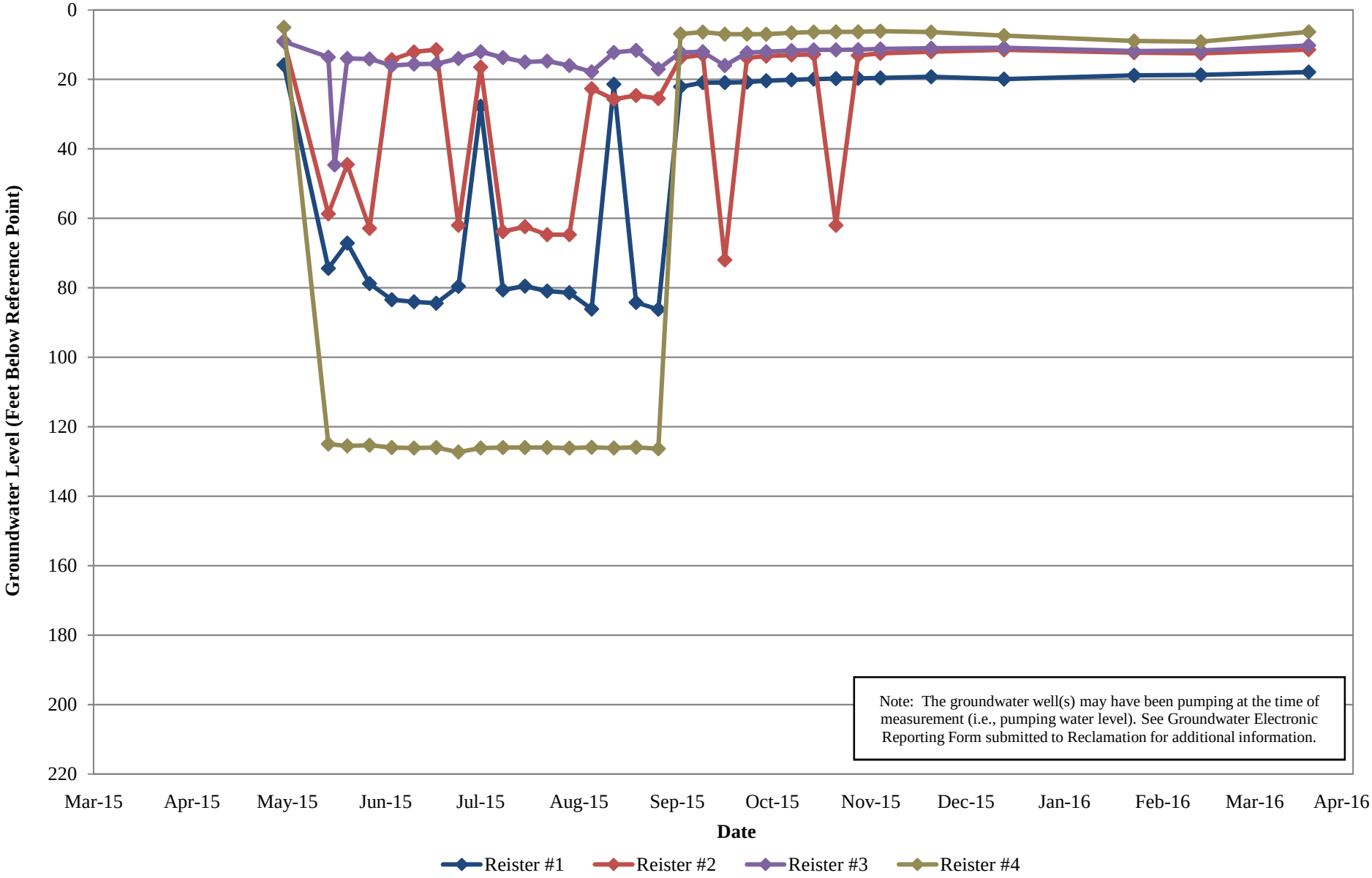

Glenn-Colusa Irrigation District
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
Date
4,000
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
4/16/15
5/6/15
5/26/15
6/15/15
7/5/15
7/25/15
8/14/15
9/3/15
9/23/15
10/13/15
11/2/15
Reister #1, #2 & #3 Pumping Rate
Reister #4 Pumping Rate
Lagrande Pumping Rate
Vann #1 Pumping Rate
Reister FM #1, #2 and #3 Total Volume
Reister #4 Total Volume
Lagrande Total Volume
Vann #1 Total Volume


Glenn-Colusa Irrigation District
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
Date
4,000
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1,200
1,160
1,120
1,080
1,040
1,000
960
920
880
840
800
760
720
680
640
600
560
520
480
440
400
360
320
280
240
200
160
120
80
40
0
5/1/15
5/31/15
6/30/15
7/30/15
8/29/15
9/28/15
10/28/15
Vann #2 Pumping Rate
Haymen Pumping Rate
La Croix #1, #2 & #3 Pumping Rate
Vann #2 Total Volume
Haymen Total Volume
La Croix #1, #2 & #3 Total Volume

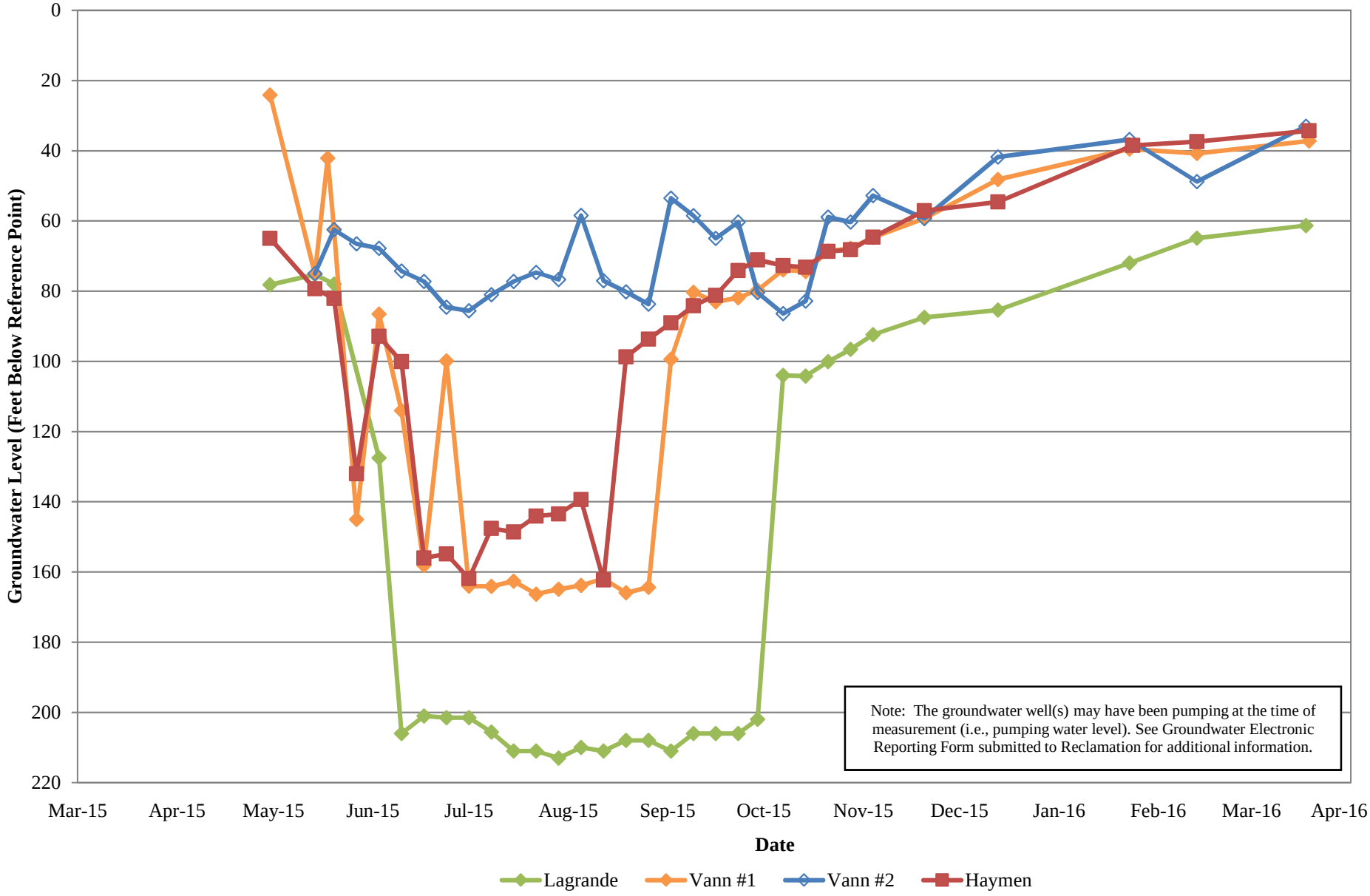

Glenn-Colusa Irrigation District
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
Date
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1,400
1,200
1,000
800
600
400
200
0
5/1/15
5/31/15
6/30/15
7/30/15
8/29/15
9/28/15
10/28/15
15 3 22H 3 Pumping Rate
17 2 6B 1 Pumping Rate
GRS 22H 1 Pumping Rate
GRS 34N 1 Pumping Rate
15 3 22H 3 Total Volume
17 2 6B 1 Total Volume
GRS 22H 1 Total Volume
GRS 34N 1 Total Volume


Glenn-Colusa Irrigation District
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
Date
4,000
3,800
3,600
3,400
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2,300
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/1/15
5/31/15
6/30/15
7/30/15
8/29/15
9/28/15
10/28/15
GRS 35A 2 Pumping Rate
GRS 84A 1 Pumping Rate
GRS 35A 2 Total Volume
GRS 84A 1 Total Volume

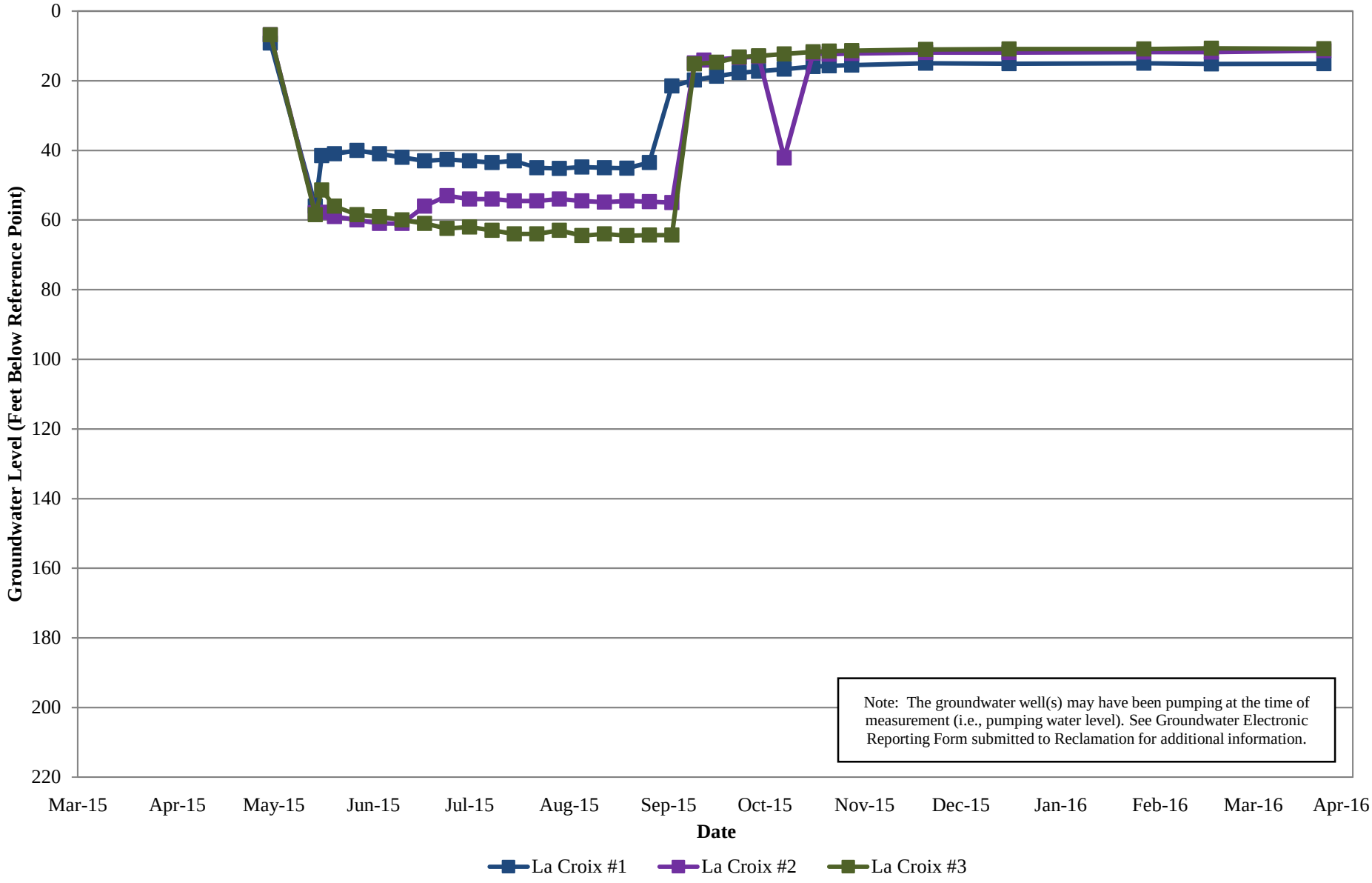
Glenn-Colusa Irrigation District
Production Well Groundwater Level Data



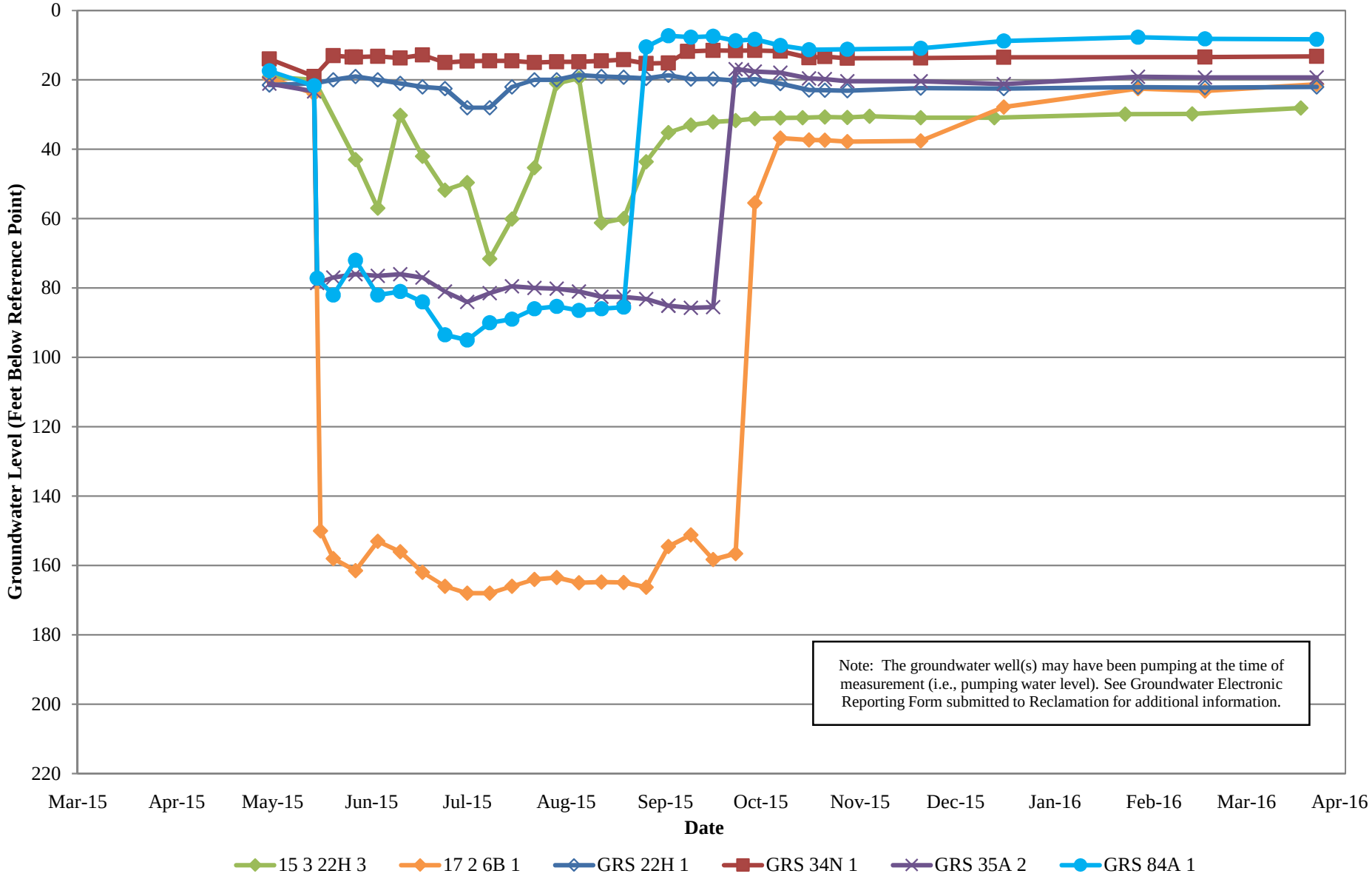
Glenn-Colusa Irrigation District
Production Well Groundwater Level Data

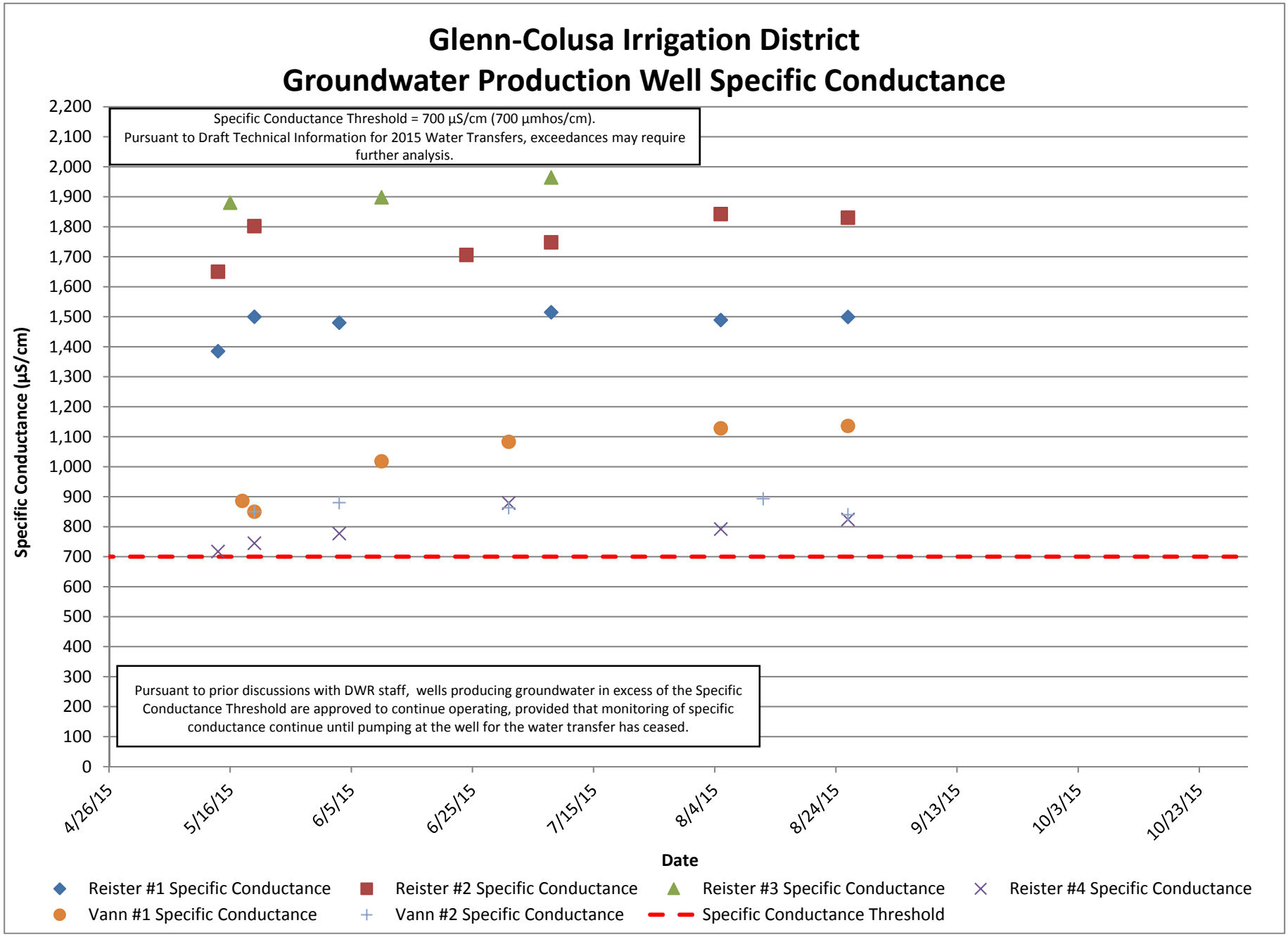


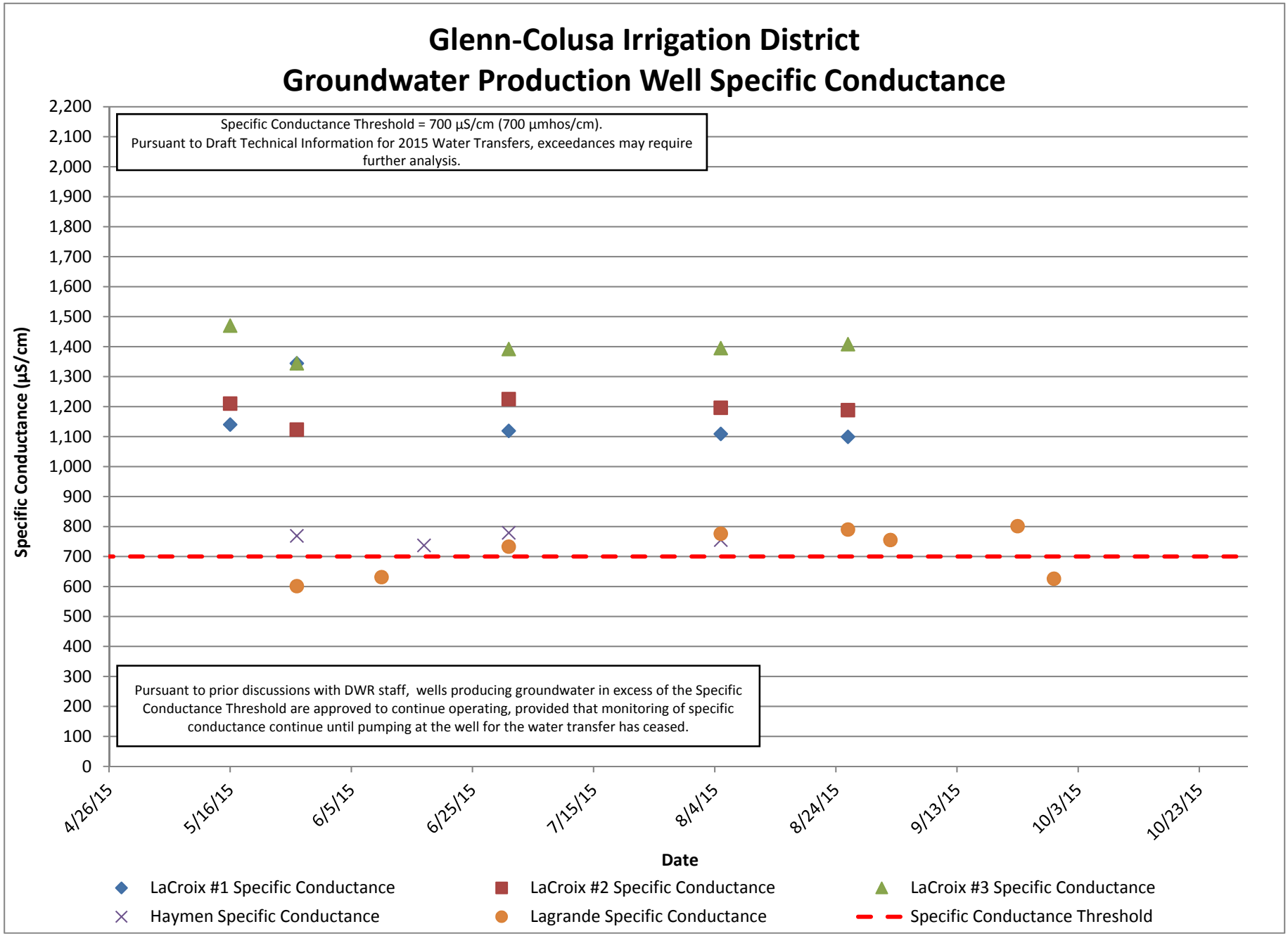
Glenn-Colusa Irrigation District
Production Well Groundwater Level Data



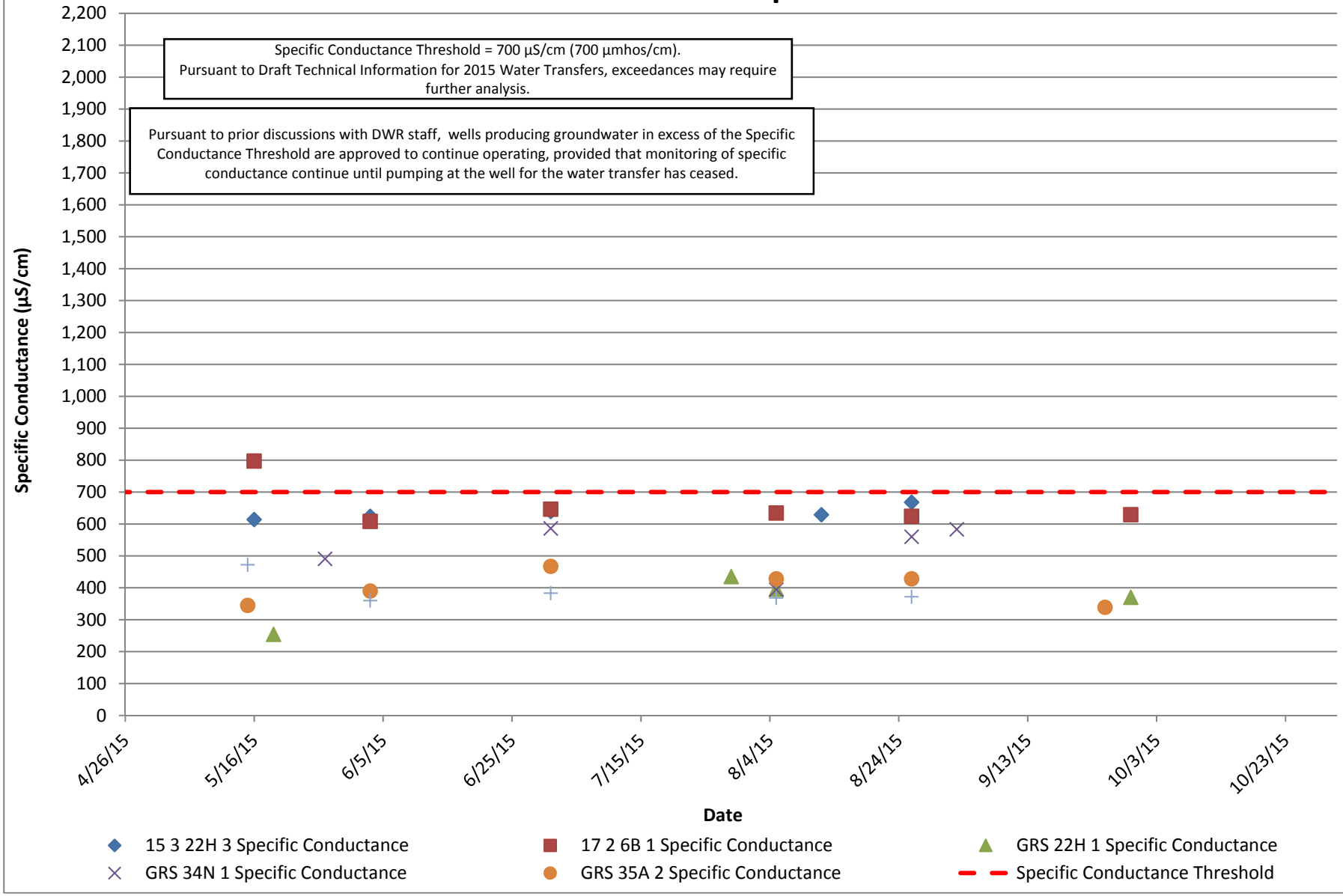
Glenn-Colusa Irrigation District
Production Well Groundwater Level Data




Glenn-Colusa Irrigation District
Groundwater Production Well Specific Conductance
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2015 Water Transfers, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
Specific Conductance (µS/cm)
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
4/26/15
5/16/15
6/5/15
6/25/15
7/15/15
8/4/15
8/24/15
9/13/15
10/3/15
10/23/15
Date
Reister #1 Specific Conductance
Reister #2 Specific Conductance
Reister #3 Specific Conductance
Reister #4 Specific Conductance
Vann #1 Specific Conductance
Vann #2 Specific Conductance
Specific Conductance Threshold


Glenn-Colusa Irrigation District
Groundwater Production Well Specific Conductance
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2015 Water Transfers, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
Specific Conductance (µS/cm)
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
4/26/15
5/16/15
6/5/15
6/25/15
7/15/15
8/4/15
8/24/15
9/13/15
10/3/15
10/23/15
Date
LaCroix #1 Specific Conductance
LaCroix #2 Specific Conductance
LaCroix #3 Specific Conductance
Haymen Specific Conductance
Lagrande Specific Conductance
Specific Conductance Threshold

Glenn-Colusa Irrigation District
Groundwater Production Well Specific Conductance



Garden Highway Mutual Water Company

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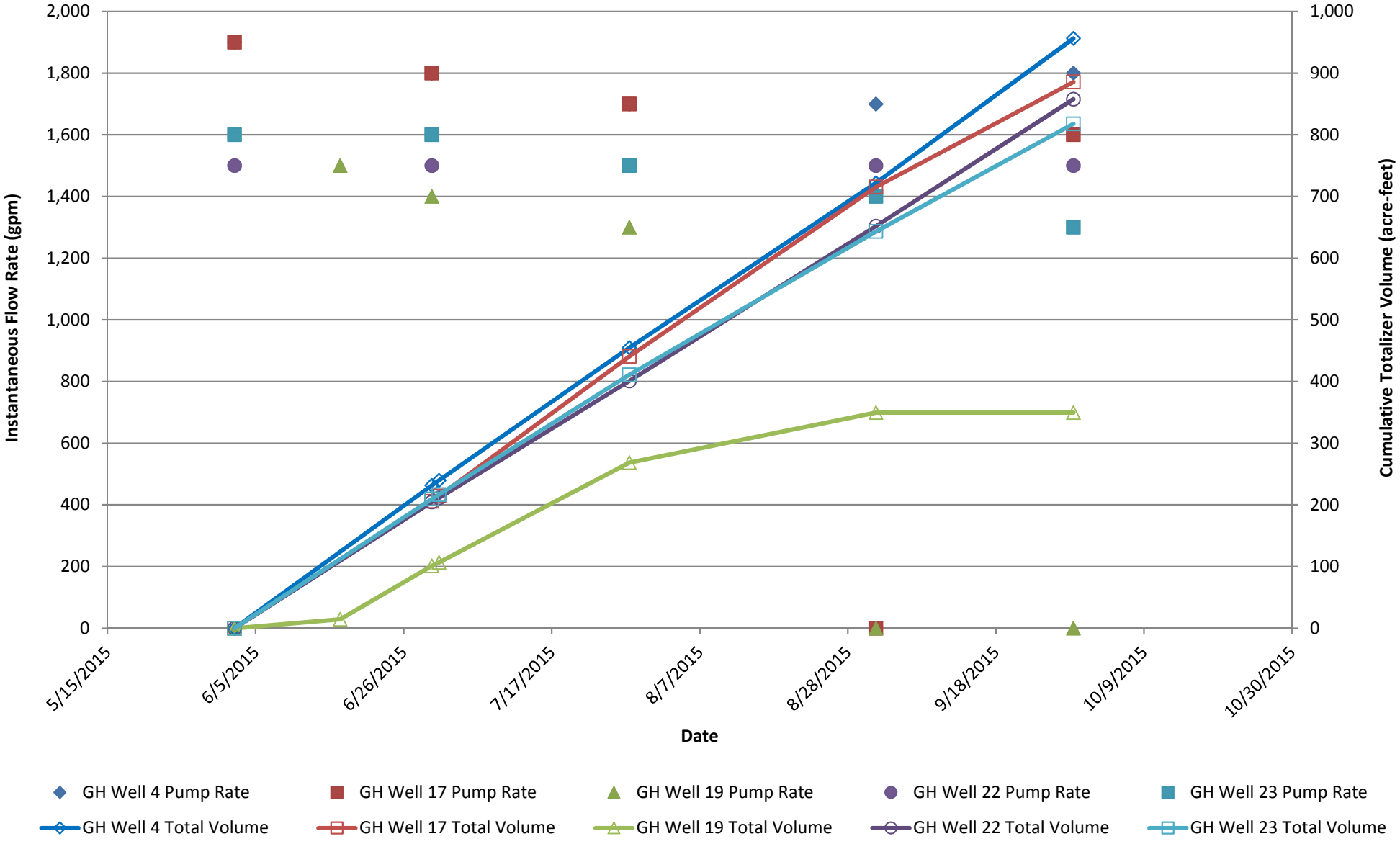
Figure 2
Garden Highway Mutual Water Company
Groundwater Production Well Flow Rates & Volumes



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Tab: Production Data

Figure 3A
Garden Highway Mutual Water Company
Production Well Groundwater Level Data

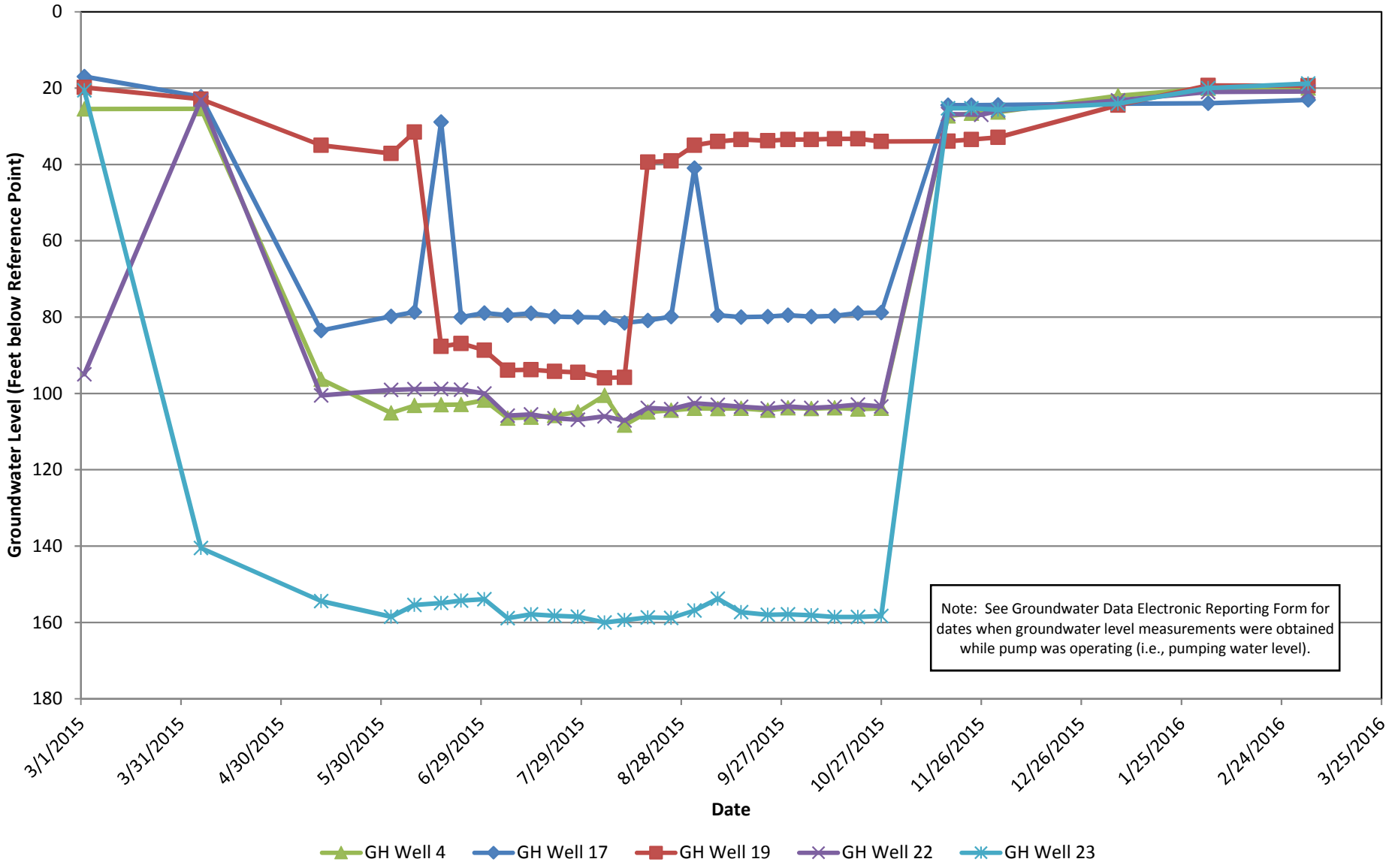
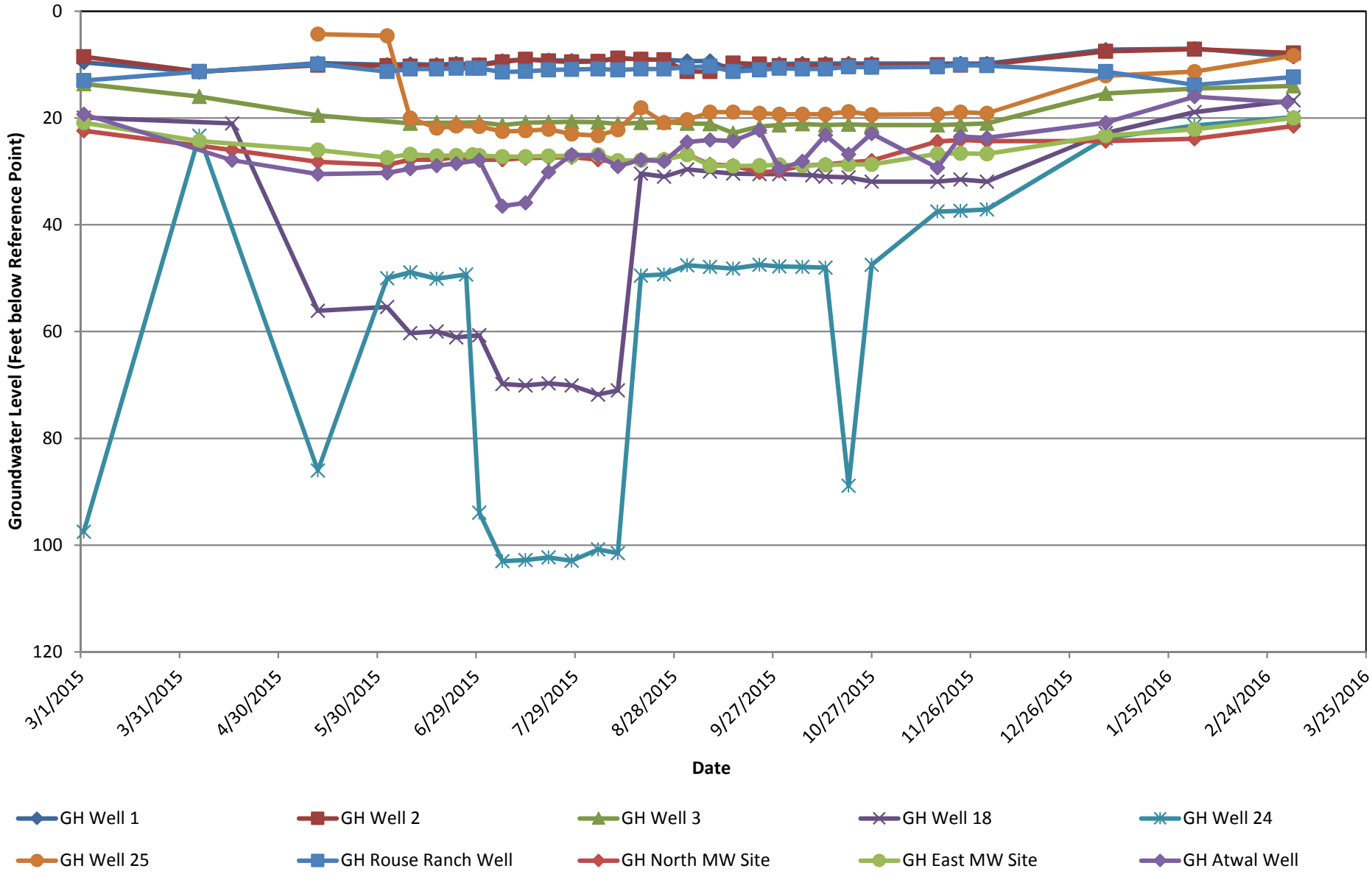


Figure 3B
Garden Highway Mutual Water Company
Monitoring Well Groundwater Level Data



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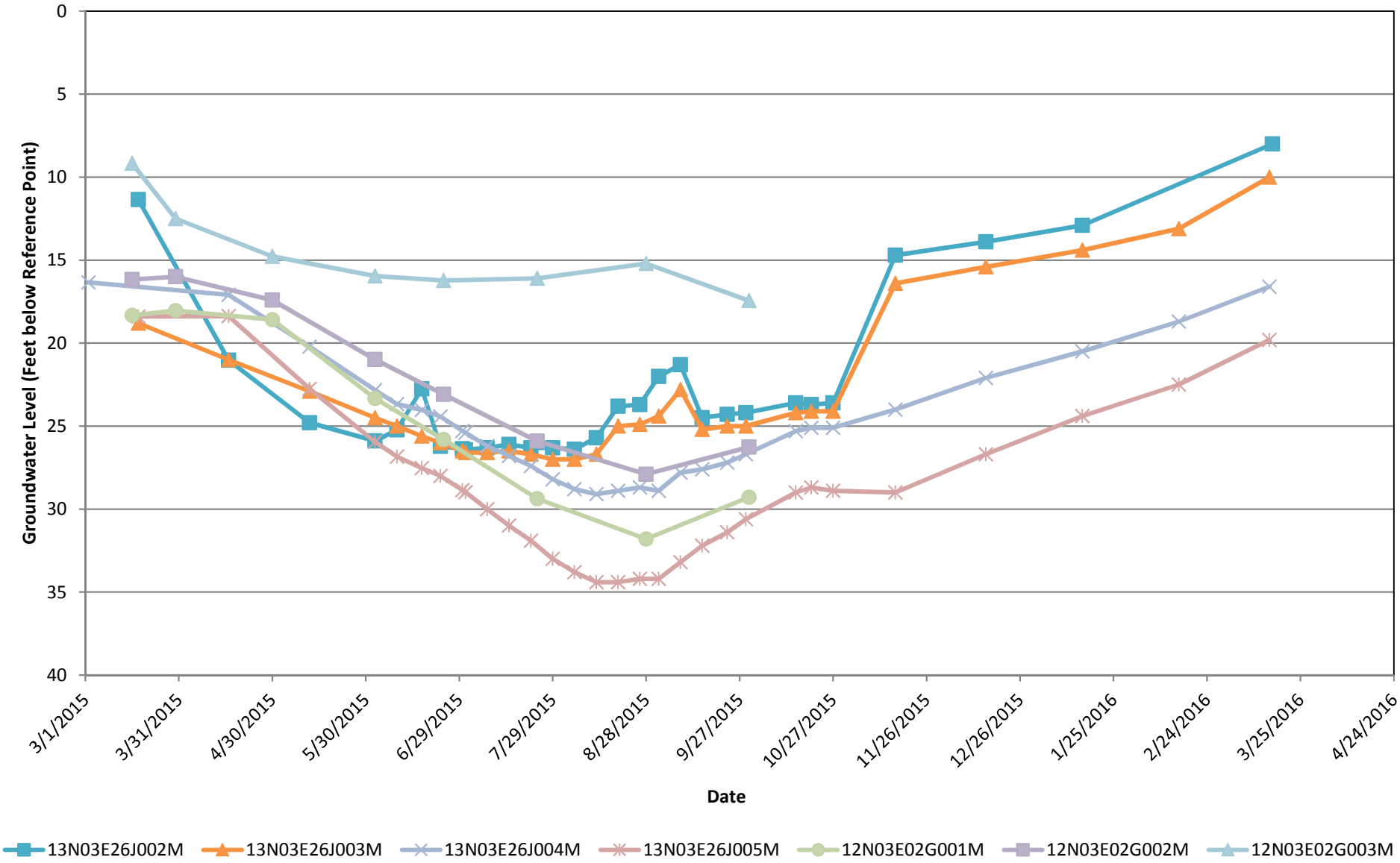
Tab: Monitoring Well Water Levels 1

