

Appendix C

Special Status Wildlife Species with Potential to Occur

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Appendix C
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Common Name Scientific Name	Special Status*		Distribution	Habitat Association	Seasonal Occurrence	Potential Impact
	Federal	State				
Invertebrates						
Conservancy fairy shrimp <i>Branchinecta conservation</i>	E, X	--	Northern two-thirds of the Central Valley. It ranges from Vina Plains of Tehama County; Sacramento NWR in Glenn County; Jepson Prairie Preserve and surrounding area east of Travis Air Force Base, Solano County; Mapes Ranch west of Modesto, Stanislaus County.	Inhabits the ephemeral water of swales and vernal pools. It is most commonly found in grass or mud bottomed swales, earth sump, or basalt flow depression pools in unplowed grasslands.	Has been collected from early December to early May.	None. Occurrences have been documented within the Seller Service Area. Suitable habitat occurs within the project area. No impacts to vernal pool or other habitats occupied by this species are anticipated. The species is not likely to occur to occur in rice fields and canals due to predators (i.e. fish).
Mid-valley fairy shrimp <i>Branchinecta mesovallensis</i>	Under review	--	Counties within the Great Central Valley, including Sacramento, Solano, Merced, Madera, San Joaquin, Fresno, and Contra Costa Counties.	Found in vernal pools, seasonal wetlands that fill with water during fall and winter rains	Has been collected from early December to early May.	Suitable habitat may occur within the project area. Low potential for occurrence due to predators (i.e. fish).
Valley elderberry longhorn beetle <i>Desmocerus californicus dimorphus</i>	T, X	--	Central Valley and surrounding foothills below 3,000 feet elevation.	Dependent on elderberry shrubs (host plant) as a food source. Potential habitat is shrubs with stems 1 inch in diameter within Central Valley.	Year round for host plant and exit holes; March-June for adults	Elderberry shrubs will not be impacted, therefore no impact to beetles will occur.
Vernal pool fairy shrimp <i>Branchinecta lynchi</i>	T, X	--	Endemic to the Central Valley, Central Coast Mountains, and South Coast Mountains of California. It ranges from the Vina Plains in Tehama County, through the Central Valley, and south along the Central Coast to northern Santa Barbara County.	Inhabits the ephemeral water of swales and vernal pools. It is most commonly found in grassed or mud bottomed swales, earth sump, or basalt flow depression pools in unplowed grasslands.	Has been collected from early December to early May.	None. Occurrences have been documented in both the Buyer and the Seller Service areas. Rice fields and canals are not likely to support this species due to the presence of predators (i.e. fish), therefore no impacts are anticipated to the species. The project is not expected to impact vernal pools or natural wetlands.
Vernal pool tadpole shrimp <i>Lepidurus packardii</i>	E, X	--	Endemic to the northern portion of the Central Valley of California. This species occurs from the Millville Plains and Stillwater Plains in Shasta County south throughout the Central Valley to Merced County.	Found in a variety of natural and artificial seasonally ponded habitat types including: vernal pools, swales, ephemeral drainages, stock ponds, reservoirs, ditches, backhoe pits, and ruts caused by vehicular activities.	Has been collected from early December to early May.	None. Occurrences have been documented in both the Buyer and the Seller Service area. Suitable habitat is present in the project area. Rice fields and canals are not likely to support this species due to the presence of predators (i.e. fish),therefore there is a low potential for impacts to the species. The project is not expected to impact vernal pools or natural wetlands. No impacts to the species are expected.

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Amphibians						
California tiger salamander <i>Ambystoma californiense</i>	T ¹ , E ² , X	CE, SSC	Found in annual grassland habitat, grassy understories of valley-foothill hardwood habitats, and uncommonly along stream courses in valley-foothill riparian habitats. Occurs from near Petaluma, Sonoma Co., east through the Central Valley to Yolo and Sacramento Counties and south to Tulare Co.; and from the vicinity of San Francisco Bay south to Santa Barbara Co.	Lives in vacant or mammal-occupied burrows, occasionally other underground retreats, throughout most of the year, in grassland, savanna, or open woodland habitats. Lays eggs on submerged stems and leaves, usually in shallow ephemeral or semi permanent pools and ponds that fill during heavy winter rains, sometimes in permanent ponds; breeding takes place in fish free pools and ponds.	Migrates up to about 2 km between terrestrial habitat and breeding pond. Migrations may occur from November through April.	None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat may occur within the project area, but will not be impacted by the project. This species is not expected to occur in rice fields due to predatory fish.
Foothill yellow-legged frog <i>Rana boylei</i>	SC	SSC	This species is known from the Pacific drainages from Oregon to the upper San Gabriel River, Los Angeles County, California, including the coast ranges and Sierra Nevada foothills in the United States.	This species inhabits partially shaded, rocky streams at low to moderate elevations, in areas of chaparral, open woodland, and forest.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat is present within the project area. However the project is not expected to impact any suitable rocky stream and woodland habitats. No impact to the species is expected.
Western spadefoot toad <i>Spea hammondi</i>	--	SSC	This species occurs in the Central Valley and bordering foothills of California and along the Coast Ranges into northwestern Baja California, Mexico.	Lowlands to foothills, grasslands, open chaparral, pine-oak woodlands. Prefers shortgrass plains, sandy or gravelly soil. It is fossorial and breeds in temporary rain pools and slow-moving streams that do not contain bullfrogs, fish, or crayfish.	Year round. Usually in underground burrows most of year, but will travel several meters on rainy nights. Movement is rarely extensive.	None. Occurrences have been documented from both the Buyer and Seller Service Areas. Suitable habitat is present in the project area. The project will not impact suitable upland habitat types. The species is not likely to occur in rice fields due to the
Reptiles						
Giant garter snake <i>Thamnophis gigas</i>	T	T	Sacramento and San Joaquin Valleys from Butte County in the north to Kern County in the south.	Primarily associated with marshes, sloughs, and irrigation ditches. Generally absent in larger rivers.	Year round	High. Suitable habitat is present within the Buyer and Seller Service Areas. Suitable habitat in the Seller Service Area is intermittent based on normal variation in cropping. Direct impacts may include reduction in suitable aquatic habitat within the Seller Service Area. The greatest impact would occur during the breeding season. Conservation measures are in place to maintain aquatic habitat corridors within irrigation ditches.
Western pond turtle <i>Actinemys marmorata</i>	Under review	SSC	Ranged from extreme western Washington and British Columbia to northern Baja California, mostly to the west of the Cascade-Sierra crest.	The western pond turtle occupies a wide variety of wetland habitats including rivers and streams (both permanent and intermittent), lakes, ponds, reservoirs, permanent and ephemeral shallow wetlands, abandoned gravel pits, stock ponds, and sewage treatment.	Year round	High. Suitable habitat occurs within the project area. Pond turtles may occur in ditches, canals, rice fields, etc.

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Birds						
Aleutian Canada goose <i>Branta canadensis leucopareia</i>	D	--	Alaska to California	Found grazing in golf courses, agricultural lands, and any open ground adjacent to water. Nests in grasses and marshes.	Year round	Suitable habitat is present in project area. Low impact will occur. Can relocate to other habitats within the area.
American peregrine falcon <i>Falco peregrinus anatum</i>	D, NMBMC	E, FP	Throughout California.	Breeds in woodland, forest and coastal habitats on protected cliffs and ledges. Riparian areas and coastal and inland wetlands are important habitats yearlong especially during the non-breeding season.	Year round	None. Rice fields may provide suitable foraging habitat for the species, but birds could relocate to other habitat areas in the vicinity. No nesting habitat will be affected by the project.
Bald eagle <i>Haliaeetus leucocephalus</i>	D	E	Throughout California.	Riparian areas near coasts, rivers, and lakes. Nesting generally occurs in large old-growth trees in areas with little disturbance.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Area and both areas provide suitable habitat. No impacts to suitable nesting habitat are anticipated. Rice fields represent marginal foraging habitat. Birds would be able to relocate to other suitable habitat areas in the vicinity if fields were fallowed. Environmental commitments limit the amount of land that can be fallowed in a given county.
Bank swallow <i>Riparia riparia</i>	--	T, SSC	A neotropical migrant found primarily in riparian and other lowland habitats in California west of the deserts during the spring-fall period. Breeding population in California occurs along banks of the Sacramento and Feather rivers in the northern Central Valley.	Requires vertical banks and cliffs with fine-textured or sandy soils near streams, rivers, ponds, lakes, and the ocean for nesting. Feeds primarily over grassland, shrub land, savannah, and open riparian areas during breeding season and over grassland, brushland, wetlands, and cropland during migration.	March-mid-September	None. Known from both the Buyer and Seller Service Areas. No suitable nesting habitat (i.e. cliffs) will be affected. There is potential that the project would reduce the area of cropland habitat used for foraging during migration (wetlands and croplands) due to changes in water application. However, fallow cropland would still providing suitable foraging habitat, and birds could forage at other croplands in the vicinity. Environmental commitments limit the amount of cropland idling that would

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Black tern <i>Chlidonias niger</i>	--	SSC	Common spring and summer visitor to fresh emergent wetlands of California.	Uses fresh emergent wetlands, lakes, ponds, moist grasslands, and agricultural fields. In migration, some take coastal routes and forage offshore.	April-September	Suitable habitat is present within the project area (i.e. rice fields) and a high potential to occur. Conservation strategies are in place for this species. High. No occurrences have been documented within either the Buyer or Seller Service Areas. However, suitable habitat (i.e. rice fields) is present, and the project area is within the known range for the species. Therefore it has moderate potential to occur. Water transfers could reduce suitable habitat for the species within the Seller Service Area. Conservation strategies are in place that would make potential impacts to this species to negligible.
Black-crowned night heron <i>Nycticorax nycticorax</i>	SC	--	Resident in lowlands and foothills throughout most of California, including the Salton Sea and Colorado River areas, and very common locally in large nesting colonies.	Feeds along the margins of lacustrine, large riverine, and fresh and saline emergent habitats. Nests and roosts in dense-foliaged trees and dense emergent wetlands.	Year round	None. No occurrences of black-crowned night heron have been documented within either the Buyer or Seller Service Areas. Suitable habitat is present in project area, however no nesting or roosting habitats will be affected.
California yellow warbler <i>Dendroica petechia brewsteri</i>	--	SSC	Throughout California	Frequents open to medium-density woodlands and forests with a heavy brush understory in breeding season. In migration, found in a variety of sparse to dense woodland and forest habitats.	April-October	None. No occurrences have been documented in the project area. The species is not likely to occur in rice fields, and no suitable habitat will be impacted (i.e. dense woodland and forest habitats).
Cooper's hawk <i>Accipiter cooperii</i>	--	WL	Throughout California	Frequents landscapes where wooded areas occur in patches and groves. Often uses patchy woodlands and edges with snags for perching. Dense stands with moderate crown-depths used for nesting.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat occurs within the project area. No potential impacts to preferred foraging or nesting habitat are anticipated.
Double-crested cormorant <i>Phalacrocorax pelagicus</i>	--	WL	Along the entire coast of California and on inland lakes, in fresh, salt and estuarine waters.	Open water with offshore rocks, islands, steep cliffs, dead branches of trees, wharfs, jetties, or even transmission lines. Requires undisturbed nest-sites beside water, on islands or mainland. Uses wide rock ledges on cliffs; rugged slopes; and live or dead trees, especially tall ones.	Year round	None. No occurrences have been documented within the project area, but the species could occur at reservoirs and inland ponds. No negative impacts to foraging or breeding habitat are expected.
Golden eagle <i>Aquila chrysaetos</i>	T	E	Throughout California	Riparian areas near coasts, rivers, and lakes. Nesting generally occurs in large old-growth trees in areas with little disturbance.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Areas. Suitable habitat occurs within the project area. No impacts to nesting habitat are expected.

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Great blue heron <i>Ardea herodias</i>	--	--	Throughout California	Found in shallow estuaries, fresh and saline emergent wetlands, along riverine and rocky marine shores, in croplands, pastures, salt ponds, and in mountains above foothills. Nests roosts in large trees.	Year round	None. Rookeries have been documented within the Buyer and Seller Service Areas. No impacts to rookeries are anticipated. Idling of cropland foraging habitat would be limited by the environmental commitments, and birds could use alternative suitable foraging areas in the vicinity.
Great egret <i>Ardea alba</i>	--	--	Throughout California	Feeds and rests in fresh, and saline emergent wetlands, along the margins of estuaries, lakes, and slow-moving streams, on mudflats and salt ponds, and in irrigated croplands and pastures. Nests roosts in large trees.	Year round	None. Occurrences have been documented in the Seller Service Area. No impacts to rookeries are anticipated. Idling of cropland foraging habitat would be limited by the environmental commitments, and birds could use alternative suitable foraging areas in the vicinity.
Greater sandhill crane <i>Grus canadensis tabida</i>	--	T, FP	Breeds only in Siskiyou, Modoc and Lassen counties and in Sierra Valley, Plumas and Sierra counties. Winters primarily in the Sacramento and San Joaquin valleys from Tehama south to Kings Counties.	In summer, this race occurs in and near wet meadow, shallow lacustrine, and fresh emergent wetland habitats. Frequents annual and perennial grassland habitats, moist croplands with rice or corn stubble, and open, emergent wetlands. It prefers relatively treeless plains.	Migration southward is September-October and northward is March-April.	High. No occurrences have been documented within the project area, but occurrences have been recorded in Butte and Sutter Counties. Suitable foraging and winter roosting habitat is present within the project area (i.e. rice fields). Conservation strategies are in place for this species and birds will have other suitable nesting sites available.
Least bell's vireo <i>Vireo bellii pusillus</i>	E	E	California to northern Baja.	Inhabits low, dense riparian growth along water or along dry parts of intermittent streams. Typically associated with willow, cottonwood, baccharis, wild blackberry, or mesquite in desert localities.	March-August	None. Occurrences have been documented in the Buyer Service Area. Suitable habitat may occur within the project action area. The project is not expected to impact any suitable willow or dense riparian habitat, therefore no impacts to the species are anticipated.
Little willow flycatcher <i>Empidonax traillii brewsteri</i>	--	E	Migrant at lower elevations, primarily in riparian habitats throughout California	Most numerous where extensive thickets of low, dense willows edge on wet meadows, ponds, or backwaters.	Spring (mid-May to early June) and fall (mid-August to early September)	None. This species has not been documented within the project area according to CNDDB. Suitable habitat may be present within the project area (i.e. dense willows), but will not be impacted by the project.

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Long-billed curlew <i>Numenius americanus</i>	SC	WL	Along the California coast, and in the Central and Imperial valleys.	Upland shortgrass prairies and wet meadows are used for nesting; coastal estuaries, open grasslands, and croplands are used in winter.	Winter migrant from July-April	Low. No CNDDB occurrences have been documented within the project area, but the species is known to occur within the action area during winter migration. There is potential for impacts to suitable foraging habitat (i.e. cropland), although this may be reduced by environmental commitments, which protect winter foraging habitat in Butte Sink, and other wildlife management areas downstream. Birds can relocate to other suitable habitats within the area.
Long-eared owl <i>Asio otus</i>	--	SSC	Throughout California	Frequents dense, riparian and live oak thickets near meadow edges, and nearby woodland and forest habitats. Also found in dense conifer stands at higher elevations.	Year round	None. Occurrences have been documented in the Buyer Service Area. Suitable habitat occurs within the project area. The project is not expected to impact any suitable habitat (i.e. forest and woodland habitats)
Northern harrier <i>Circus cyaneus</i>	--	SSC	Throughout lowland California, concentrated in the Central Valley and coastal valleys.	Breeds in annual grasslands and wetlands. Prefers marshes and grasslands for foraging and nesting. Also uses agricultural fields for nesting and foraging, although nests may be destroyed by agricultural activities.	Year round	None. CNDDB occurrences have been documented in the Buyer Service Area. Suitable habitat is present in project area. Foraging and breeding habitat may be affected, but fallow fields would still represent suitable habitat. Birds can relocate to other habitats within the area.
Osprey <i>Pandion haliaetus</i>	--	WL	Northern California from Cascade Ranges south to Lake Tahoe, and along the coast south to Marin County.	Associated strictly with large, fish-bearing waters, primarily in ponderosa pine through mixed conifer habitats.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat occurs within the project area. Water transfers would be subject to flow requirements. Therefore no impacts to foraging area expected. No impacts to nesting sites are anticipated.
Short-eared owl <i>Asio flammeus</i>	--	SSC	Endemic to marshes bordering the San Francisco, San Pablo Bays and Suisun Bay .	Open country, including grasslands, wet meadows and cleared forests. Occasionally in estuaries during breeding season.	Year round	None. Occurrences have been documented in the Buyer Service Area. Suitable habitat occurs within the project area. No impacts to breeding habitat will occur. Fallow rice fields would still represent suitable foraging habitat for the species.

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Snowy egret <i>Egretta thula</i>	--	--	Throughout California	Found along shores of coastal estuaries, fresh and saline emergent wetlands, ponds, slow-moving rivers, irrigation ditches, and wet fields.	Year round	None. Occurrences have been documented in the Buyer Service Area, however suitable habitat is present in both the Buyer and Seller Service area. No impacts to rookeries are anticipated. Idling of cropland foraging habitat would be limited by the environmental commitments, and birds could use alternative suitable foraging areas in the vicinity.
Swainson's hawk <i>Buteo swainsoni</i>	SC, MNBMC	T	Lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley.	Nests in mature trees, including valley oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain and row crop fields.	Spring and Summer; small wintering population in the Delta	None. CNDDDB occurrences have been documented within both the Seller and Buyer Service Area. Suitable habitat is present within the project area. The project may alter the composition of foraging habitat in the Buyer and Seller Service Areas, but these areas would still be suitable for the species, and additional habitats in the vicinity would be available. No impacts to breeding habitat are expected.
Tricolored blackbird <i>Agelaius tricolor</i>	--	SSC	A resident in California found throughout the Central Valley and in coastal districts from Sonoma Co. south.	Breeds near fresh water, preferably in emergent wetlands with tall, dense cattails or tules, but also in thickets of willow, blackberry, wild rose, tall herbs. Feeds in grassland and cropland habitats.	Year round	Low. CNDDDB occurrences have been documented within both the Seller and Buyer Service Area. Suitable habitat is present within the project area. Foraging habitat may be affected by the project. Environmental commitments limit cropland idling and birds can relocate to other adjacent foraging habitats within the area.
Western burrowing owl <i>Athene cunicularia hypugaea</i>	--	SSC	Central and southern coastal habitats, Central Valley, Great Basin, and deserts.	Open annual grasslands or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Dependent upon burrowing mammals (especially California ground squirrel) for burrows.	Year round	None. Occurrences have been documented within both the Buyer and Seller Service Area. Suitable habitat occurs within the project area. Agricultural ditches may be suitable habitat for burrowing owl burrow and nesting activity. Water transfers would not affect the suitability of habitat for burrowing owl in the project area.

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Western yellow-billed cuckoo <i>Coccyzus americanus</i>	SC, C	E	Uncommon to rare summer resident in scattered locations throughout California.	Deciduous riparian thickets or forests with dense, low-level or understory foliage, and which abut on slow-moving watercourses, backwaters, or seeps. Willow almost always a dominant component of the vegetation. In Sacramento Valley, also utilizes adjacent orchards, especially of walnut. Nests in sites with some willows, dense low-level or understory foliage, high humidity, and wooded foraging spaces.	Summer migration is from June-September.	None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present within the project area. However this species is not likely to occur in rice fields due to lack of suitable foraging and roosting habitat (i.e. dense riparian thickets). No impacts are anticipated.
White-faced ibis <i>Plegadis chihi</i>	--	WL	Uncommon summer resident in sections of southern California, a rare visitor in the Central Valley, and is more widespread in migration.	Feeds in fresh emergent wetlands, shallow lacustrine waters, muddy grounds of wet meadows, and irrigated or flooded pastures and croplands. Nests in dense, fresh emergent wetlands.	Present in California from April-October.	Low. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in project area. Low potential impact to foraging habitat in the Seller Service Area. No potential impacts are expected to roosting habitat. Can relocate to other habitats within the area. Environmental commitments would limit acreage of allowable cropland idling.
White-tailed kite <i>Elanus leucurus</i>	SC, MNBMC	FP	Central Valley, coastal valleys, San Francisco Bay area, and low foothills of Sierra Nevada.	Savanna, open woodlands, marshes, partially cleared lands and cultivated fields, mostly in lowland situations (Tropical to Temperate zones).	Year round	None. CNDDB occurrences have been documented within both the Seller and Buyer Service Area. Suitable habitat is present within the project area. Foraging habitat may be altered, but will still be suitable for the species. No potential impacts to breeding habitat are anticipated.
Mammals						
California wolverine <i>Gulo gulo</i>	SC	T, FP	A scarce resident of North Coast mountains and Sierra Nevada. Sightings range from Del Norte and Trinity cos. east through Siskiyou and Shasta cos., and south through Tulare Co. A few possible sightings occur in the north coastal region as far south as Lake Co. Habitat distribution in California is poorly known for the North Coast and northern Sierra Nevada.	In north coastal areas, has been observed in Douglas-fir and mixed conifer habitats. In the northern Sierra Nevada, have been found in mixed conifer, red fir, and lodgepole habitats, and probably use subalpine conifer, alpine dwarf-shrub, wet meadow, and montane riparian habitats. In the southern Sierra Nevada occur in red fir, mixed conifer, lodgepole, subalpine conifer, alpine dwarf-shrub, barren, and probably wet meadows, montane chaparral, and Jeffrey pine.	Year round (largely nocturnal)	None. Suitable habitat may occur within the project area, however no CNDDB occurrences have been documented in the Buyer or Seller Service area. The species is not likely to occur in agriculture fields. No impacts are anticipated.
Greater western mastiff bat <i>Eumops perotis californicus</i>	SC	SSC	Uncommon resident in southeastern San Joaquin Valley and Coastal Ranges from Monterey Co. southward through southern California, from the coast eastward to the Colorado Desert.	Occurs in many open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, annual and perennial grasslands, palm oases, chaparral, desert scrub, and urban areas. Crevices in cliff faces, high buildings, trees, and tunnels are required for roosting.	Year round (nocturnal activity)	None. Occurrences have been documented in the Seller Service Area. Suitable habitat is present in project area, but no project impacts are anticipated.

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Ring-tailed cat <i>Brassariscus astutus</i>	SC	FP	Ringtails are found in a variety of habitats centered around the semi-arid to arid climates of the west and southwest. Little information available on distribution and relative abundance among habitats.	Occurs in various riparian habitats, and in brush stands of most forest and shrub habitats, at low to middle elevations. Uses hollow trees, logs, snags, cavities in talus and other rocky areas, and other recesses are for cover.	Year round (nocturnal)	None. No CNDDB records of this species have been documented in the project area. Suitable habitat is present in project area, but the species is not likely to occur in rice fields. No potential impact to suitable habitat are expected.
Riparian brush rabbit <i>Sylvilagus bachmani riparius</i>	E	E	Isolated populations on Caswell Memorial State Park on the Stanislaus River and along an overflow channel of the San Joaquin River.	Riparian thickets	Year round	None. No CNDDB records of this species have been documented in the project area. Suitable habitat is present in the project area, however, no potential impacts are expected to suitable habitat (i.e. riparian thickets).

¹Central CA DPS

²Santa Barbara and Sonoma Counties

Green Shading: potential to be affected, further evaluated in Chapter 3

*** Status explanations:**

Federal

E = listed as endangered under the federal Endangered Species Act

T = listed as threatened under the federal Endangered Species Act

MNBMC = Fish and Wildlife Service: Migratory Nongame Birds of Management Concern

SC = species of concern; formerly Category 2 candidate for federal listing

C = Candidate for listing as threatened or endangered

-- = no designations

X = critical habitat

PX = potential critical habitat

D = delisted

State

E = listed as endangered under the California Endangered Species Act

T = listed as threatened under the California Endangered Species Act

CE = candidate endangered under the California Endangered Species Act

FP = fully protected under the California Fish and Game Code

SSC = species of special concern

WL = Watch List

-- = no designations

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Appendix D

Special-Status Plants Species with Potential to Occur

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Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Ahart's dwarf rush <i>Juncus leiospermus</i> var. <i>ahartii</i>	-/- 1B	Butte, Calaveras, Placer, Sacramento, Tehama, and Yuba Counties.	Valley and foothill grassland (mesic).	March-May	Not likely to occur in rice fields, no suitable habitat present.
Ahart's paronychia <i>Paronychia ahartii</i>	-/- 1B	Butte, Shasta, and Tehama Counties.	Cismontane woodland, valley and foothill grassland, and vernal pools.	March-June	Not likely to occur in rice fields, no suitable habitat present.
Alkali milk-vetch <i>Astragalus tener</i> var. <i>tener</i>	-/- 1B	Central western California including Yolo County.	Subalkaline flats and areas around vernal pools.	March-June	Not likely to occur in rice fields, no suitable habitat present (i.e. subalkali flats).
Antioch Dunes evening-primrose <i>Oenothera deltoides</i> ssp. <i>howellii</i>	E/E/ 1B	Found only in Contra Costa and Sacramento Counties.	Occurs in inland dunes.	March-September	Not likely to occur in rice fields, no suitable habitat present. Located outside of the project area.
Brittlescale <i>Atriplex depressa</i>	-/-1B	Western Central Valley and valleys of adjacent foothills.	Alkali grassland, alkali meadow, alkali scrub, and vernal pools.	April-October	There is a CNDDDB occurrence within Glenn, Colusa, and Yolo counties, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali and vernal pools).
Boggs Lake hedge- hyssop <i>Gratiola hetersepela</i>	-/-1B	Dispersed throughout the Sacramento and Central Valley. Also in Oregon.	Marsh's, swamps, and vernal pools (clay).	April-August	There is a CNDDDB occurrence within Sacramento County. Suitable habitat is present but has low potential to occur.
Butte County meadowfoam <i>Limnanthes floccosa</i> ssp. <i>californica</i>	E/E/1B	Only located in Butte County.	Valley and foothill grassland (mesic), and vernal pools.	March-May	Not likely to occur in rice fields, no suitable habitat present.

Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Contra Costa goldfields <i>Lasthenia conjugens</i>	E/SSC/1B	San Francisco Bay Delta Regions, and scattered coastal areas.	Cismontane woodlands, playas, valley and foothill grasslands, and vernal pools.	March-June	No CNDDDB occurrences; not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools, playas).
Colusa grass <i>Neostapfia colusana</i>	T/E/1B	Southern Sacramento Valley, and northern San Joaquin Valley.	Vernal pools.	May-July	There is a CNDDDB occurrence within Glenn and Colusa counties, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
Crampton's tuctoria (Solano grass) <i>Tuctoria mucronata</i>	E/E/1B	Located only in Yolo and Solano Counties.	Valley and foothill grassland (mesic), and vernal pools.	April-August	Not likely to occur in rice fields, no suitable habitat present.
Ferris' milk-vetch <i>Astragalus tener</i> var. <i>ferrisae</i>	-/-/1B	Sacramento Valley.	Subalkaline flats and areas around vernal pools.	March-June	Not likely to occur in rice fields, no suitable habitat present.
Fox sedge <i>Carex vulpinoidea</i>	-/-/2	Northern Sacramento Valley, including Butte County, isolated populations in San Joaquin County.	Riparian woodland, marshes and swamps.	May-June	Suitable habitat present in project area. Low potential to occur. Not likely to establish in rice fields.
Greene's tuctoria <i>Tuctoria greeni</i>	E/SSC/1B	Butte, Colusa, Fresno, Glenn, Madera, Merced, Modoc, Shasta, San Joaquin, Stanislaus, Tehama, and Tulare Counties.	Vernal pools.	May-July	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).

Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Hairy Orcutt grass <i>Orcuttia pilosa</i>	E/E/1B	Northern Sacramento Valley, Pit River Valley; isolated populations in Lake and Sacramento counties.	Vernal pools.	May-September	There is a CNDDDB occurrence within Butte and Glenn counties, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
Hartweg's golden sunburst <i>Pseudobahia bahiifolia</i>	E/E/1B	Found in El Dorado, Fresno, Madera, Merced, Stanislaus, Tuolumne, and Yuba Counties.	Cismontane woodland, valley and foothill grassland, often acidic.	April-May	There is a CNDDDB occurrence within Yolo County, however this species is not likely to occur in rice fields due to lack of suitable habitat
Heartscale <i>Atriplex cordulata</i>	-/-/1B	Western Central Valley and valleys of adjacent foothills.	Alkali grasslands, alkali meadows, and alkali scrub.	May-October	There is a CNDDDB occurrence within Butte, Colusa, Yolo, and Glenn counties, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali areas).
Heckard's pepper-grass <i>Lepidium latipes</i> var. <i>heckardii</i>	-/-/1B	Glenn, Solano, and Yolo Counties.	Valley and foothill grassland alkaline flats.	March-May	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali flats).
Henderson's bent grass <i>Agrostis hendersonii</i>	- /- / 3	Found in Butte, Calaveras, Merced, Placer, Shasta, and Tehama counties. Also found in Oregon.	Vernal pools.	March- June	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).

Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Hoover's spurge <i>Chamaesyce hooveri</i>	T/-/1B	Scattered in Glenn, Butte, Colusa, Merced, Stanislaus, Tehama, and Tulare Counties.	Vernal pools.	July-September	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
Indian valley brodiaea <i>Brodiaea coronaria</i> ssp. <i>rosea</i>	-/E/1B	Scattered in Glenn, Lake, Colusa, and Tehama Counties.	Closed cone coniferous forest, chaparral, valley and foothill grasslands (serpentinite).	May-June	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat.
Jepson's milk-vetch <i>Astragalus rattanii</i> var. <i>jepsonianus</i>	-/-/1B	Colusa, Glenn, Lake, Napa, Tehama, and Yolo counties.	Chaparral, cismontane woodland, valley and foothill grassland, often serpentinite.	April-June	There is a CNDDDB occurrence, however this species is not likely to occur on the site due to lack of suitable habitat.
Keck's checkerbloom <i>Sidalcea keckii</i>	E/-/1B	Colusa, Fresno, Merced, Napa, Solano, Tulare, and Yolo counties.	Cismontane woodlands, foothill and valley grasslands (serpentinite).	April-May	There is a CNDDDB occurrence, however this species is not likely to occur on the site due to lack of suitable habitat.
Layne's ragwort <i>Packera layneae</i>	T/-/1B	Butte, El Dorado, Tuolumne, and Yuba Counties.	Chaparral and cismontane woodland, rocky and often serpentinite.	April-August	There is a CNDDDB occurrence, however this species is not likely to occur on the site due to lack of suitable habitat.
Legenere <i>Legenere limosa</i>	SC/-/1B	Sacramento Valley and south of the North Coast Ranges.	Vernal pools.	May-June	Not likely to occur in rice fields, no suitable habitat present (i.e. vernal pools)
Lesser saltscale <i>Atriplex minuscule</i>	-/-/1B	Found in Butte, Fresno, Kern, Madera, Merced, Stanislaus, and Tulare Counties.	Chenopod scrub, playas, valley and foothill grasslands (alkali and sandy).	May-October	Not likely to occur in rice fields, no suitable habitat present (i.e. alkali, sandy)

Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Lone buckwheat <i>Eriogonum apricum</i> var. <i>apricum</i>	E/E/1B	Found in Amador and Sacramento Counties.	Chaparral.	July-October	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (chaparral).
Marsh checkerbloom <i>Sidalcea oregana</i> ssp. <i>hydrophila</i>	-/-/1B	Glenn, Lake, Mendocino, and Napa Counties.	Meadows and seeps, and riparian forest.	June-August	Suitable habitat present in project area. Low potential to occur. Not likely to establish in rice fields.
Milo Baker's lupine <i>Lupinus milo-bakeri</i>	-/T/1B	Glenn and Mendocino Counties.	Cismontane woodlands, foothill and valley grasslands.	June-September	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat.
Palmate-bracted bird's-beak <i>Cordylanthus palmatus</i>	E/E/1B	Found in Glenn and Colusa Counties and within the Central Valley.	Alkali meadow, alkali scrub, valley and grasslands.	May-October	Not likely to occur in rice fields, no suitable habitat present (i.e. alkali).
Pincushion navarretia <i>Navarretia myersii</i> ssp. <i>myersii</i>	-/-/1B	Alamador, Calaveras, Merced, Placer, and Sacramento Counties.	Vernal pools (often acidic).	May	No CNDDDB occurrences; not likely to occur due to lack of suitable habitat (i.e. vernal pools).
Recurved larkspur <i>Delphinium recurvatum</i>	-/-/1B	Disbursed throughout the Sacramento and Central Valley.	Chenopod scrub, cismontane, valley and foothill grasslands (alkali).	March-June	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. alkali).
Red mountain catchfly <i>Silene campanulata</i> ssp. <i>campanulata</i>	-/E/1B	Found in Colusa, Glenn, Mendocino, Shasta, Tehama, and Trinity Counties.	Chaparral and lower montane coniferous forest, usually serpentine and rocky.	April-July	There is a CNDDDB occurrence in Colusa County, however this species is not likely to occur in rice fields due to lack of suitable habitat.

Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Rose-mallow <i>Hibiscus laiocarpus</i>	-/-/2	Northern Sacramento County.	Marshes and swamps.	June-September	Suitable habitat present in project area. Low potential to occur. Not likely to establish in rice fields.
Sacramento orcutt grass <i>Orcuttia viscida</i>	E/E/1B	Valley grasslands and freshwater wetlands.	Vernal pools.	May-June	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).
San Joaquin spearscale <i>Atriplex joaquiniana</i>	-/-/1B	Western Central Valley and valleys of adjacent foothills.	Alkali grasslands, and alkali scrub.	April-September	Not likely to occur in rice fields, no suitable habitat present (i.e. alkali).
Sanford's arrowhead <i>Sagittaria sanfordii</i>	-/-/1B	Central Valley.	Freshwater marshes, shallow streams, and ditches.	May-August	Suitable habitat on present in ditches; not yet detected. Not likely to establish in rice fields.
Silky cryptantha <i>Cryptantha crinita</i>	-/-/1B	Shasta and Tehama Counties.	Cismontane woodland, lower montane coniferous forest, riparian forest and woodland, valley foothill and grasslands.	April-May	Not likely to occur in rice fields, no suitable habitat present. Located outside of the project area.
Slender Orcutt grass <i>Orcuttia tenuis</i>	T/E/1B	Northern Sacramento Valley, Pit River Valley; isolated populations in Lake and Sacramento Counties	Vernal pools.	May-July	There is a CNDDDB occurrence, however this species is not likely to occur in rice fields due to lack of suitable habitat (i.e. vernal pools).

Common Name Scientific name	Special Status* (F/S/CNPS)	Distribution	Habitat Association	Blooming Period	Potential Impact
Soft bird's beak <i>Cordylanthus mollis</i> ssp. <i>mollis</i>	E/SSC/1B	Located in Contra Costa, Marin, Napa, Sacramento, Solano, and Sonoma Counties.	Coastal salt marshes and swamps.	July-November	There is a CNDDDB occurrence in Sacramento County, however this species is not likely to occur in rice fields due to lack of suitable habitat.

***Status explanations:**

F=Federal

E=Endangered

T=Threatened

SC= Special Concern

S=State

E=Endangered

T=Threatened

SSC=Species of Special Concern

CNPS=California Native Plant Society

1B=Rare, threatened, or endangered in California and elsewhere

2=Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere

3=Plants about which we need more information - A review list

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Appendix E

Greenhouse Gas Emission Calculations

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Summary of Annual Greenhouse Gas Emissions

Table 1. GHG Emissions from Groundwater Substitution

Water Agency	Emissions (MTCO ₂ e/year)			
	CO ₂	CH ₄	N ₂ O	Total
Anderson-Cottonwood Irrigation District	151	0	1	152
Burroughs Farms	82	0	0	82
Canal Farms	35	0	0	35
Conaway Preservation Group	428	1	1	430
Cranmore Farms	107	0	0	107
Eastside Mutual Water Company	316	0	1	317
Glenn-Colusa Irrigation District	6,379	6	15	6,401
Maxwell Irrigation District	97	0	0	97
Natomas Central Mutual Water Company	1,496	2	5	1,503
Pelger Mutual Water Company	222	0	1	223
Pleasant Grove-Verona Mutual Water Company	1,336	2	4	1,341
Princeton-Cordora-Glenn Irrigation District	1,228	1	3	1,233
Provident Irrigation District	794	1	2	797
Reclamation District 108	642	1	3	646
Reclamation District 1004	1,003	1	3	1,007
River Garden Farms	361	1	1	363
Sutter Mutual Water Company	No Groundwater Substitution			0
Sycamore Mutual Water Company	261	0	1	263
T&P Farms	33	0	0	33
Te Velde Revocable Family Trust	202	0	1	203
Total	15,172	17	42	15,232

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	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Barney Street	Shasta	Electric	2012	200	5,500	85%	4,062	4,010	598,578	n/a	121	0.0077	0.0016	121	0.19	0.49	121
Crowley Gulch	Shasta	Electric	2012	50	1,000	15%	738	4,010	149,645	n/a	30	0.0019	0.0004	30	0.05	0.12	30
Total					6,500	100%	4,800	8,021	748,223	0	151	0.0097	0.0020	151	0.24	0.61	152

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

Burroughs Farms

Transfer Volume

2,000 acre-feet/year

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

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

Table 5. Burroughs Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Well #1	Sutter	Electric	2013	200	4,000	100%	2,000	2,715	405,287	n/a	82	0.0052	0.0011	82	0.13	0.33	82
Total					4,000	100%	2,000	2,715	405,287	0	82	0.0052	0.0011	82	0.13	0.33	82

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

CO21

CH425

N2O298

Diesel Engine Fuel Consumption

0.4 lb/hp-hr

0.855 g/mL

7.13 lb/gal

(Based on spec sheet for John Deere 6068H, 6.8L Engine, 173 HP)

(Based on MSDS for Hess Diesel Fuel All Types)

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

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

Table 6. 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 7. Canal Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(MMBtu/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Dennis Well North	Colusa	E	unknown	125	3,500	29%	292	453	42,217	n/a	9	0.0005	0.0001	9	0.01	0.03	9
Dennis Well South	Colusa	E	unknown	125	3,500	29%	292	453	42,217	n/a	9	0.0005	0.0001	9	0.01	0.03	9
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	0.0020	0.0004	35	0.05	0.12	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

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 Conaway Preservation Group
Transfer Volume 5,368 acre-feet/year

Table 8. Conaway Preservation Group Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Yolo	2	12	0	0	14
Total	2	12	0	0	14

Table 9. Conaway Preservation Group GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
1W3	Yolo	Electric	unknown	250	4,700	11%	690	797	148,780	n/a	30	0.0019	0.0004	30	0.05	0.12	30
5W2	Yolo	Electric	unknown	250	4,500	11%	380	459	85,593	n/a	17	0.0011	0.0002	17	0.03	0.07	17
7W1	Yolo	Electric	unknown	75	1,800	4%	414	1,248	69,859	n/a	14	0.0009	0.0002	14	0.02	0.06	14
7W2	Yolo	Electric	unknown	250	2,700	6%	605	1,217	227,135	n/a	46	0.0029	0.0006	46	0.07	0.19	46
7W4S	Yolo	Electric	unknown	200	3,500	8%	212	329	49,034	n/a	10	0.0006	0.0001	10	0.02	0.04	10
12W1	Yolo	Electric	unknown	250	4,500	11%	633	763	142,444	n/a	29	0.0018	0.0004	29	0.05	0.12	29
13W3	Yolo	Electric	unknown	200	2,900	7%	488	914	136,439	n/a	28	0.0018	0.0004	28	0.04	0.11	28
16W2	Yolo	Diesel	2,005	227	1,600	4%	231	785	n/a	9,993	102	0.0041	0.0008	102	0.10	0.25	102
17W3	Yolo	Diesel	2,005	227	1,700	4%	220	702	n/a	8,944	91	0.0037	0.0007	91	0.09	0.22	92
20W1	Yolo	Electric	unknown	100	2,500	6%	203	441	32,920	n/a	7	0.0004	0.0001	7	0.01	0.03	7
21W3	Yolo	Electric	unknown	100	2,500	6%	332	721	53,815	n/a	11	0.0007	0.0001	11	0.02	0.04	11
31W1	Yolo	Electric	unknown	100	2,300	5%	28	66	4,948	n/a	1	0.0001	0.0000	1	0.00	0.00	1
32NW1	Yolo	Electric	unknown	100	3,300	8%	107	177	13,189	n/a	3	0.0002	0.0000	3	0.00	0.01	3
32NW2	Yolo	Electric	unknown	250	4,200	10%	824	1,066	198,888	n/a	40	0.0026	0.0005	40	0.06	0.16	40
Total					42,700	100%	5,368	9,686	1,163,044	18,937	428	0.0229	0.0047	428	0.57	1.42	430

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

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

Agency Cranmore Farms
Transfer Volume 3,400 acre-feet/year

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

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

Table 11. Cranmore Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
North Well	Sutter	Electric	unknown	125	3,500	54%	1,831	2,841	264,996	n/a	53	0.0034	0.0007	53	0.09	0.22	54
South Well	Sutter	Electric	unknown	125	3,000	46%	1,569	2,841	264,996	n/a	53	0.0034	0.0007	53	0.09	0.22	54
Total					6,500	100%	3,400	5,682	529,991	0	107	0.0068	0.0014	107	0.17	0.43	107

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

Table 12. Eastside Mutual Water Company Summary of Engines by Fuel Type and Location

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

Table 13. Eastside Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
7631T	Colusa	Diesel	2006	215	4,720	100%	2,230	2,566	n/a	30,948	316	0.0128	0.0026	316	0.32	0.76	317
Total					4,720	100%	2,230	2,566	0	30,948	316	0.0128	0.0026	316	0.32	0.76	317

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

2015 Tehama-Colusa Canal Authority Water Transfers
Draft Environmental Assessment/Initial Study

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

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

Table 14. Glenn-Colusa Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	12	0	0	0	12
Colusa	9	0	0	0	9
Total	21	0	0	0	21

Table 15. Glenn-Colusa Irrigation District GHG Emissions

	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Pump Rate (gpm)	(% of Total)	Transfer Volume (AF/year)	Operation (hours/year)	(kWh/yr)	Fuel Consumption (gal/yr)	GHG Emissions (tonnes per year)						
Well											CO2			(MTCO2e per year)			
											CO2	CH4	N2O	CO2	CH4	N2O	Total
Well1	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well2	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well3	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well4	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well5	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well6	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well7	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well8	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well9	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well10	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well11	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well12	Glenn	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well13	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well14	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well15	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well16	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well17	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well18	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well19	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well20	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Well21	Colusa	Diesel	unknown	121	590	5%	476	4,383	n/a	29,751	304	0.0123	0.0025	304	0.31	0.73	305
Total				12,392	100%	10,000	92,037	0	624,765	6,379	0.2587	0.0517	6,379	6.47	15.42	6,401	

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 3,600 acre-feet/year

Table 16. Maxwell Irrigation District 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 17. Maxwell Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
MainWell	Colusa	Electric	unknown	125	3,800	50%	1,800	2,573	239,973	n/a	48	0.0031	0.0007	48	0.08	0.20	49
TuttleWell	Colusa	Electric	unknown	125	3,800	50%	1,800	2,573	239,973	n/a	48	0.0031	0.0007	48	0.08	0.20	49
Total					7,600	100%	3,600	5,145	479,946	0	97	0.0062	0.0013	97	0.16	0.39	97

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

Table 18. Natomas Central Mutual Water Company Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Sacramento	1	6	0	0	7
Sutter	0	7	0	0	7
Total	1	13	0	0	14

Table 19. Natomas Central Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions									
					(hp)	(gpm)					(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	(tonnes per year)			(MTCO2e per year)	
								CO2	CH4							N2O	CO2	CH4	N2O	Total
Frazer	Sutter	Electric	unknown	50	2,000	8%	1,569	4,259	158,936	n/a	32	0.0021	0.0004	32	0.05	0.13	32			
Lucich North	Sutter	Electric	unknown	75	2,500	10%	1,961	4,259	238,404	n/a	48	0.0031	0.0007	48	0.08	0.19	48			
Bennett North	Sutter	Electric	unknown	150	2,000	8%	1,569	4,259	476,809	n/a	96	0.0062	0.0013	96	0.15	0.39	97			
Atkinson	Sutter	Electric	unknown	60	1,800	7%	1,412	4,259	190,723	n/a	38	0.0025	0.0005	38	0.06	0.16	39			
L-2	Sutter	Electric	unknown	100	1,900	7%	1,490	4,259	317,872	n/a	64	0.0041	0.0009	64	0.10	0.26	64			
L-12	Sutter	Electric	unknown	50	1,500	6%	1,176	4,259	158,936	n/a	32	0.0021	0.0004	32	0.05	0.13	32			
Spangler	Sutter	Electric	unknown	60	2,400	9%	1,882	4,259	190,723	n/a	38	0.0025	0.0005	38	0.06	0.16	39			
Natomas Farms	Sacramento	Electric	unknown	60	1,500	6%	1,176	4,259	190,723	n/a	45	0.0025	0.0005	45	0.06	0.16	45			
Silva	Sacramento	Electric	unknown	150	1,000	4%	784	4,259	476,809	n/a	113	0.0062	0.0013	113	0.15	0.39	113			
Betts	Sacramento	Electric	unknown	150	1,500	6%	1,176	4,259	476,809	n/a	113	0.0062	0.0013	113	0.15	0.39	113			
MAP	Sacramento	Electric	unknown	150	2,000	8%	1,569	4,259	476,809	n/a	113	0.0062	0.0013	113	0.15	0.39	113			
Ose-1	Sacramento	Diesel	2013	225	1,800	7%	1,412	4,259	n/a	53,766	549	0.0223	0.0045	549	0.56	1.33	551			
Ose-2	Sacramento	Electric	unknown	150	1,600	6%	1,255	4,259	476,809	n/a	113	0.0062	0.0013	113	0.15	0.39	113			
Perry	Sacramento	Electric	unknown	135	2,000	8%	1,569	4,259	429,128	n/a	102	0.0055	0.0012	102	0.14	0.35	102			
Total					25,500	100%	20,000	59,633	4,259,490	53,766	1,496	0.0773	0.0161	1,496	1.93	4.80	1,503			

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

Pelger Mutual Water Company

Transfer Volume

4,670 acre-feet/year

Table 20. 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 21. Pelger Mutual Water Company GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
PMWC#1	Sutter	Electric	unknown	150	5,000	34%	1,599	1,737	194,455	n/a	39	0.0025	0.0005	39	0.06	0.16	39
Well 1 Tucker	Sutter	Electric	unknown	75	2,800	19%	896	1,737	97,227	n/a	20	0.0013	0.0003	20	0.03	0.08	20
Well 2 Flopet	Sutter	Diesel	2008	125	2,500	17%	800	1,737	n/a	12,182	124	0.0050	0.0010	124	0.13	0.30	125
Well 3 Klein	Sutter	Electric	unknown	150	4,300	29%	1,375	1,737	194,455	n/a	39	0.0025	0.0005	39	0.06	0.16	39
Total					14,600	100%	4,670	6,949	486,137	12,182	222	0.0113	0.0023	222	0.28	0.70	223

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

CO21

CH425

N2O298

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

2015 Tehama-Colusa Canal Authority Water Transfers
Draft Environmental Assessment/Initial Study

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

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

Table 22. 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 23. Pleasant Grove-Verona Mutual Water Company GHG Emissions

Well	Well	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer	Operation		Fuel	GHG Emissions						
	Location			(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	Consumption (gall/yr) - diesel (MMBtu/yr) - propane	(tonnes per year)			(MTCO2e per year)			
	(County)										CO2	CH4	N2O	CO2	CH4	N2O	Total
Kelly 190 Field Well #2	Sutter	Electric	unknown	30	2,000	2%	350	951	21,281	n/a	4	0.0003	0.0001	4	0.01	0.02	4
Kelly Windmill Field Well #2	Sutter	Electric	2002	62.1	2,000	2%	350	951	44,052	n/a	9	0.0006	0.0001	9	0.01	0.04	9
Kelly Windmill North Field Well	Sutter	Propane	2014	133	1,750	2%	306	951	n/a	321	20	0.0010	0.0002	20	0.02	0.06	20
Kelly306	Sutter	Electric	unknown	60	2,600	3%	455	951	42,562	n/a	9	0.0006	0.0001	9	0.01	0.03	9
MLF Clubhouse B Well	Sutter	Electric	unknown	300	3,700	4%	648	951	212,811	n/a	43	0.0028	0.0006	43	0.07	0.17	43
MLF Marsh Well	Sutter	Electric	unknown	300	3,700	4%	648	951	212,811	n/a	43	0.0028	0.0006	43	0.07	0.17	43
MLF Monster Well	Sutter	Electric	unknown	60	3,100	4%	543	951	42,562	n/a	9	0.0006	0.0001	9	0.01	0.03	9
MLF Well #1	Sutter	Electric	unknown	30	2,000	2%	350	951	21,281	n/a	4	0.0003	0.0001	4	0.01	0.02	4
MLF Well #16	Sutter	Electric	unknown	50	1,700	2%	298	951	35,469	n/a	7	0.0005	0.0001	7	0.01	0.03	7
MLF Well#11	Sutter	Diesel	2004	250	4,200	5%	735	951	n/a	13,332	136	0.0055	0.0011	136	0.14	0.33	137
MLF Well#12/17	Sutter	Electric	unknown	50	1,500	2%	263	951	35,469	n/a	7	0.0005	0.0001	7	0.01	0.03	7
MLF Well#13	Sutter	Electric	2000	215	4,800	6%	840	951	152,515	n/a	31	0.0020	0.0004	31	0.05	0.12	31
MLF Well#2B	Sutter	Electric	2000	300	3,700	4%	648	951	212,811	n/a	43	0.0028	0.0006	43	0.07	0.17	43
Nicholas 72-Acre Field North	Sutter	Electric	unknown	40	2,000	2%	350	951	28,375	n/a	6	0.0004	0.0001	6	0.01	0.02	6
Nicholas 72-Acre Field South	Sutter	Diesel	2002	62.1	2,000	2%	350	951	n/a	3,312	34	0.0014	0.0003	34	0.03	0.08	34
Nicholas BBC Well	Sutter	Electric	unknown	30	2,000	2%	350	951	21,281	n/a	4	0.0003	0.0001	4	0.01	0.02	4
Nicholas Filipino Camp South	Sutter	Diesel	2002	62.1	2,000	2%	350	951	n/a	3,312	34	0.0014	0.0003	34	0.03	0.08	34
Nicholas Filipino Camp#2	Sutter	Electric	unknown	40	2,000	2%	350	951	28,375	n/a	6	0.0004	0.0001	6	0.01	0.02	6
Nicholas Johnston Field Well #2	Sutter	Electric	unknown	40	2,000	2%	350	951	28,375	n/a	6	0.0004	0.0001	6	0.01	0.02	6
Nicholas Sand Field Well	Sutter	Diesel	2002	62.1	2,000	2%	350	951	n/a	3,312	34	0.0014	0.0003	34	0.03	0.08	34
RiverRanch#19	Sutter	Diesel	2008	99	2,000	2%	350	951	n/a	5,279	54	0.0022	0.0004	54	0.05	0.13	54
S&O#16	Sutter	Electric	2014	159	3,000	4%	525	951	112,790	n/a	23	0.0015	0.0003	23	0.04	0.09	23
S&O#17	Sutter	Diesel	1999	101	2,250	3%	394	951	n/a	5,386	55	0.0022	0.0004	55	0.06	0.13	55
S&O#18A	Sutter	Diesel	1999	101	1,800	2%	315	951	n/a	5,386	55	0.0022	0.0004	55	0.06	0.13	55
S&O#19	Sutter	Diesel	2007	215	2,150	3%	376	951	n/a	11,465	117	0.0047	0.0009	117	0.12	0.28	117
S&O#20	Sutter	Propane	2014	154	2,250	3%	394	951	n/a	372	23	0.0011	0.0002	23	0.03	0.07	23
Willey#1	Sutter	Diesel	2000	168	3,000	4%	525	951	n/a	8,959	91	0.0037	0.0007	91	0.09	0.22	92
Willey#2	Sutter	Diesel	unknown	250	3,000	4%	525	951	n/a	13,332	136	0.0055	0.0011	136	0.14	0.33	137
Willey#3	Sutter	Electric	unknown	75	2,000	2%	350	951	53,203	n/a	11	0.0007	0.0001	11	0.02	0.04	11
Willey#4	Sutter	Diesel	1974	150	2,000	2%	350	951	n/a	7,999	82	0.0033	0.0007	82	0.08	0.20	82
Will-Lee Well#30	Sutter	Diesel	2000	100	2,500	3%	438	951	n/a	5,333	54	0.0022	0.0004	54	0.06	0.13	55
Will-Lee Well#31	Sutter	Electric	unknown	50	2,500	3%	438	951	35,469	n/a	7	0.0005	0.0001	7	0.01	0.03	7
Will-Lee Well#32	Sutter	Electric	unknown	300	2,500	3%	438	951	212,811	n/a	43	0.0028	0.0006	43	0.07	0.17	43
Will-Lee Well#33	Sutter	Electric	unknown	75	2,500	3%	438	951	53,203	n/a	11	0.0007	0.0001	11	0.02	0.04	11
Will-Lee Well#4A	Sutter	Diesel	2000	160	1,500	2%	263	951	n/a	8,532	87	0.0035	0.0007	87	0.09	0.21	87
Total					85,700	100%	15,000	33,270	1,607,506	n/a	1,336	0.0622	0.0127	1,336	1.55	3.78	1,341

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

5,000 acre-feet/year

Table 24. Princeton-Codora-Glenn Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	4	0	0	0	4
Colusa	0	0	0	0	0
Total	4	0	0	0	4

Table 25. Princeton-Codora-Glenn Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Joel Mann	Glenn	D	1995	150	3,000	34%	1,705	3,086	n/a	25,967	265	0.0108	0.0022	265	0.27	0.64	266
D.Withrow	Glenn	D	1992	180	1,200	14%	682	3,086	n/a	31,160	318	0.0129	0.0026	318	0.32	0.77	319
Chrisman	Glenn	D	1998	195	1,600	18%	909	3,086	n/a	33,757	345	0.0140	0.0028	345	0.35	0.83	346
D.Schmidt	Glenn	D	2013	170	3,000	34%	1,705	3,086	n/a	29,429	300	0.0122	0.0024	300	0.30	0.73	302
Total					8,800	100%	5,000	12,343	0	120,312	1,228	0.0498	0.0100	1,228	1.25	2.97	1,233

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

CO21

CH425

N2O298

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 6,000 acre-feet/year

Table 26. Provident Irrigation District Summary of Engines by Fuel Type and Location

County	Diesel	Electric	Natural Gas	Propane	Total
Glenn	5	2	0	0	7
Colusa	0	0	0	0	0
Total	5	2	0	0	7

Table 27. Provident Irrigation District GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Weller62V	Glenn	Diesel	2014	190	3,000	13%	766	1,387	n/a	14,780	151	0.0061	0.0012	151	0.15	0.36	151
L Hansen#1	Glenn	Diesel	1991	210	4,000	17%	1,021	1,387	n/a	16,336	167	0.0068	0.0014	167	0.17	0.40	167
L Hansen#2	Glenn	Diesel	2013	140	4,500	19%	1,149	1,387	n/a	10,891	111	0.0045	0.0009	111	0.11	0.27	112
K Hansen#1	Glenn	Diesel	1992	185	2,500	11%	638	1,387	n/a	14,391	147	0.0060	0.0012	147	0.15	0.36	147
K Hansen#2	Glenn	Electric	n/a	170	3,500	15%	894	1,387	175,912	n/a	35	0.0023	0.0005	35	0.06	0.14	36
E Weller	Glenn	Diesel	1993	185	3,000	13%	766	1,387	n/a	14,391	147	0.0060	0.0012	147	0.15	0.36	147
Weller#4	Glenn	Electric	n/a	170	3,000	13%	766	1,387	175,912	n/a	35	0.0023	0.0005	35	0.06	0.14	36
Total					23,500	100%	6,000	9,706	351,824	70,789	794	0.0339	0.0068	794	0.85	2.03	797

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

County	Diesel	Electric	Natural Gas	Propane	Total
Colusa	0	4	0	0	4
Yolo	0	1	0	0	1
Total	0	5	0	0	5

Table 29. Reclamation District 108 GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating (hp)	Pump Rate		Transfer Volume (AF/year)	Operation		Fuel Consumption (gal/yr)	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
					(gpm)	(% of Total)		(hours/year)	(kWh/yr)		CO2	CH4	N2O	CO2	CH4	N2O	Total
Well #4 Huff	Colusa	Electric	unknown	250	4,000	21%	3,141	4,265	795,721	n/a	160	0.0103	0.0022	160	0.26	0.65	161
Well #5 RiggsRanch	Colusa	Electric	unknown	150	1,700	9%	1,335	4,265	477,433	n/a	96	0.0062	0.0013	96	0.15	0.39	97
Well #6 CountyLine	Colusa	Electric	unknown	250	5,900	31%	4,634	4,265	795,721	n/a	160	0.0103	0.0022	160	0.26	0.65	161
Well#1 Heidrick	Colusa	Electric	unknown	100	3,500	18%	2,749	4,265	318,288	n/a	64	0.0041	0.0009	64	0.10	0.26	65
Well#7 Tract 6	Yolo	Electric	unknown	250	4,000	21%	3,141	4,265	795,721	n/a	160	0.0103	0.0022	160	0.26	0.65	161
Total					19,100	100%	15,000	21,325	3,182,885	0	642	0.0411	0.0087	642	1.03	2.59	646

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

2015 Tehama-Colusa Canal Authority Water Transfers
Draft Environmental Assessment/Initial Study

Groundwater Substitution Greenhouse Gas Emissions (Unmitigated)

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

Table 30. 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 31. Reclamation District 1004 GHG Emissions

Well	Location	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer	Operation		Fuel	GHG Emissions							
	Location				(hp)	(gpm)	(% of Total)	(AF)/year	(hours)/year	(kWh)/yr	Consumption	(tonnes per year)			(MTCO2e per year)			
	(County)											CO2	CH4	N2O	CO2	CH4	N2O	Total
Barale Well	Colusa	Diesel	TBD	225	4,000	4%	313	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55	
Behring Ranch 10 Field Well No. 496441	Colusa	Diesel	2008	225	5,800	6%	453	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55	
Behring Ranch Club House Well No.496461	Colusa	Electric	unknown	125	3,400	4%	266	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8	
Behring Ranch Nursery Well No. 17N1W10H1	Colusa	Diesel	TBD	225	1,000	1%	78	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55	
Behring Ranch Pearl Well No. 20094	Colusa	Diesel	TBD	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55	
Behring Ranch West Well No.97863	Colusa	Electric	unknown	125	2,300	3%	180	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8	
Drumheller Well No.7	Colusa	Diesel	TBD	225	4,000	4%	313	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55	
East Morgan Well #1 No. 374667 17N01W14N001M	Colusa	Diesel	TBD	225	2,600	3%	203	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55	
East Morgan Well#2 No. 498195 17N01W15Q001M	Colusa	Diesel	TBD	225	1,300	1%	102	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55	
Gardener No. 374672	Colusa	Diesel	2008	215	3,500	4%	274	424	n/a	5,120	52	0.0021	0.0004	52	0.05	0.13	52	
Gardener No. 498178	Colusa	Diesel	2009	215	3,500	4%	274	424	n/a	5,120	52	0.0021	0.0004	52	0.05	0.13	52	
Hall Well No. X	Glenn	Electric	TBD	125	4,500	5%	352	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8	
Hall Well No.369428	Glenn	Electric	2011	125	4,500	5%	352	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8	
Mohammad No.e0084085 17N01W02D001M	Colusa	Electric	TBD	125	4,500	5%	352	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8	
Myers Well #1 No.3457	Glenn	Electric	2006	40	2,200	2%	172	424	12,671	n/a	3	0.0002	0.0000	3	0.00	0.01	3	
Myers Well #2 No. 340884	Glenn	Electric	1982	100	4,100	4%	320	424	31,677	n/a	6	0.0004	0.0001	6	0.01	0.03	6	
Rancho Caleta No. 726883	Colusa	Diesel	2004	170	4,500	5%	352	424	n/a	4,048	41	0.0017	0.0003	41	0.04	0.10	41	
Sikes & Parachini Well #1 WS No.93124	Colusa	Diesel	2006	173	4,000	4%	313	424	n/a	4,120	42	0.0017	0.0003	42	0.04	0.10	42	
Sikes & Parachini Well #2 WS No. 374682	Colusa	Diesel	2008	150	4,000	4%	313	424	n/a	3,572	36	0.0015	0.0003	36	0.04	0.09	37	
Southam Sartain Well 18N01W26D001M	Glenn	Diesel	TBD	225	4,800	5%	375	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55	
Stone Well #6 No.11334	Colusa	Electric	2006	40	1,800	2%	141	424	12,671	n/a	3	0.0002	0.0000	3	0.00	0.01	3	
Wilder Farms Well	Glenn	Electric	unknown	125	2,500	3%	195	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8	
Dan Charter Well#1	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55	
Dan Charter Well#2	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55	
GVL Well#1	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55	
Behring Ranch Well	Colusa	Electric	unknown	125	4,000	4%	313	424	39,596	n/a	8	0.0005	0.0001	8	0.01	0.03	8	
Claudia Charter	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55	
GVL Well#2	Colusa	Diesel	unknown	225	2,500	3%	195	424	n/a	5,358	55	0.0022	0.0004	55	0.06	0.13	55	
Total					91,800	100%	7,175	11,885	334,191	91,633	1,003	0.0423	0.0085	1,003	1.06	2.53	1,007	

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 9,000 acre-feet/year

Table 32. 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 33. River Garden Farms GHG Emissions

Well	Well Location (County)	Fuel Type	Model Year	Power Rating	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Field 65 PW	Yolo	Electric	2008	125	2500	12%	1,103	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Field 71 PW	Yolo	Electric	2001	125	1700	8%	750	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Field 98 PW	Yolo	Electric	1963	125	2900	14%	1,280	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Field 104 PW	Yolo	Electric	2008	125	2500	12%	1,103	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Field 104-09 PW	Yolo	Electric	2009	125	2990	15%	1,319	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Field 91-09 PW	Yolo	Electric	2009	125	2840	14%	1,253	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Field 117 PW	Yolo	Electric	2009	125	1965	10%	867	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Shop PW	Yolo	Electric	2009	125	3000	15%	1,324	2,397	223,559	n/a	45	0.0029	0.0006	45	0.07	0.18	45
Total					20,395	100%	9,000	19,172	1,788,471	0	361	0.0231	0.0049	361	0.58	1.46	363

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 Sycamore Mutual Water Company
Transfer Volume 11,300 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	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
Well #15	Colusa	electric	n/a	125	3,270	15%	1,672	2,776	258,990	n/a	52	0.0033	0.0007	52	0.08	0.21	53
Well #14	Colusa	electric	n/a	125	3,270	15%	1,672	2,776	258,990	n/a	52	0.0033	0.0007	52	0.08	0.21	53
Well #11	Colusa	electric	n/a	125	6,409	29%	3,276	2,776	258,990	n/a	52	0.0033	0.0007	52	0.08	0.21	53
Well #2b	Colusa	electric	n/a	125	4,578	21%	2,340	2,776	258,990	n/a	52	0.0033	0.0007	52	0.08	0.21	53
Well #2a	Colusa	electric	n/a	125	4,578	21%	2,340	2,776	258,990	n/a	52	0.0033	0.0007	52	0.08	0.21	53
Total					22,104	100%	11,300	13,882	1,294,949	0	261	0.0167	0.0035	261	0.42	1.06	263

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
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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	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
NW-3	Colusa	E	unknown	125	3,500	47%	560	869	81,057	n/a	16	0.0010	0.0002	16	0.03	0.07	16
NW-4	Colusa	E	unknown	125	4,000	53%	640	869	81,057	n/a	16	0.0010	0.0002	16	0.03	0.07	16
				Total	7,500	100%	1,200	1,738	162,115	0	33	0.0021	0.0004	33	0.05	0.13	33

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 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	Pump Rate		Transfer Volume	Operation		Fuel Consumption	GHG Emissions						
											(tonnes per year)			(MTCO2e per year)			
				(hp)	(gpm)	(% of Total)	(AF/year)	(hours/year)	(kWh/yr)	(gal/yr)	CO2	CH4	N2O	CO2	CH4	N2O	Total
GW1	Yolo	Electric	N/A	127	4,656	29%	2,090	2,438	231,042	n/a	47	0.0030	0.0006	47	0.07	0.19	47
GW10	Yolo	Electric	N/A	143	2,833	18%	1,272	2,438	260,150	n/a	52	0.0034	0.0007	52	0.08	0.21	53
GW9	Yolo	Electric	N/A	104	2,400	15%	1,077	2,438	189,200	n/a	38	0.0024	0.0005	38	0.06	0.15	38
GW3	Yolo	Electric	N/A	52	3,715	24%	1,668	2,438	94,600	n/a	19	0.0012	0.0003	19	0.03	0.08	19
GW4	Yolo	Electric	N/A	125	2,200	14%	988	2,438	227,404	n/a	46	0.0029	0.0006	46	0.07	0.19	46
Total					15,804	100%	7,094	12,189	1,002,395	0	202	0.0130	0.0027	202	0.32	0.82	203

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

Engine Size Summary

Table 40. 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 41. GHG Emission Factors for Electric Pumps

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

Table 42. Utility-Specific CO2 Emission Factors

2012 Emission Rates		
Utility	Factor Type	Emission Factor (lbs CO ₂ /MWh)
City of Vernon, Light and Power	System Average	765.97
Pacific Gas & Electric	System Average	444.62
Sacramento Municipal Utility District	Retail Power	521.73
	Special Power	0.00
	Wholesale Power	799.77
Seattle City Light	Retail Power	25.62
	Special Power	0.00
	Wholesale Power	362.85
Metropolitan Water District of Southern California	Wholesale Power	658.73
	Self-consumed Power	157.87

Source:

The Climate Registry. 2015. Utility-Specific Emission Factors. Accessed on: January 20, 2015. Available at: <http://www.theclimateresistry.org/resources/protocols/general-reporting-protocol/#jump3>.

Table 43. Diesel Emission Factors

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

Source: The Climate Registry. 2014. 2014 Climate Registry Default Emission Factors. Accessed on: January 20, 2015. Available at: <http://www.theclimateresistry.org/downloads/2014/04/2014-Climate-Registry-Default-Emissions-Factors.pdf>.

Table 44. Natural Gas Emission Factors

Pollutant	Emission Factor	Unit	Emission Factor Description
CO2	53.02	kg/MMBtu	Table 12.1, US Weighted Average
CH4	0.001	kg/MMBtu	Table 12.9, Natural Gas, Industrial
N2O	0.0001	kg/MMBtu	Table 12.9, Natural Gas, Industrial
Heat Content	1,028	Btu/scf	Table 12.1, US Weighted Average

Source: The Climate Registry. 2014. 2014 Climate Registry Default Emission Factors. Accessed on: January 20, 2015. Available at: <http://www.theclimateresistry.org/downloads/2014/04/2014-Climate-Registry-Default-Emissions-Factors.pdf>.

Table 45. Propane Emission Factors

Pollutant	Emission Factor	Unit	Emission Factor Description
CO2	61.46	kg/MMBtu	Table 12.1, Propane (liquid)
CH4	0.003	kg/MMBtu	Table 12.9, Petroleum Products, Industrial
N2O	0.0006	kg/MMBtu	Table 12.9, Petroleum Products, Industrial
Heat Content	0.091	MMBtu/gal	Table 12.1, Propane (liquid)

Source: The Climate Registry. 2014. 2014 Climate Registry Default Emission Factors. Accessed on: January 20, 2015. Available at: <http://www.theclimateresistry.org/downloads/2014/04/2014-Climate-Registry-Default-Emissions-Factors.pdf>.

Table 46. Year 2010 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	3,350,817.0	1,256.87	139,035.5	26.08	38,279.9	7.18	3,358,210.3	1,259.64
AKMS	ASCC Miscellaneous	317,398.6	448.57	26,527.0	18.74	5,208.6	3.68	318,484.5	450.1
AZNM	WECC Southwest	104,967,483.8	1,177.61	3,424,005.1	19.21	2,802,975.8	15.72	105,437,897.1	1,182.89
CAMX	WECC California	64,799,260.4	610.82	6,044,809.1	28.49	1,278,773.3	6.03	65,060,940.8	613.28
ERCT	ERCOT All	210,366,837.2	1,218.17	5,820,108.3	16.85	4,859,884.0	14.07	211,181,230.4	1,222.88
FRCC	FRCC All	130,376,587.7	1,196.71	8,478,102.7	38.91	2,995,217.6	13.75	130,929,866.5	1,201.79
HIMS	HICC Miscellaneous	1,963,642.7	1,330.16	218,438.7	73.98	40,985.9	13.88	1,972,289.1	1,336.02
HIOA	HICC Oahu	6,393,027.4	1,621.86	782,825.4	99.3	176,679.8	22.41	6,428,632.4	1,630.90
MROE	MRO East	26,009,237.7	1,610.80	784,331.9	24.29	888,770.5	27.52	26,155,232.6	1,619.84
MROW	MRO West	156,444,752.4	1,536.36	5,809,874.5	28.53	5,354,351.3	26.29	157,335,680.5	1,545.11
NEWE	NPCC New England New England	46,905,984.7	722.07	9,322,707.0	71.76	1,685,853.4	12.98	47,265,180.4	727.6
NWPP	WECC Northwest	112,891,853.5	842.58	4,300,901.6	16.05	3,502,980.9	13.07	113,479,975.1	846.97
NYCW	NPCC NYC/Westchester	12,733,660.7	622.42	974,161.1	23.81	114,582.6	2.8	12,761,649.6	623.78
NYLI	NPCC Long Island	8,115,858.7	1,336.11	989,929.6	81.49	124,943.6	10.28	8,145,619.2	1,341.01
NYUP	NPCC Upstate NY	24,165,154.6	545.79	1,443,157.6	16.3	641,283.5	7.24	24,279,706.7	548.37
RFCE	RFC East	137,558,868.7	1,001.72	7,434,984.1	27.07	4,210,267.5	15.33	138,289,527.5	1,007.04
RFCM	RFC Michigan	74,602,328.8	1,629.38	2,789,651.5	30.46	2,457,844.2	26.84	75,012,586.0	1,638.34
RFCW	RFC West	449,994,271.4	1,503.47	10,897,168.6	18.2	14,813,680.5	24.75	452,404,812.2	1,511.52
RMPA	WECC Rockies	61,839,528.9	1,896.74	1,477,560.7	22.66	1,904,448.4	29.21	62,150,232.8	1,906.27
SPNO	SPP North	62,457,258.2	1,799.45	1,444,401.4	20.81	1,986,994.1	28.62	62,780,408.5	1,808.76
SPSO	SPP South	117,325,297.0	1,580.60	3,444,187.9	23.2	3,095,469.5	20.85	117,841,258.7	1,587.55
SRMV	SERC Mississippi Valley	90,967,299.2	1,029.82	3,650,522.7	20.66	1,900,187.0	10.76	91,300,158.7	1,033.58
SRMW	SERC Midwest	123,042,911.4	1,810.83	2,783,643.6	20.48	4,019,051.2	29.57	123,695,092.6	1,820.43
SRSO	SERC South	183,236,856.9	1,354.09	6,176,437.4	22.82	5,653,138.2	20.89	184,177,945.9	1,361.05
SRTV	SERC Tennessee Valley	163,960,526.8	1,389.20	4,177,202.5	17.7	5,290,412.2	22.41	164,824,401.3	1,396.52
SRVC	SERC Virginia/Carolina	167,452,188.6	1,073.65	6,766,296.6	21.69	5,502,582.8	17.64	168,376,135.0	1,079.57

Source: U.S. Environmental Protection Agency. 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available online at: http://www.epa.gov/cleanenergy/documents/egridzips/eGRID_9th_edition_V1-0_year_2010_Summary_Tables.pdf [Accessed on January 20, 2015].

Table 47. 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
Canal Farms	1,000	635	149	56	0.00283	0.00058	56	0.071	0.174	56
Conaway Preservation Group	5,368	21,350	5,024	1,872	0.095	0.0197	1,872	2.38	5.9	1,880
Eastside Mutual Water Company	2,230	1,846	434	162	0.0082	0.00170	162	0.206	0.51	162
Glenn-Colusa Irrigation District	10,000	66,000	15,529	5,786	0.295	0.061	5,786	7.4	18.1	5,811
Maxwell Irrigation District	3,600	2,400	565	210	0.0107	0.00221	210	0.268	0.66	211
Pelger Mutual Water Company	4,670	2,538	597	222	0	0	222	0	1	223
Pleasant Grove-Verona Mutual Water Company	15,000	9,000	2,118	789	0.0402	0.0083	789	1.00	2.47	793
Princeton-Codora-Glenn Irrigation District	5,000	3,000	706	263	0.0134	0.00277	263	0.335	0.82	264
Provident Irrigation District	6,000	3,000	706	263	0.0134	0.00277	263	0.335	0.82	264
Reclamation District 108	15,000	20,000	4,706	1,753	0.089	0.0184	1,753	2.23	5.5	1,761
Reclamation District 1004	7,175	12,500	2,941	1,096	0.056	0.0115	1,096	1.39	3.43	1,101
River Garden Farms	9,000	3,500	824	307	0.0156	0.00323	307	0.391	0.96	308
Sutter Mutual Water Company	--	18,000	4,235	1,578	0.080	0.0166	1,578	2.01	4.94	1,585
Sycamore Mutual Water Company	11,300	10,000	2,353	877	0.0446	0.0092	877	1.12	2.75	881
T&P Farms	1,200	890	209	78	0.00396	0.00082	78	0.099	0.244	78
Te Velde Revocable Family Trust	7,094	6,975	1,641	611	0.0311	0.0064	611	0.78	1.92	614
Total	133,837	181,634	42,737	15,922	0.81	0.167	15,922	20.3	49.9	15,992

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

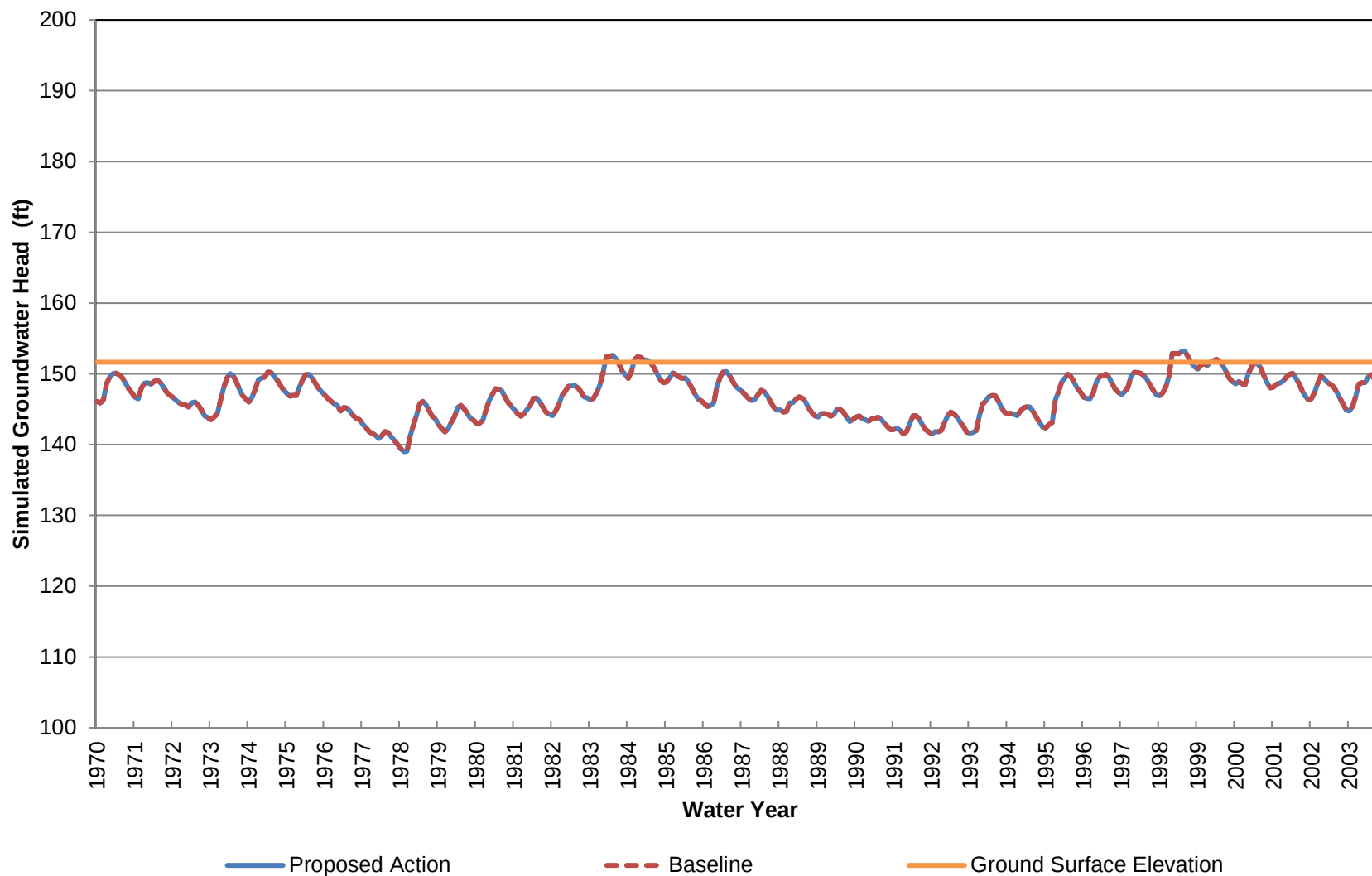
Source: Byron Buck & Associates. 2009. "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping."

Appendix F

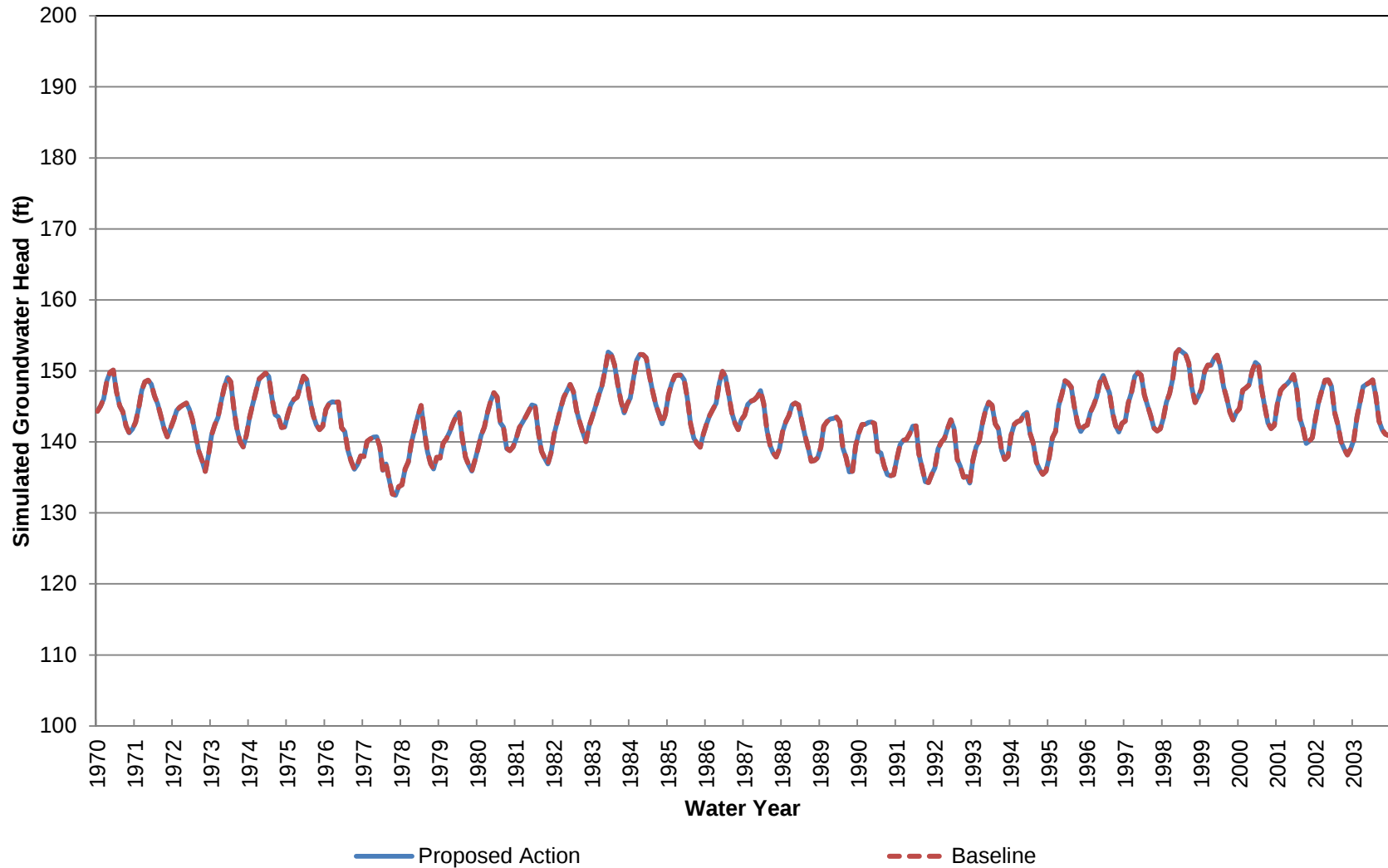
Groundwater Modeling Results

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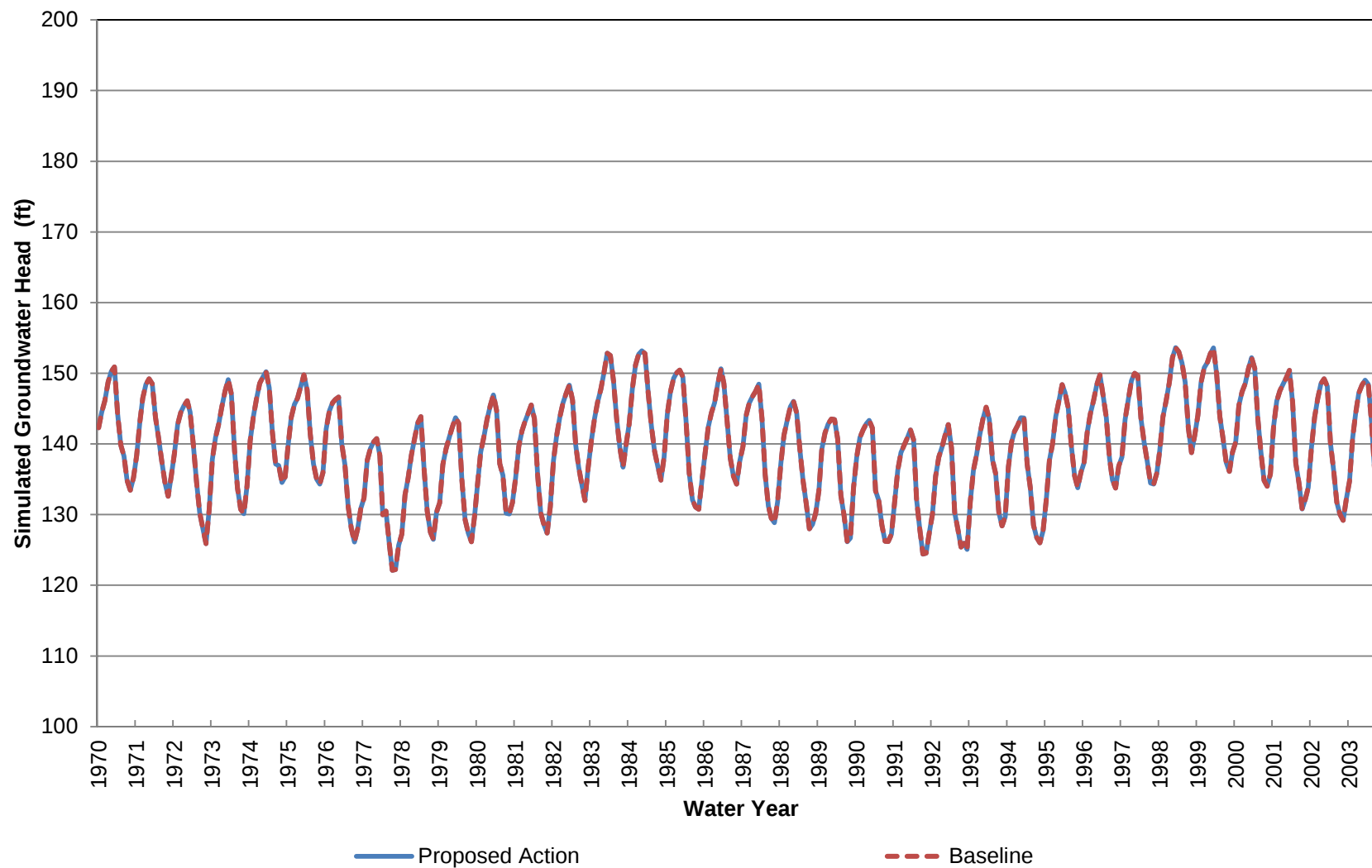
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 1 (Approximately 0-70 ft bgs)**



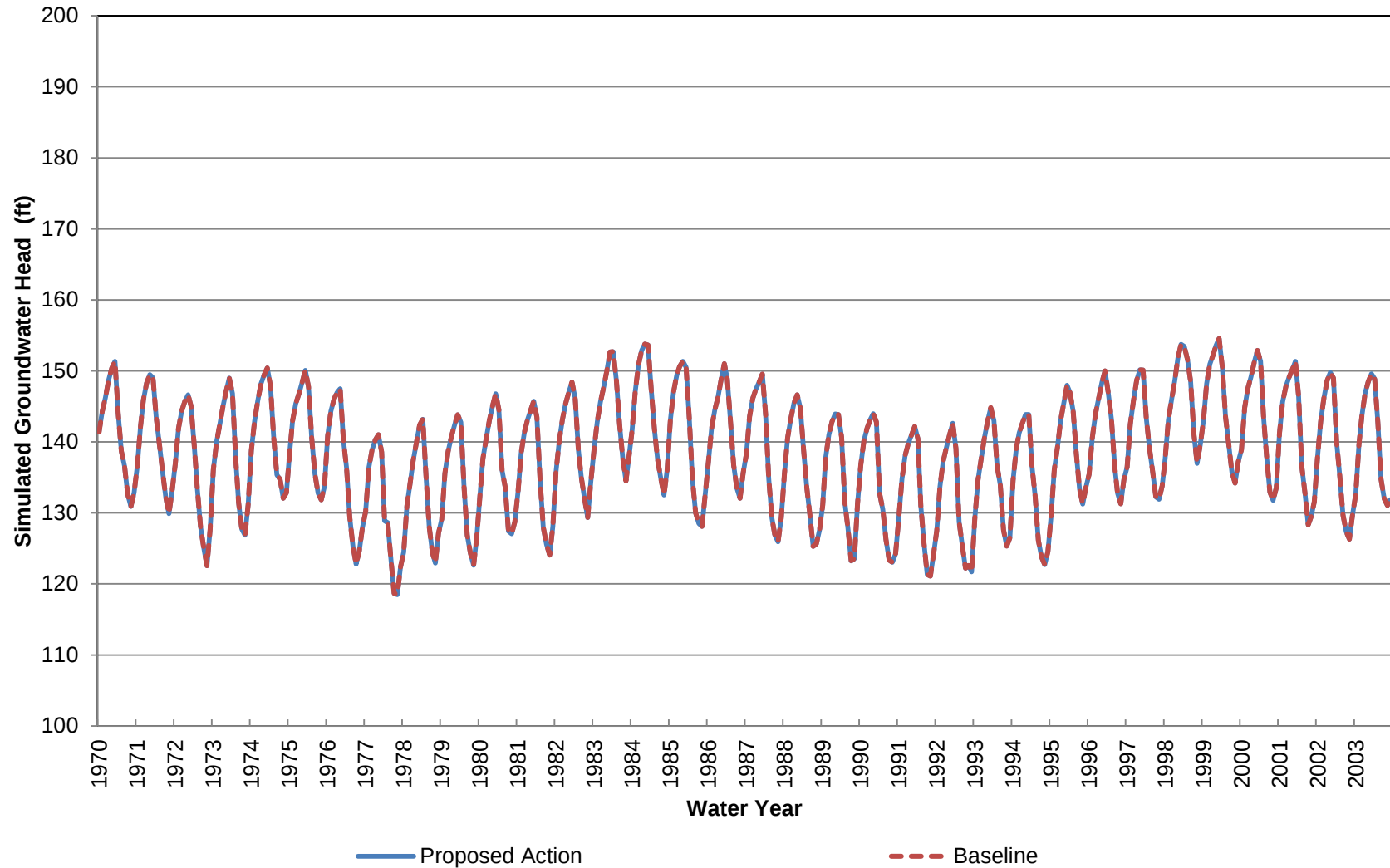
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 70-200 ft bgs)**



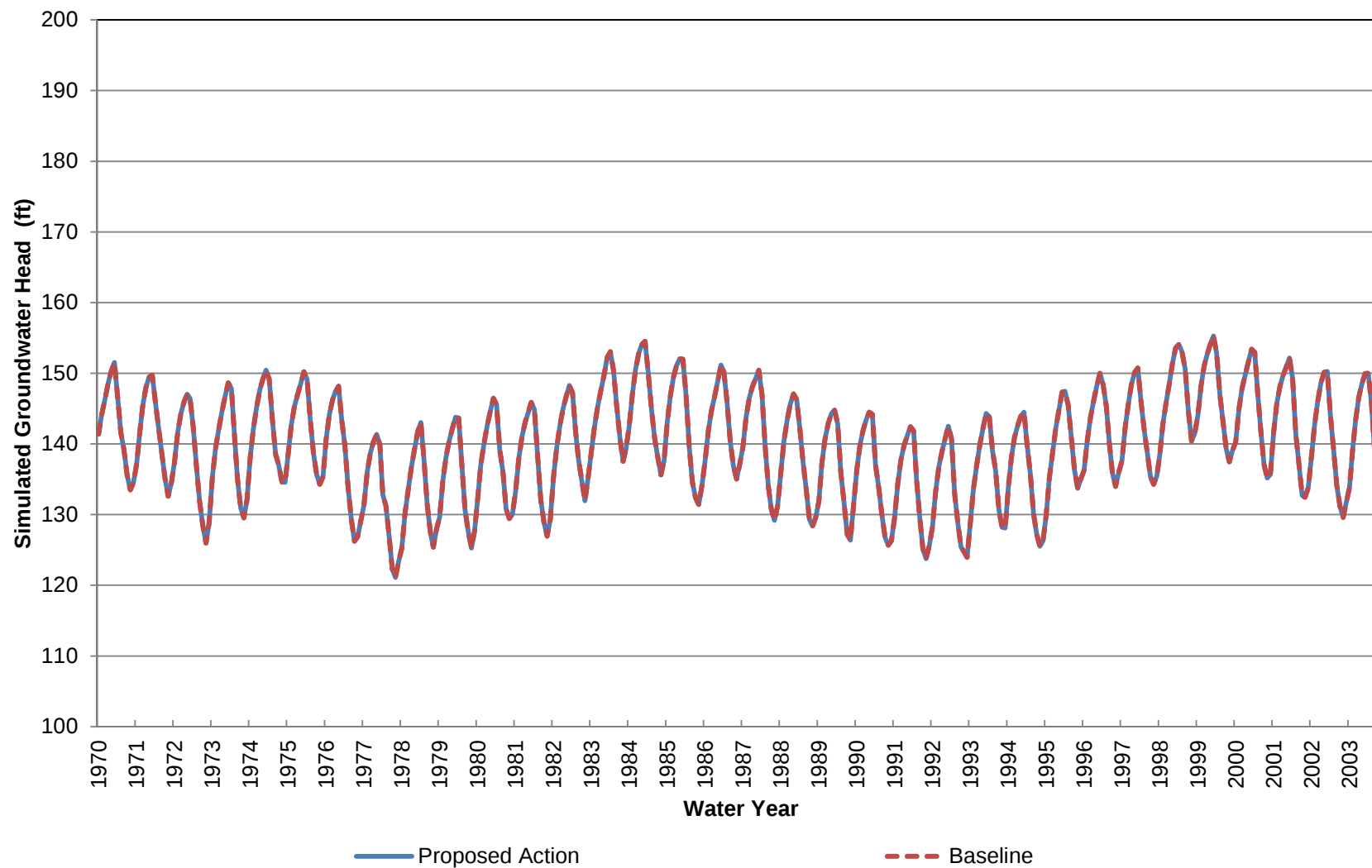
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 200-330 ft bgs)**



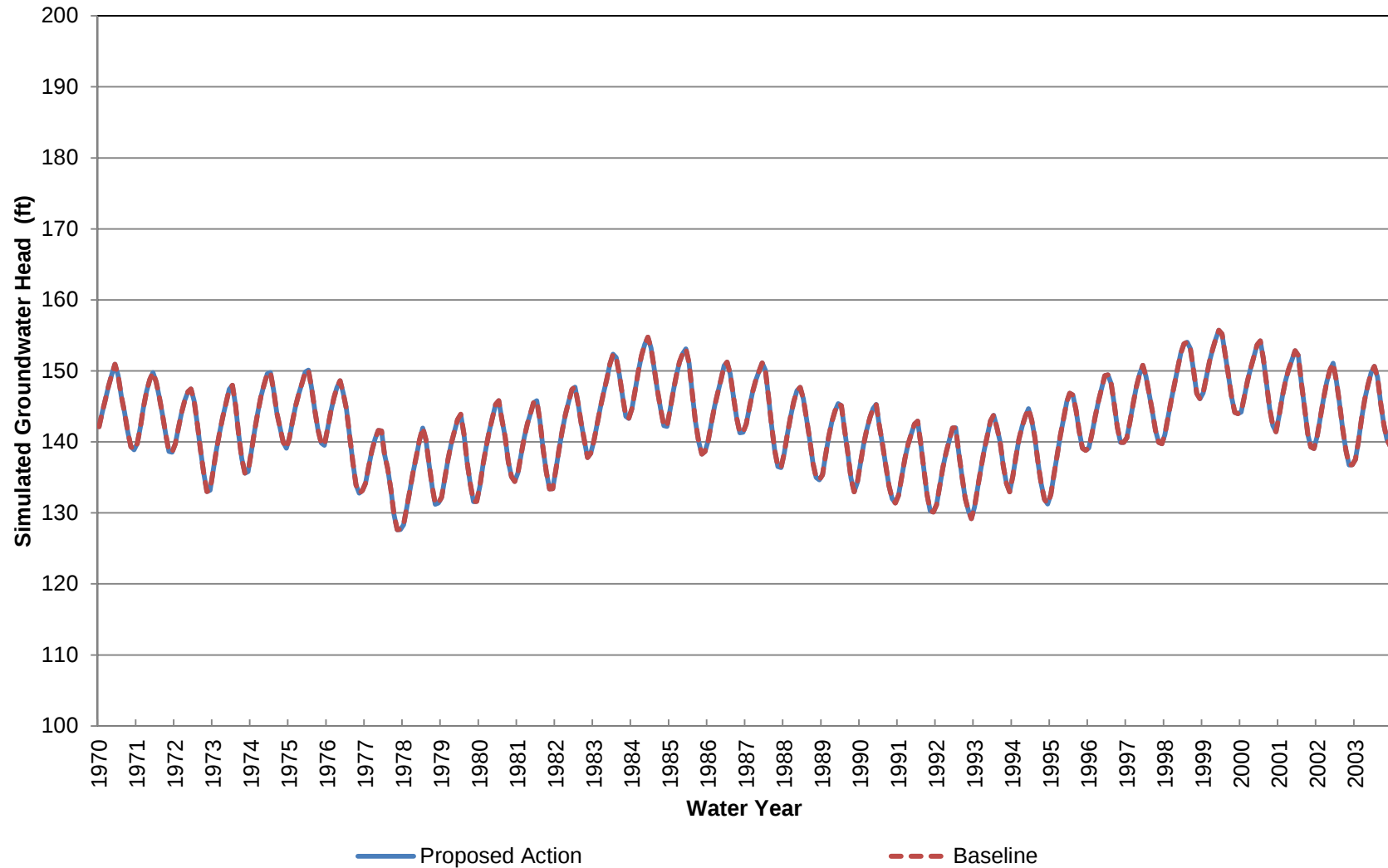
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 330-450 ft bgs)**



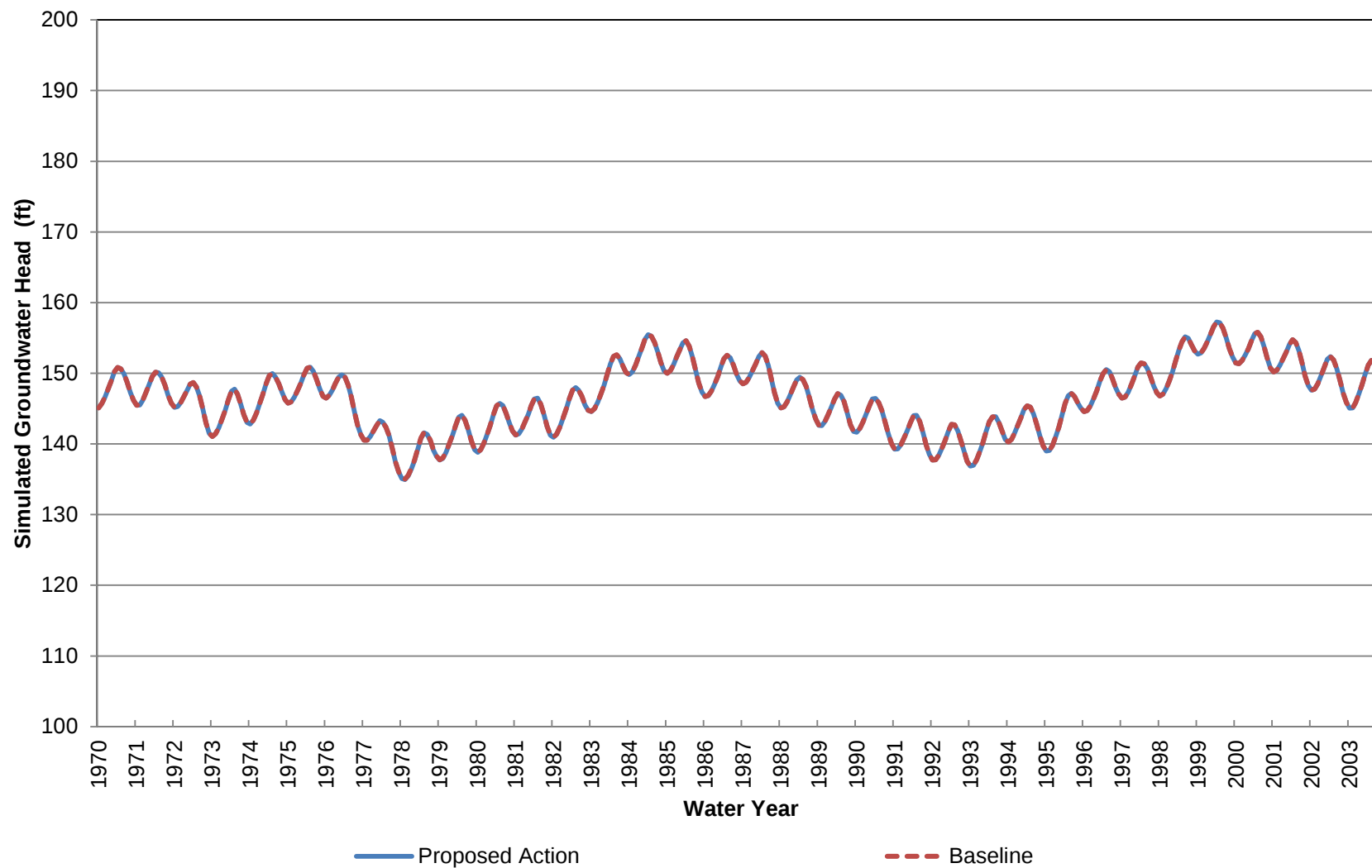
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 450-640 ft bgs)**



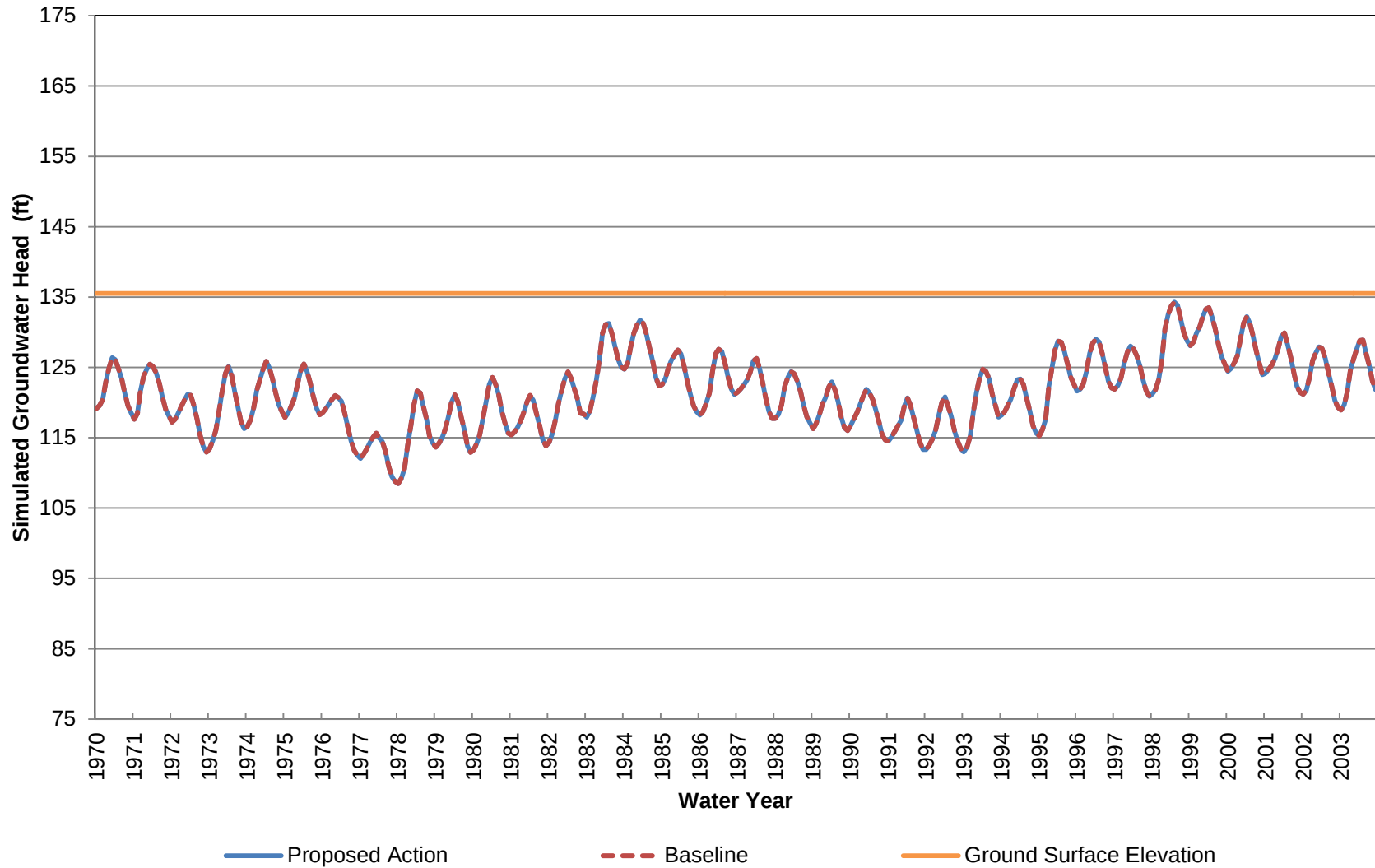
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 640-890 ft bgs)**



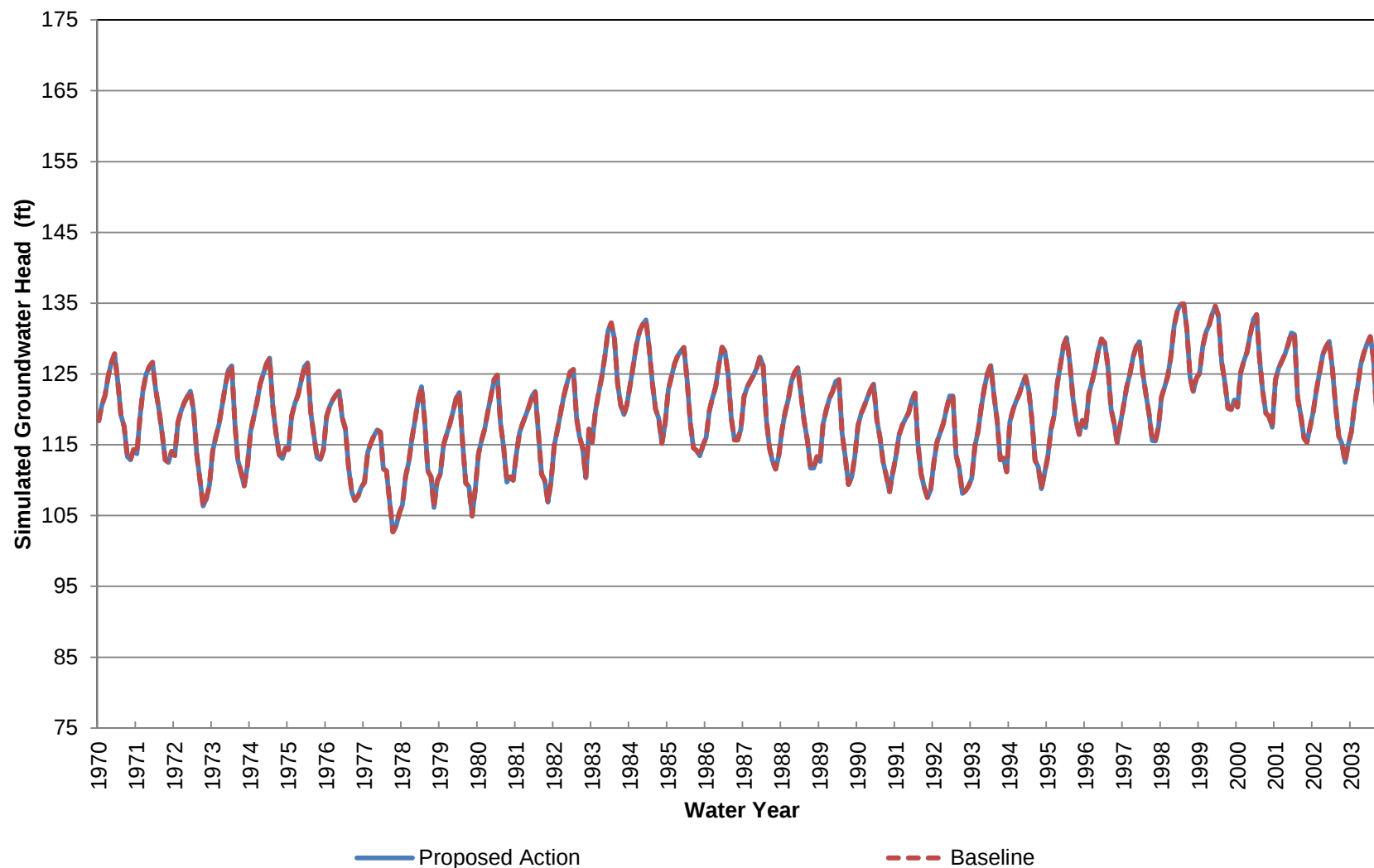
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 1 (Approximately 890-1360 ft bgs)**



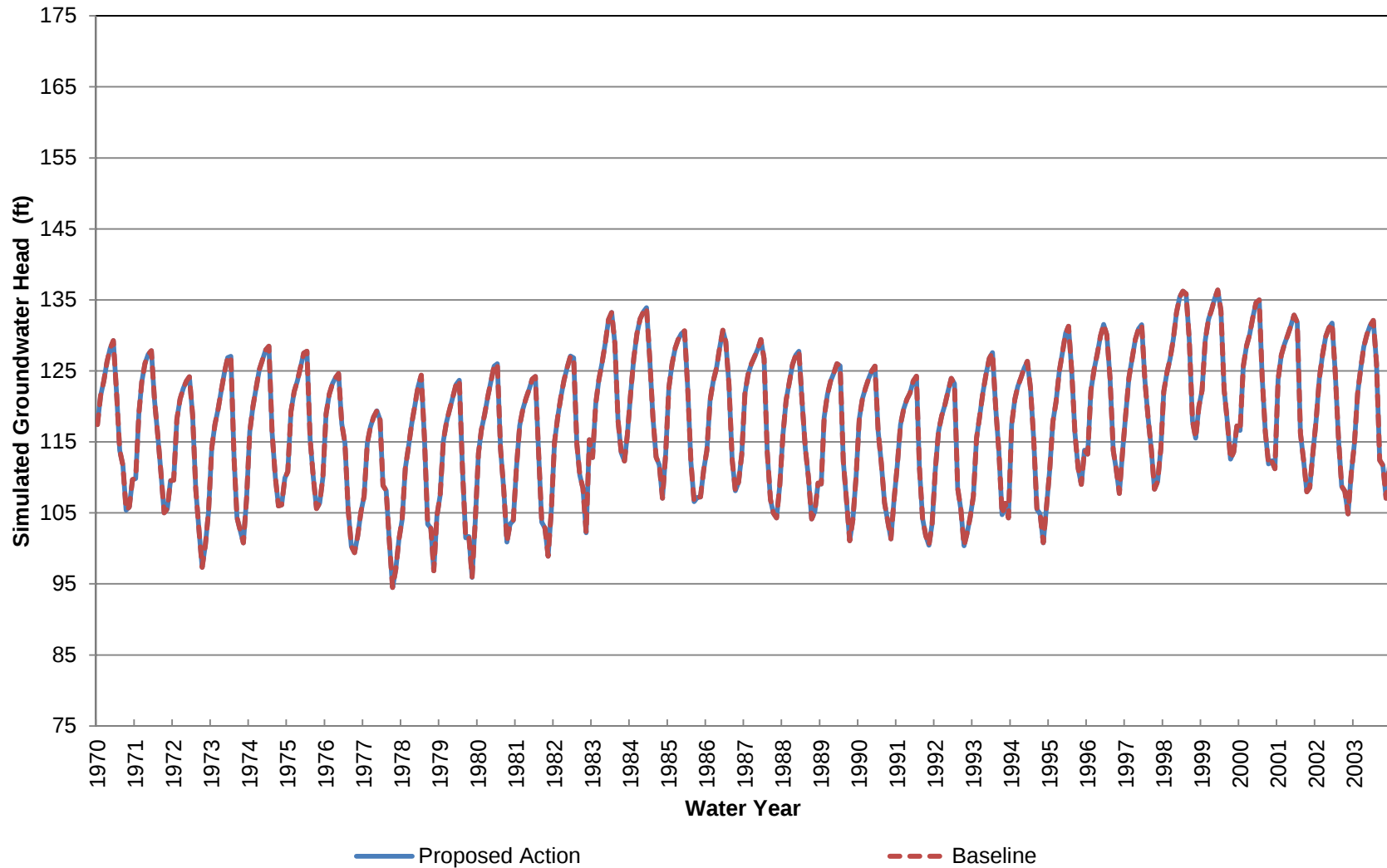
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 2 (Approximately 0-70 ft bgs)**



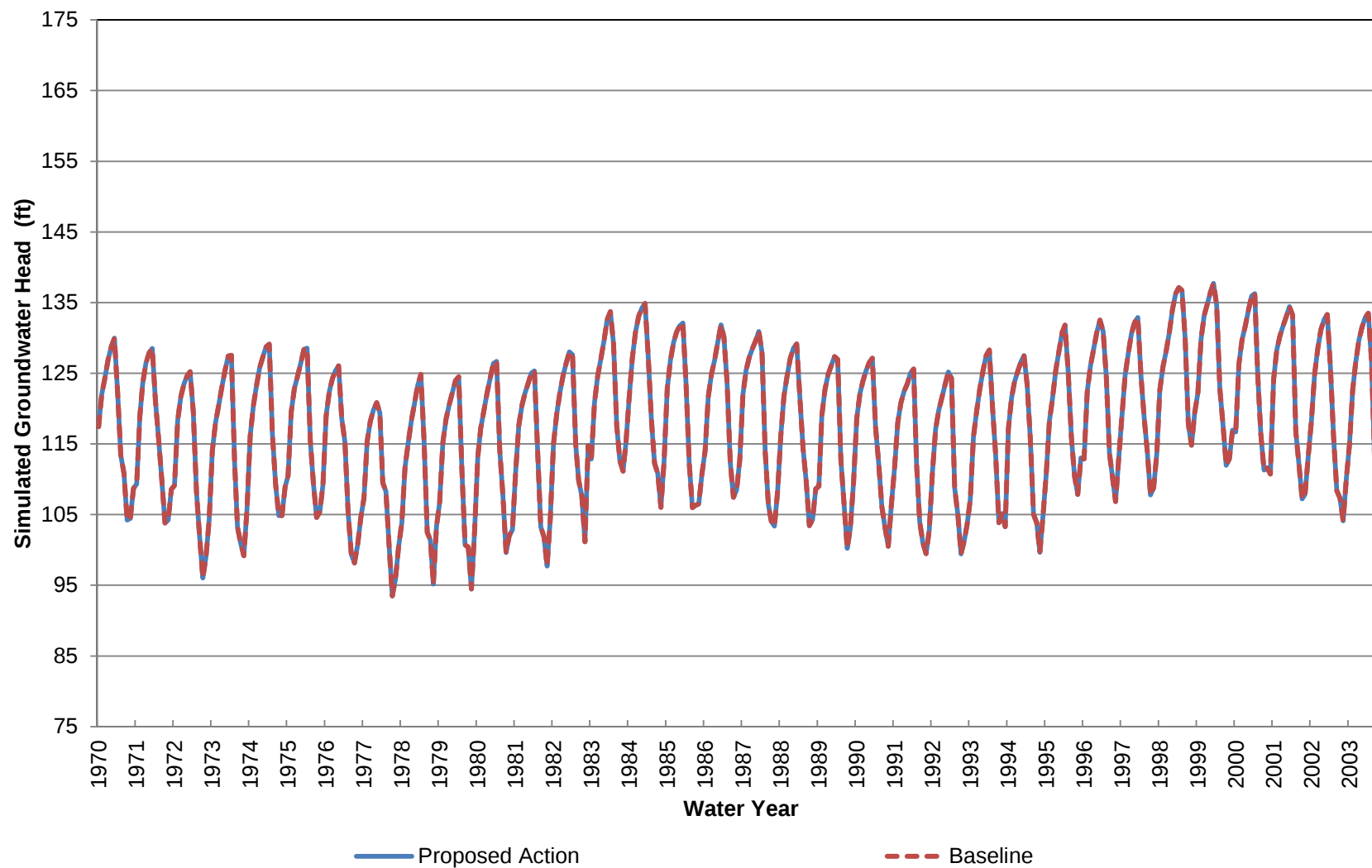
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 70-190 ft bgs)**



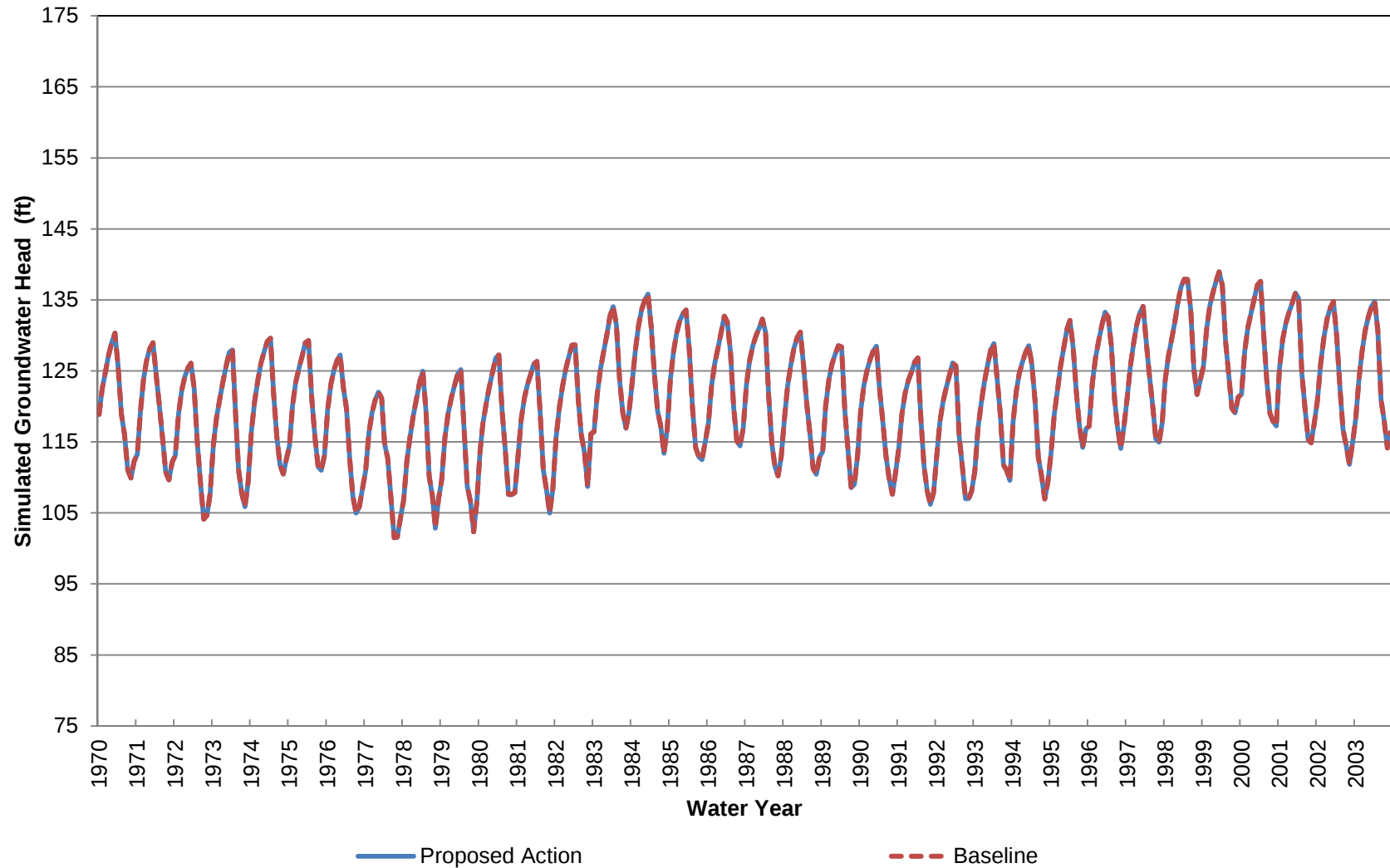
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 190-300 ft bgs)**



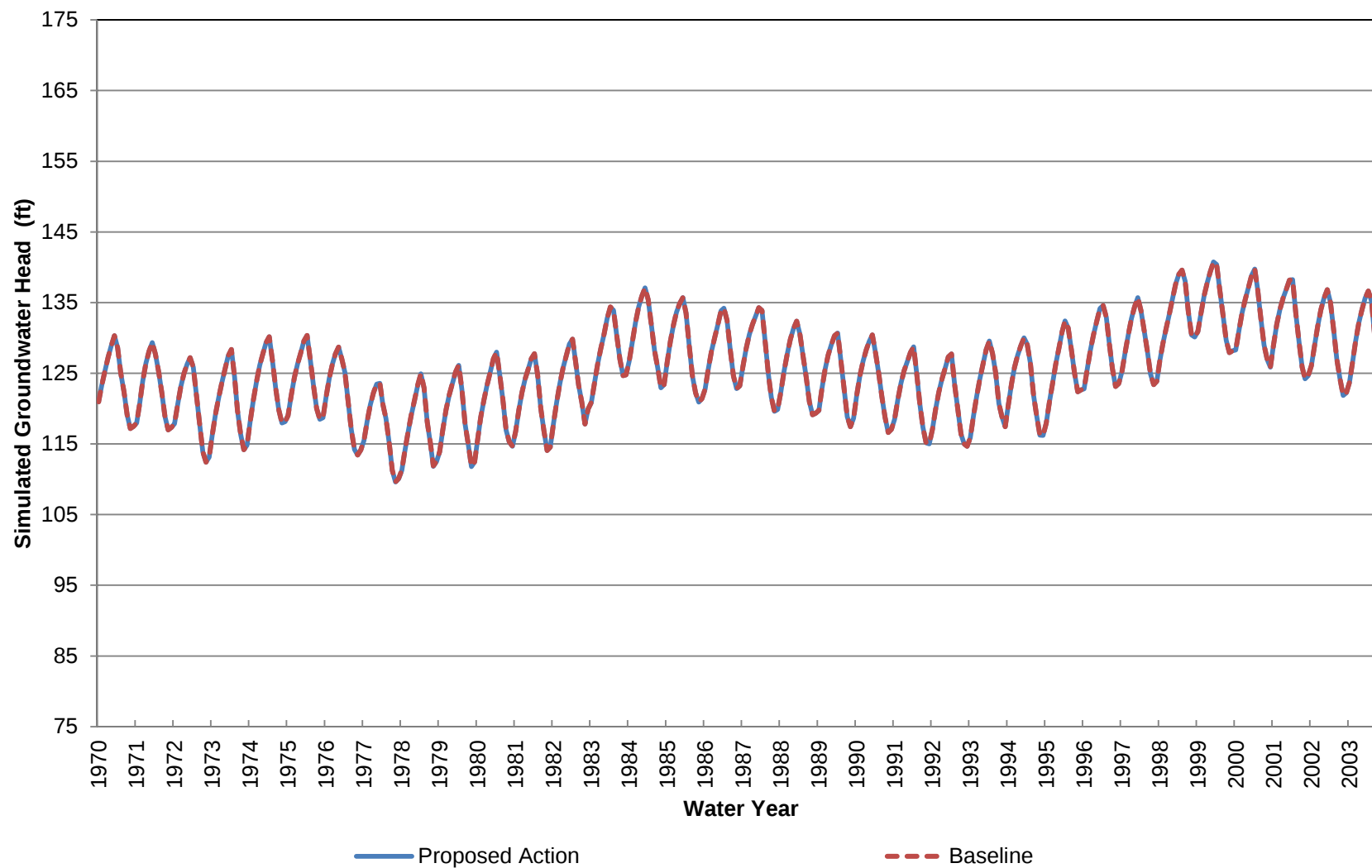
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 300-420 ft bgs)**



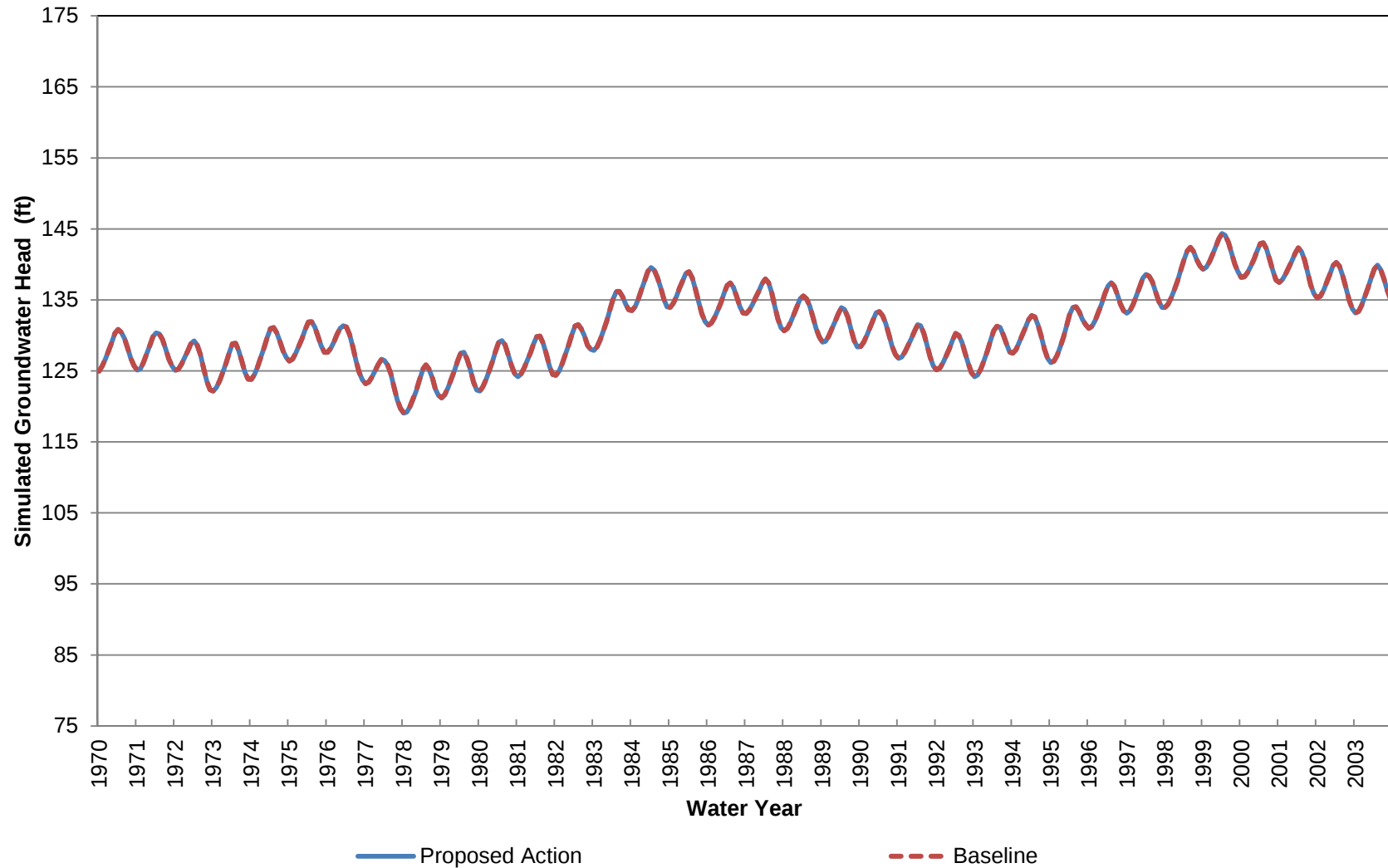
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 420-580 ft bgs)**



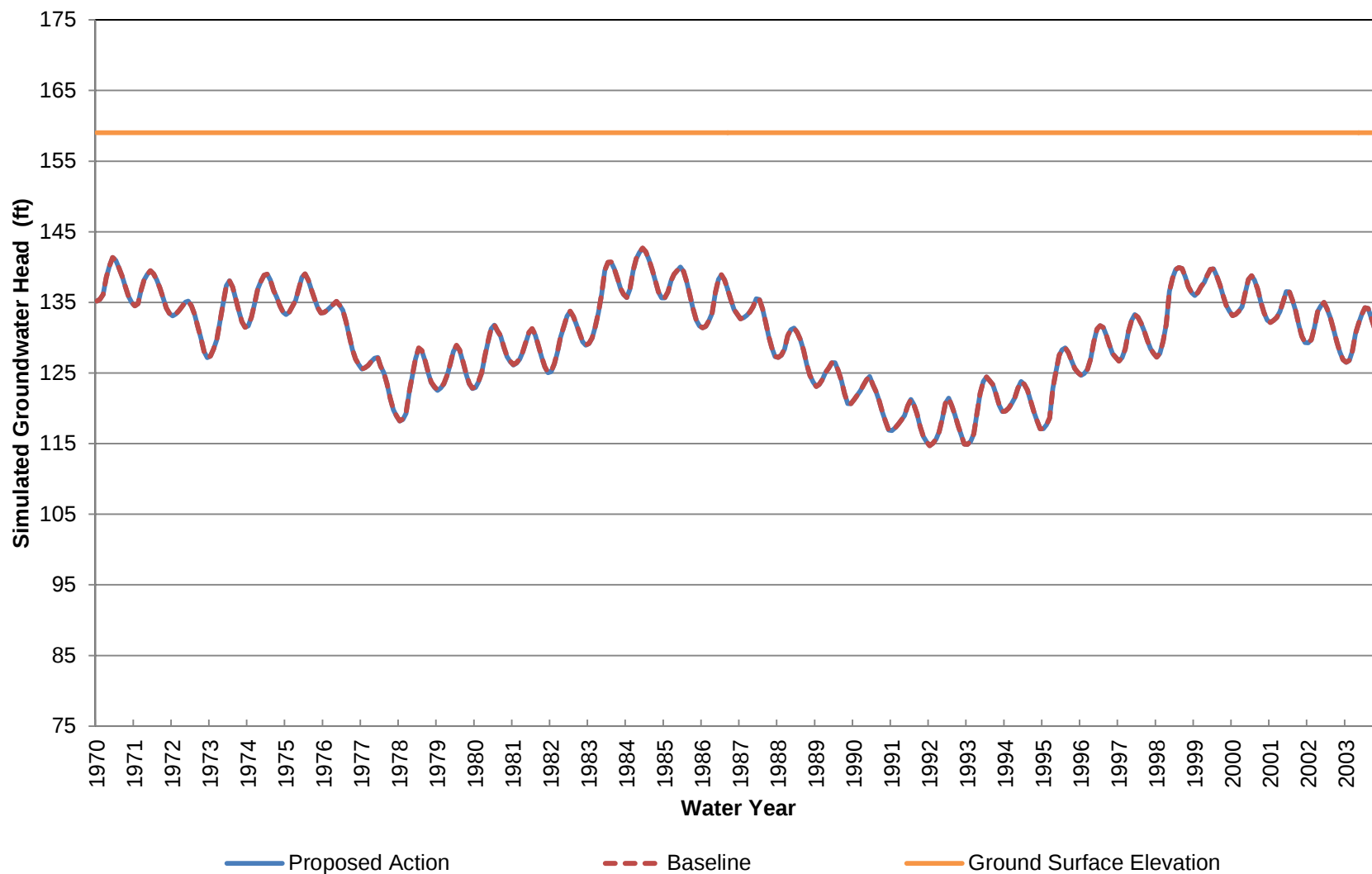
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 580-830 ft bgs)**