Figure 3C
Garden Highway Mutual Water Company
Monitoring Well Groundwater Level Data



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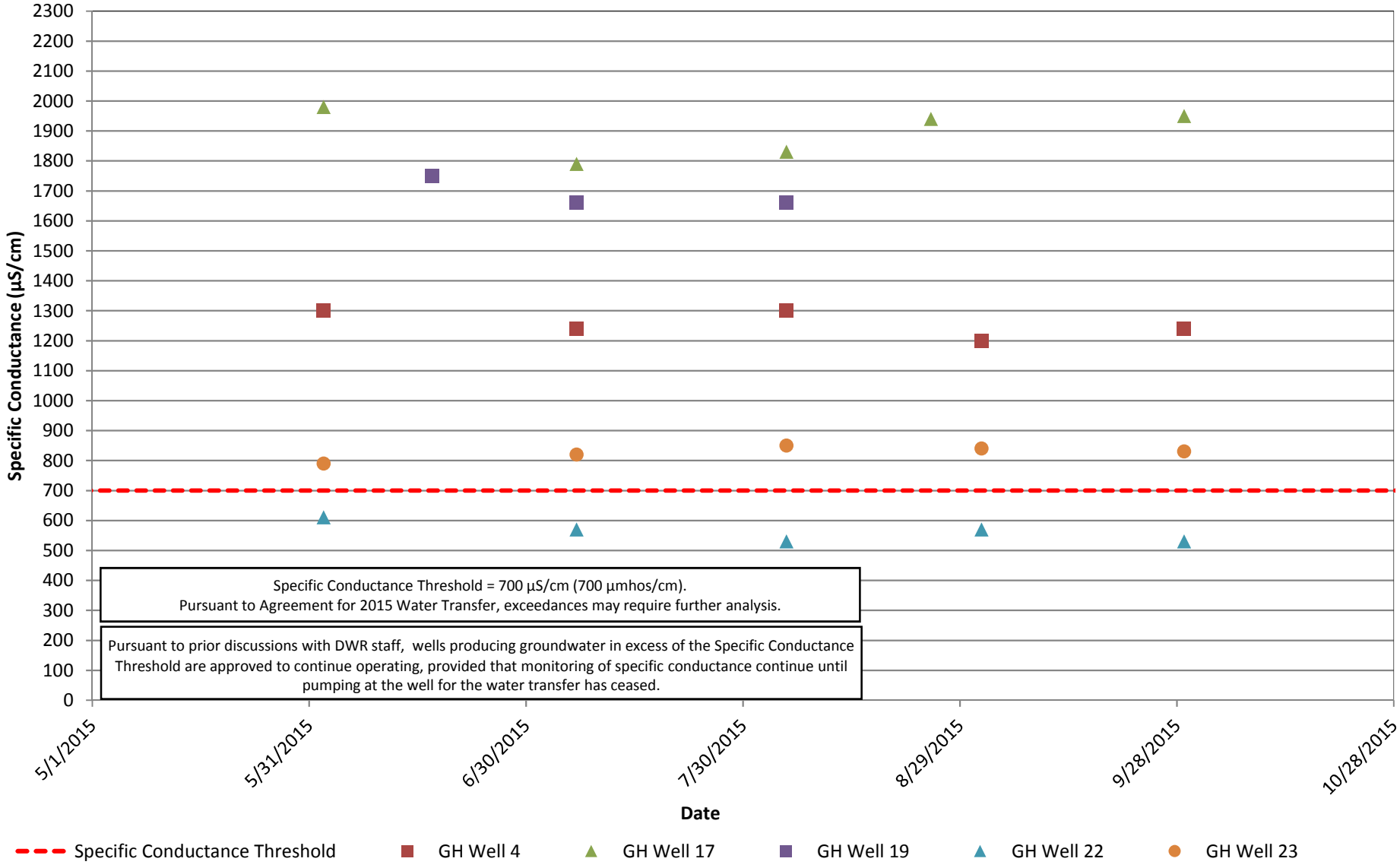
Tab: Monitoring Well Water Levels 2

Figure 7
Garden Highway Mutual Water Company
Groundwater Production Well Specific Conductance



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Tab: Water Quality Data

Natomas Central Mutual Water Company

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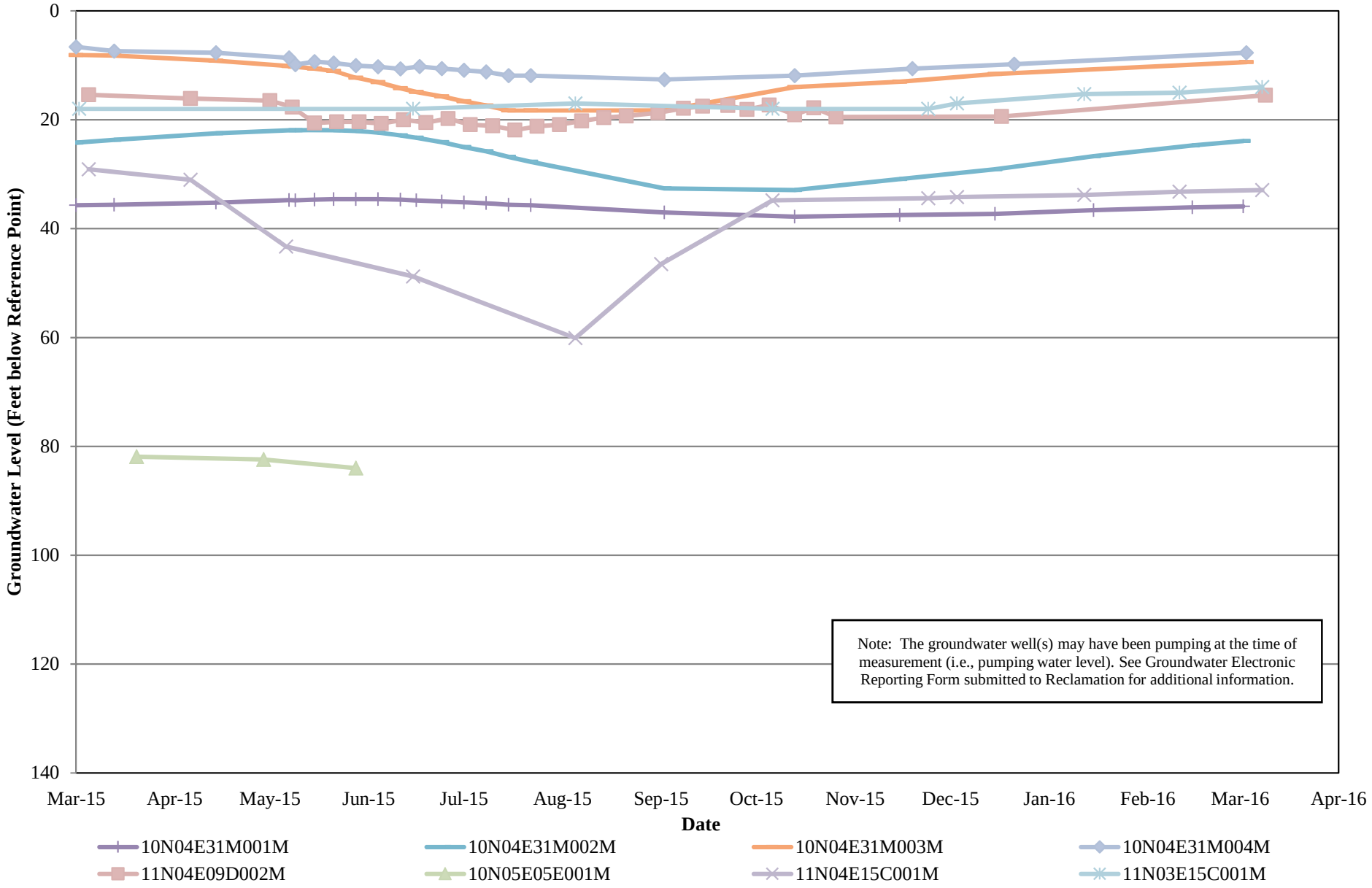
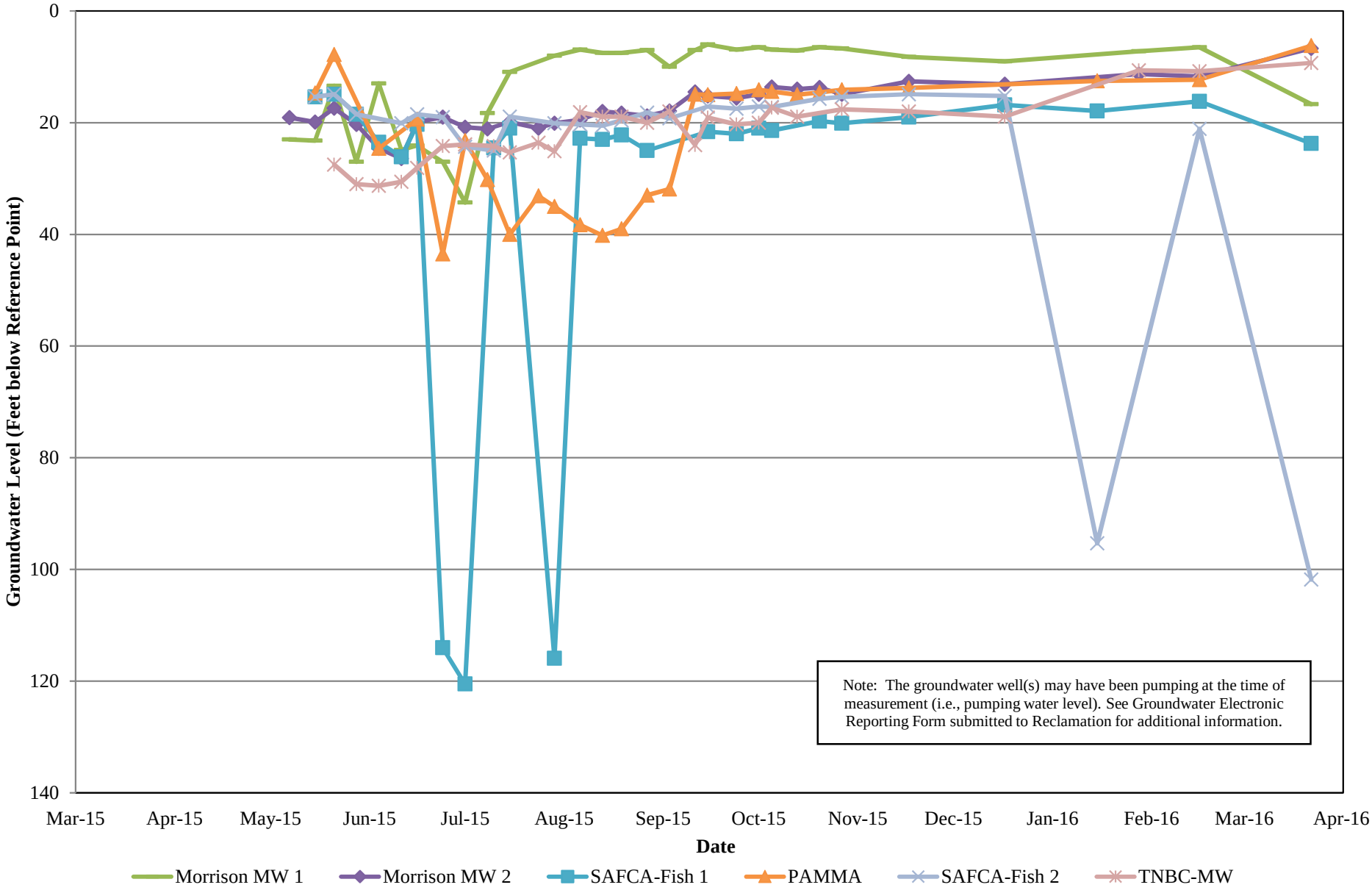
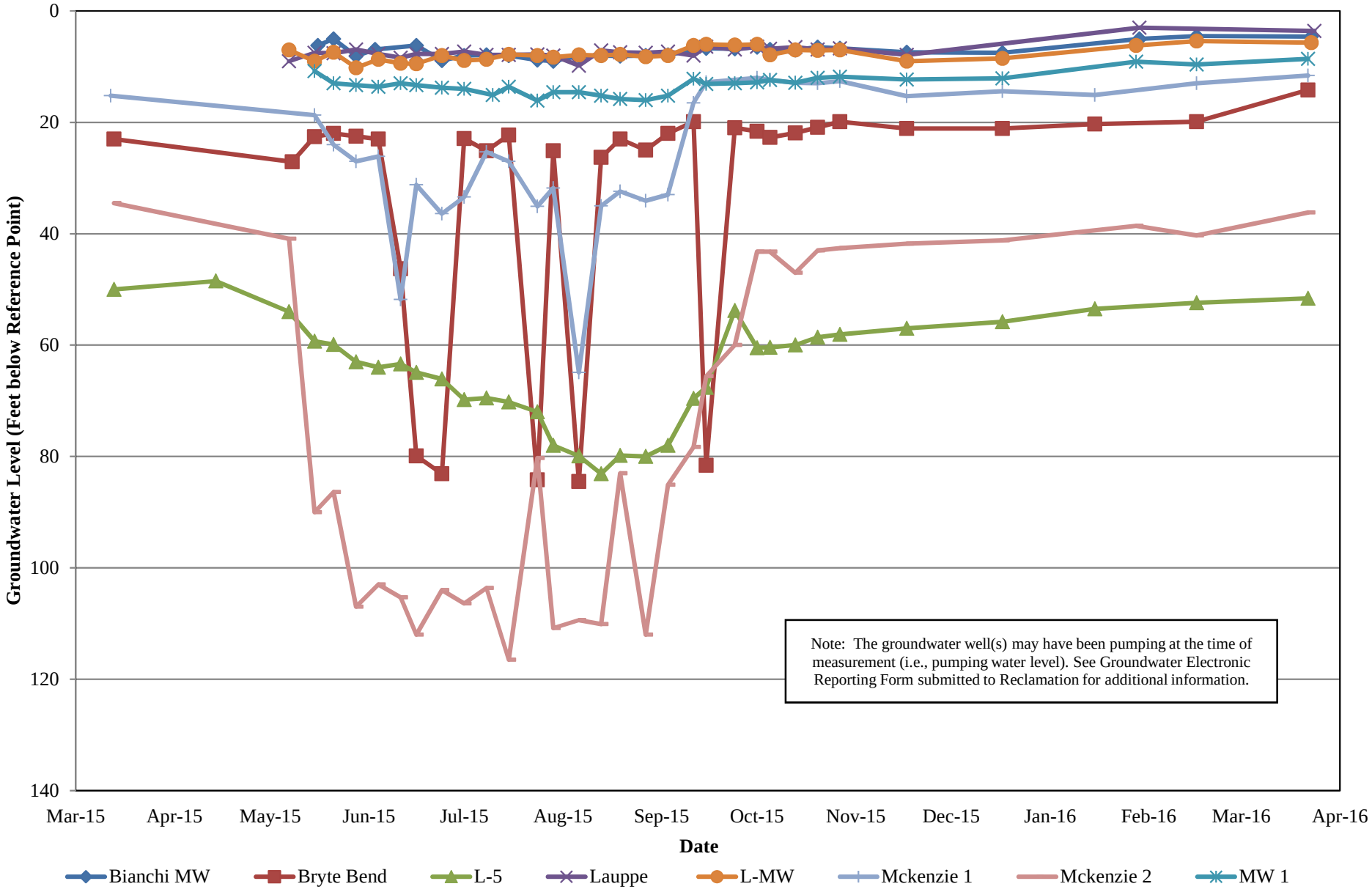
Natomas Central Mutual Water Company
DWR Monitoring Well Groundwater Level Data



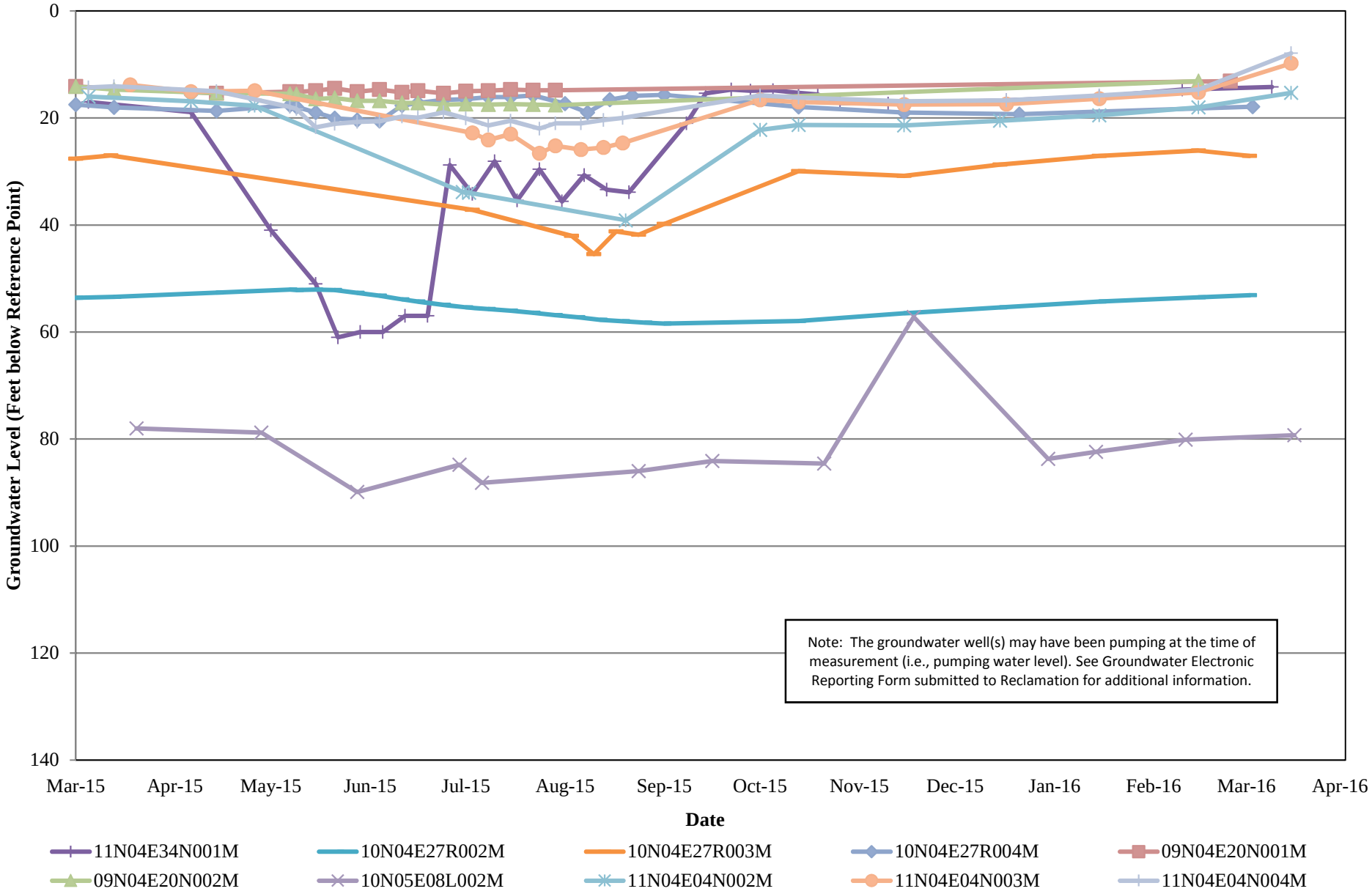
Natomas Central Mutual Water Company
Monitoring Well Groundwater Level Data

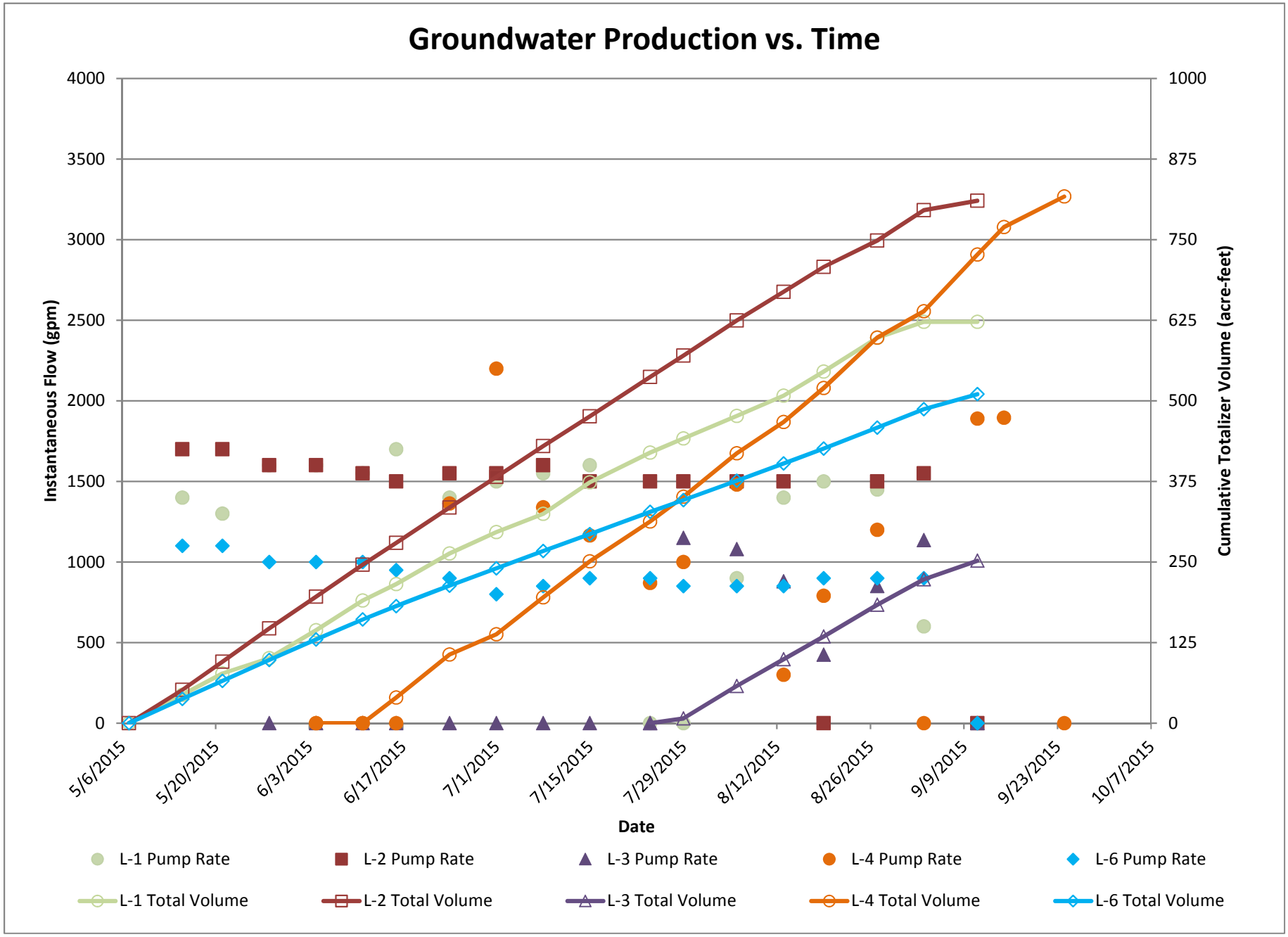


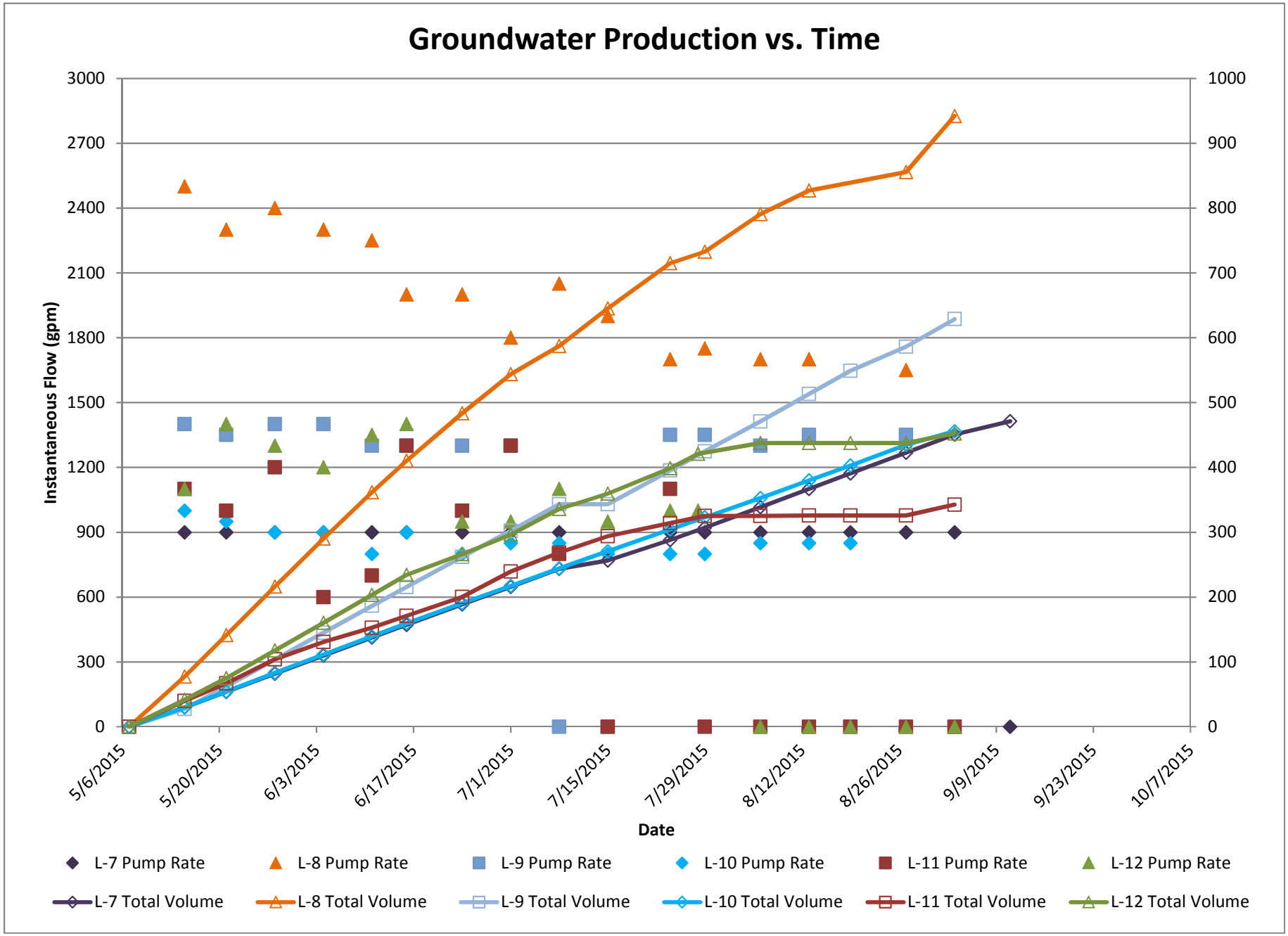
Natomas Central Mutual Water Company
Monitoring Well Groundwater Level Data

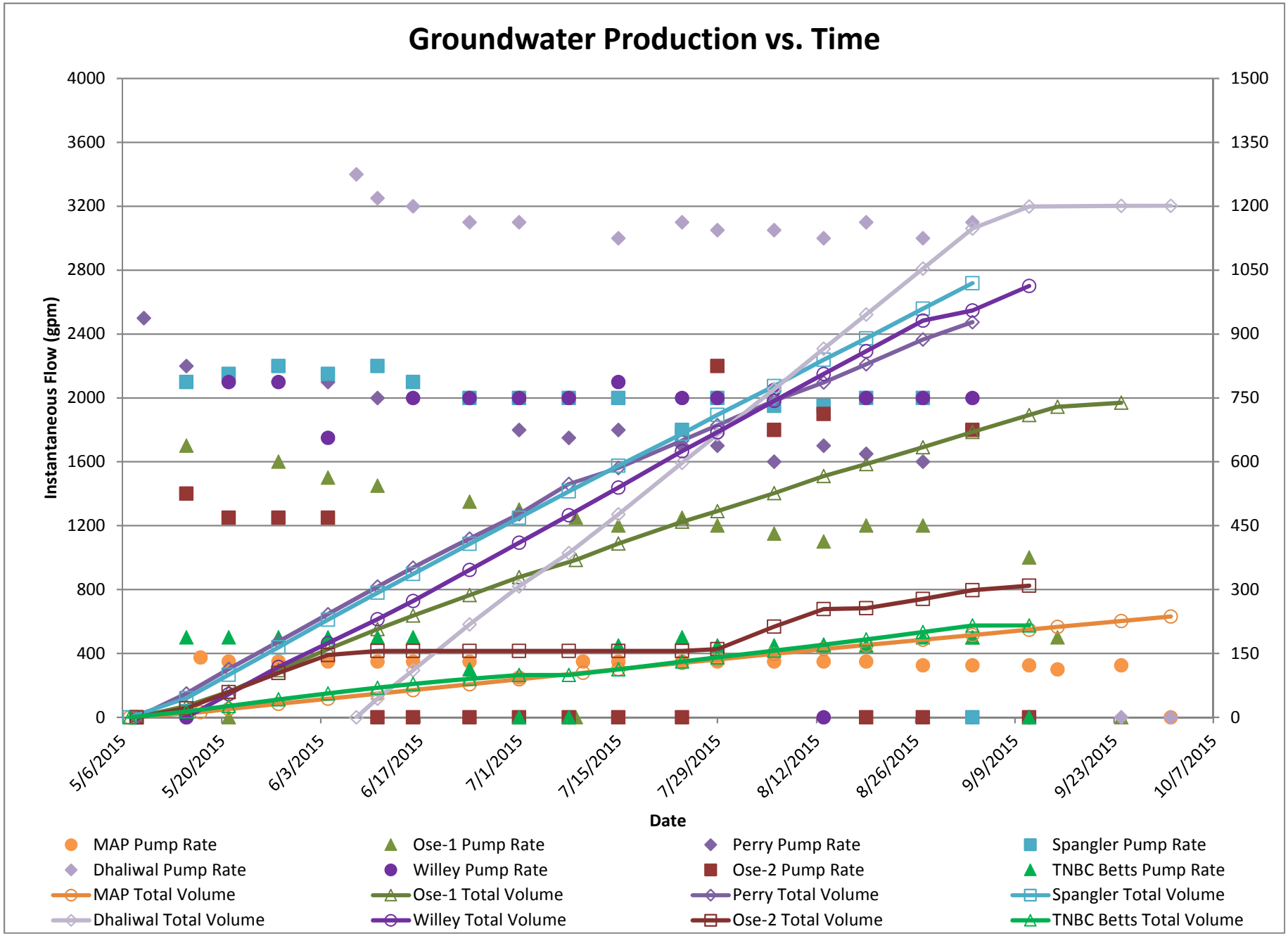


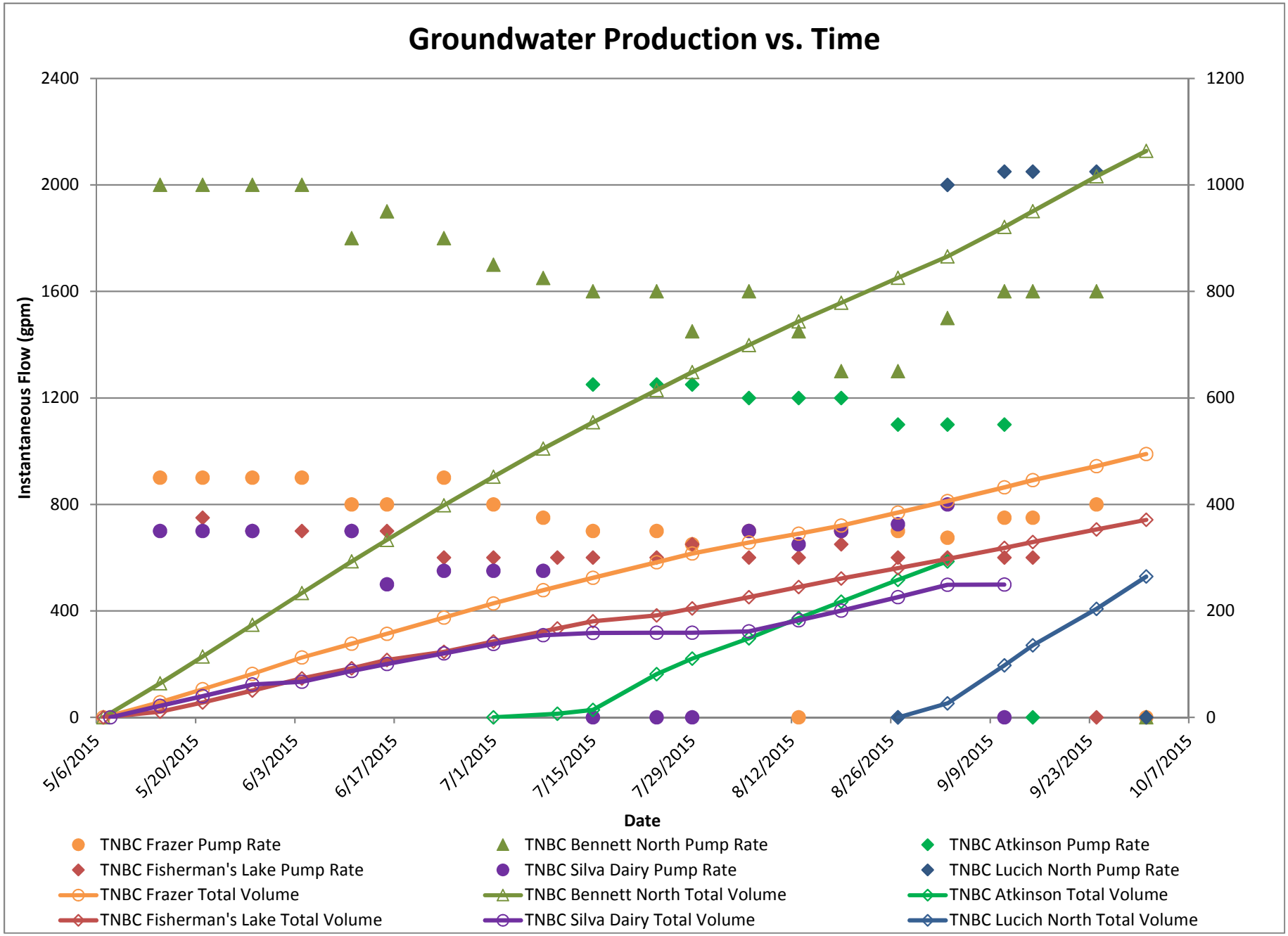
Natomas Central Mutual Water Company
DWR Monitoring Well Groundwater Level Data



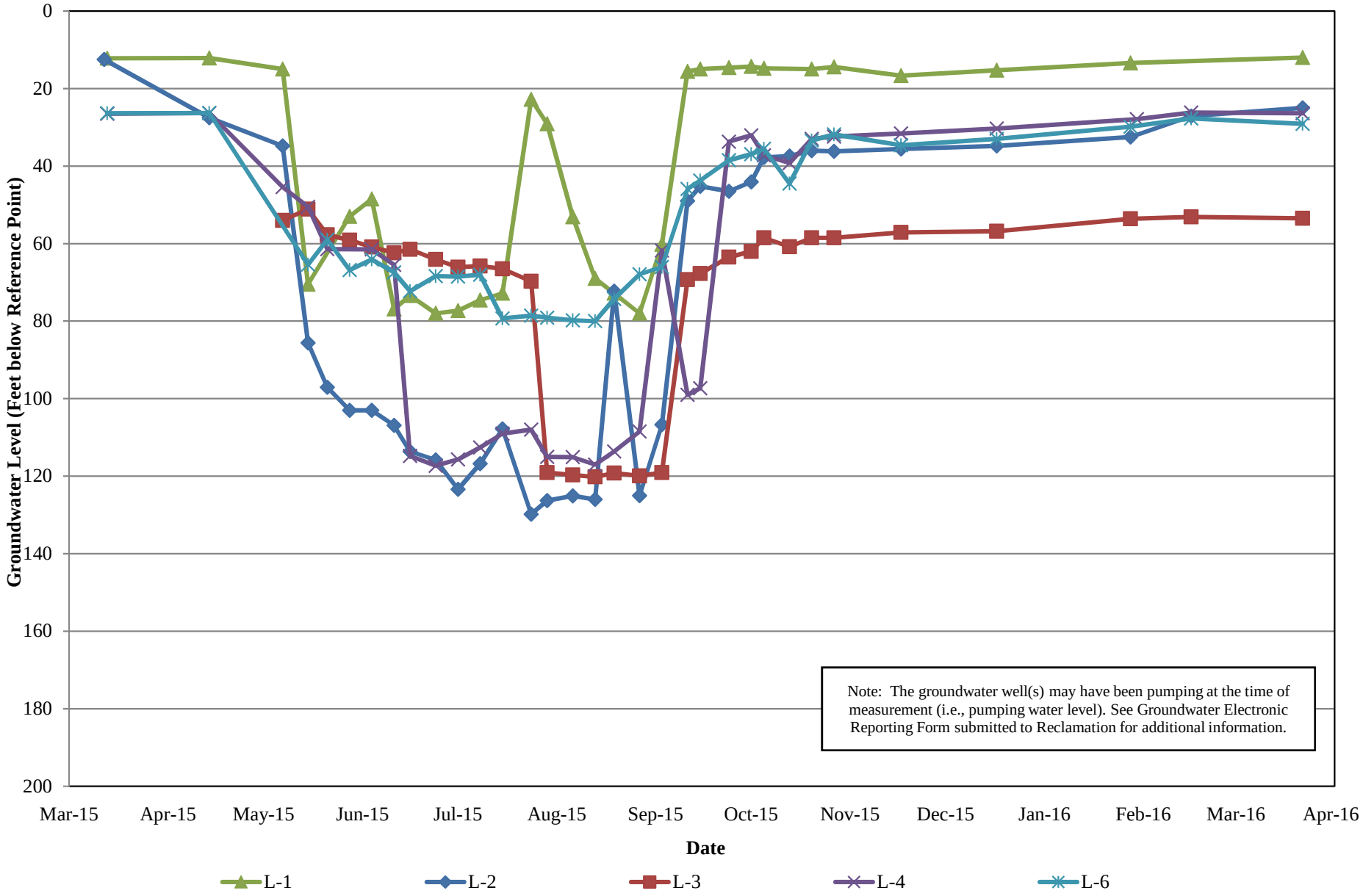

Groundwater Production vs. Time
Instantaneous Flow (gpm)
Cumulative Totalizer Volume (acre-feet)
4000
3500
3000
2500
2000
1500
1000
500
0
1000
875
750
625
500
375
250
125
0
5/6/2015
5/20/2015
6/3/2015
6/17/2015
7/1/2015
7/15/2015
7/29/2015
8/12/2015
8/26/2015
9/9/2015
9/23/2015
10/7/2015
Date
L-1 Pump Rate
L-2 Pump Rate
L-3 Pump Rate
L-4 Pump Rate
L-6 Pump Rate
L-1 Total Volume
L-2 Total Volume
L-3 Total Volume
L-4 Total Volume
L-6 Total Volume


Groundwater Production vs. Time
Instantaneous Flow (gpm)
3000
2700
2400
2100
1800
1500
1200
900
600
300
0
1000
900
800
700
600
500
400
300
200
100
0
5/6/2015
5/20/2015
6/3/2015
6/17/2015
7/1/2015
7/15/2015
7/29/2015
8/12/2015
8/26/2015
9/9/2015
9/23/2015
10/7/2015
Date
L-7 Pump Rate
L-8 Pump Rate
L-9 Pump Rate
L-10 Pump Rate
L-11 Pump Rate
L-12 Pump Rate
L-7 Total Volume
L-8 Total Volume
L-9 Total Volume
L-10 Total Volume
L-11 Total Volume
L-12 Total Volume

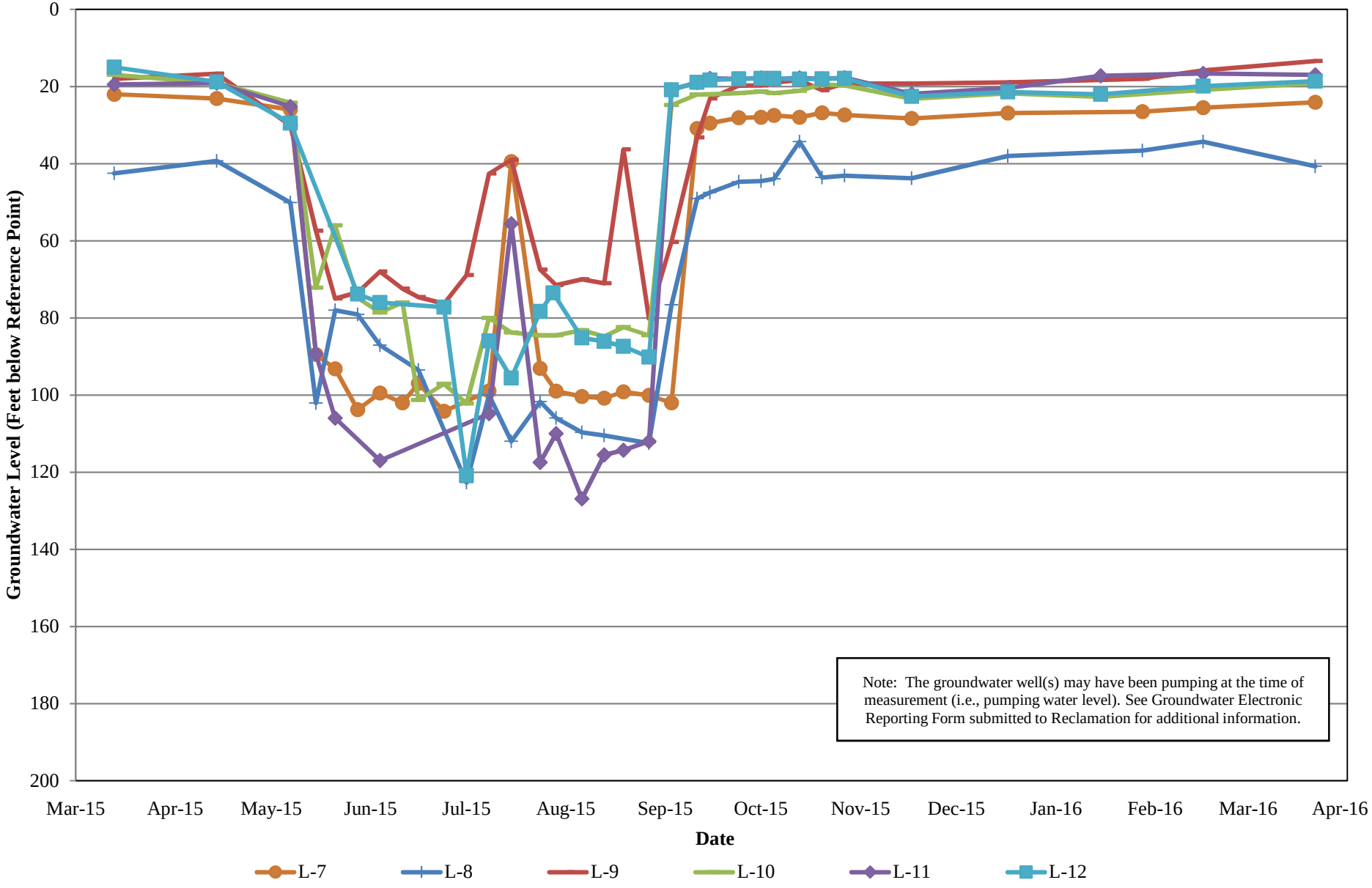

Groundwater Production vs. Time
Instantaneous Flow (gpm)
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
1500
1350
1200
1050
900
750
600
450
300
150
0
5/6/2015
5/20/2015
6/3/2015
6/17/2015
7/1/2015
7/15/2015
7/29/2015
8/12/2015
8/26/2015
9/9/2015
9/23/2015
10/7/2015
Date
MAP Pump Rate
Ose-1 Pump Rate
Perry Pump Rate
Spangler Pump Rate
Dhaliwal Pump Rate
Willey Pump Rate
Ose-2 Pump Rate
TNBC Betts Pump Rate
MAP Total Volume
Ose-1 Total Volume
Perry Total Volume
Spangler Total Volume
Dhaliwal Total Volume
Willey Total Volume
Ose-2 Total Volume
TNBC Betts Total Volume


Groundwater Production vs. Time
Instantaneous Flow (gpm)
2400
2000
1600
1200
800
400
0
1200
1000
800
600
400
200
0
5/6/2015
5/20/2015
6/3/2015
6/17/2015
7/1/2015
7/15/2015
7/29/2015
8/12/2015
8/26/2015
9/9/2015
9/23/2015
10/7/2015
Date
TNBC Frazer Pump Rate
TNBC Bennett North Pump Rate
TNBC Atkinson Pump Rate
TNBC Fisherman's Lake Pump Rate
TNBC Silva Dairy Pump Rate
TNBC Lucich North Pump Rate
TNBC Frazer Total Volume
TNBC Bennett North Total Volume
TNBC Atkinson Total Volume
TNBC Fisherman's Lake Total Volume
TNBC Silva Dairy Total Volume
TNBC Lucich North Total Volume

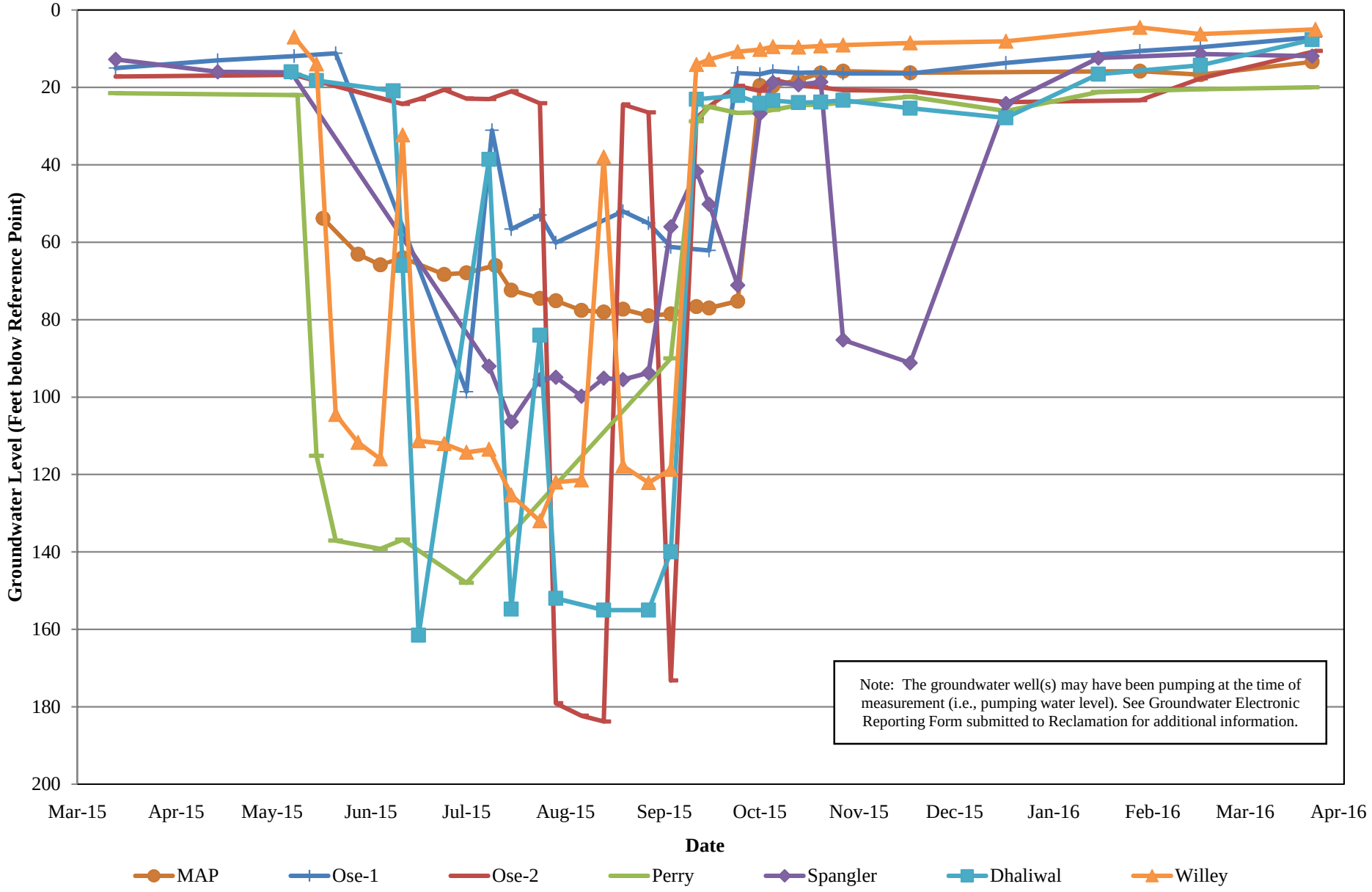
Natomas Central Mutual Water Company
Production Well Groundwater Level Data



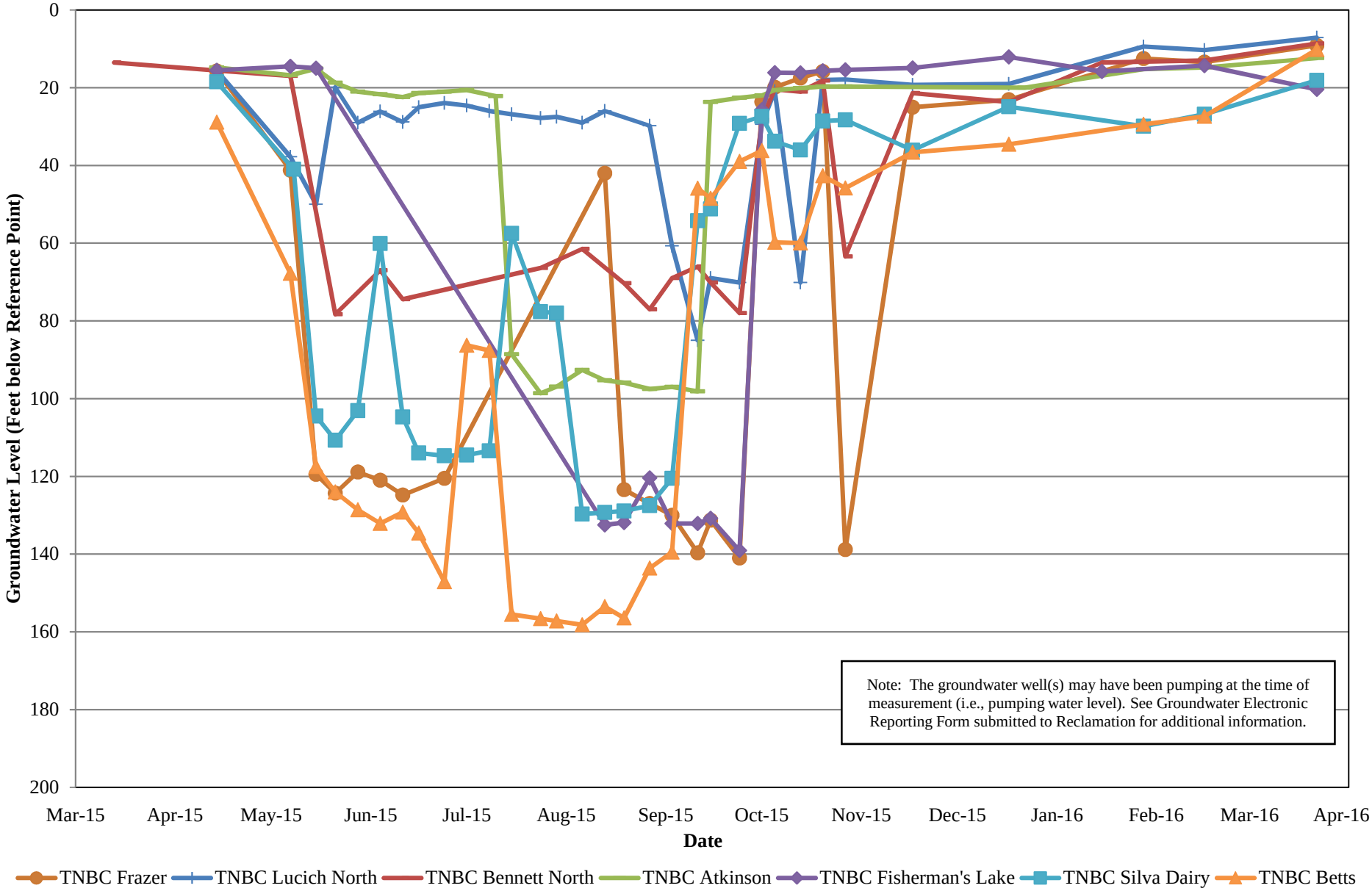
Natomas Central Mutual Water Company
Production Well Groundwater Level Data

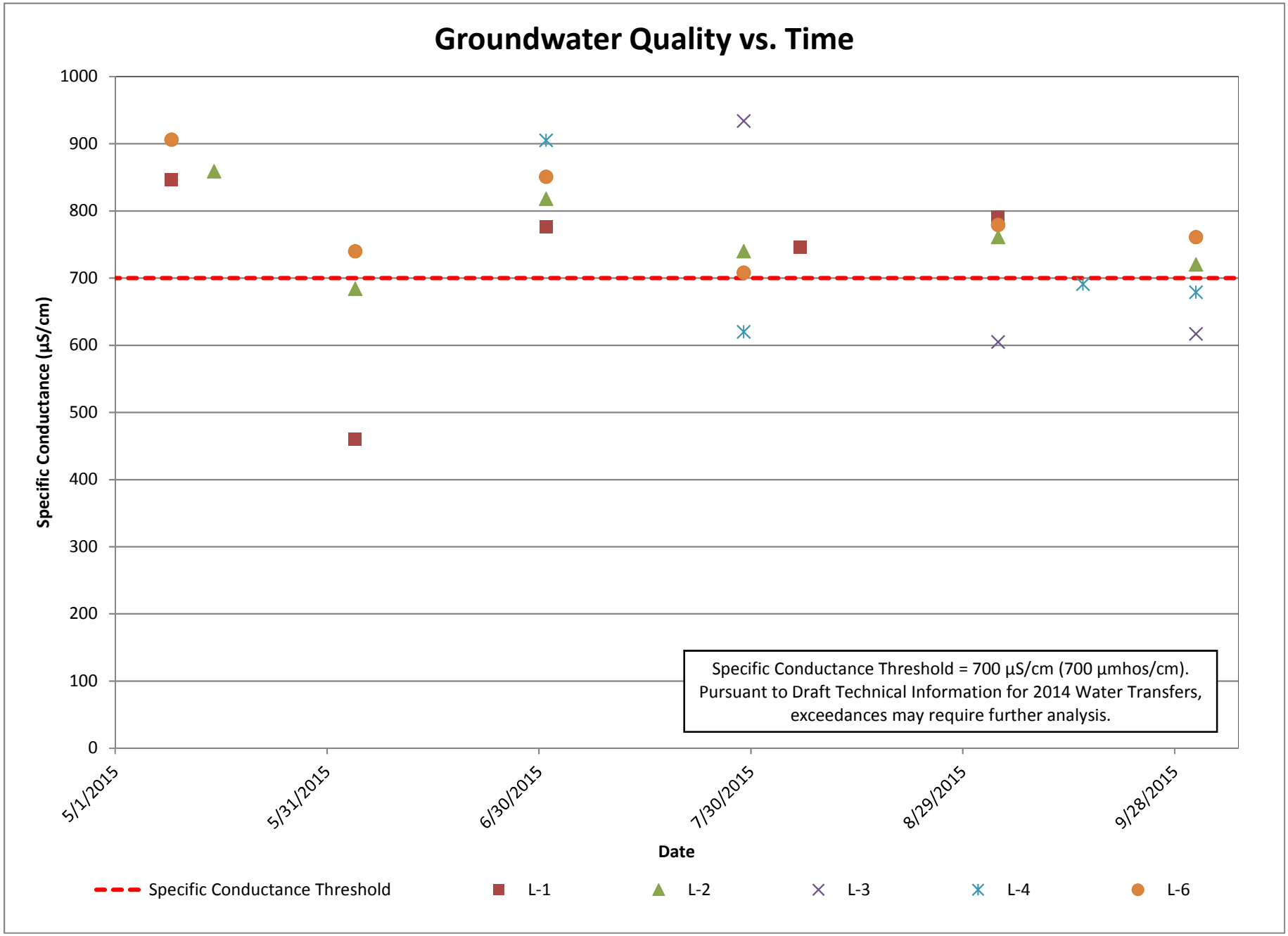


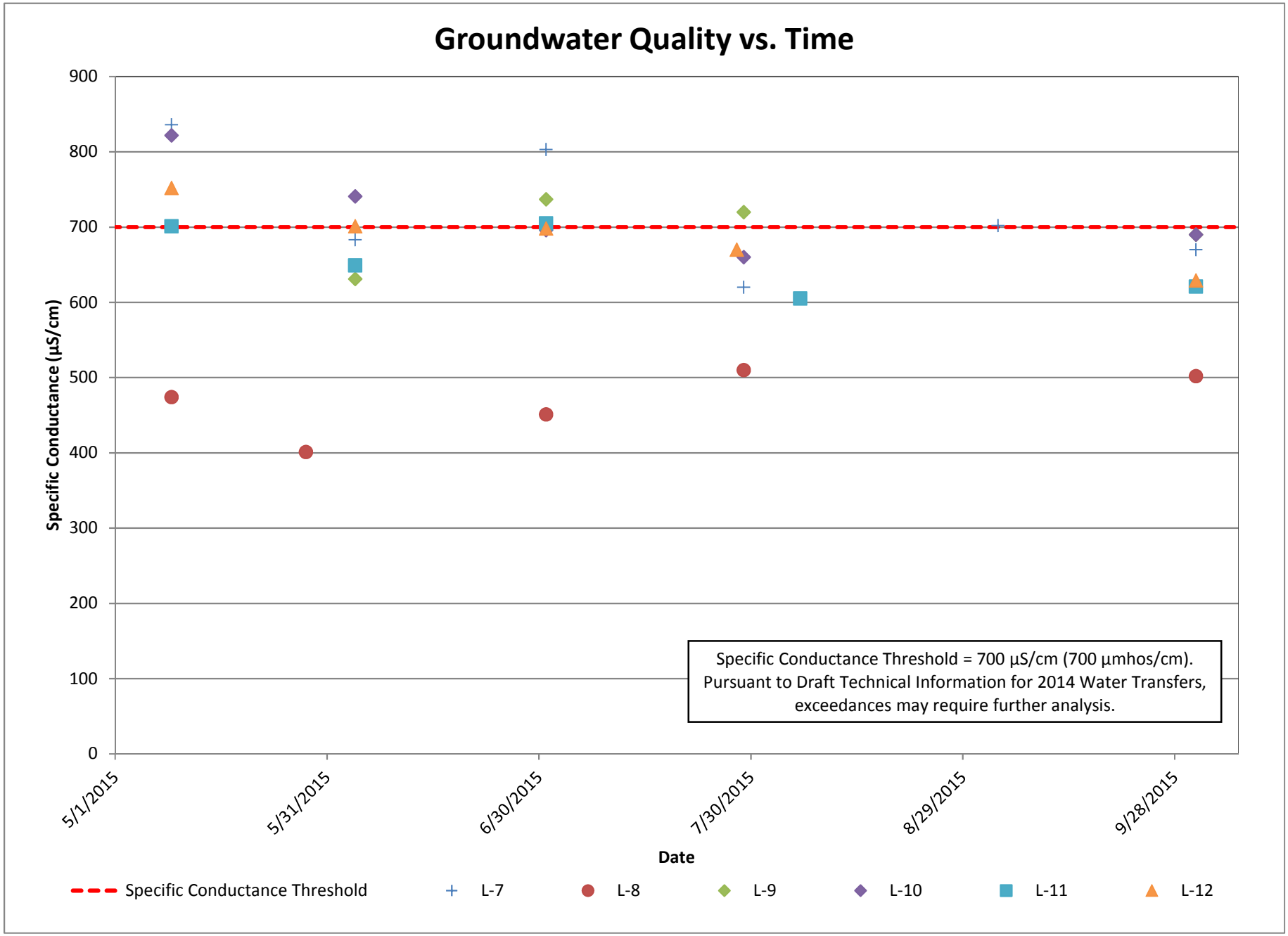
Natomas Central Mutual Water Company
Production Well Groundwater Level Data

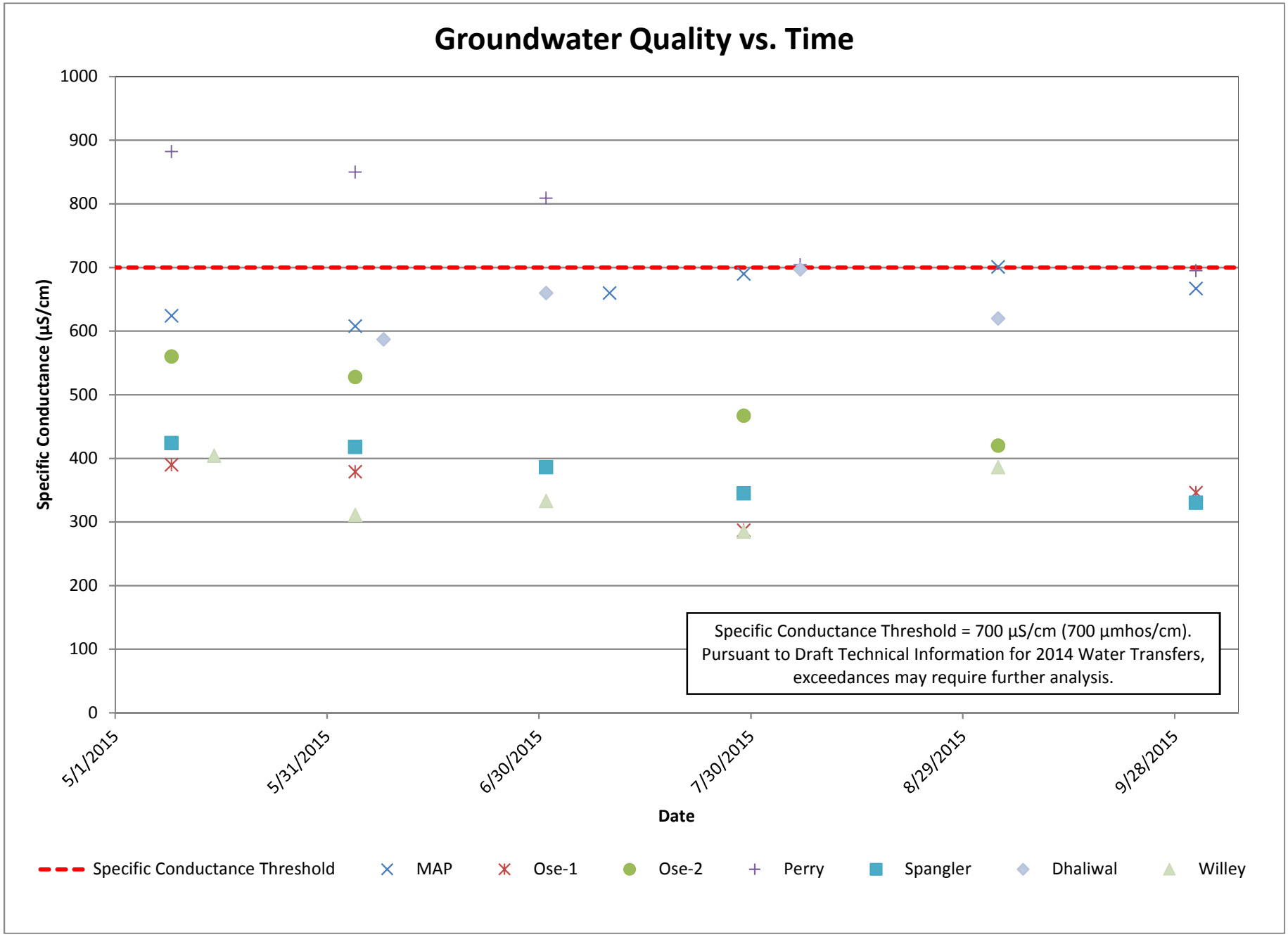


Natomas Central Mutual Water Company
Production Well Groundwater Level Data




Groundwater Quality vs. Time
Specific Conductance (µS/cm)
1000
900
800
700
600
500
400
300
200
100
0
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
Date
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2014 Water Transfers,
exceedances may require further analysis.
Specific Conductance Threshold
L-1
L-2
L-3
L-4
L-6


Groundwater Quality vs. Time
Specific Conductance (µS/cm)
900
800
700
600
500
400
300
200
100
0
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
Date
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm). Pursuant to Draft Technical Information for 2014 Water Transfers, exceedances may require further analysis.
Specific Conductance Threshold
L-7
L-8
L-9
L-10
L-11
L-12


Groundwater Quality vs. Time
Specific Conductance (µS/cm)
1000
900
800
700
600
500
400
300
200
100
0
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
Date
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm). Pursuant to Draft Technical Information for 2014 Water Transfers, exceedances may require further analysis.
Specific Conductance Threshold
MAP
Ose-1
Ose-2
Perry
Spangler
Dhaliwal
Willey


Groundwater Quality vs. Time
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm). Pursuant to Draft Technical Information for 2014 Water Transfers, exceedances may require further analysis.
Specific Conductance (µS/cm)
1400
1200
1000
800
600
400
200
0
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
Date
Specific Conductance Threshold
TNBC Frazer
TNBC Lucich North
TNBC Bennett North
TNBC Atkinson
TNBC Fisherman's Lake
TNBC Silva Dairy
TNBC Betts

Pelger Mutual Water Company

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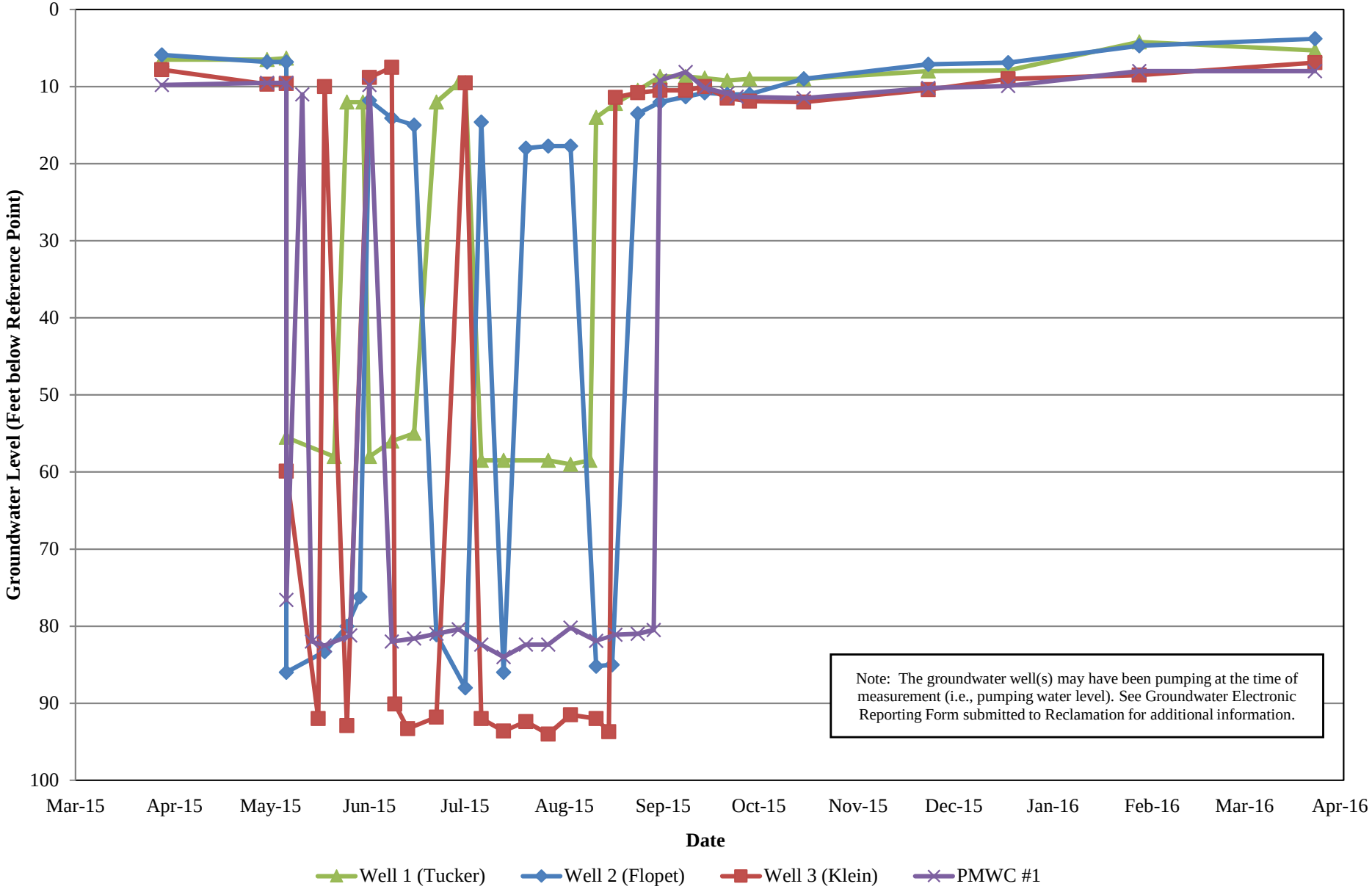
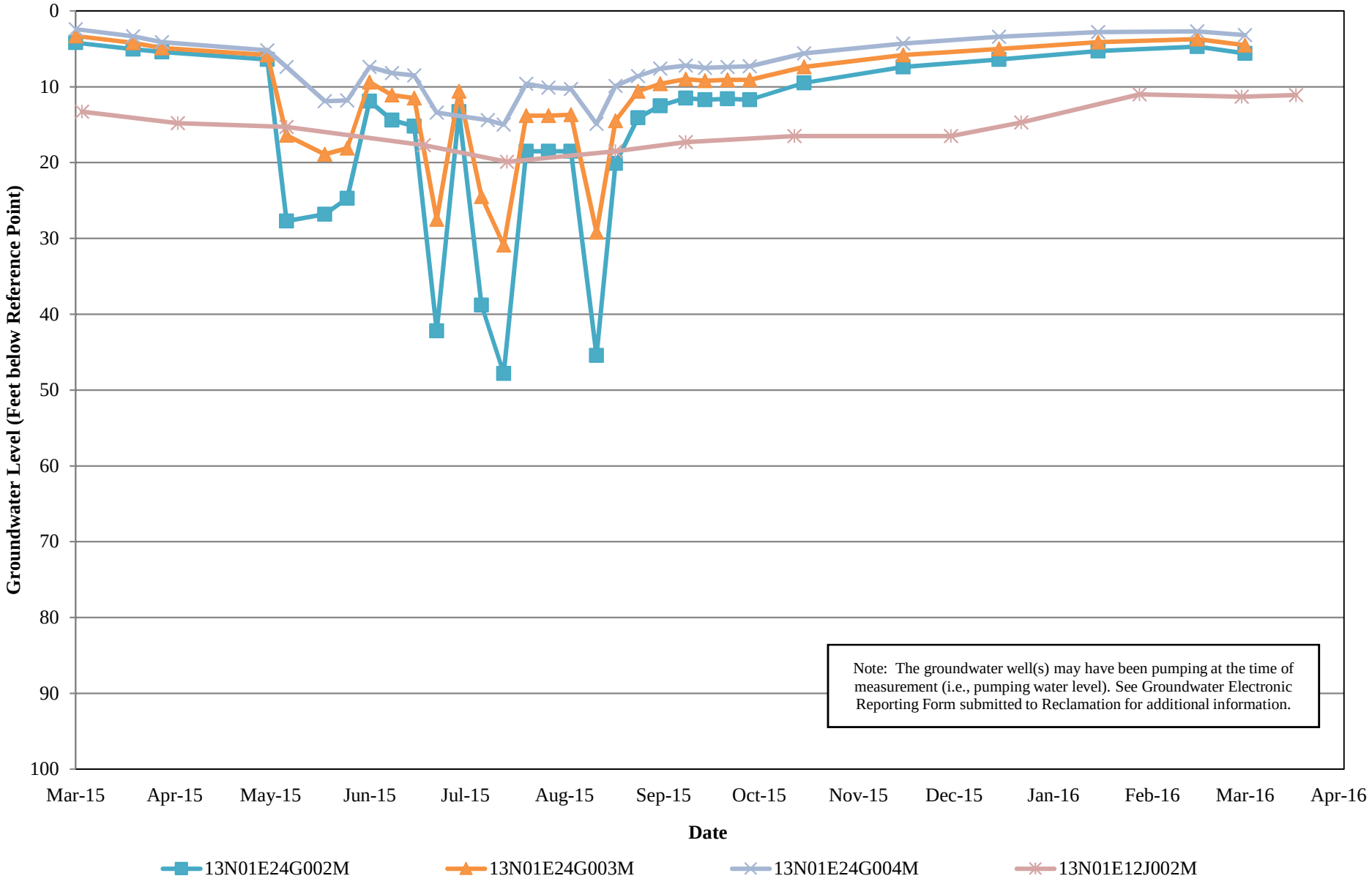
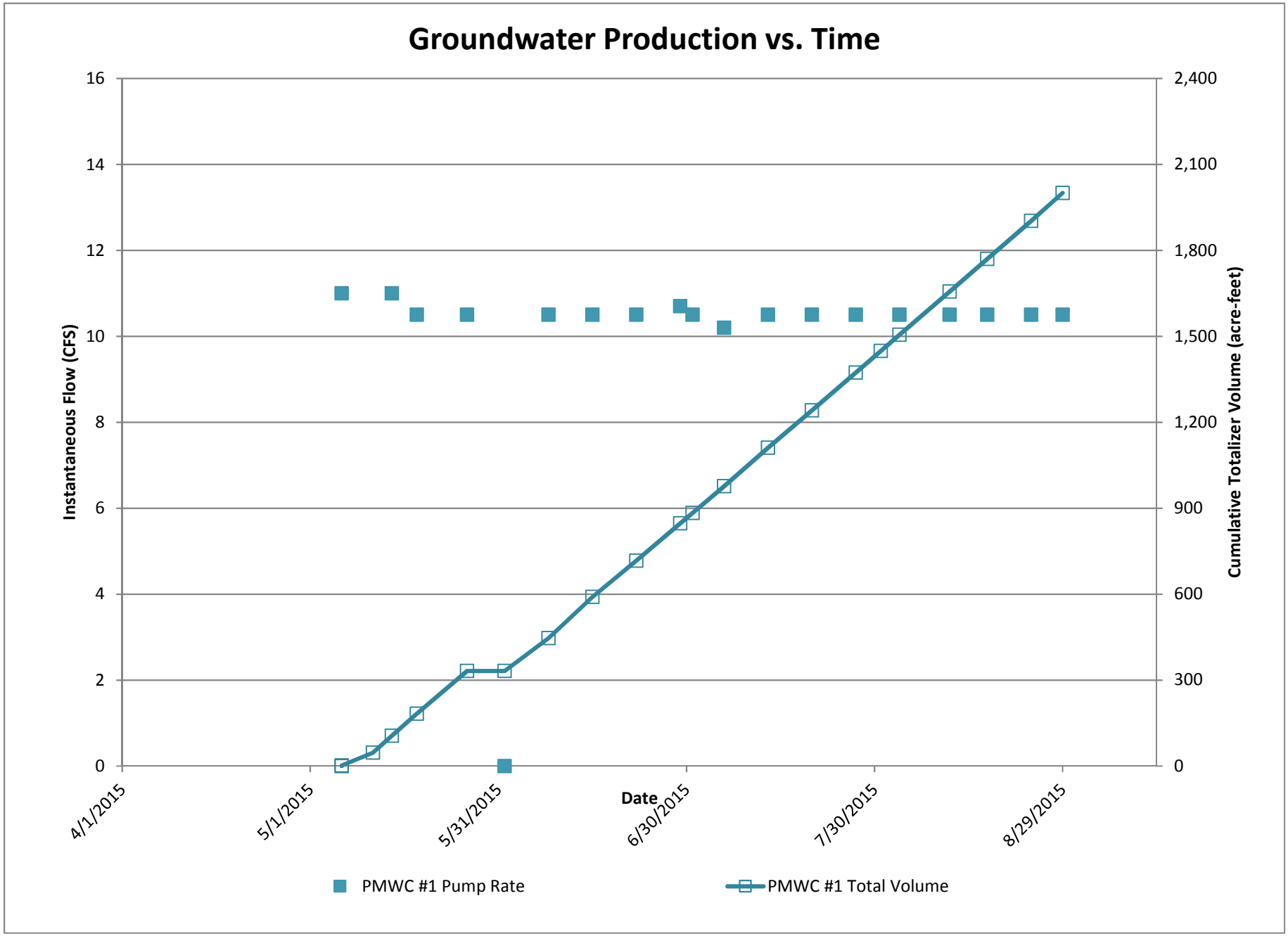
Pelger Mutual Water Company
Production Well Groundwater Level Data

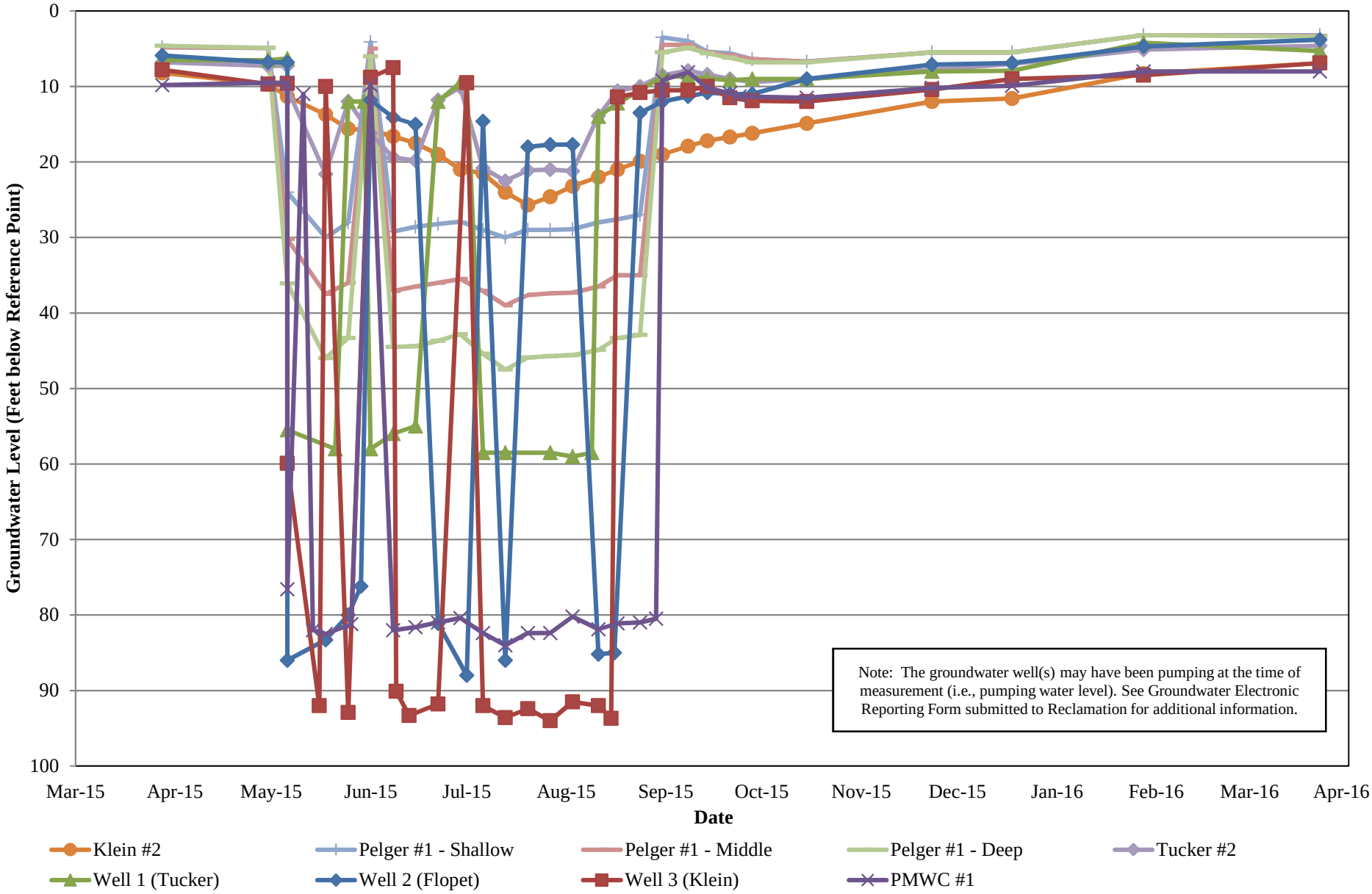


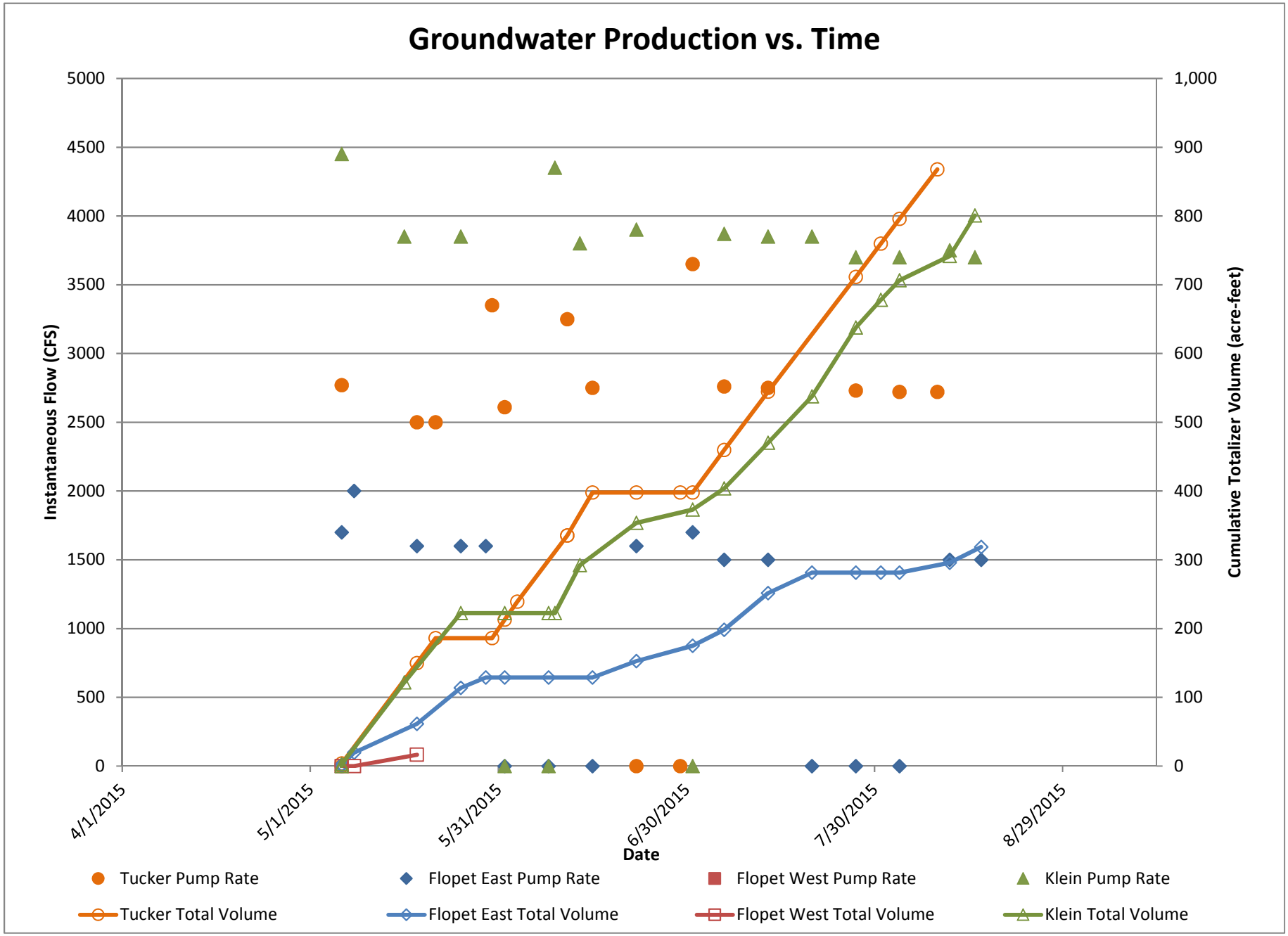
Pelger Mutual Water Company
DWR Monitoring Well Groundwater Level Data

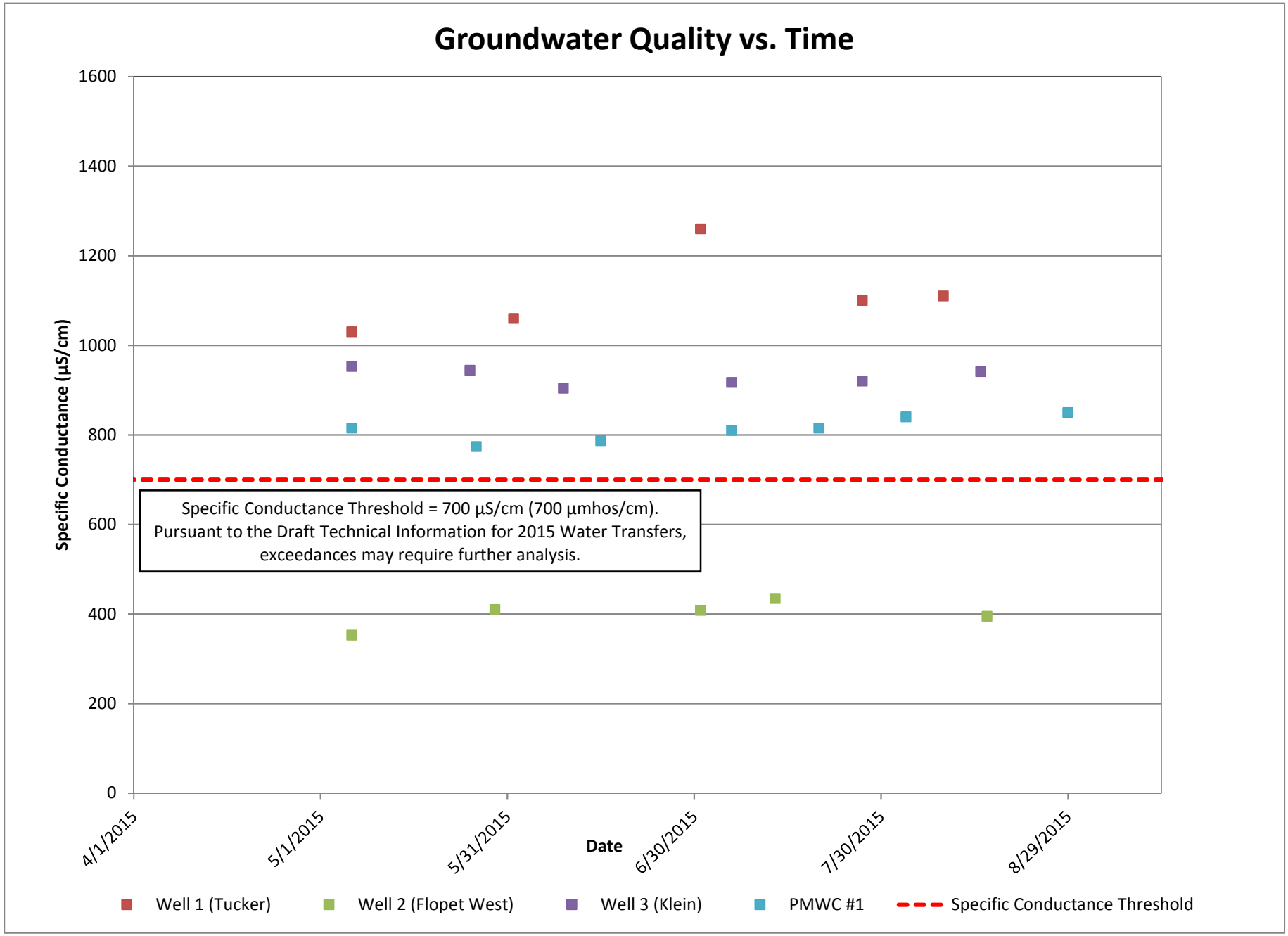



Groundwater Production vs. Time
Instantaneous Flow (CFS)
Cumulative Totalizer Volume (acre-feet)
Date
16
14
12
10
8
6
4
2
0
2,400
2,100
1,800
1,500
1,200
900
600
300
0
4/1/2015
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
PMWC #1 Pump Rate
PMWC #1 Total Volume

Pelger Mutual Water Company
Monitoring Well Groundwater Level Data




Groundwater Production vs. Time
Instantaneous Flow (CFS)
Cumulative Totalizer Volume (acre-feet)
Date
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1,000
900
800
700
600
500
400
300
200
100
0
4/1/2015
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
Tucker Pump Rate
Flopet East Pump Rate
Flopet West Pump Rate
Klein Pump Rate
Tucker Total Volume
Flopet East Total Volume
Flopet West Total Volume
Klein Total Volume