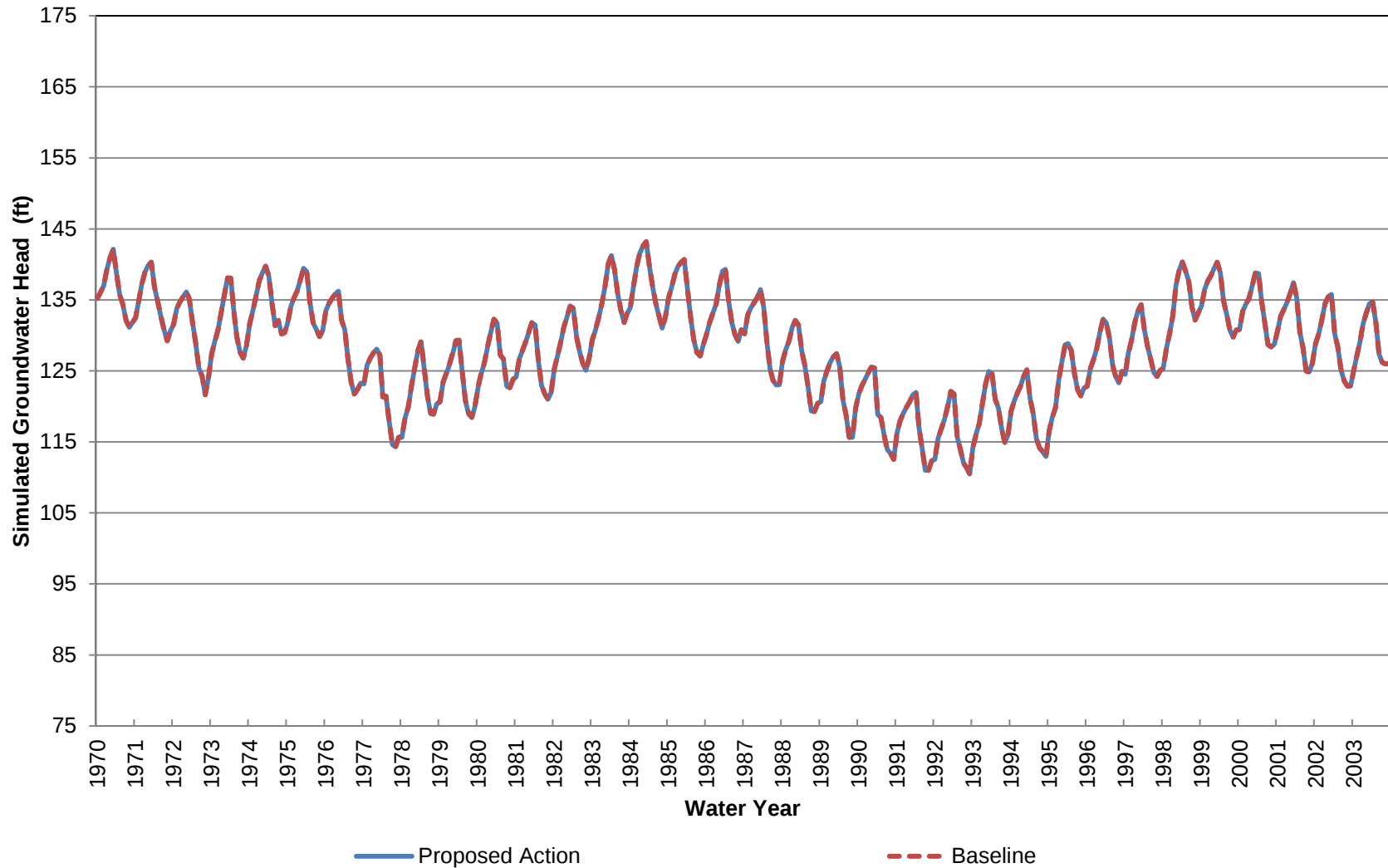
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 2 (Approximately 830-1330 ft bgs)**



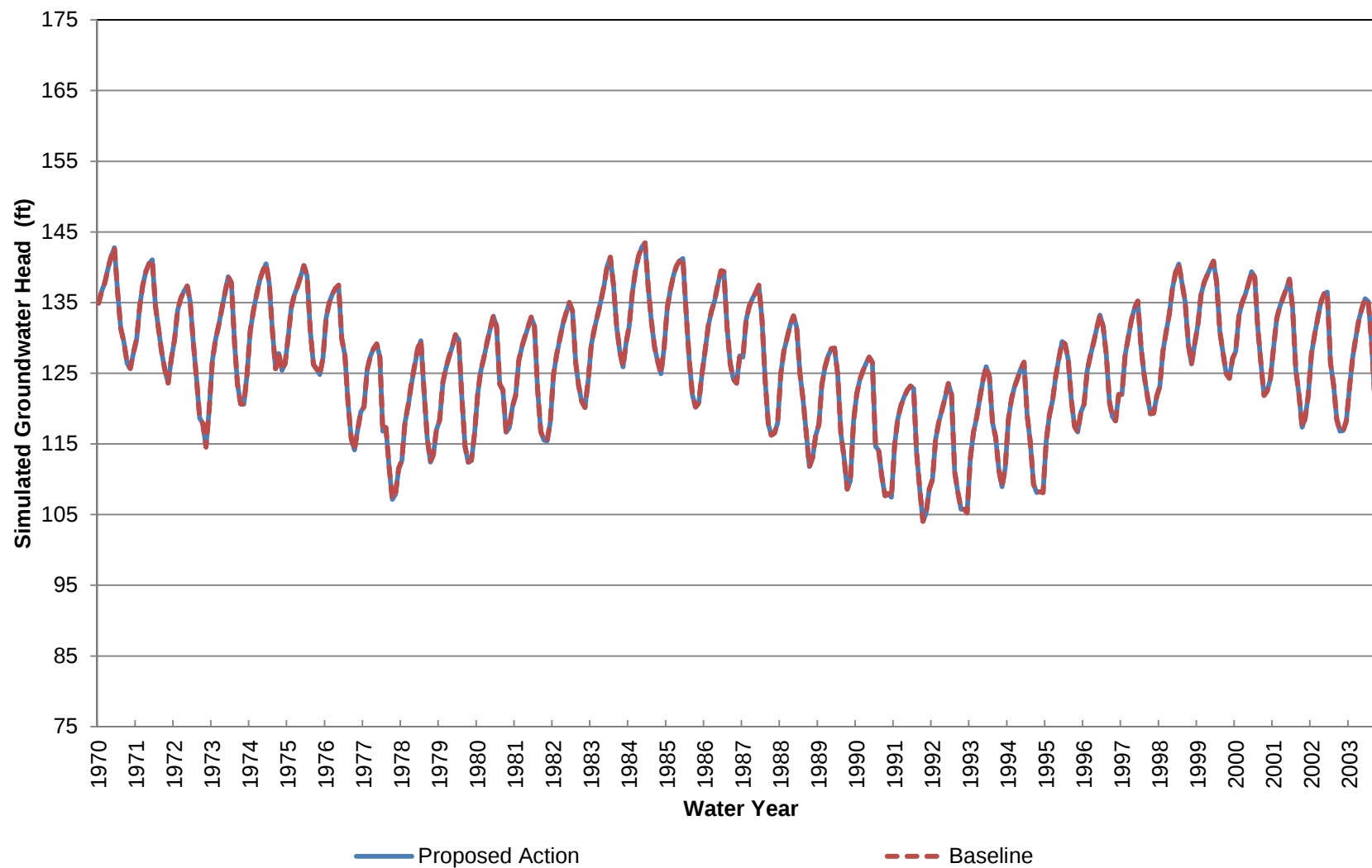
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 3 (Approximately 0-70 ft bgs)**



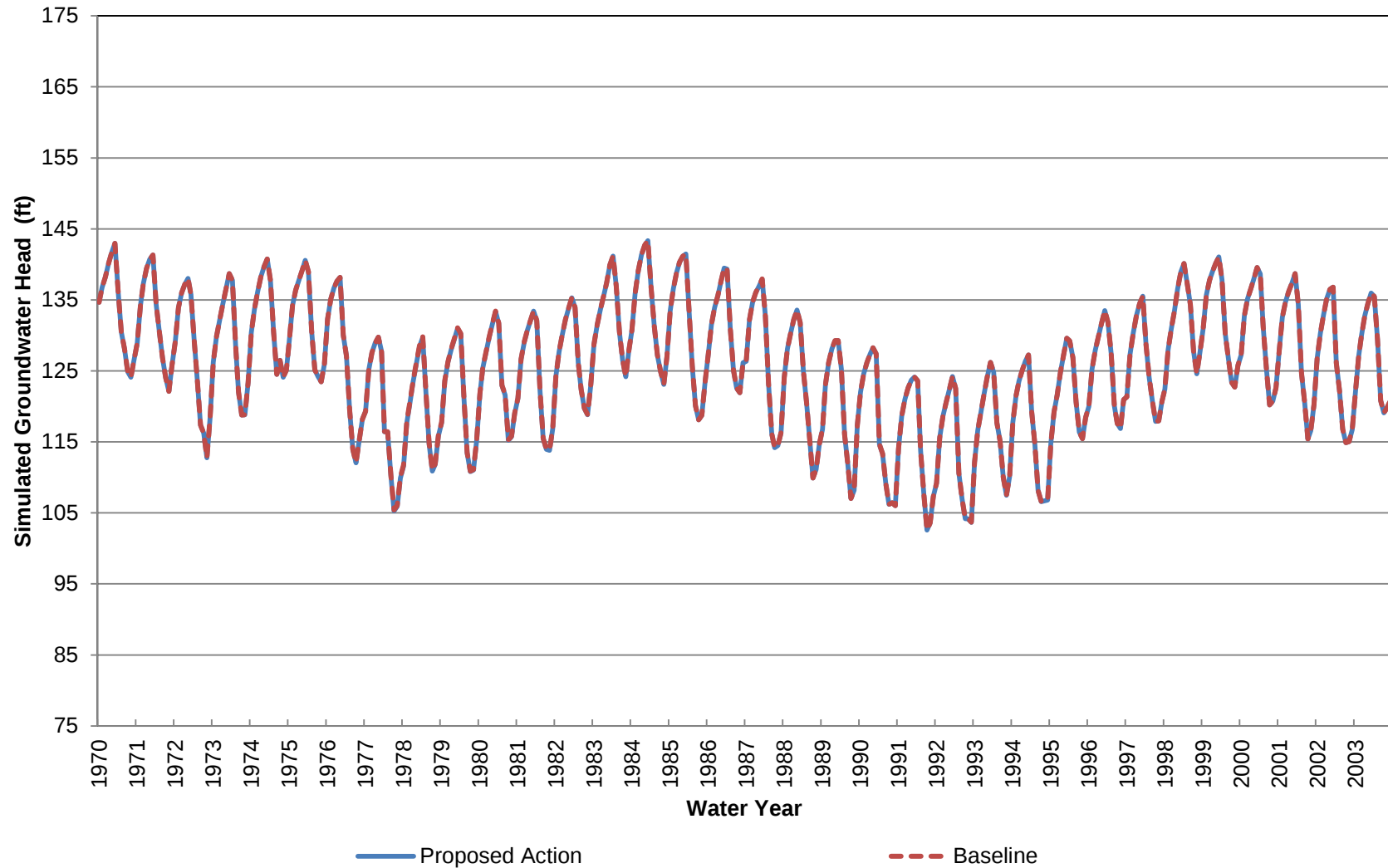
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 70-210 ft bgs)**



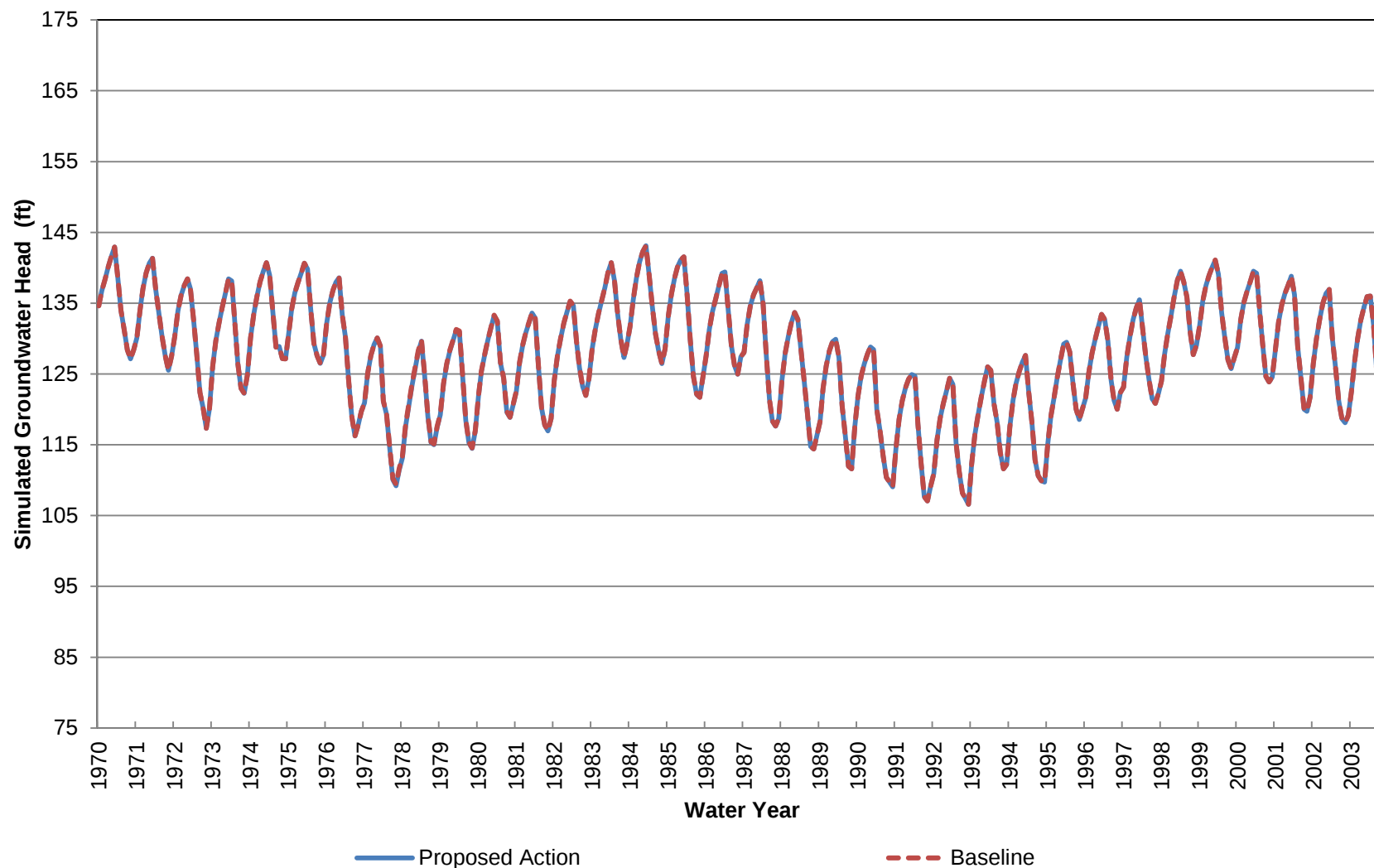
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 210-350 ft bgs)**



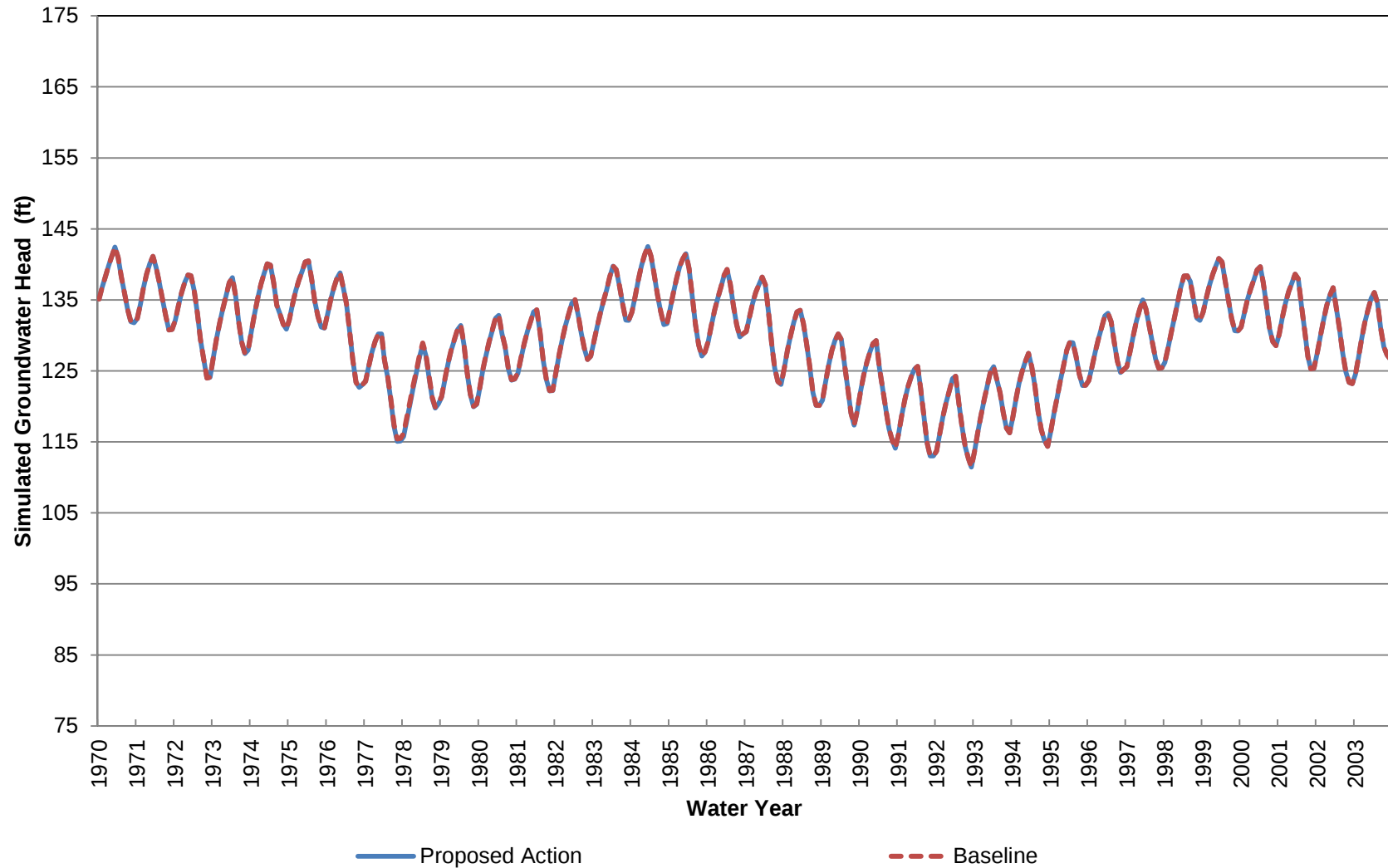
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 350-480 ft bgs)**



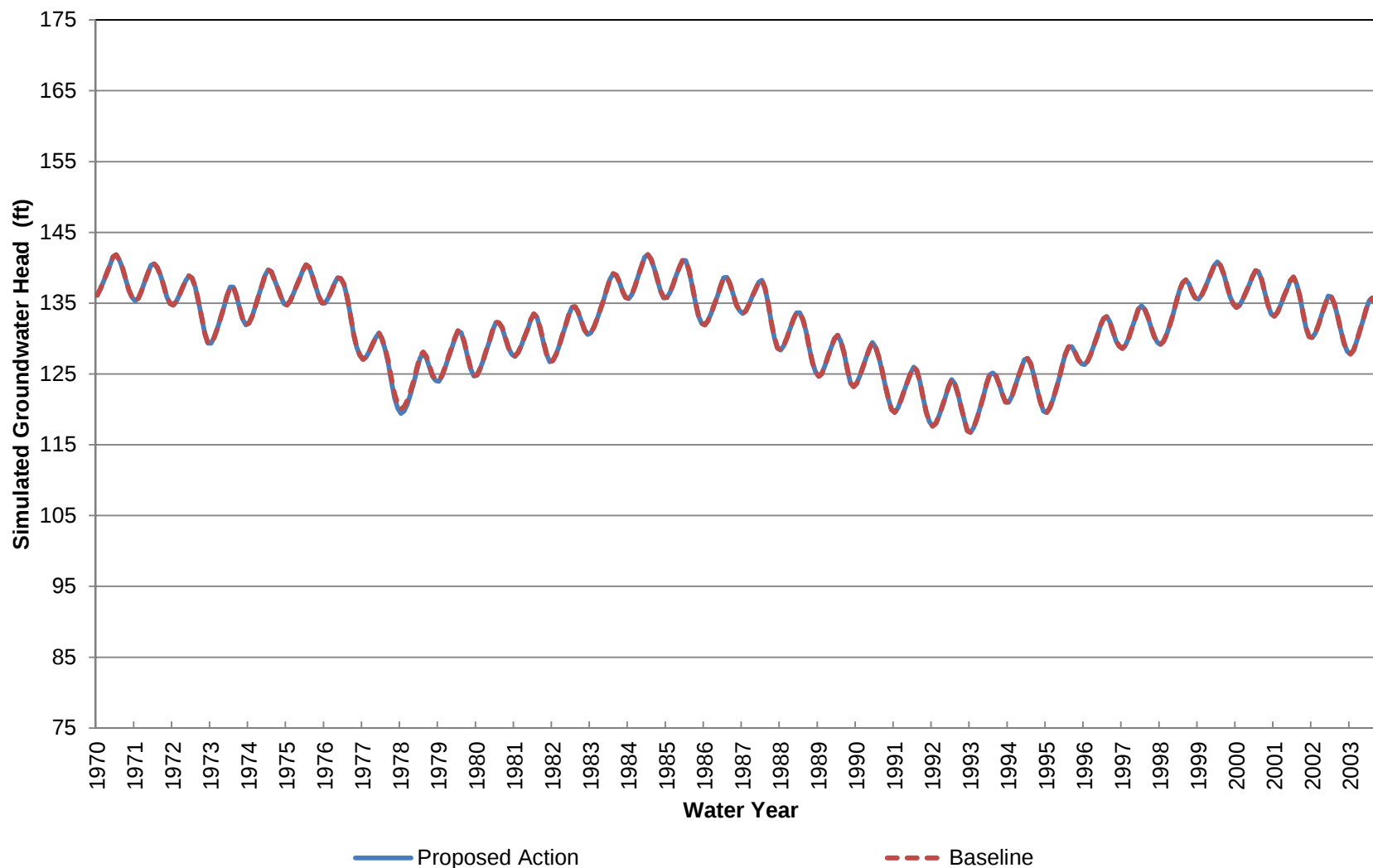
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 480-700 ft bgs)**



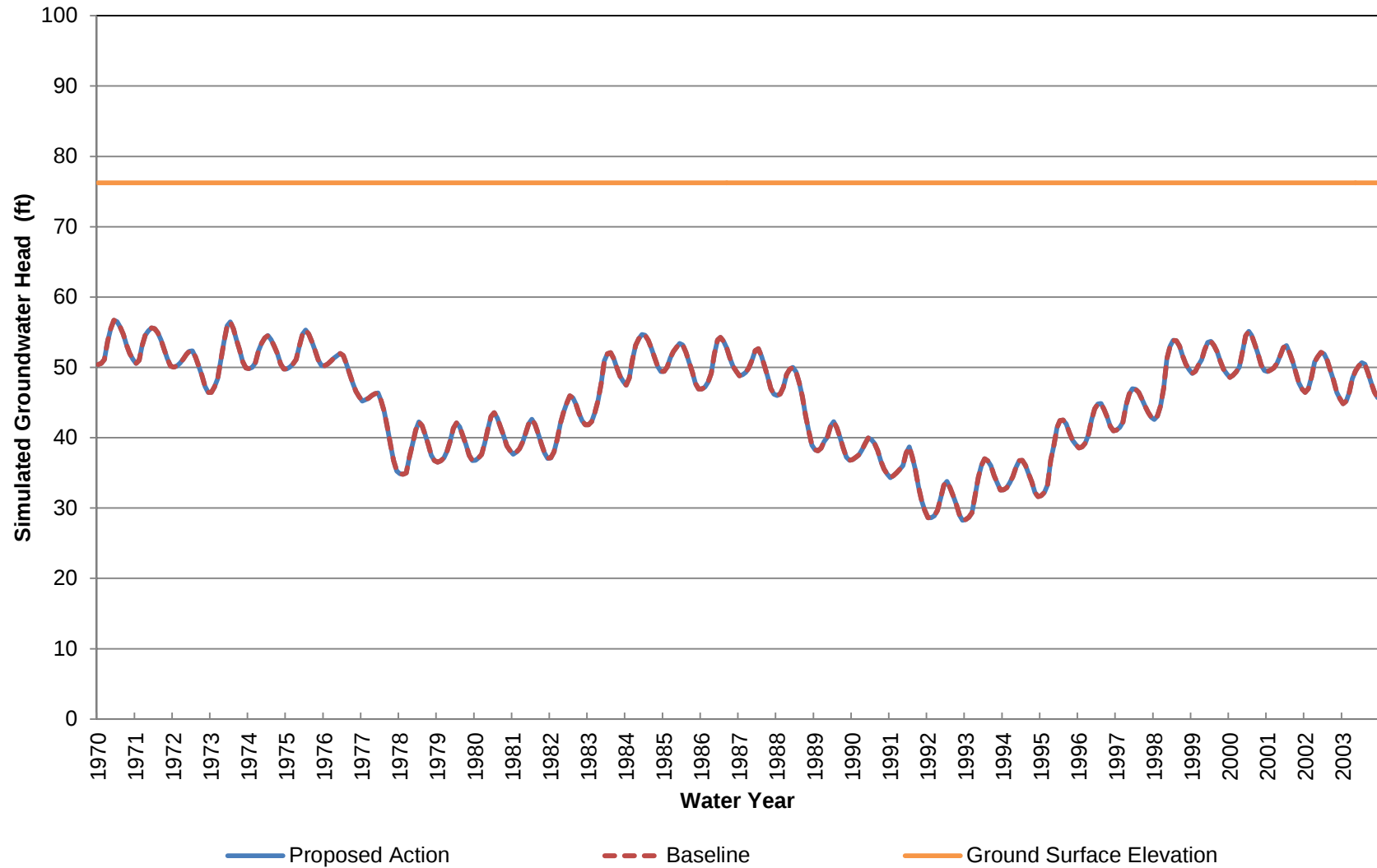
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 700-930 ft bgs)**



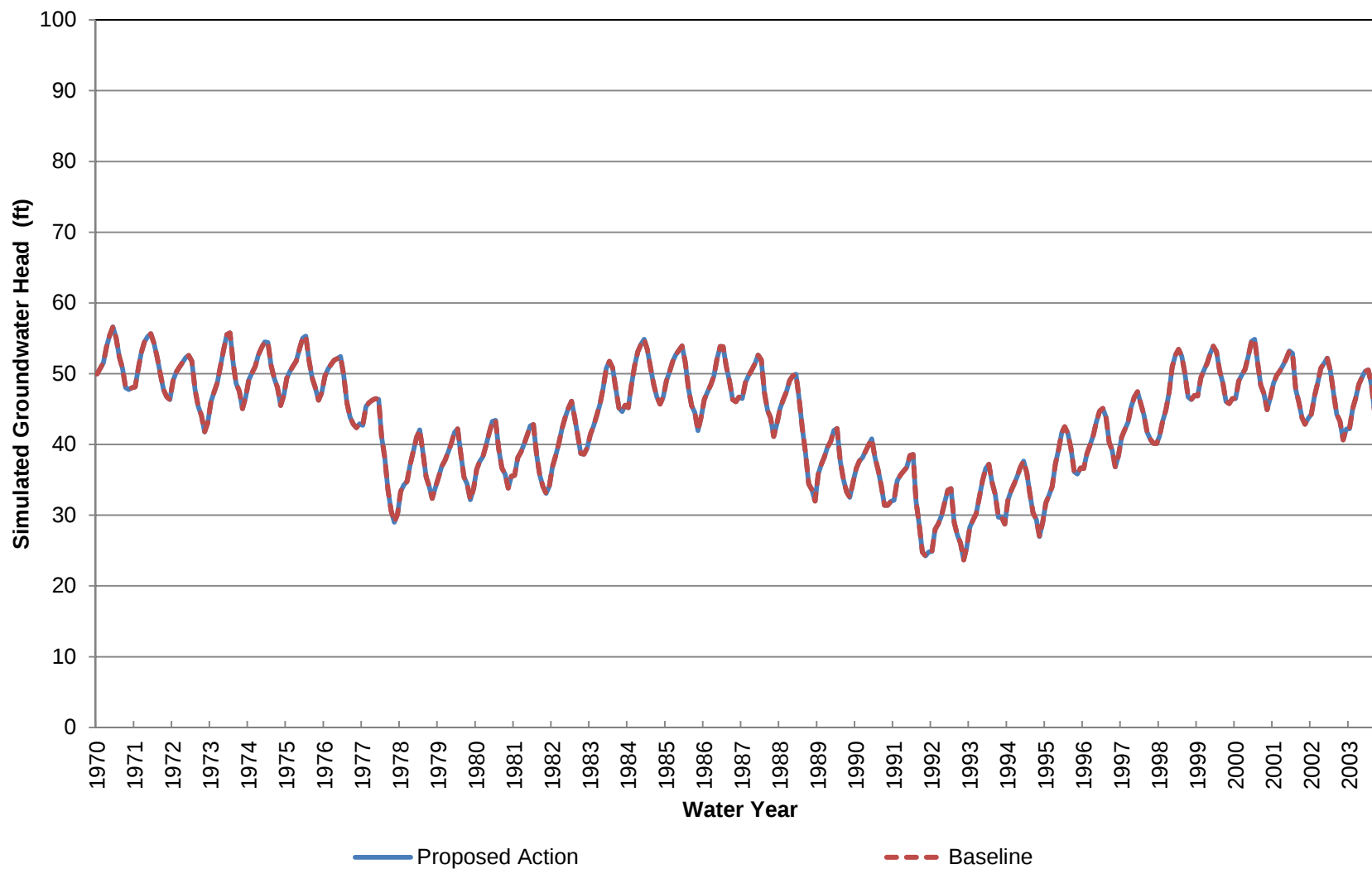
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 3 (Approximately 930-1290 ft bgs)**



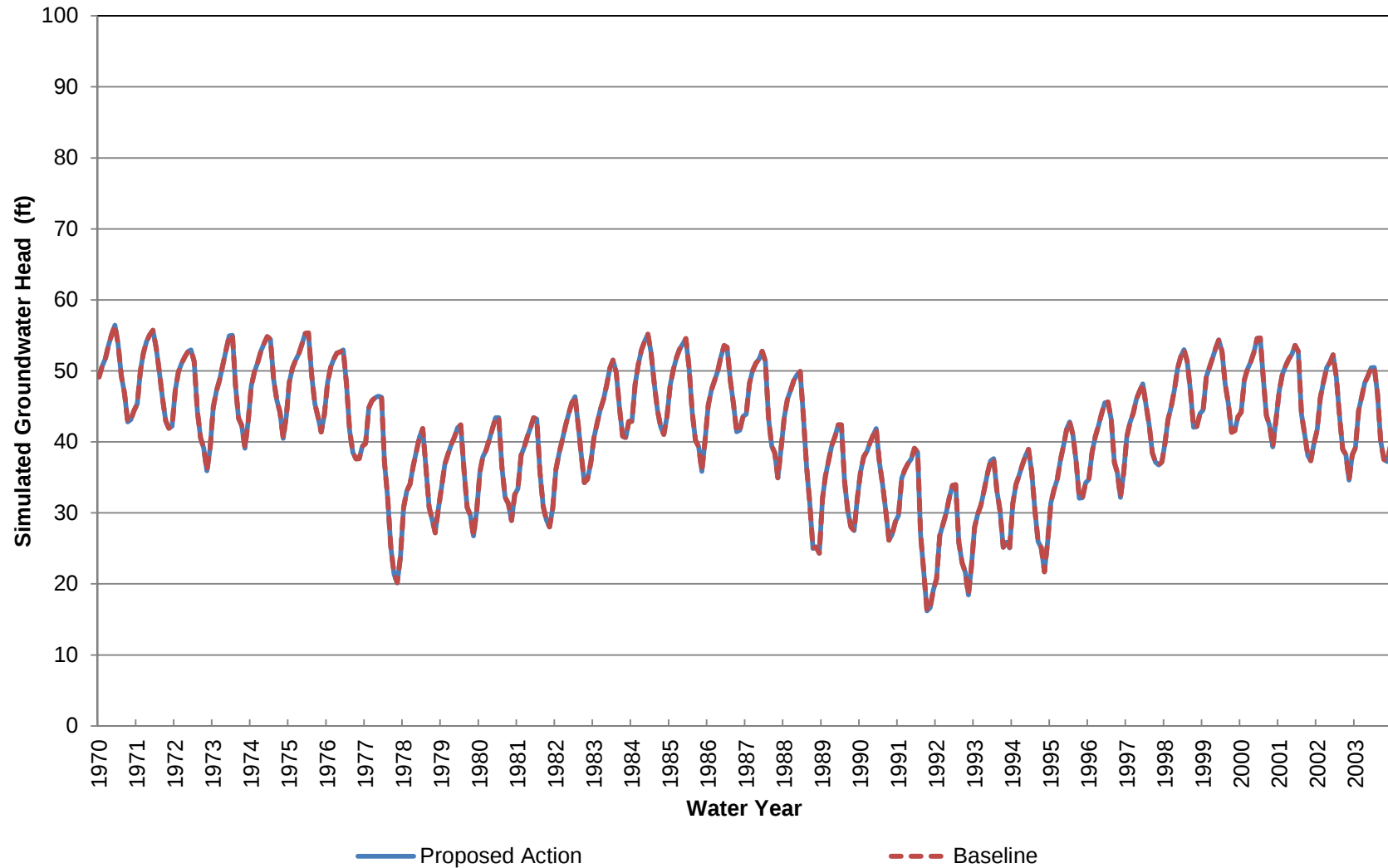
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 4 (Approximately 0-70 ft bgs)**



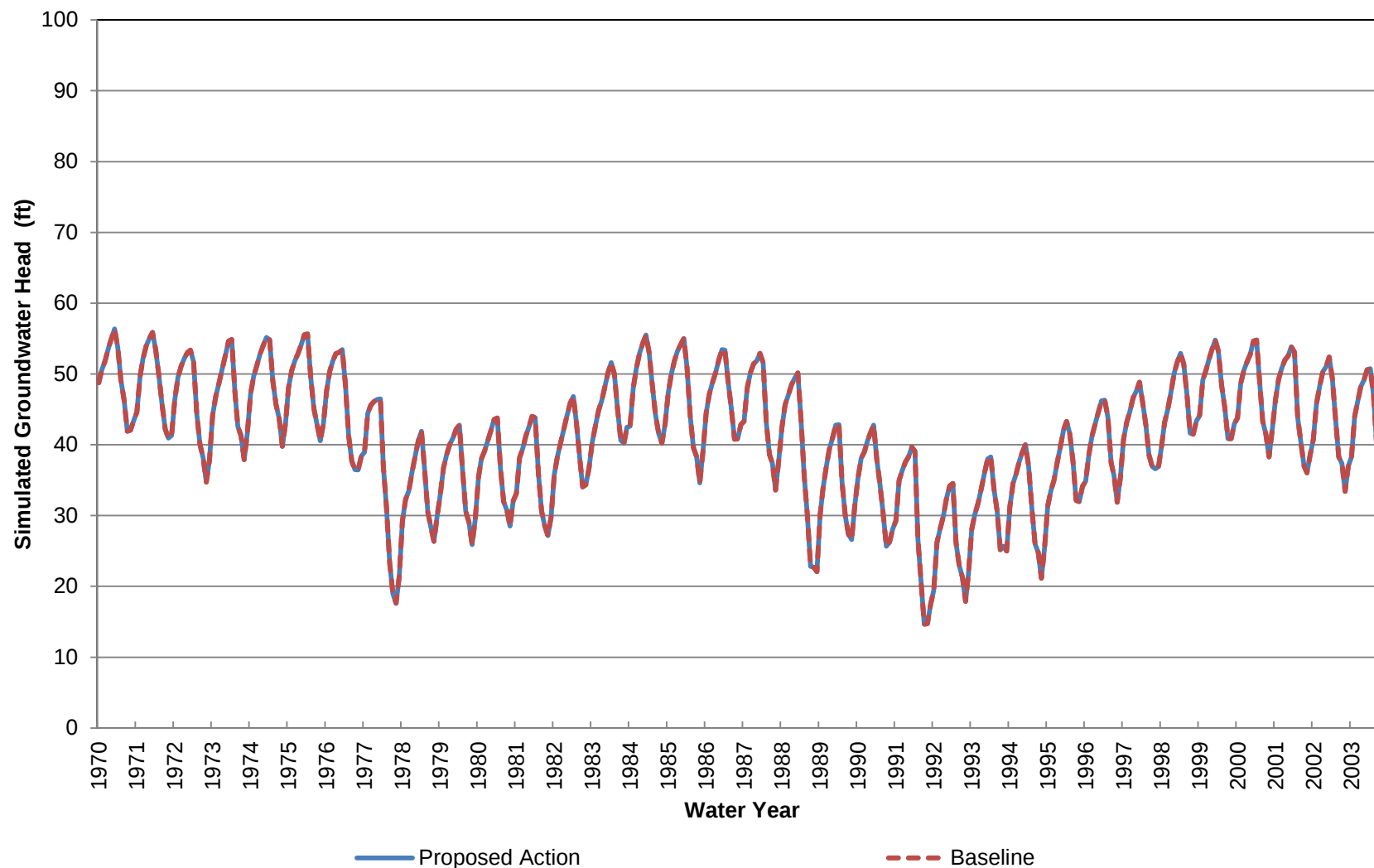
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 70-190 ft bgs)**



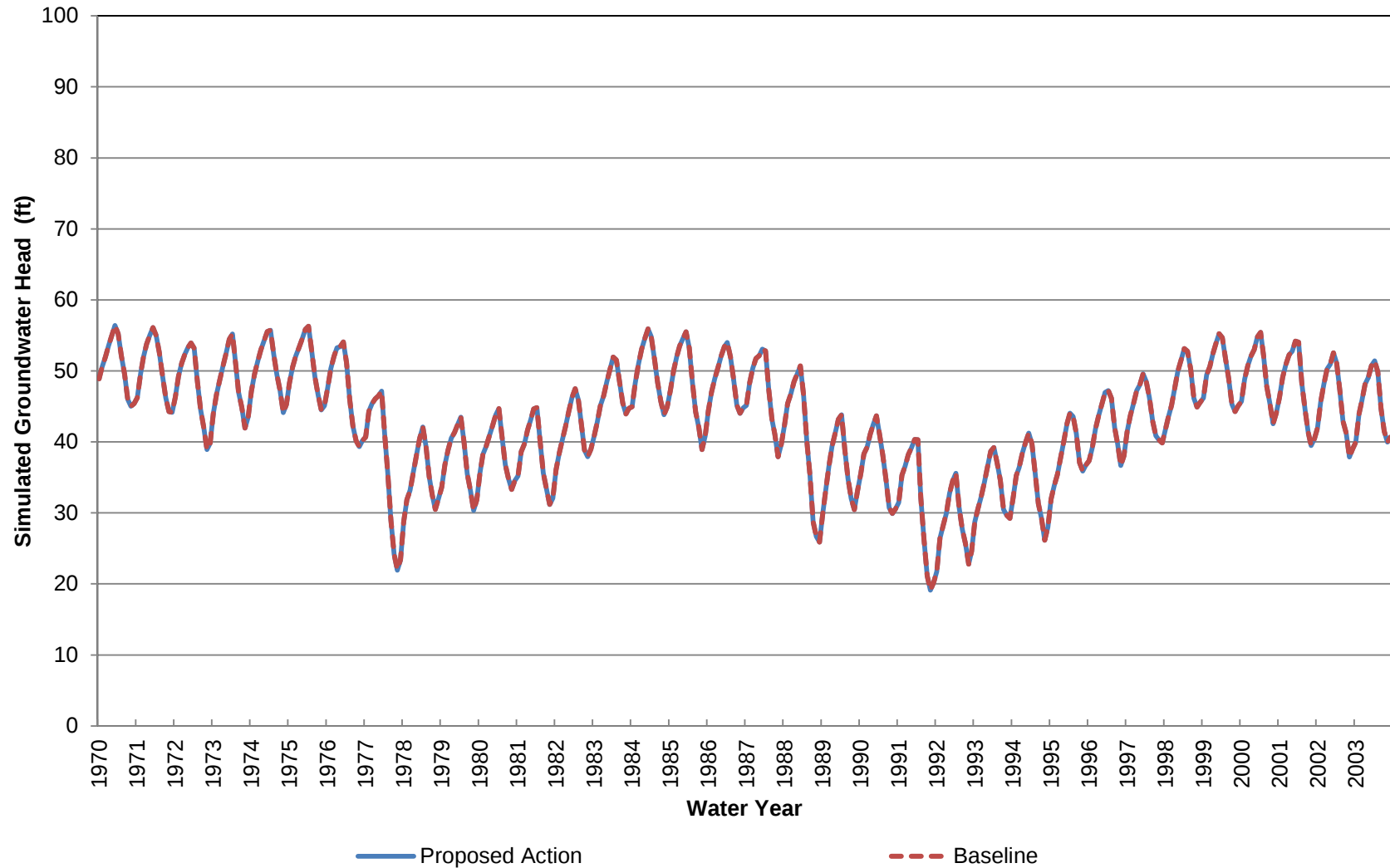
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 190-300 ft bgs)**



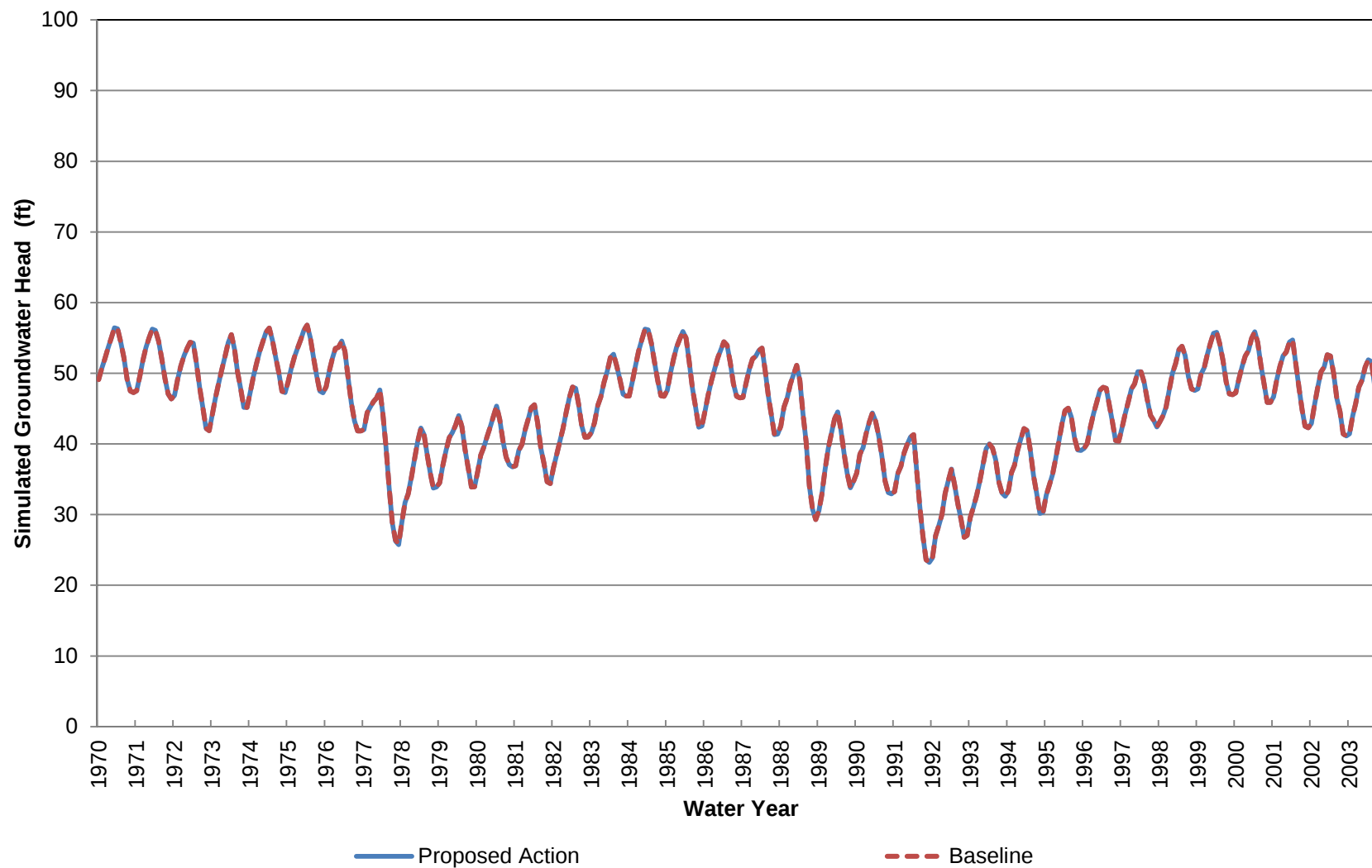
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 300-420 ft bgs)**



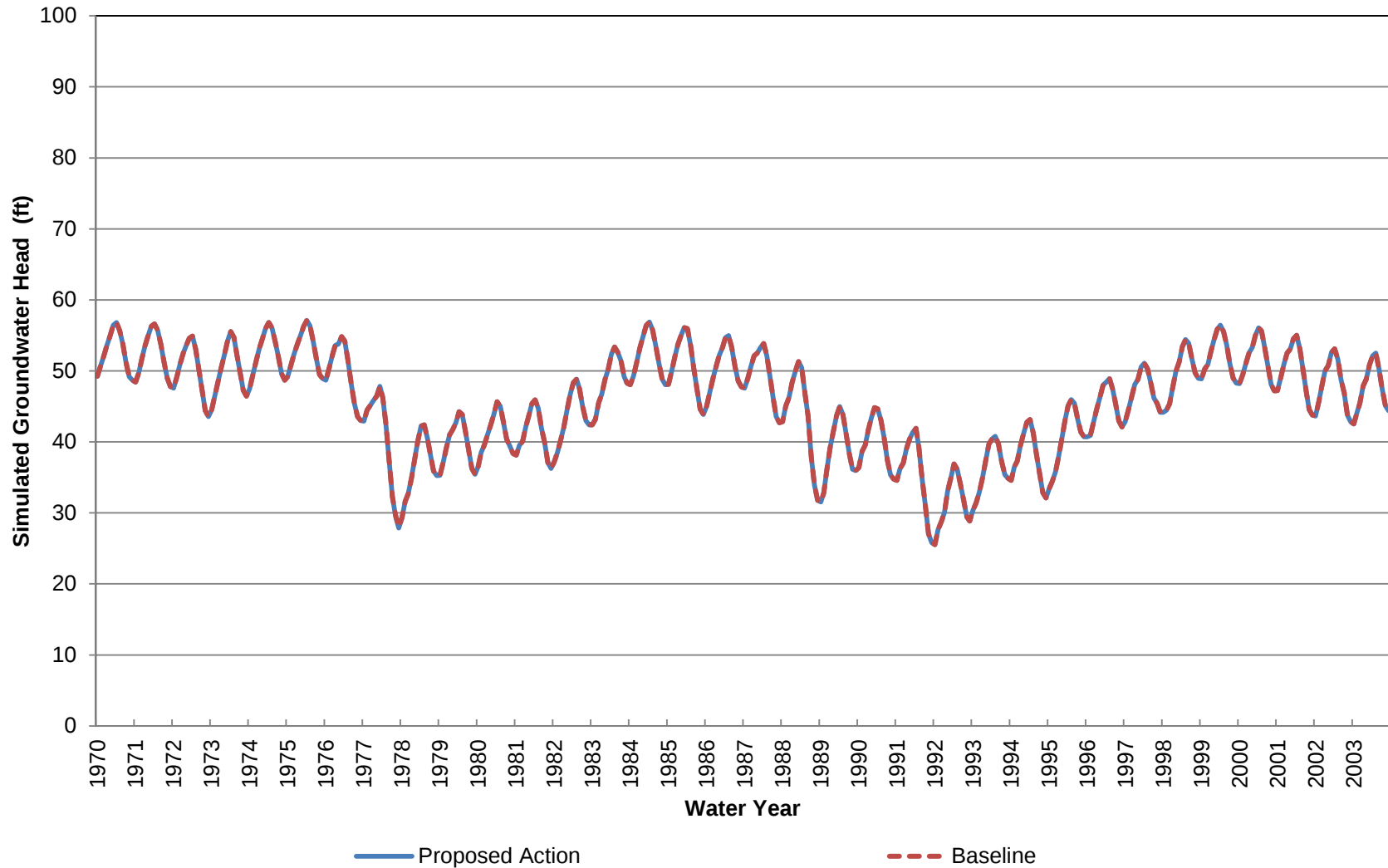
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 420-580 ft bgs)**



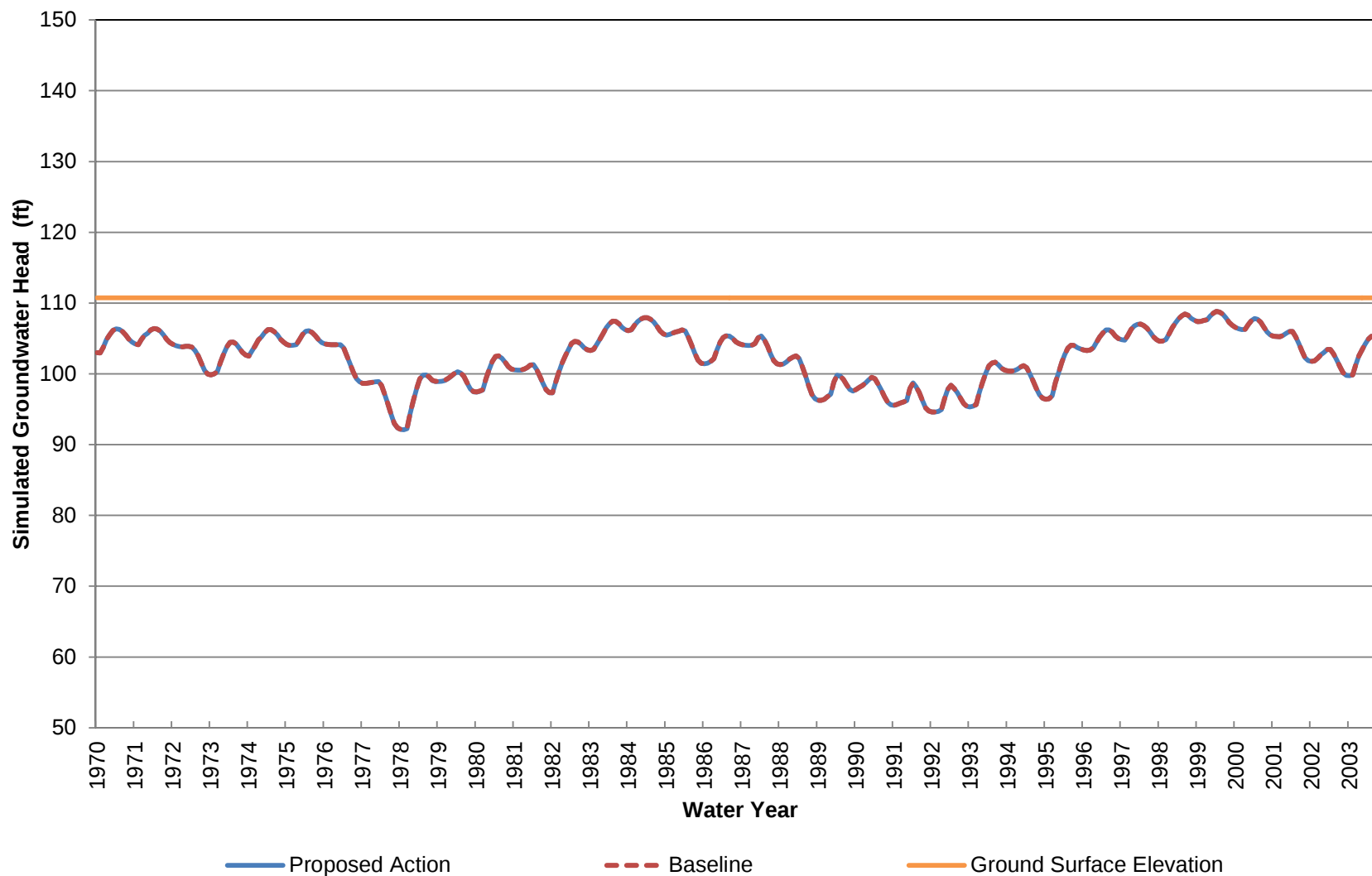
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 580-780 ft bgs)**



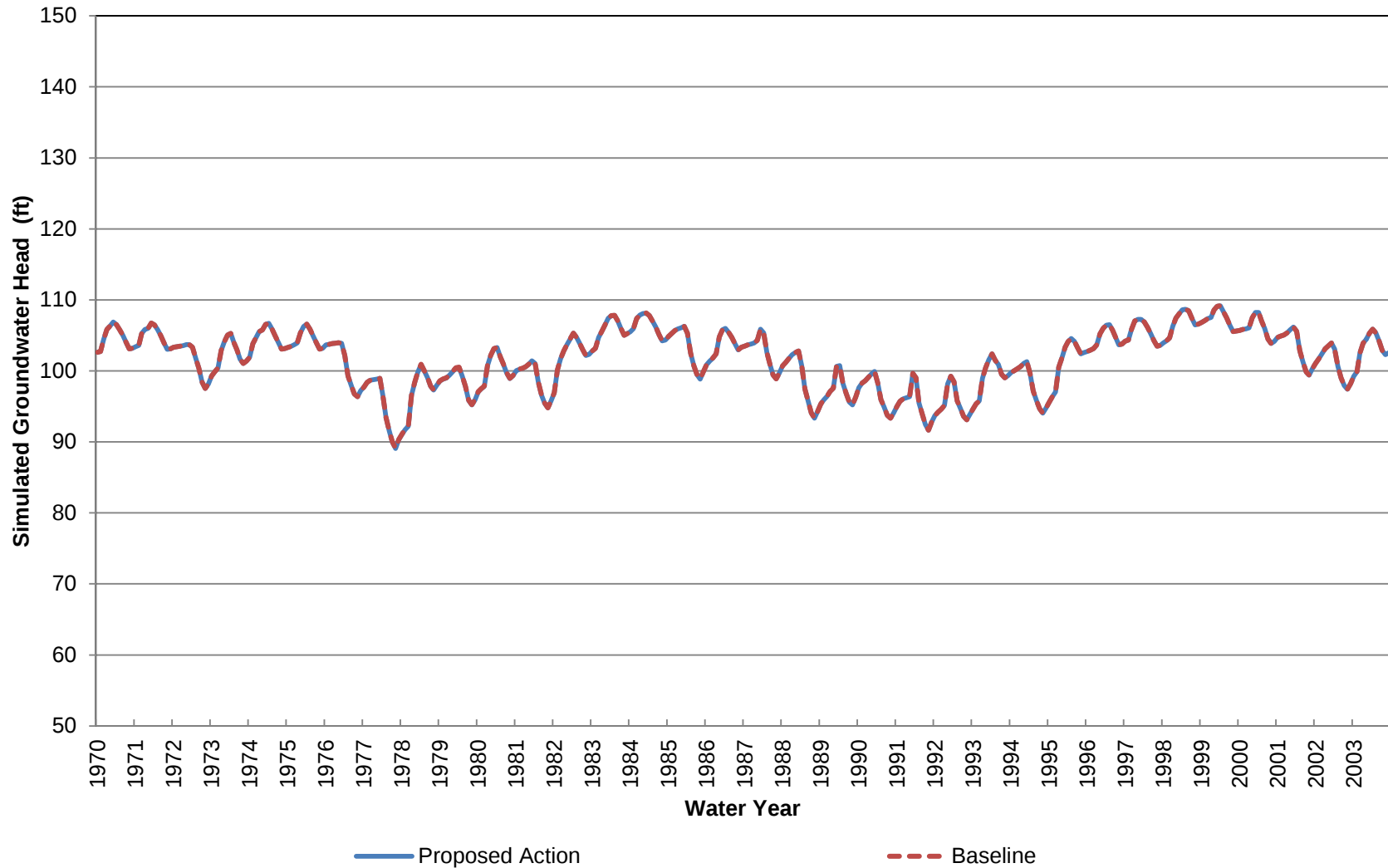
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 4 (Approximately 780-1060 ft bgs)**



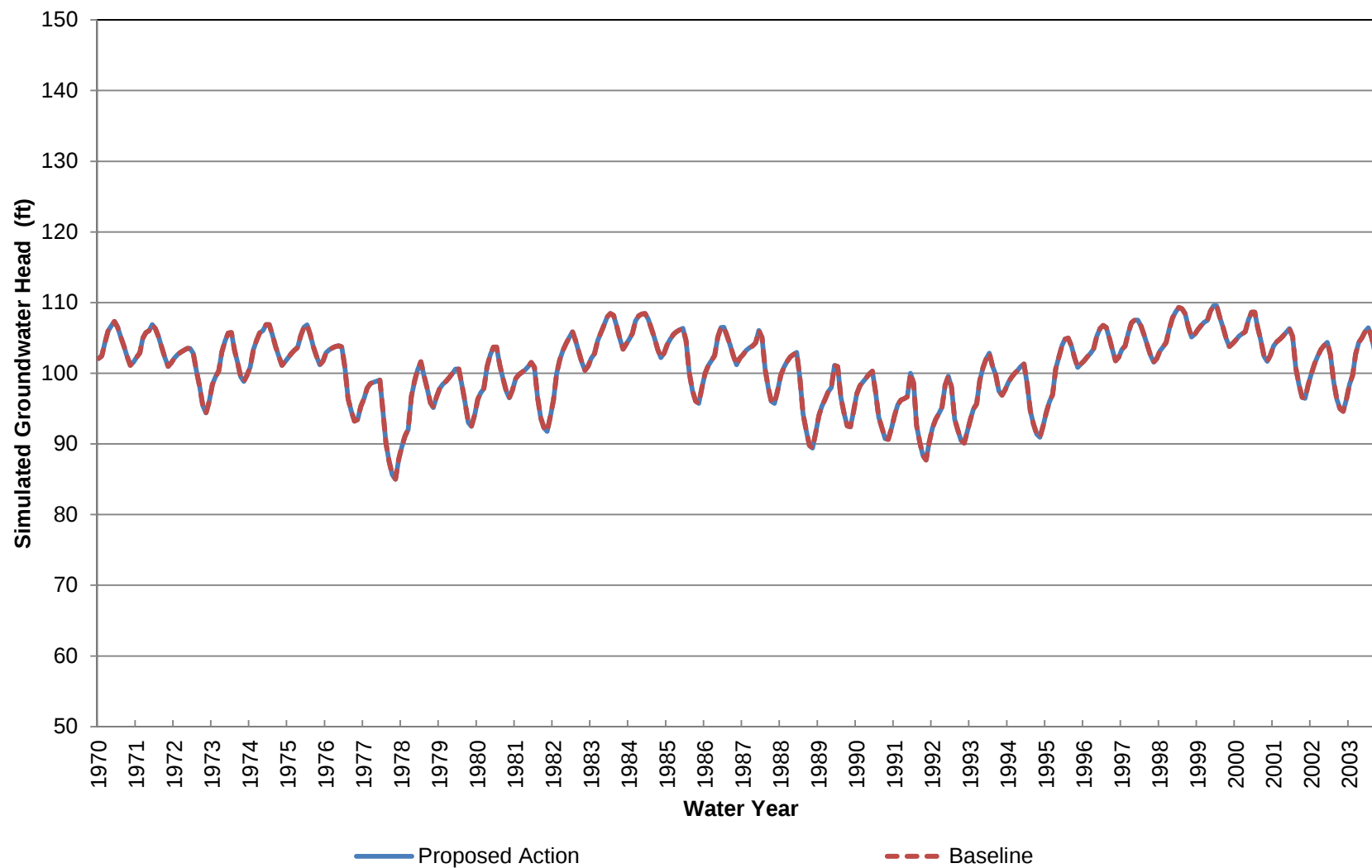
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 5 (Approximately 0-70 ft bgs)**



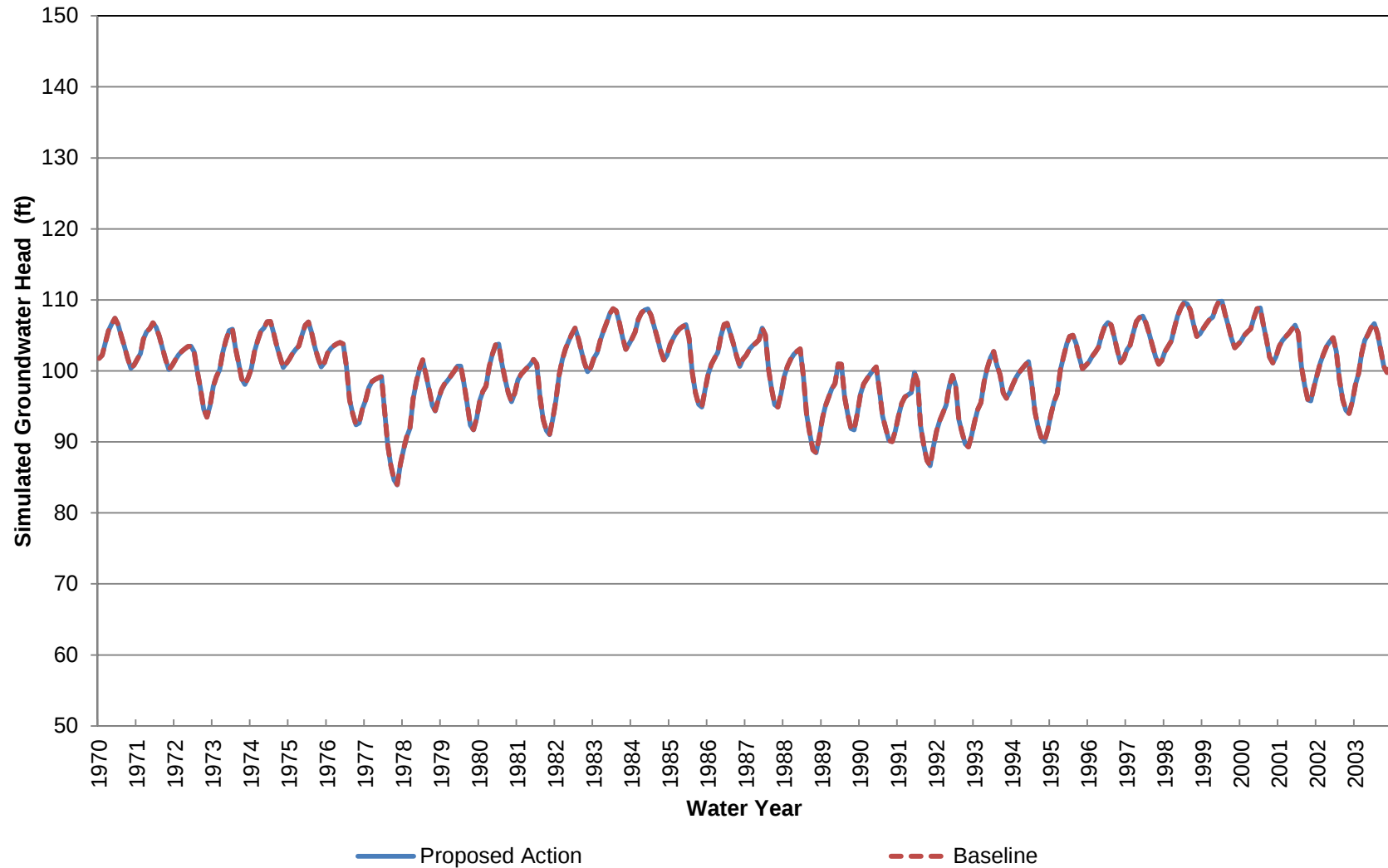
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 70-200 ft bgs)**