Groundwater Quality vs. Time
Specific Conductance (µS/cm)
1600
1400
1200
1000
800
600
400
200
0
4/1/2015
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
Date
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to the Draft Technical Information for 2015 Water Transfers,
exceedances may require further analysis.
Well 1 (Tucker)
Well 2 (Flopet West)
Well 3 (Klein)
PMWC #1
Specific Conductance Threshold

Pelger Road 1700, LLC

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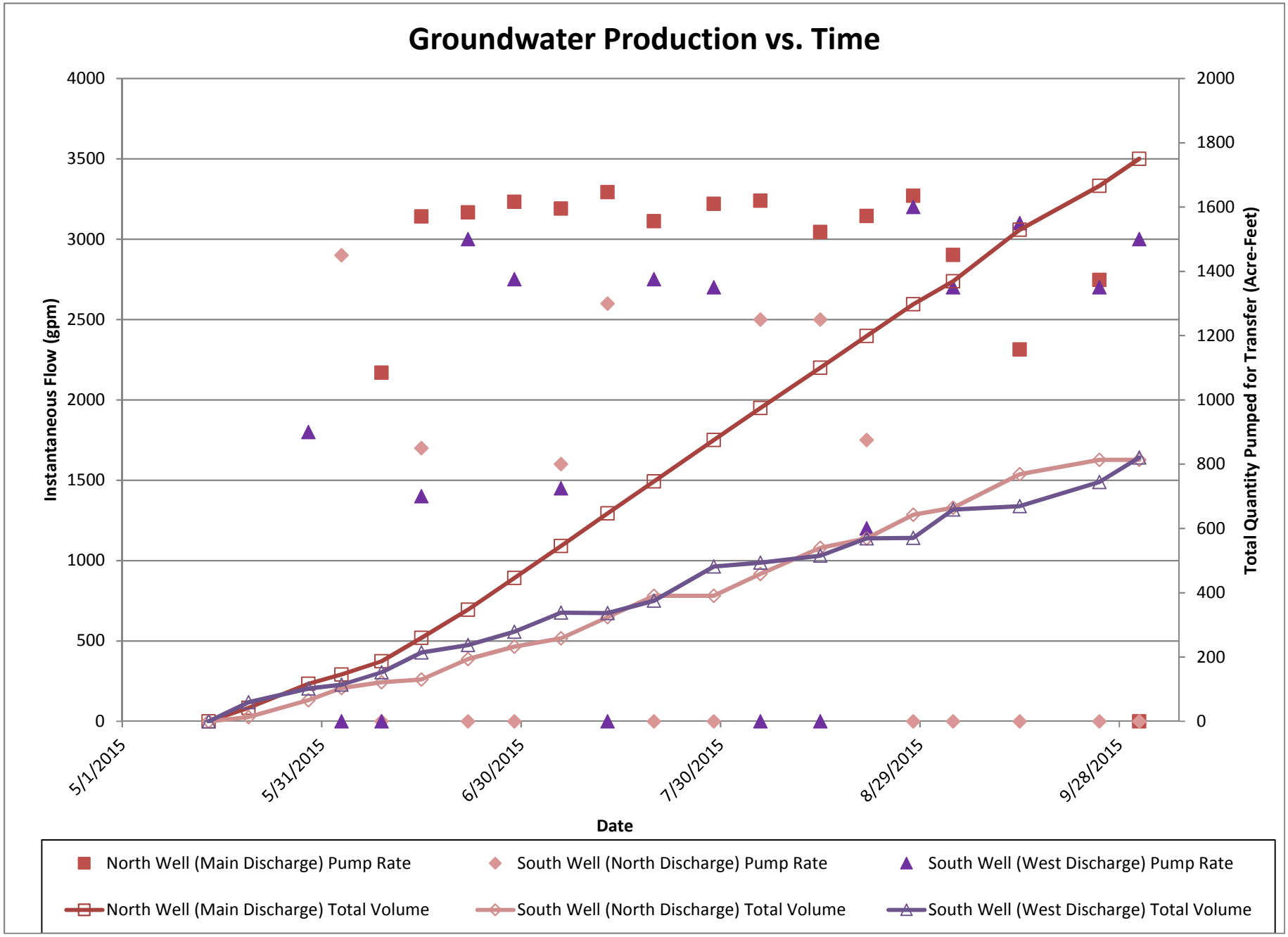
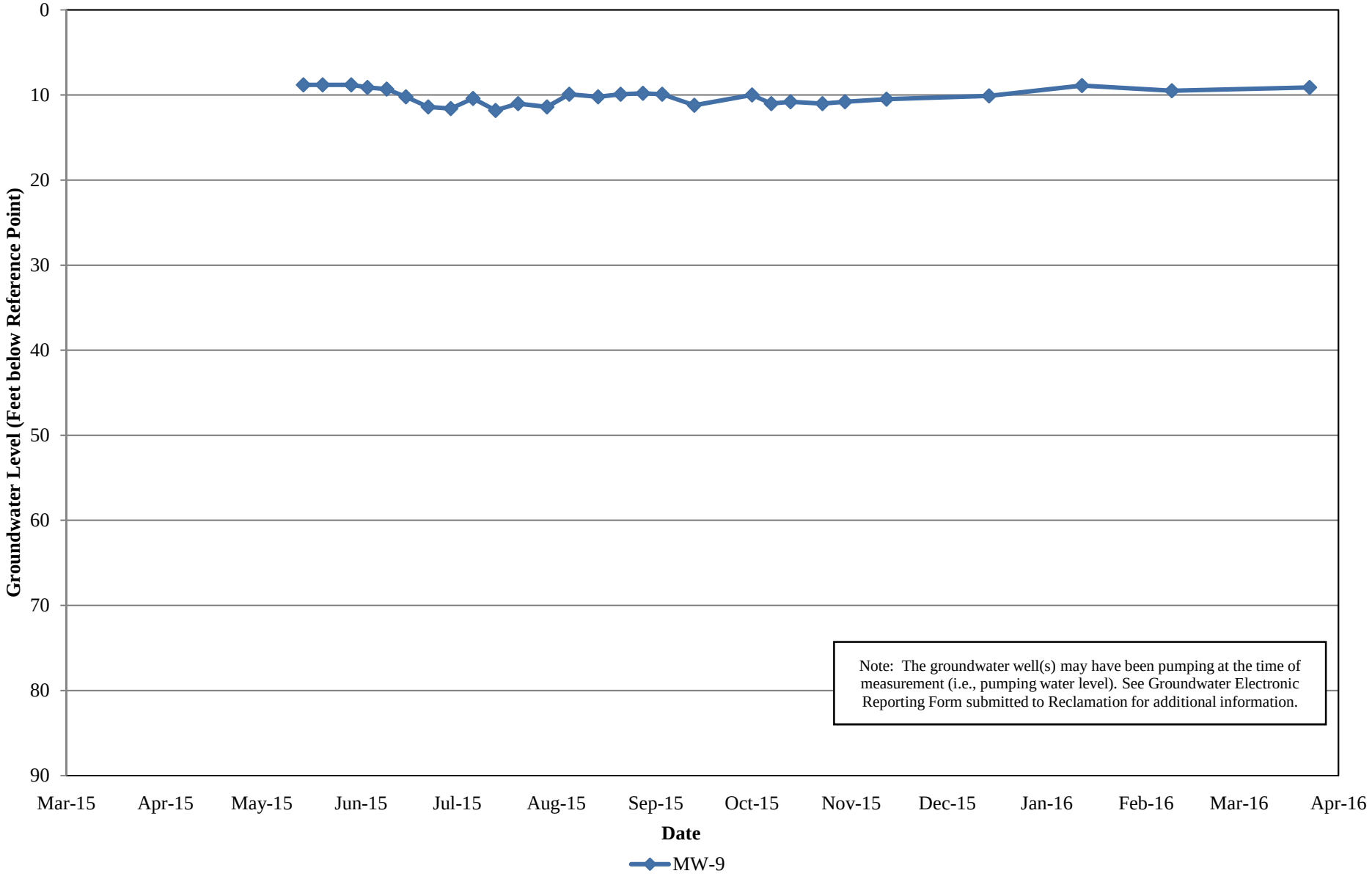
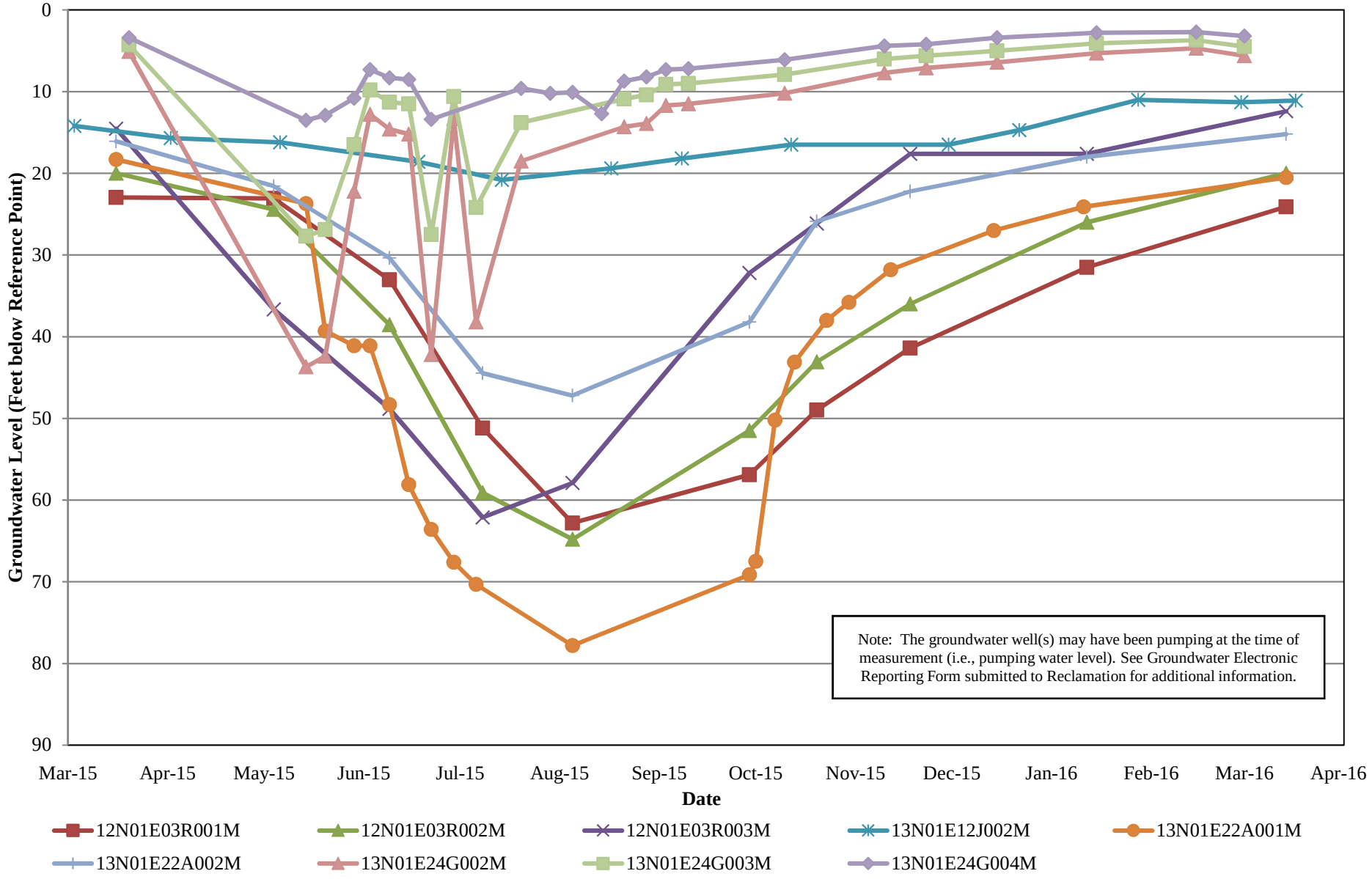
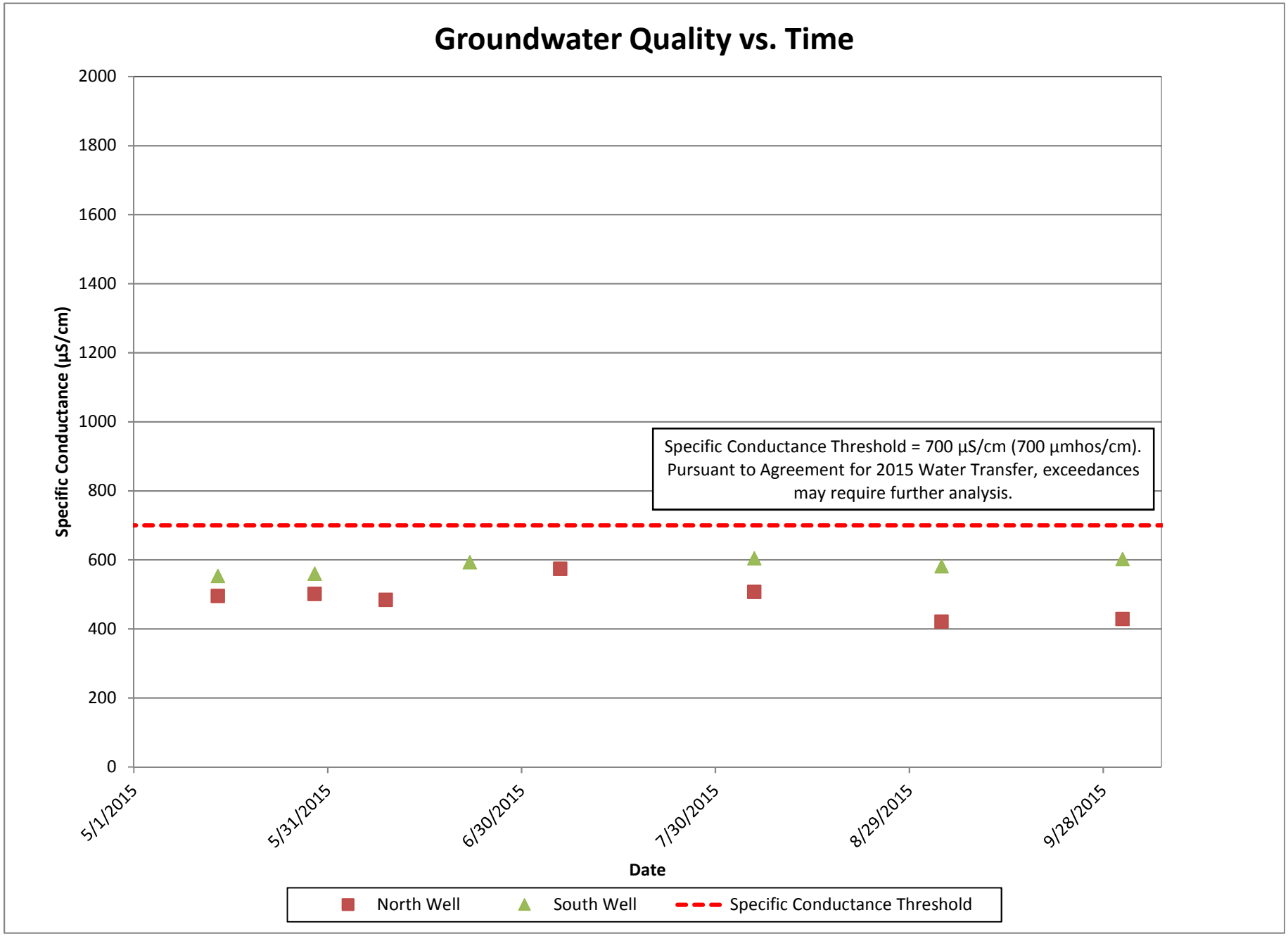

Groundwater Production vs. Time
Instantaneous Flow (gpm)
Total Quantity Pumped for Transfer (Acre-Feet)
Date
4000
3500
3000
2500
2000
1500
1000
500
0
2000
1800
1600
1400
1200
1000
800
600
400
200
0
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
North Well (Main Discharge) Pump Rate
South Well (North Discharge) Pump Rate
South Well (West Discharge) Pump Rate
North Well (Main Discharge) Total Volume
South Well (North Discharge) Total Volume
South Well (West Discharge) Total Volume

Pelger Road 1700, LLC
Monitoring Well Groundwater Level Data



Pelger Road 1700, LLC
DWR Monitoring Well Groundwater Level Data




Groundwater Quality vs. Time
Specific Conductance (µS/cm)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
Date
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm). Pursuant to Agreement for 2015 Water Transfer, exceedances may require further analysis.
North Well
South Well
Specific Conductance Threshold

Pleasant Grove-Verona Mutual Water Company

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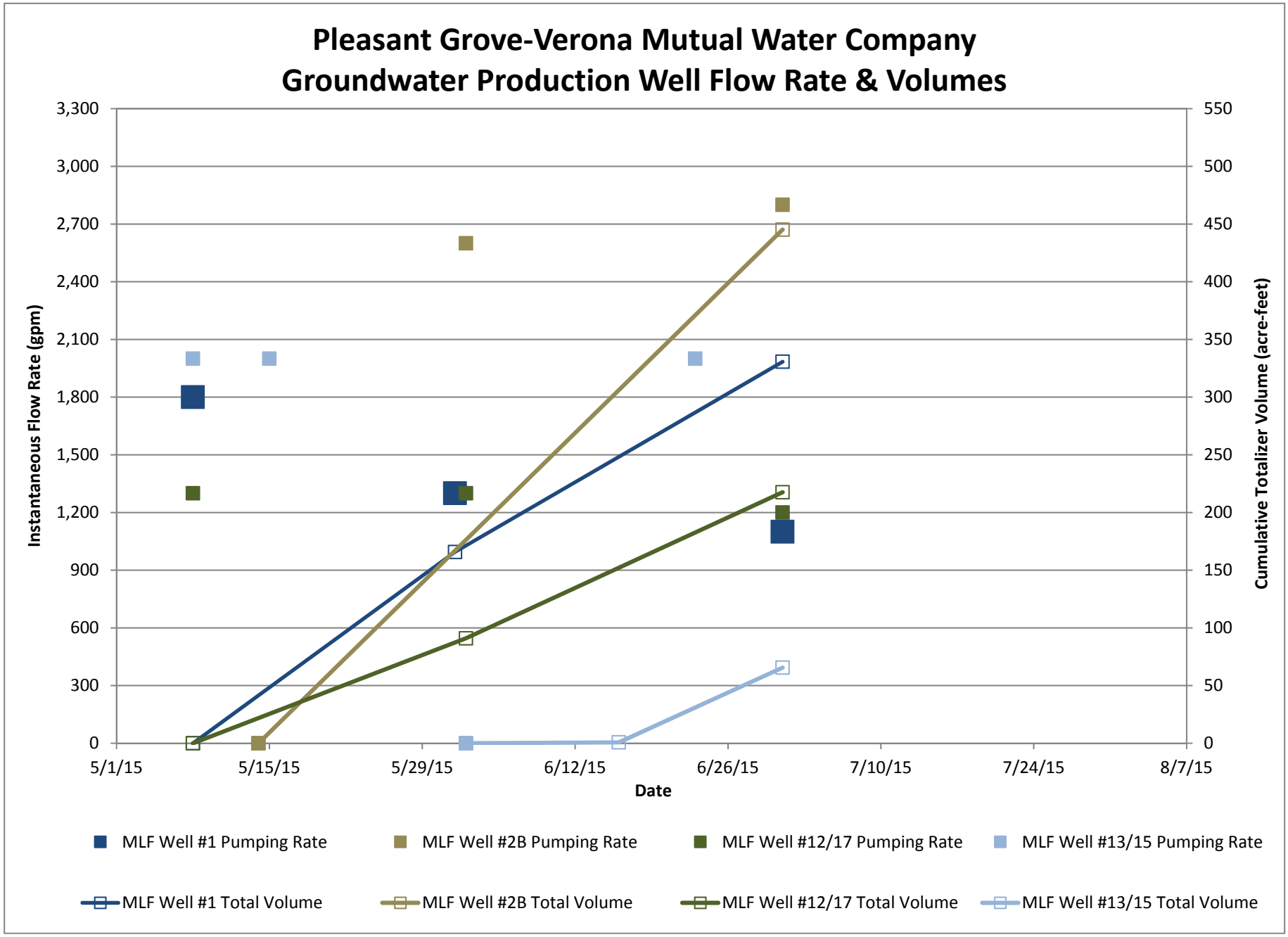
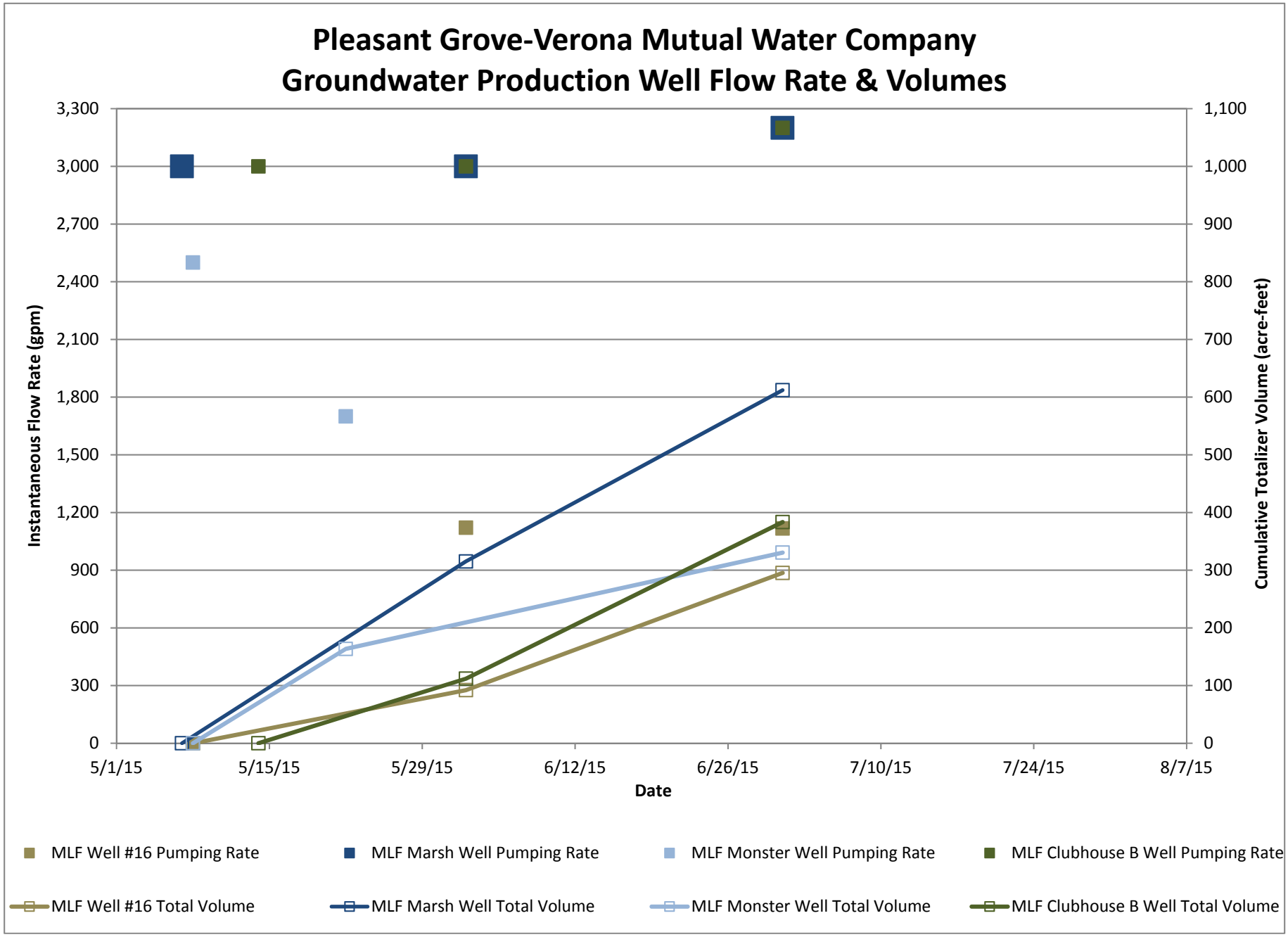
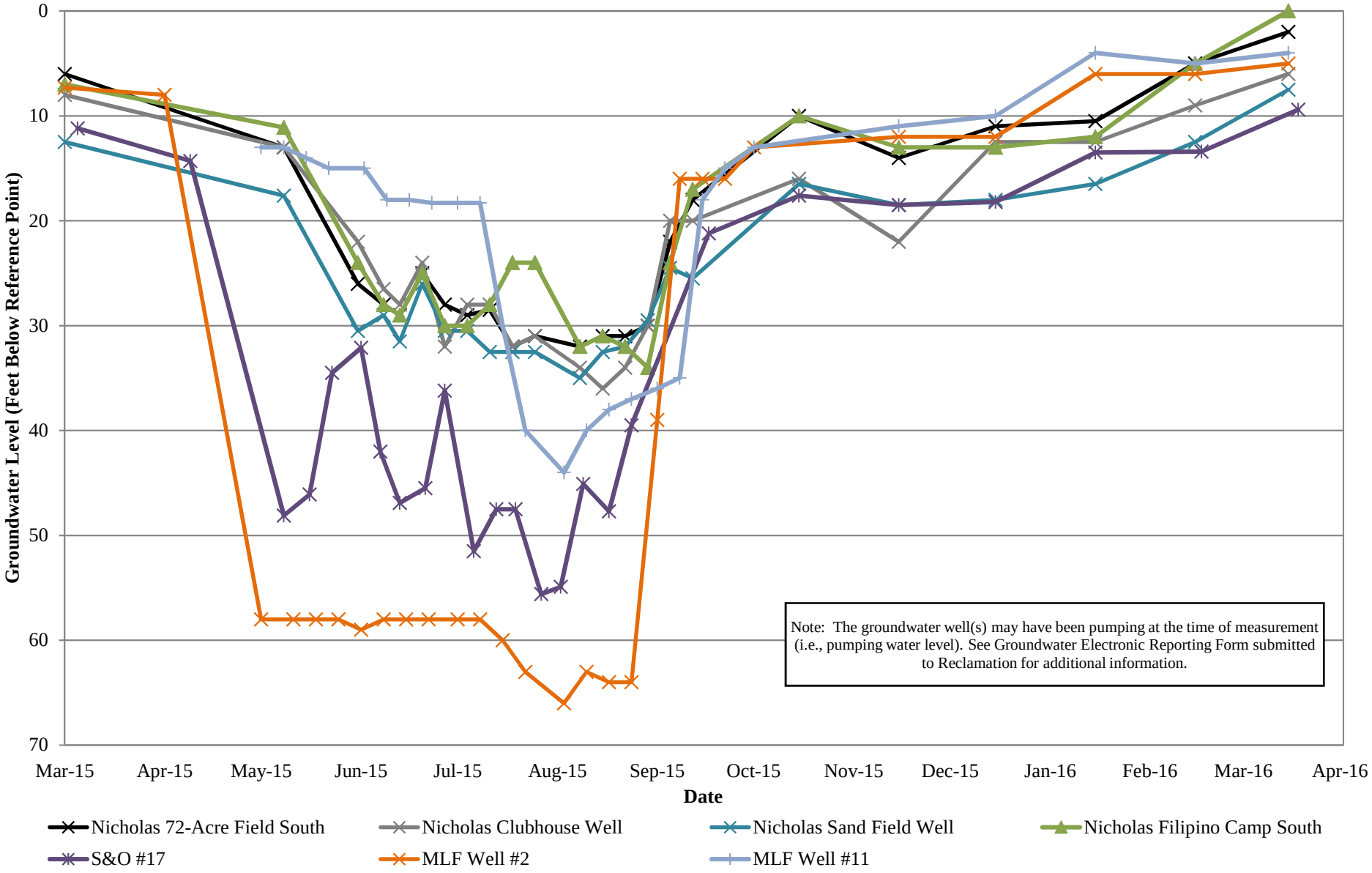
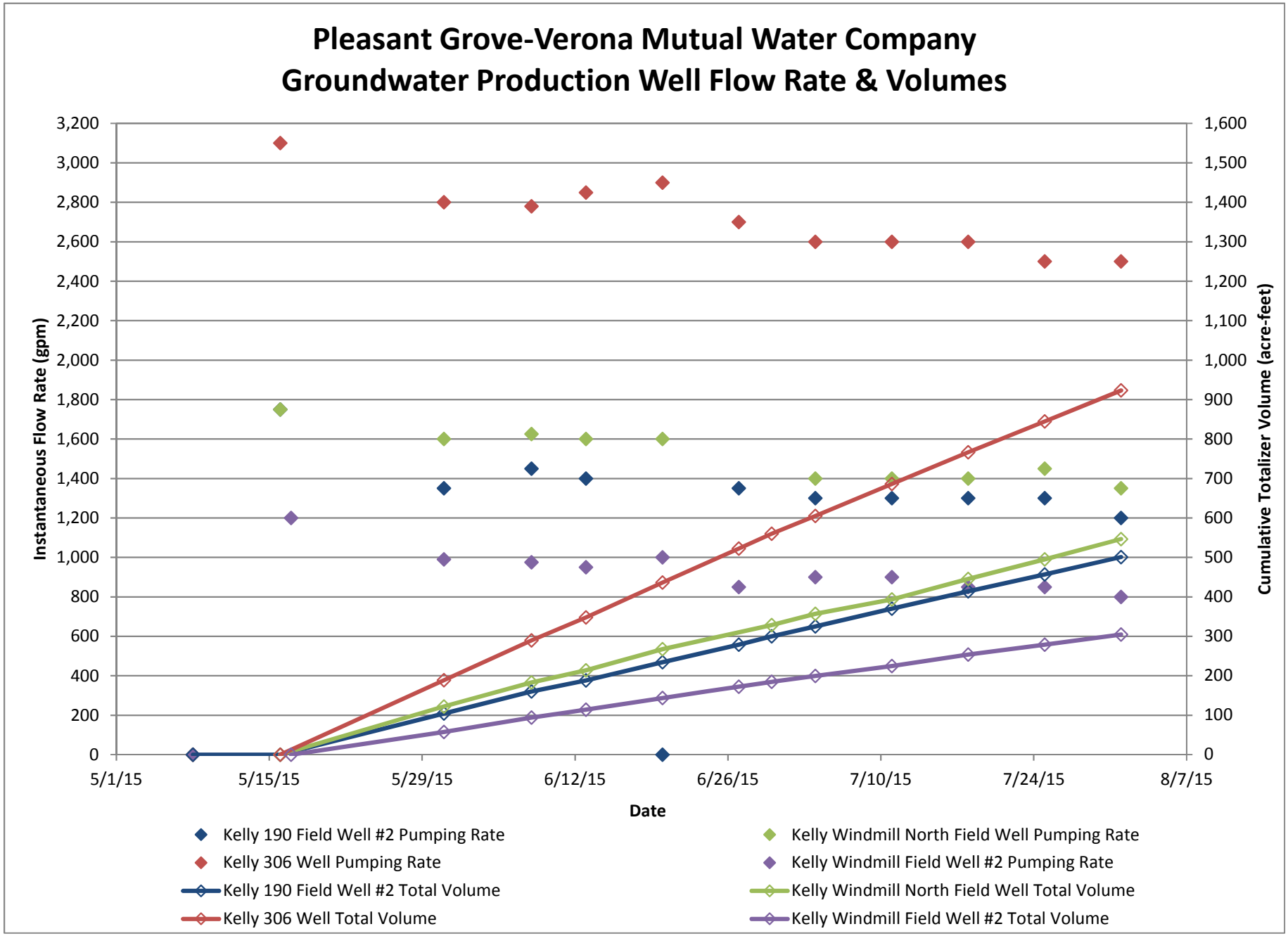
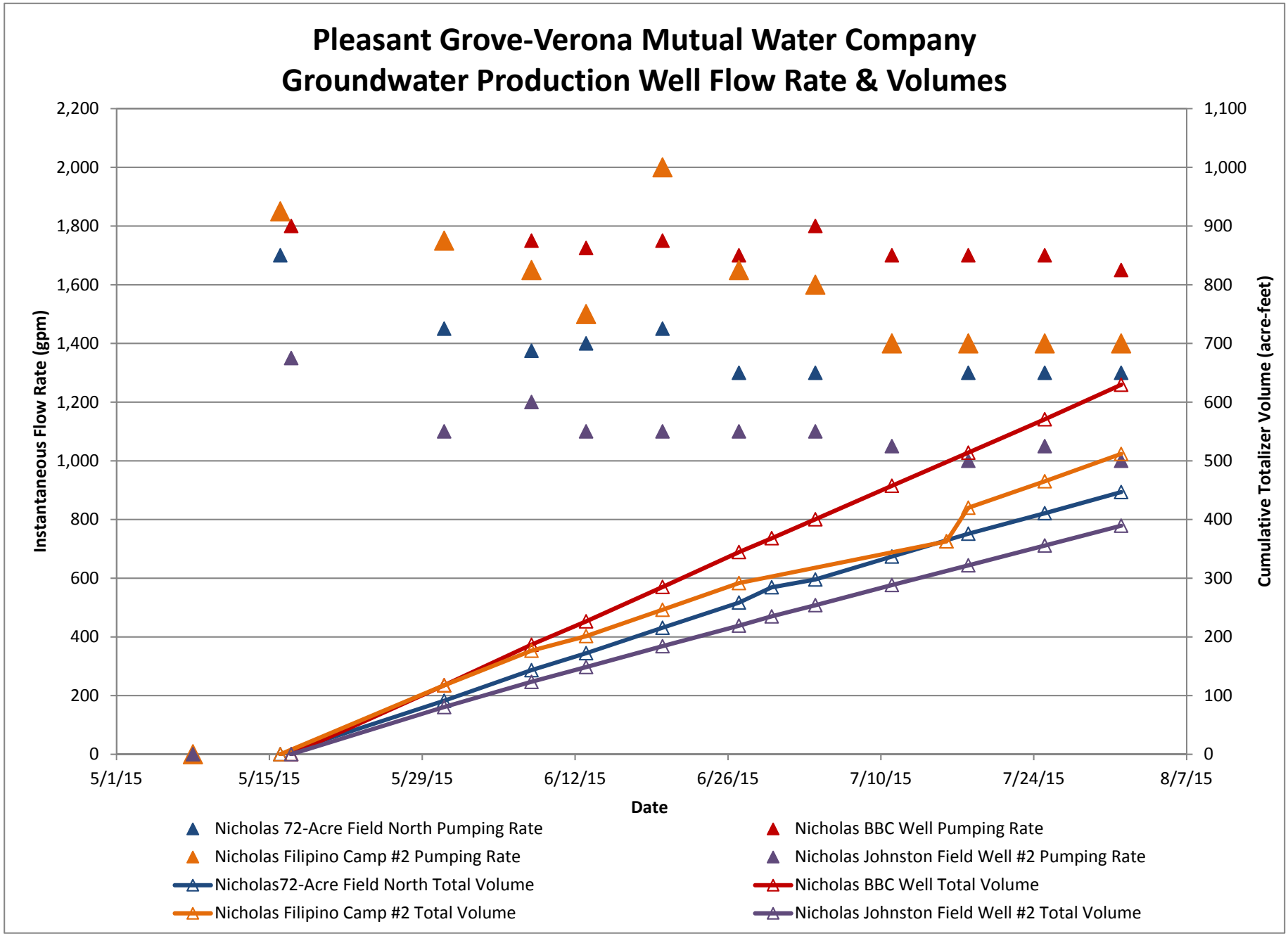

Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
Date
3,300
3,000
2,700
2,400
2,100
1,800
1,500
1,200
900
600
300
0
550
500
450
400
350
300
250
200
150
100
50
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
MLF Well #1 Pumping Rate
MLF Well #2B Pumping Rate
MLF Well #12/17 Pumping Rate
MLF Well #13/15 Pumping Rate
MLF Well #1 Total Volume
MLF Well #2B Total Volume
MLF Well #12/17 Total Volume
MLF Well #13/15 Total Volume


Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
Date
3,300
3,000
2,700
2,400
2,100
1,800
1,500
1,200
900
600
300
0
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
MLF Well #16 Pumping Rate
MLF Marsh Well Pumping Rate
MLF Monster Well Pumping Rate
MLF Clubhouse B Well Pumping Rate
MLF Well #16 Total Volume
MLF Marsh Well Total Volume
MLF Monster Well Total Volume
MLF Clubhouse B Well Total Volume

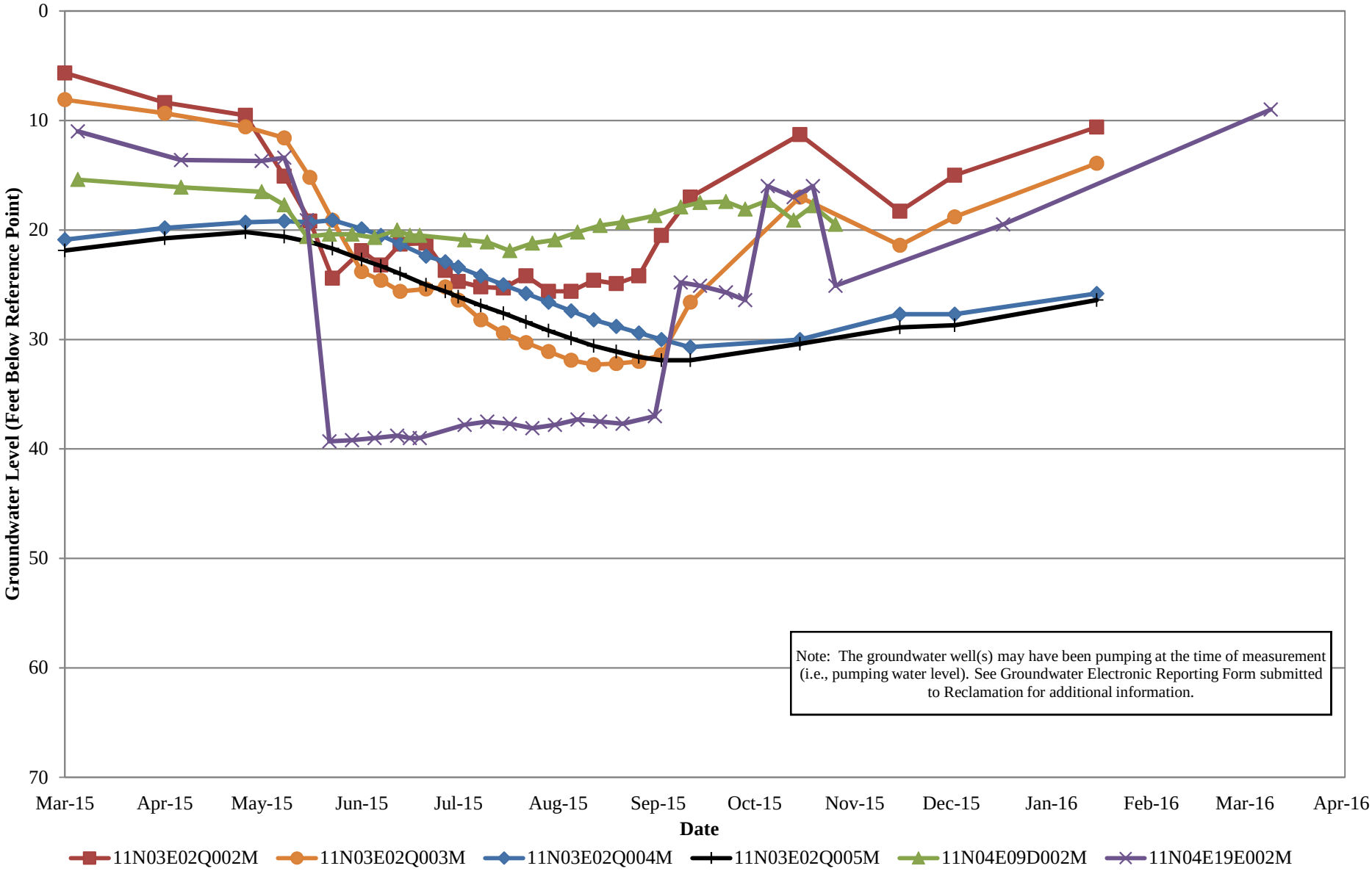
Pleasant Grove-Verona Mutual Water Company
Monitoring Well Groundwater Level Data

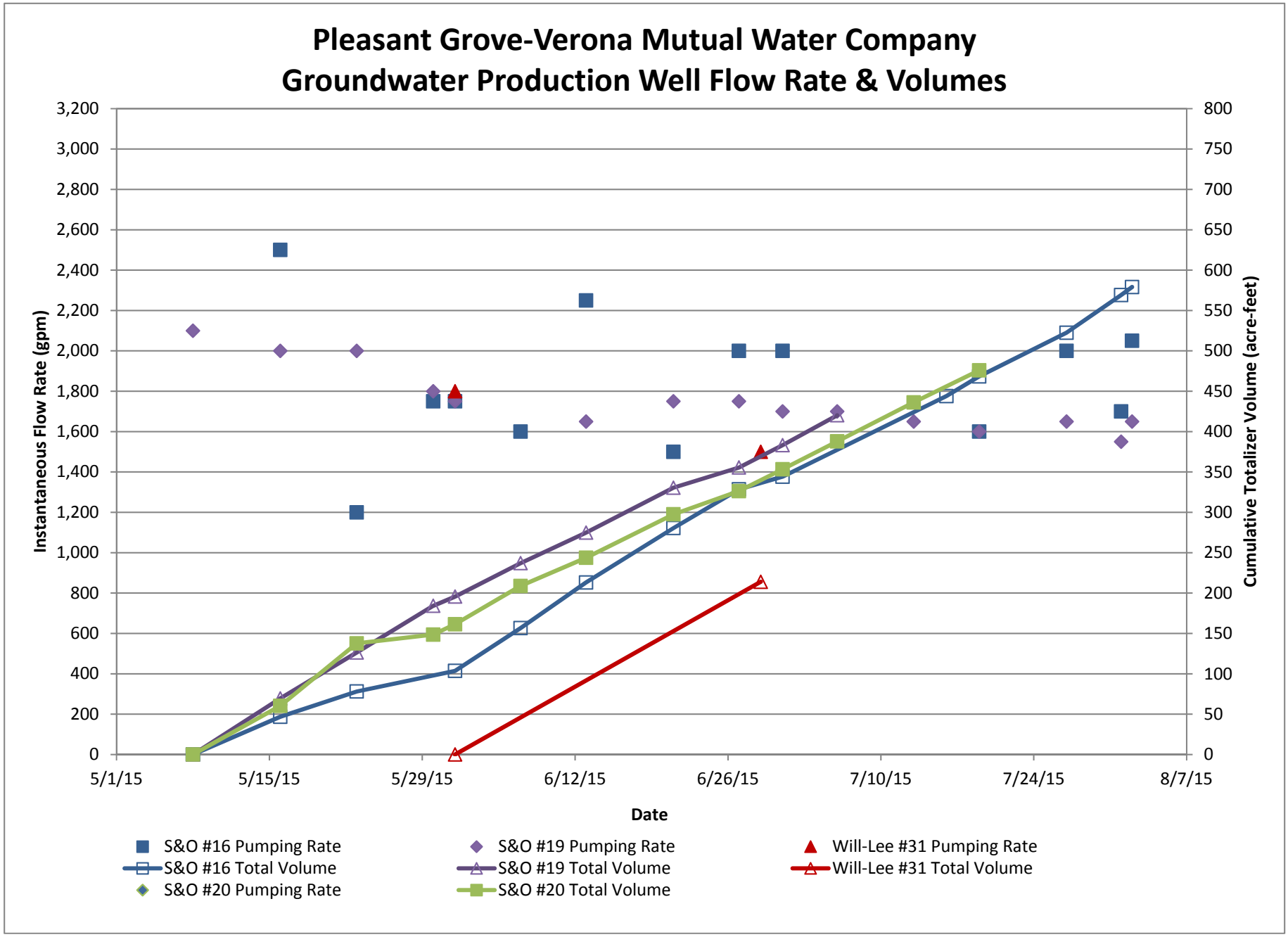



Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
Date
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
Kelly 190 Field Well #2 Pumping Rate
Kelly Windmill North Field Well Pumping Rate
Kelly 306 Well Pumping Rate
Kelly Windmill Field Well #2 Pumping Rate
Kelly 190 Field Well #2 Total Volume
Kelly Windmill North Field Well Total Volume
Kelly 306 Well Total Volume
Kelly Windmill Field Well #2 Total Volume