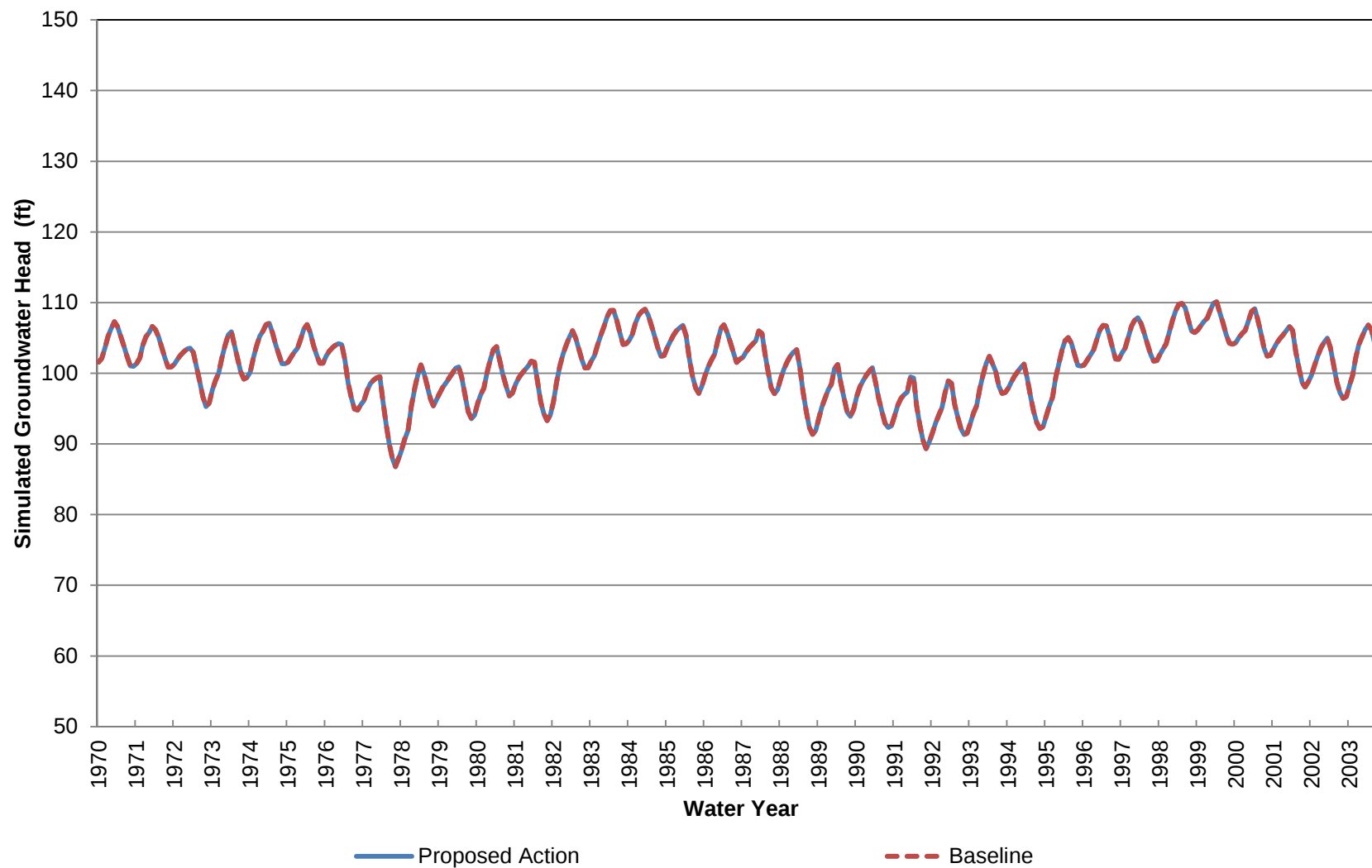
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 200-340 ft bgs)**



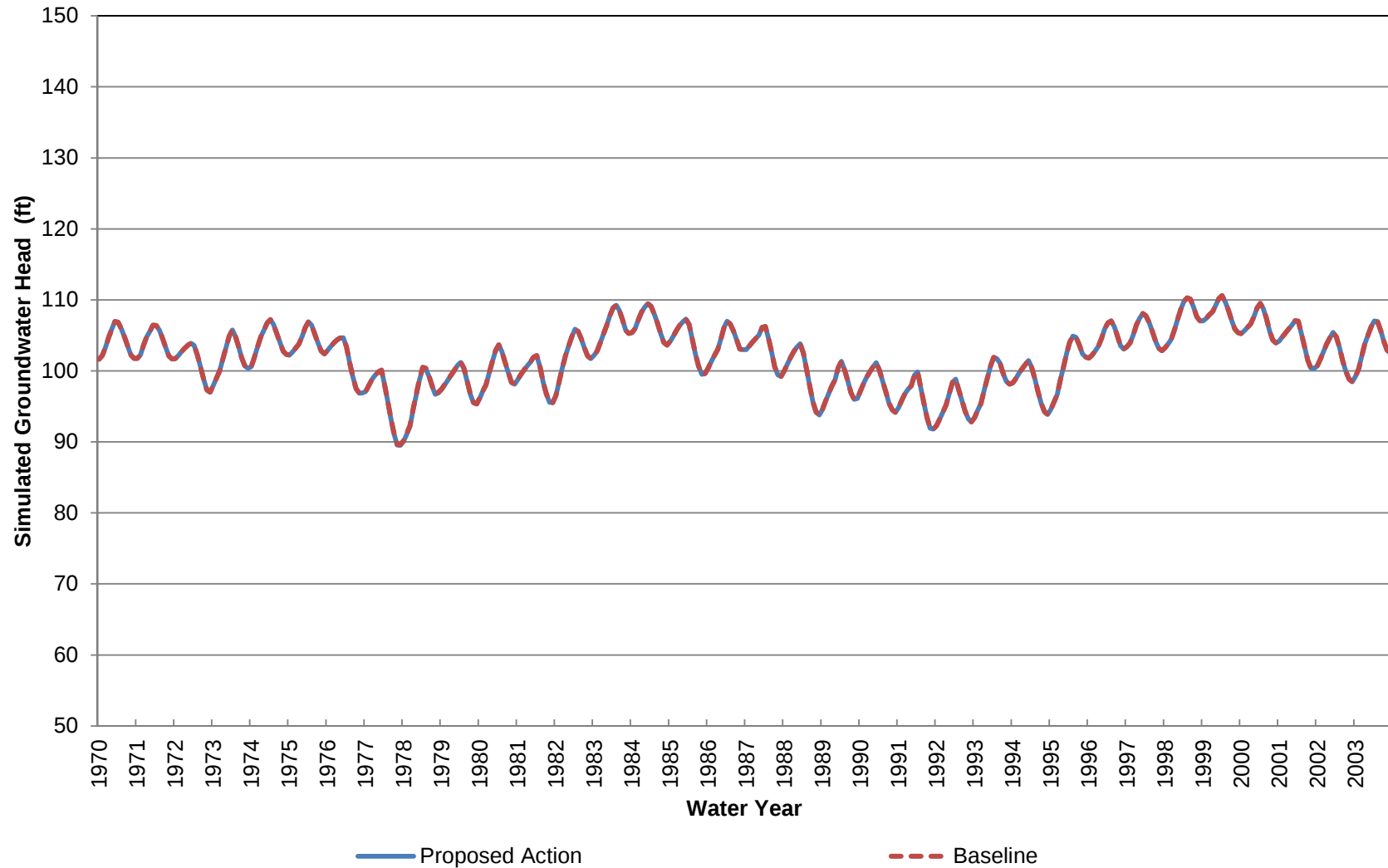
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 340-470 ft bgs)**



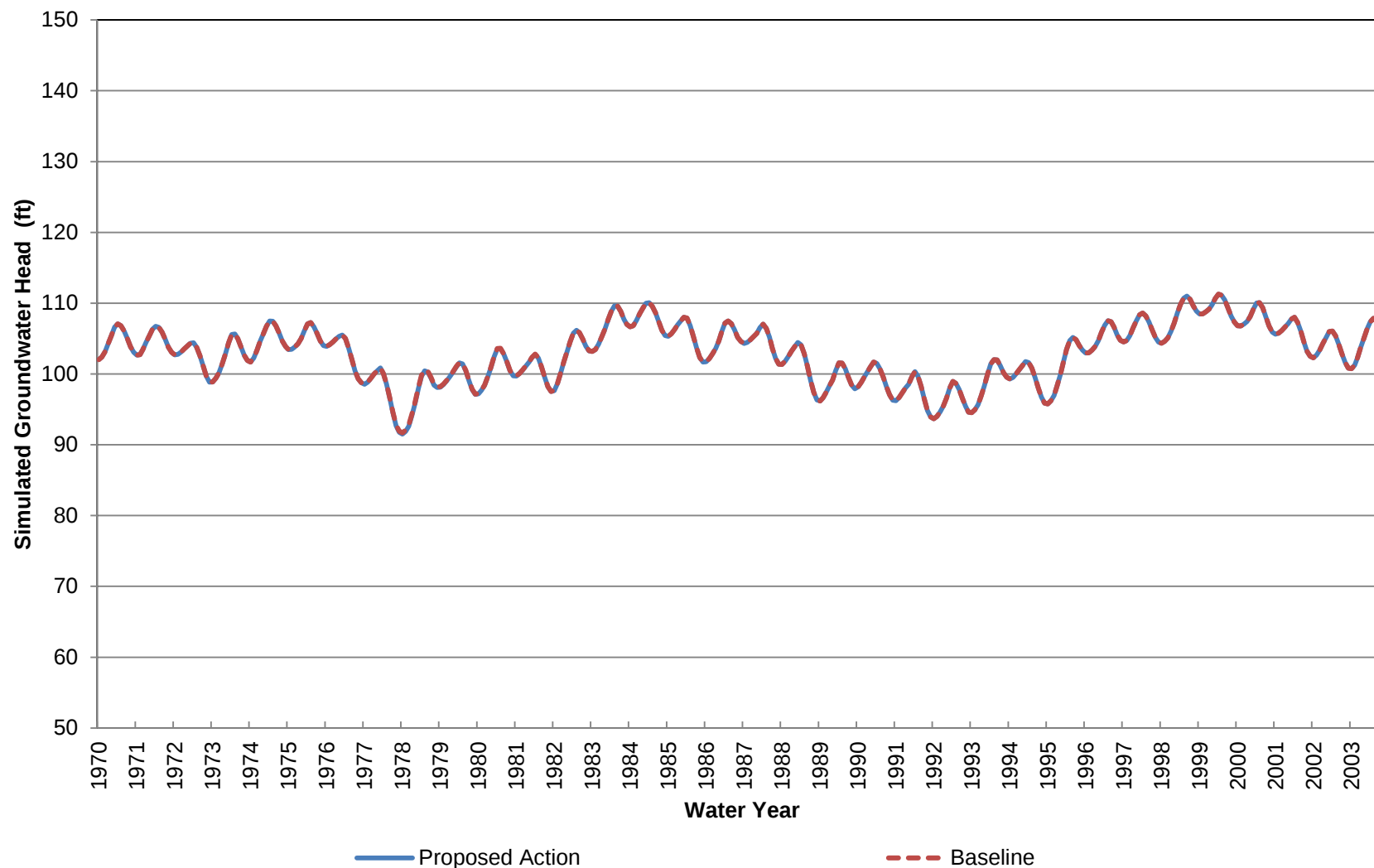
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 470-670 ft bgs)**



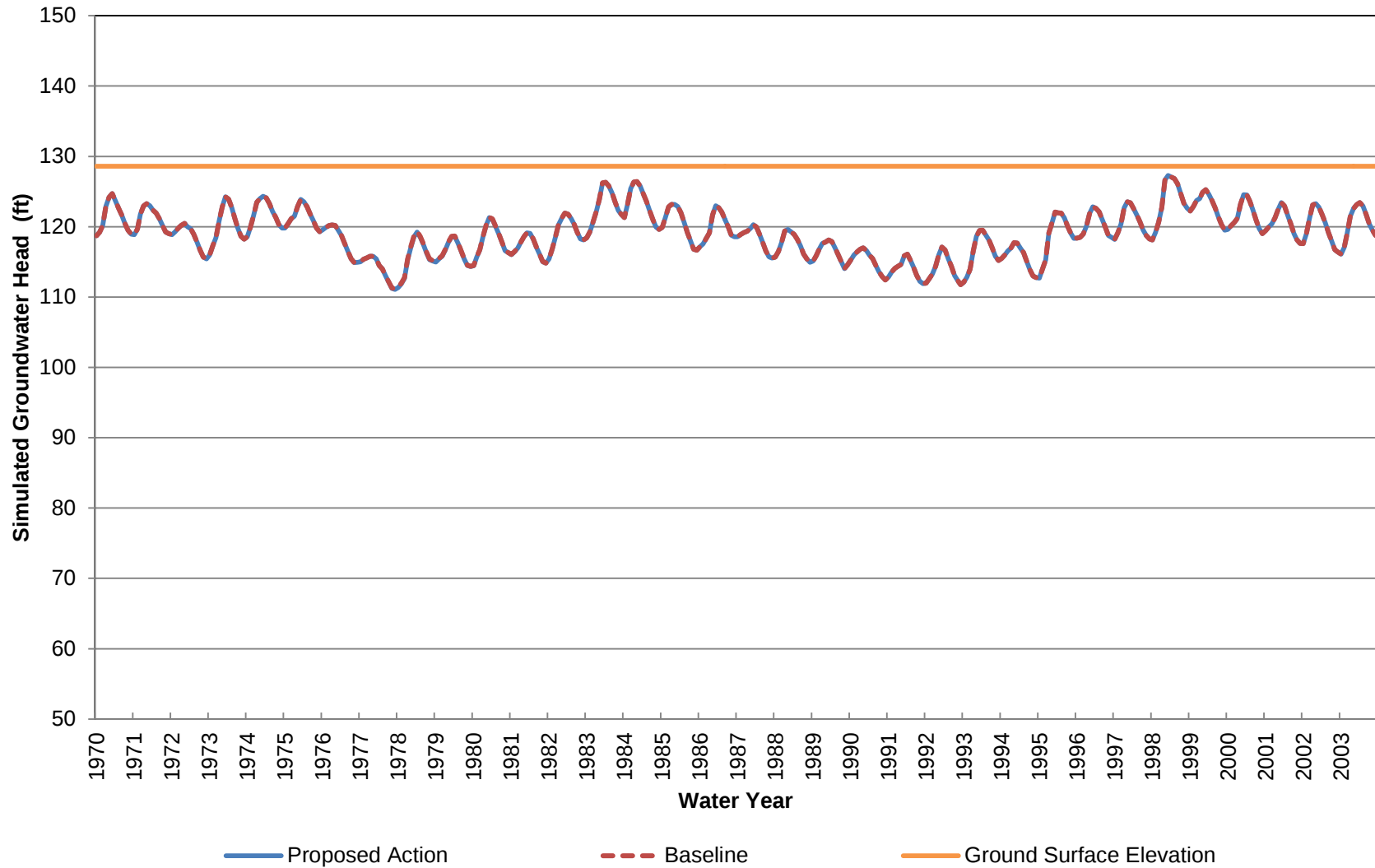
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 670-910 ft bgs)**



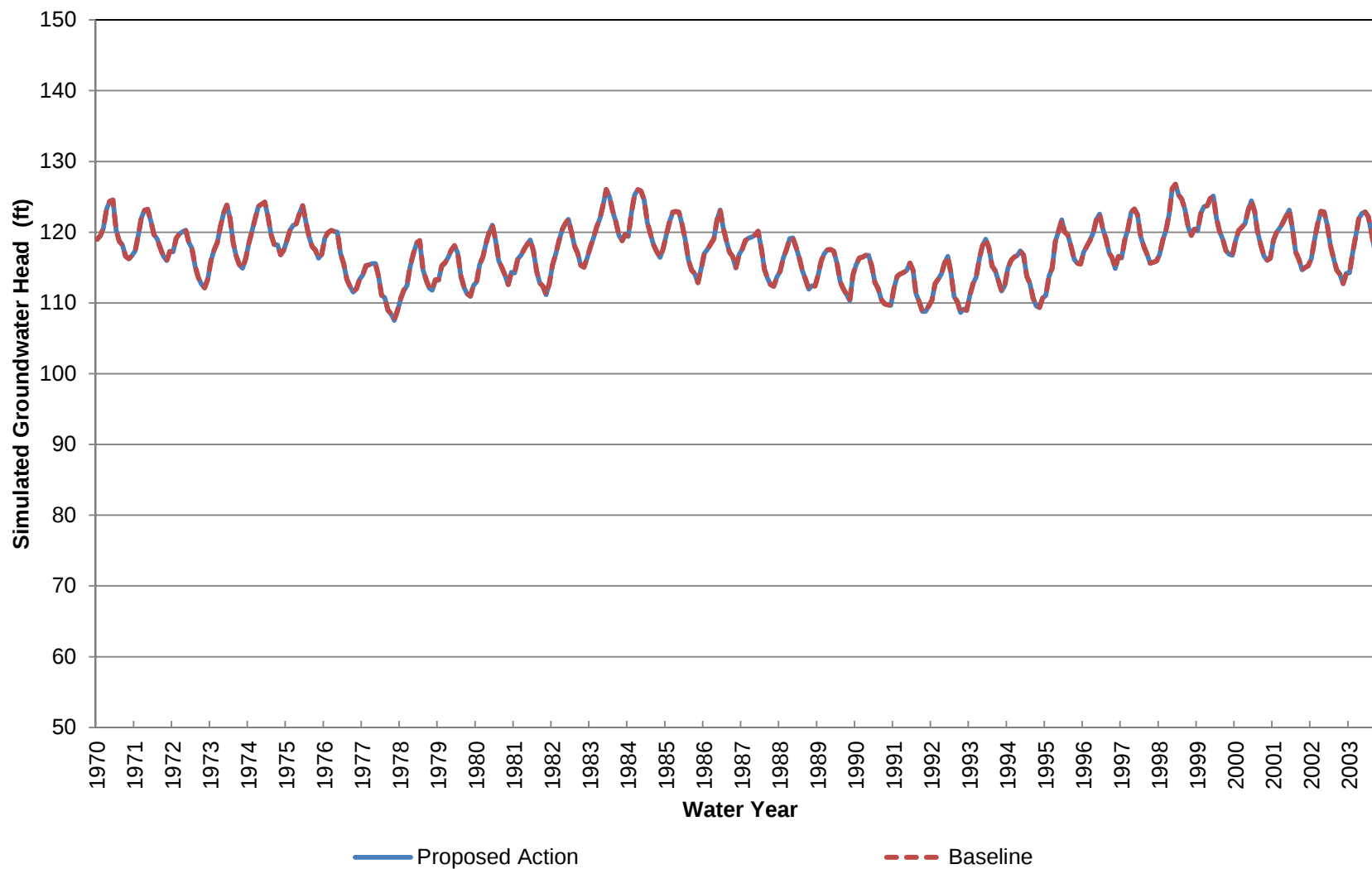
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 5 (Approximately 910-1310 ft bgs)**



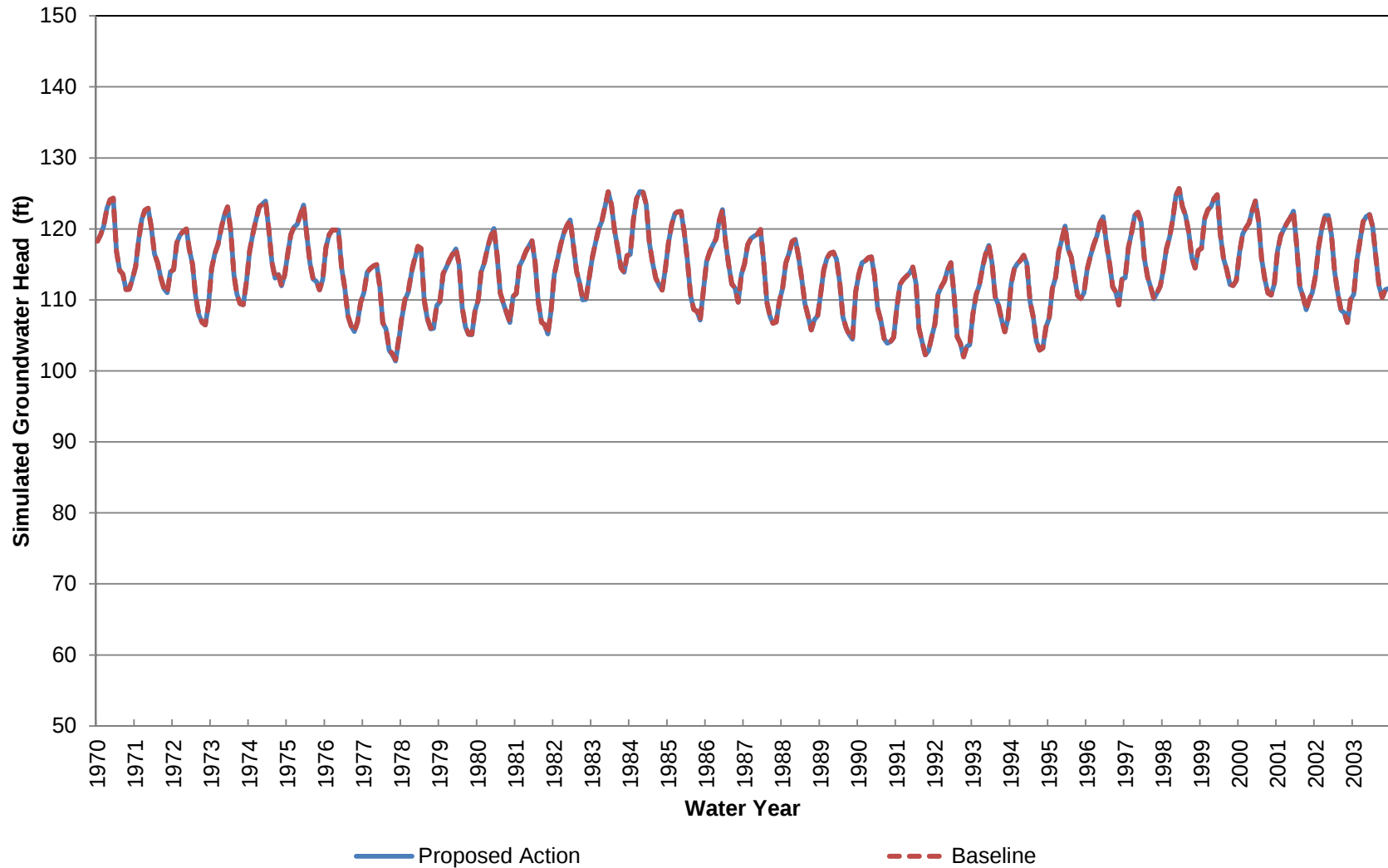
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 6 (Approximately 0-70 ft bgs)**



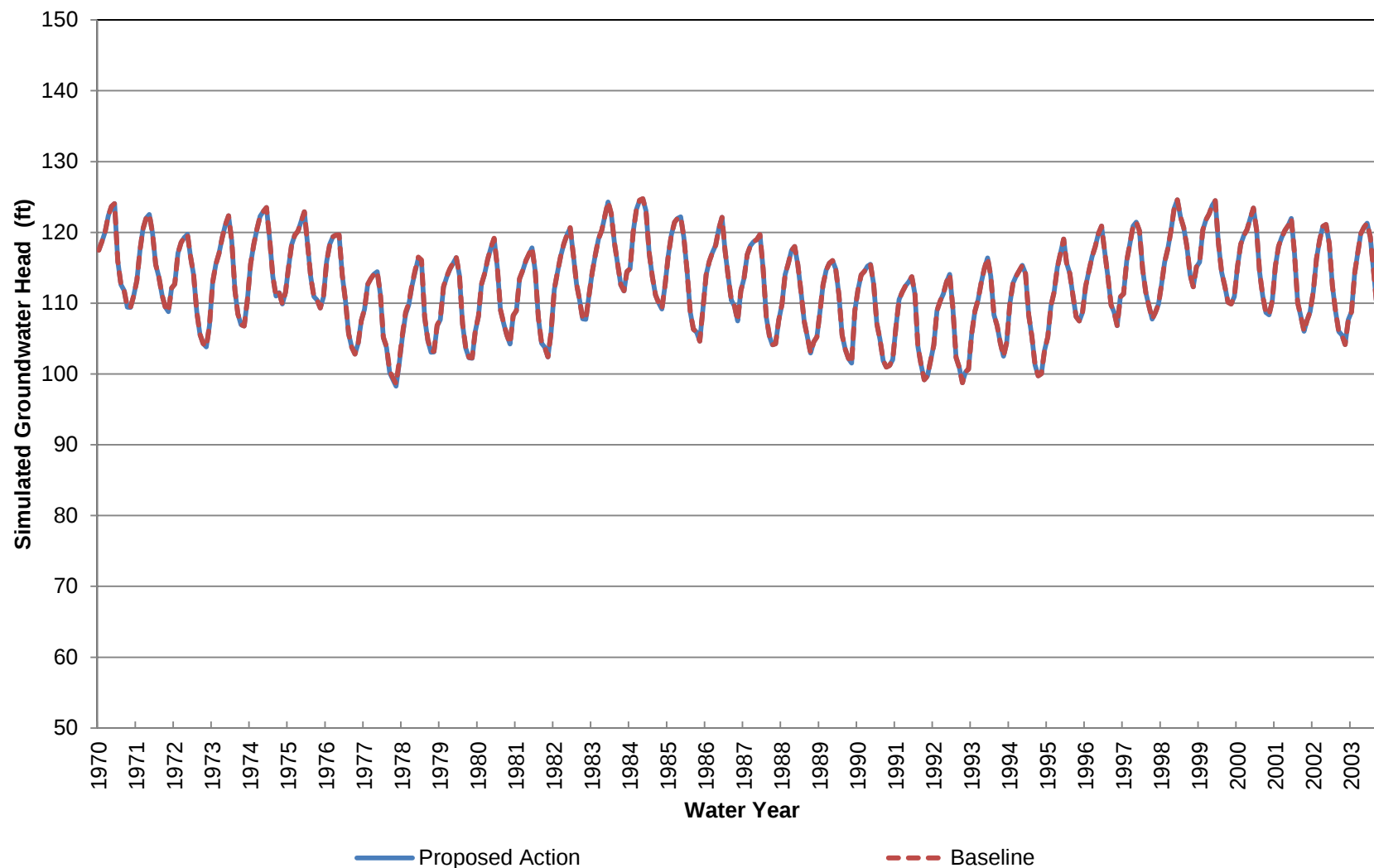
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 70-200 ft bgs)**



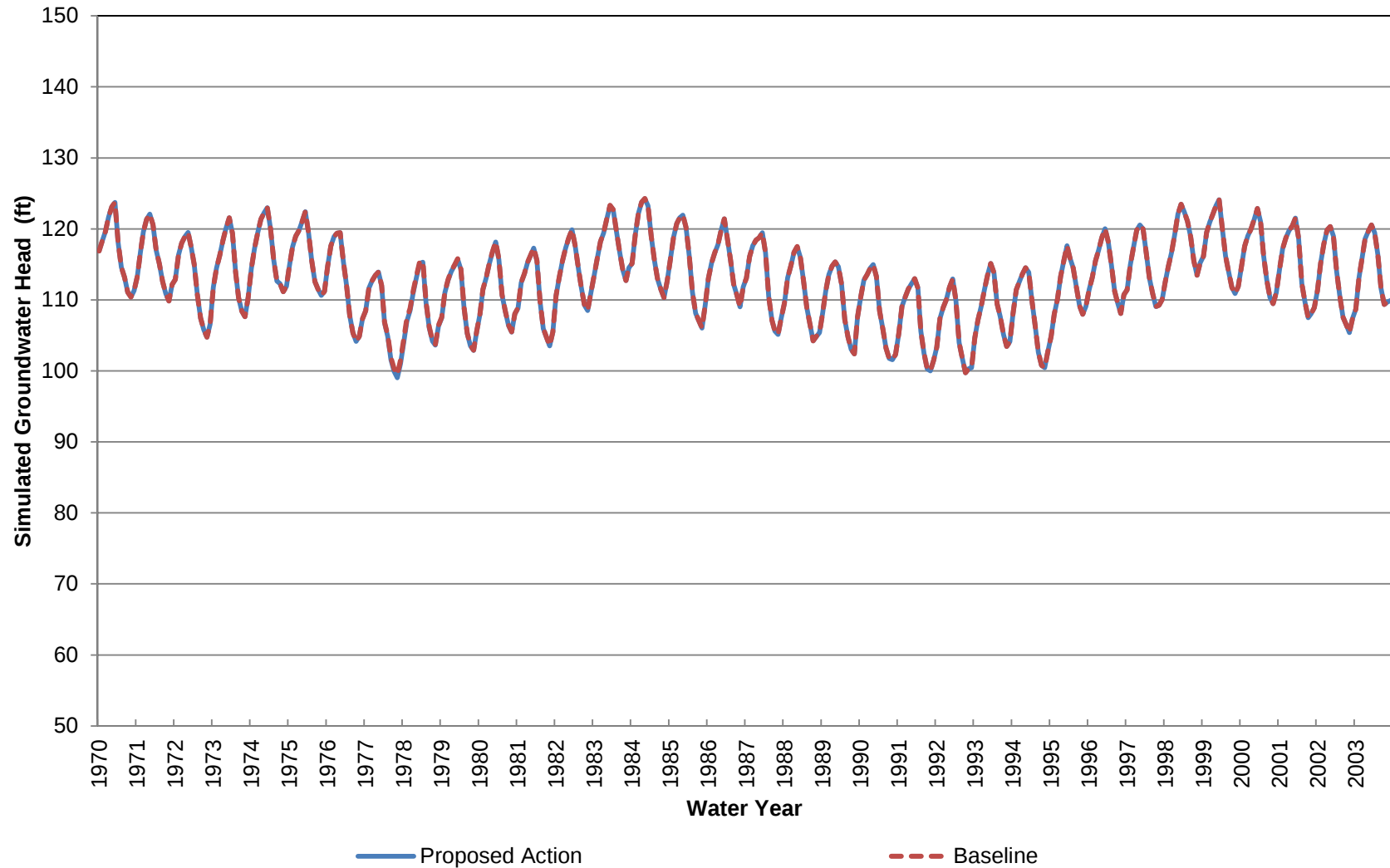
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 200-320 ft bgs)**



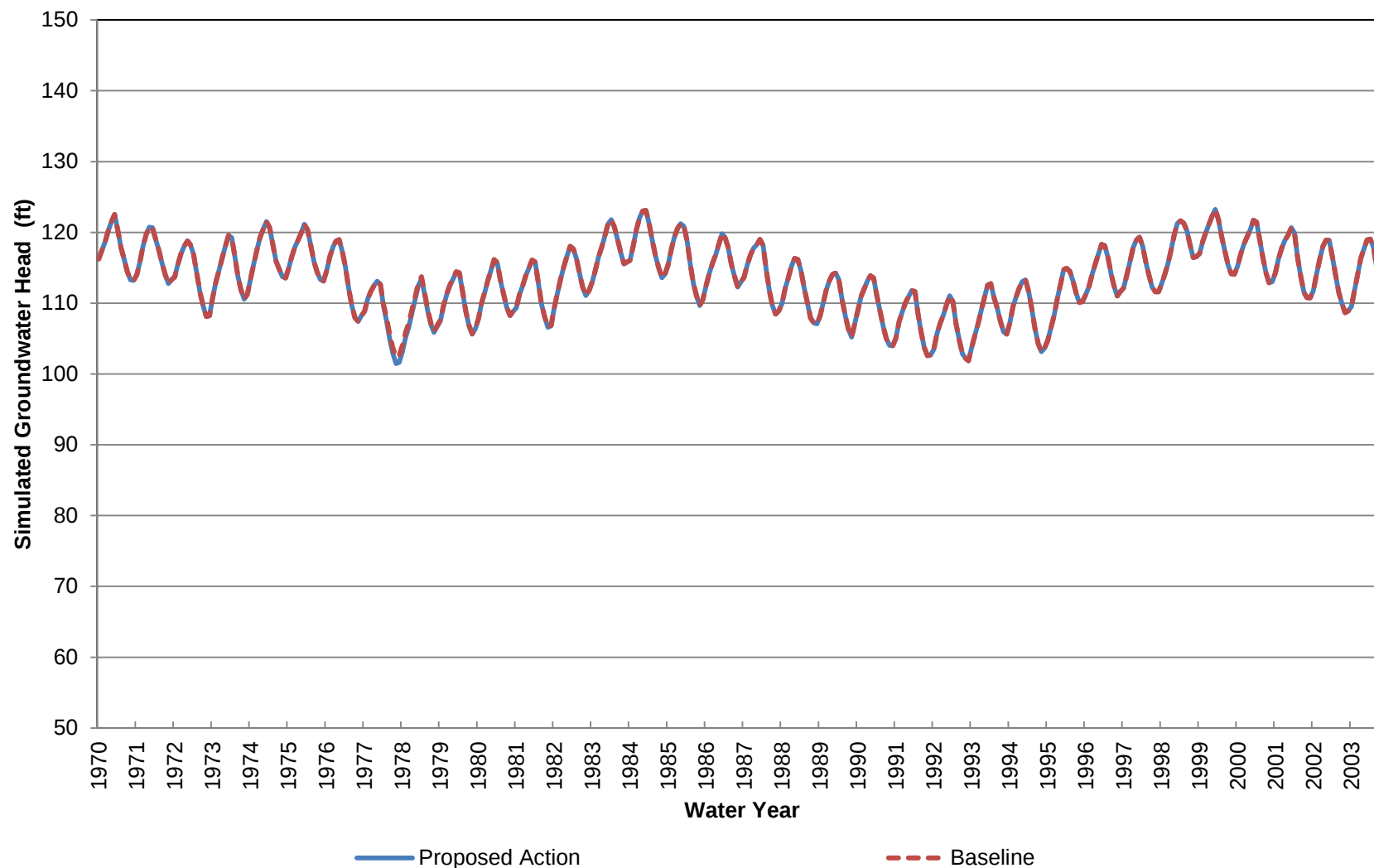
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 320-440 ft bgs)**



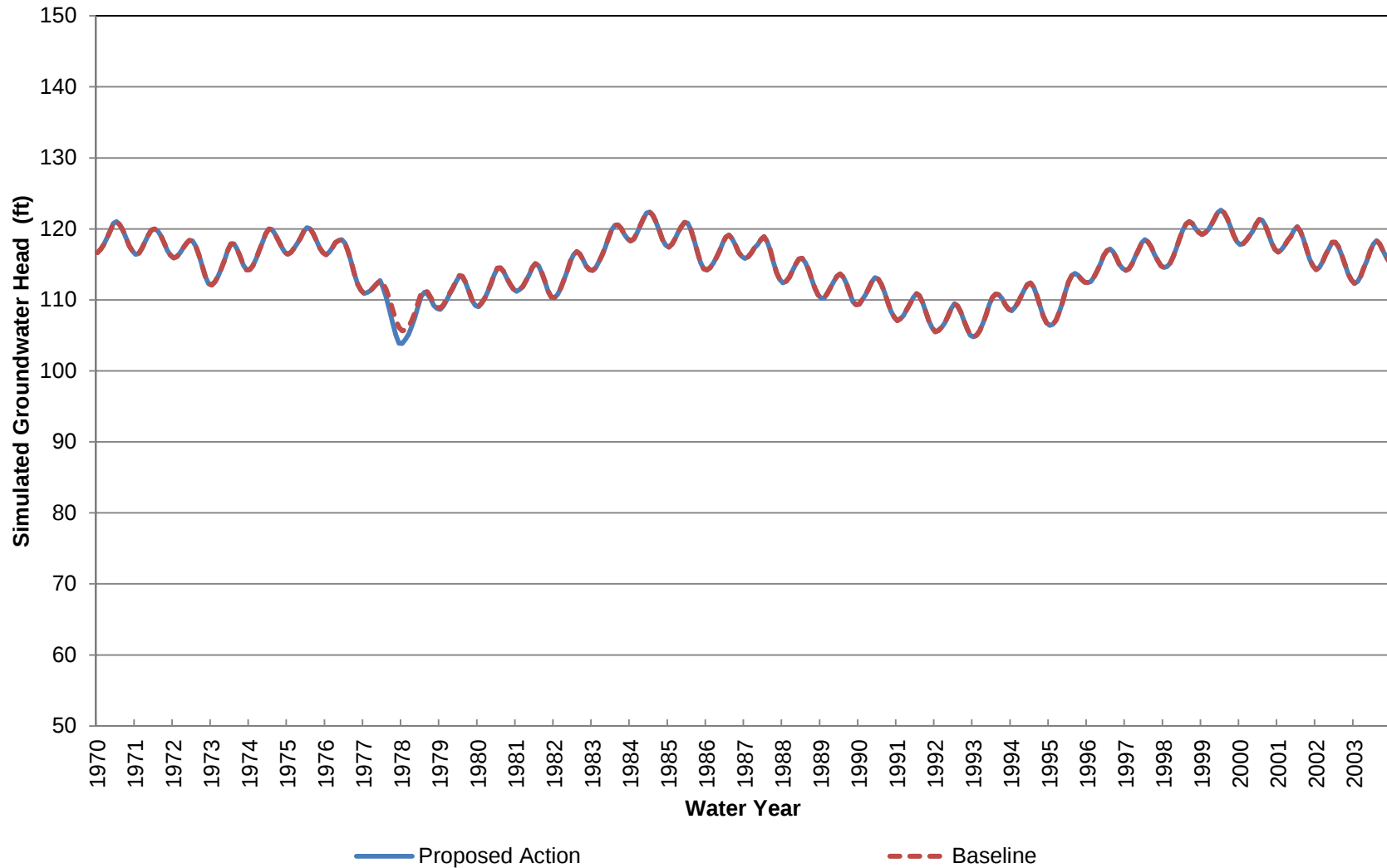
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 440-630 ft bgs)**



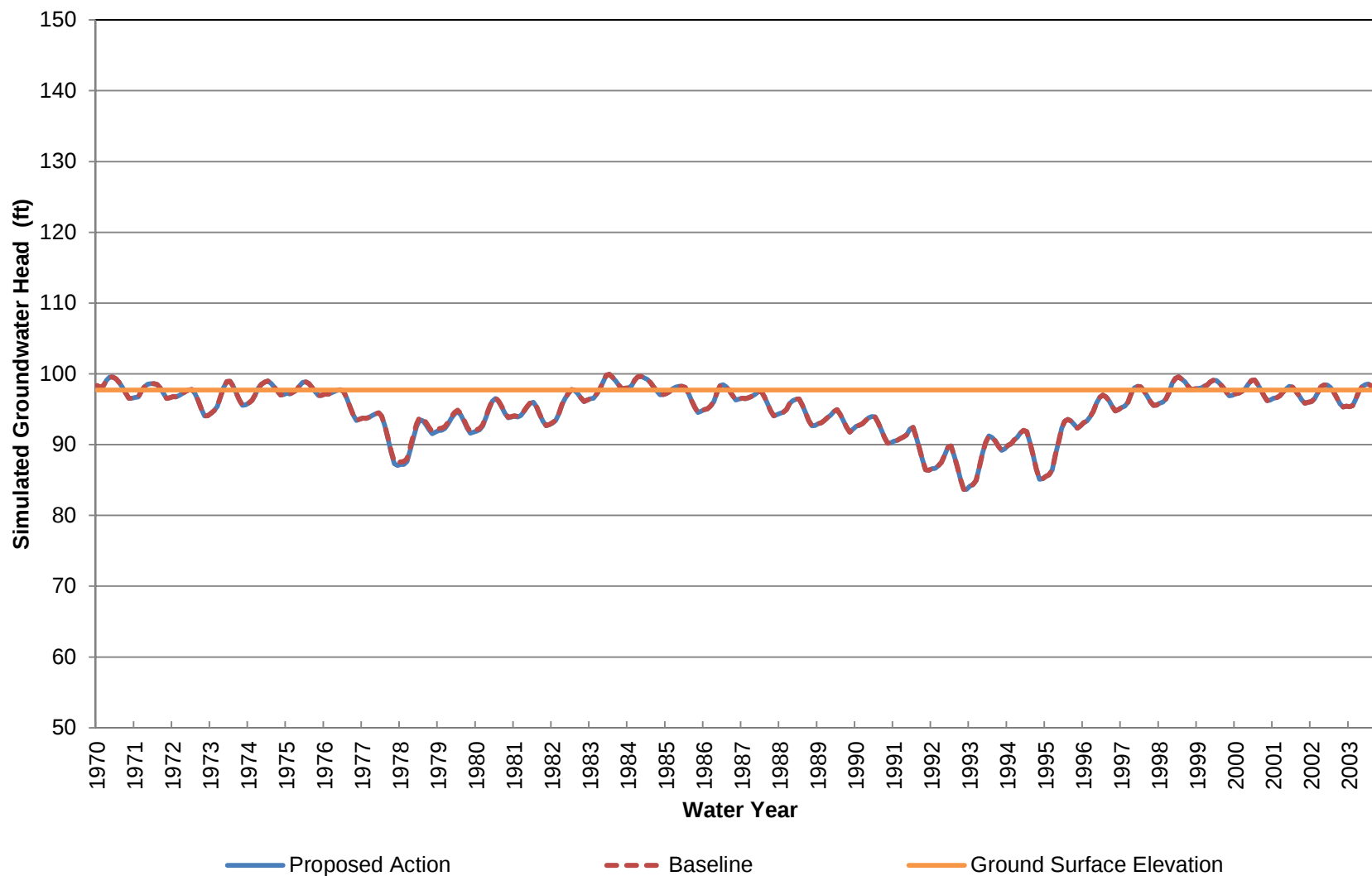
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 630-860 ft bgs)**



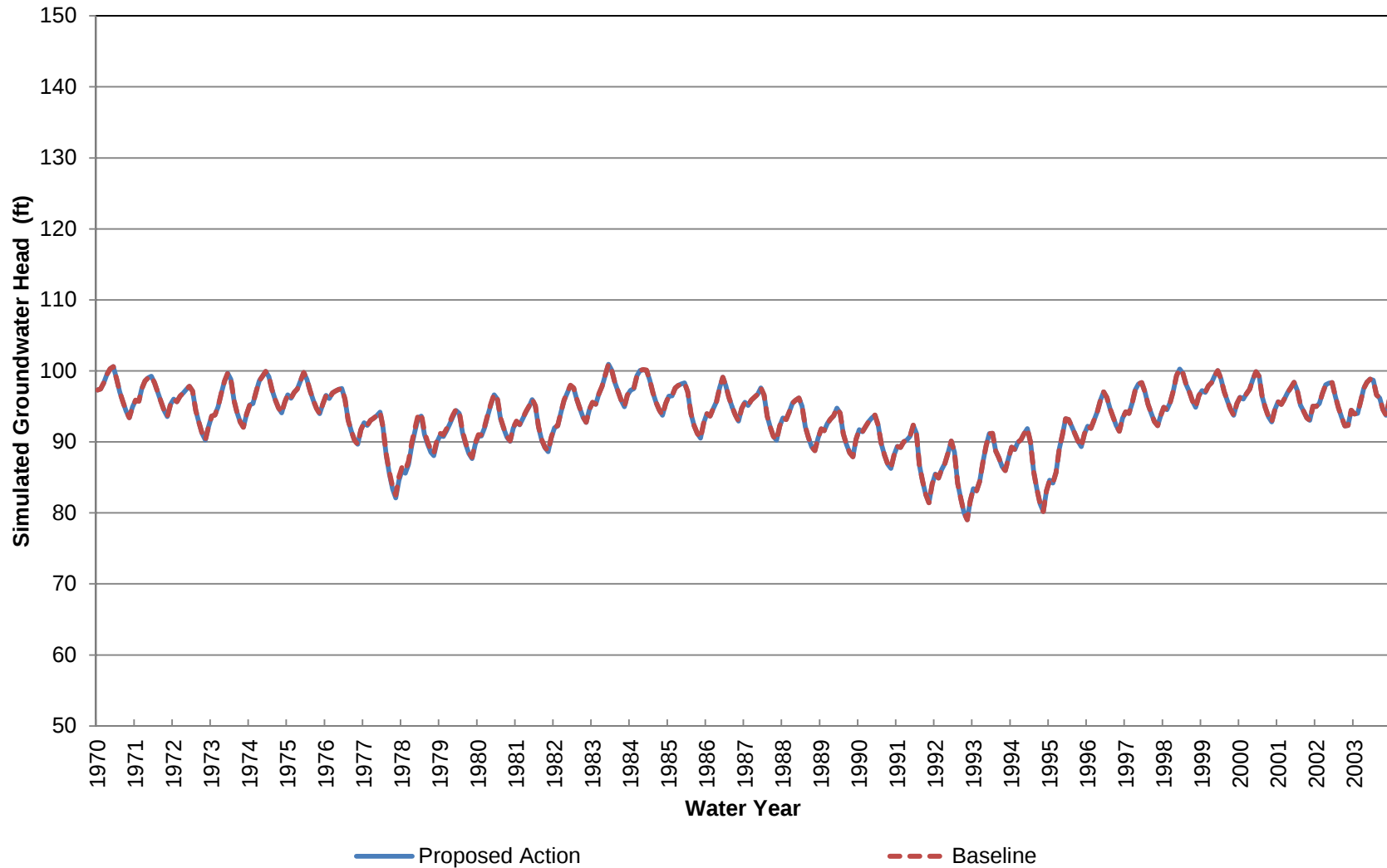
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 6 (Approximately 860-1290 ft bgs)**



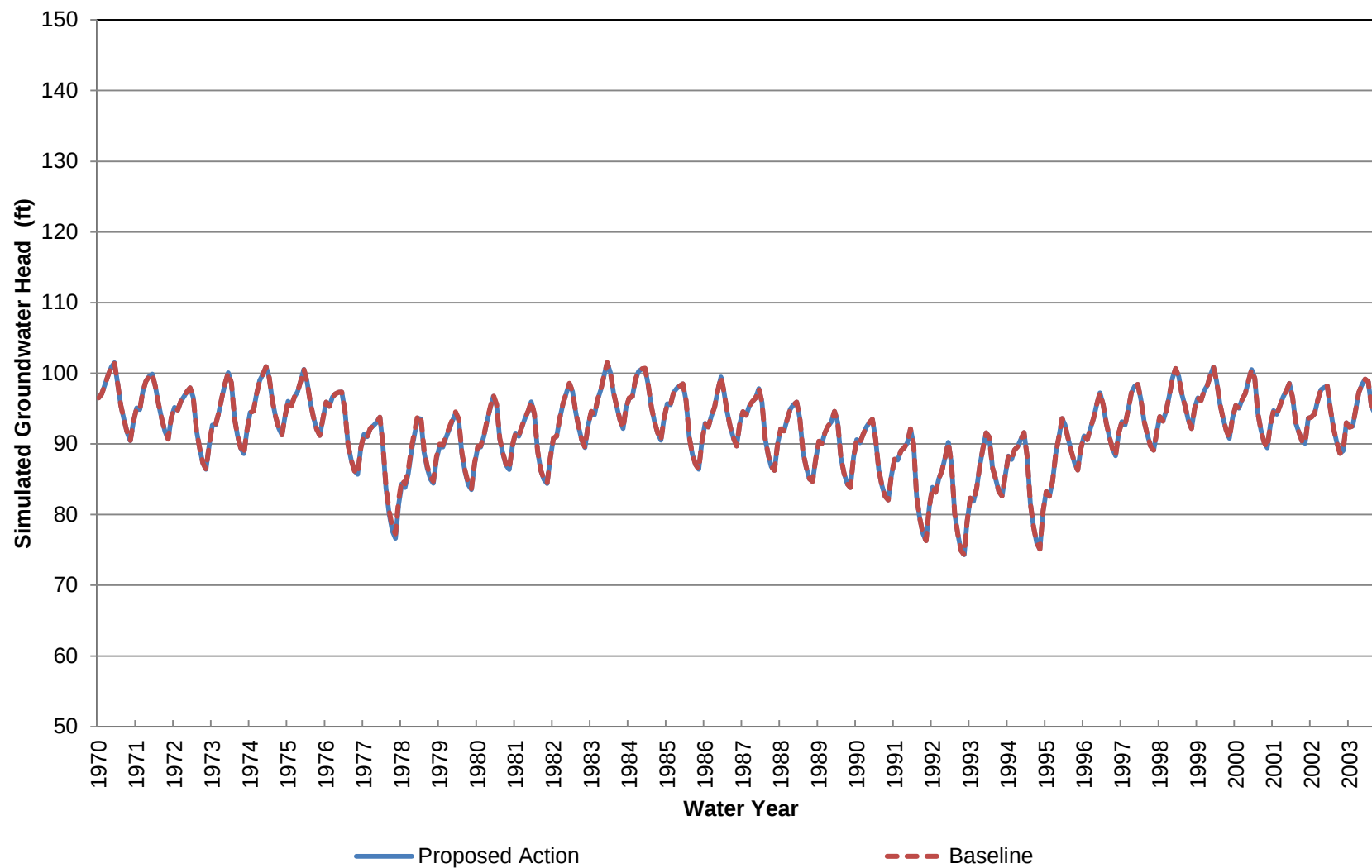
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 7 (Approximately 0-70 ft bgs)**



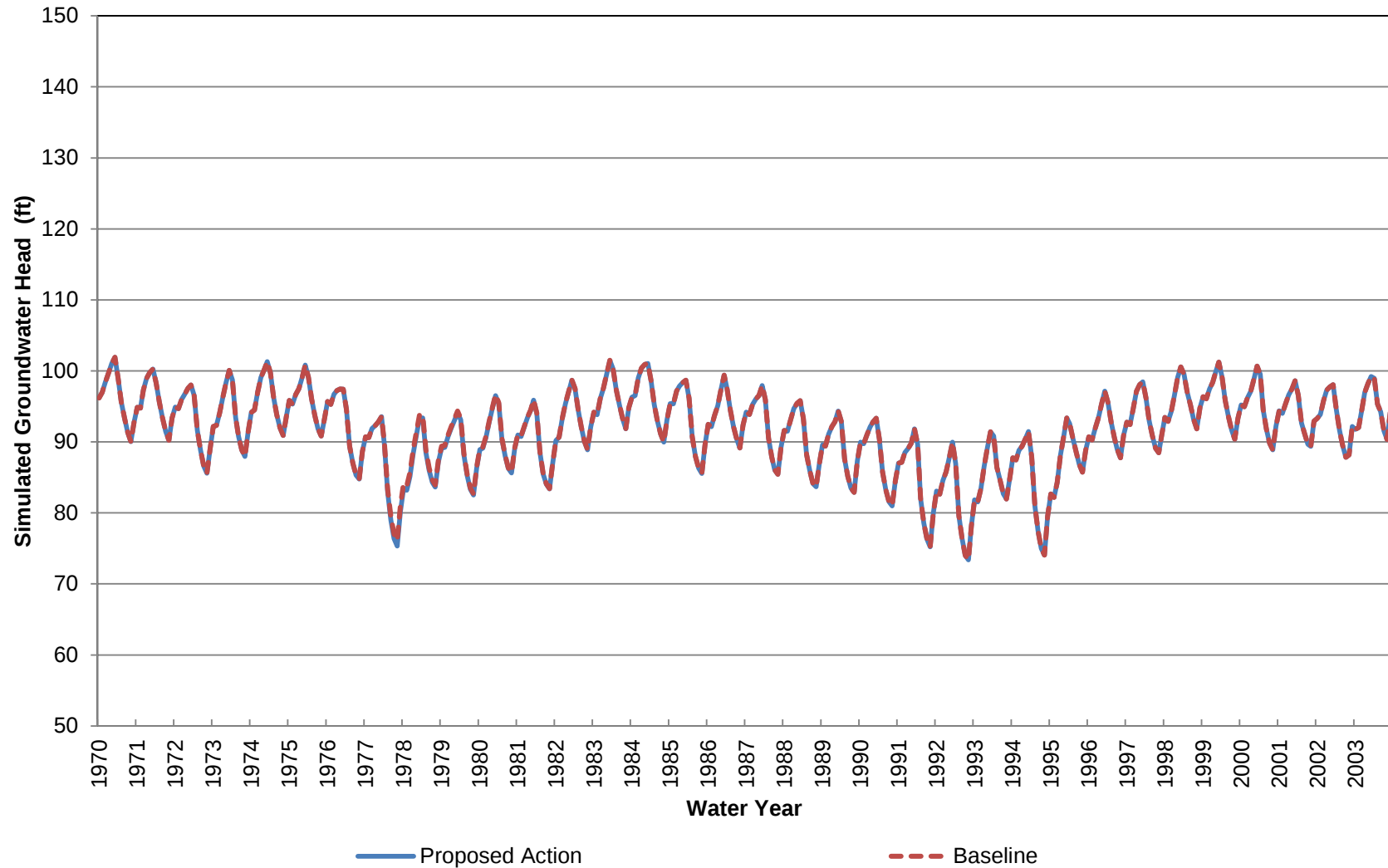
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 7 (Approximately 70-220 ft bgs)**



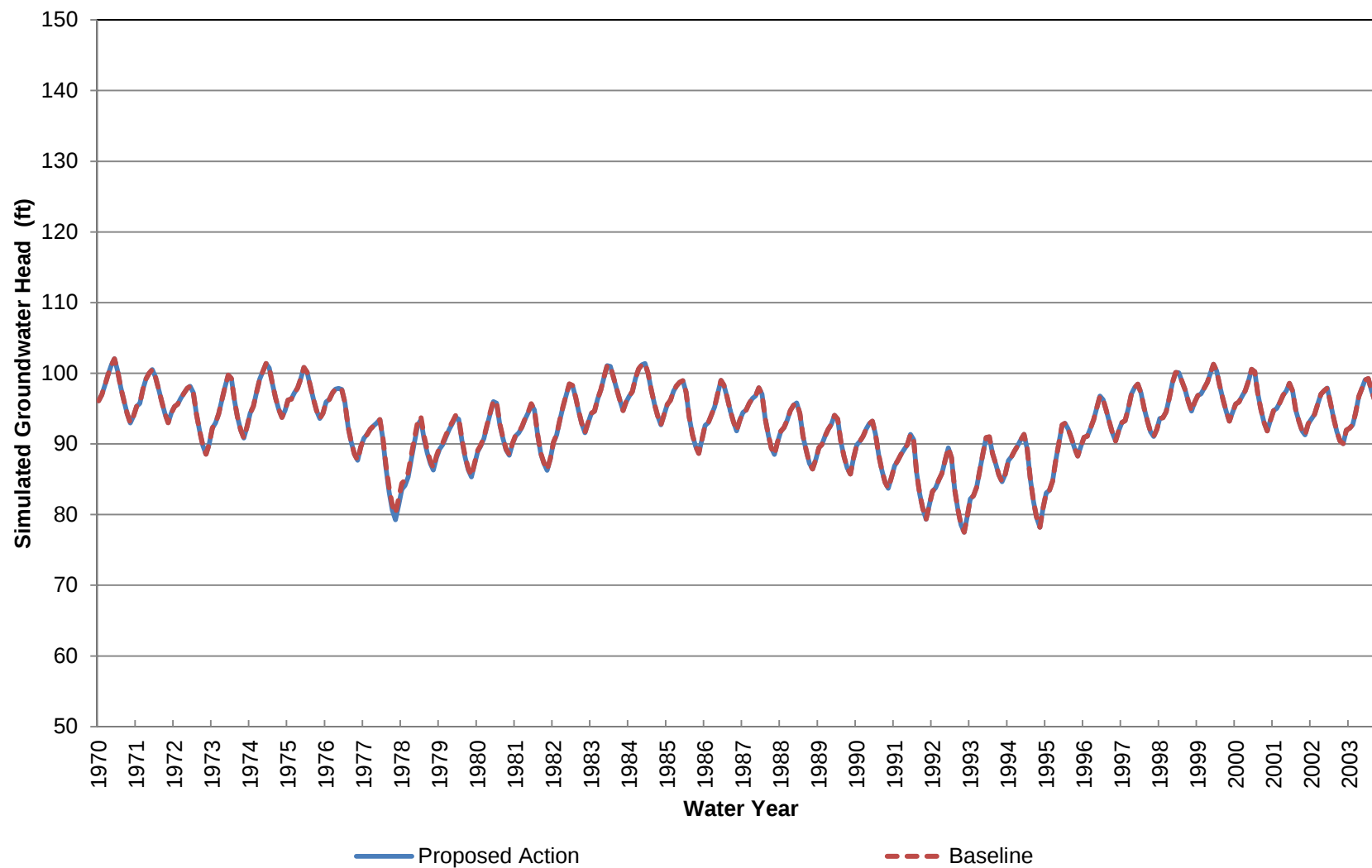
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 7 (Approximately 220-370 ft bgs)**



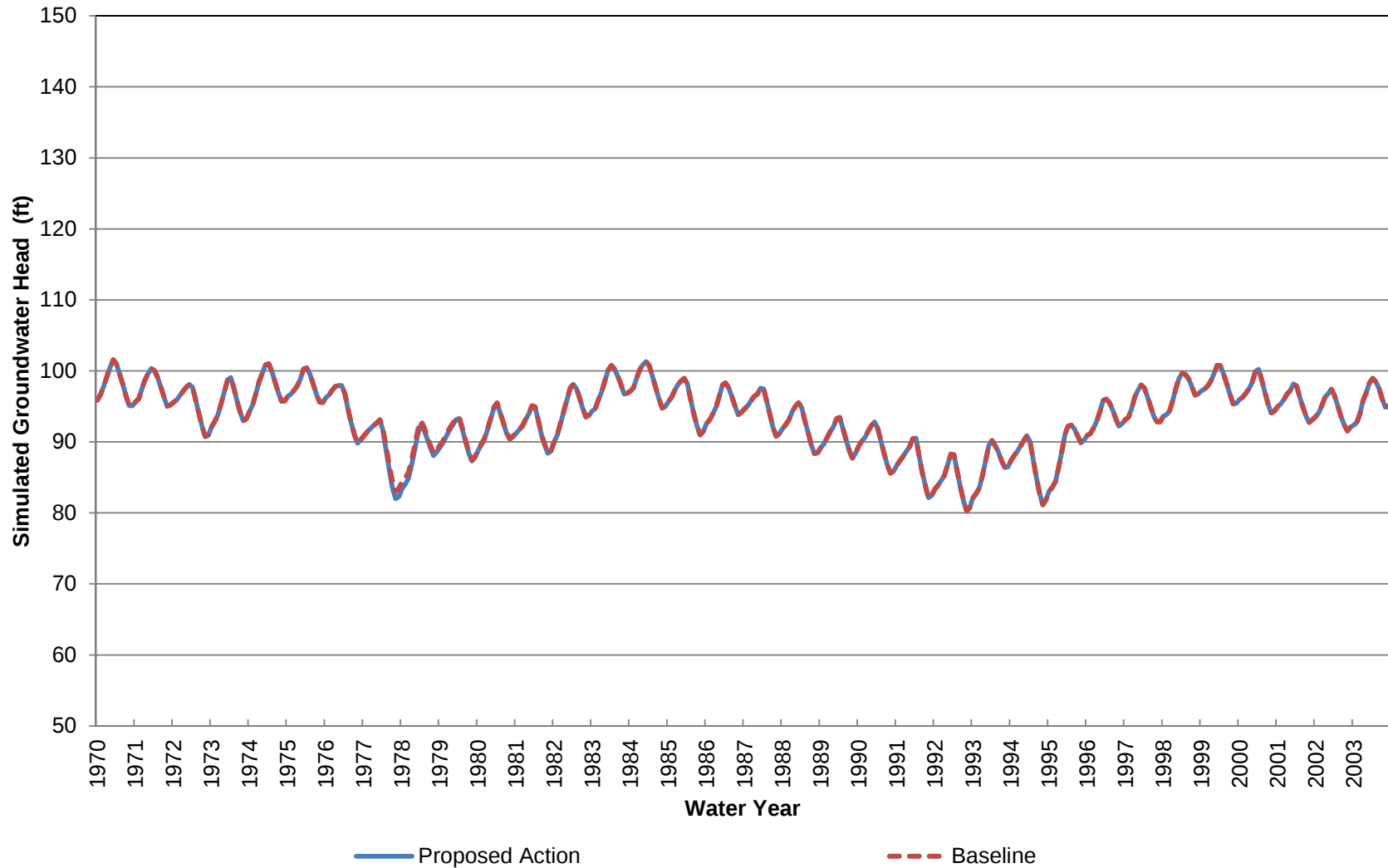
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 7 (Approximately 370-520 ft bgs)**



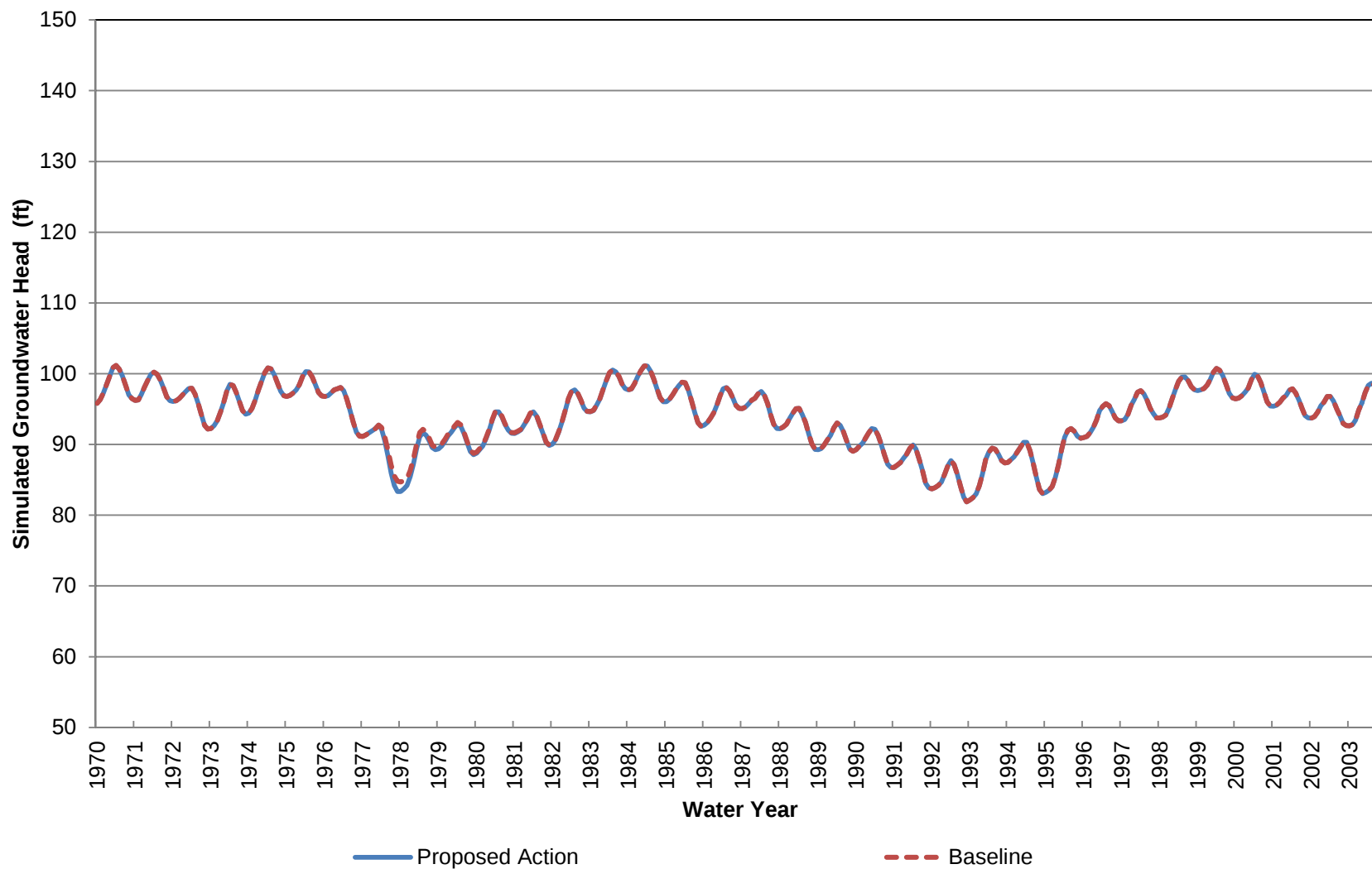
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 7 (Approximately 520-760 ft bgs)**