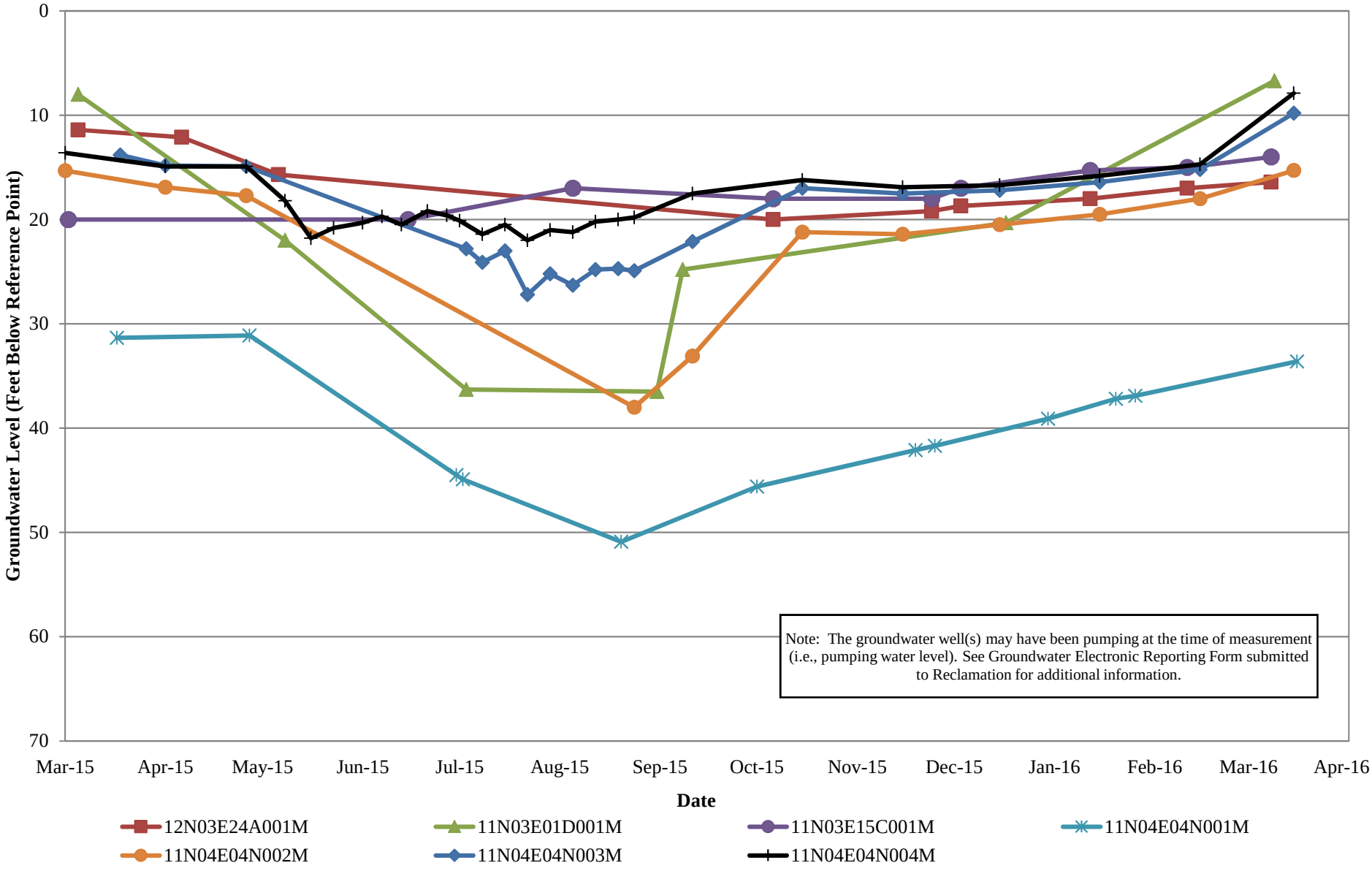

Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
Date
Nicholas 72-Acre Field North Pumping Rate
Nicholas BBC Well Pumping Rate
Nicholas Filipino Camp #2 Pumping Rate
Nicholas Johnston Field Well #2 Pumping Rate
Nicholas72-Acre Field North Total Volume
Nicholas BBC Well Total Volume
Nicholas Filipino Camp #2 Total Volume
Nicholas Johnston Field Well #2 Total Volume

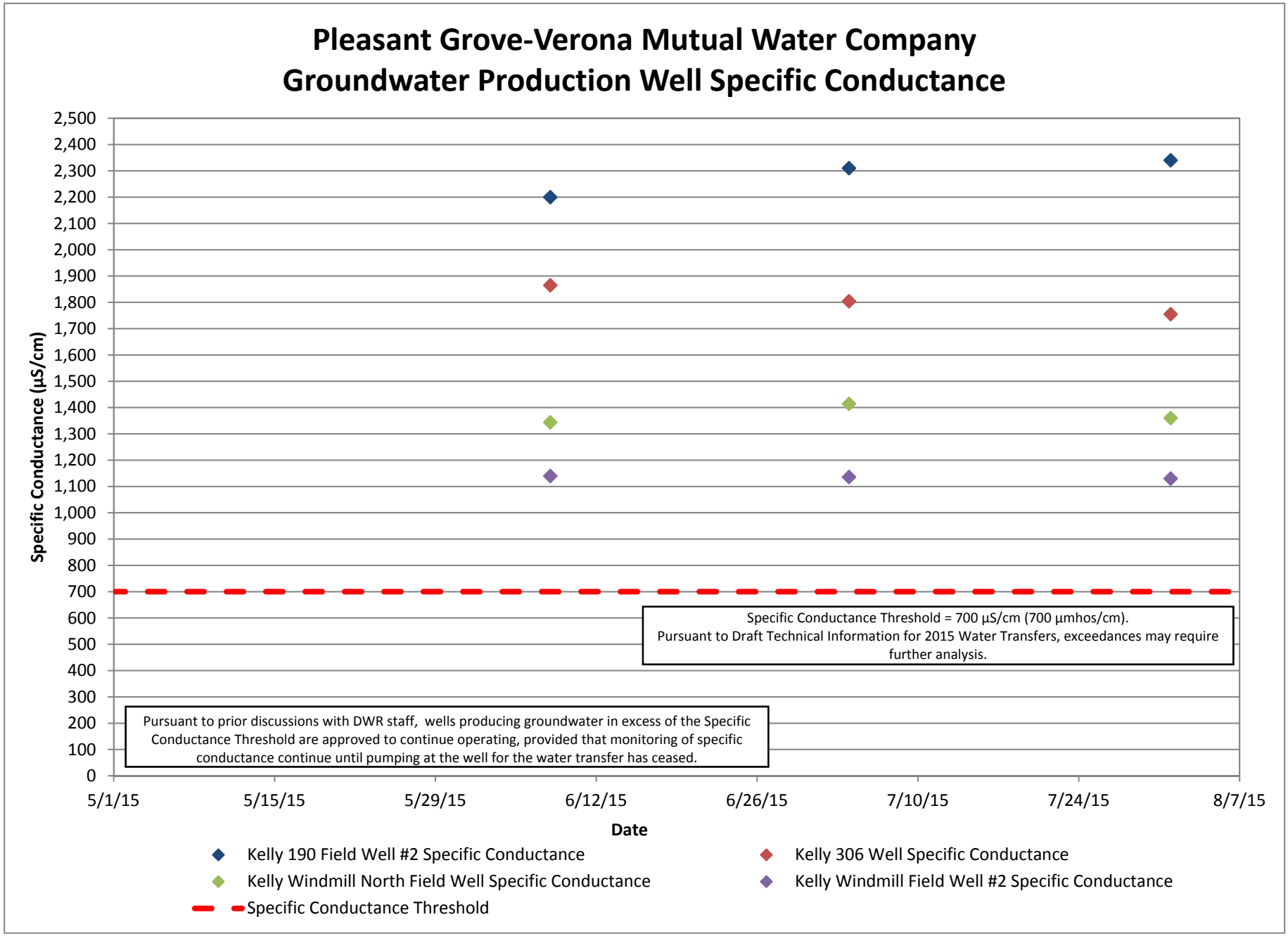
Pleasant Grove-Verona Mutual Water Company
DWR Monitoring Well Groundwater Level Data



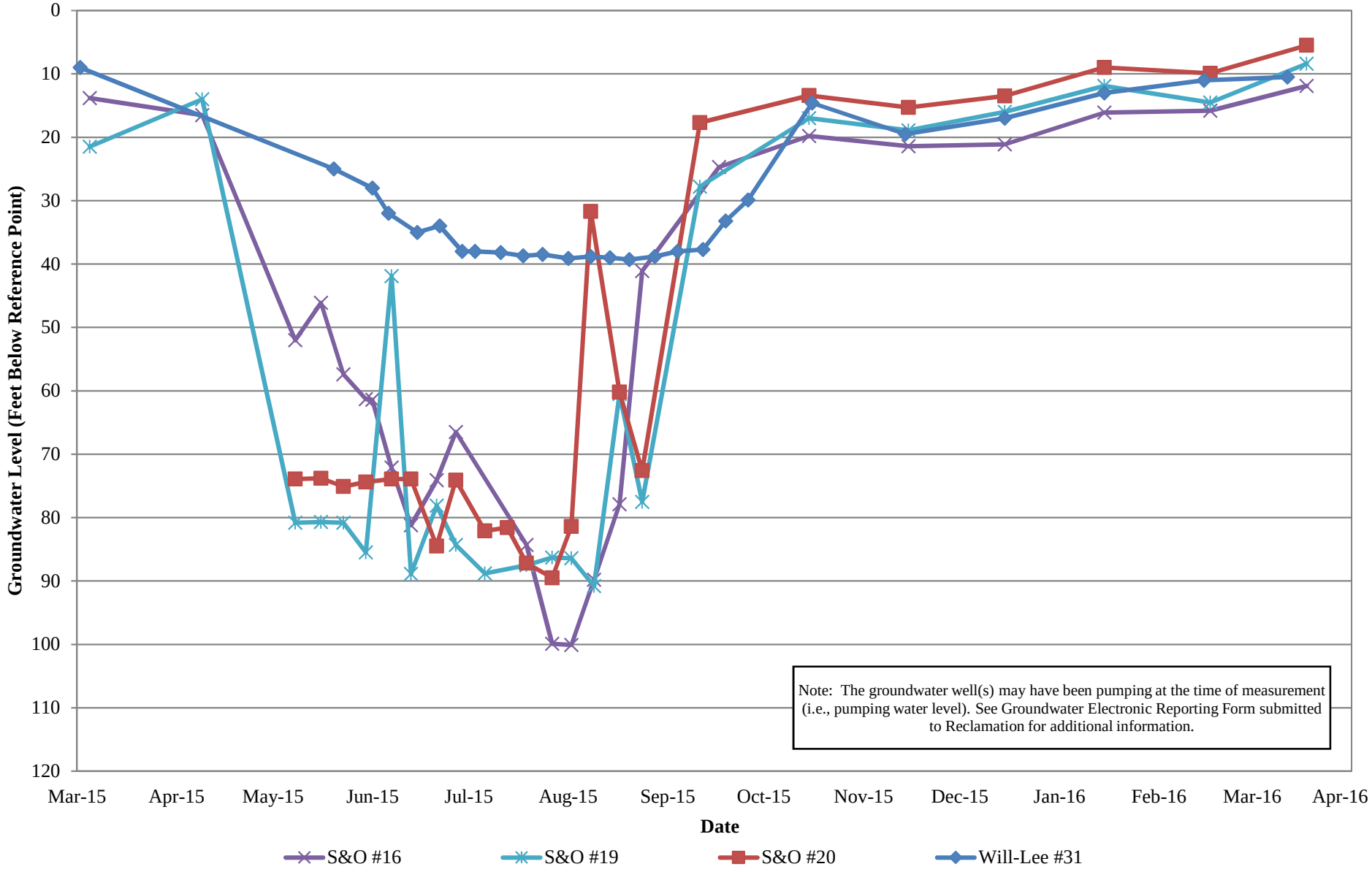

Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
Date
3,200
3,000
2,800
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
S&O #16 Pumping Rate
S&O #19 Pumping Rate
Will-Lee #31 Pumping Rate
S&O #16 Total Volume
S&O #19 Total Volume
Will-Lee #31 Total Volume
S&O #20 Pumping Rate
S&O #20 Total Volume

Pleasant Grove-Verona Mutual Water Company
DWR Monitoring Well Groundwater Level Data

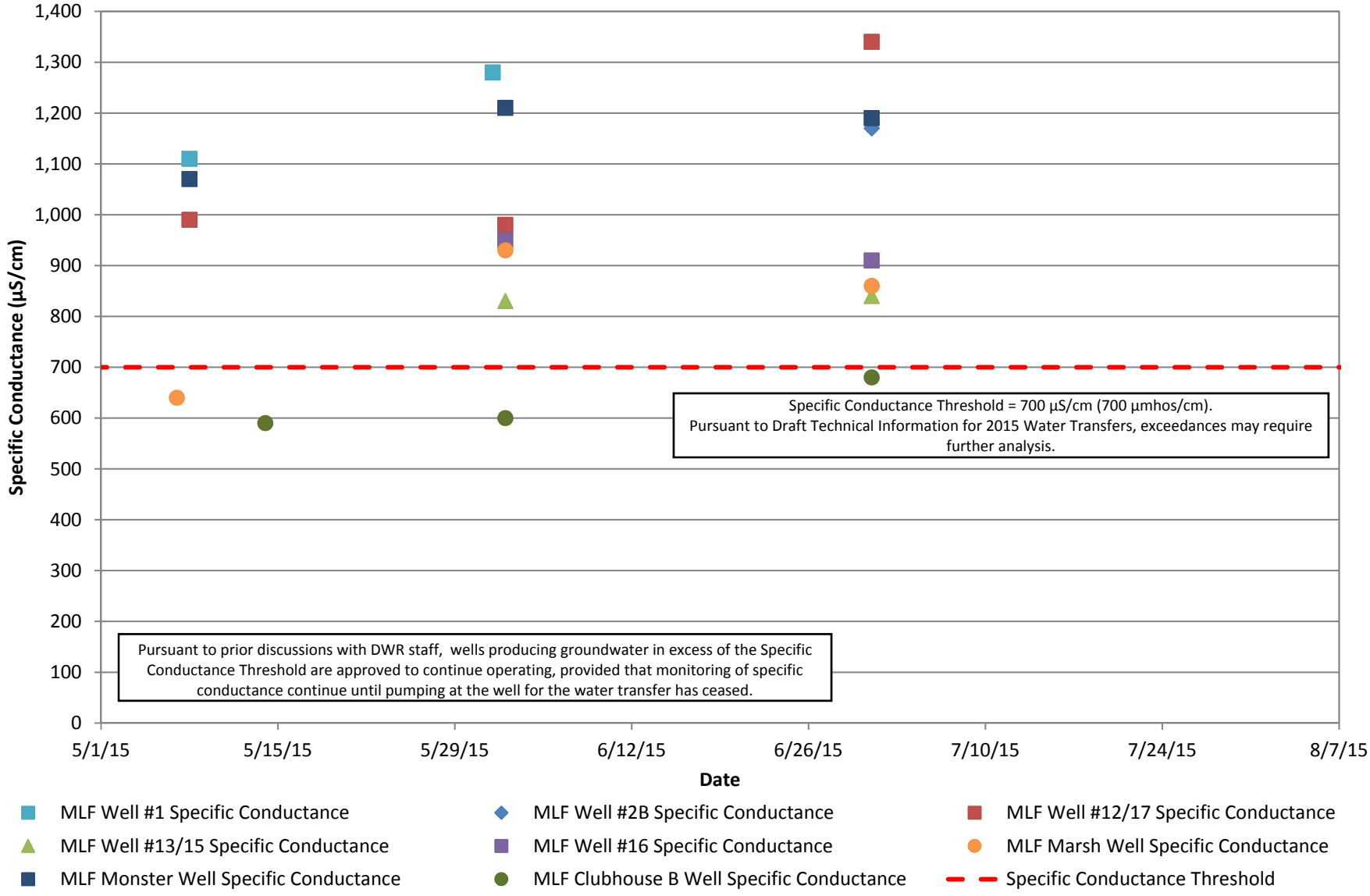



Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Specific Conductance
Specific Conductance (µS/cm)
2,500
2,400
2,300
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
Date
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2015 Water Transfers, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
Kelly 190 Field Well #2 Specific Conductance
Kelly 306 Well Specific Conductance
Kelly Windmill North Field Well Specific Conductance
Kelly Windmill Field Well #2 Specific Conductance
Specific Conductance Threshold

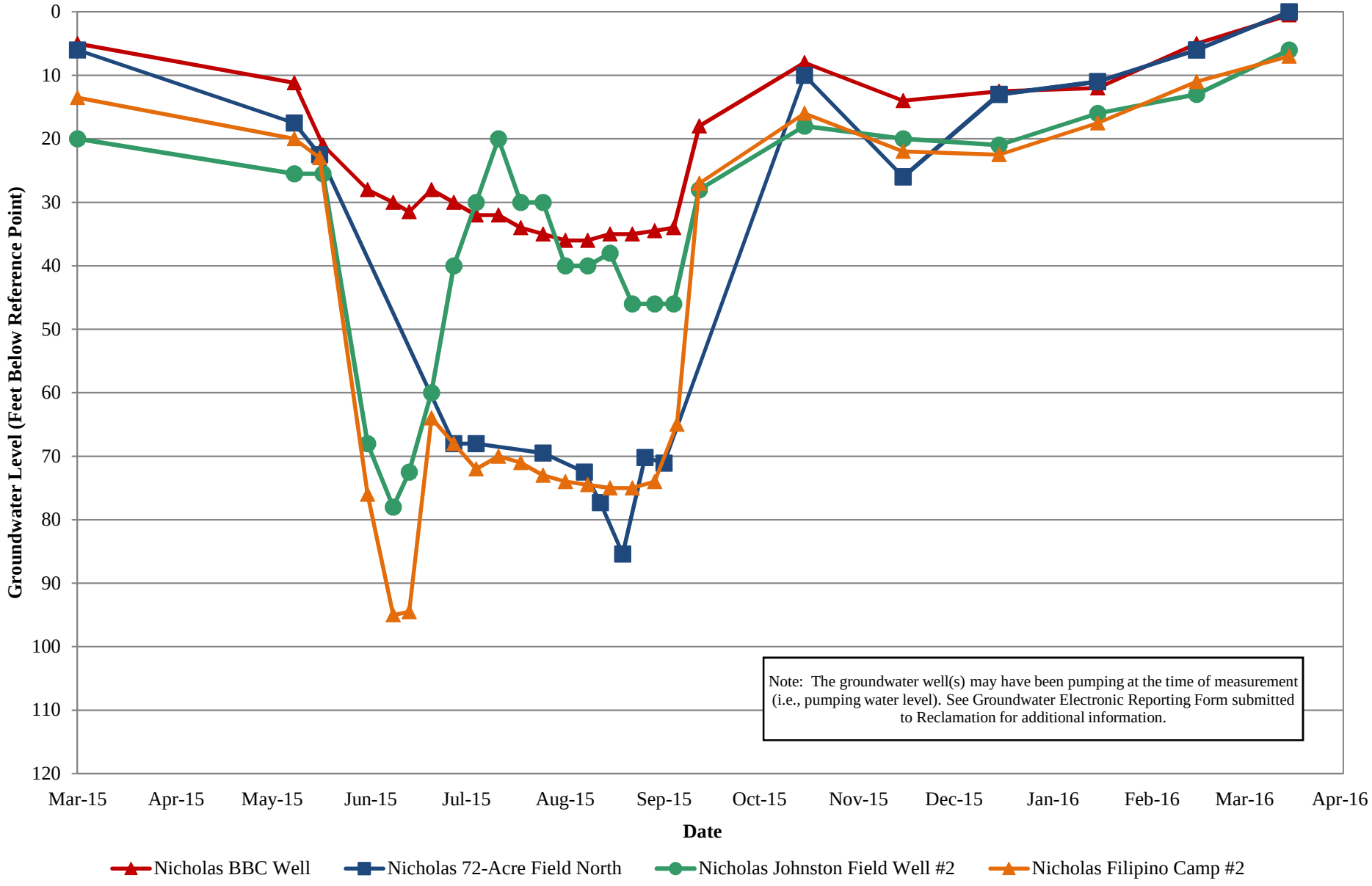
Pleasant Grove-Verona Mutual Water Company
Production Well Groundwater Level Data

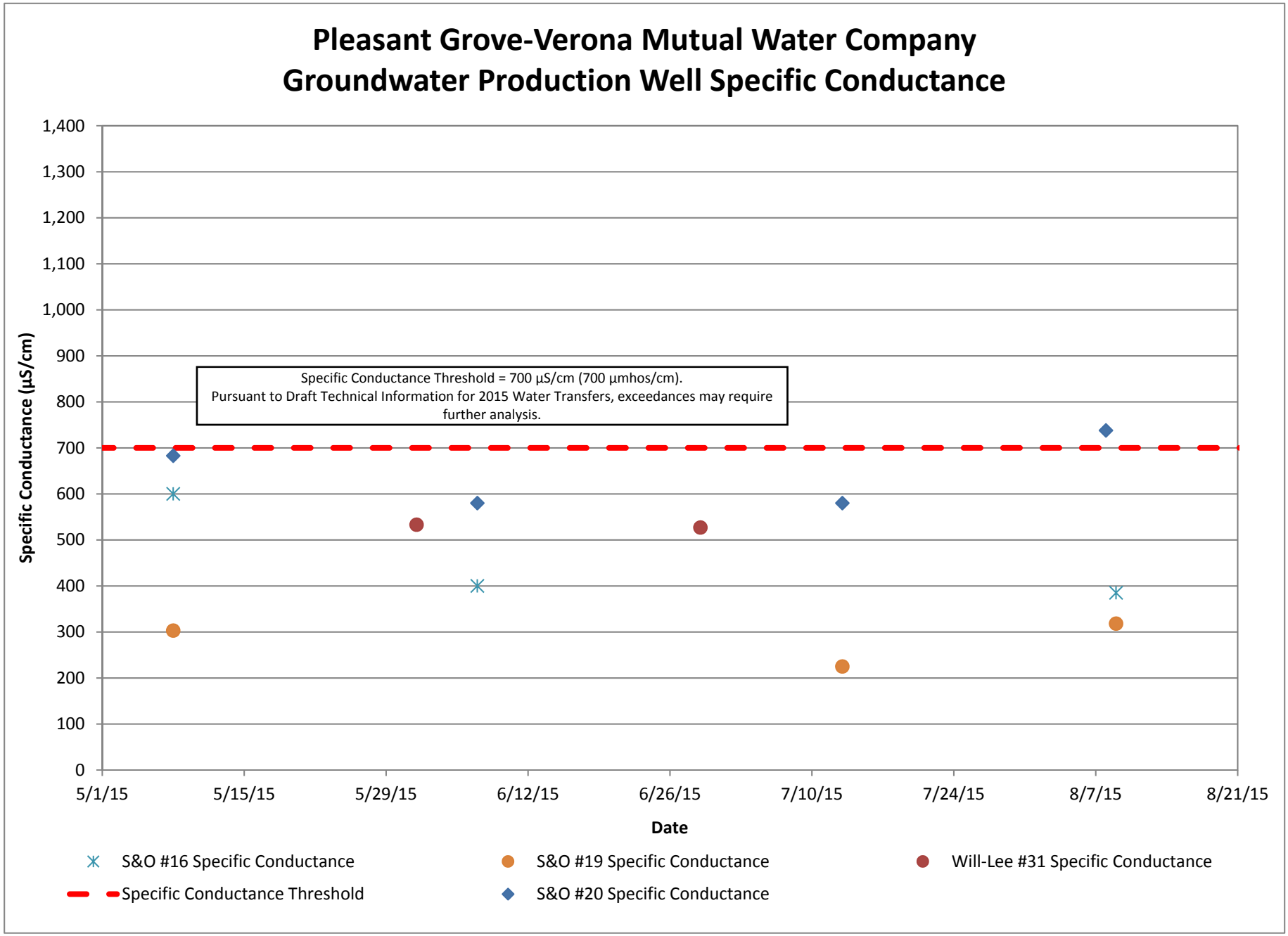


Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Specific Conductance

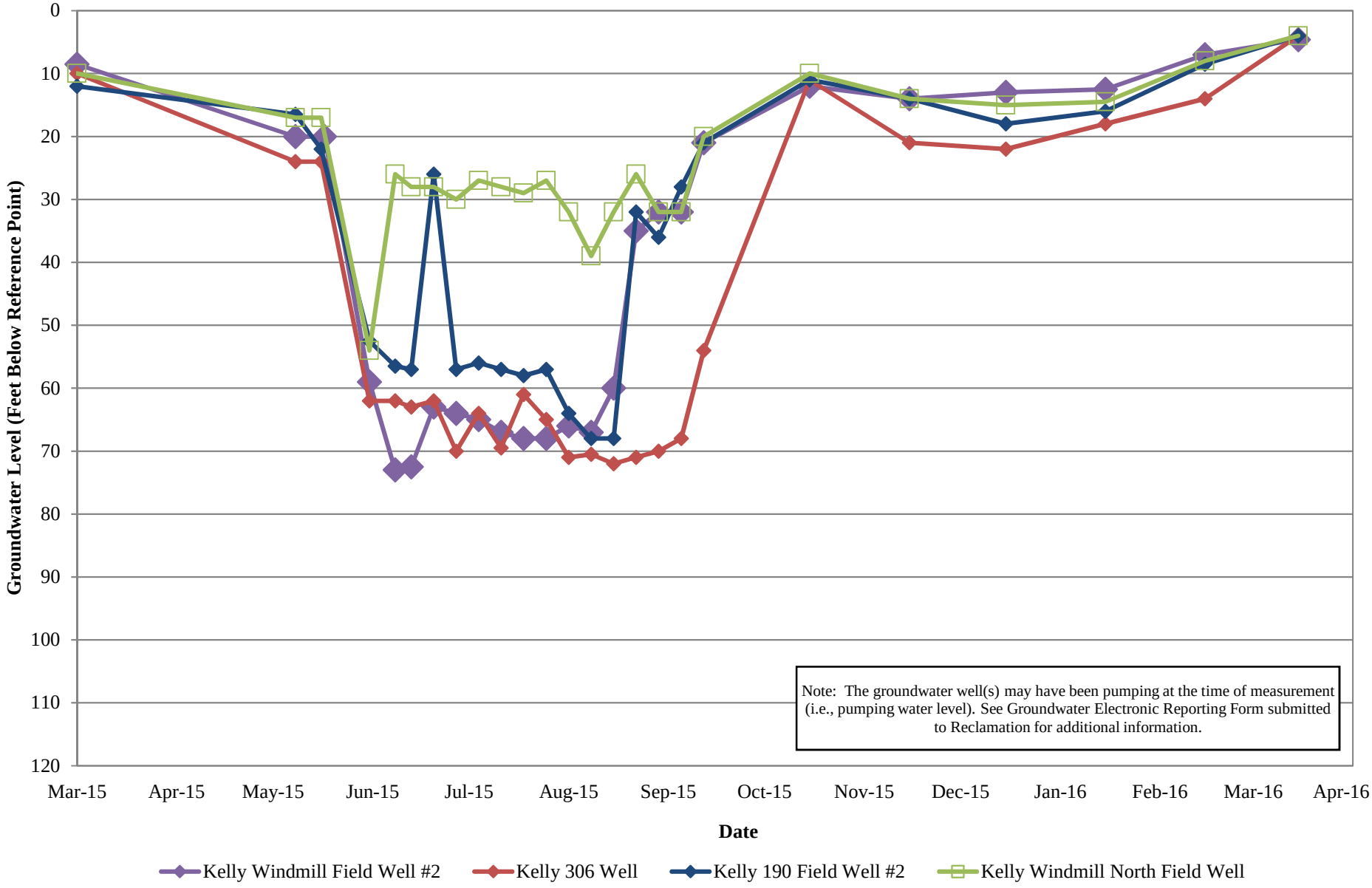


Pleasant Grove-Verona Mutual Water Company
Production Well Groundwater Level Data

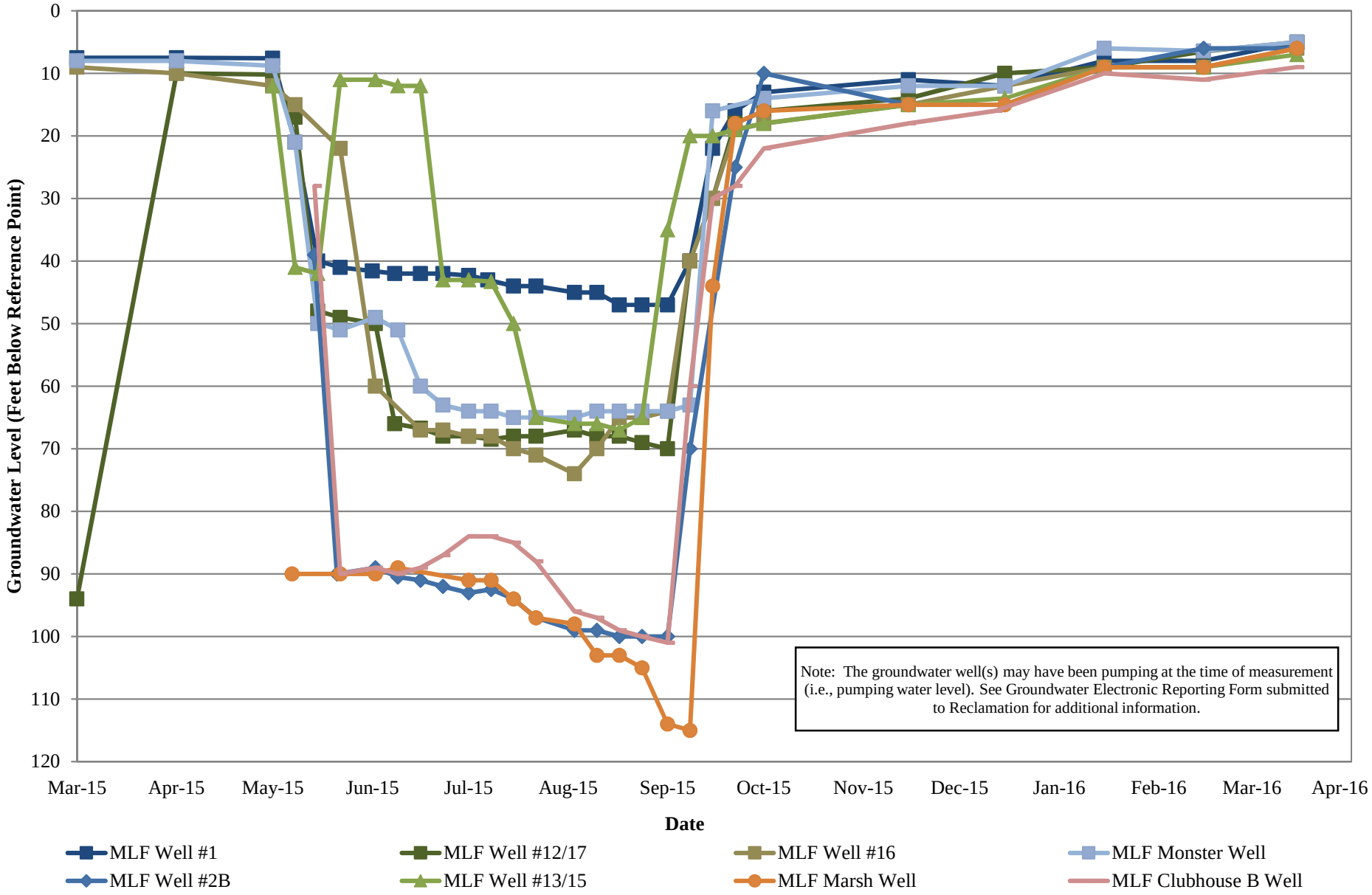



Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Specific Conductance
Specific Conductance (µS/cm)
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2015 Water Transfers, exceedances may require further analysis.
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
8/21/15
Date
S&O #16 Specific Conductance
S&O #19 Specific Conductance
Will-Lee #31 Specific Conductance
Specific Conductance Threshold
S&O #20 Specific Conductance

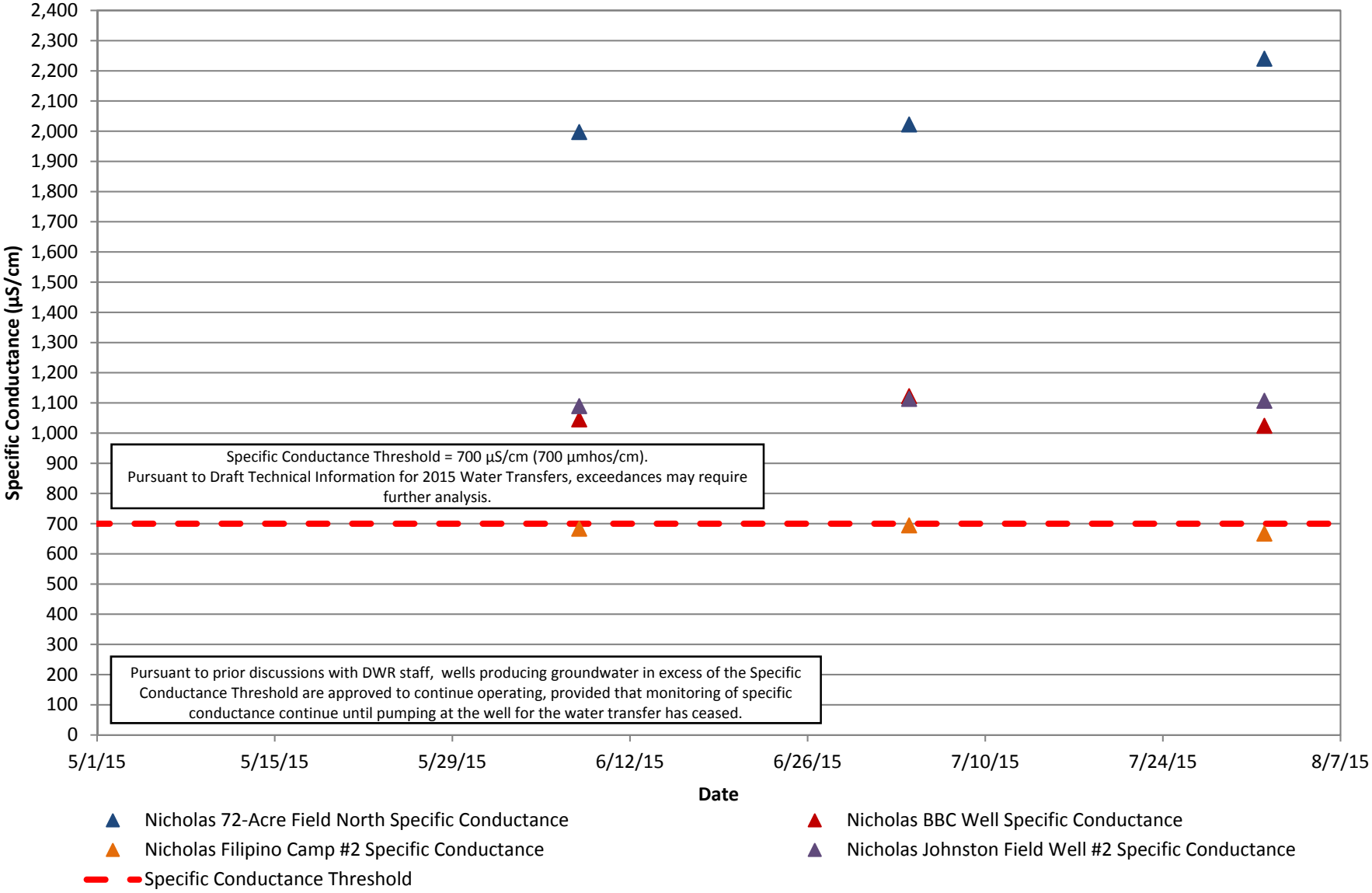
Pleasant Grove-Verona Mutual Water Company
Production Well Groundwater Level Data



Pleasant Grove-Verona Mutual Water Company
Production Well Groundwater Level Data



Pleasant Grove-Verona Mutual Water Company
Groundwater Production Well Specific Conductance



Princeton-Codora-Glenn Irrigation District

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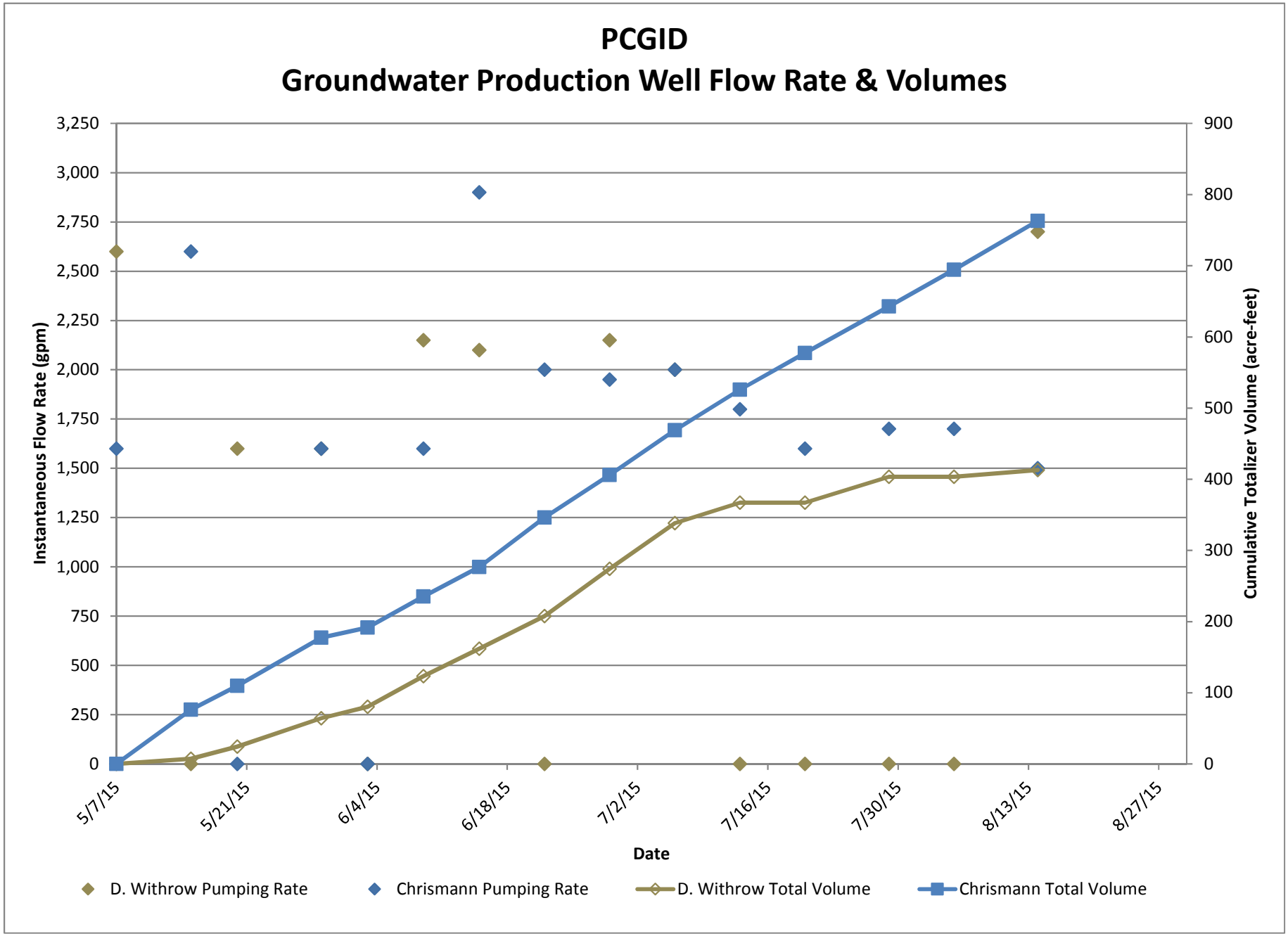
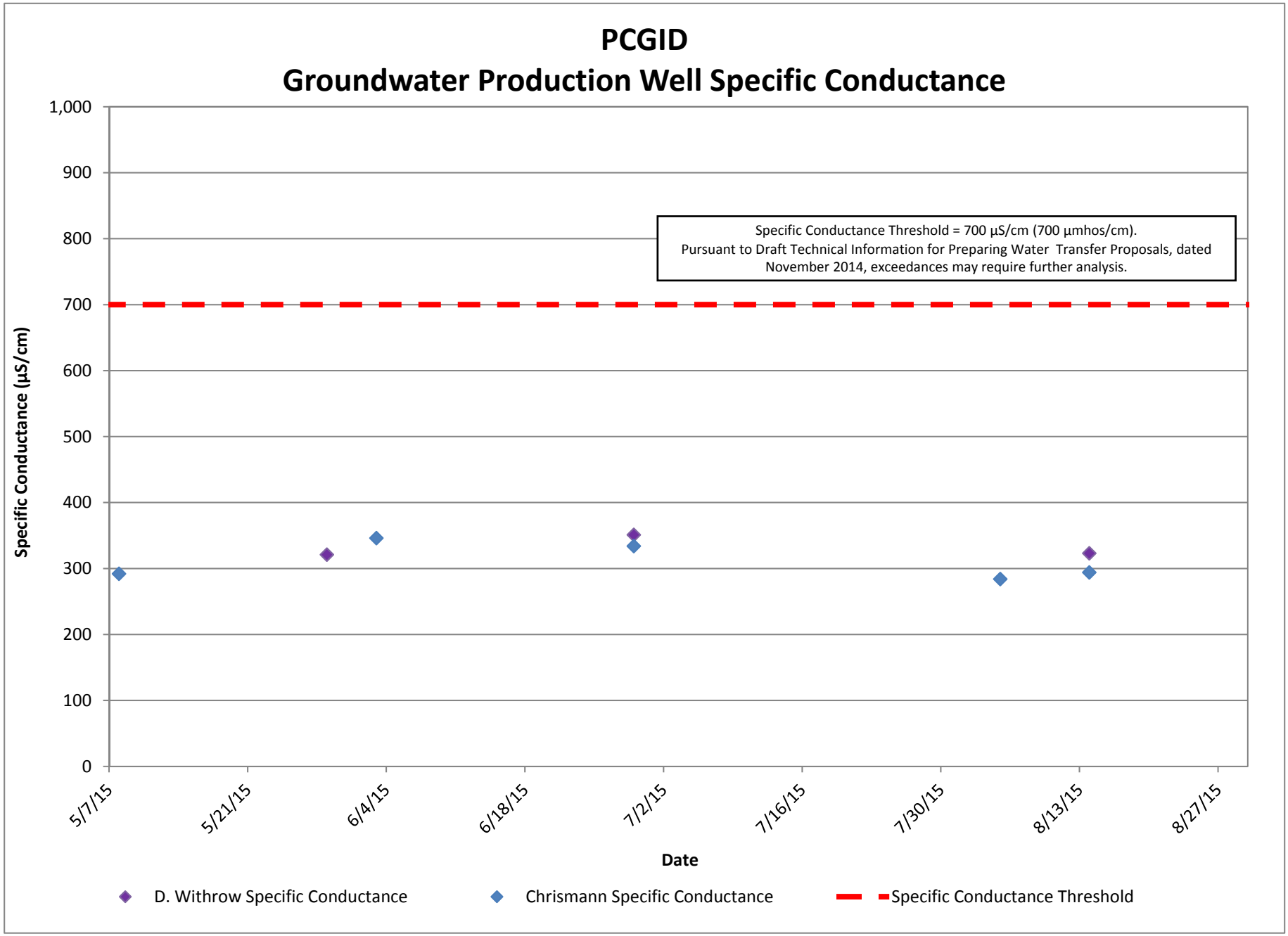
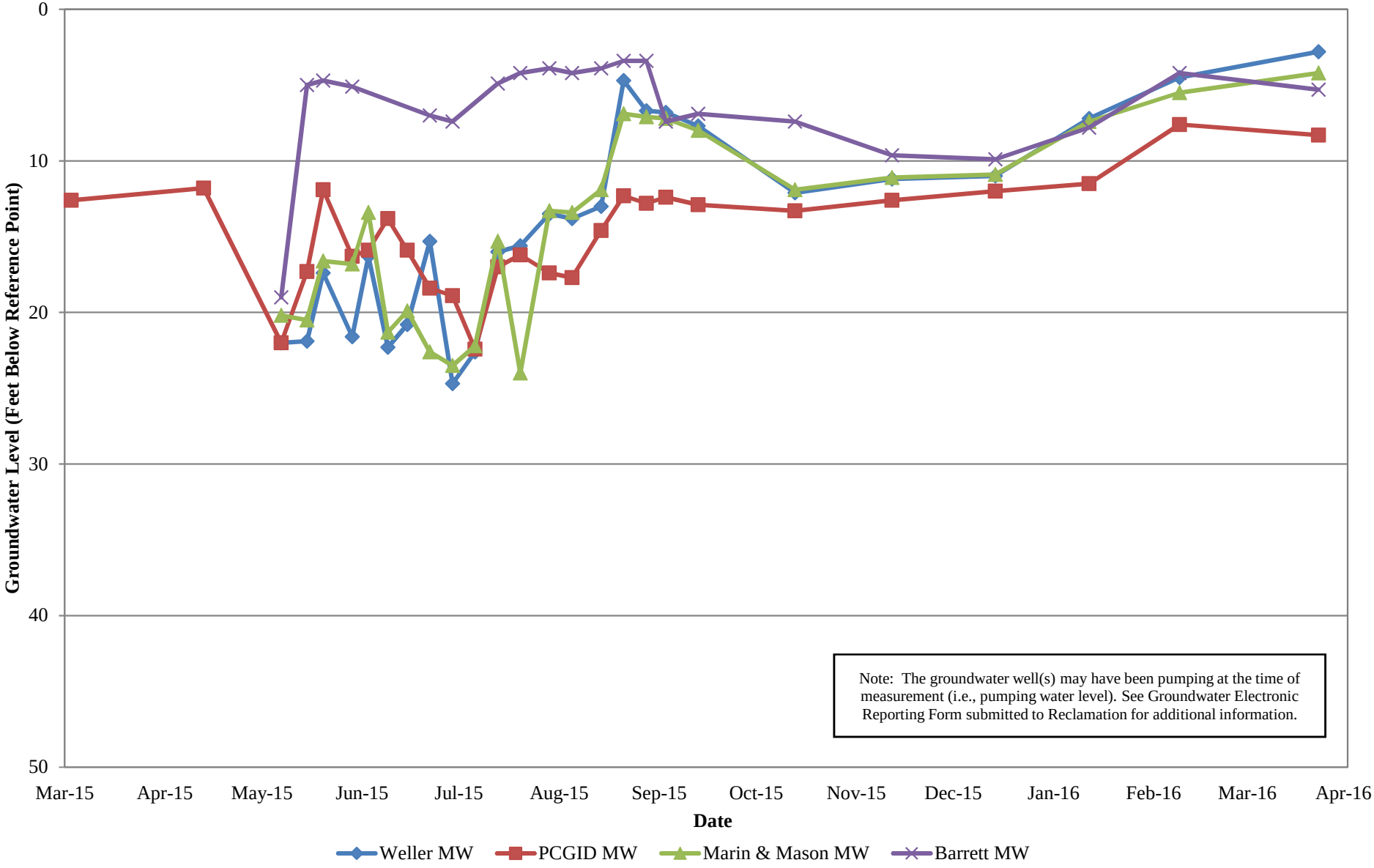