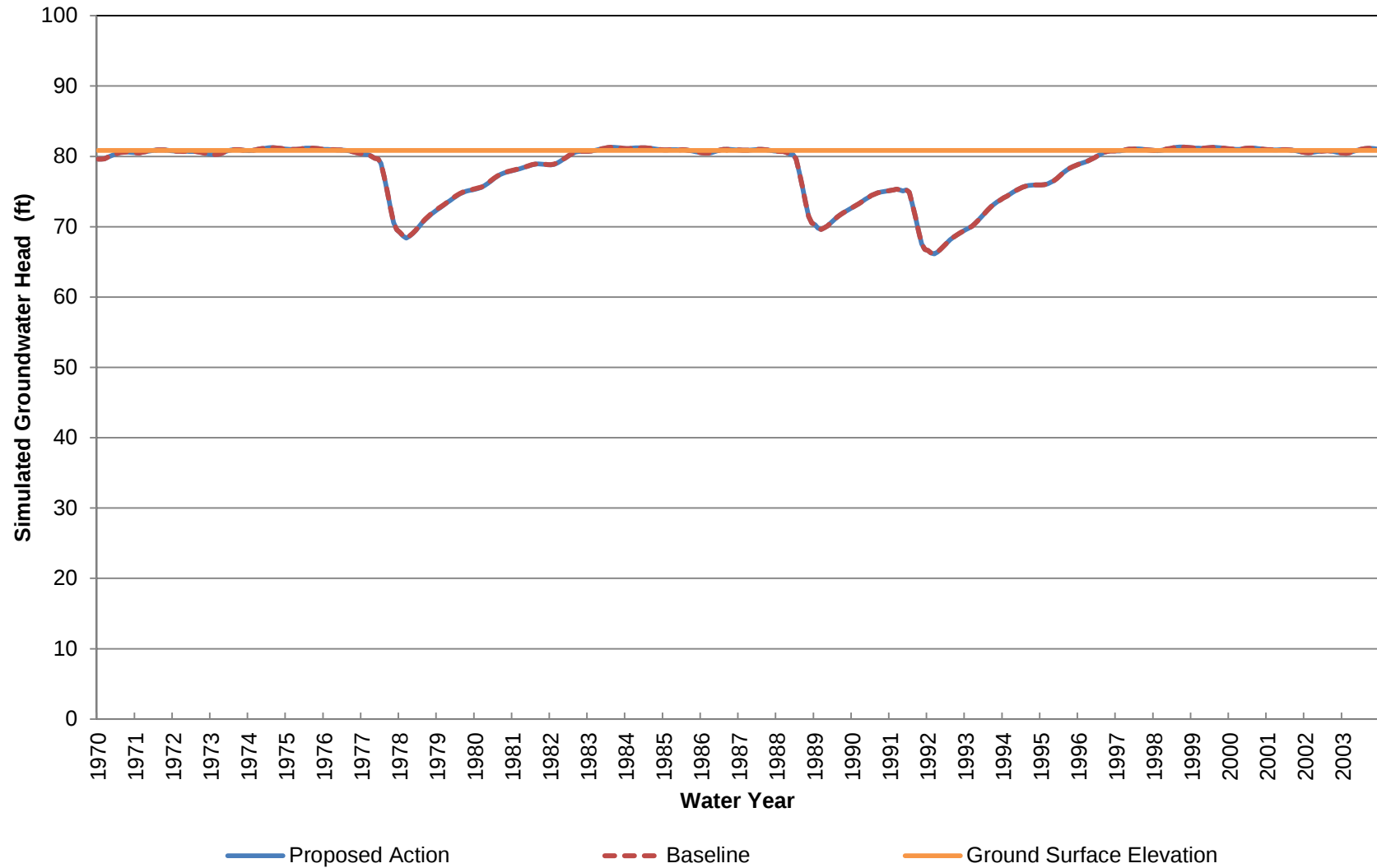
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 7 (Approximately 760-1030 ft bgs)**



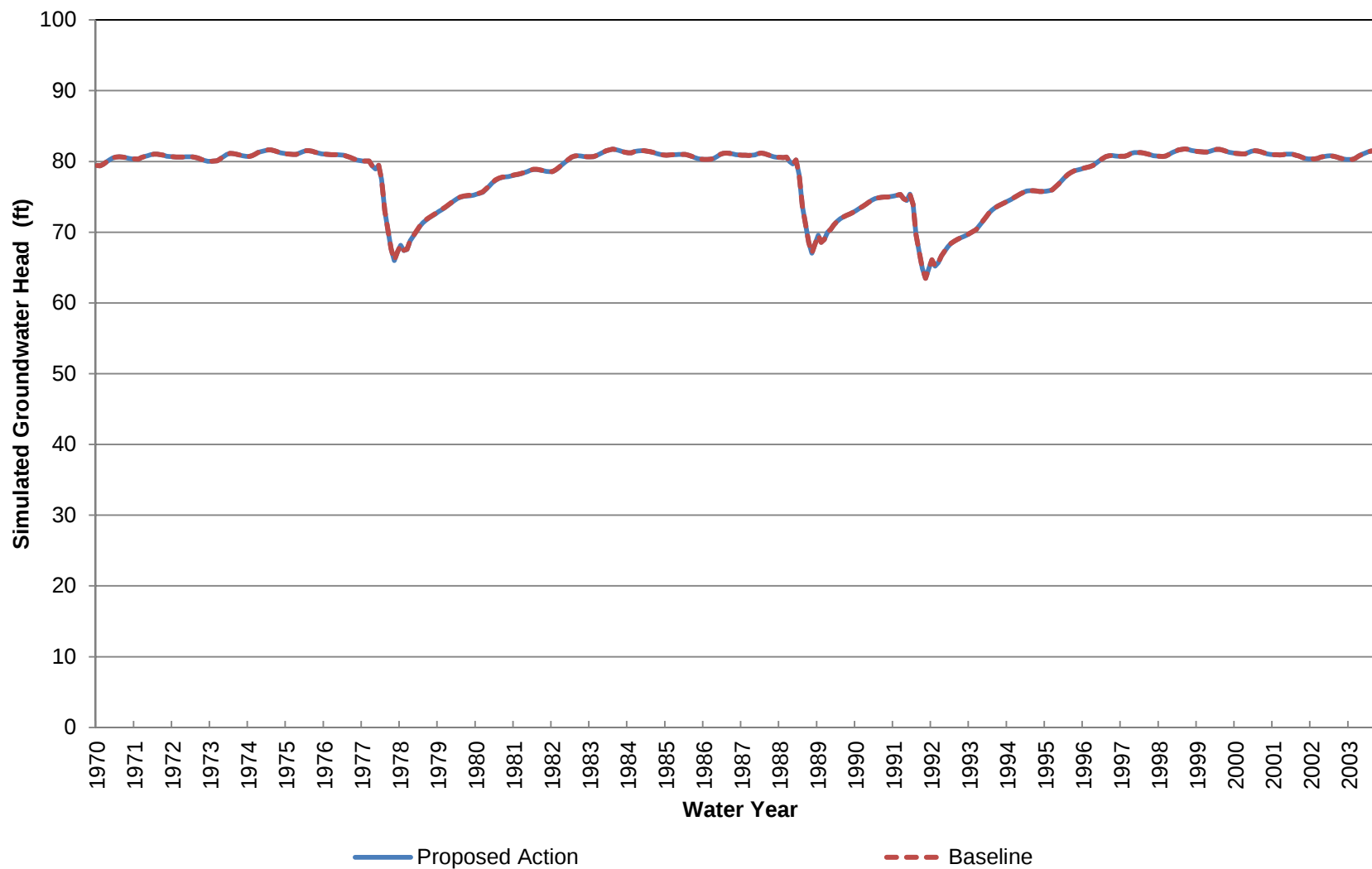
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 7 (Approximately 1030-1520 ft bgs)**



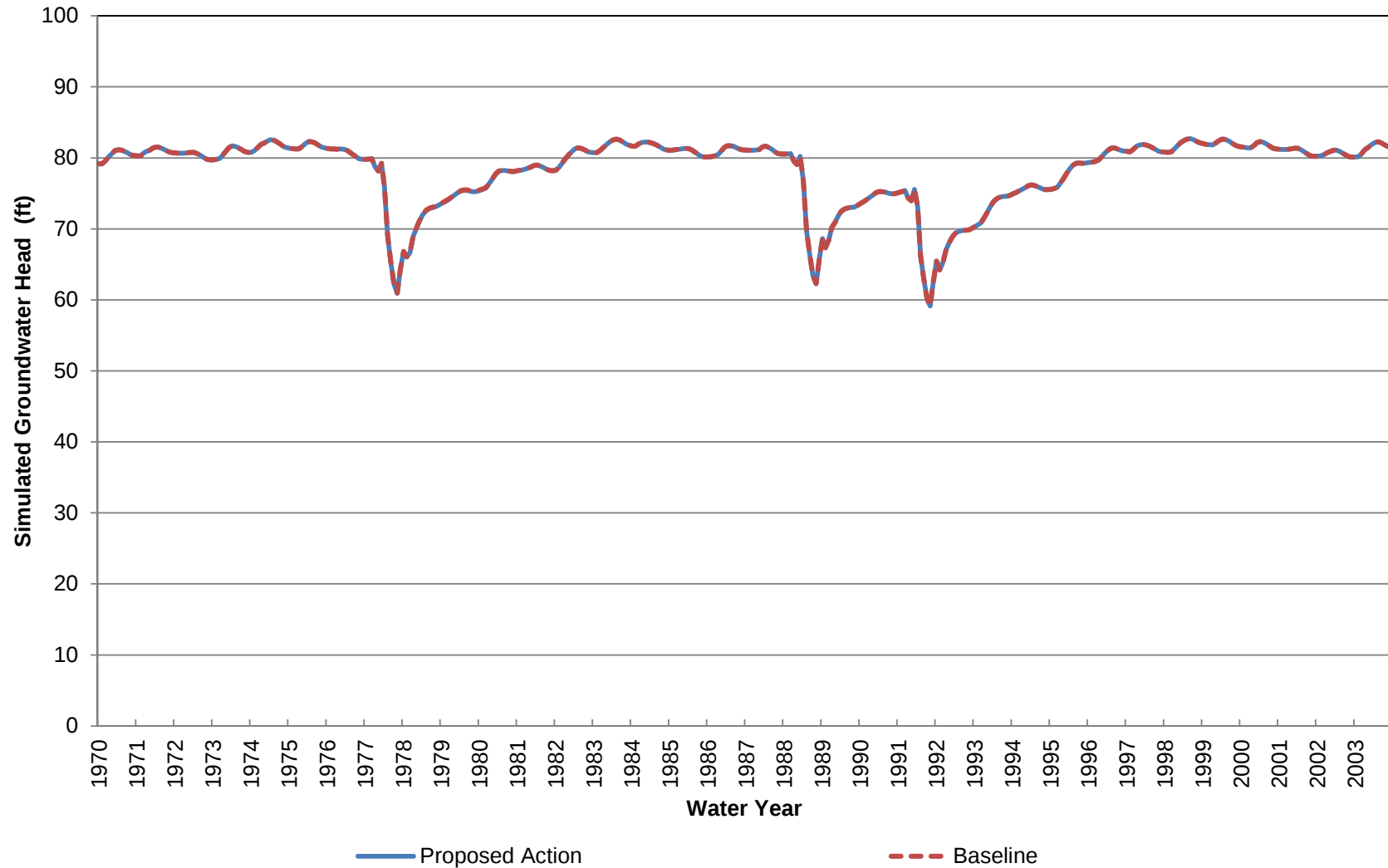
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 8 (Approximately 0-70 ft bgs)**



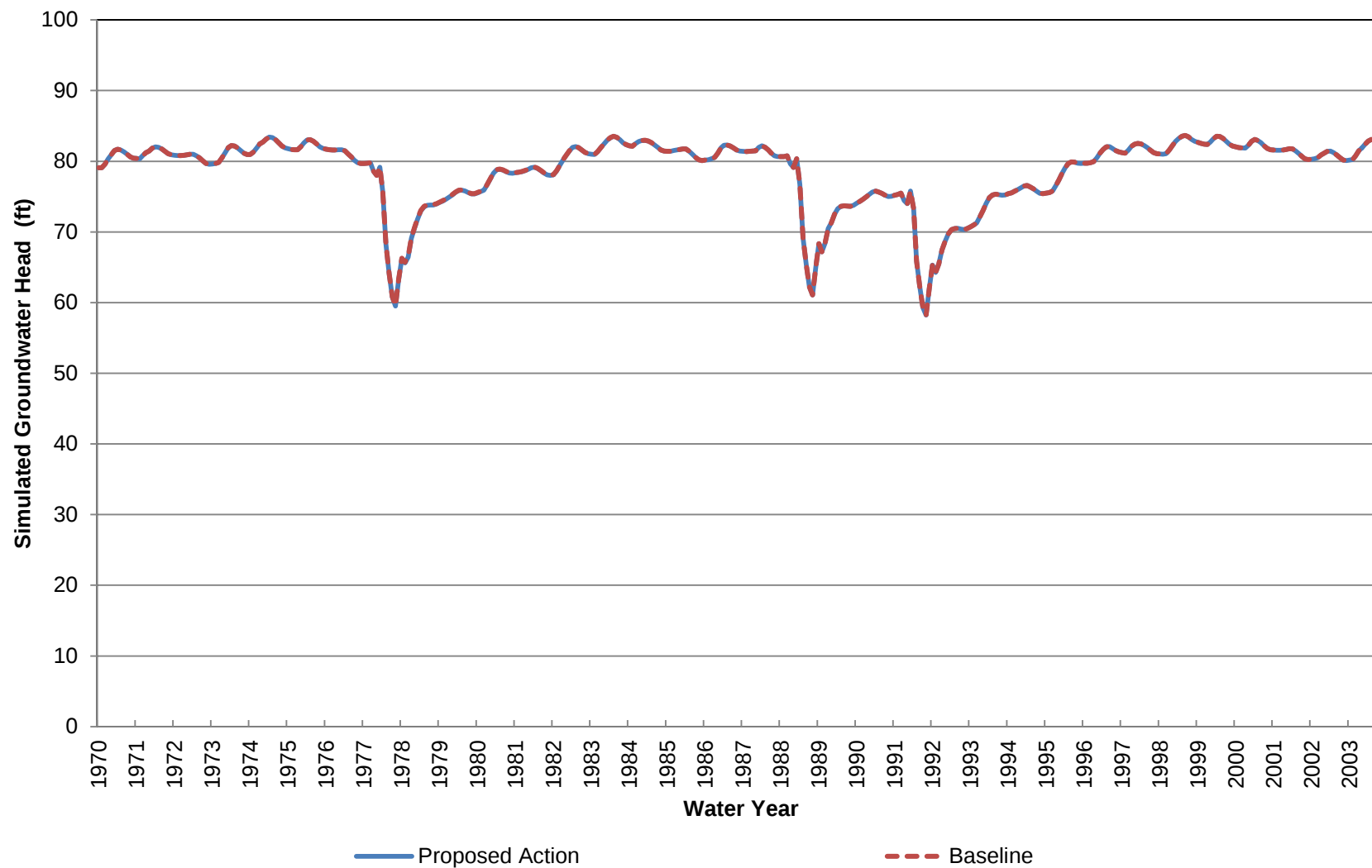
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 8 (Approximately 70-200 ft bgs)**



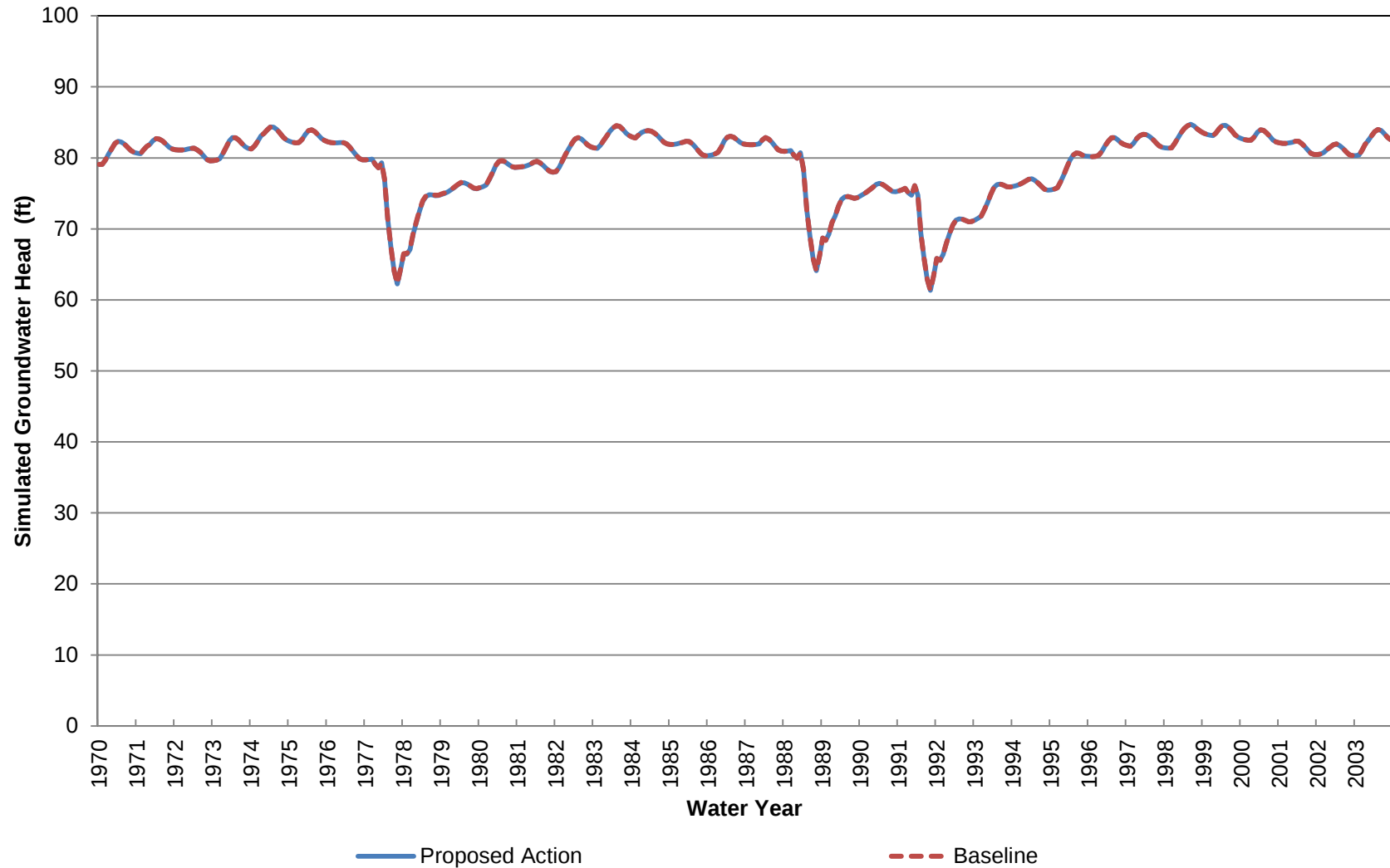
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 8 (Approximately 200-330 ft bgs)**



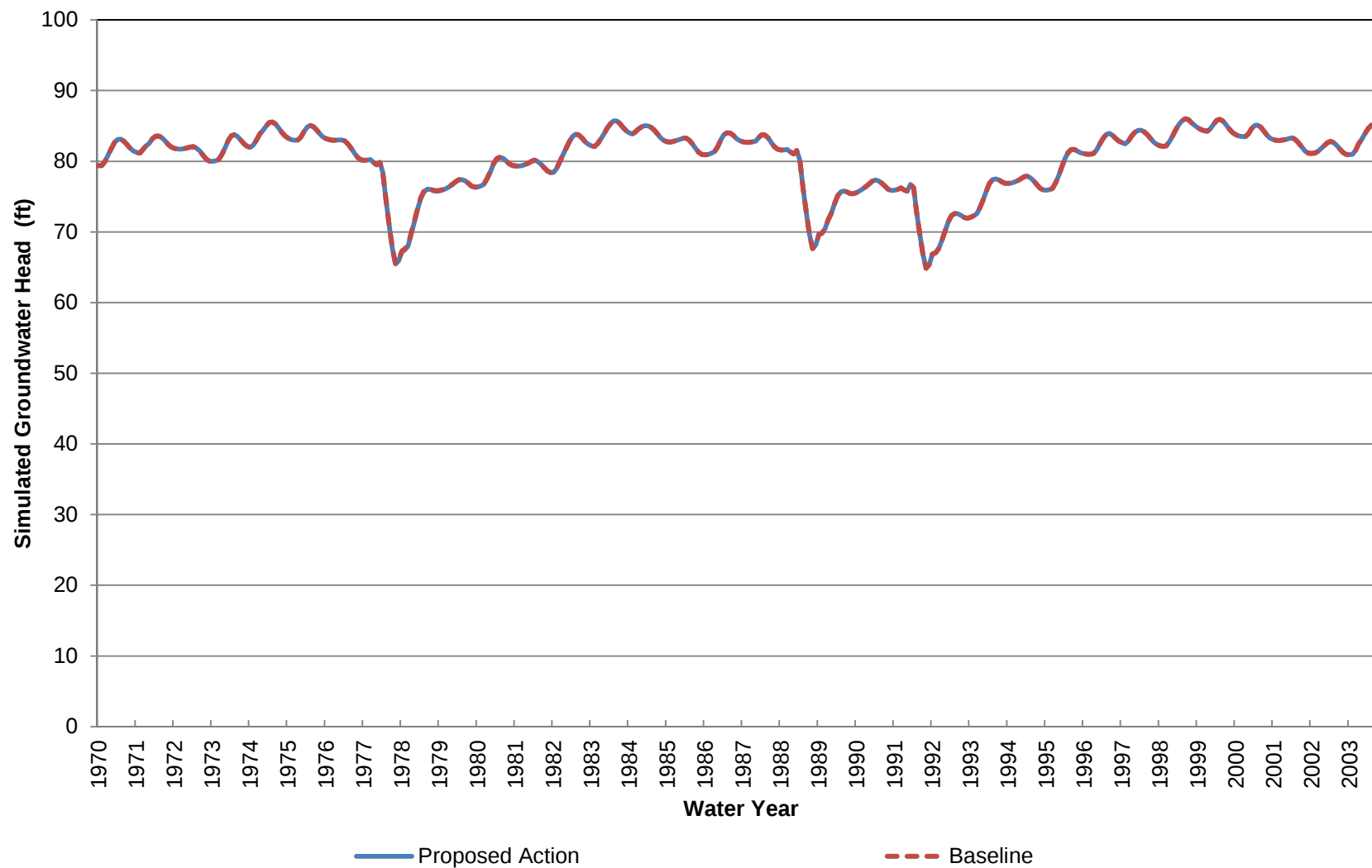
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 8 (Approximately 330-450 ft bgs)**



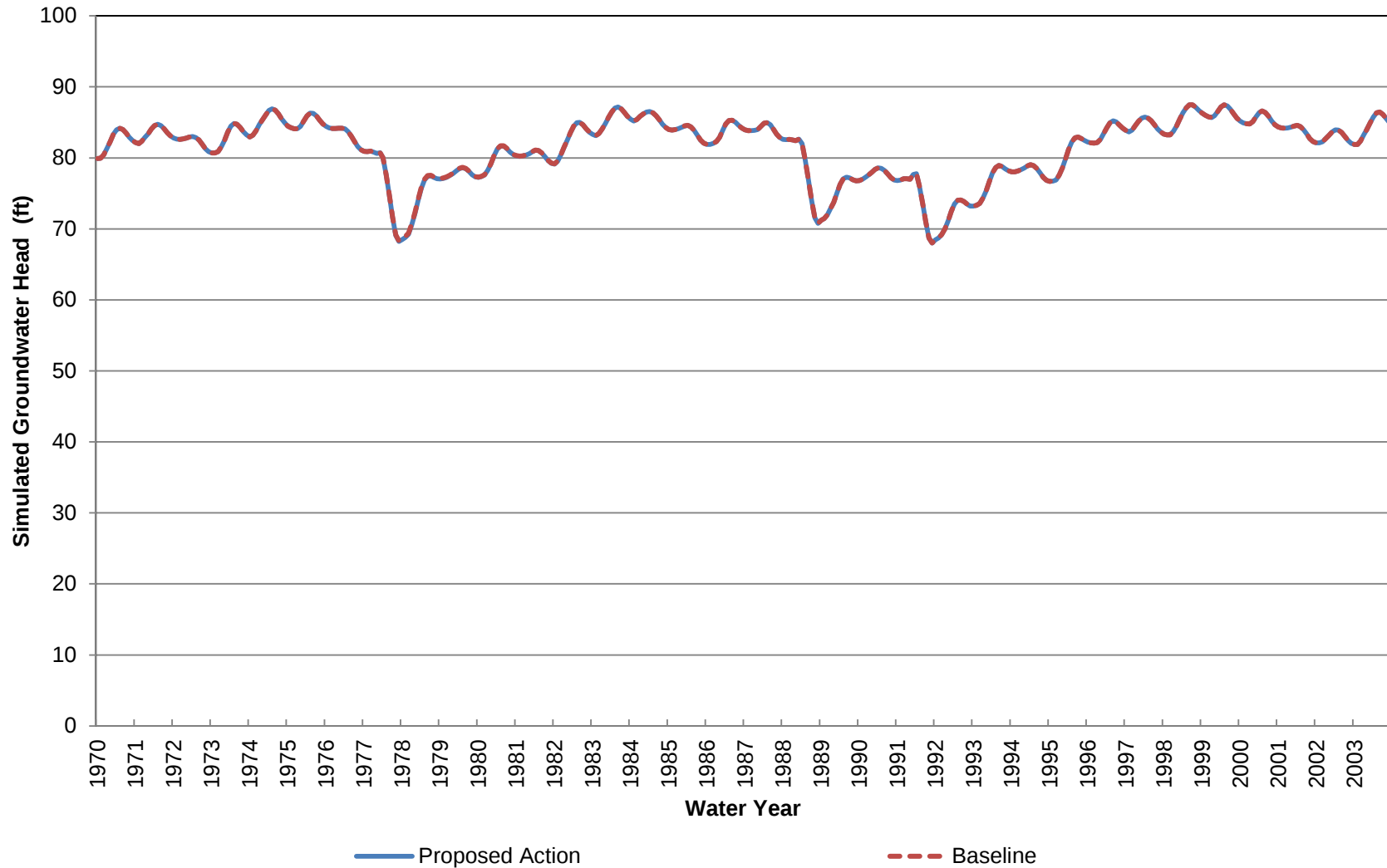
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 8 (Approximately 450-650 ft bgs)**



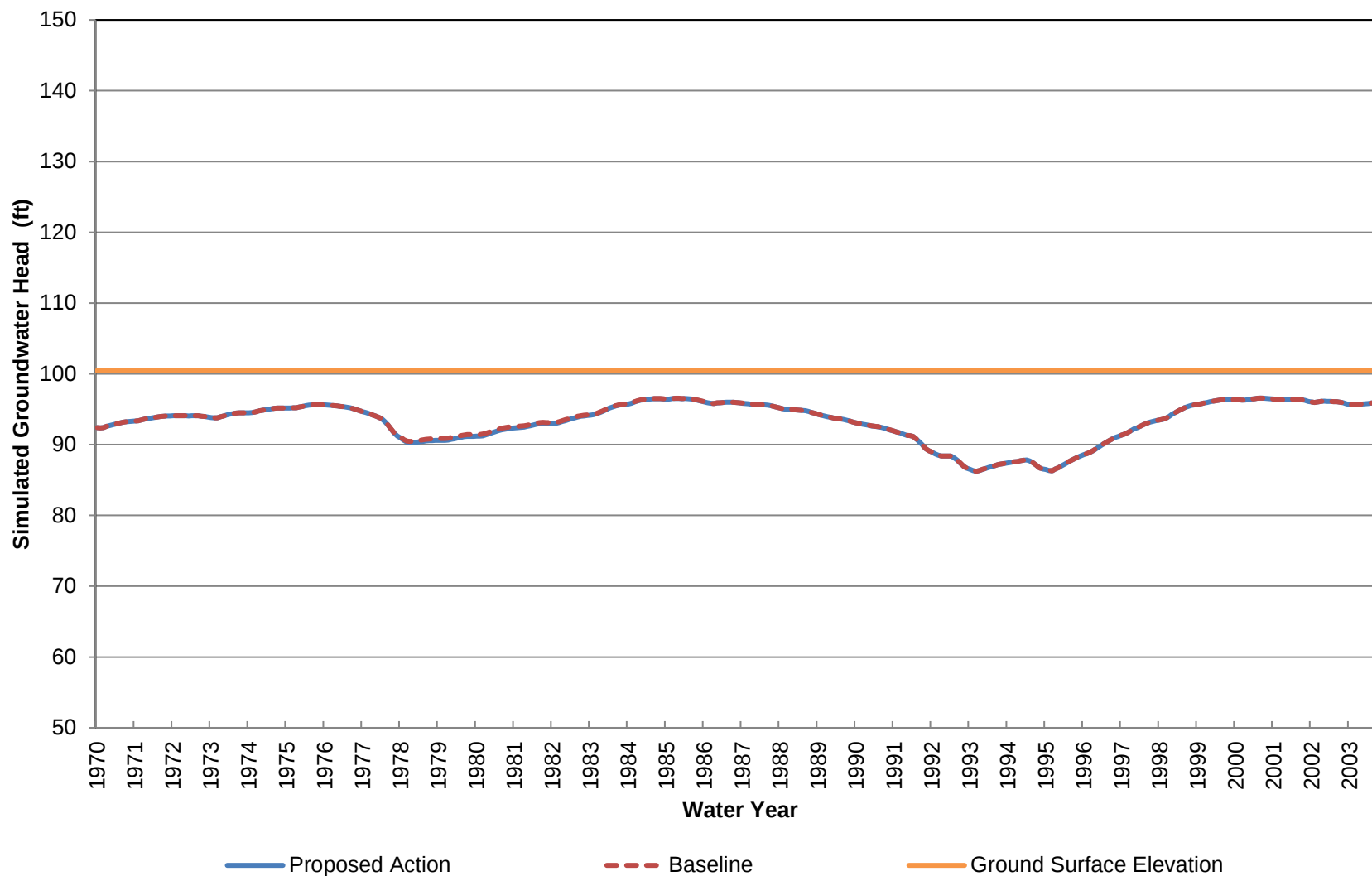
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 8 (Approximately 650-890 ft bgs)**



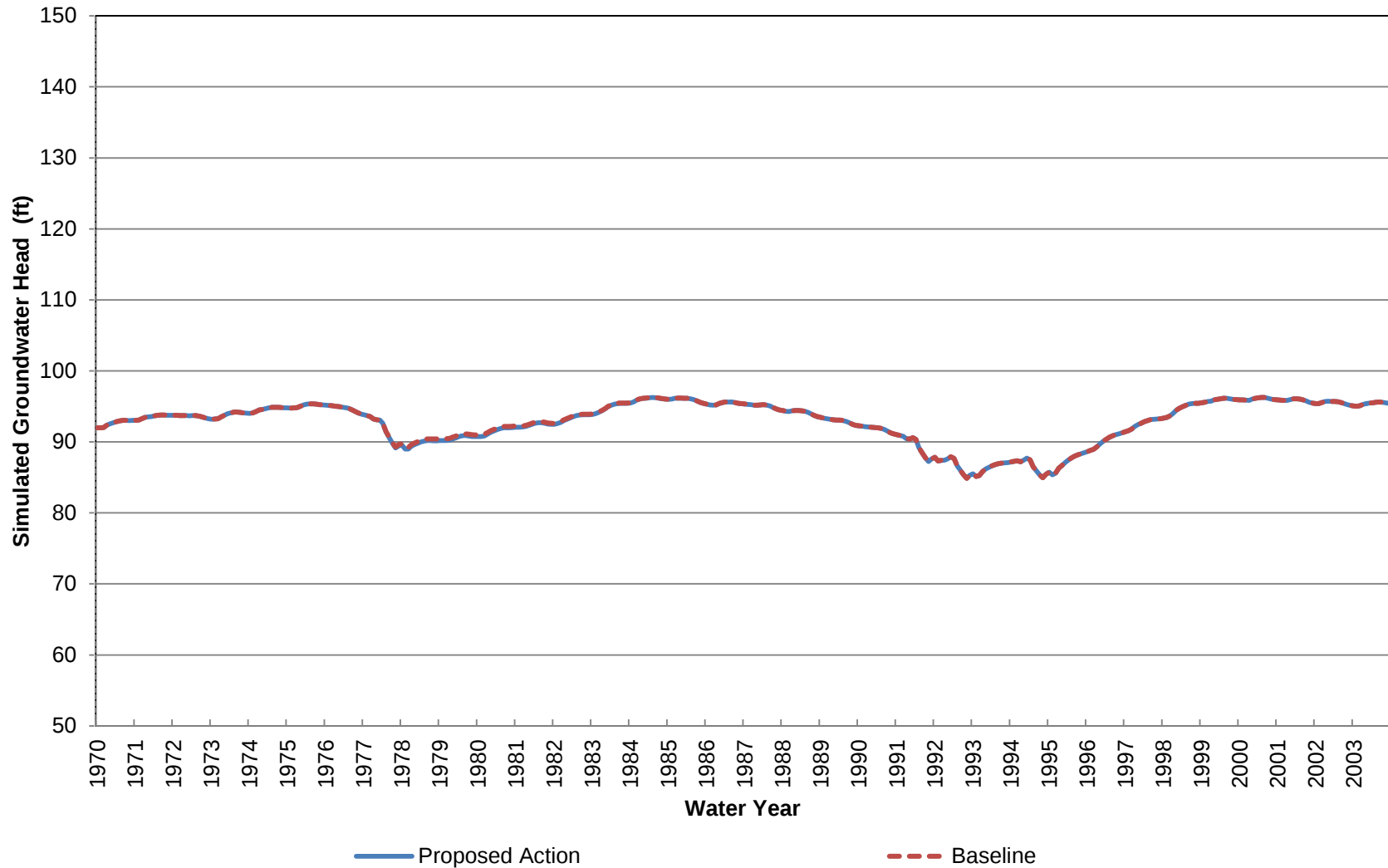
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 8 (Approximately 890-1330 ft bgs)**



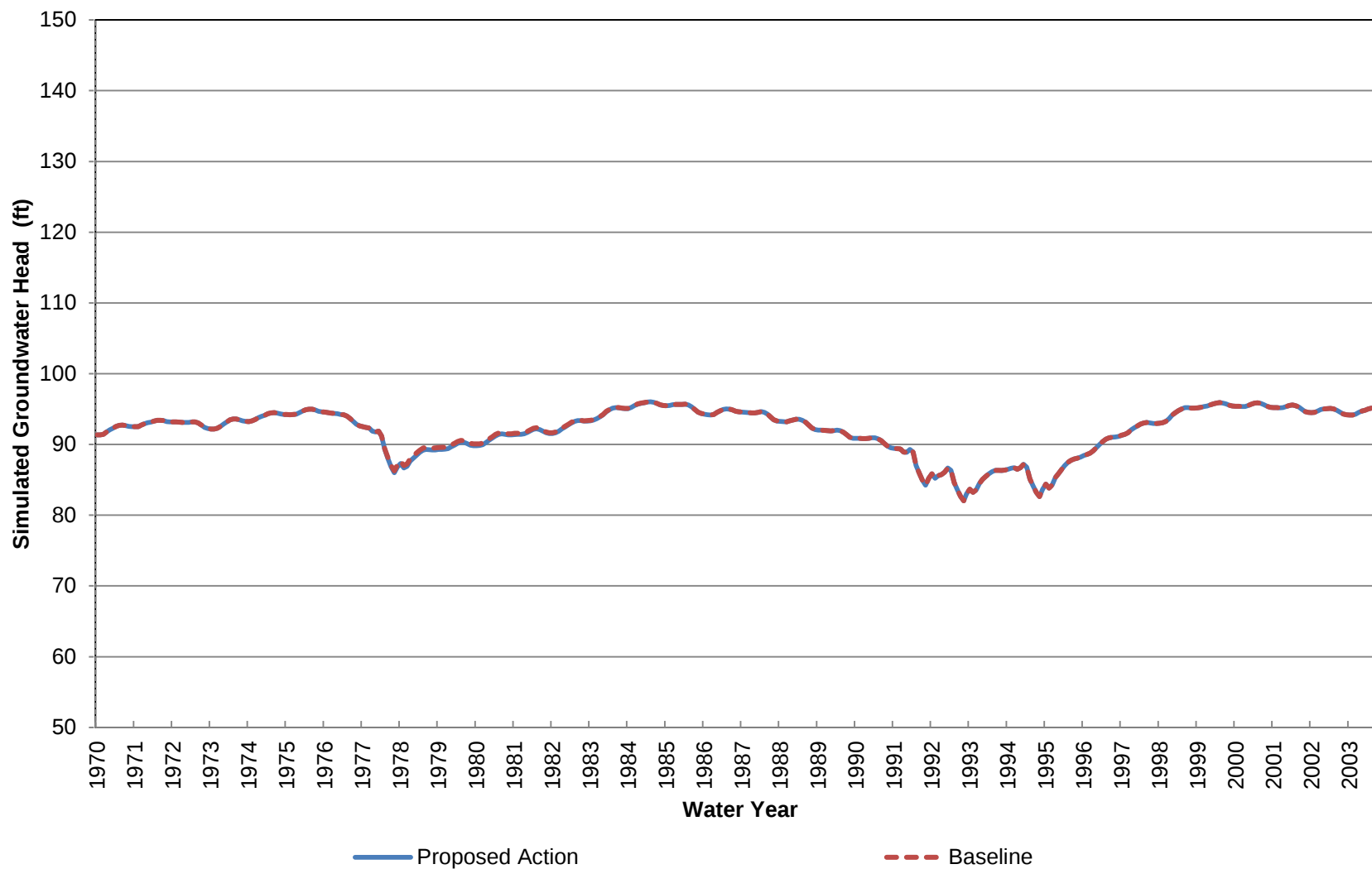
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 9 (Approximately 0-70 ft bgs)**



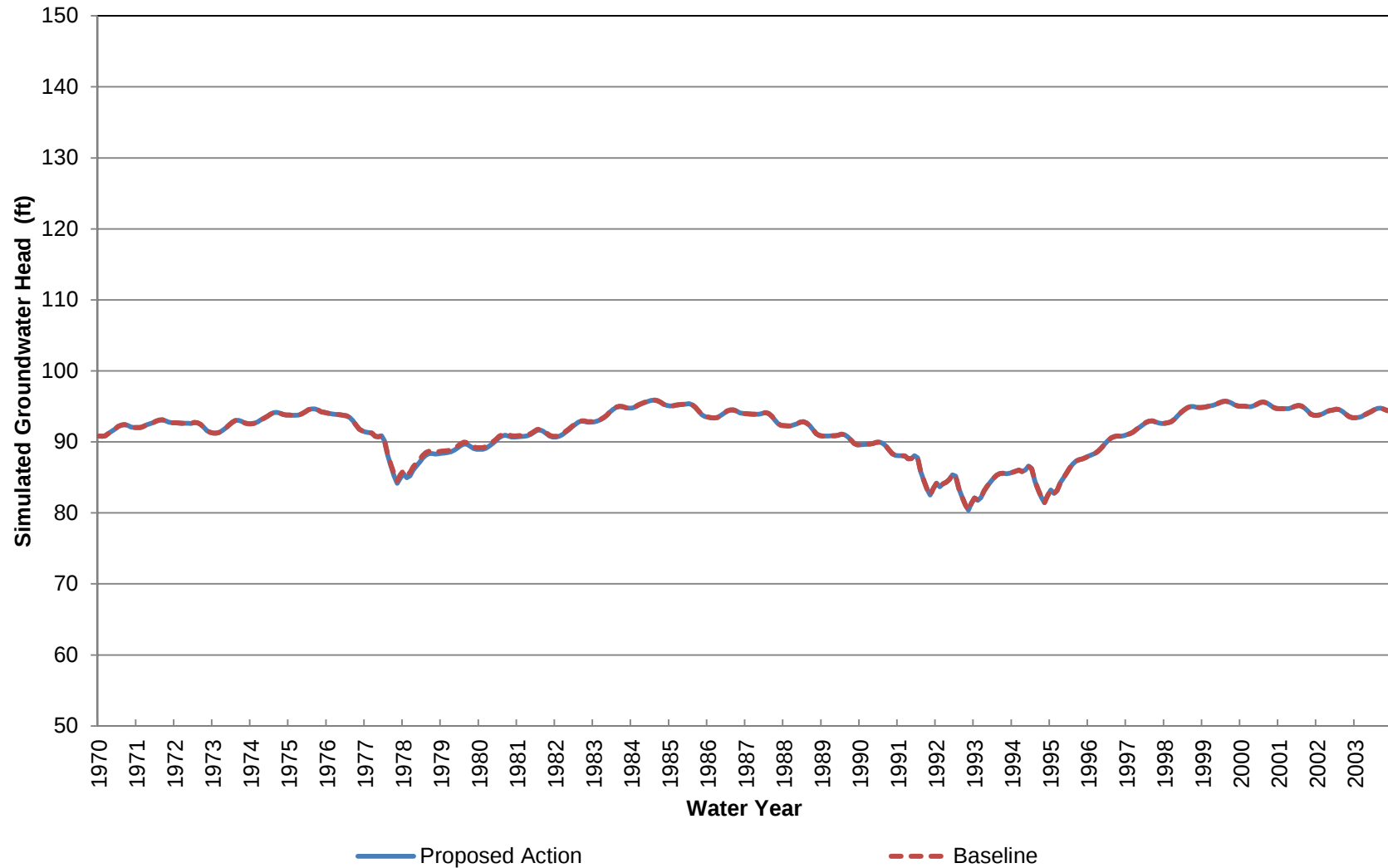
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 70-210 ft bgs)**



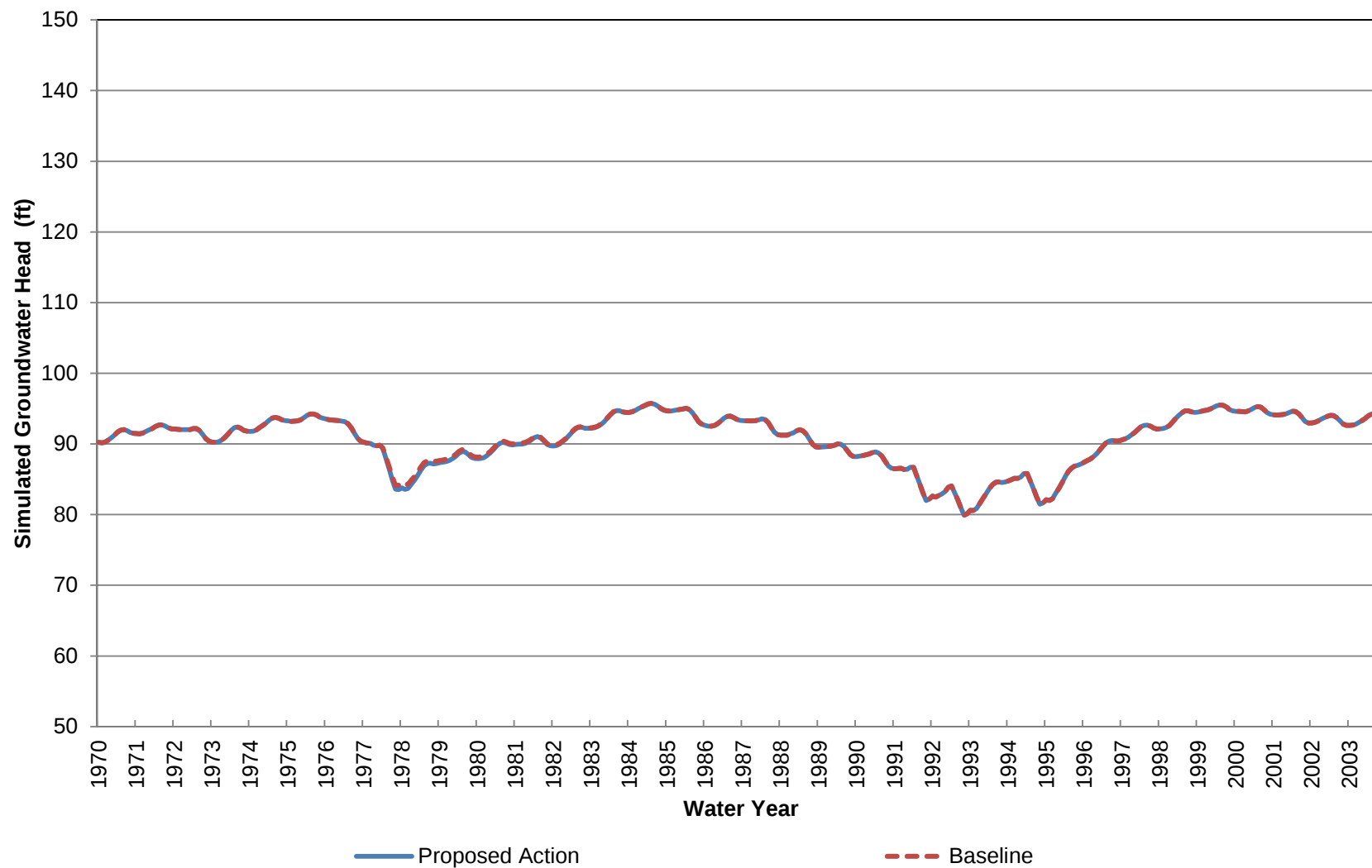
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 210-340 ft bgs)**



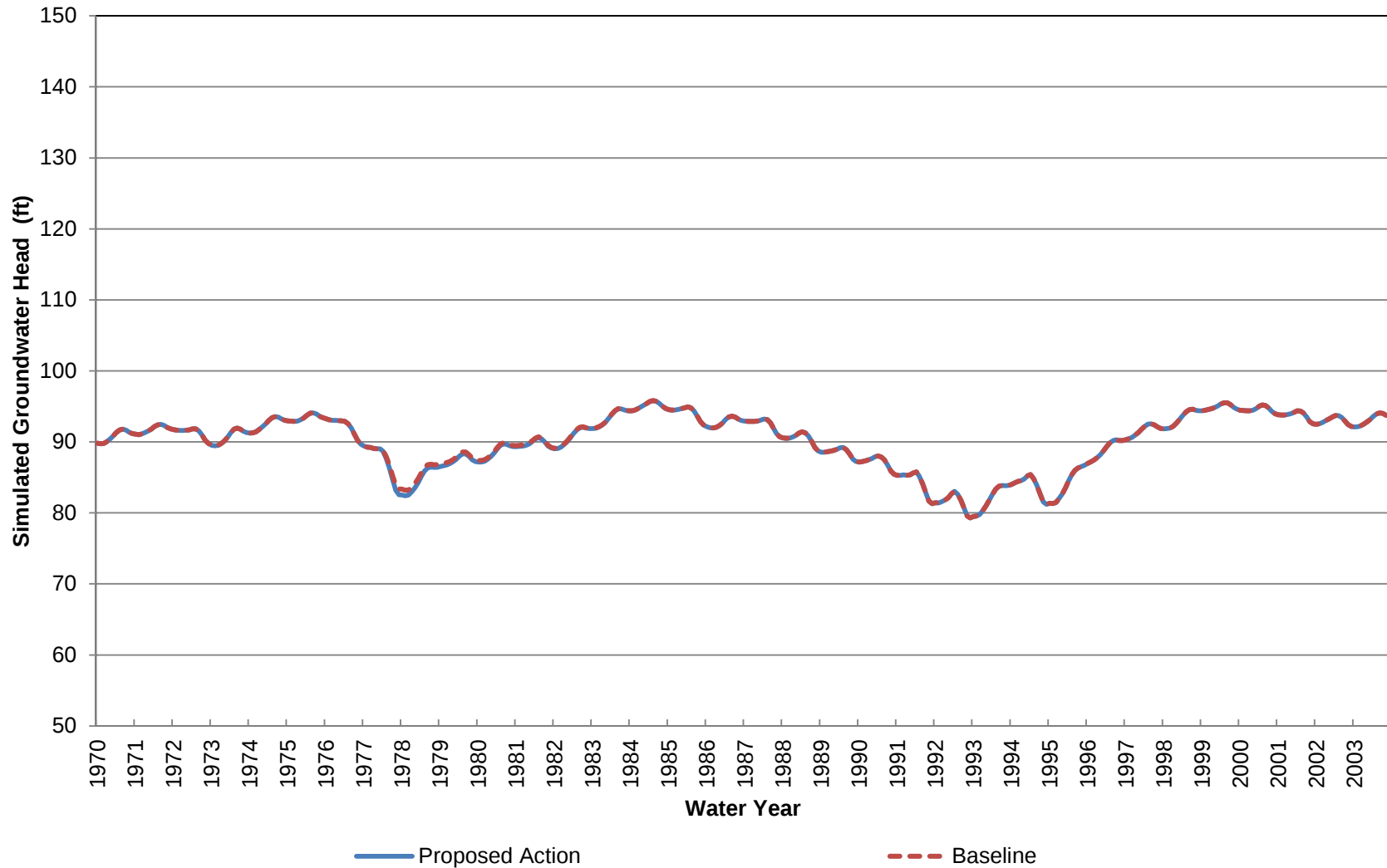
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 340-480 ft bgs)**



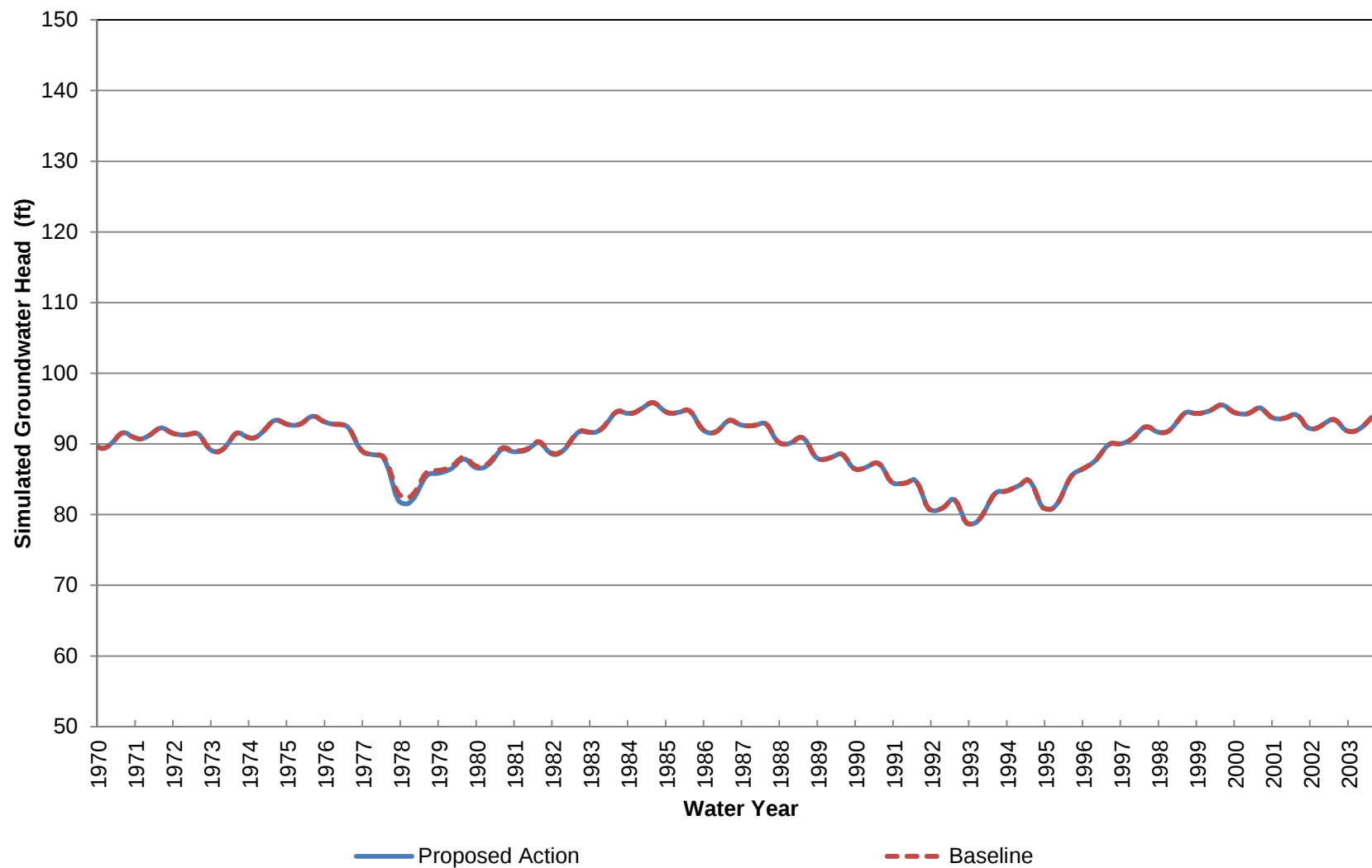
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 480-690 ft bgs)**



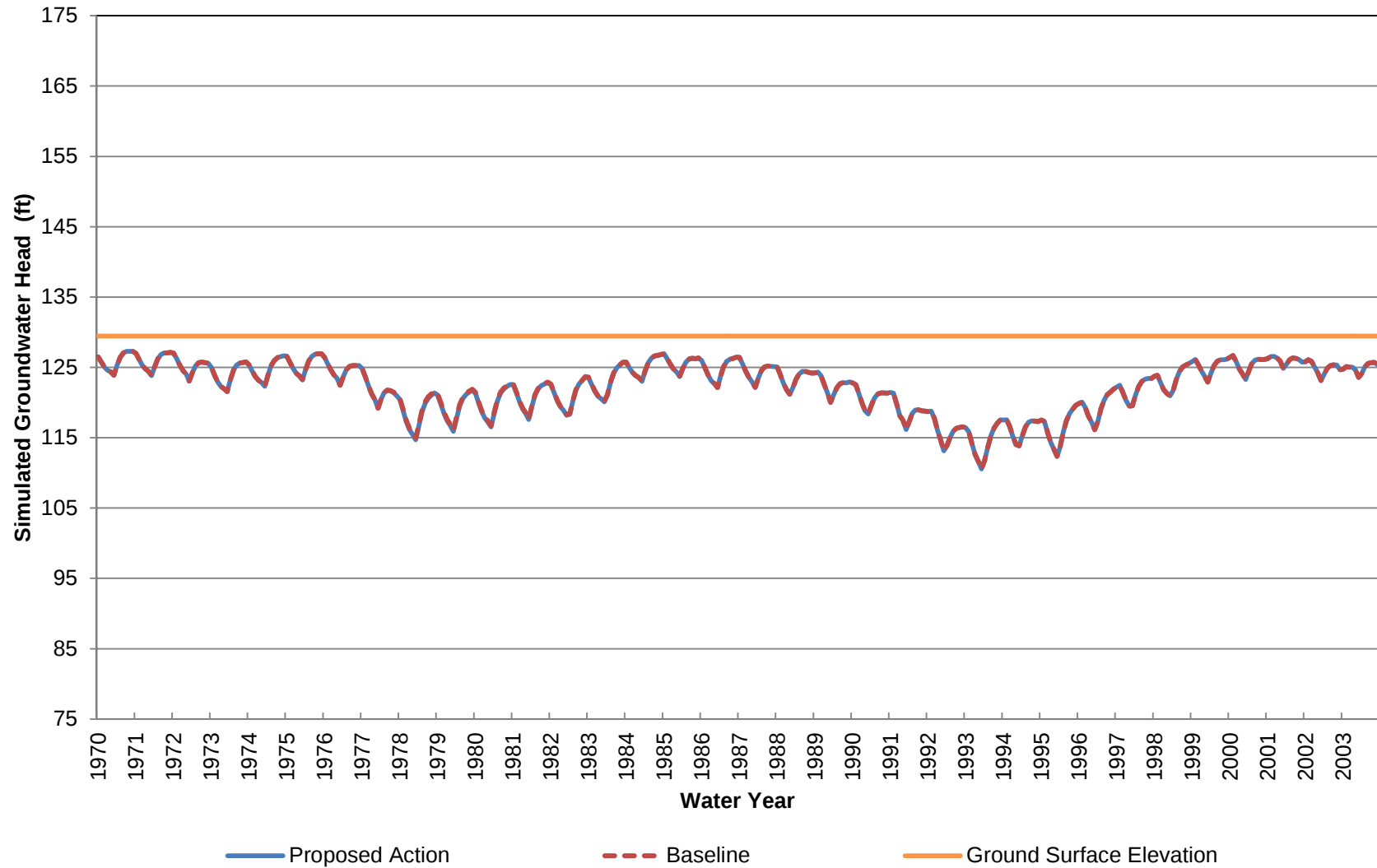
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 690-910 ft bgs)**



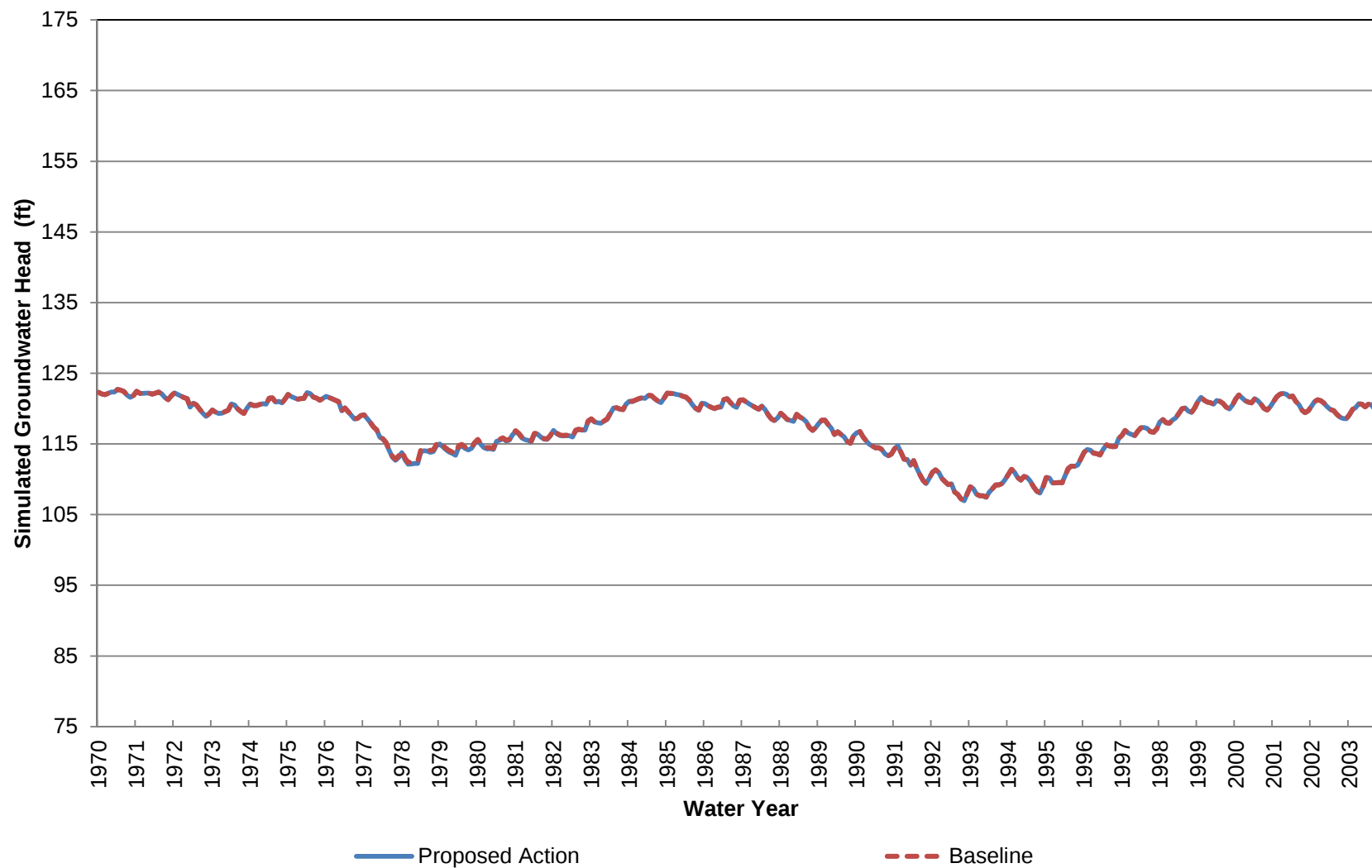
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 9 (Approximately 910-1250 ft bgs)**



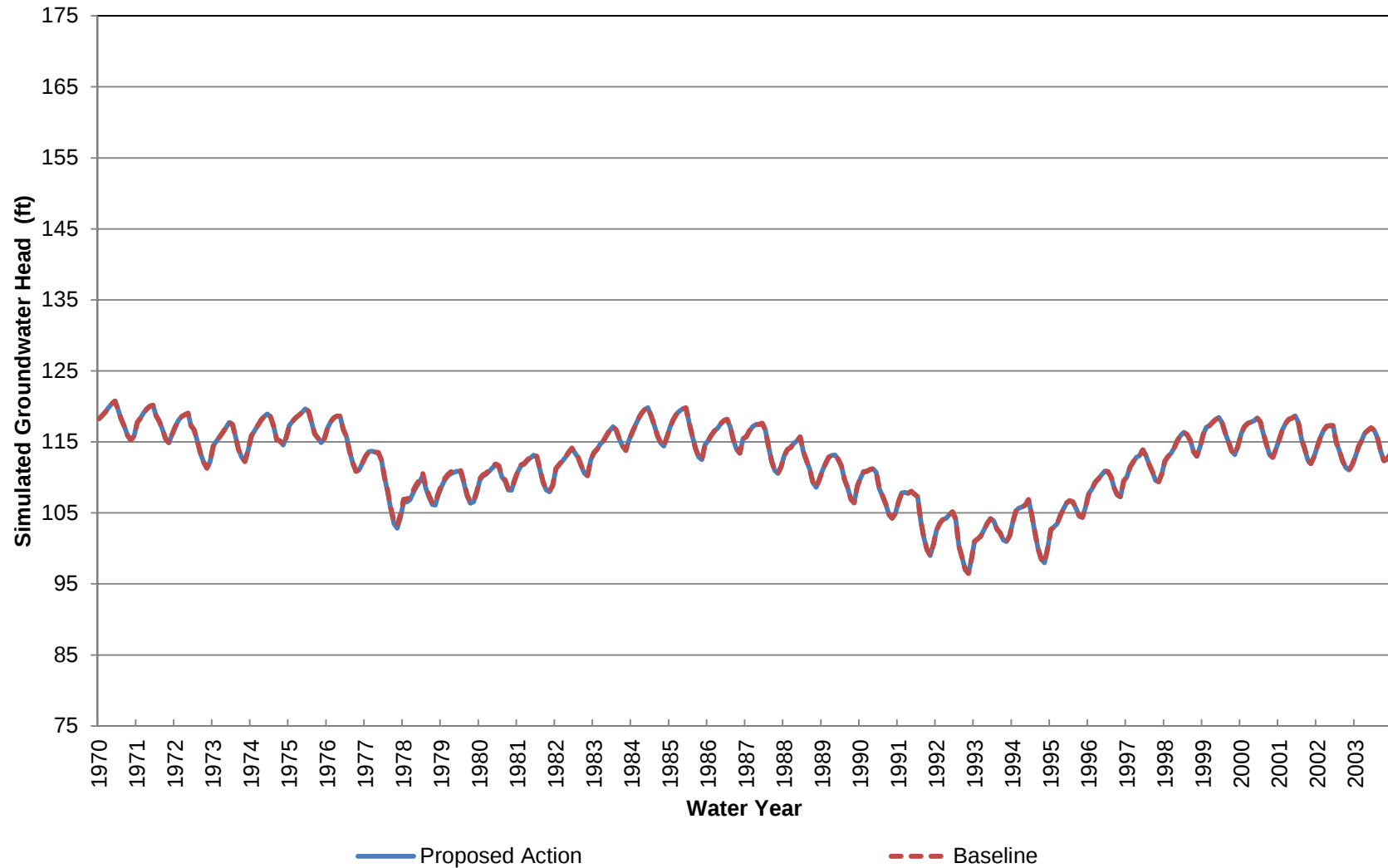
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 10 (Approximately 0-70 ft bgs)**