PCGID
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
3,250
3,000
2,750
2,500
2,250
2,000
1,750
1,500
1,250
1,000
750
500
250
0
900
800
700
600
500
400
300
200
100
0
5/7/15
5/21/15
6/4/15
6/18/15
7/2/15
7/16/15
7/30/15
8/13/15
8/27/15
Date
D. Withrow Pumping Rate
Chrismann Pumping Rate
D. Withrow Total Volume
Chrismann Total Volume

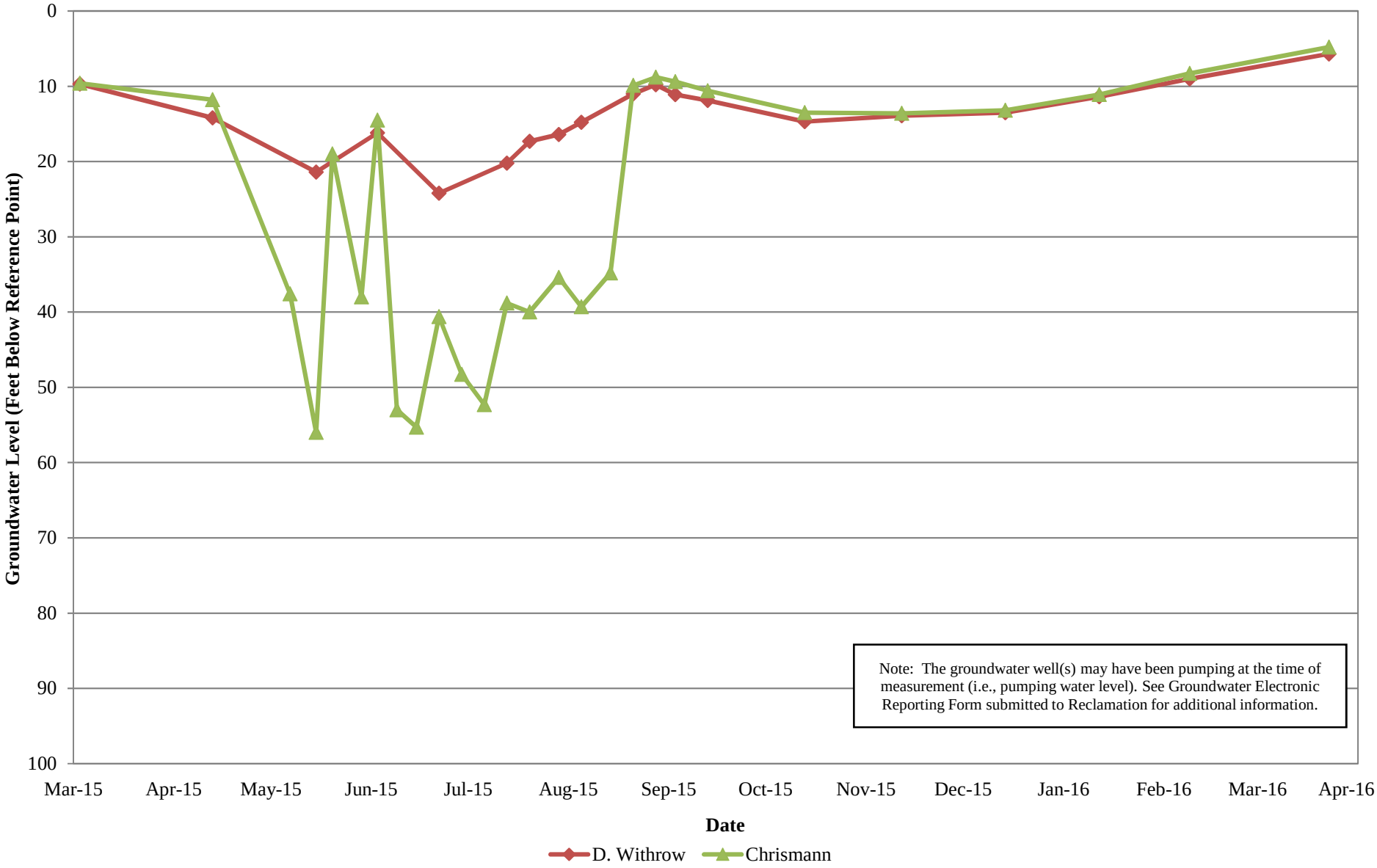

PCGID
Groundwater Production Well Specific Conductance
Specific Conductance (µS/cm)
1,000
900
800
700
600
500
400
300
200
100
0
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for Preparing Water Transfer Proposals, dated November 2014, exceedances may require further analysis.
5/7/15
5/21/15
6/4/15
6/18/15
7/2/15
7/16/15
7/30/15
8/13/15
8/27/15
Date
D. Withrow Specific Conductance
Chrismann Specific Conductance
Specific Conductance Threshold

Princeton-Codora-Glenn Irrigation District
Monitoring Well Groundwater Level Data

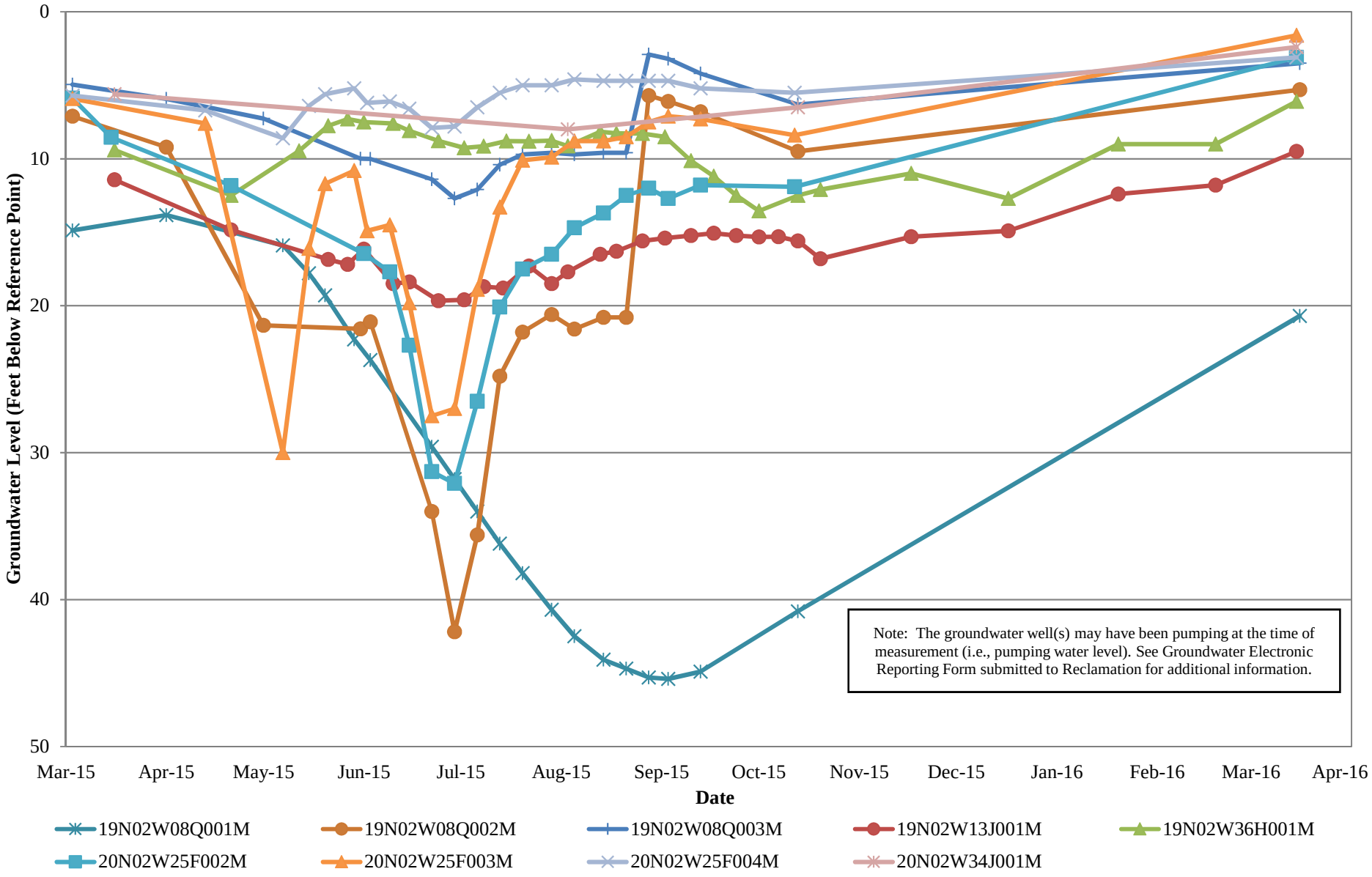


Note: The groundwater well(s) may have been pumping at the time of measurement (i.e., pumping water level). See Groundwater Electronic Reporting Form submitted to Reclamation for additional information.

Princeton-Codora-Glenn Irrigation District
Production Well Groundwater Level Data



Princeton-Codora-Glenn Irrigation District
DWR Monitoring Well Groundwater Level Data



Provident Irrigation District

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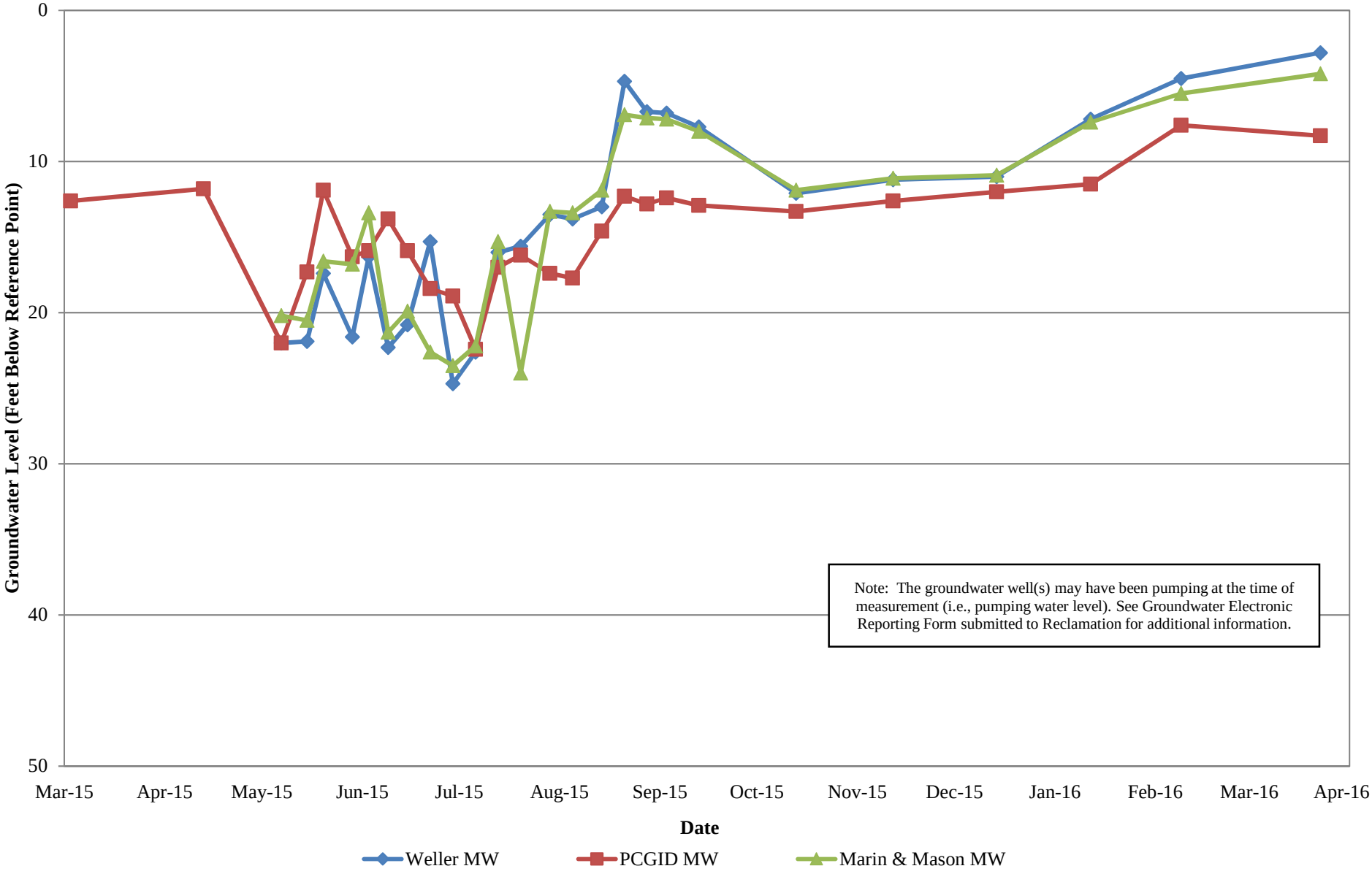
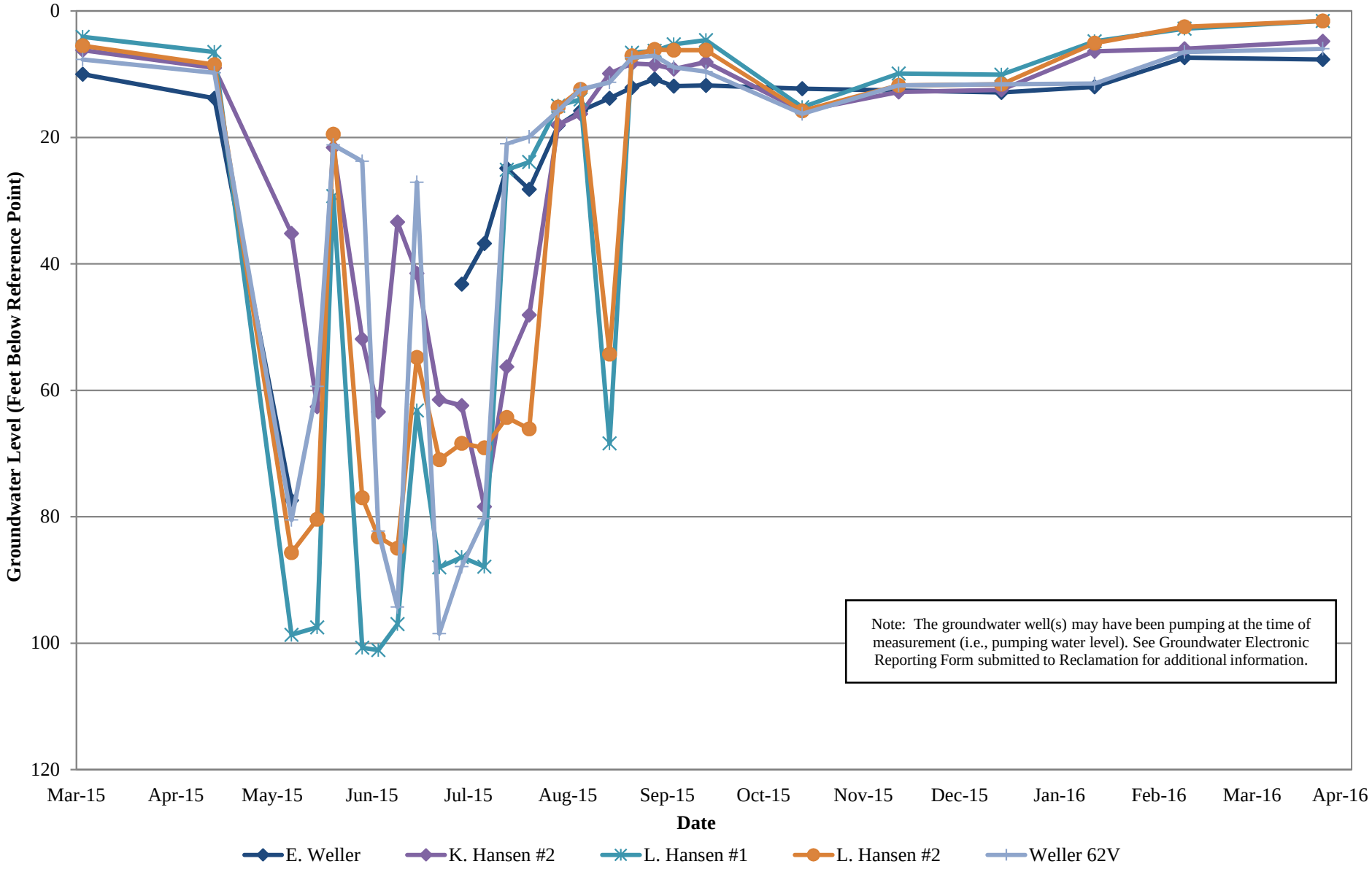
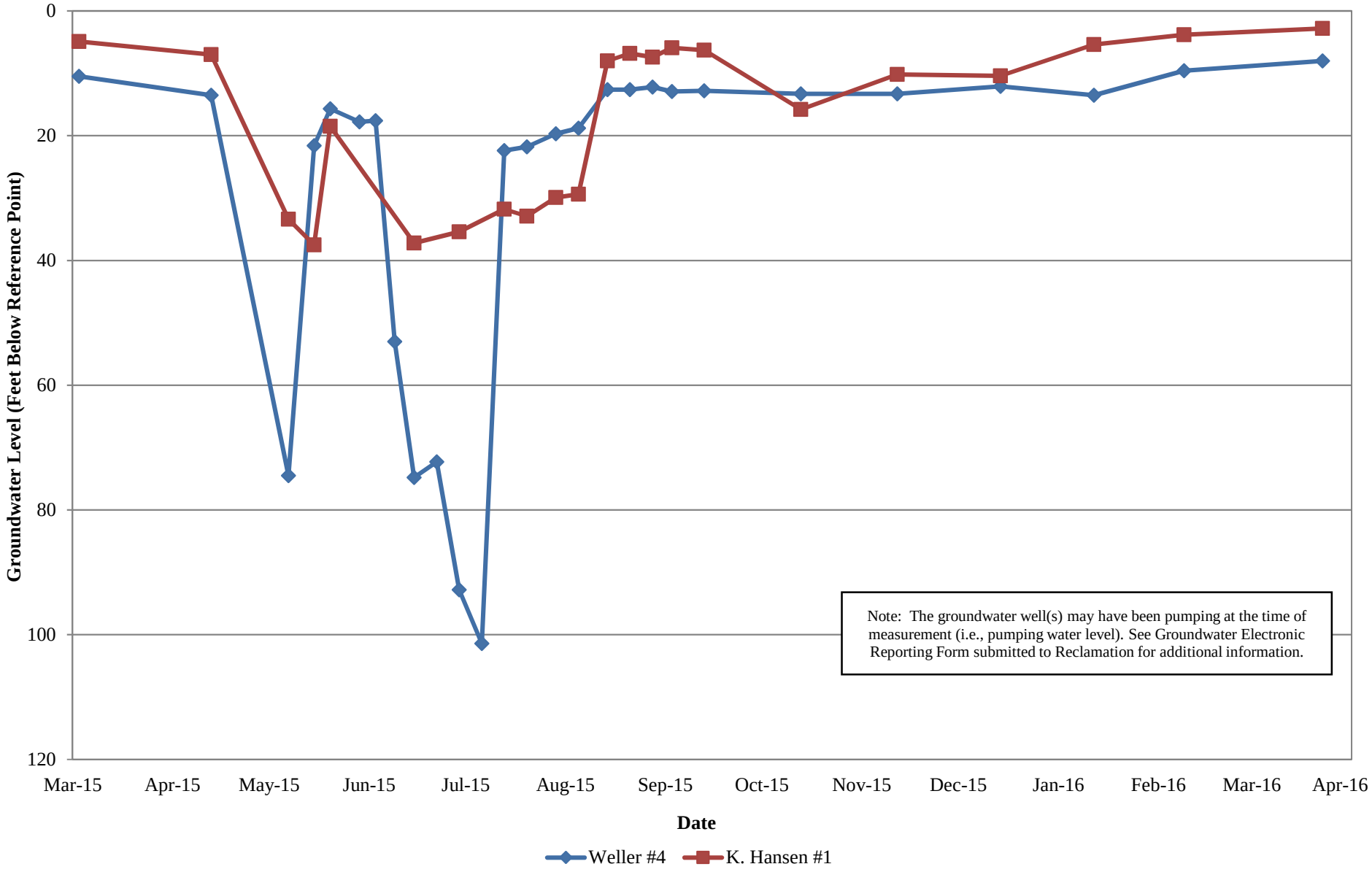
Provident Irrigation District
Monitoring Well Groundwater Level Data

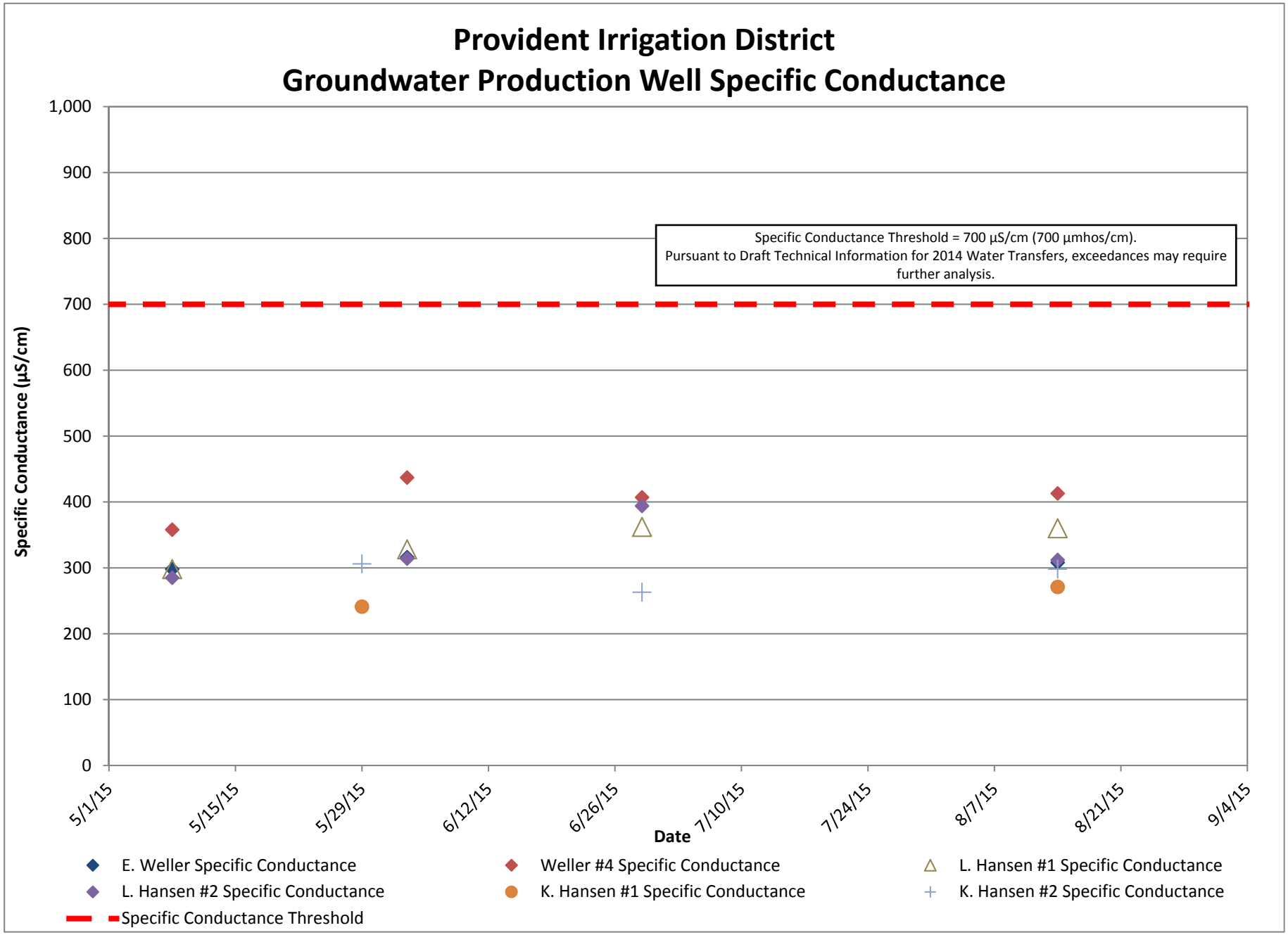


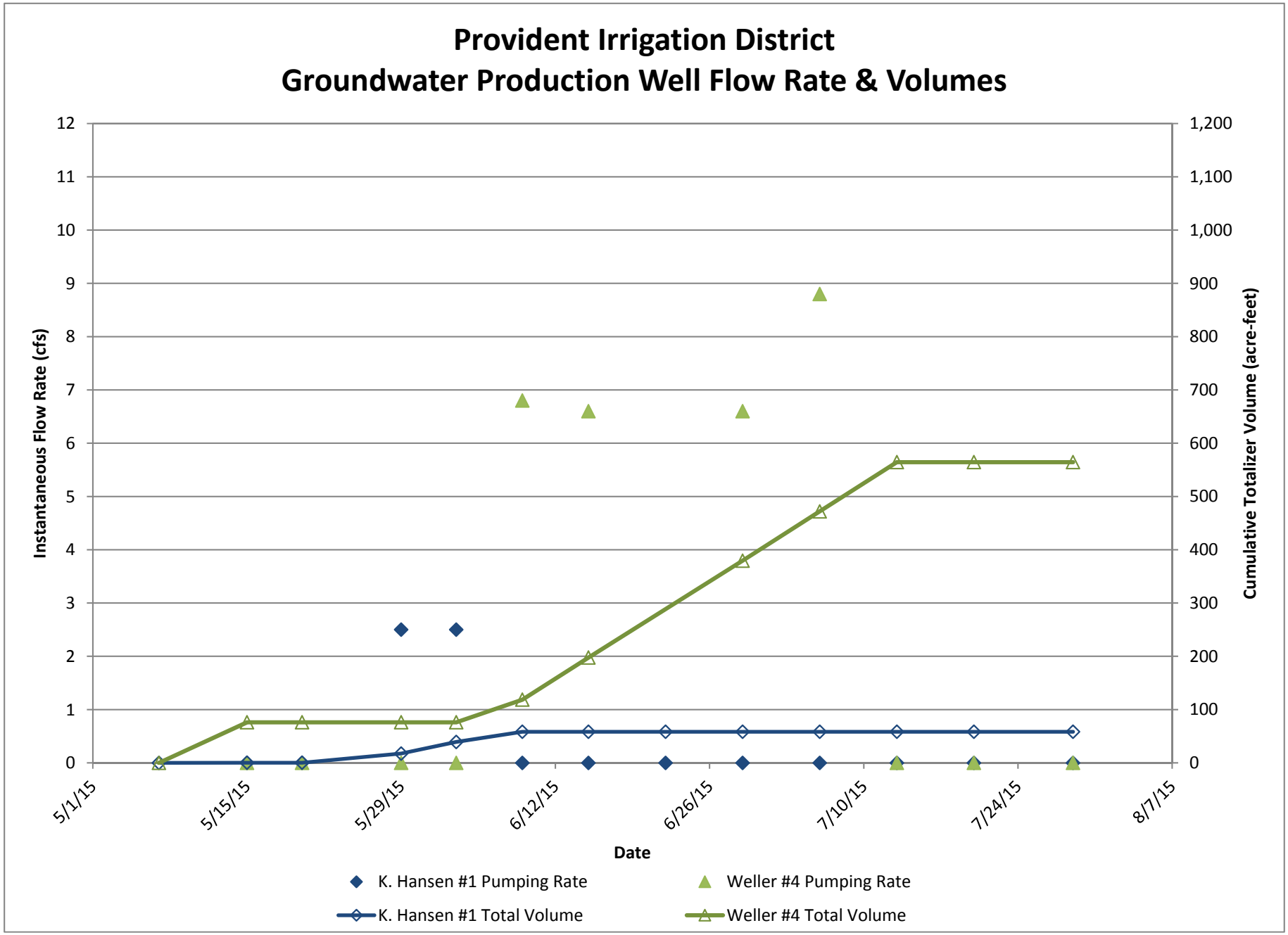
Provident Irrigation District
Production Well Groundwater Level Data

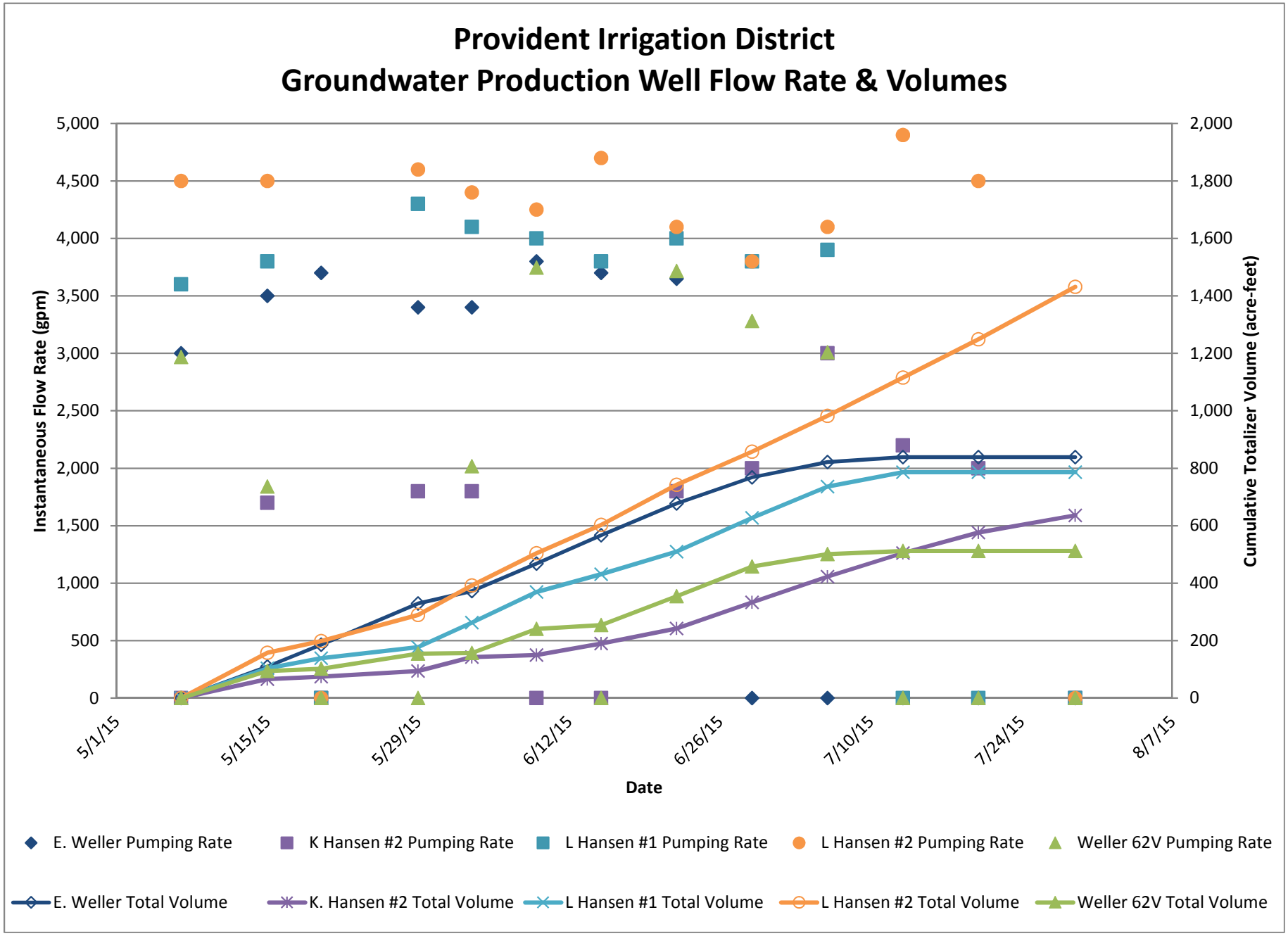


Provident Irrigation District
Production Well Groundwater Level Data

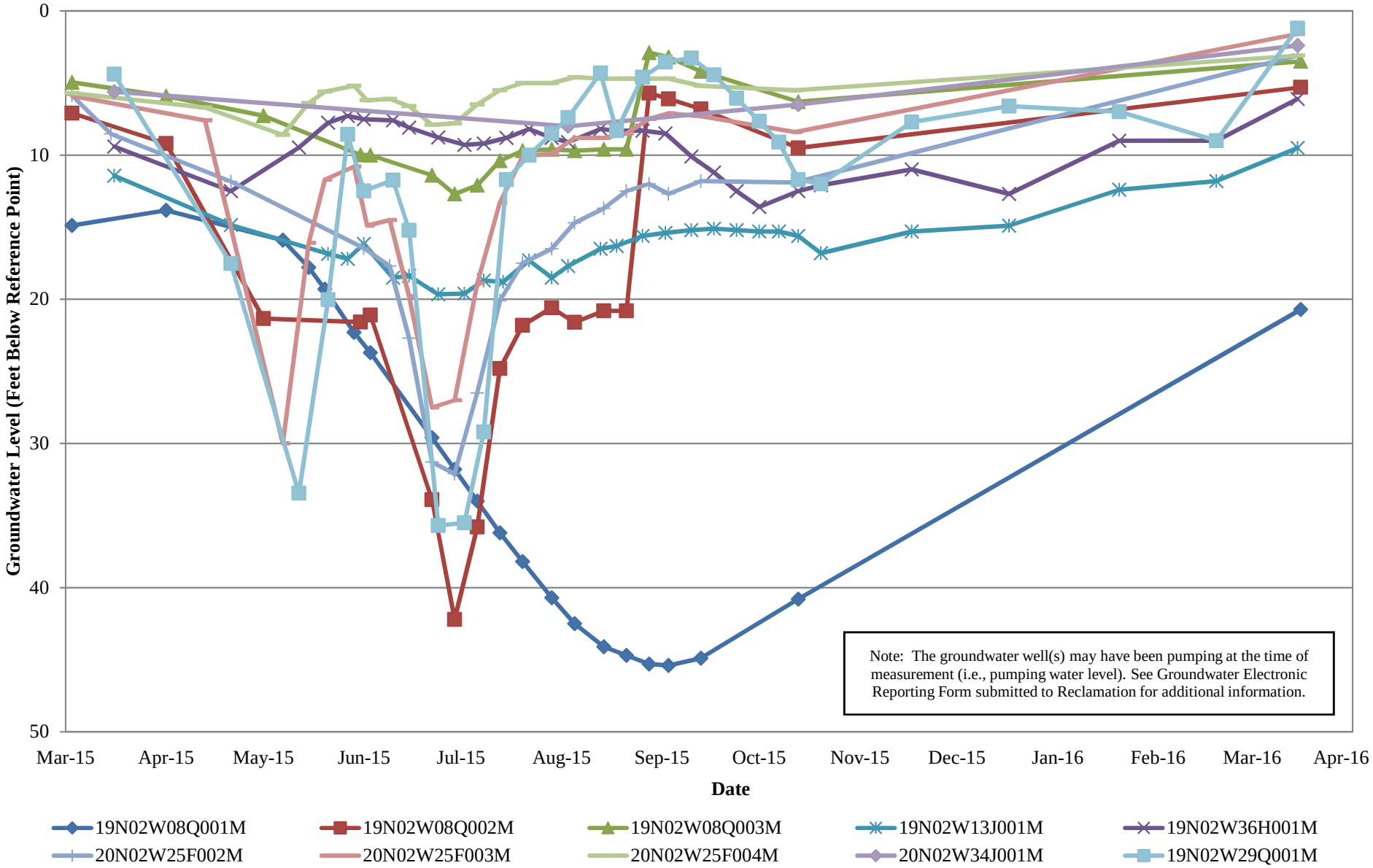



Provident Irrigation District
Groundwater Production Well Specific Conductance
Specific Conductance (µS/cm)
1,000
900
800
700
600
500
400
300
200
100
0
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for 2014 Water Transfers, exceedances may require further analysis.
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
8/21/15
9/4/15
Date
E. Weller Specific Conductance
Weller #4 Specific Conductance
L. Hansen #1 Specific Conductance
L. Hansen #2 Specific Conductance
K. Hansen #1 Specific Conductance
K. Hansen #2 Specific Conductance
Specific Conductance Threshold


Provident Irrigation District
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (cfs)
Cumulative Totalizer Volume (acre-feet)
0
1
2
3
4
5
6
7
8
9
10
11
12
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
Date
K. Hansen #1 Pumping Rate
Weller #4 Pumping Rate
K. Hansen #1 Total Volume
Weller #4 Total Volume


Provident Irrigation District
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
5/1/15
5/15/15
5/29/15
6/12/15
6/26/15
7/10/15
7/24/15
8/7/15
Date
E. Weller Pumping Rate
K Hansen #2 Pumping Rate
L Hansen #1 Pumping Rate
L Hansen #2 Pumping Rate
Weller 62V Pumping Rate
E. Weller Total Volume
K. Hansen #2 Total Volume
L Hansen #1 Total Volume
L Hansen #2 Total Volume
Weller 62V Total Volume

Provident Irrigation District
DWR Monitoring Well Groundwater Level Data



Reclamation District No. 108

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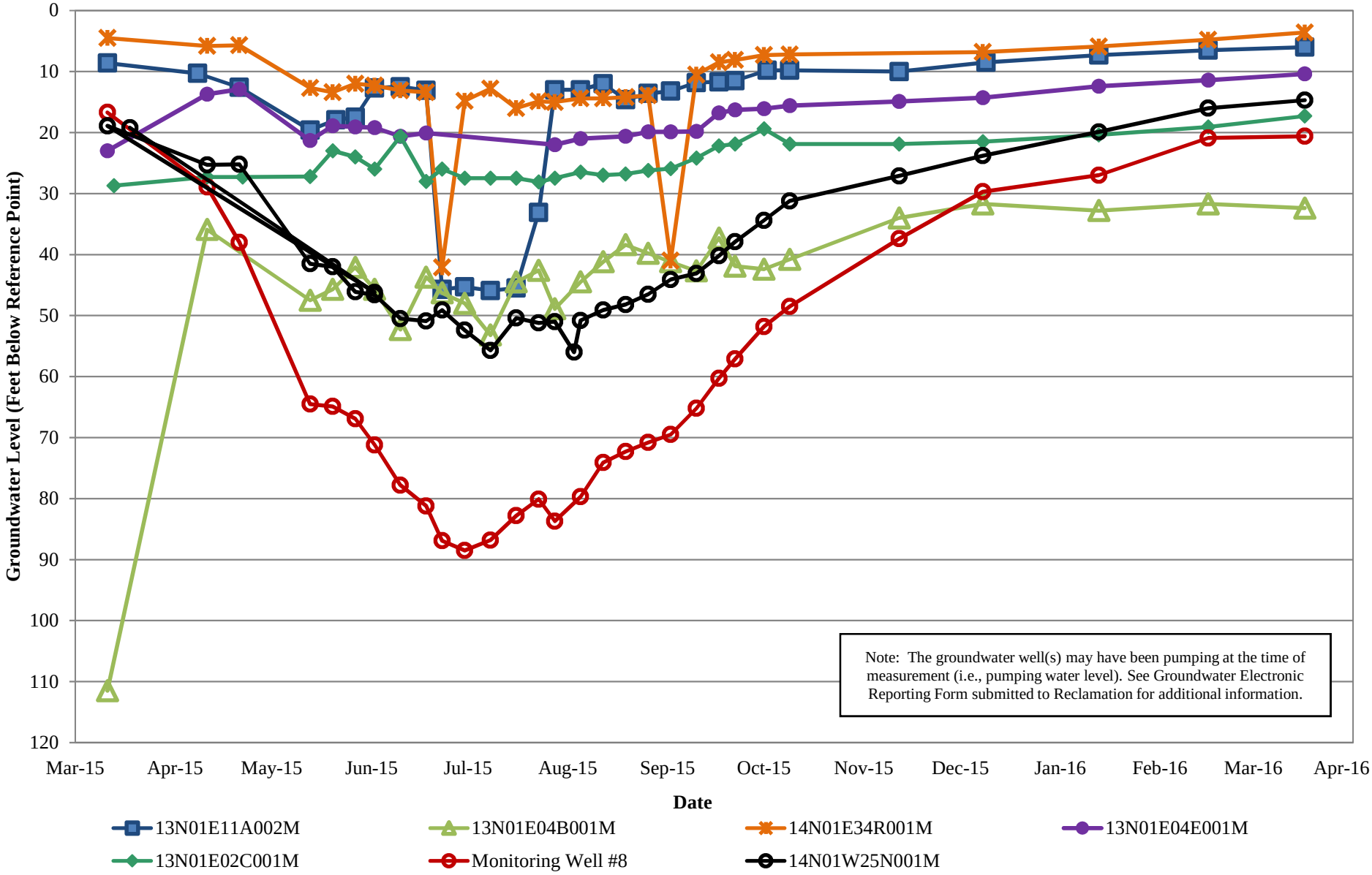
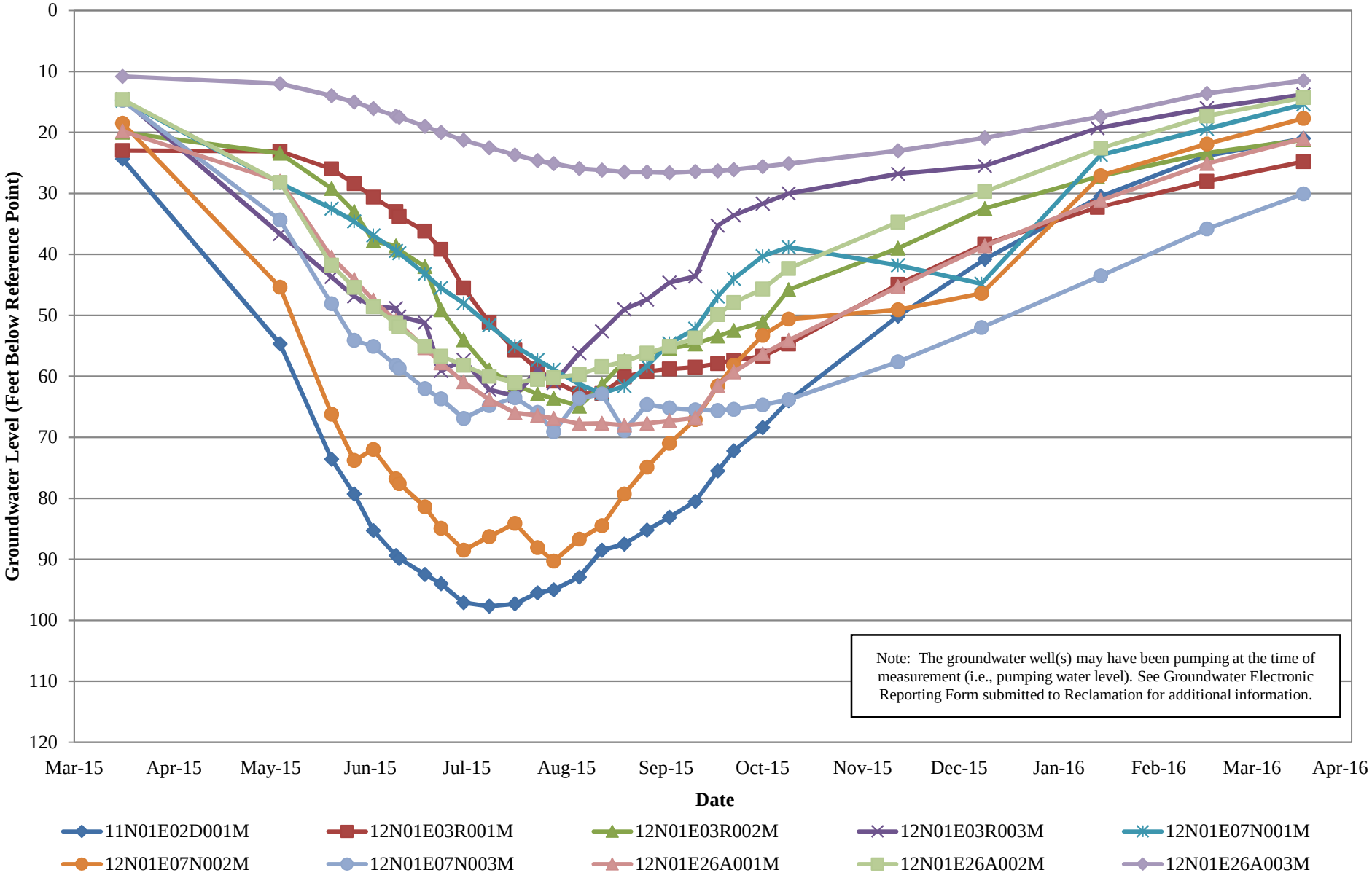
Reclamation District No. 108
Monitoring Well Groundwater Level Data