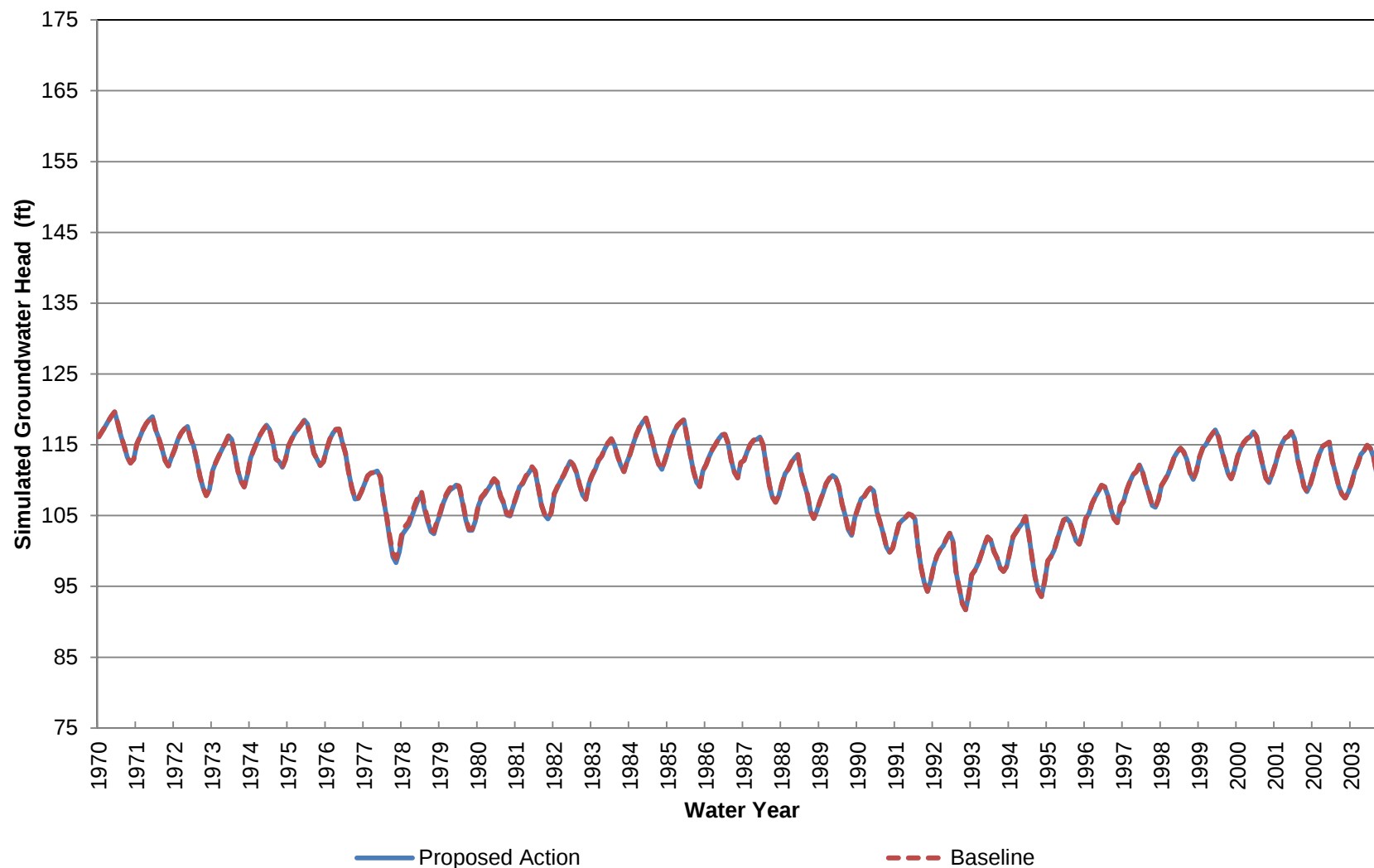
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 10 (Approximately 70-240 ft bgs)**



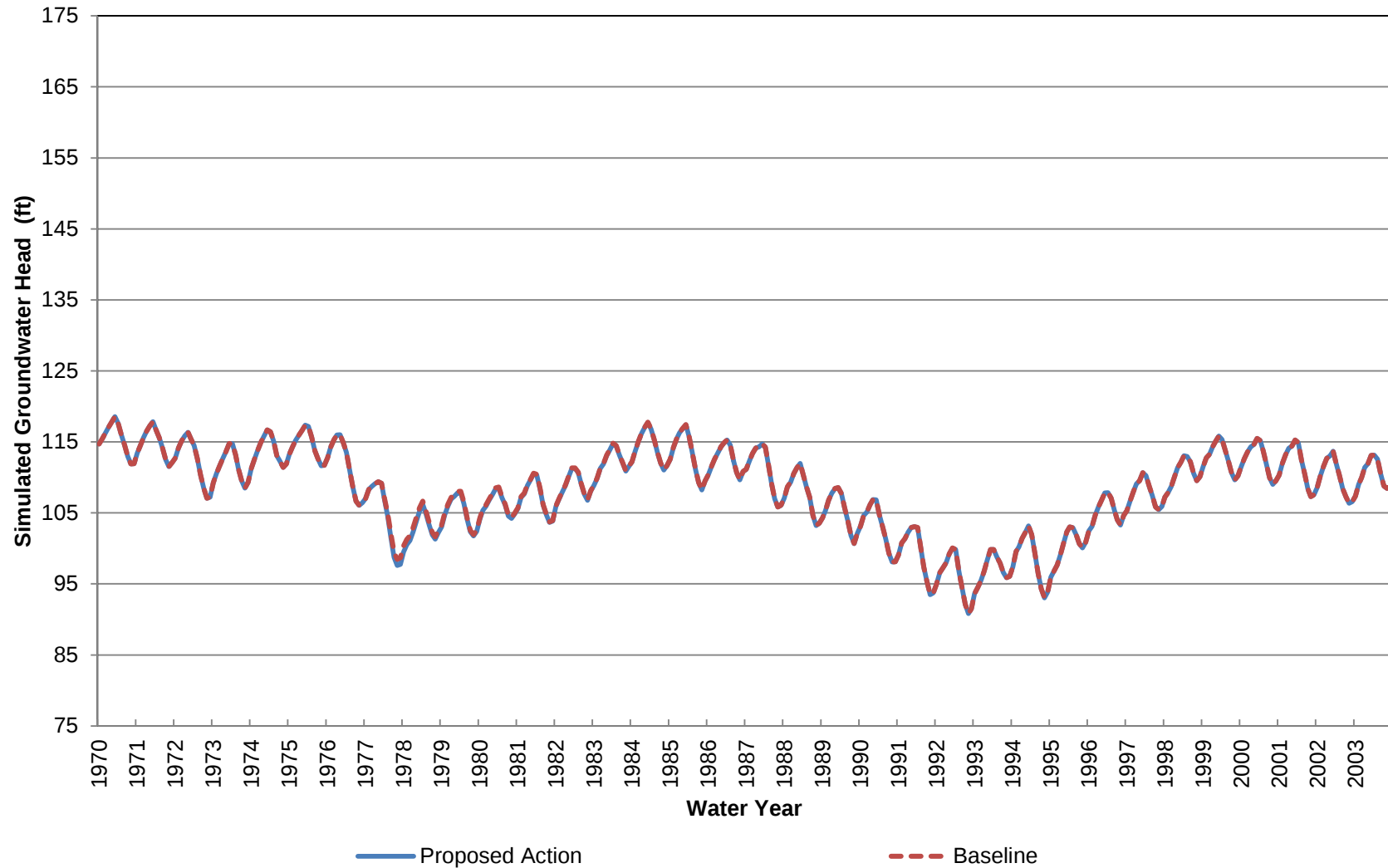
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 10 (Approximately 240-420 ft bgs)**



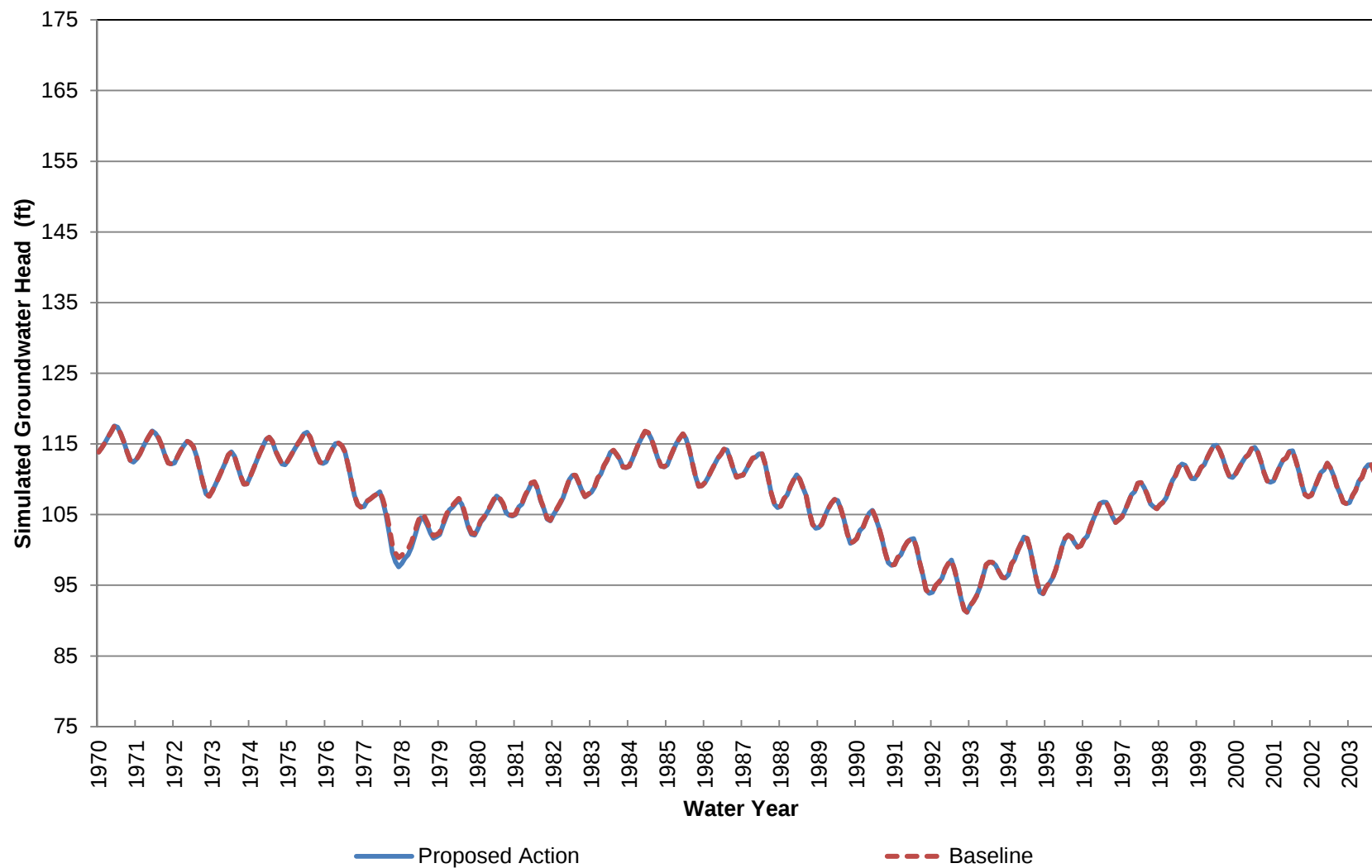
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 10 (Approximately 420-590 ft bgs)**



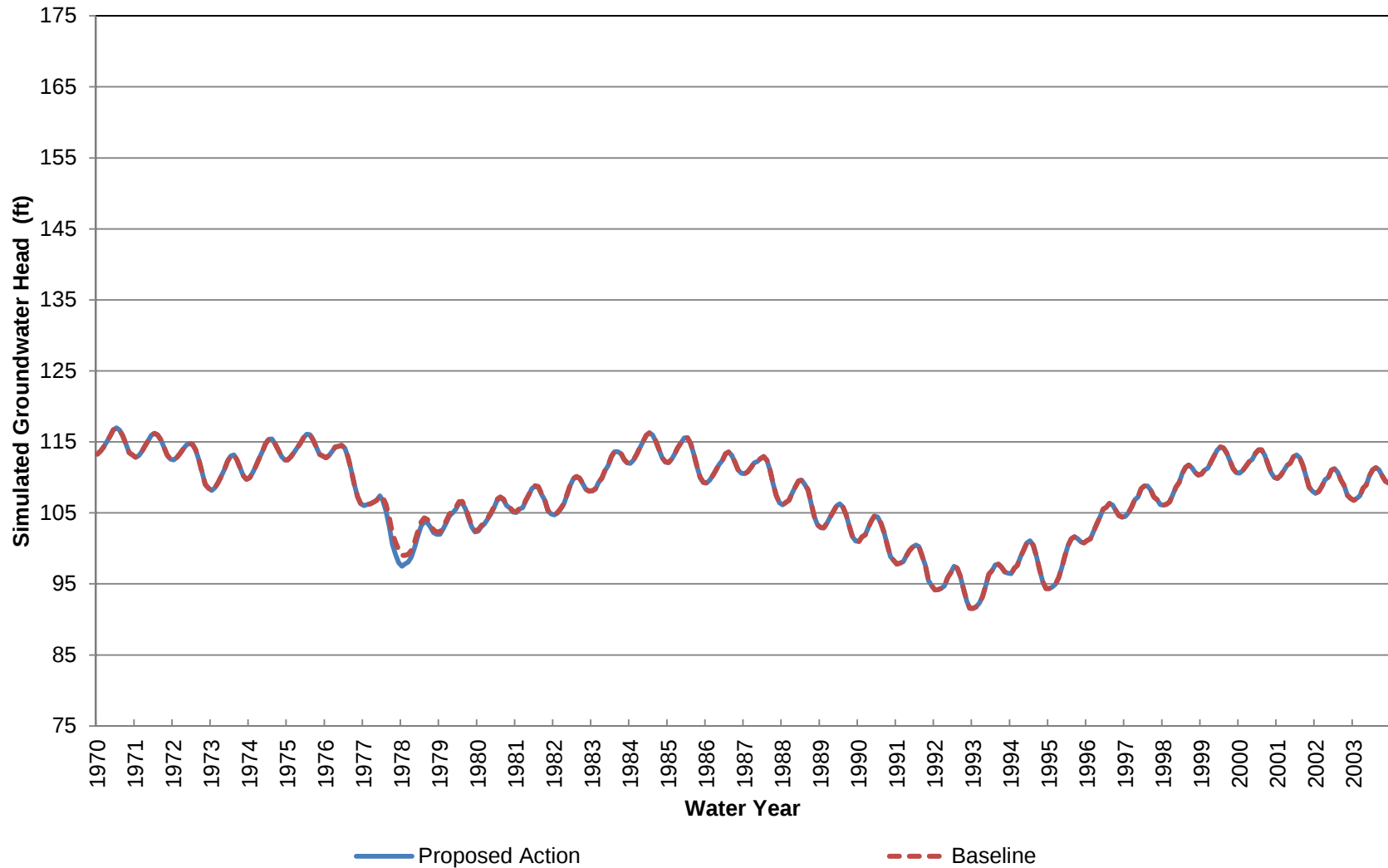
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 10 (Approximately 590-870 ft bgs)**



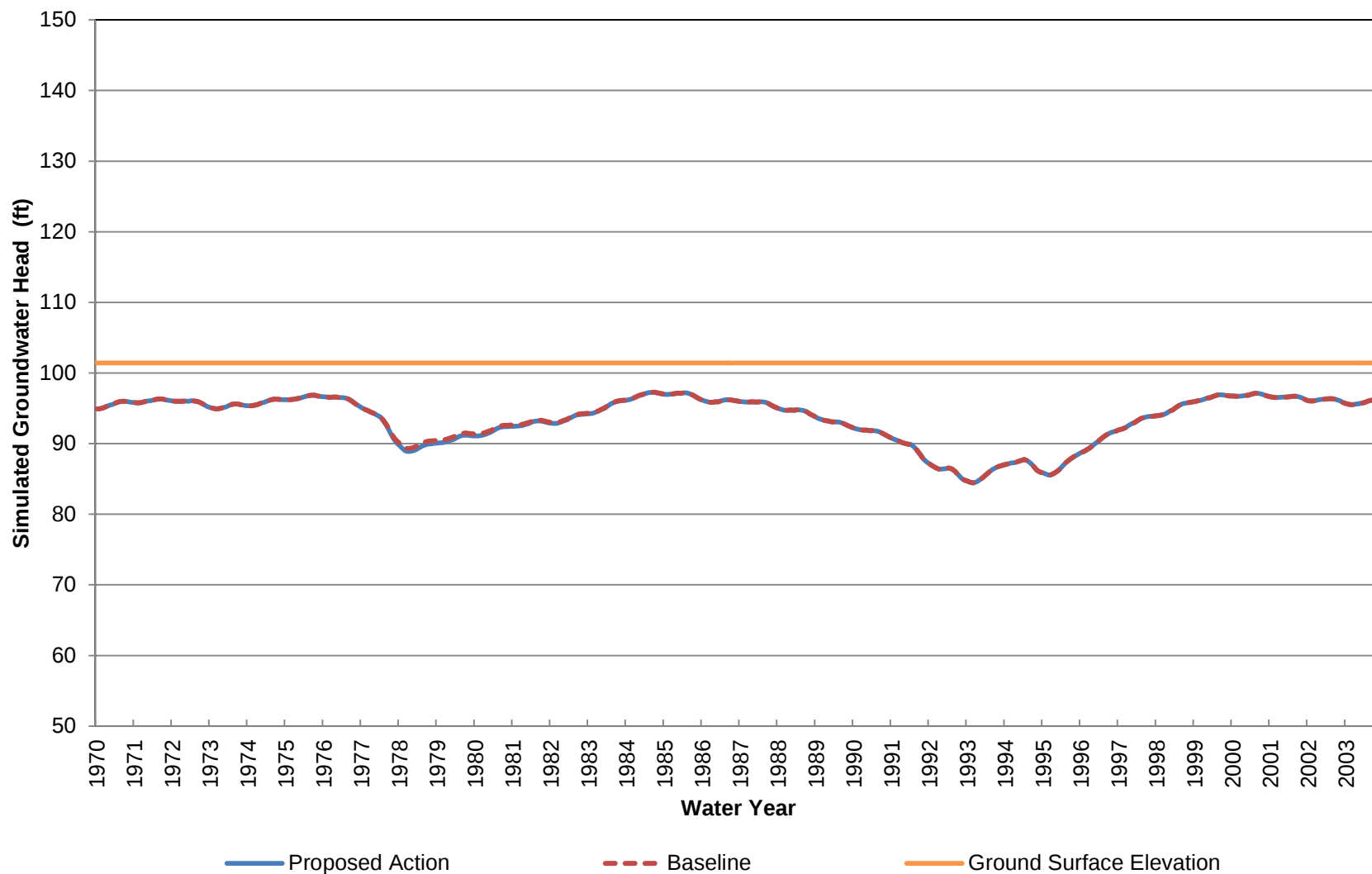
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 10 (Approximately 870-1160 ft bgs)**



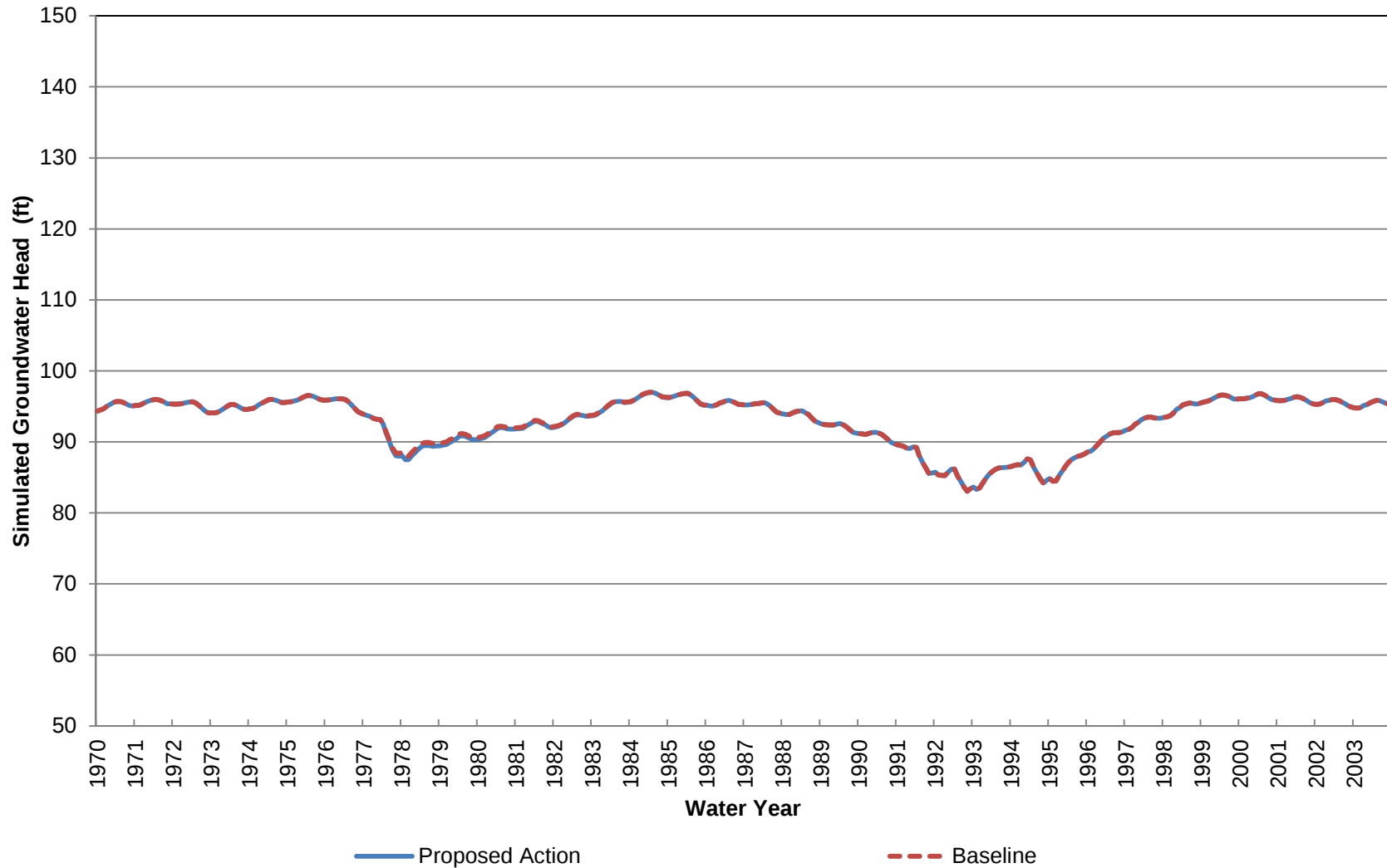
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 10 (Approximately 1160-1590 ft bgs)**



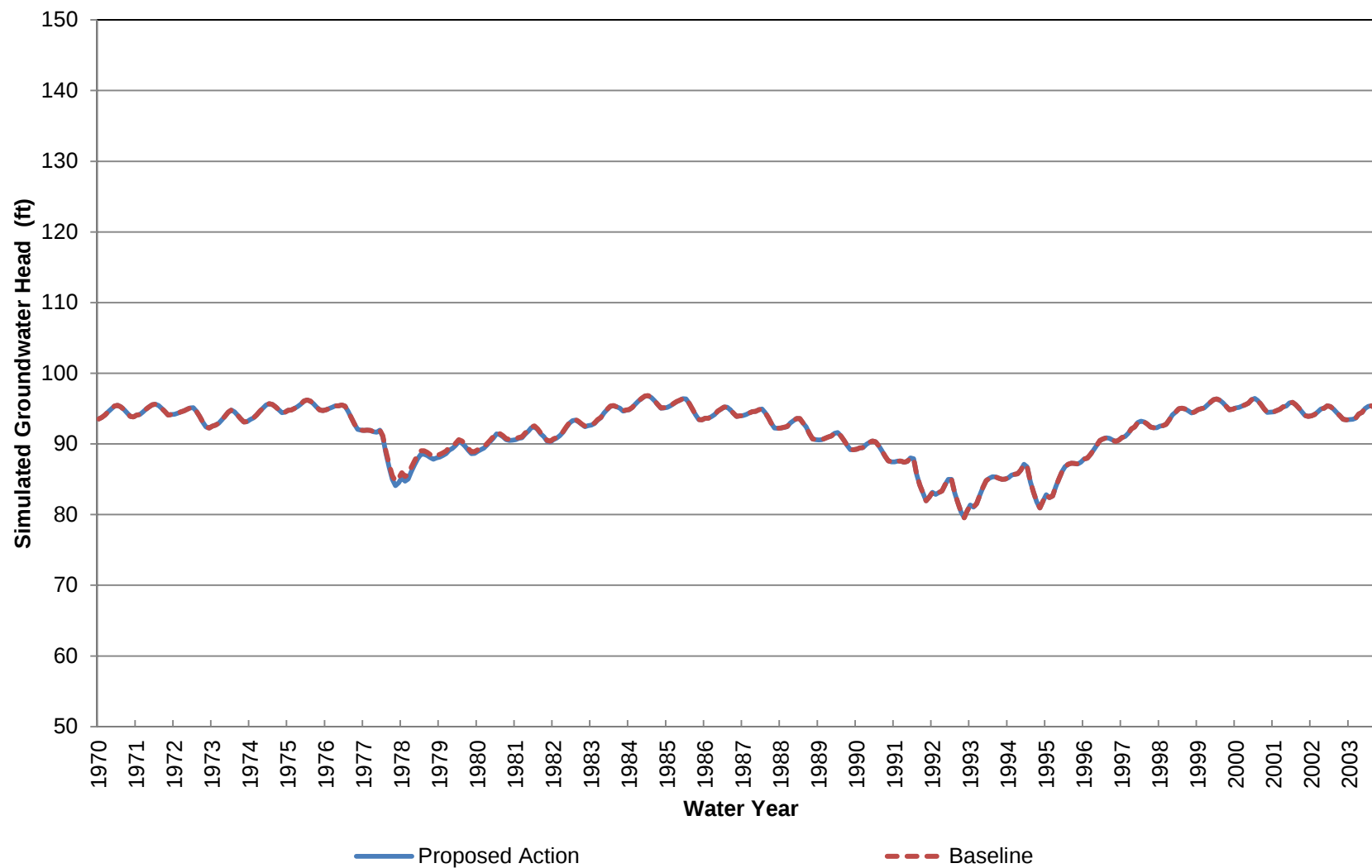
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 11 (Approximately 0-70 ft bgs)**



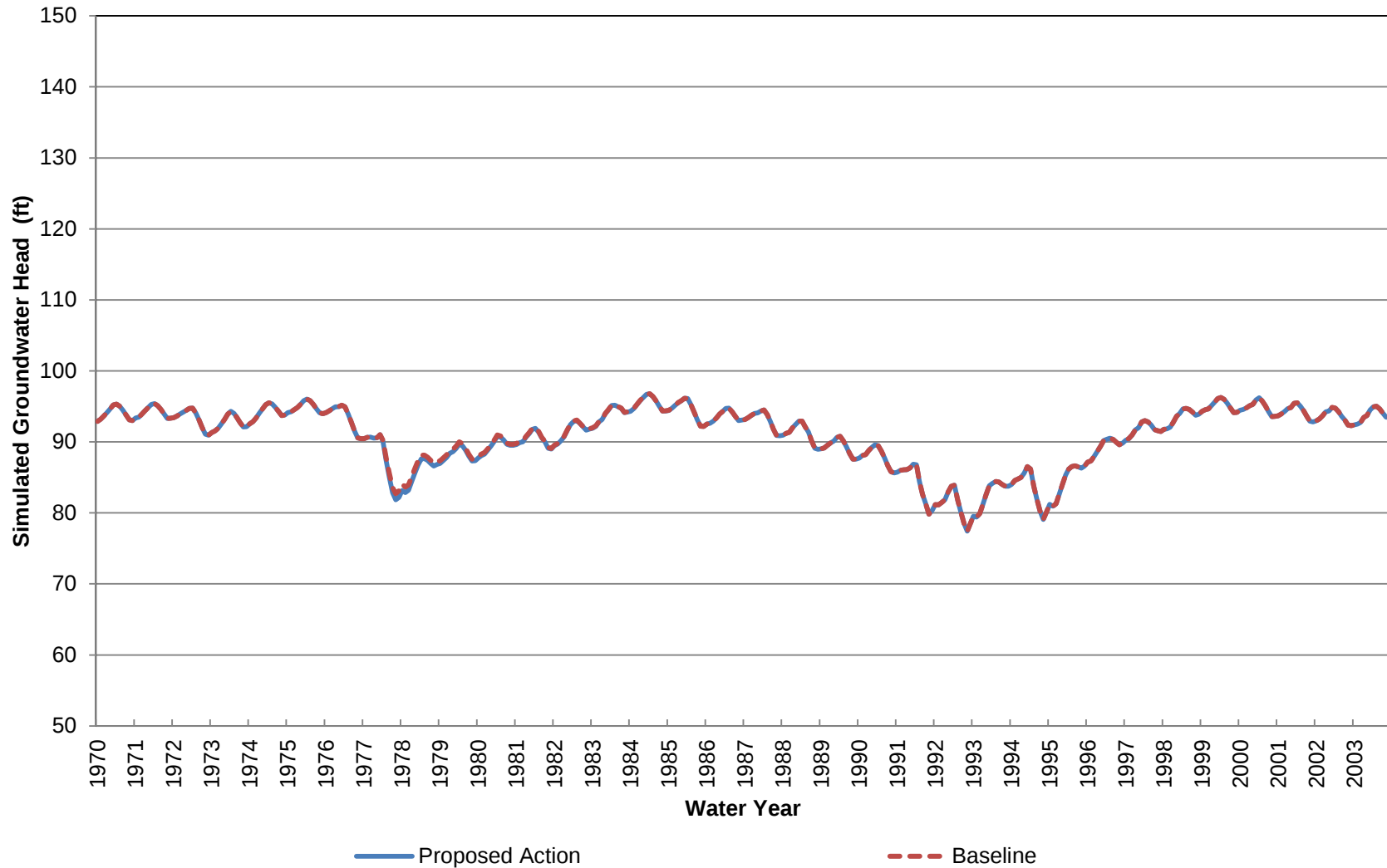
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 70-260 ft bgs)**



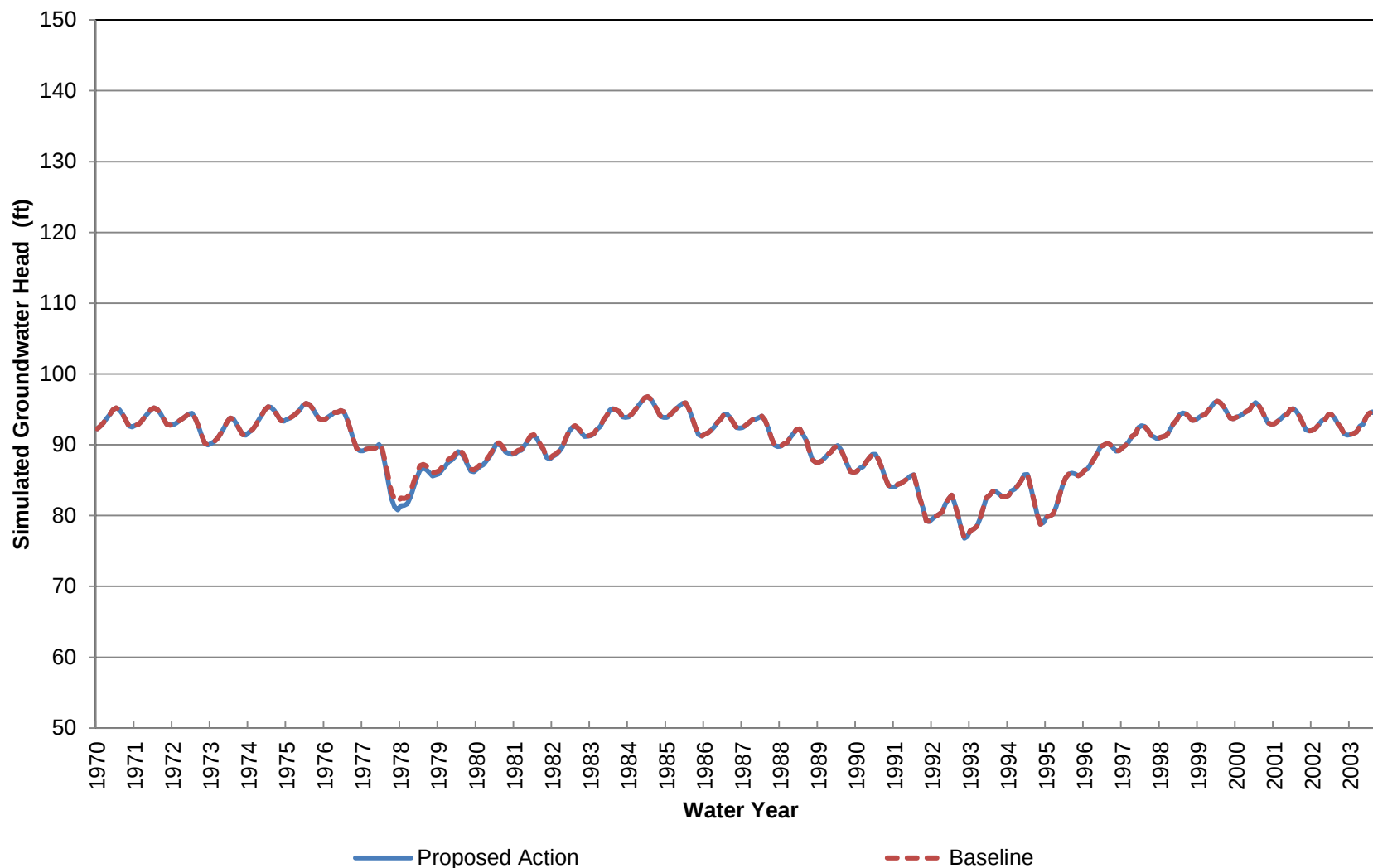
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 260-450 ft bgs)**



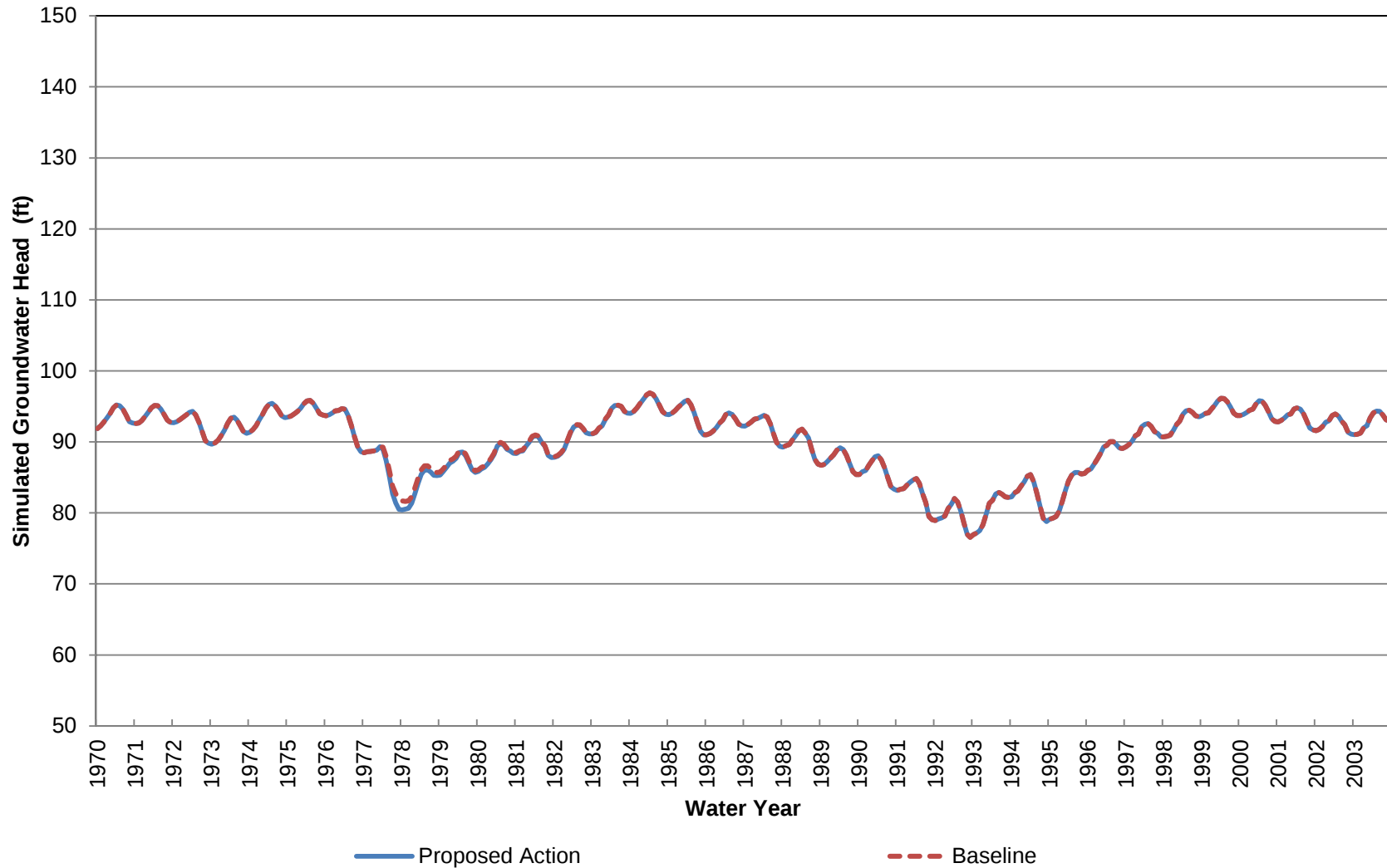
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 450-640 ft bgs)**



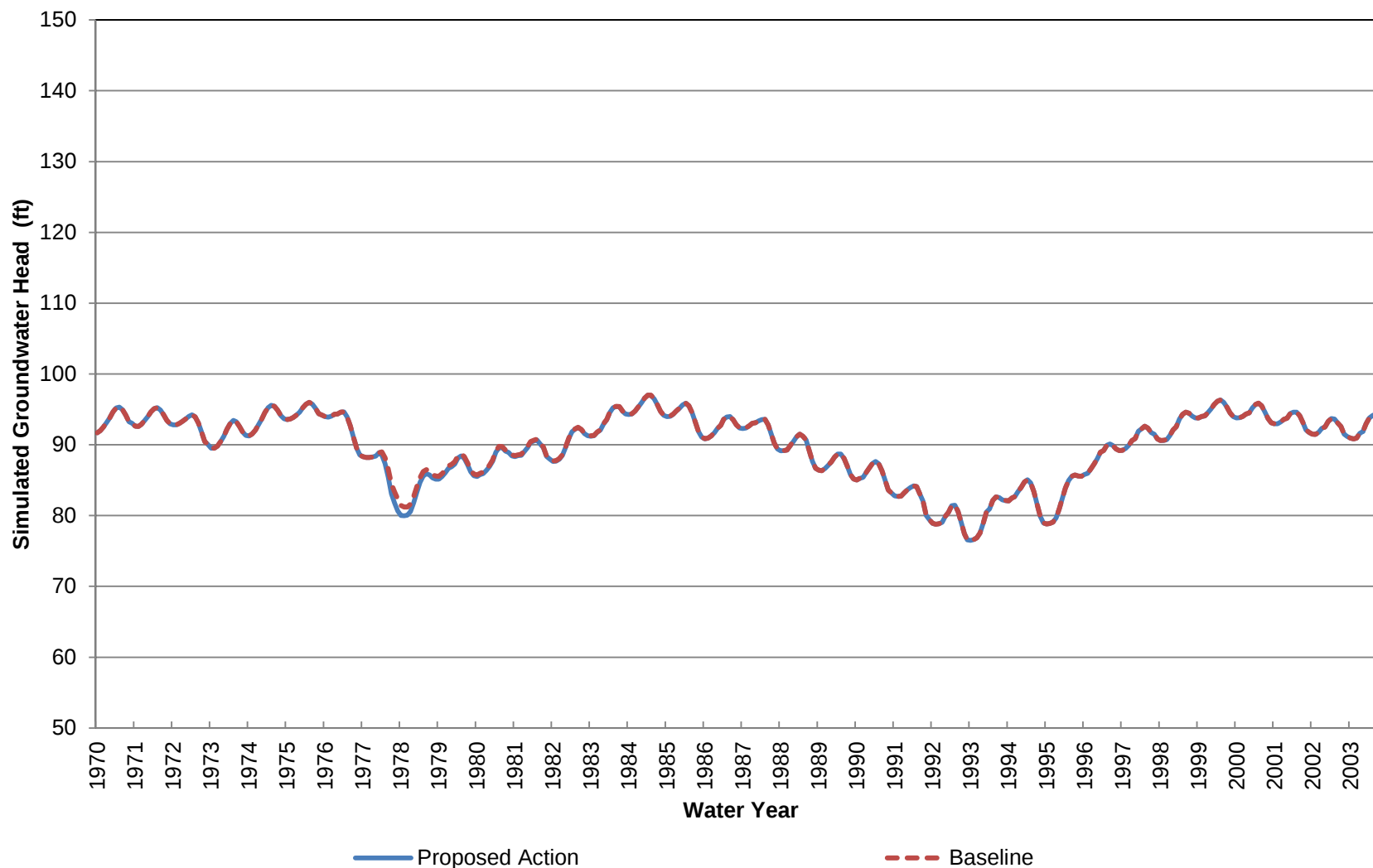
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 640-950 ft bgs)**



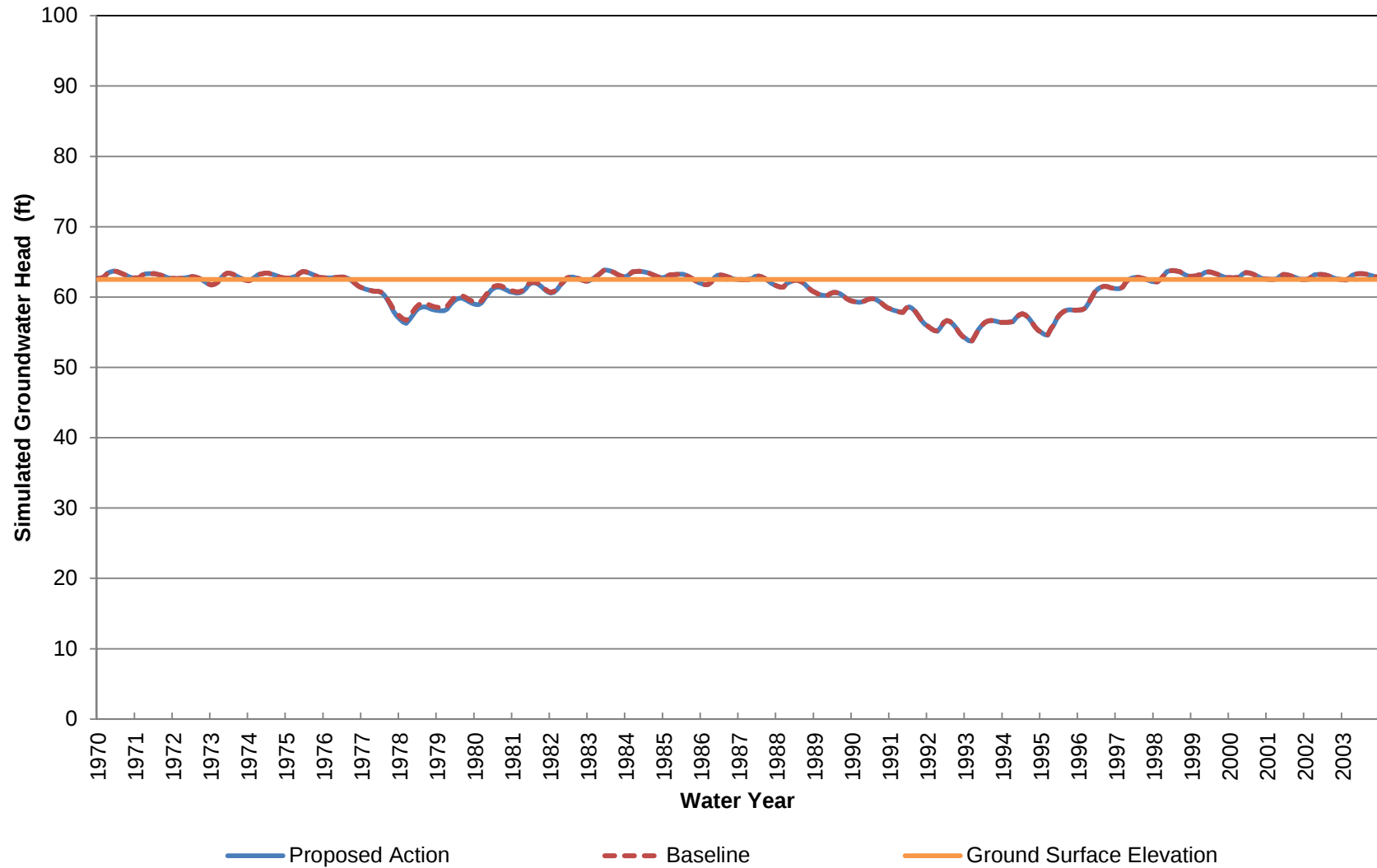
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 950-1260 ft bgs)**



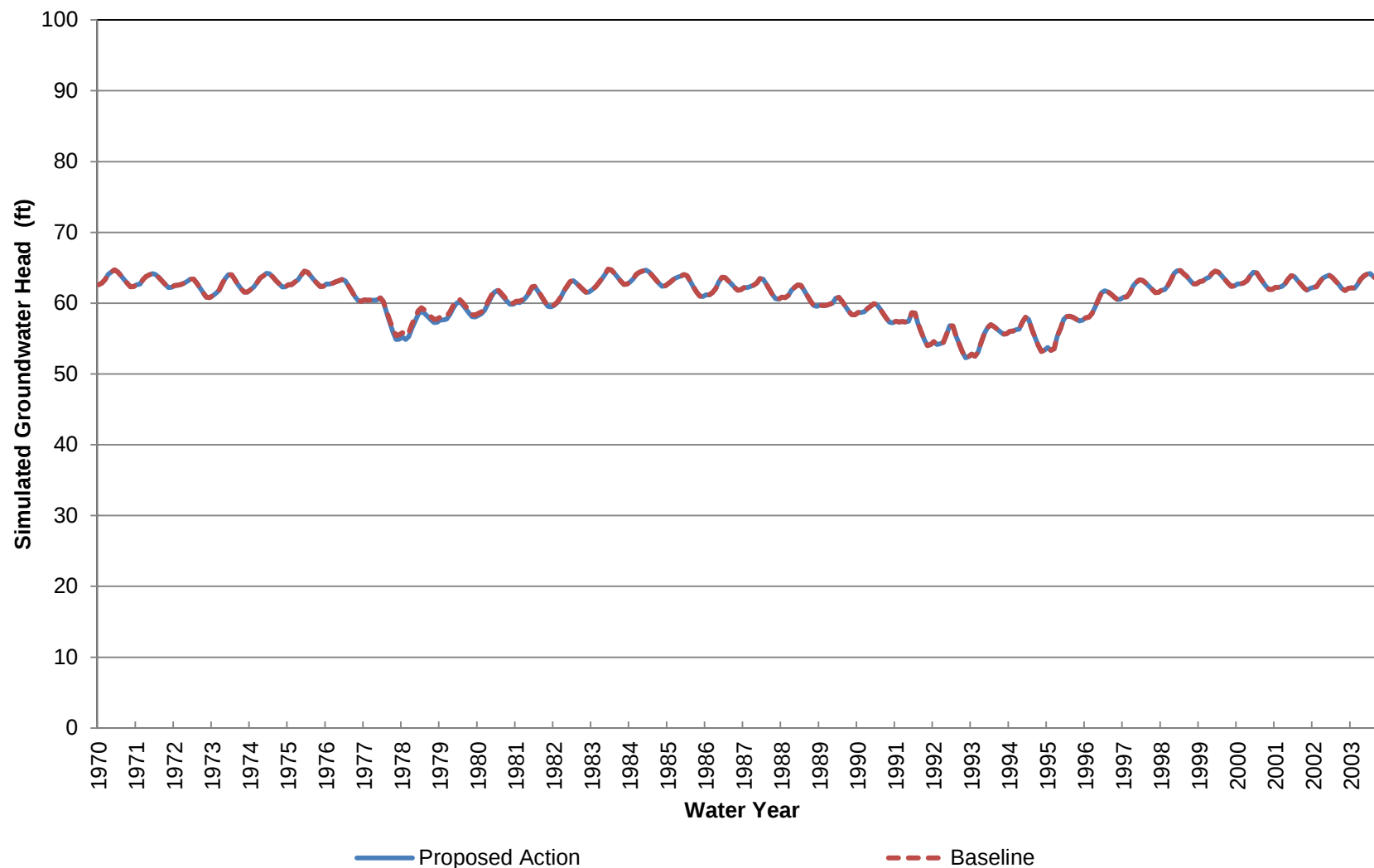
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 11 (Approximately 1260-1740 ft bgs)**



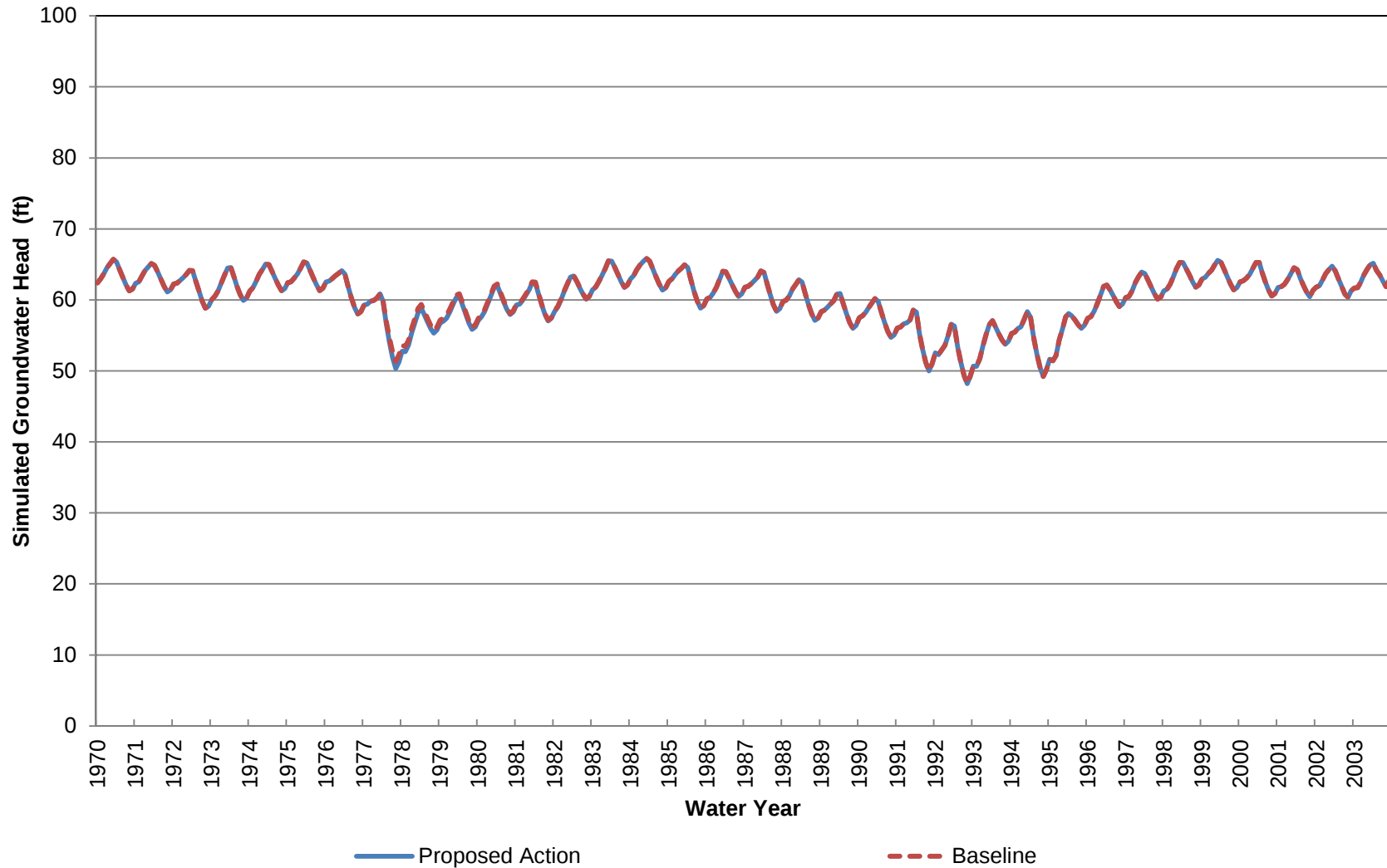
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 12 (Approximately 0-70 ft bgs)**



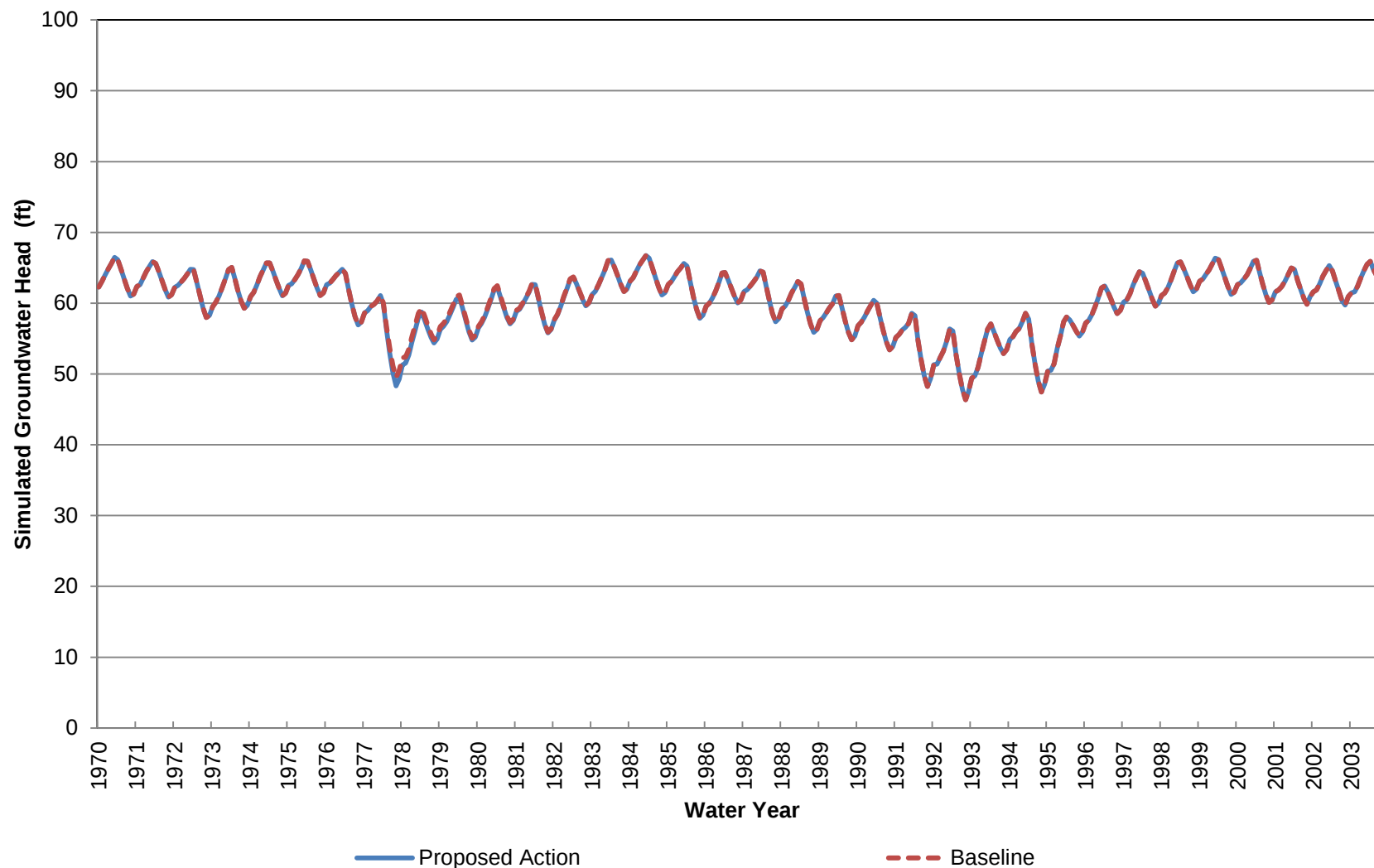
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 12 (Approximately 70-260 ft bgs)**



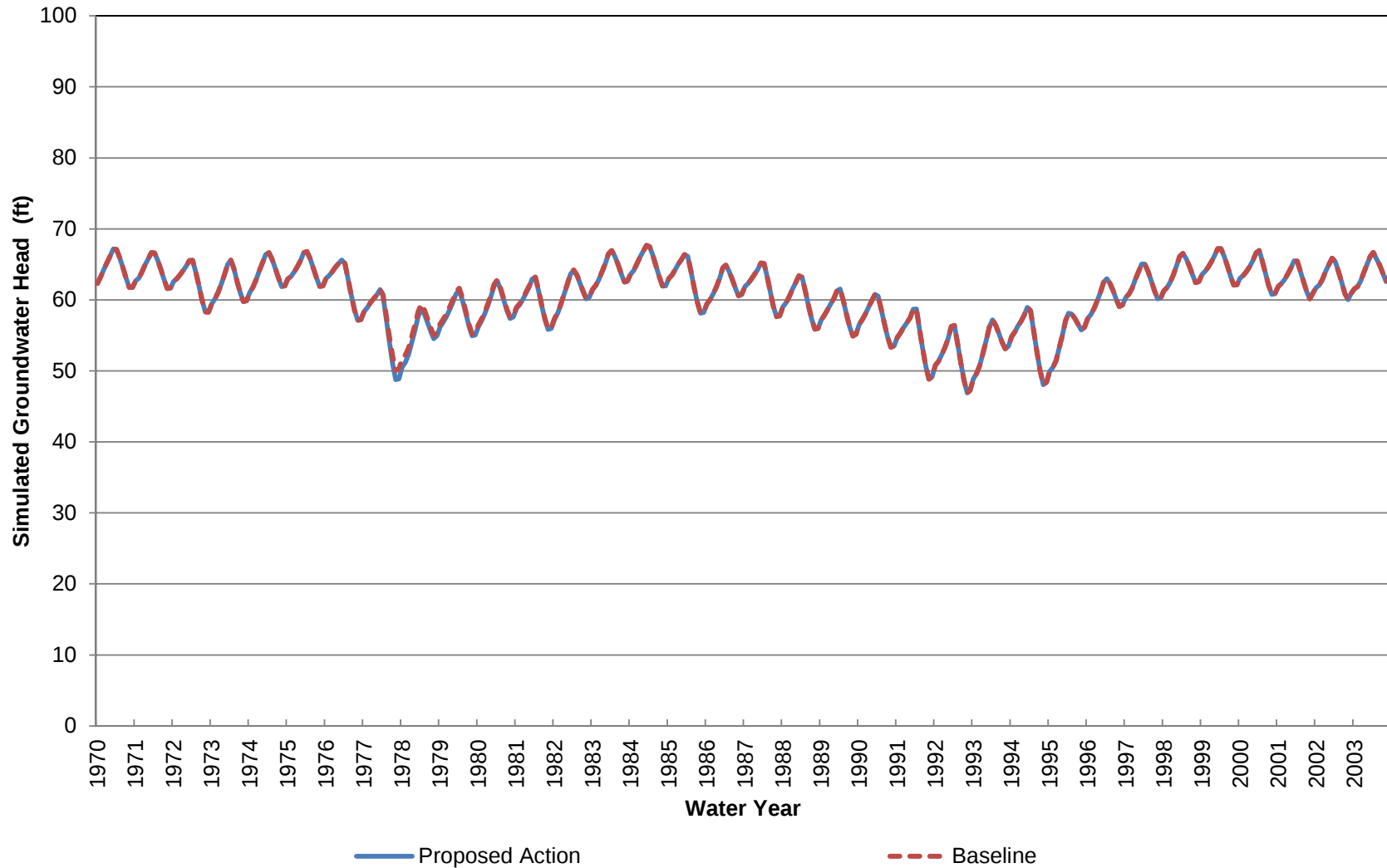
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 12 (Approximately 260-440 ft bgs)**



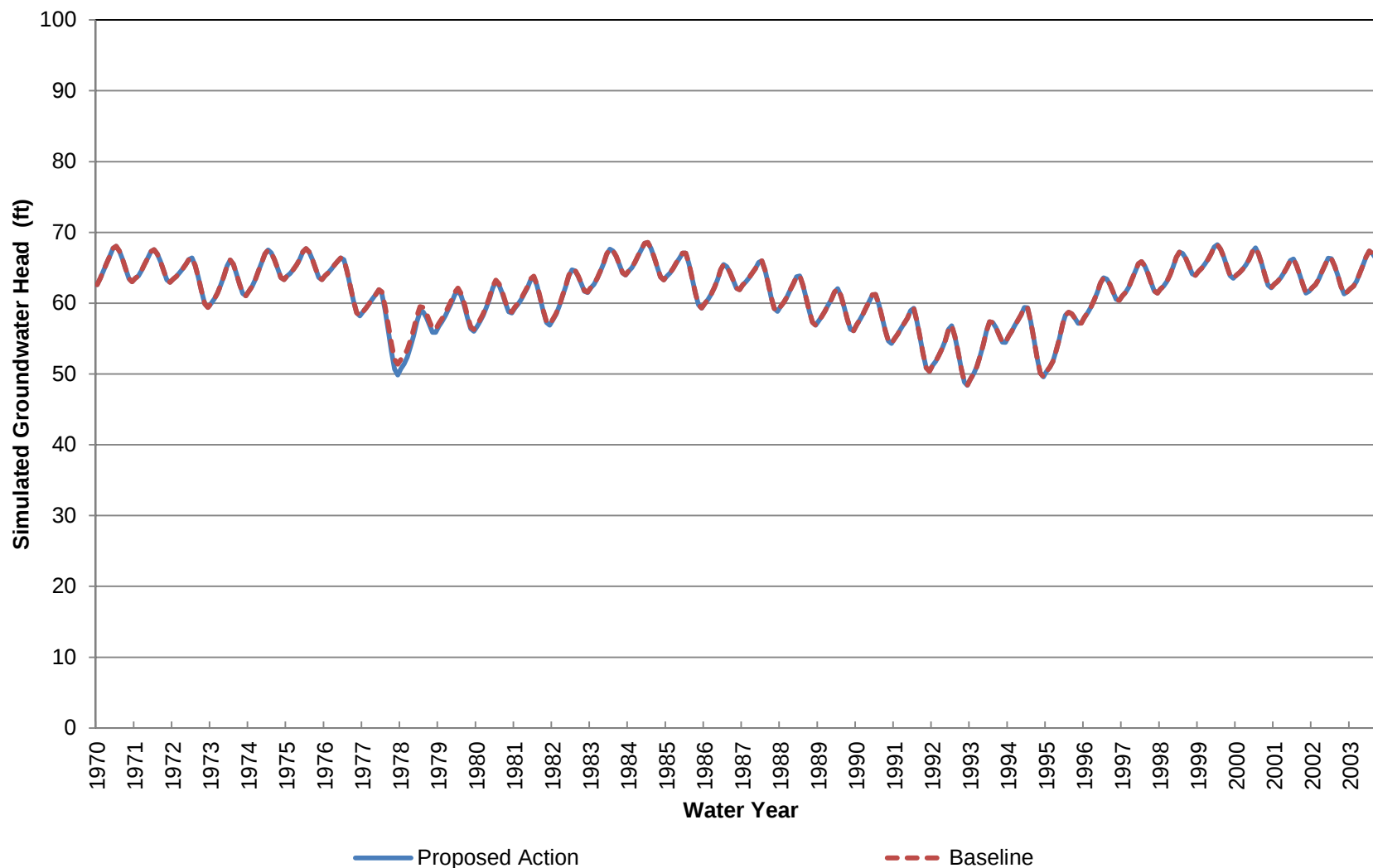
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 12 (Approximately 440-630 ft bgs)**



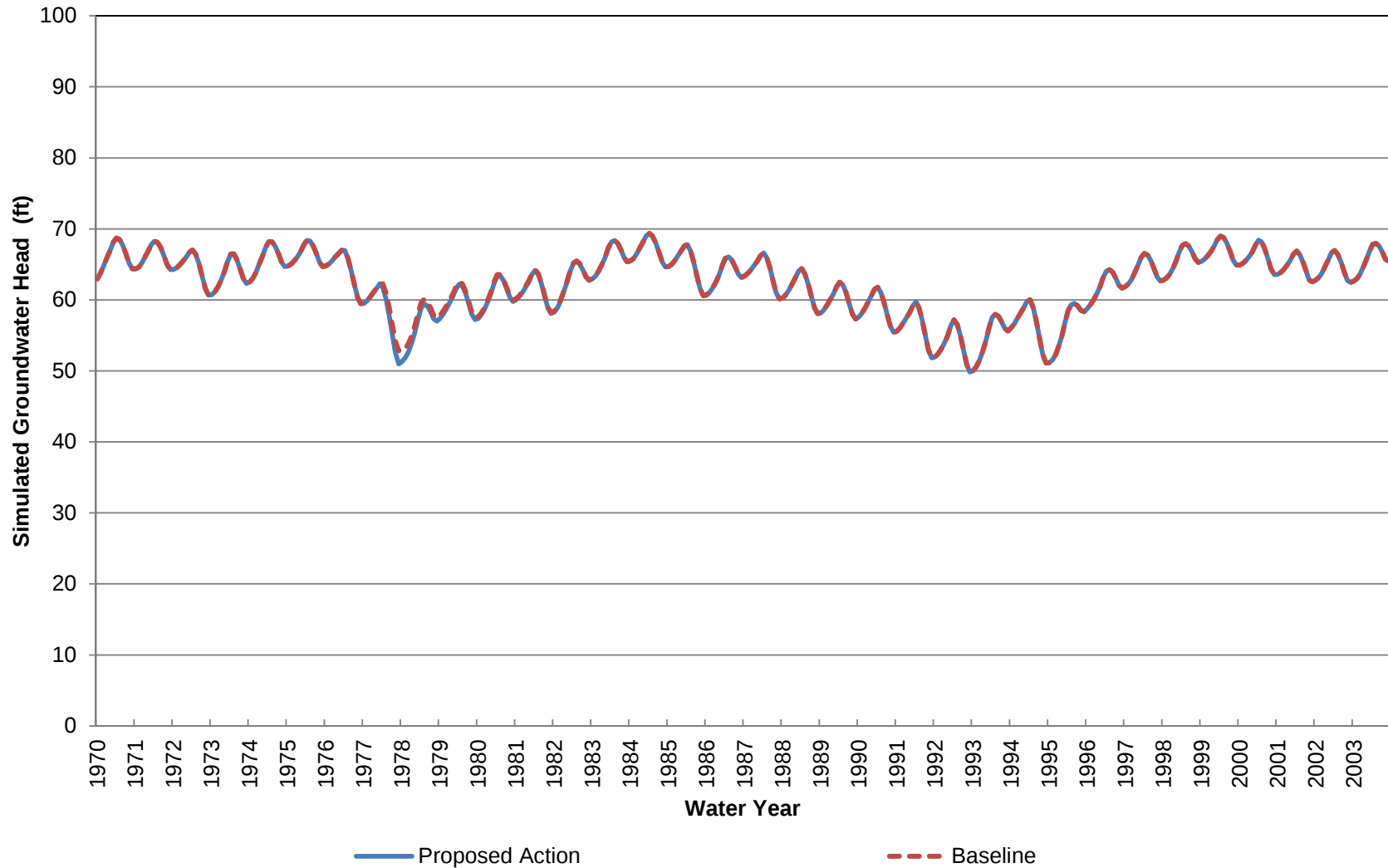
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 12 (Approximately 630-930 ft bgs)**



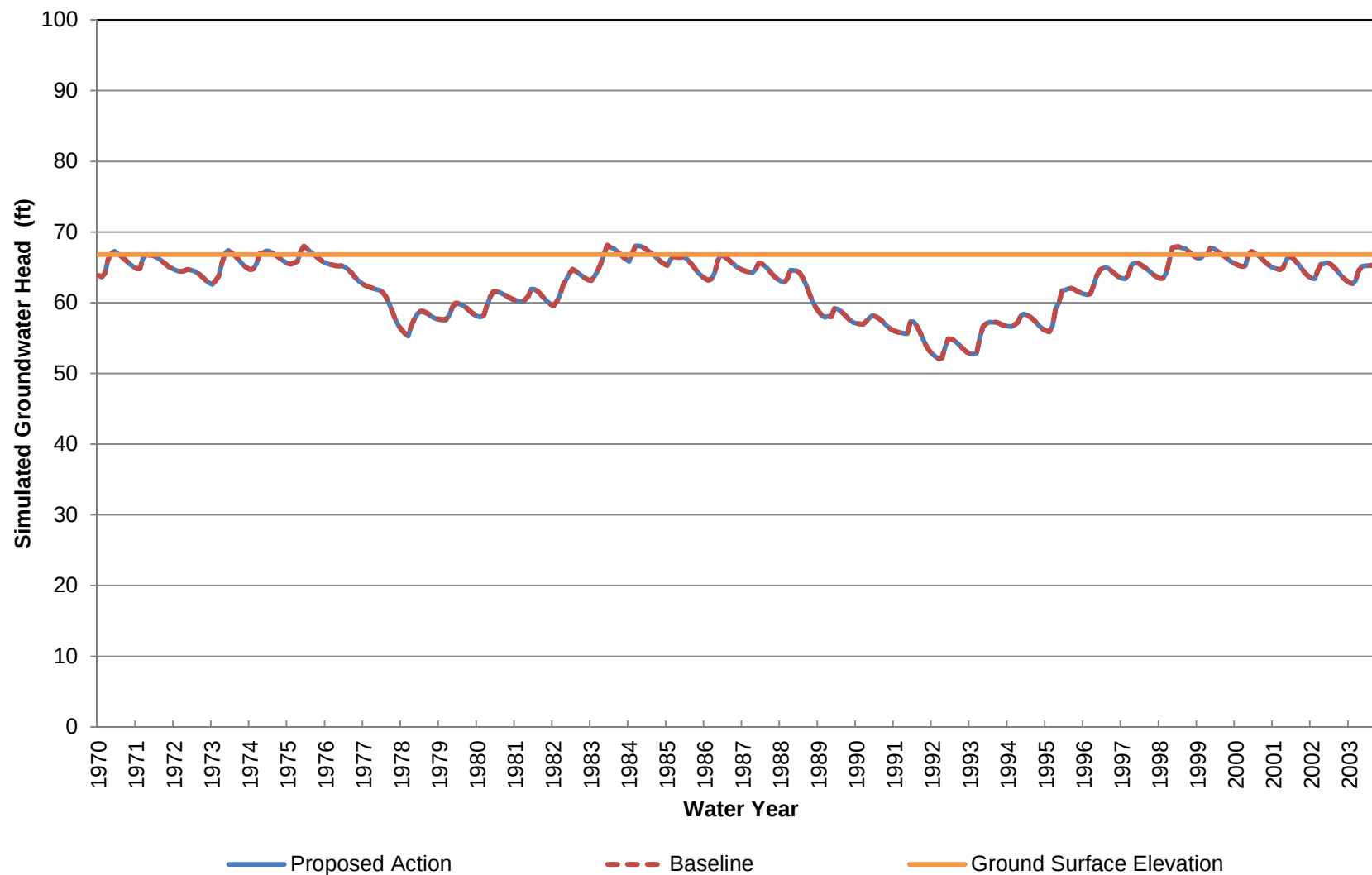
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 12 (Approximately 930-1240 ft bgs)**



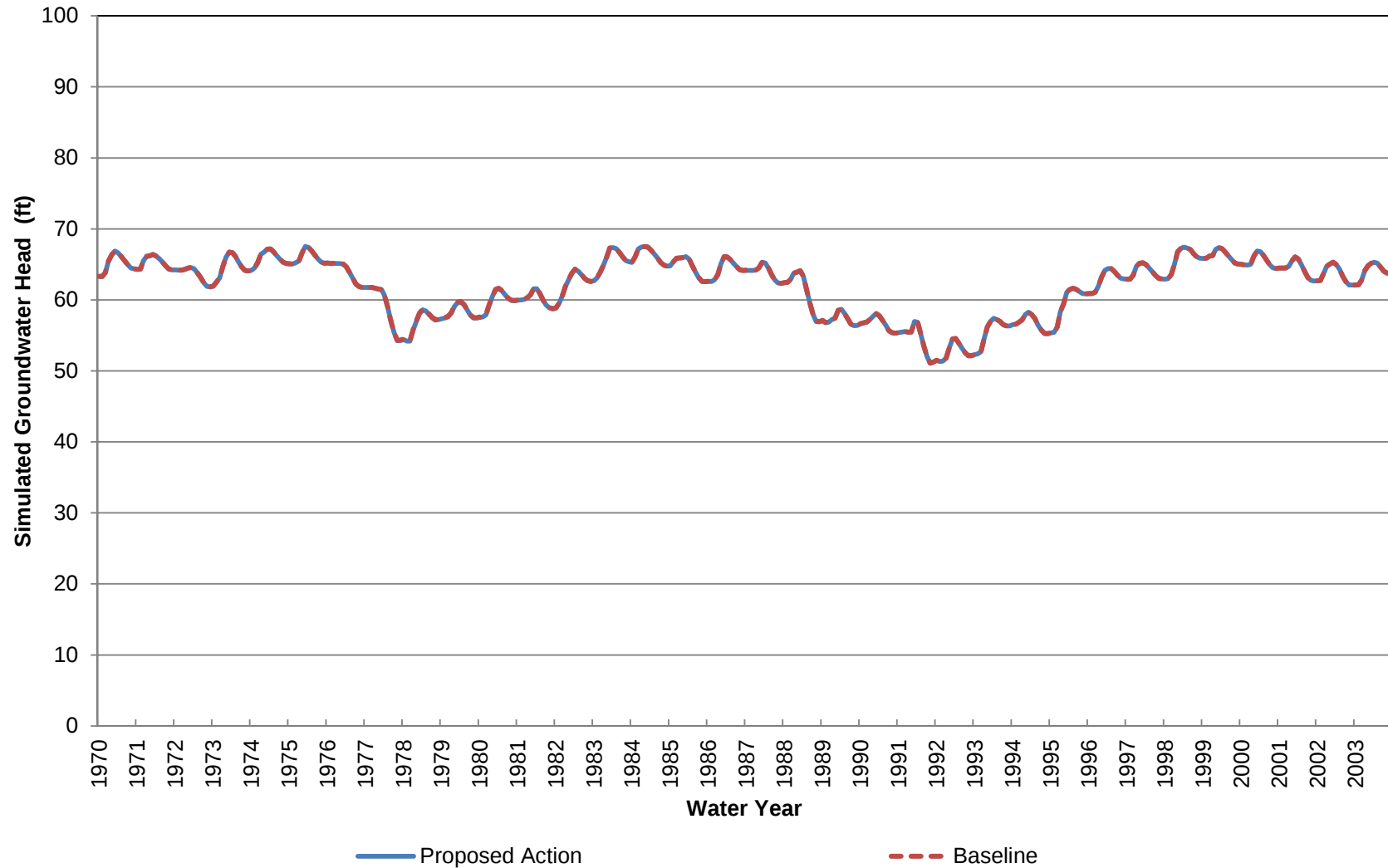
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 12 (Approximately 1240-1700 ft bgs)**



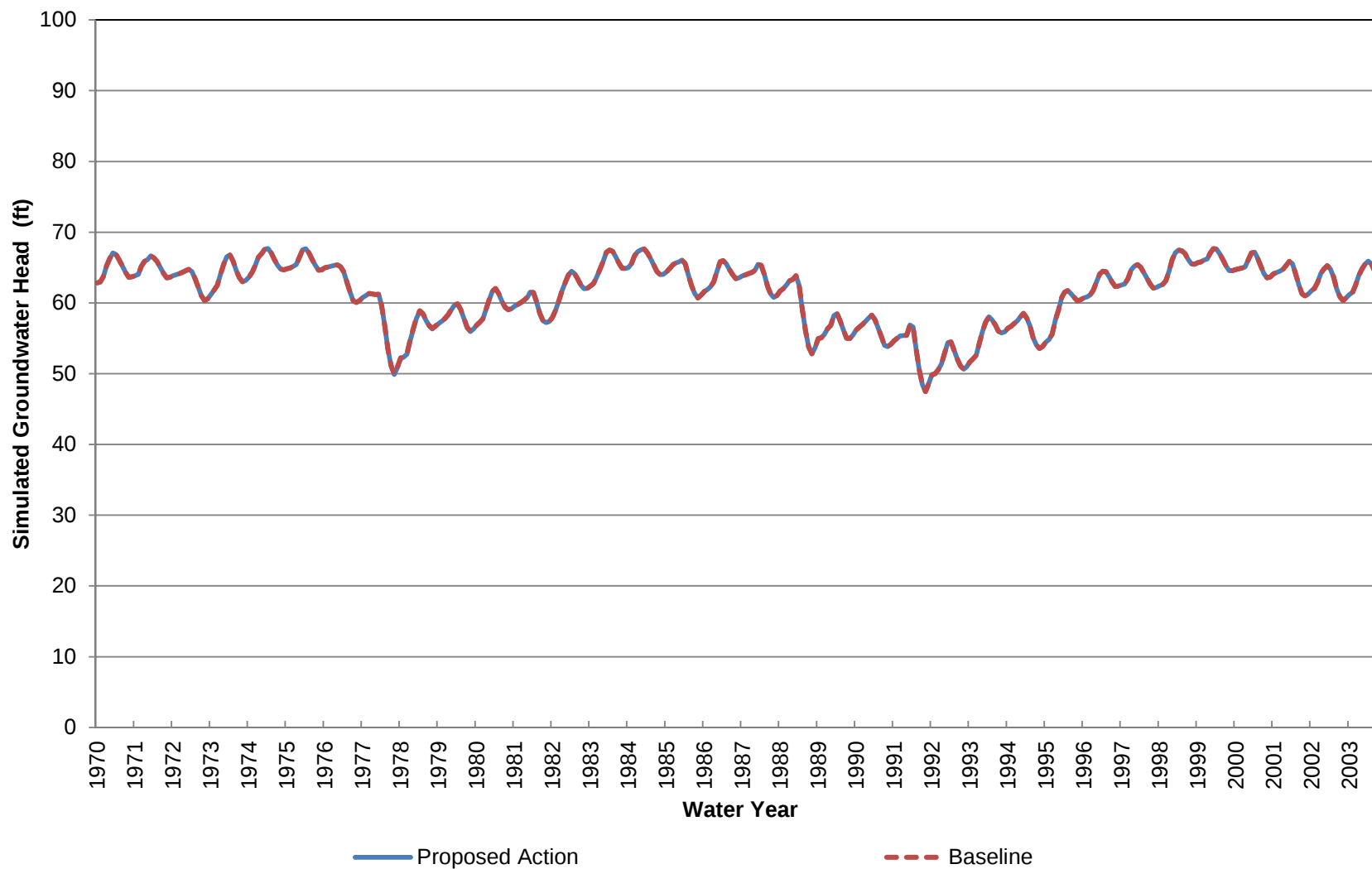
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 13 (Approximately 0-70 ft bgs)**



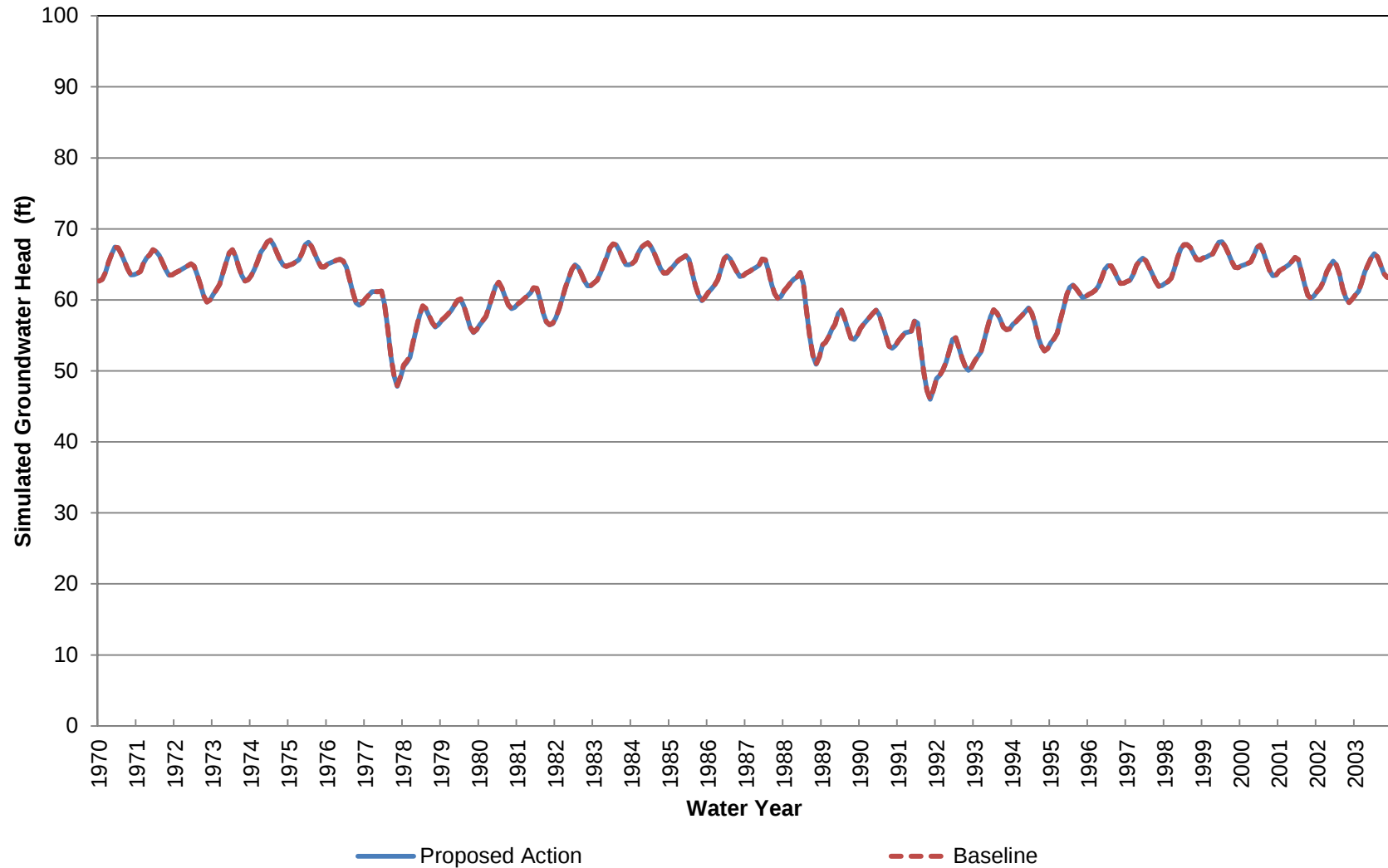
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 70-210 ft bgs)**



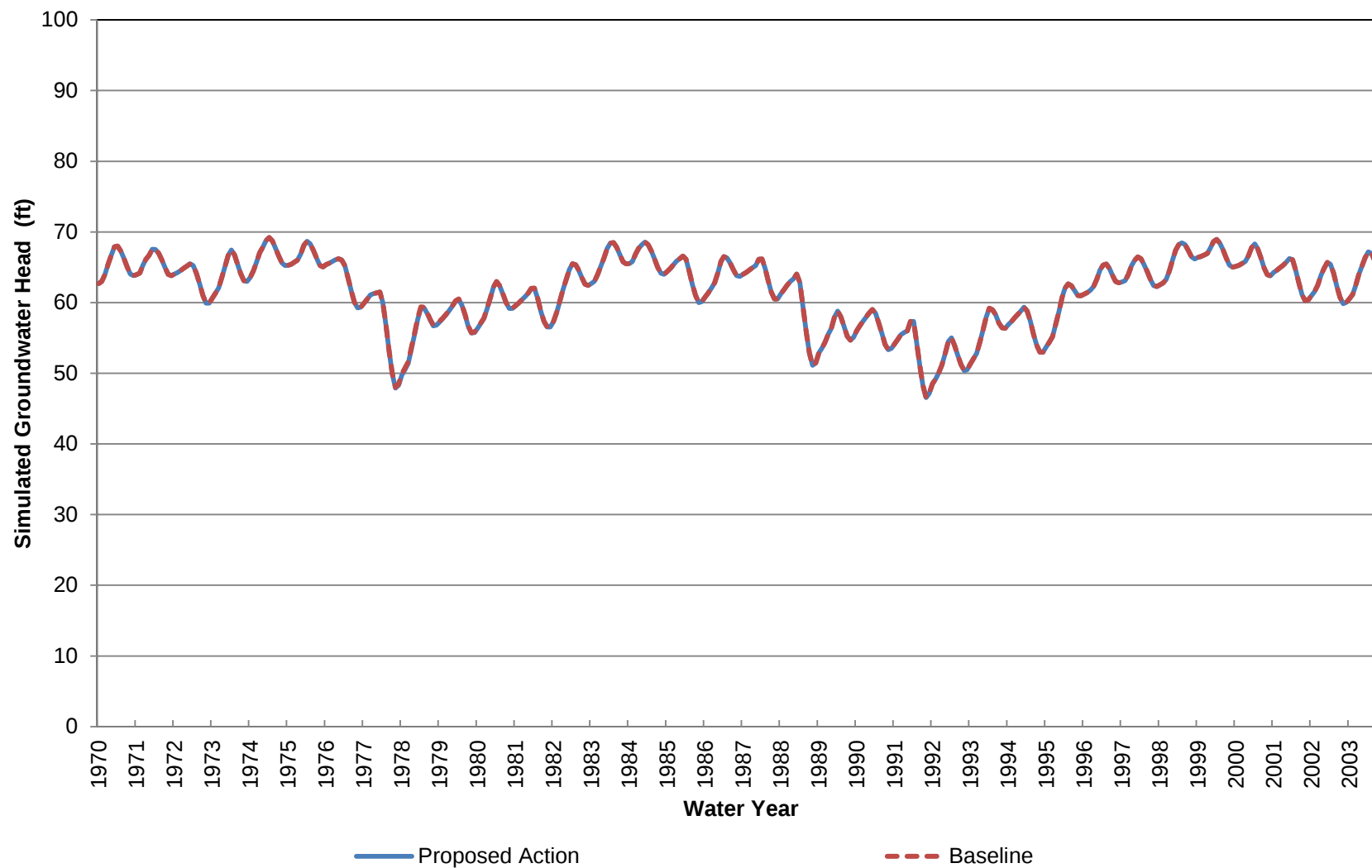
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 210-350 ft bgs)**



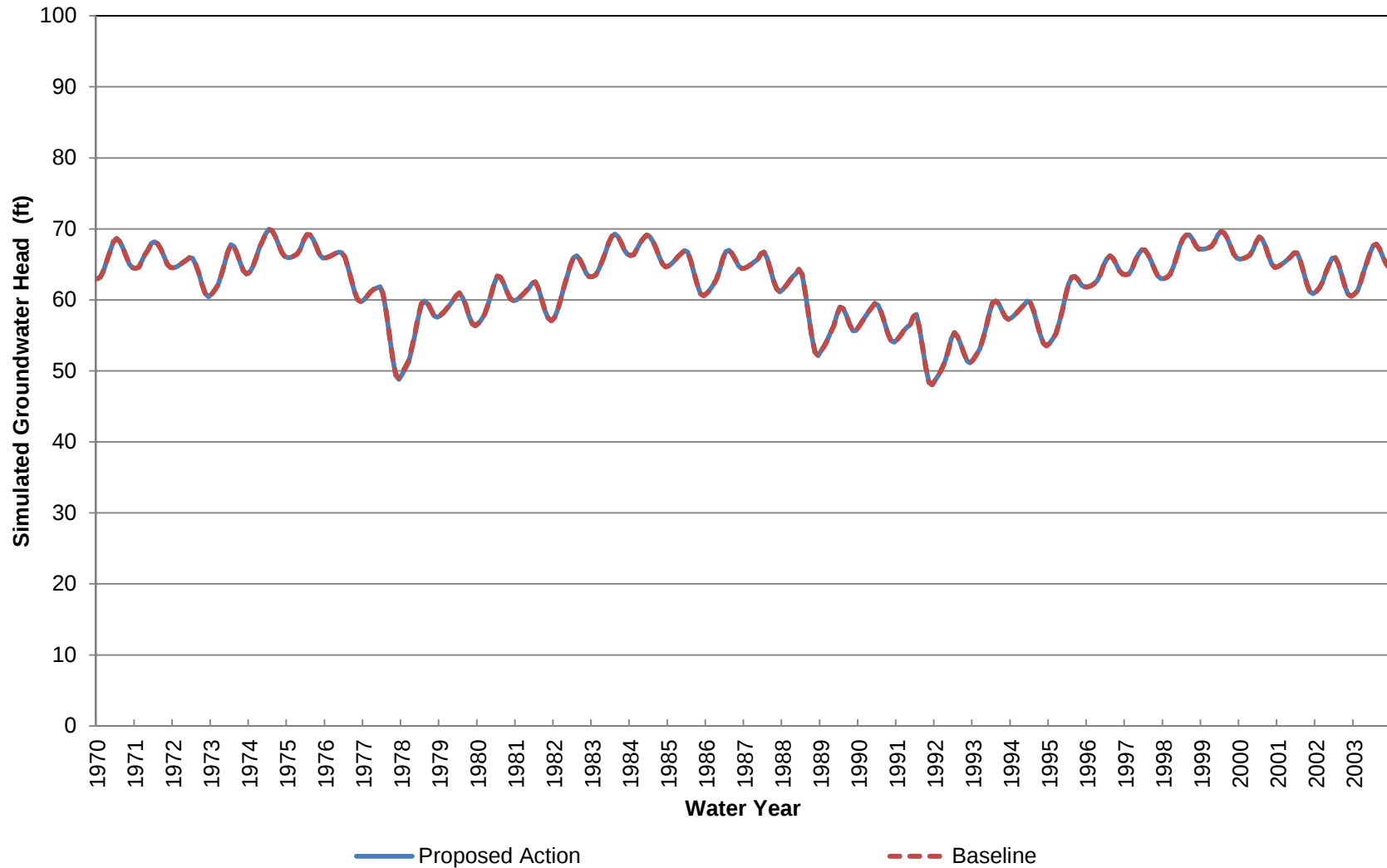
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 350-490 ft bgs)**



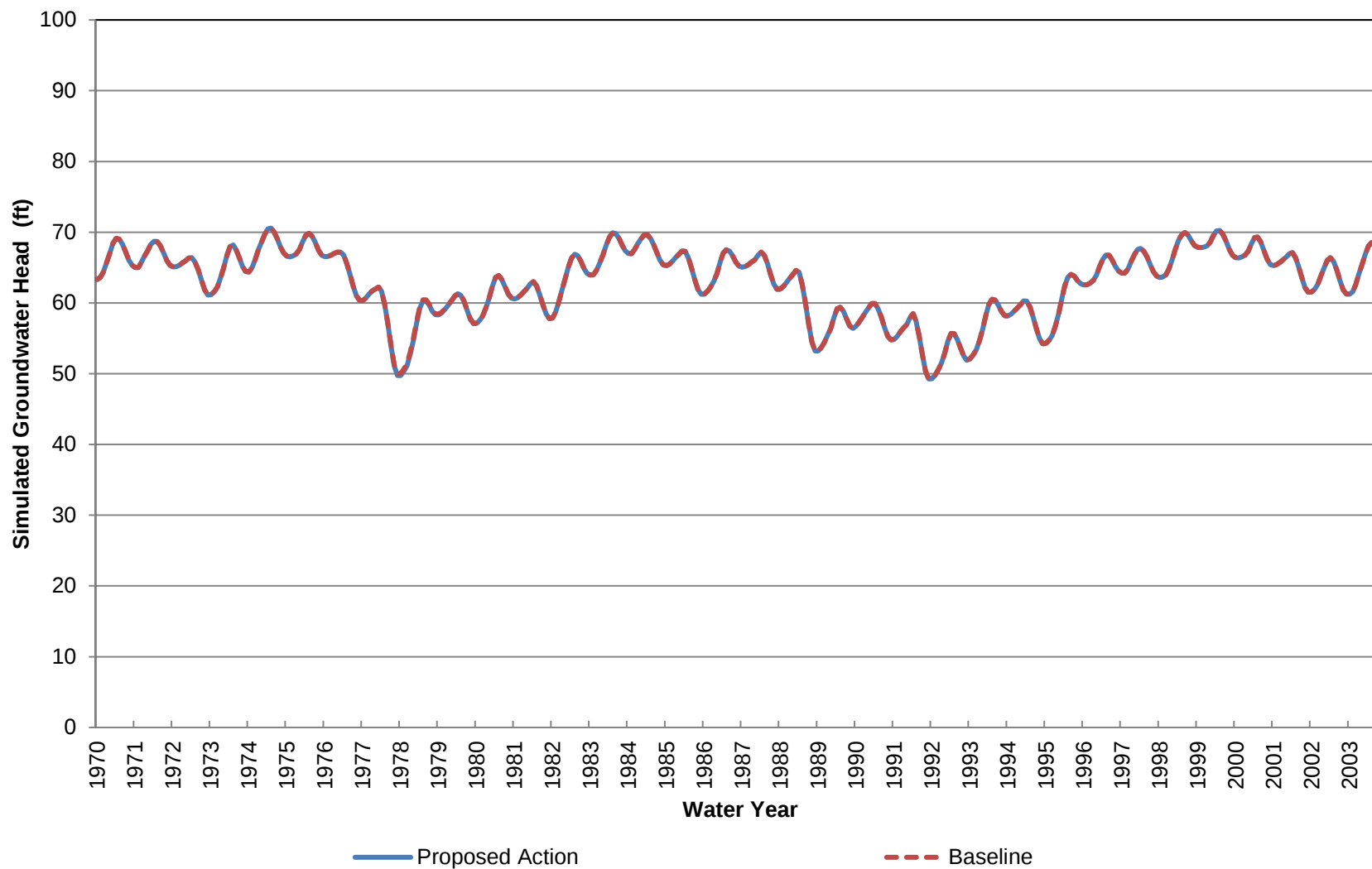
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 490-700 ft bgs)**



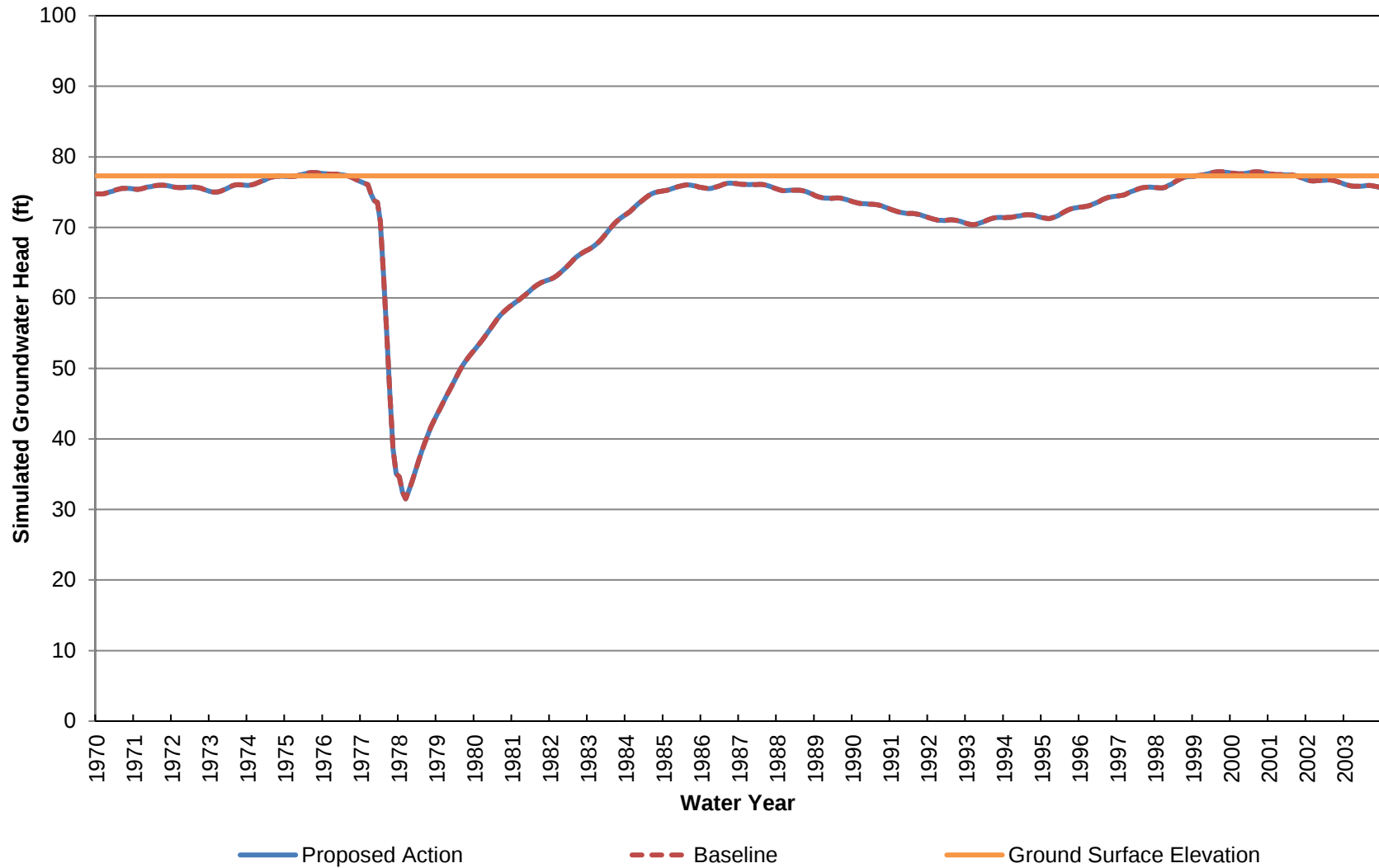
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 700-930 ft bgs)**



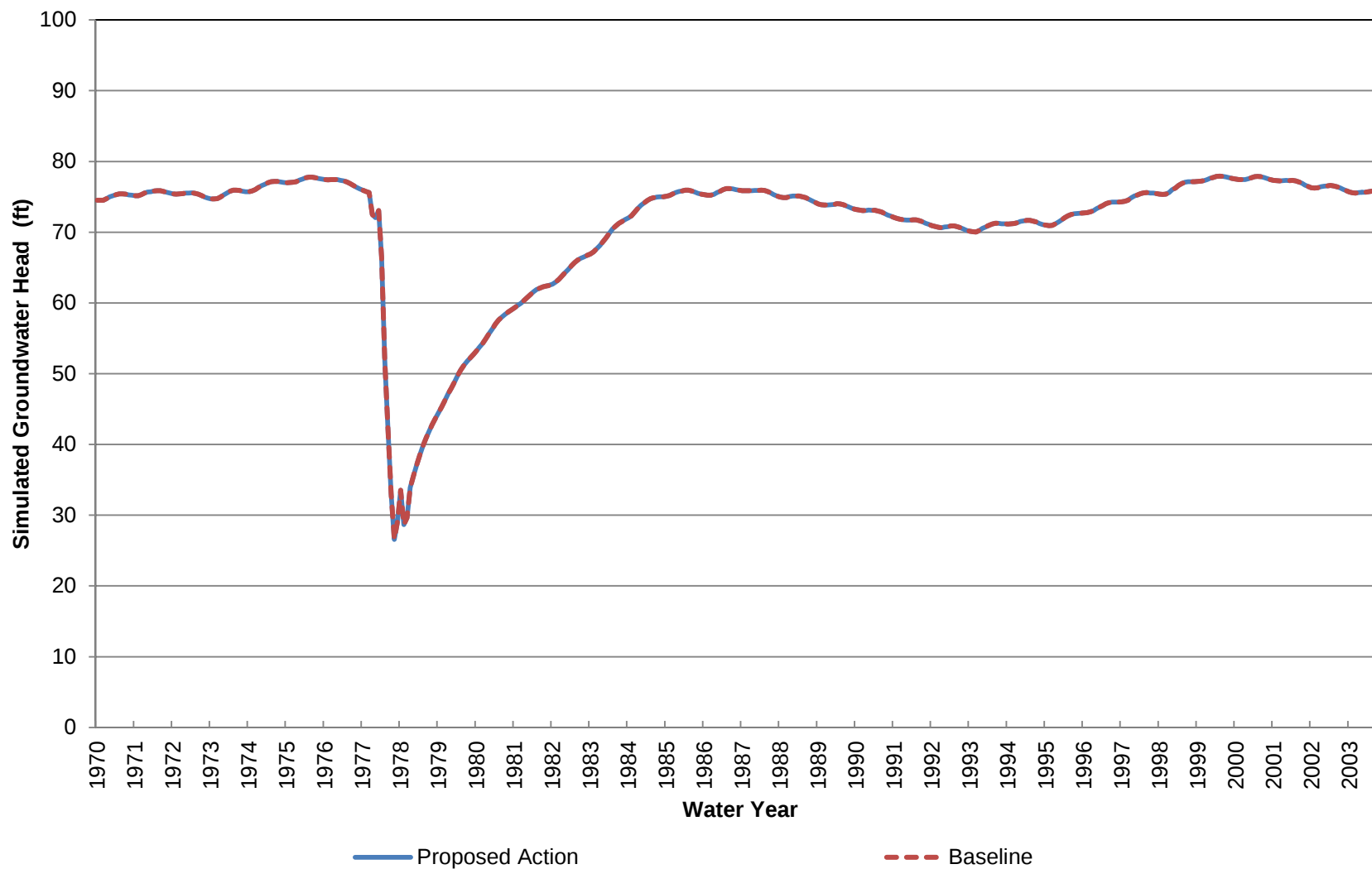
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 13 (Approximately 930-1280 ft bgs)**



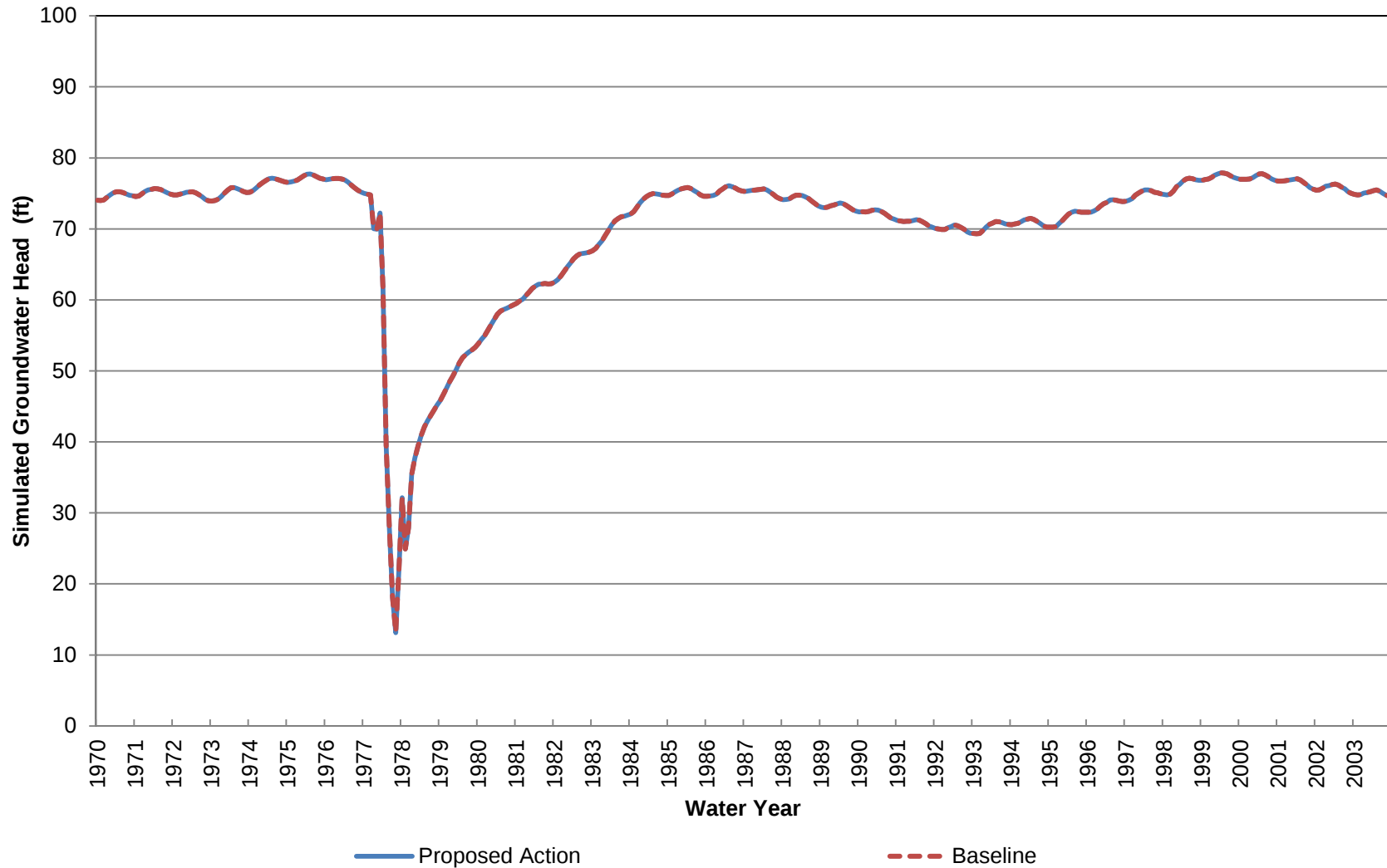
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 14 (Approximately 0-40 ft bgs)**



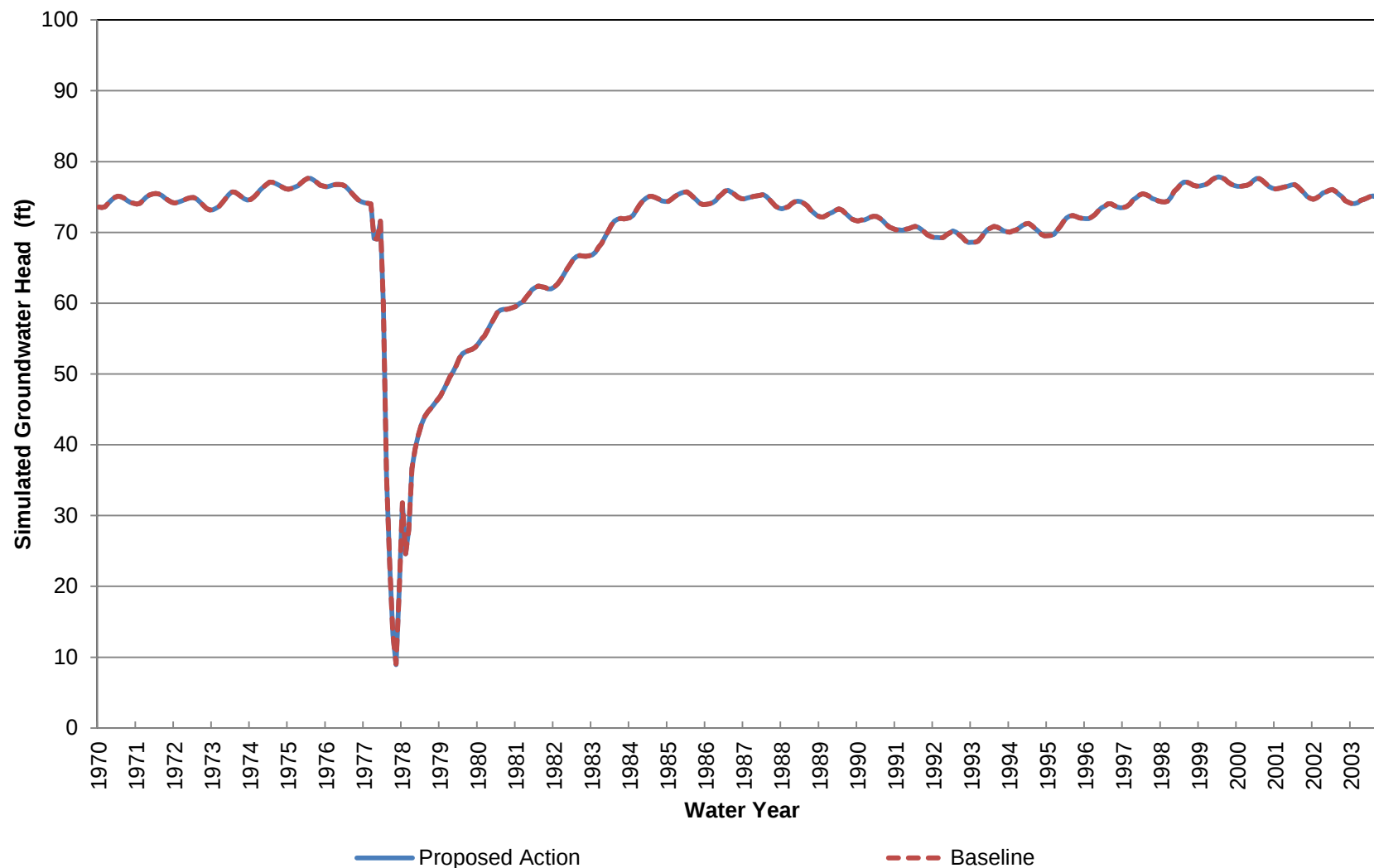
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 40-110 ft bgs)**



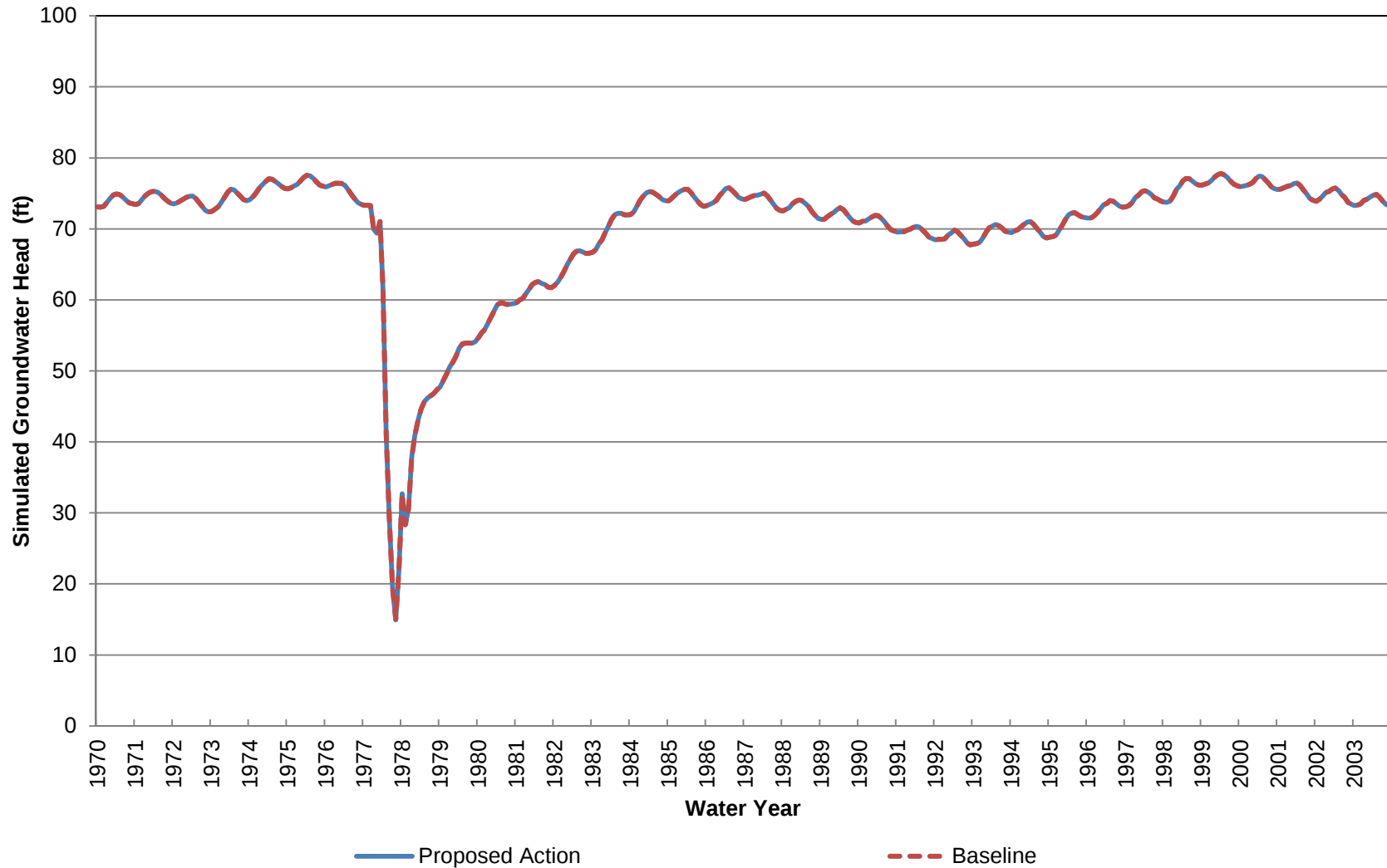
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 110-170 ft bgs)**



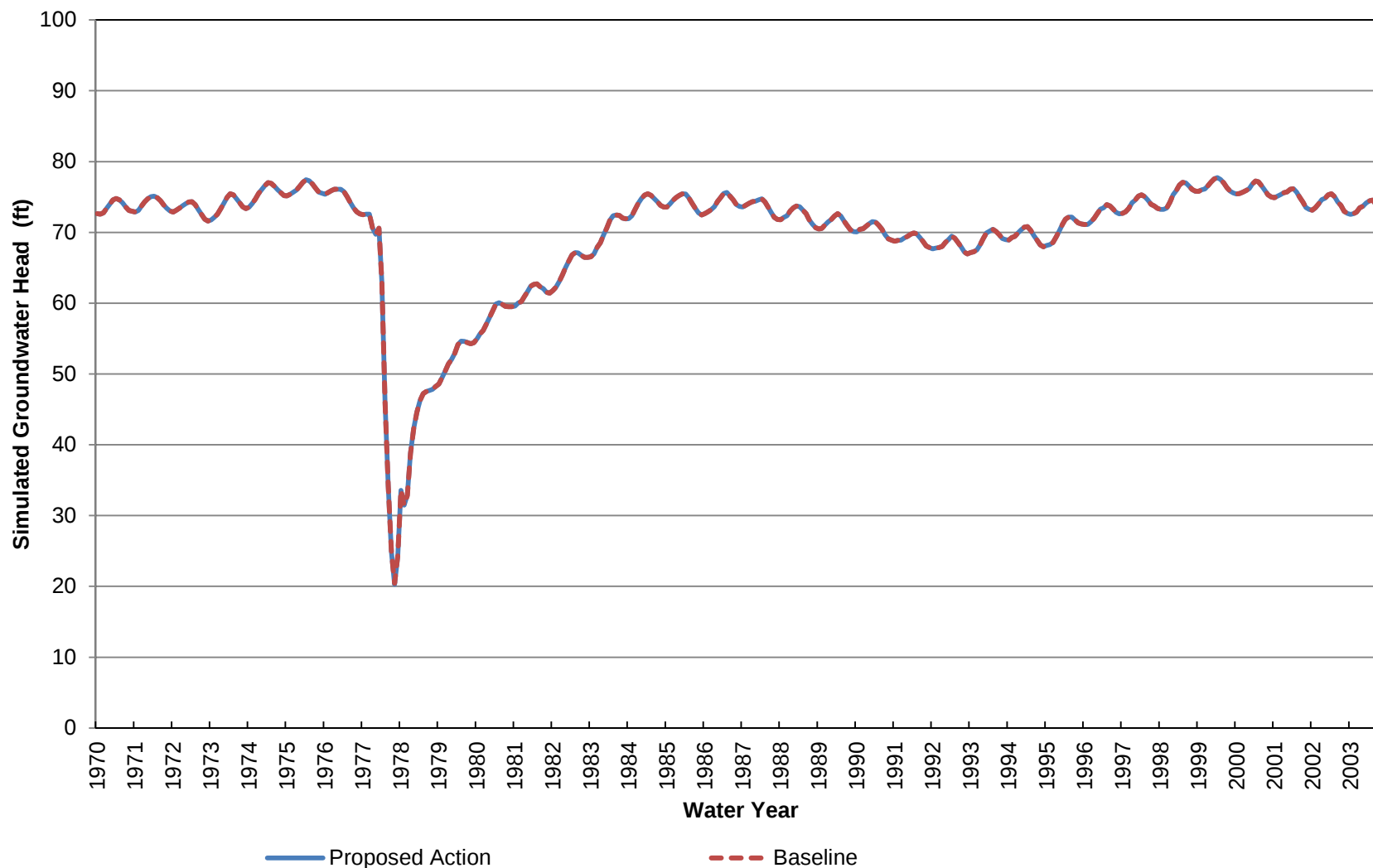
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 170-230 ft bgs)**



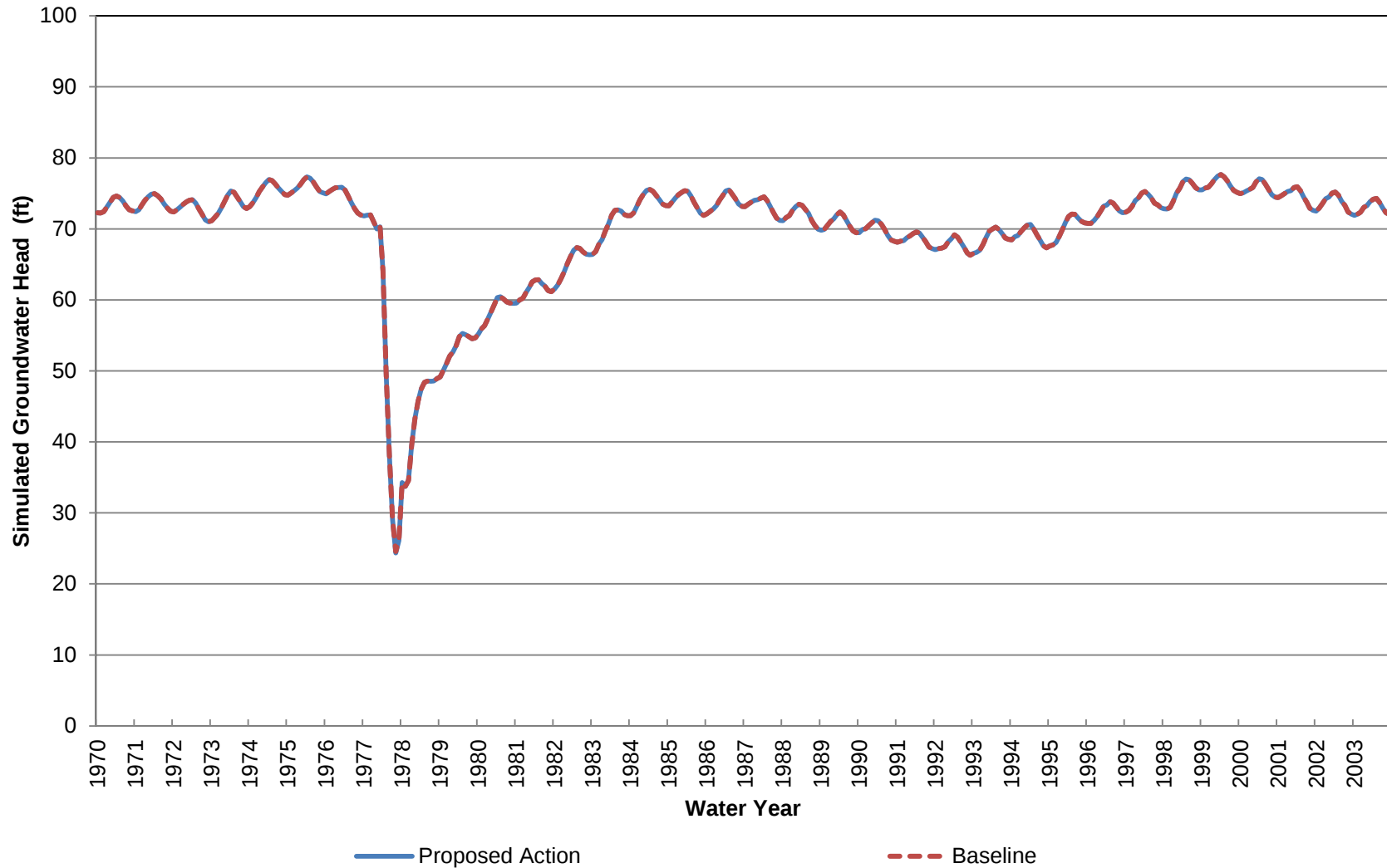
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 230-310 ft bgs)**



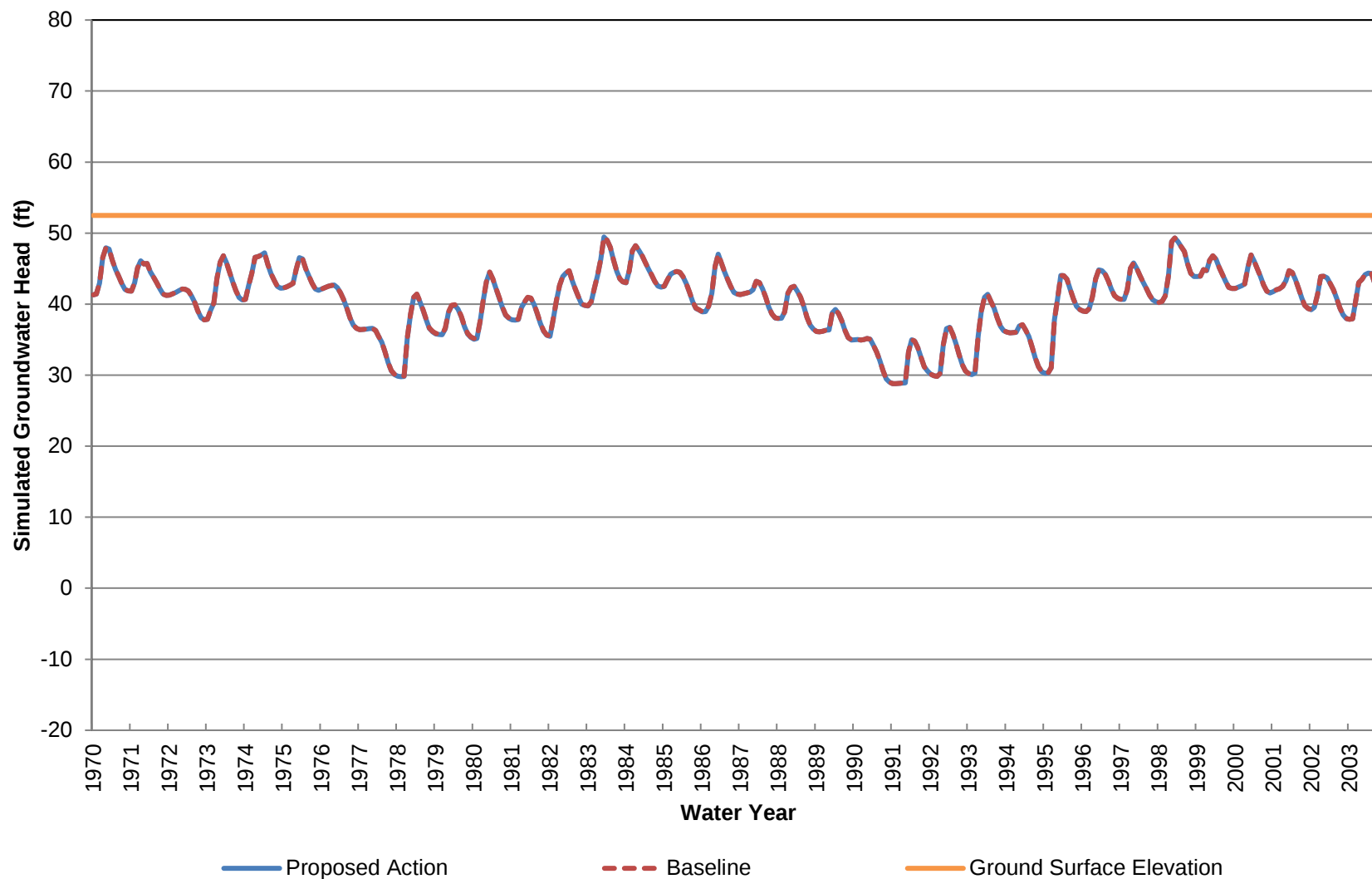
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 310-420 ft bgs)**



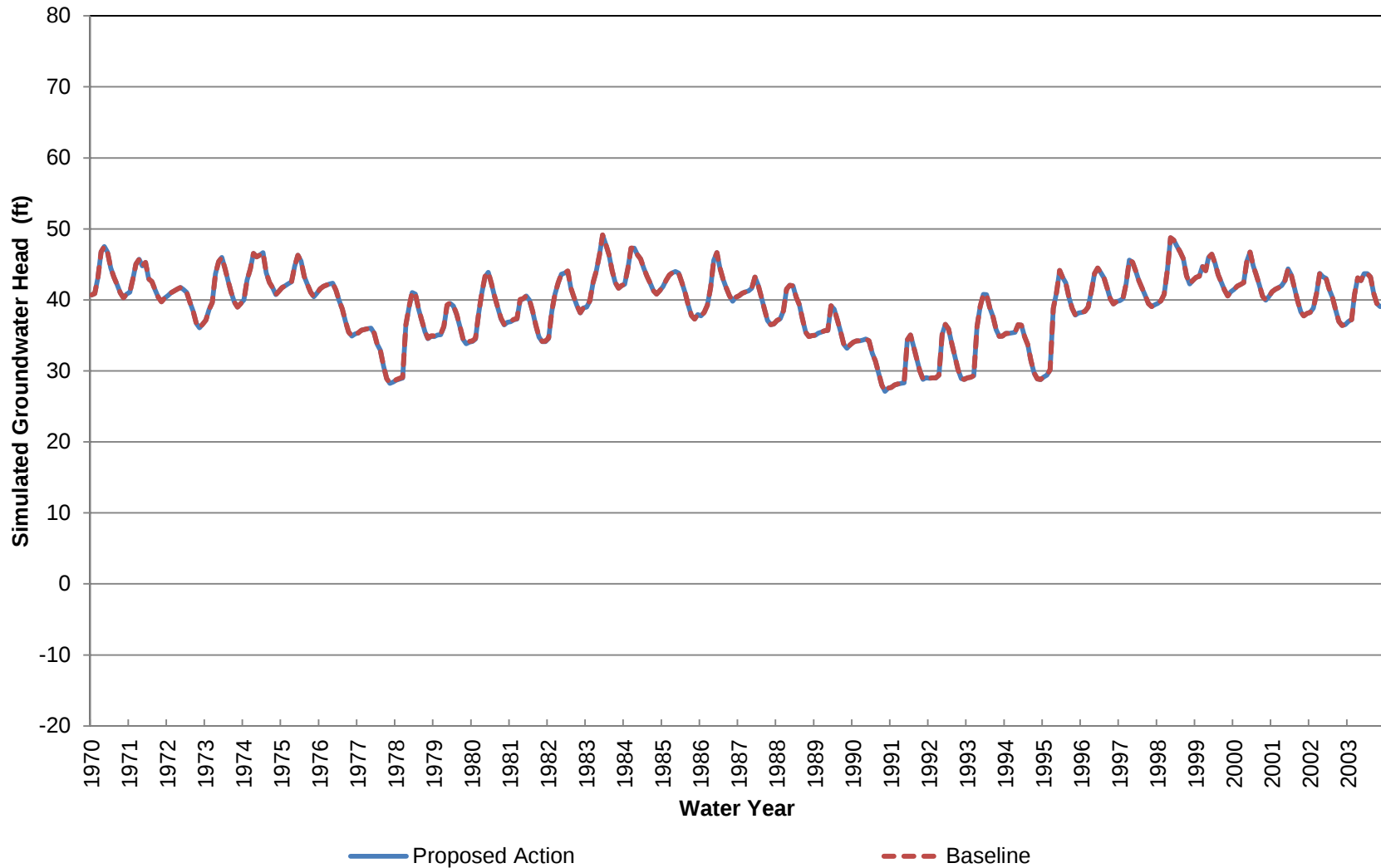
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 14 (Approximately 420-570 ft bgs)**