Reclamation District No. 108
Monitoring Well Groundwater Level Data



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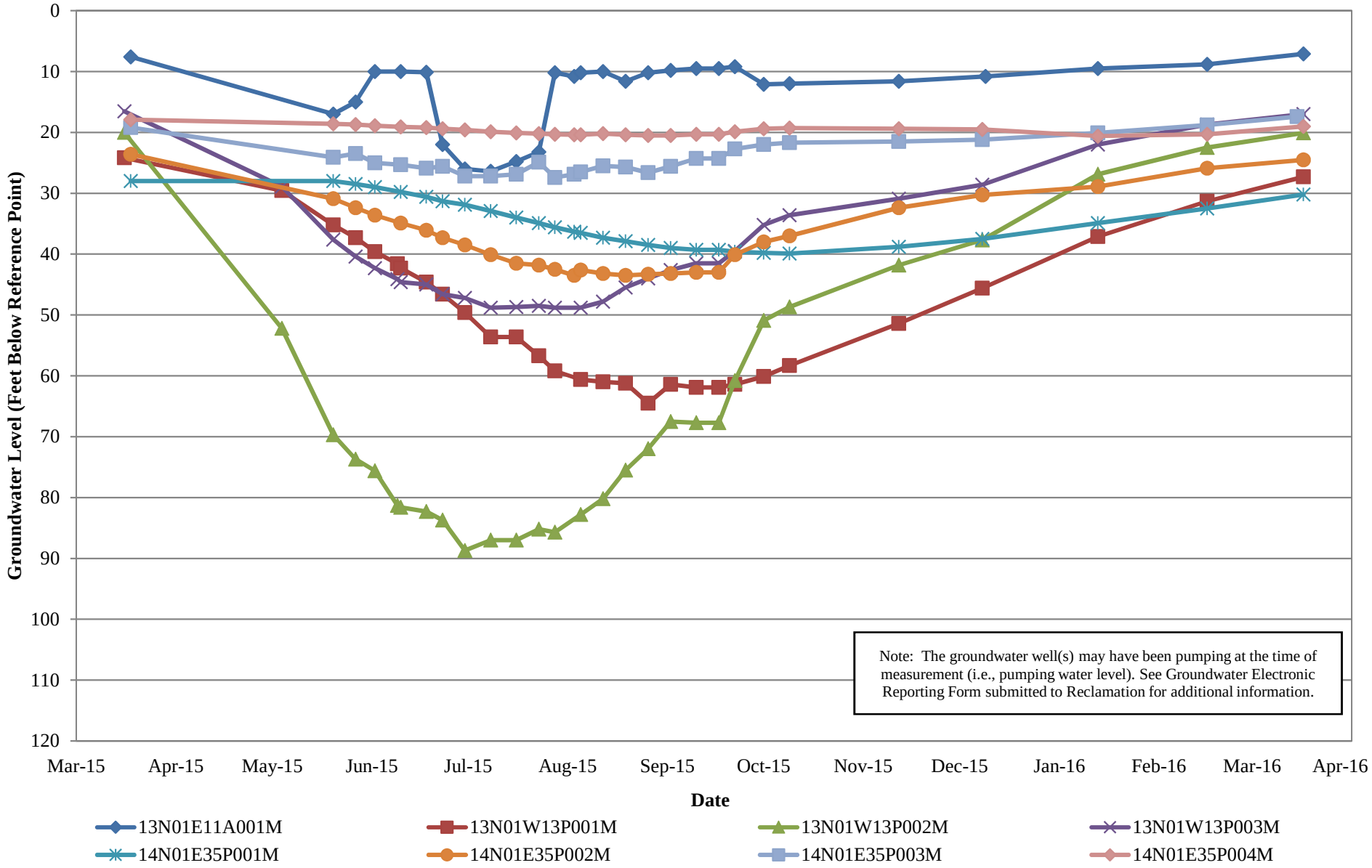
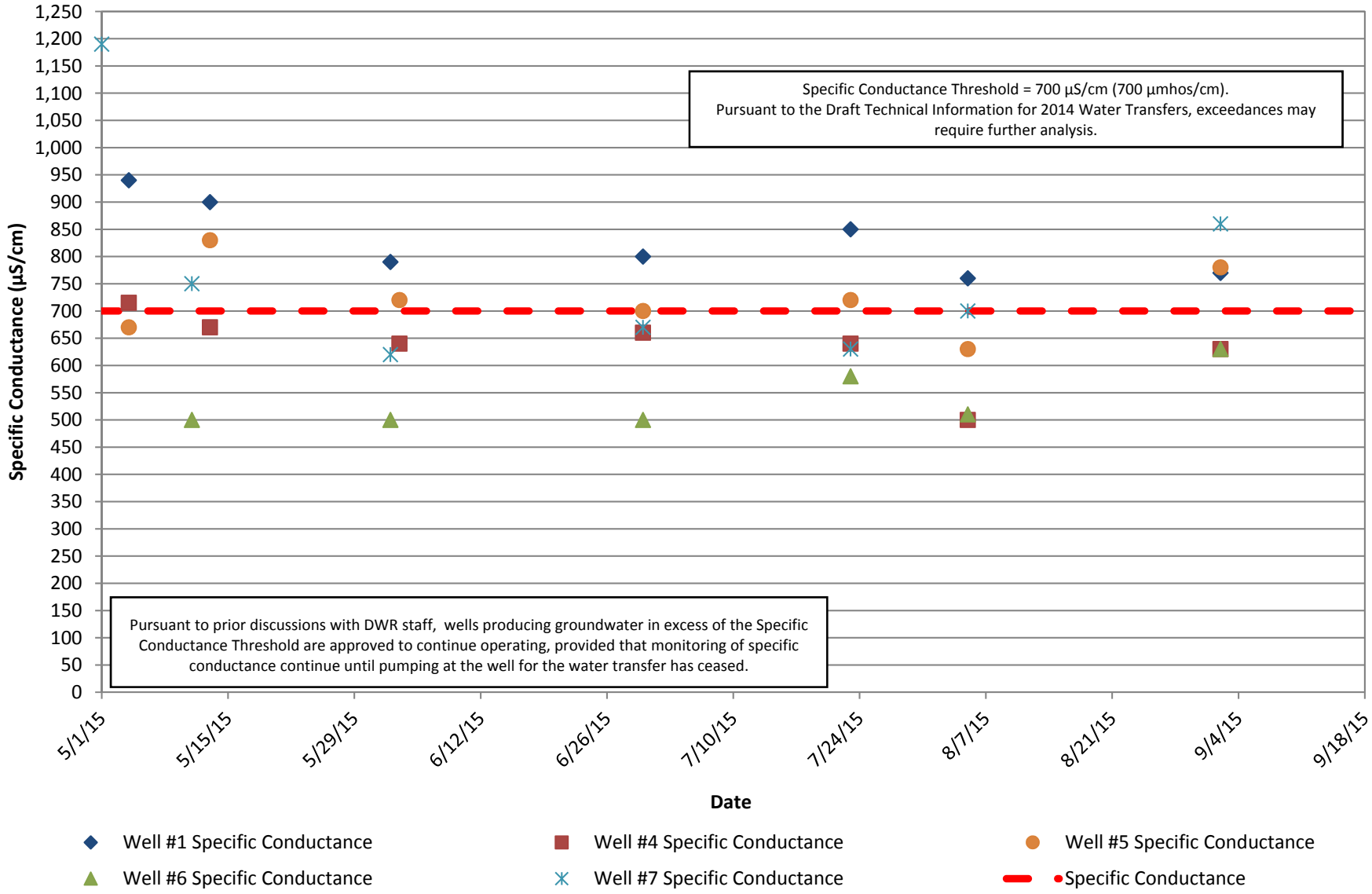
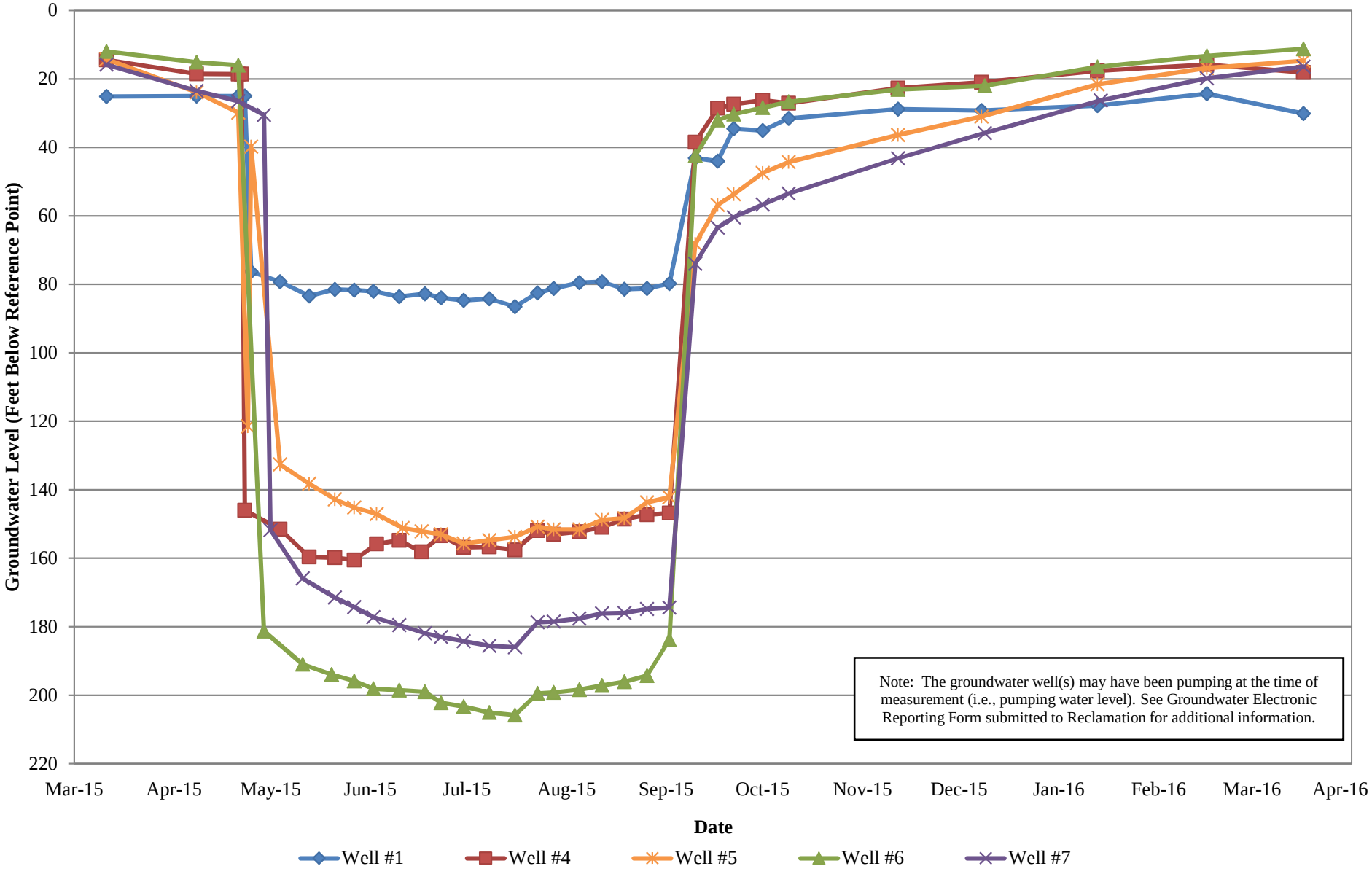
Monitoring Well Groundwater Level Data

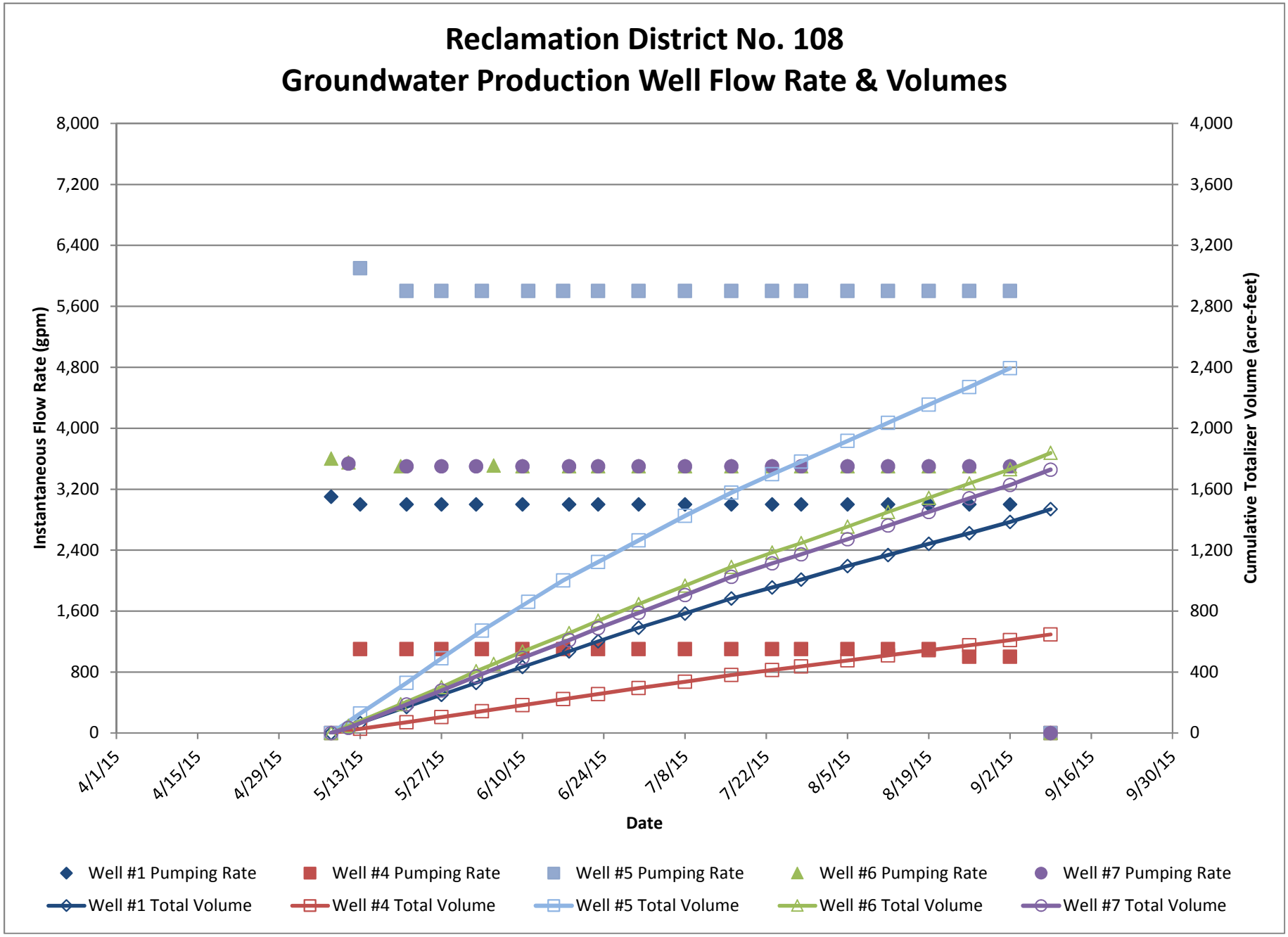


Reclamation District No. 108
Groundwater Production Well Specific Conductance



Reclamation District No. 108
Production Well Groundwater Level Data




Reclamation District No. 108
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
8,000
7,200
6,400
5,600
4,800
4,000
3,200
2,400
1,600
800
0
4,000
3,600
3,200
2,800
2,400
2,000
1,600
1,200
800
400
0
4/1/15
4/15/15
4/29/15
5/13/15
5/27/15
6/10/15
6/24/15
7/8/15
7/22/15
8/5/15
8/19/15
9/2/15
9/16/15
9/30/15
Date
Well #1 Pumping Rate
Well #4 Pumping Rate
Well #5 Pumping Rate
Well #6 Pumping Rate
Well #7 Pumping Rate
Well #1 Total Volume
Well #4 Total Volume
Well #5 Total Volume
Well #6 Total Volume
Well #7 Total Volume

River Garden Farms

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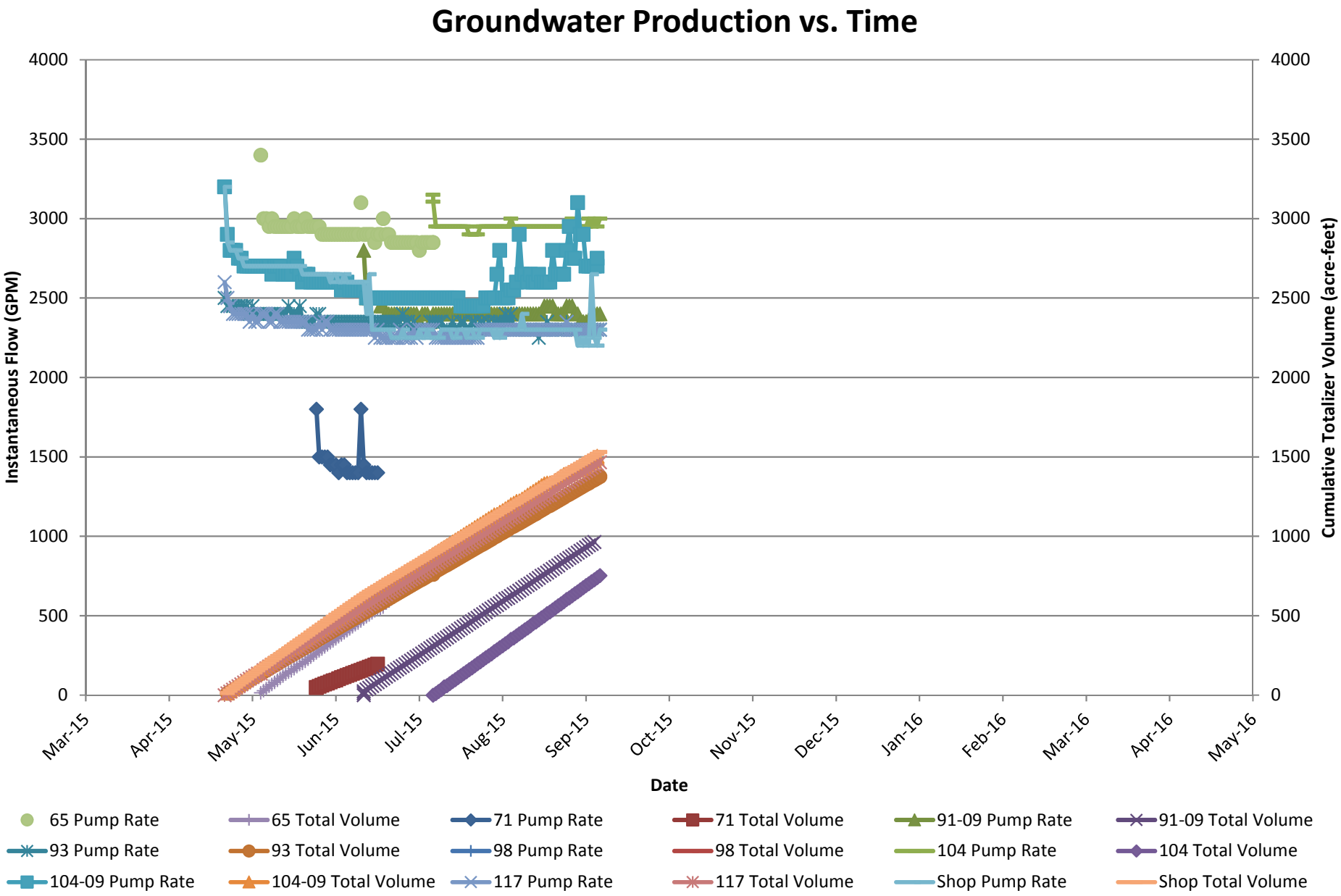

River Garden Farms
Final Report of 2015 Water Transfer Monitoring
July 2016

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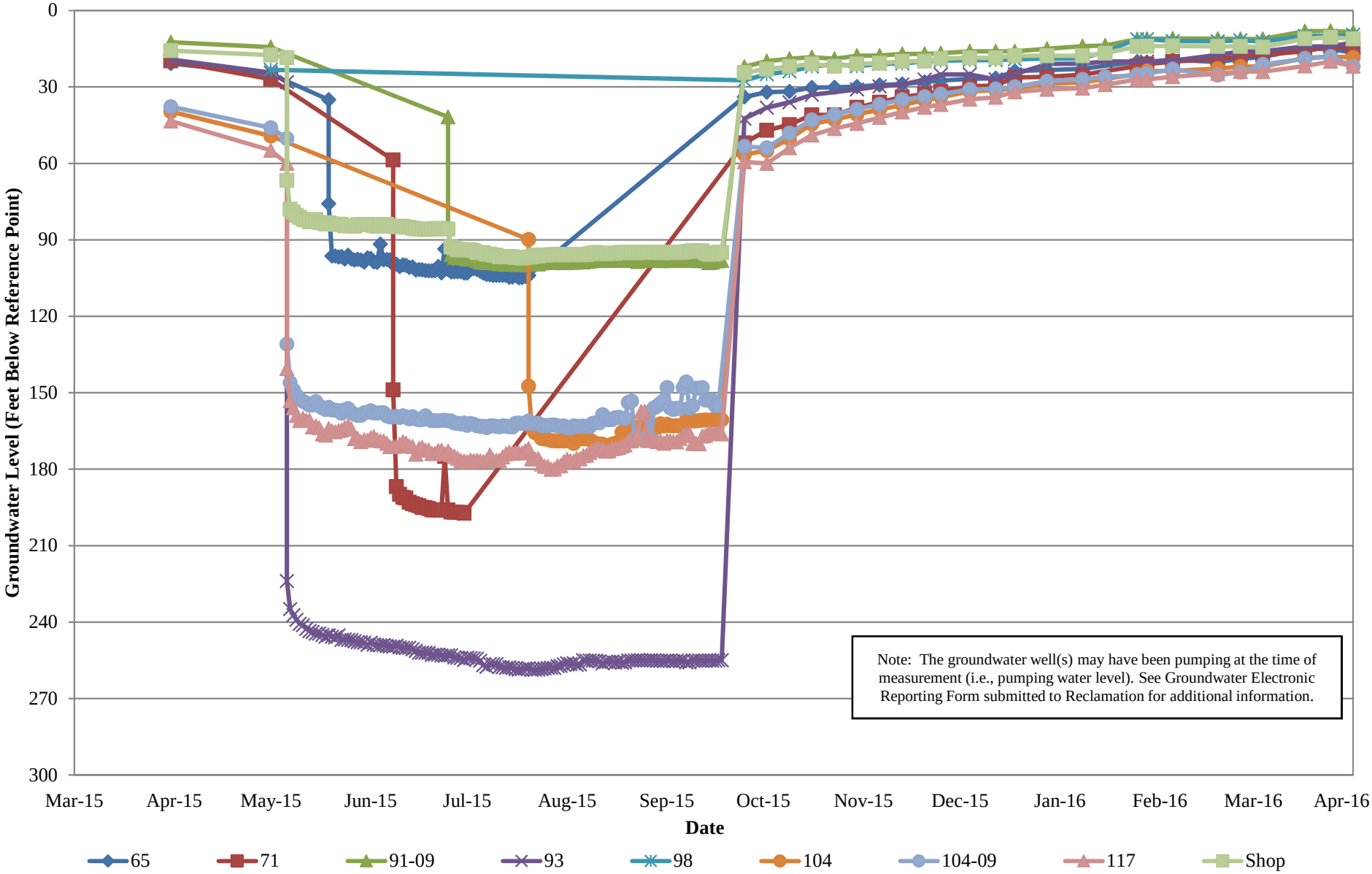
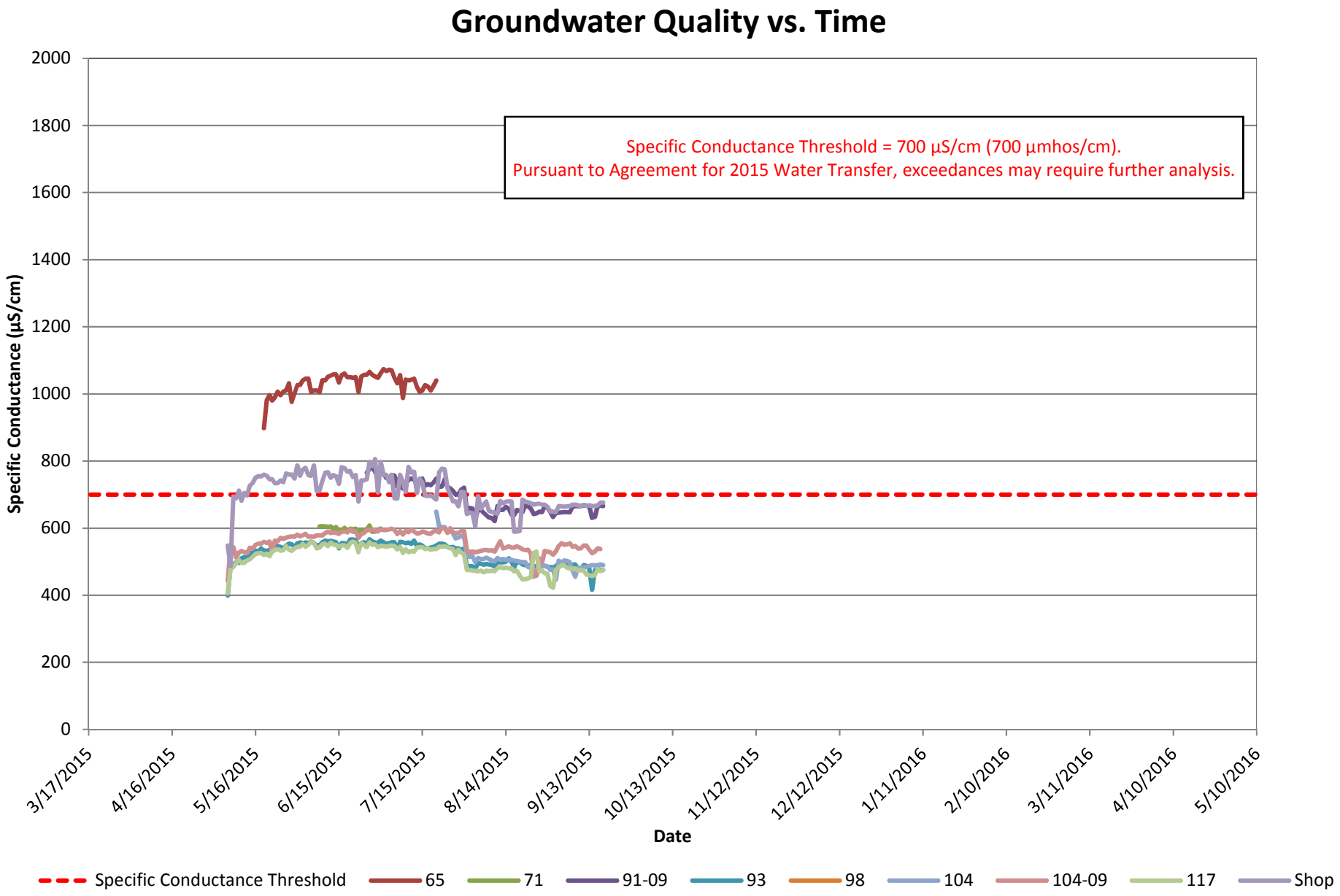
Tab: Production Data

River Garden Farms
Production Well Groundwater Level Data





River Garden Farms
Final Report of 2015 Water Transfer Monitoring
July 2016

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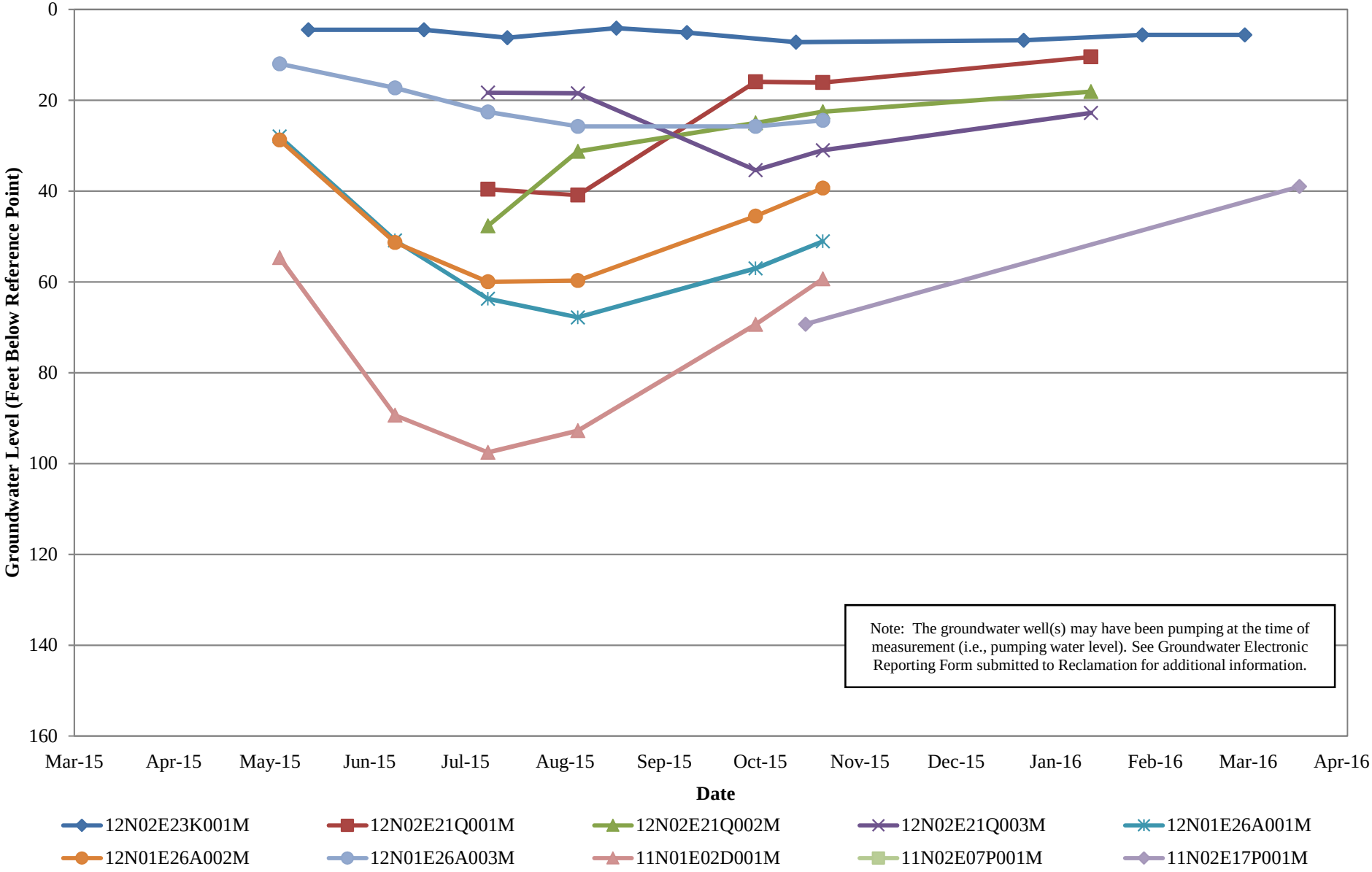
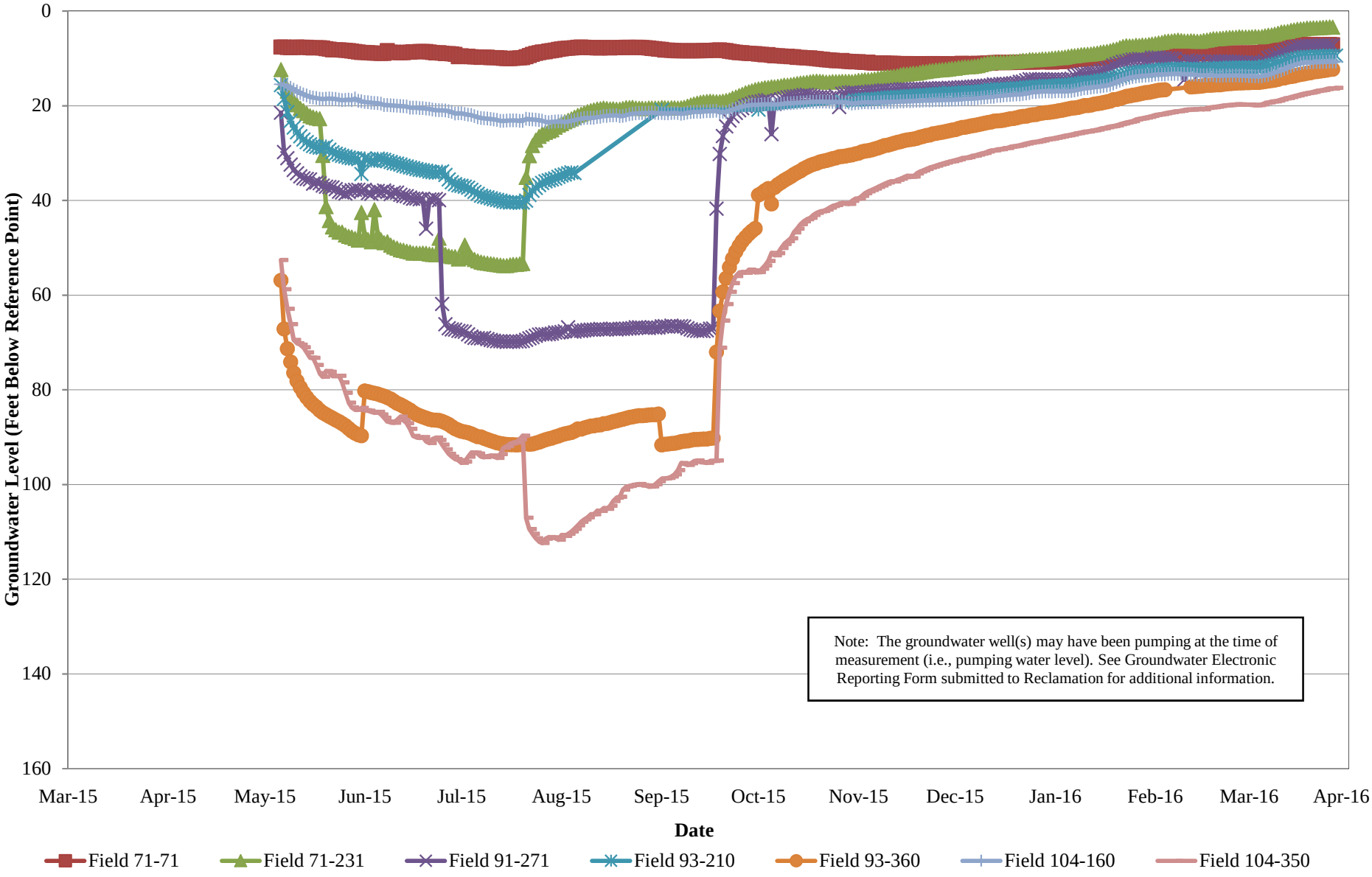
Tab: Water Quality Data

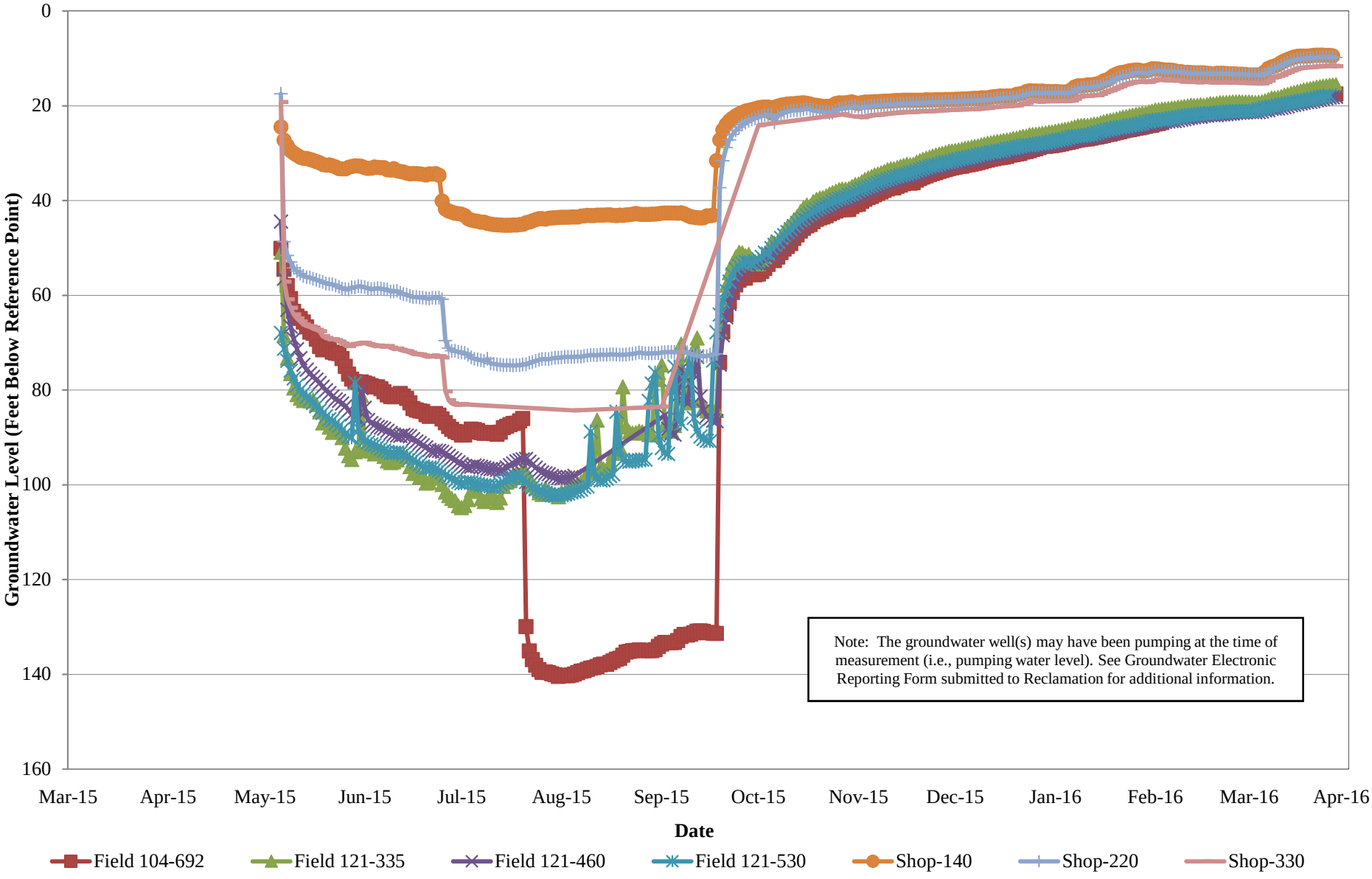
River Garden Farms
DWR Monitoring Well Groundwater Level Data



River Garden Farms
Monitoring Well Groundwater Level Data



River Garden Farms
Monitoring Well Groundwater Level Data



T&P Farms

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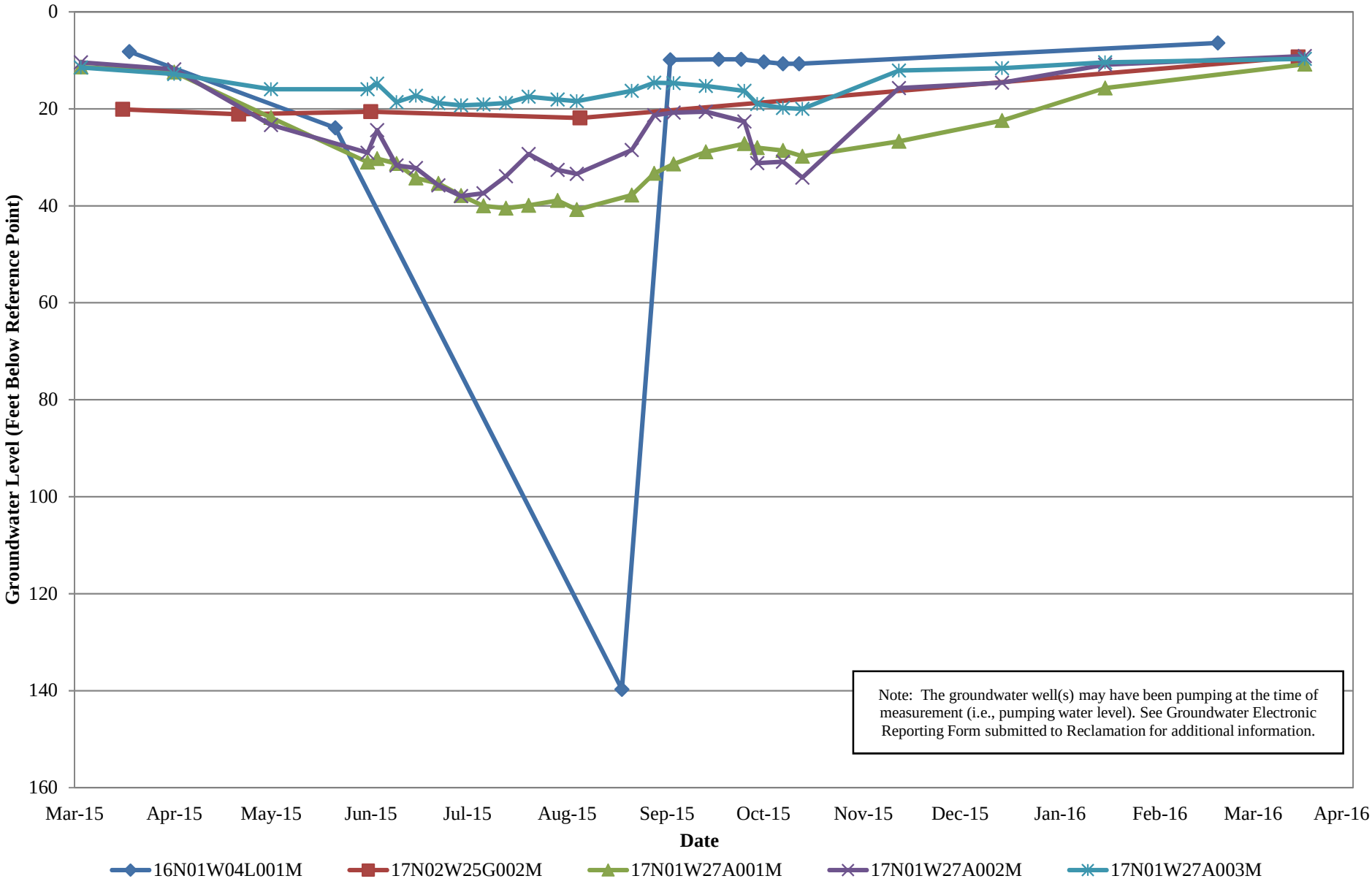
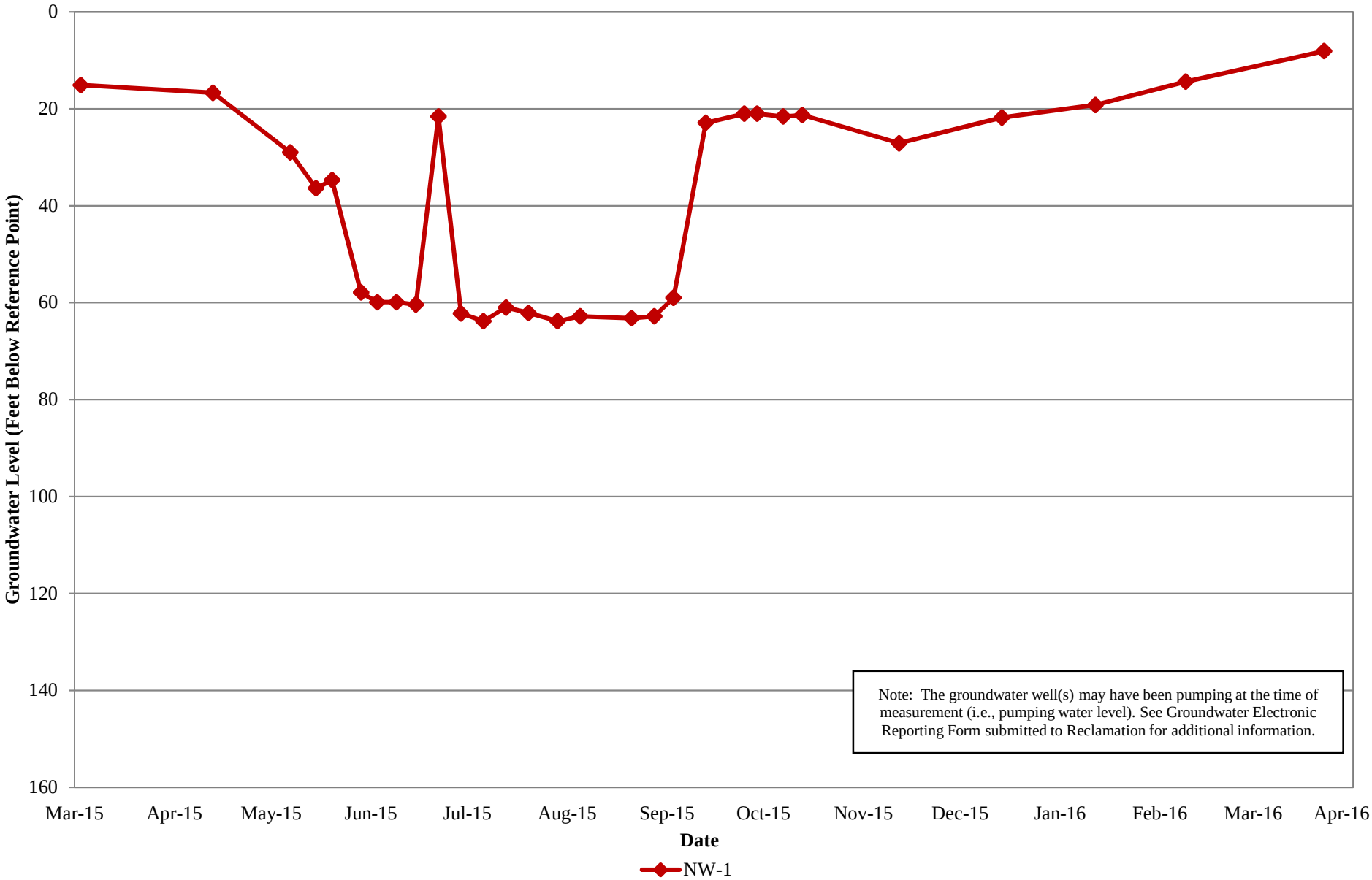
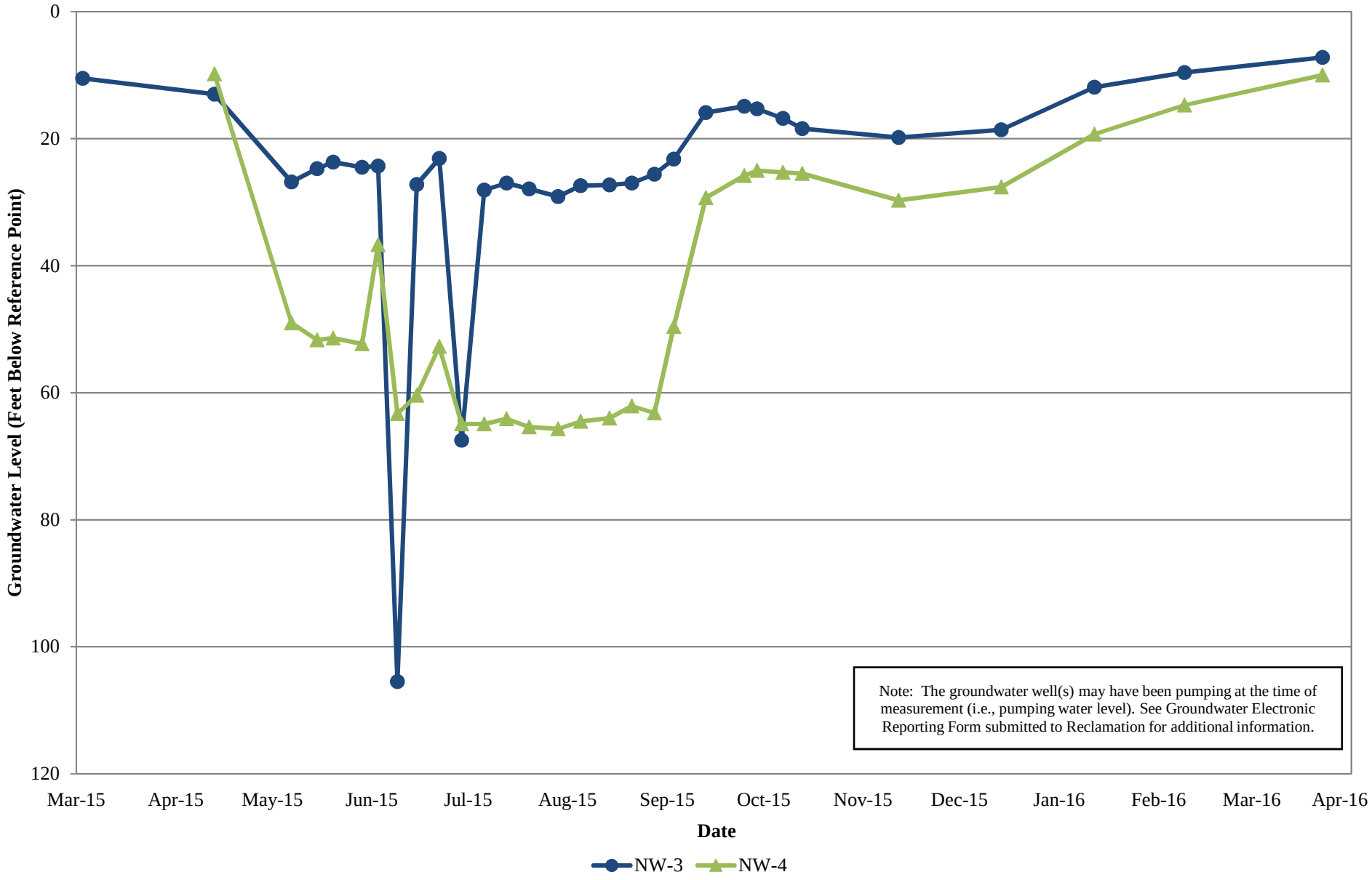
T&P Farms
DWR Monitoring Well Groundwater Level Data

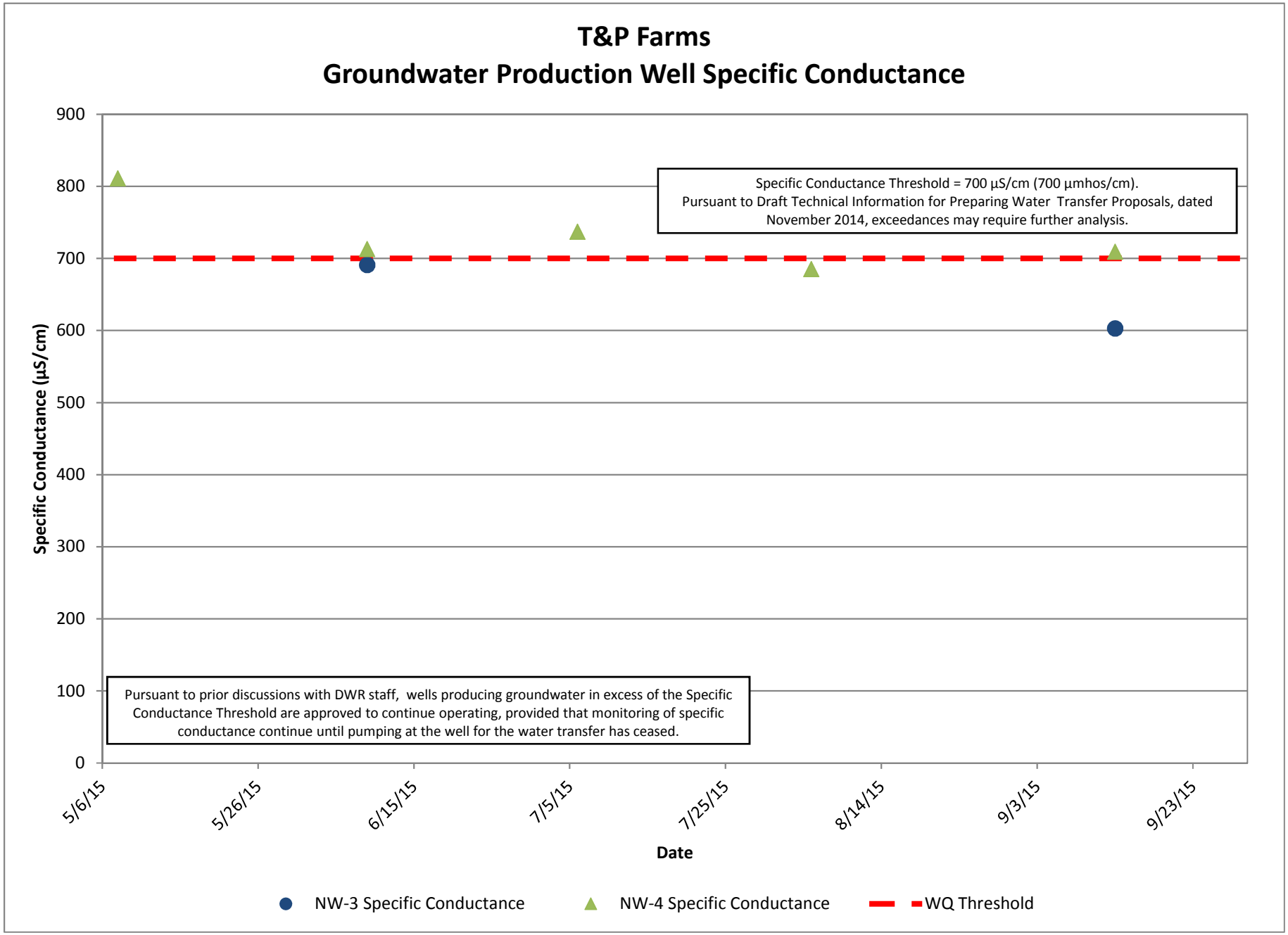


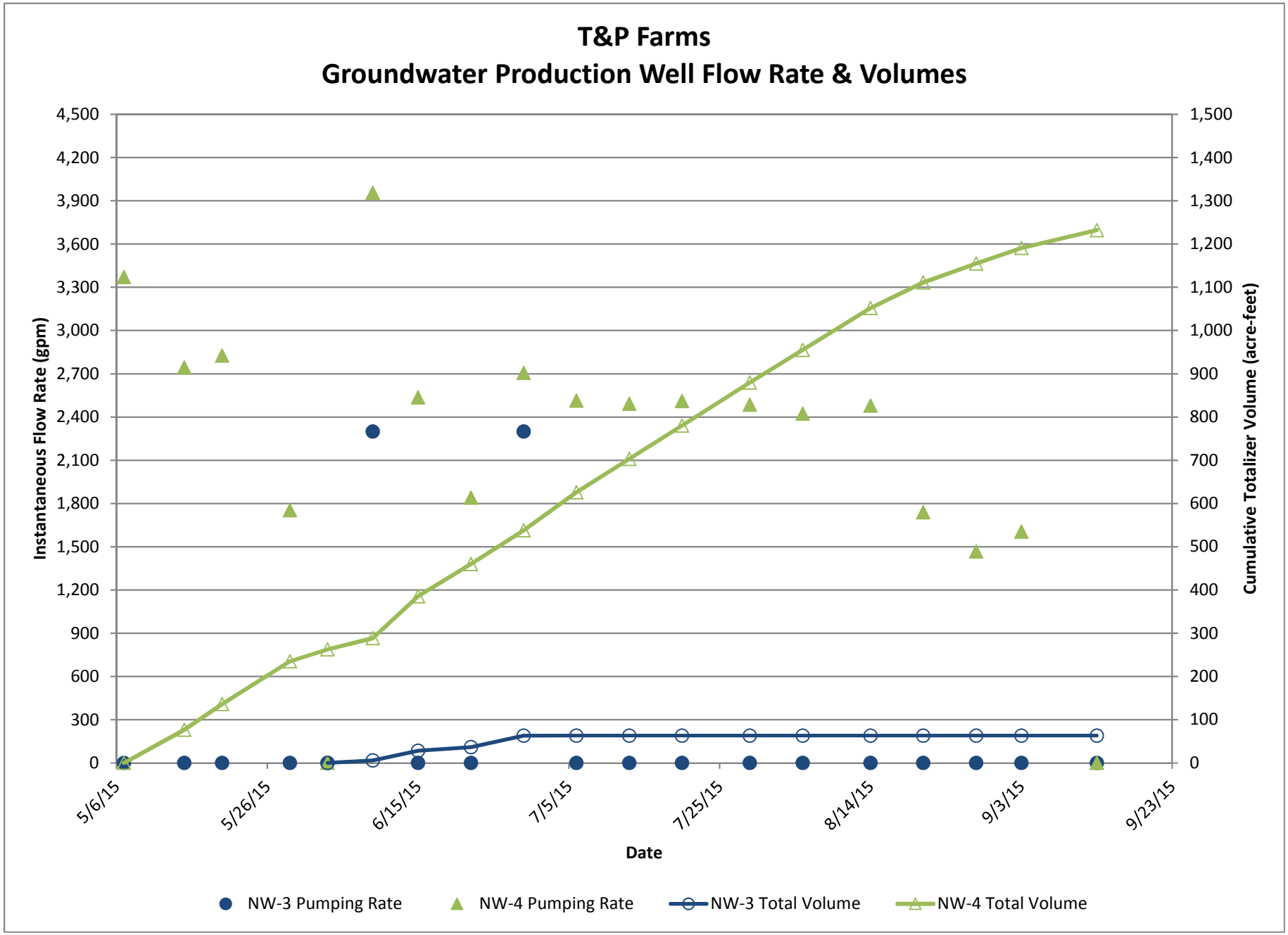
T&P Farms
Monitoring Well Groundwater Level Data



T&P Farms
Production Well Groundwater Level Data




T&P Farms
Groundwater Production Well Specific Conductance
Specific Conductance (µS/cm)
900
800
700
600
500
400
300
200
100
0
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Draft Technical Information for Preparing Water Transfer Proposals, dated November 2014, exceedances may require further analysis.
Pursuant to prior discussions with DWR staff, wells producing groundwater in excess of the Specific Conductance Threshold are approved to continue operating, provided that monitoring of specific conductance continue until pumping at the well for the water transfer has ceased.
5/6/15
5/26/15
6/15/15
7/5/15
7/25/15
8/14/15
9/3/15
9/23/15
Date
NW-3 Specific Conductance
NW-4 Specific Conductance
WQ Threshold


T&P Farms
Groundwater Production Well Flow Rate & Volumes
Instantaneous Flow Rate (gpm)
Cumulative Totalizer Volume (acre-feet)
4,500
4,200
3,900
3,600
3,300
3,000
2,700
2,400
2,100
1,800
1,500
1,200
900
600
300
0
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
5/6/15
5/26/15
6/15/15
7/5/15
7/25/15
8/14/15
9/3/15
9/23/15
Date
NW-3 Pumping Rate
NW-4 Pumping Rate
NW-3 Total Volume
NW-4 Total Volume

Te Velde Revocable Family Trust

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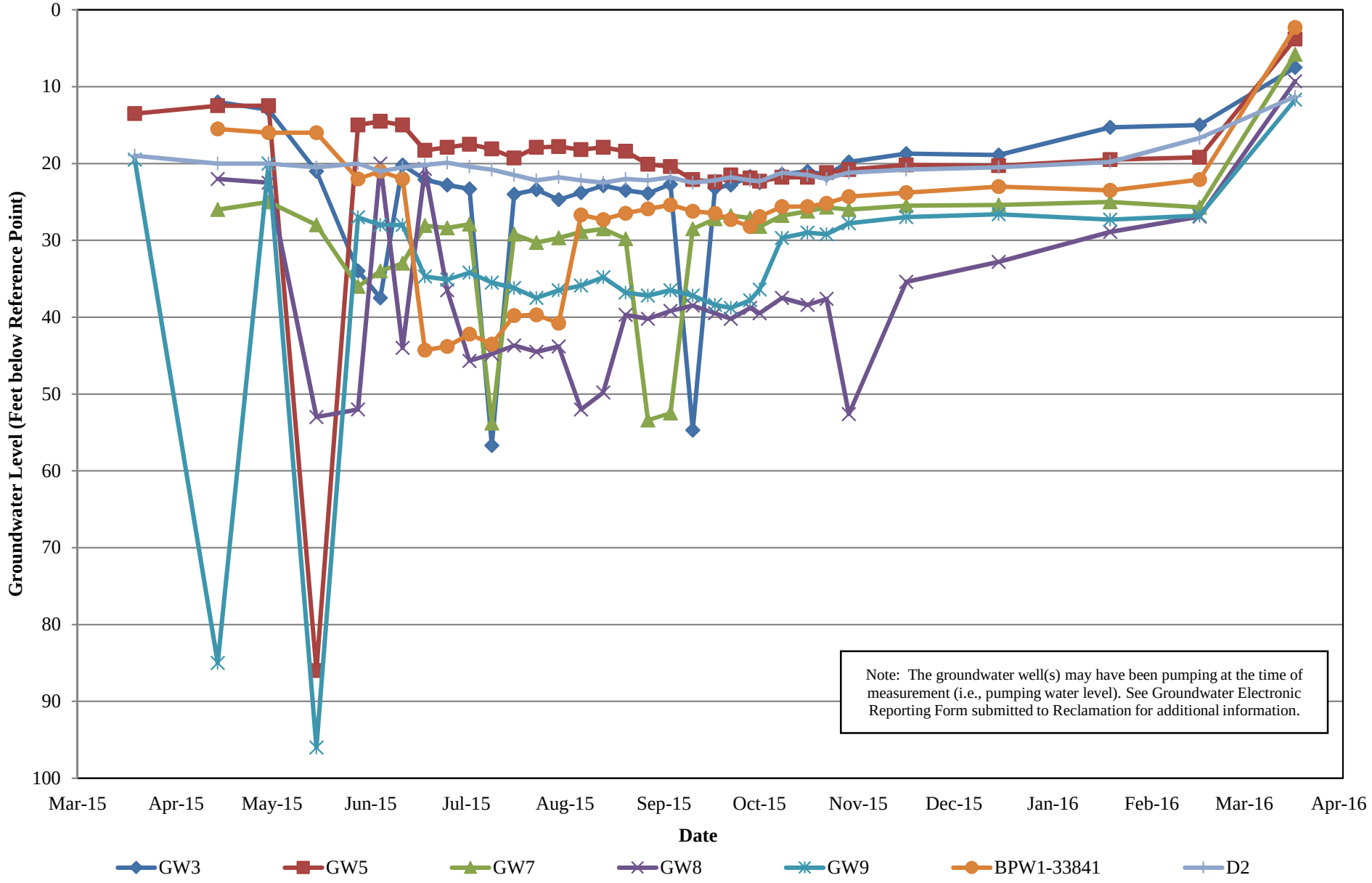
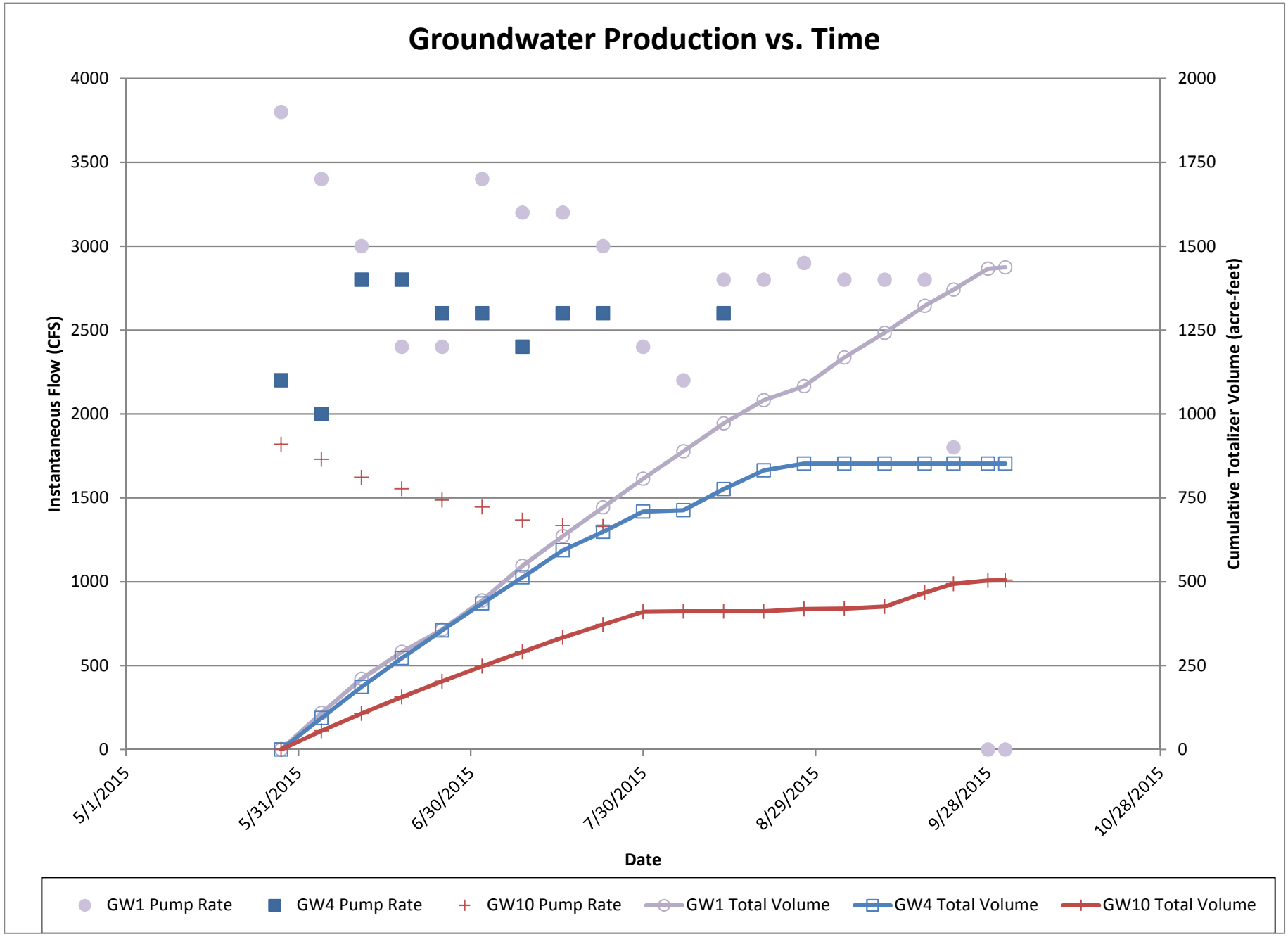
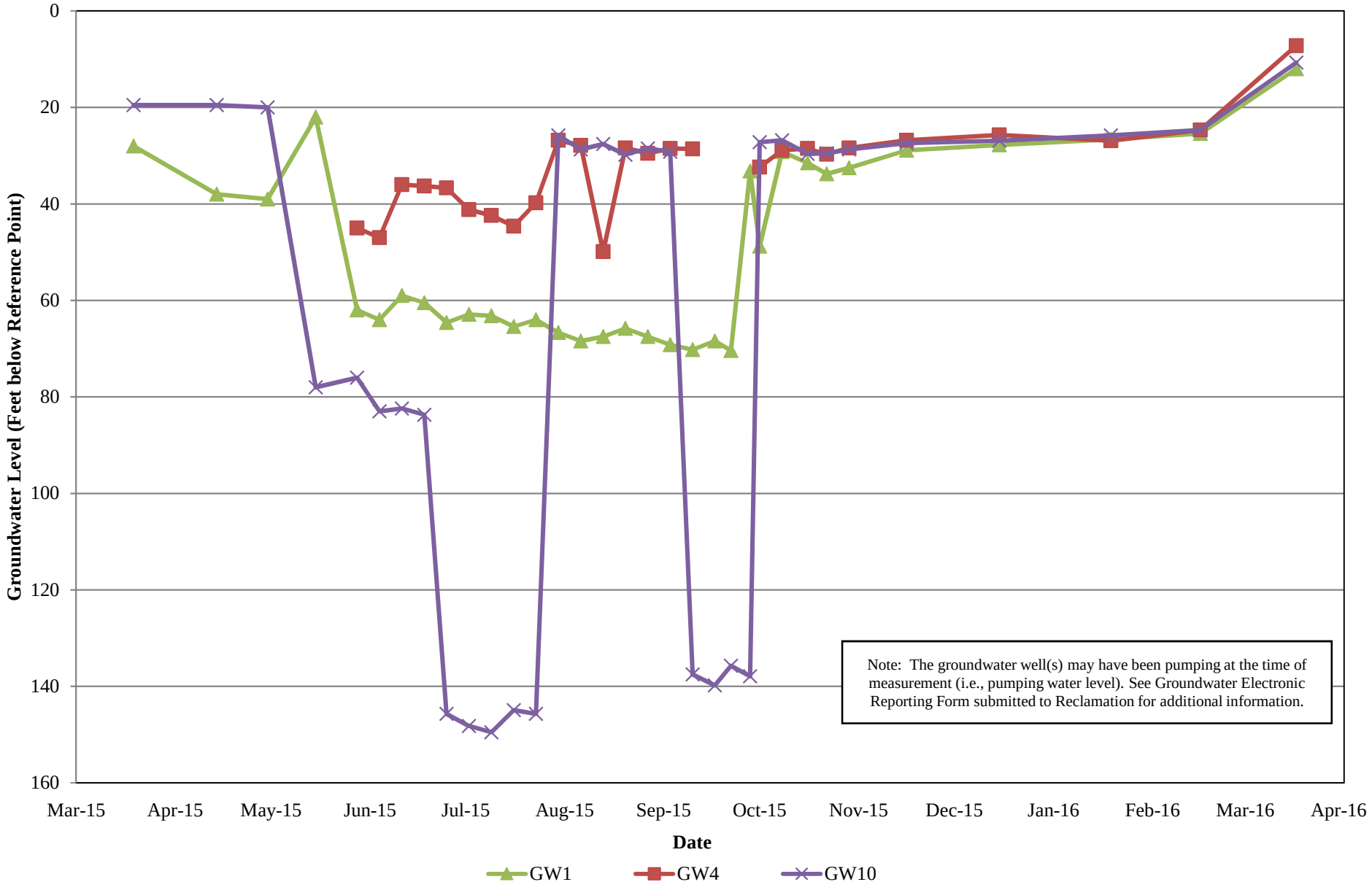
Te Velde Revocable Family Trust
Monitoring Well Groundwater Level Data

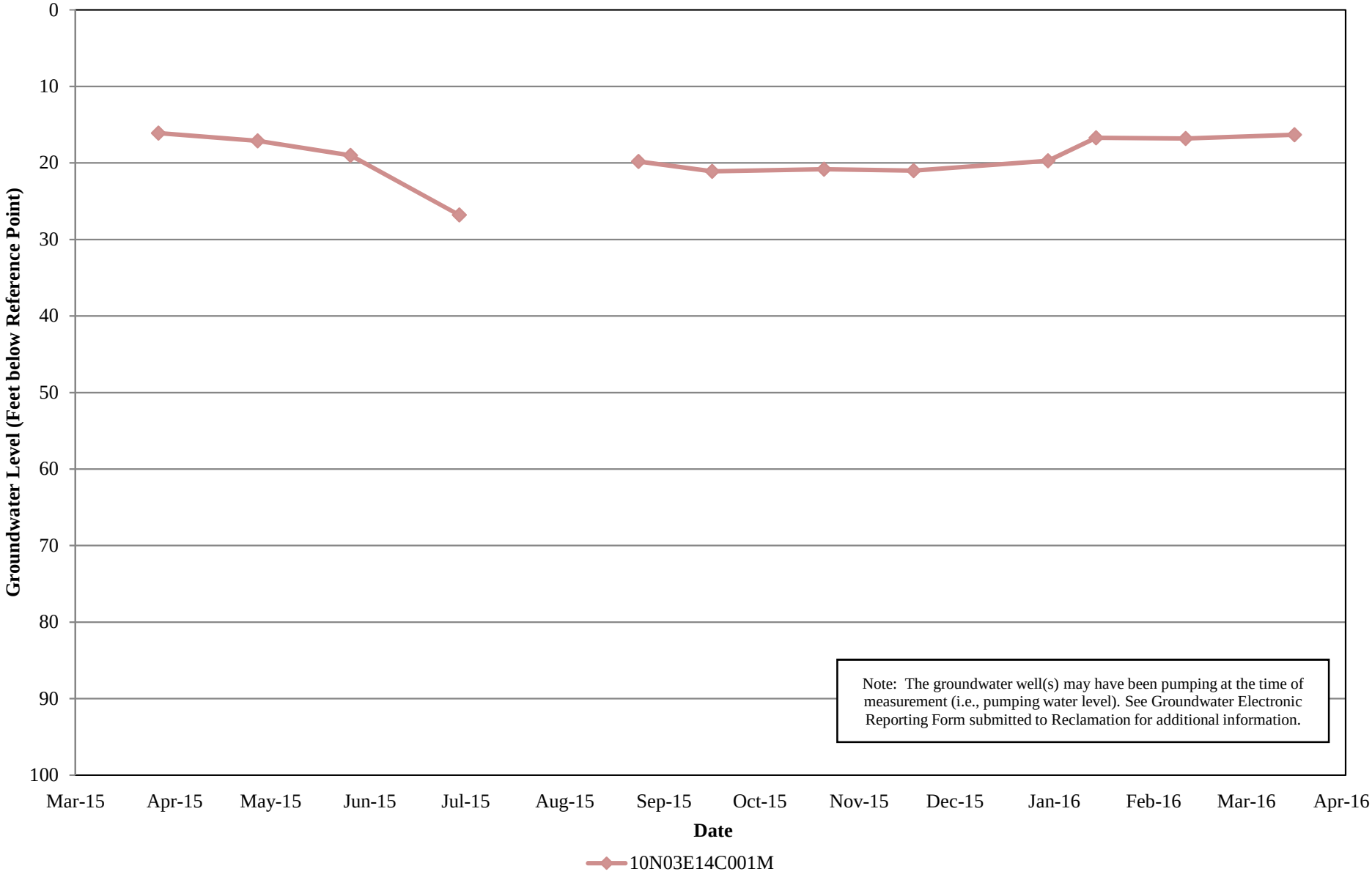


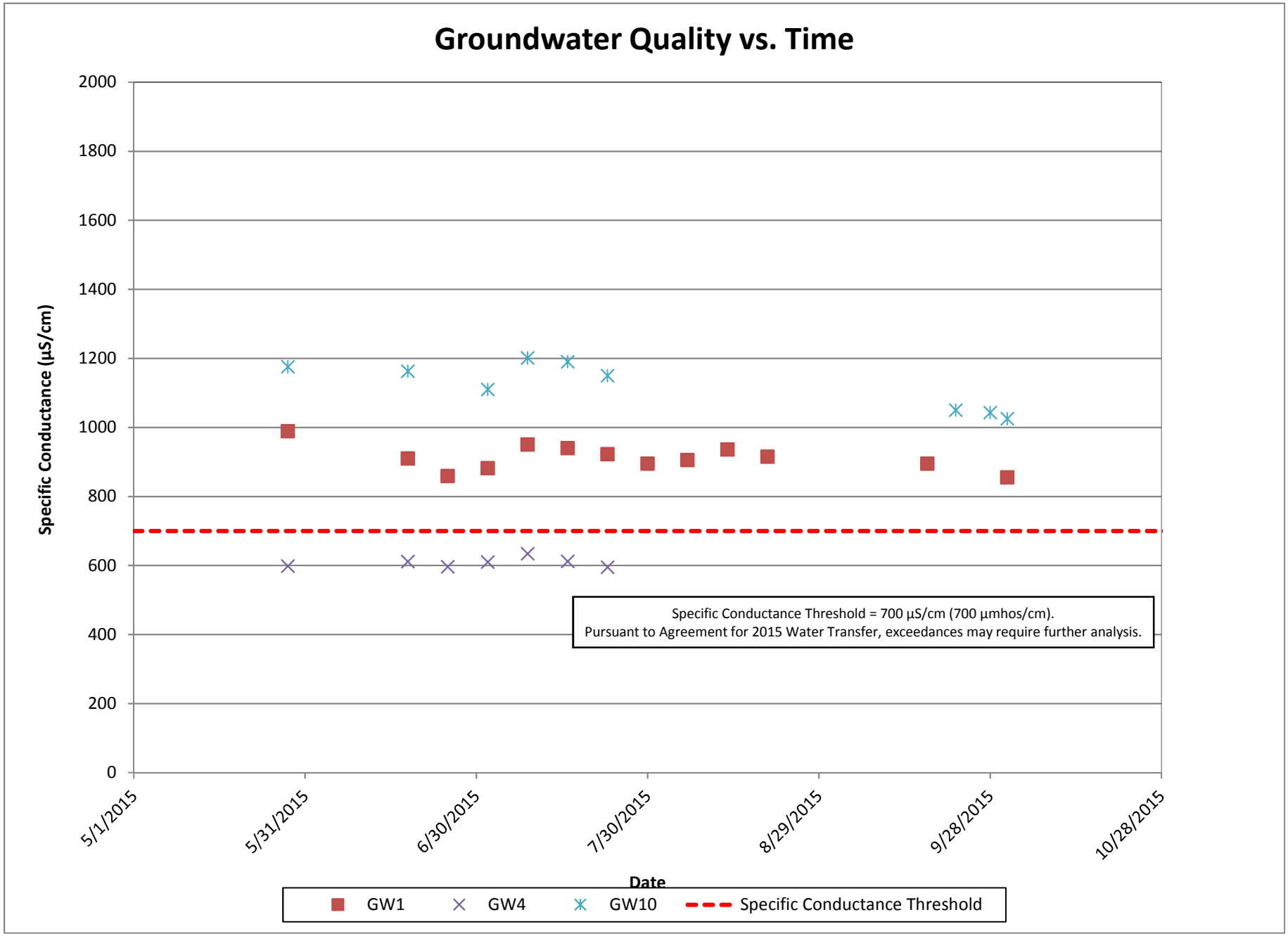

Groundwater Production vs. Time
Instantaneous Flow (CFS)
Cumulative Totalizer Volume (acre-feet)
Date
4000
3500
3000
2500
2000
1500
1000
500
0
2000
1750
1500
1250
1000
750
500
250
0
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
10/28/2015
GW1 Pump Rate
GW4 Pump Rate
GW10 Pump Rate
GW1 Total Volume
GW4 Total Volume
GW10 Total Volume

Te Velde Revocable Family Trust
Production Well Groundwater Level Data



Te Velde Revocable Family Trust
DWR Monitoring Well Groundwater Level Data




Groundwater Quality vs. Time
Specific Conductance (µS/cm)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
5/1/2015
5/31/2015
6/30/2015
7/30/2015
8/29/2015
9/28/2015
10/28/2015
Date
Specific Conductance Threshold = 700 µS/cm (700 µmhos/cm).
Pursuant to Agreement for 2015 Water Transfer, exceedances may require further analysis.
GW1
GW4
GW10
Specific Conductance Threshold

Appendix J

Cumulative Projects

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Appendix J Cumulative Projects

This appendix provides an analysis of overall cumulative effects of Proposed Action taken together with other past, present, and reasonably foreseeable probable future projects (or actions) as required by NEPA implementing regulations (40 CFR, Section 1508.7) and CEQA Guidelines (14 CFR, Section 15130). The reasonably foreseeable probable future actions considered in this cumulative effects analysis are actions located within the Seller Service Area that have been identified as potentially having an effect on resources that also may be affected by the Proposed Project. This analysis follows applicable guidance provided by the CEQ in *Considering Cumulative Effects under the National Environmental Policy Act* (1997) and *Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (*2005).

J.1 Cumulative Projects

The cumulative analysis considers other potential water transfers that could occur in the 2019 transfer season, including other CVP water transfers, non-CVP water transfers, and additional water transfers. No construction projects within the Seller Service Area were analyzed. Table J-1 lists potential sellers, including those in the Proposed Action, that have indicated interest or have provided water for transfer in the past, including:

- Potential transfers from sellers in the Sacramento River, American River, Yuba River, and north-westerly Delta areas. The majority of these potential sellers, which include the sellers in the Proposed Action, were evaluated in the Long-Term Water Transfers EIS/EIR and subsequent Long-Term Water Transfers RDEIR/SDEIS prepared by SLDMWA and Reclamation that analyzed potential CVP-related transfers from 2019 to 2024. Additional sellers in the Sacramento River area not evaluated in the EIS/EIR have indicated interest in selling water in 2019 and are also included in Table J-1.

- Potential transfers from sellers in the Feather River Region from entities holding settlement agreements with DWR that could make surface water available for CVP or SWP contractors. These transfers would be approved and facilitated by DWR.

The Lower Yuba River Accord (Yuba Accord) transfers were not included in the cumulative condition analysis in Chapter 3 because transfers would be made available in a different geographical area than the Proposed Action. The Yuba Accord provides for both stored water and groundwater substitution transfers ranging from 60,000 AF per year and up to an additional 140,000 AF for state and federal contractors in drier years. From 2007 through 2014, Yuba Accord transfers averaged approximately 129,000 AF. Transfers under the Yuba Accord historically account for a large portion of the DWR approved water transfers and represented 73 percent of the DWR approved transfers in 2015 (DWR 2015a). Groundwater substitution transfers for the Yuba Accord would occur in the North Yuba and South Yuba subbasins and would not affect groundwater levels near the Proposed Action.

J.1.1 Potential transfers analyzed in the cumulative analysis

The cumulative analysis considers other CVP and non-CVP water transfers that could occur in addition to Proposed Action. These water transfer methods could include cropland idling and groundwater substitution (the same as described for the Proposed Action). Transfer methods could also include additional methods such as conservation, where a seller takes a conservation action to reduce irrecoverable water losses, and stored reservoir water, which includes releases of water that would have remained in storage in non-CVP or SWP reservoirs.

Transfer water shown in Table J-1 could be sold to multiple agencies, including, TCCA, East Bay Municipal Utility District (MUD), SWP contractors receiving water from the North Bay Aqueduct, and south of Delta buyers, including SLDMWA and Metropolitan Water District of Southern California. Unlike transfers to TCCA and East Bay MUD that would be diverted off the Sacramento River, transfers to south of Delta buyers would be exported through the Delta via Banks or Jones Pumping Plants.

Table J-1. Potential Cumulative Sellers (Upper Limits)

Water Agency	Groundwater Substitution[1] (acre-feet)	Cropland Idling/ Crop Shifting[1] (acre-feet)	Stored Reservoir Release[1] (acre-feet)	Conservation[1] (acre-feet)	Maximum Potential Transfer (acre-feet per year)
Sacramento River Area					
Anderson-Cottonwood Irrigation District	5,225				5,225
Baber, Jack et al.		2,310			2,310
Canal Farms	1,000	635			1,635
Conaway Preservation Group	35,000	21,349			35,000
Cranmore Farms (Pelger Road 1700 LLC)	8,000	2,500			8,000
Eastside Mutual Water Company	2,230				2,230
Giusti Farms	1,000				1,000
Glenn-Colusa Irrigation District	25,000	66,000			91,000
Henle Family Limited Partnership	700				700
Maxwell Irrigation District	3,000	5,000			8,000
Natomas Central Mutual Water Company	30,000				30,000
Pelger Mutual Water Company	4,670	2,538			4,670
Pleasant Grove-Verona Mutual Water Company	18,000	9,000			18,000
Princeton-Cordora-Glenn Irrigation District	6,600	6,600			12,100
Provident Irrigation District	10,000	9,900			16,900
Reclamation District 108	15,000	20,000			35,000
Reclamation District 1004	7,175	12,500			19,675
River Garden Farms	10,000	10,000			16,000
Sutter Mutual Water Company	18,000	18,000			18,000
Sycamore Mutual Water Company	15,000	10,000			20,000

Water Agency	Groundwater Substitution[1] (acre-feet)	Cropland Idling/ Crop Shifting[1] (acre-feet)	Stored Reservoir Release[1] (acre-feet)	Conservation[1] (acre-feet)	Maximum Potential Transfer (acre-feet per year)
T&P Farms	1,200	890			1,200
Te Velde Revocable Family Trust	7,094	6,975			7,094
Windswept Land & Livestock	2,000				2,000
American River Area					
City of Sacramento	5,000				5,000
Placer County Water Agency			47,000		47,000
Sacramento County Water Agency	15,000				15,000
Sacramento Suburban Water District	30,000				30,000
Yuba River Area					
Browns Valley Irrigation District			5,000	3,100	8,100
Cordua Irrigation District	12,000				12,000
Feather River Area					
Butte Water District	5,500	11,500			17,000
Garden Highway Mutual Water Company	14,000				14,000
Gilsizer Slough Ranch	3,900				3,900
Goose Club Farms and Teichert Aggregates	10,000	10,000			10,000
South Sutter Water District			15,000		15,000
Tule Basin Farms	7,320				7,320
Biggs-West Gridley Water District[2]		32,190			32,190
Richvale Irrigation District[2]		22,345			22,345
Plumas Mutual Water Company[2]	5,000	1,750			4,550
South Feather Water and Power[2]			10,000		10,000
Sutter Extension Water District[2]	4,000	11,000			15,000
Western Canal Water District[2]		37,655			37,655
Total	**337,614**	**330,637**	**77,000**	**3,100**	**661,799**

[1] These totals cannot be added together. Agencies could make water available through groundwater substitution, cropland idling, or a combination of the two; however, they will not make the full quantity available through both methods. The last column reflects the total upper limit for each agency and will not equal the sum of all the individual transfer quantities for each agency.

[2] Entity holds Settlement Agreement with DWR.

Table J-1 lists the transfer method and associated maximum annual transfer quantity potentially available from each seller. The actual quantity of water transferred in a given year, as evidenced by past dry years, is less than the totals shown in Table J-1 and depends on a number of factors, including hydrologic conditions and available conveyance capacity. Cross Delta transfers to south-of-Delta buyers require pumping at the CVP and SWP south Delta export facilities and historically account for the majority of the transfers from sellers listed in Table J-1. Table J-2 lists the total quantities of cross Delta transfers from 2009 to 2015 that ranged from zero to 414,629 AF from 2009 through 2015, or approximately zero to 55 percent of the maximum total

shown in Table J-1. In 2014, Sacramento Valley sellers transferred 35,446 AF to TCCA Member Units. In 2015, TCCA used 23,997 AF of transfer water from Settlement Contractors. TCCA did not engage in water transfers in 2016, 2017, and 2018, and cross-Delta water transfers were not implemented.

Table J-2. Historic Cross Delta Water Transfers (2009 – 2015)

Year	Total Acre-Feet
2009	274,551
2010	264,165
2011	0
2012	84,781
2013[1]	351,515
2014[1]	414,629
2015[1]	262,466

Source: DWR and SWRCB 2015

[1] Data for 2013, 2014 and 2015 are for quantities made available North of the Delta and include Streamflow Depletion losses (where applicable) but do not include carriage water losses across the Delta. Data for 2015 is preliminary as of May 2015 and may change as the year develops. Cross Delta water transfers using facilities operated by DWR in 2014 and 2015 were 305,699 AF and 104,348 AF respectively and Reclamation 73,930 AF and 157,018 AF respectively.

Transfers originating from the Sacramento Valley represent a small portion of the Sacramento Valley's overall water supply. In addition to the transfers described in Table J-1, TCCA may also engage in "Project Water" transfers under the Central Valley Project Improvement Act section 3405(a)(1)(m). Reclamation analyzed potential impacts of these transfers in an EA in 2016, the "Accelerated Water Transfer and Exchange Program for Sacramento Valley Central Valley Project Contractors – Contract Years 2016-2020." The EA identified no effect to biological resources and potentially small, beneficial effects to other resources. Because these transfers would not have adverse effects, they are not included in the cumulative conditions analysis in Chapter 3.

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