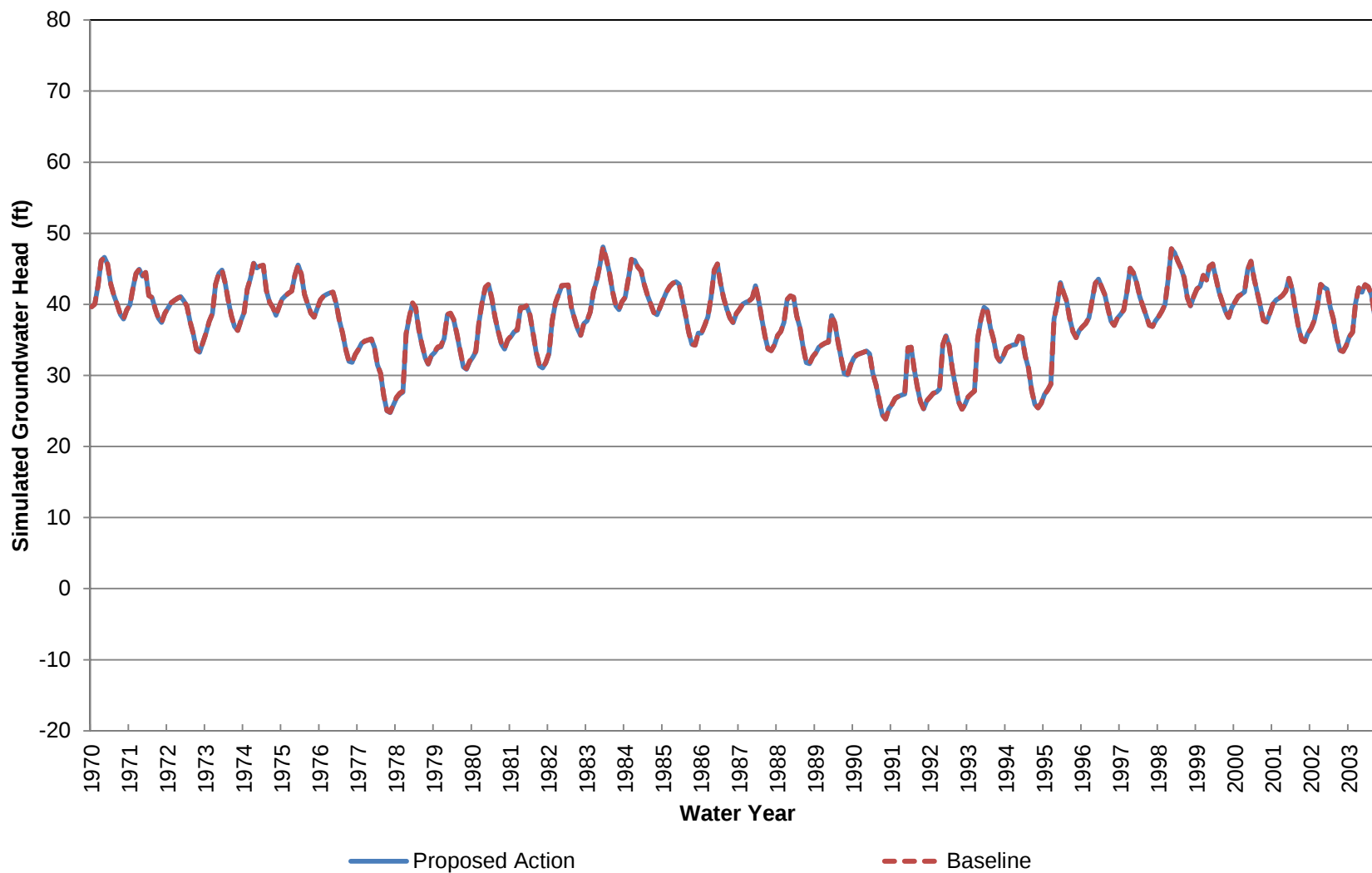
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 15 (Approximately 0-30 ft bgs)**



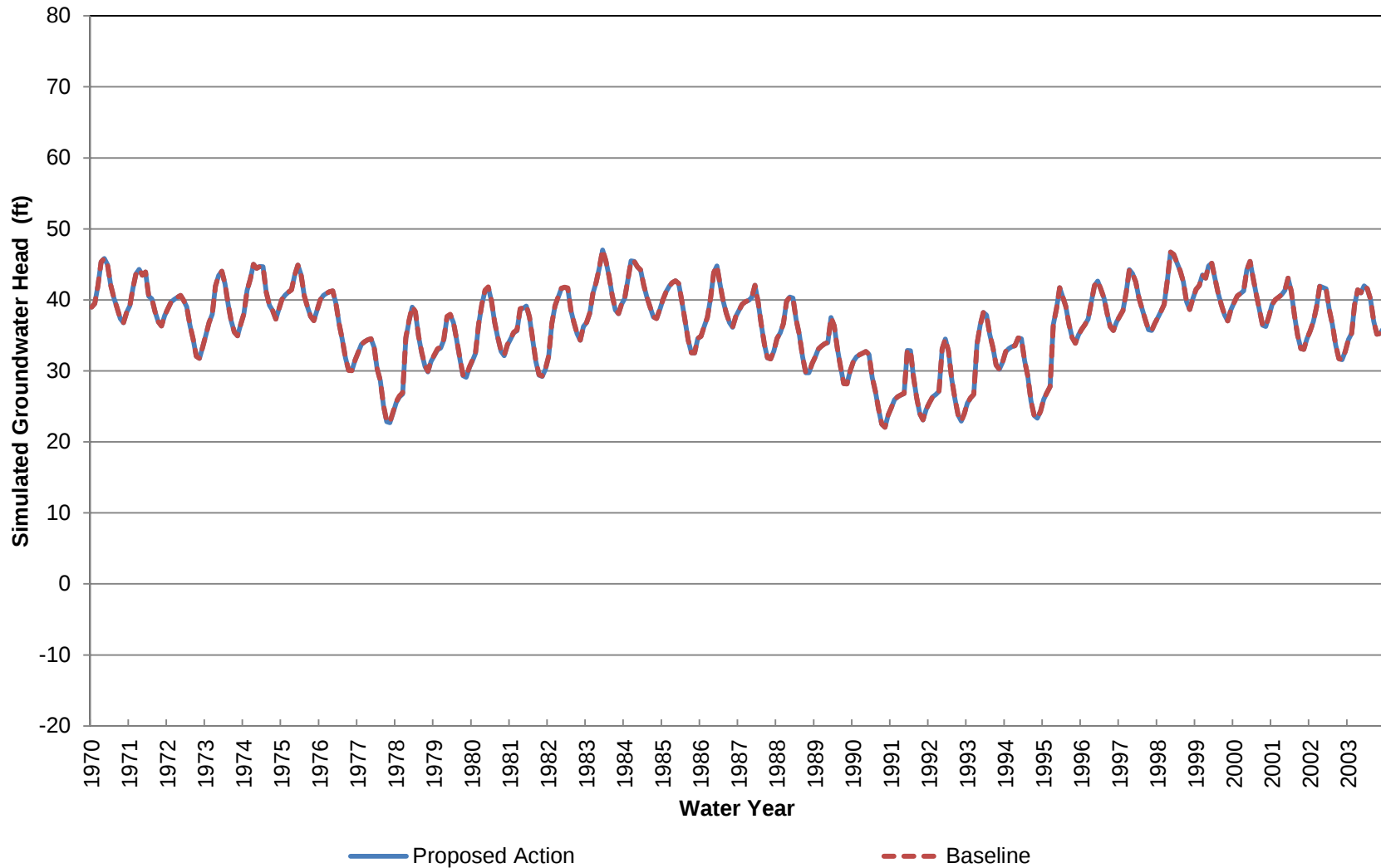
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 30-70 ft bgs)**



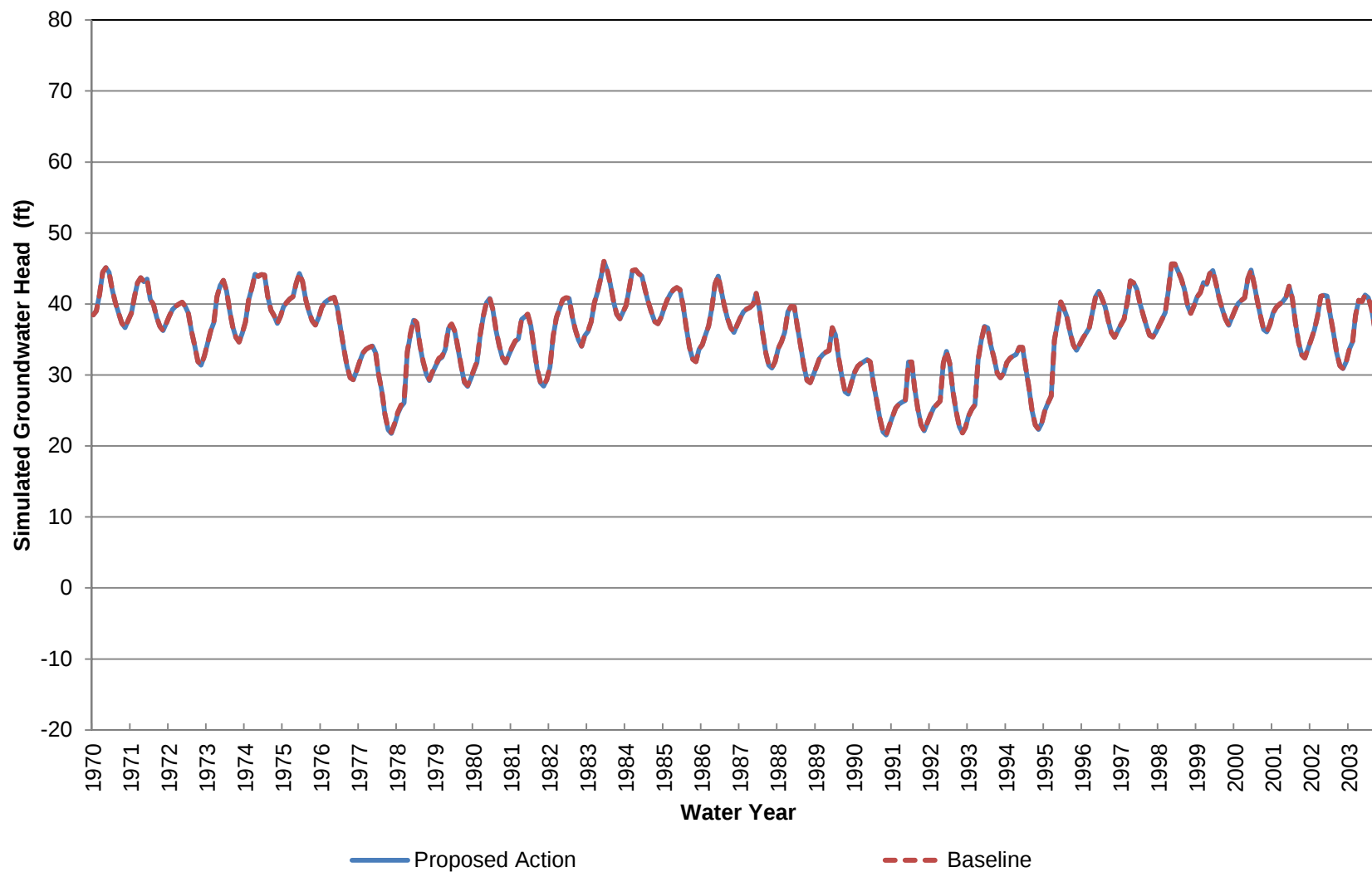
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 70-110 ft bgs)**



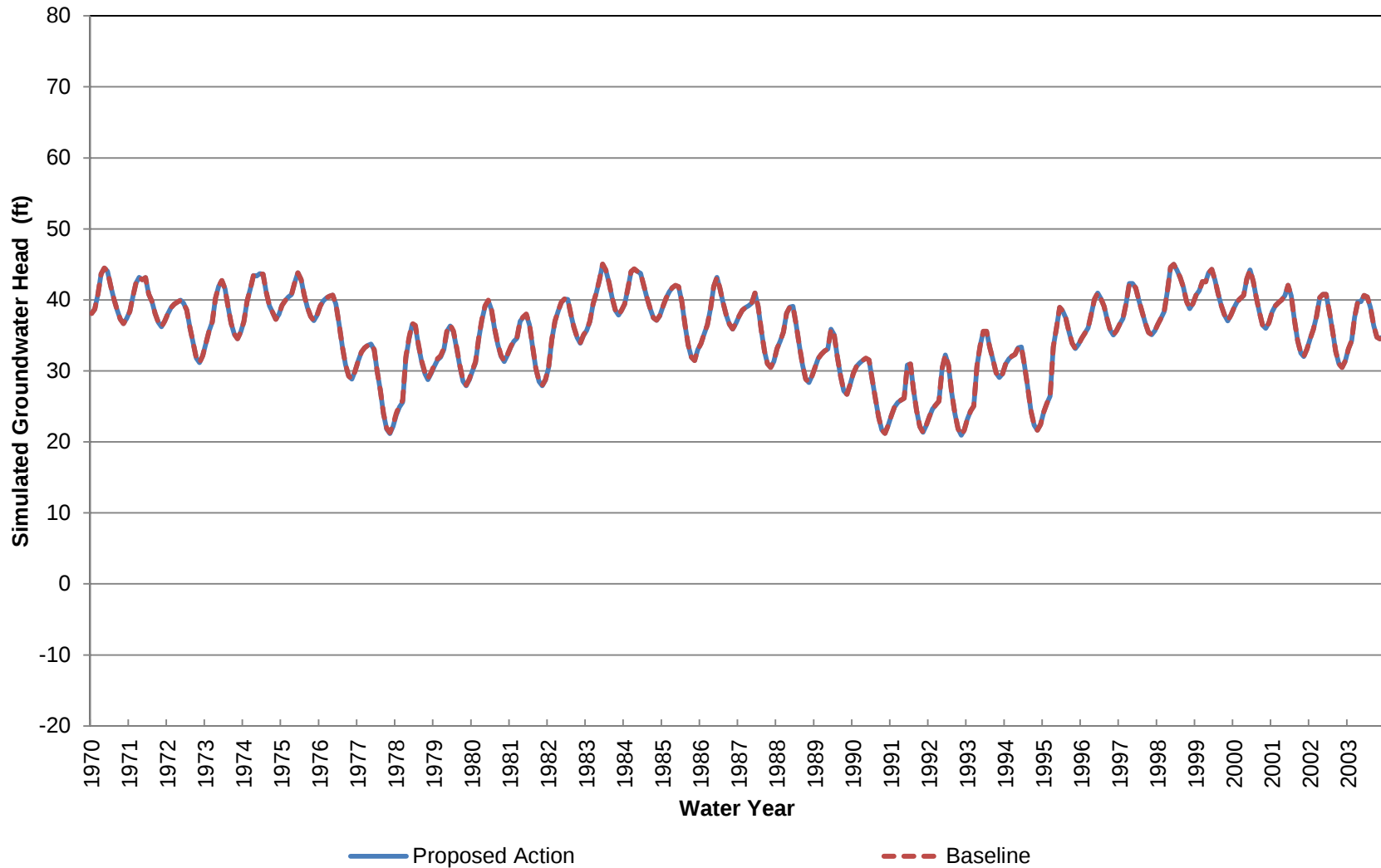
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 110-150 ft bgs)**



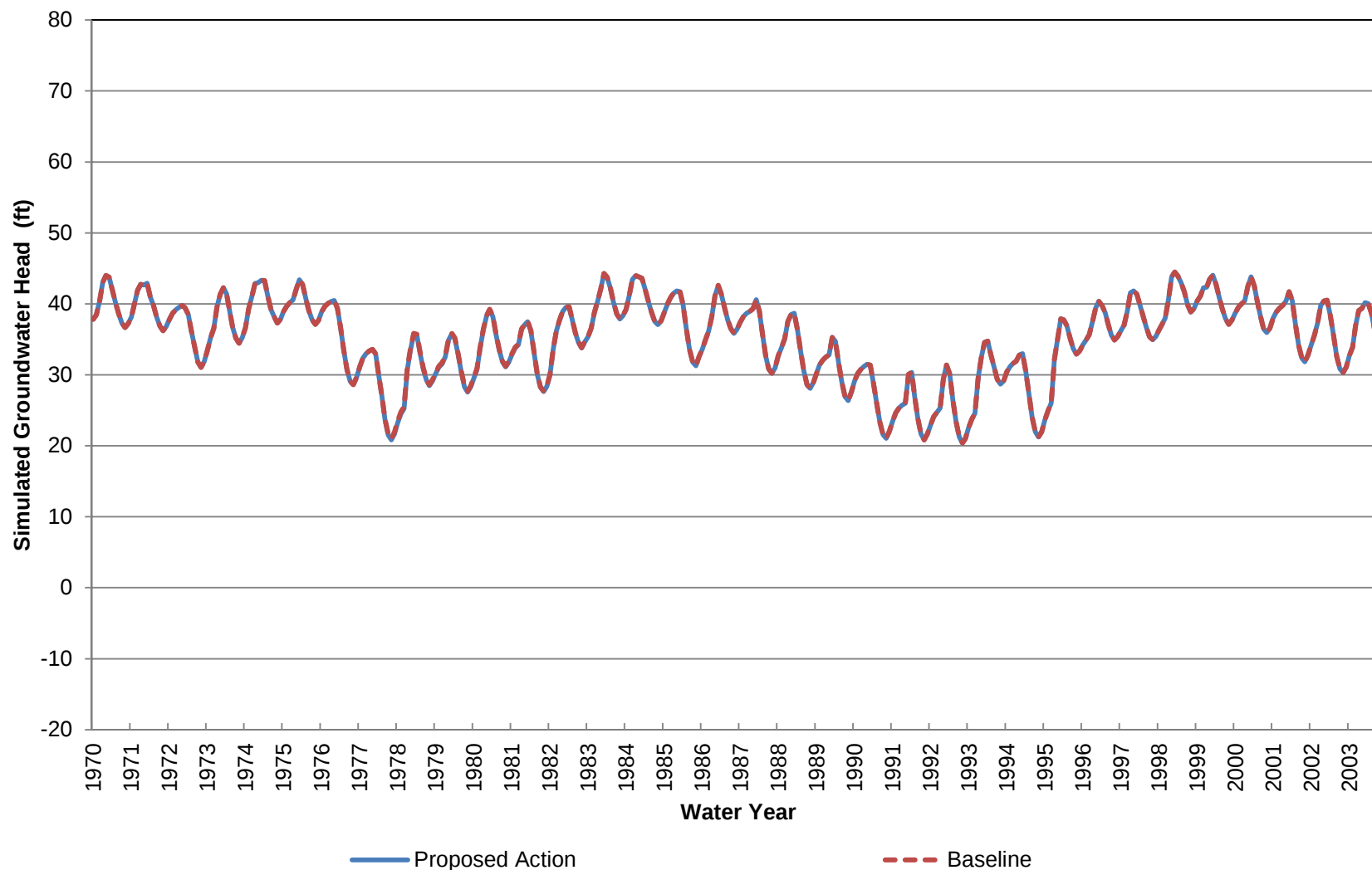
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 150-200 ft bgs)**



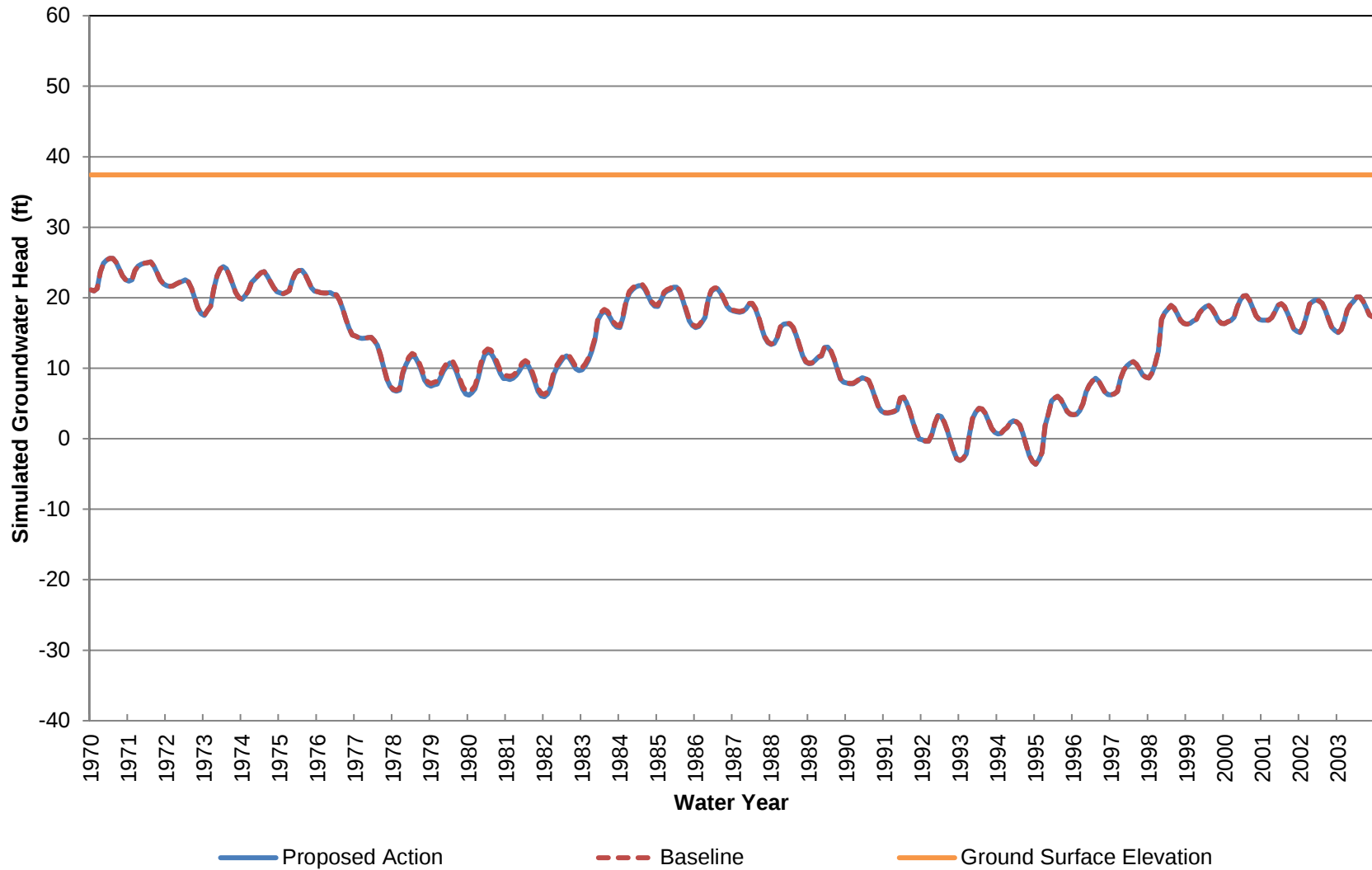
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 200-270 ft bgs)**



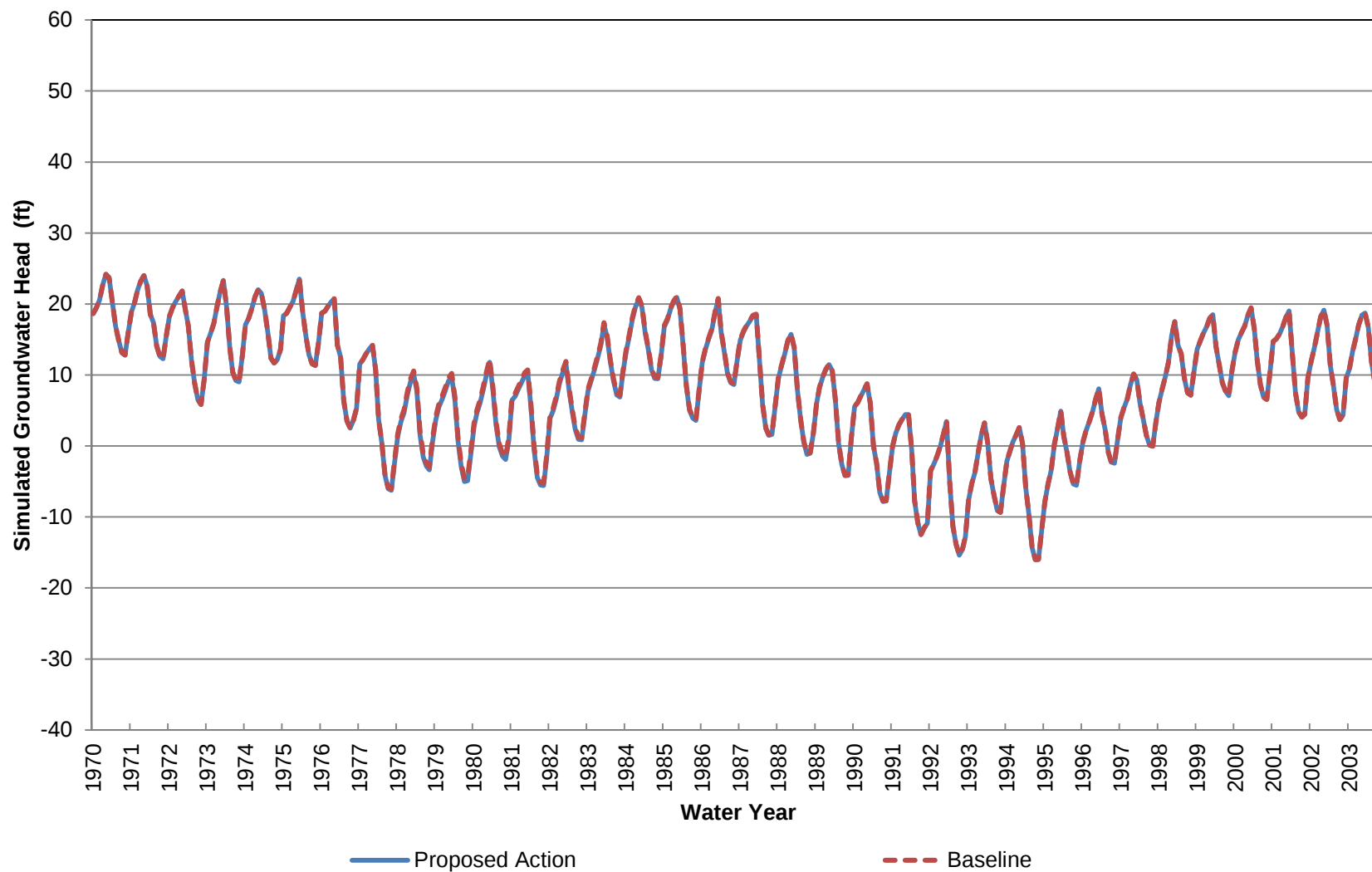
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 15 (Approximately 270-360 ft bgs)**



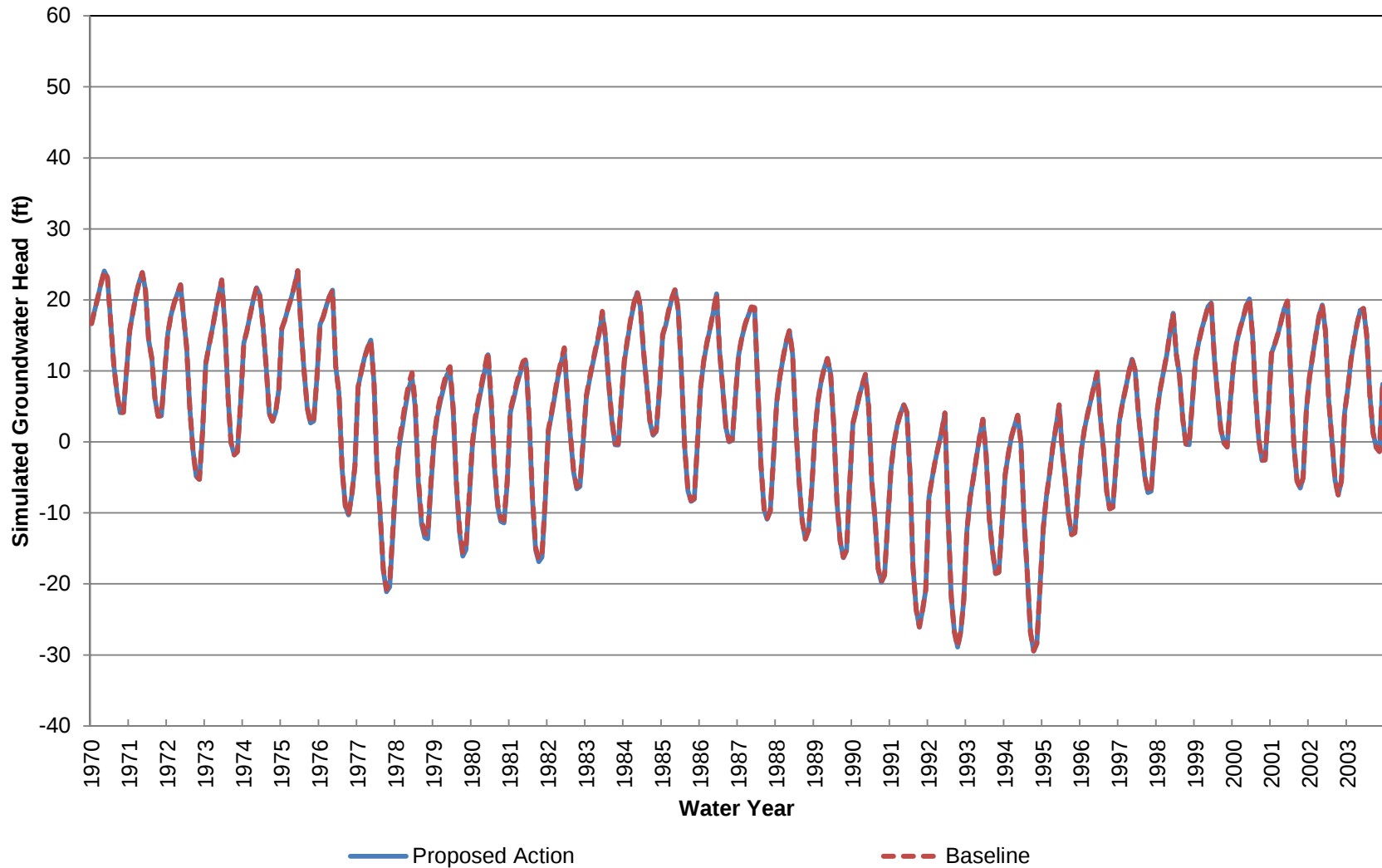
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 16 (Approximately 0-70 ft bgs)**



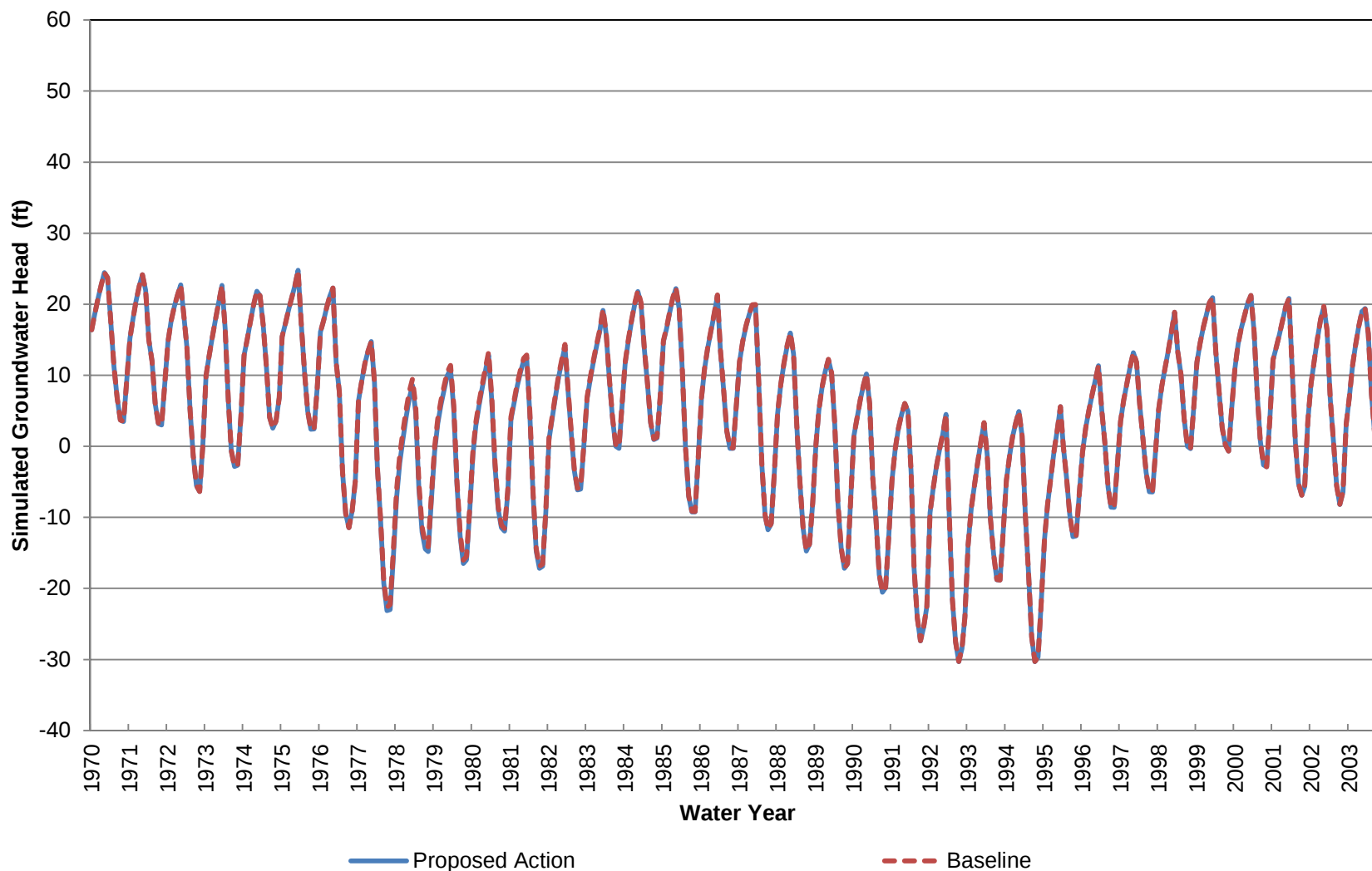
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 70-220 ft bgs)**



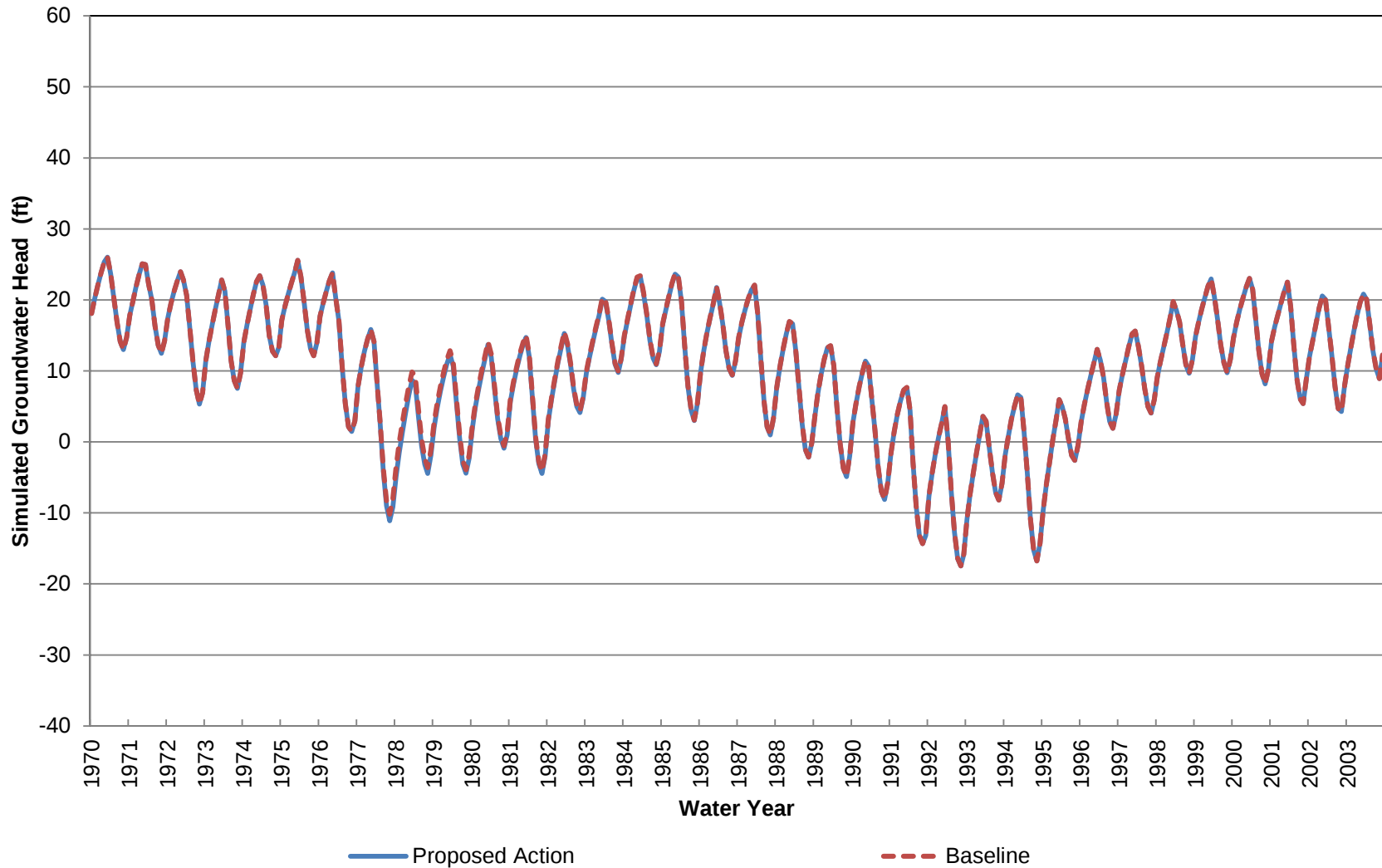
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 220-370 ft bgs)**



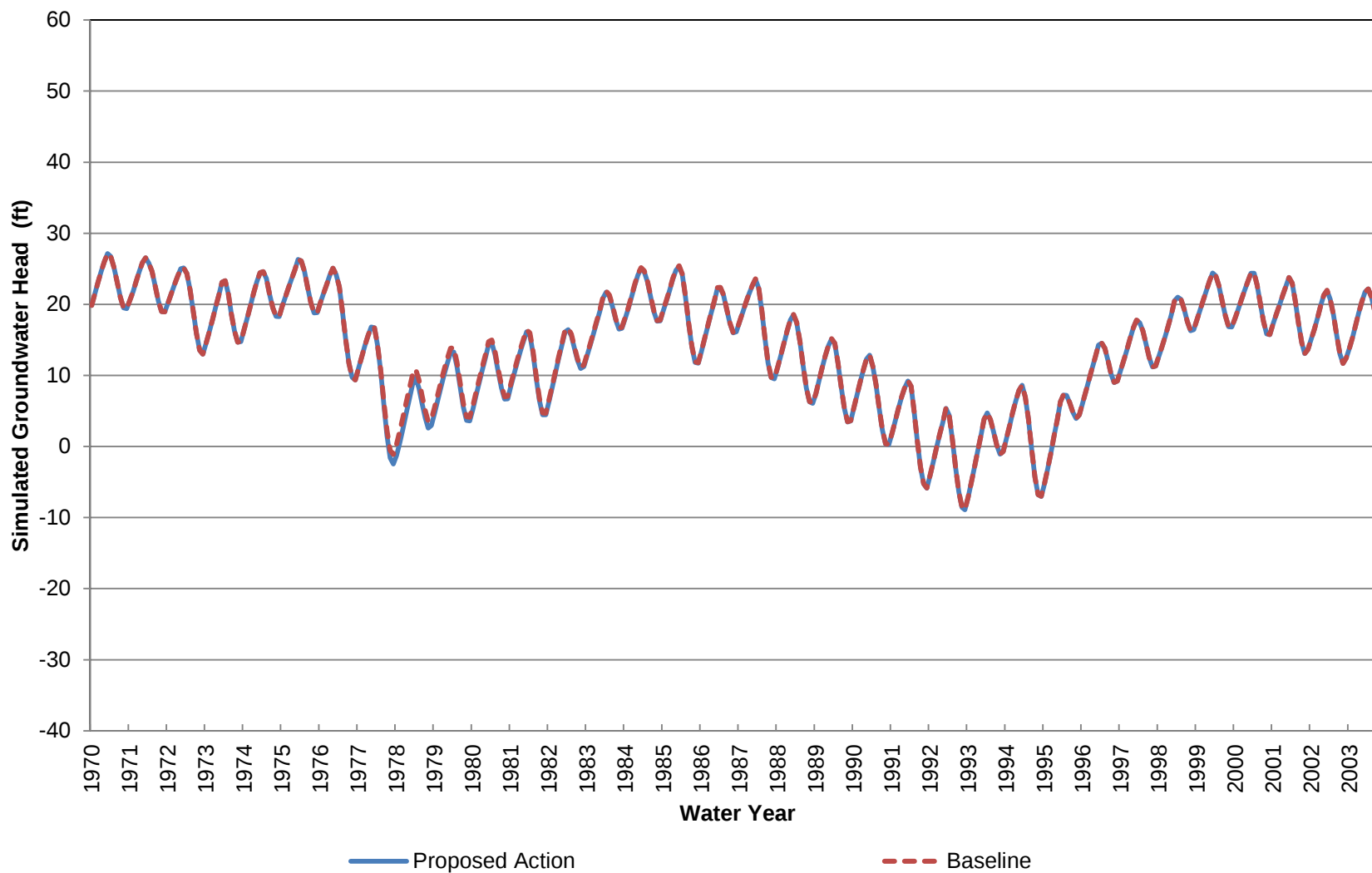
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 370-530 ft bgs)**



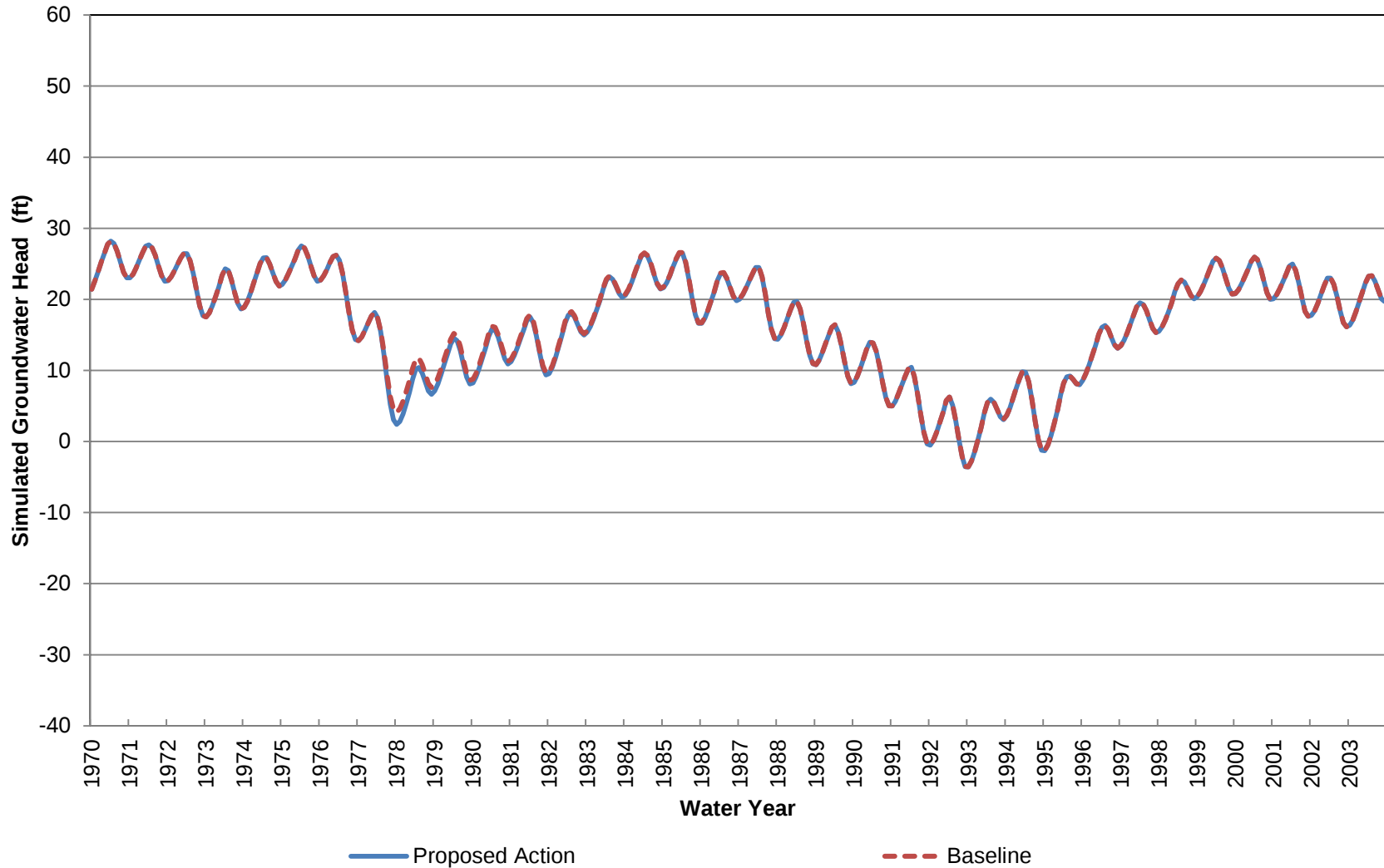
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 530-760 ft bgs)**



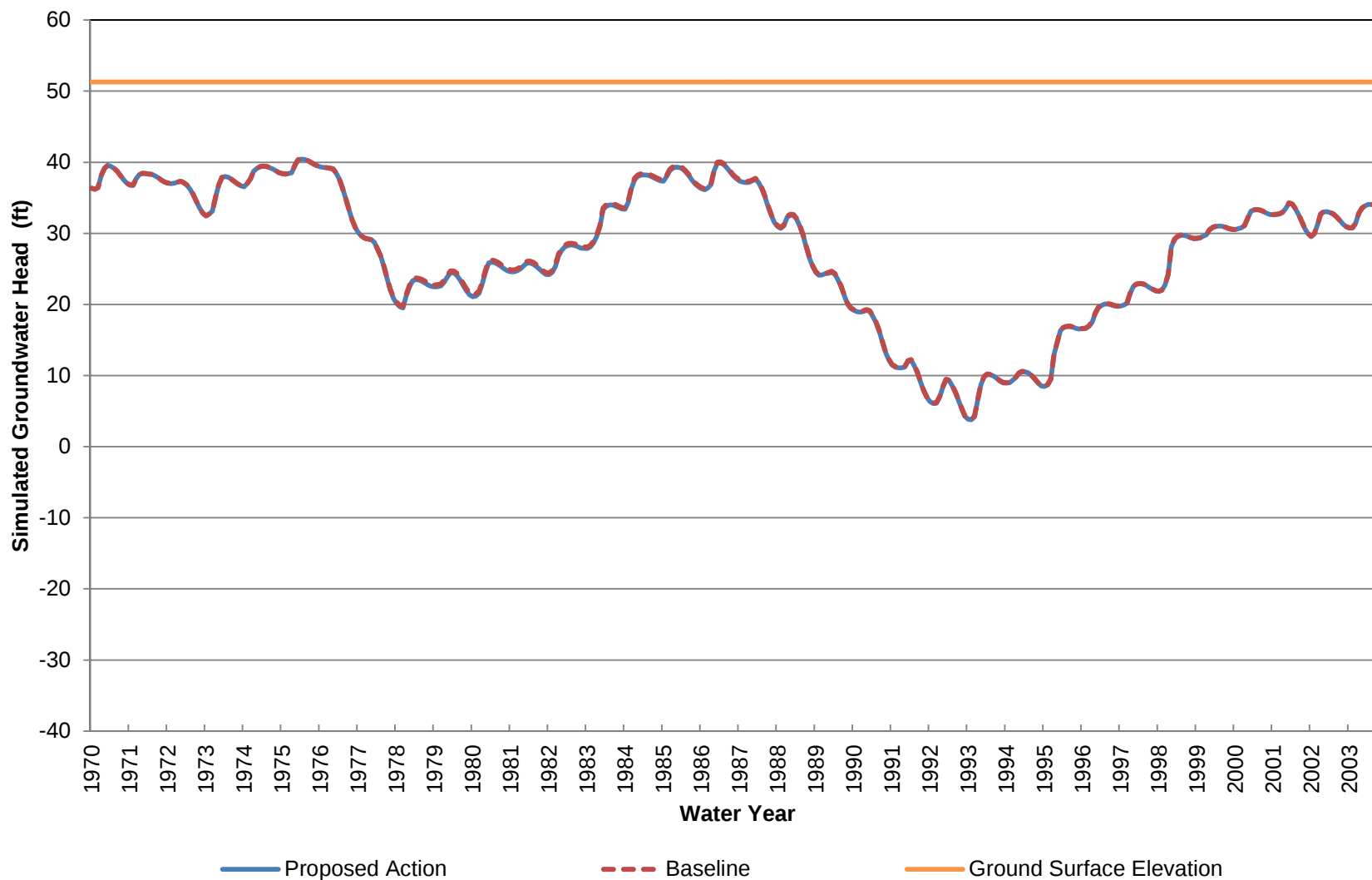
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 760-1020 ft bgs)**



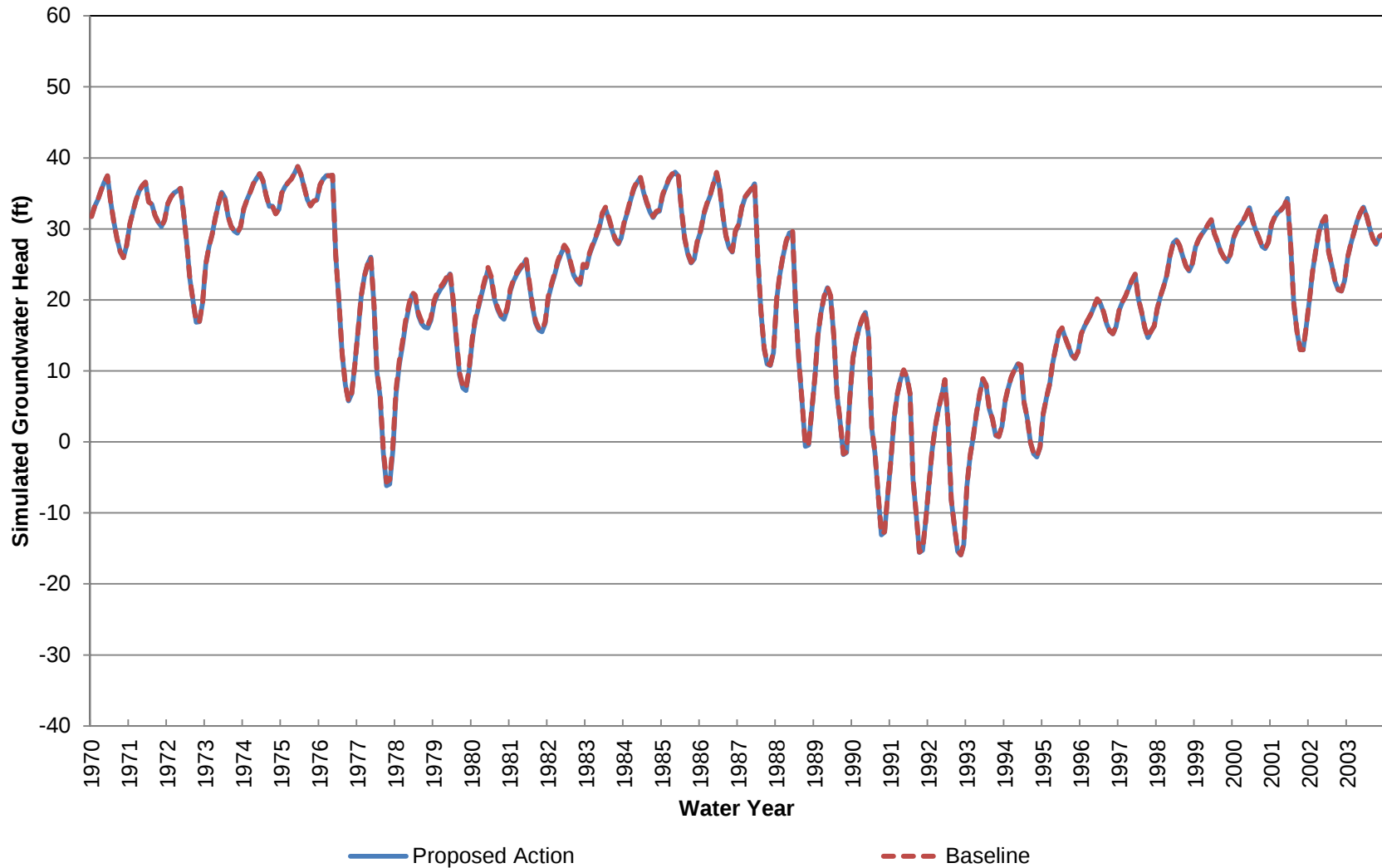
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 16 (Approximately 1020-1390 ft bgs)**



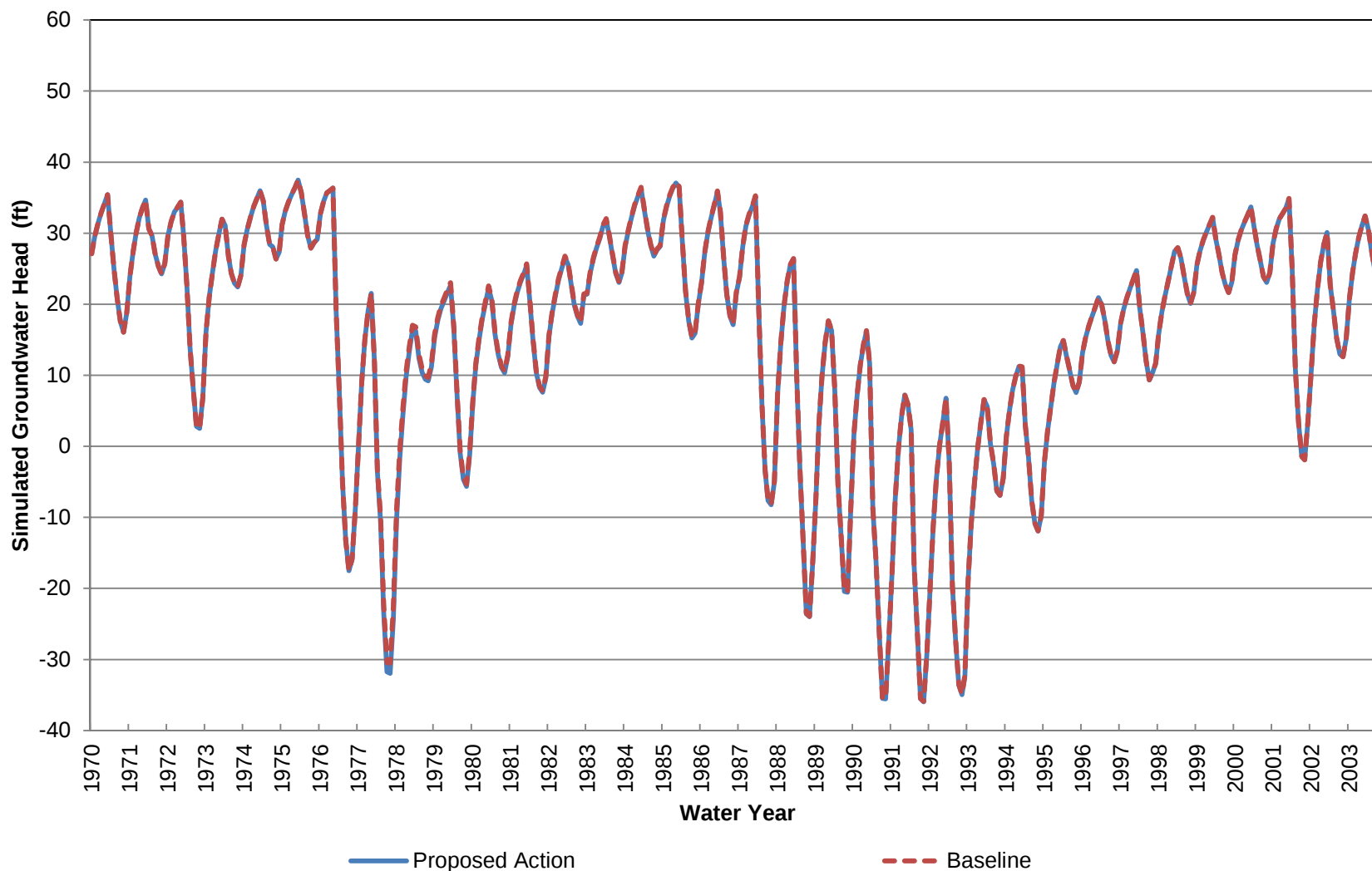
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 17 (Approximately 0-70 ft bgs)**



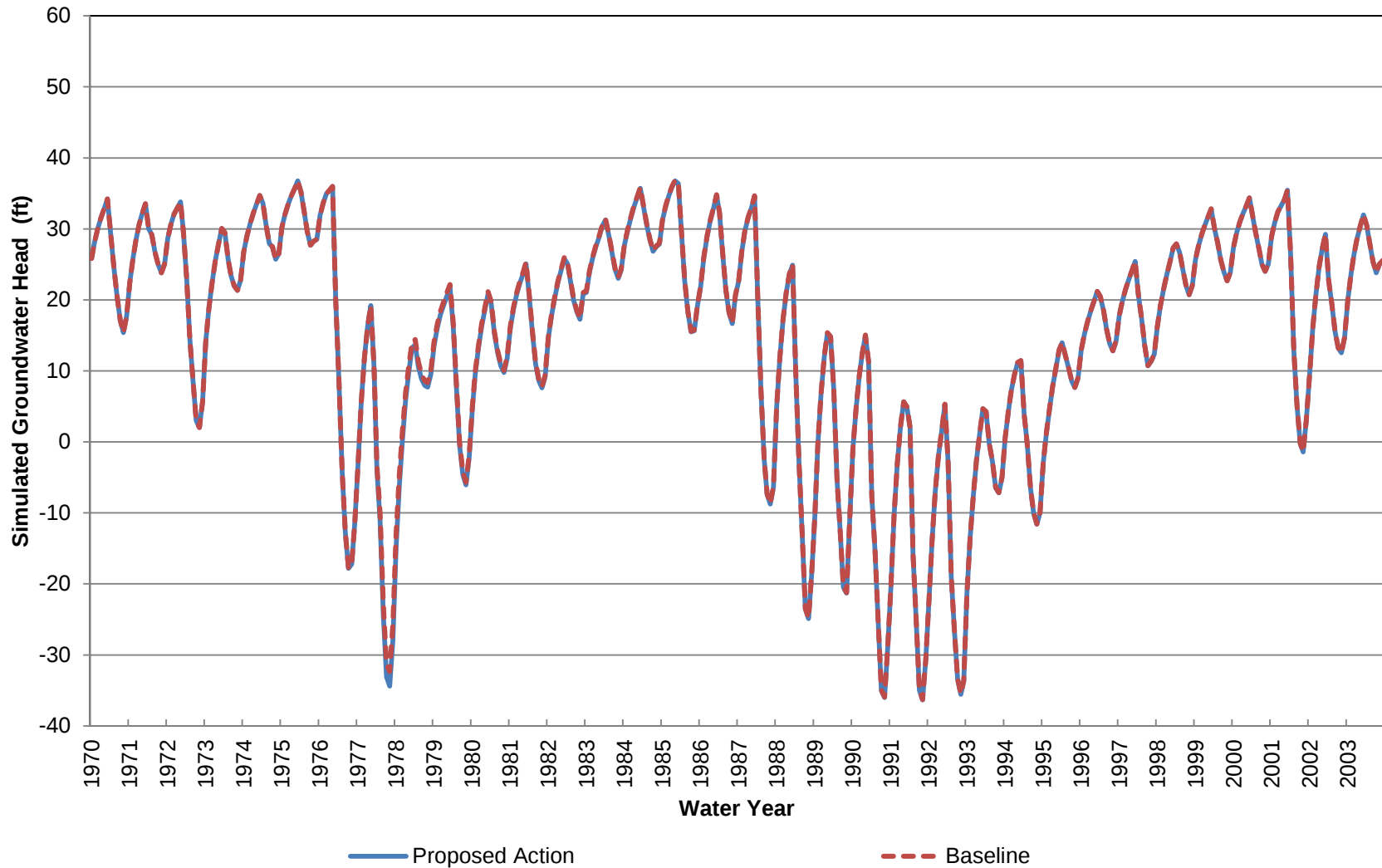
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 70-250 ft bgs)**



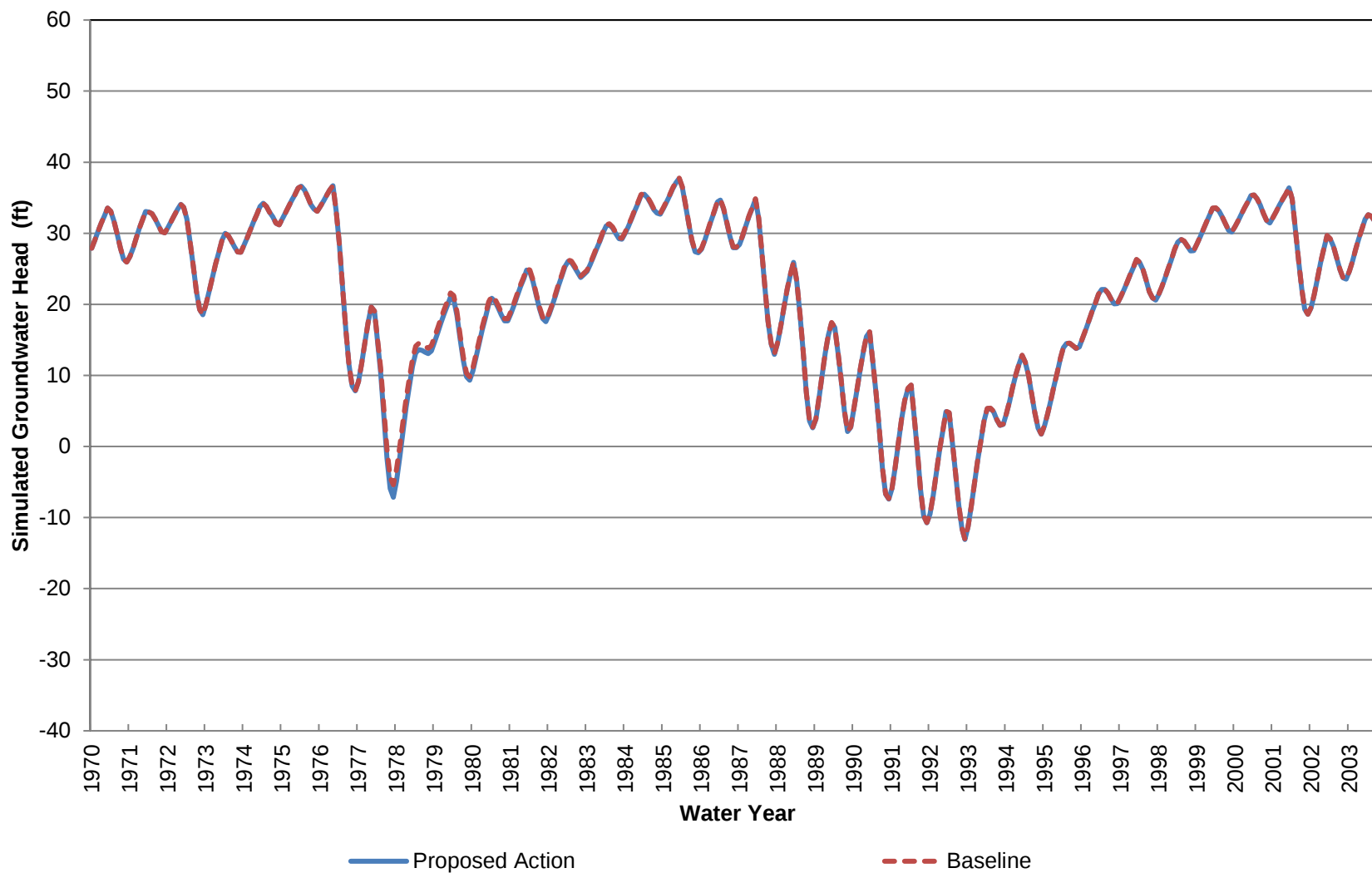
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 250-440 ft bgs)**



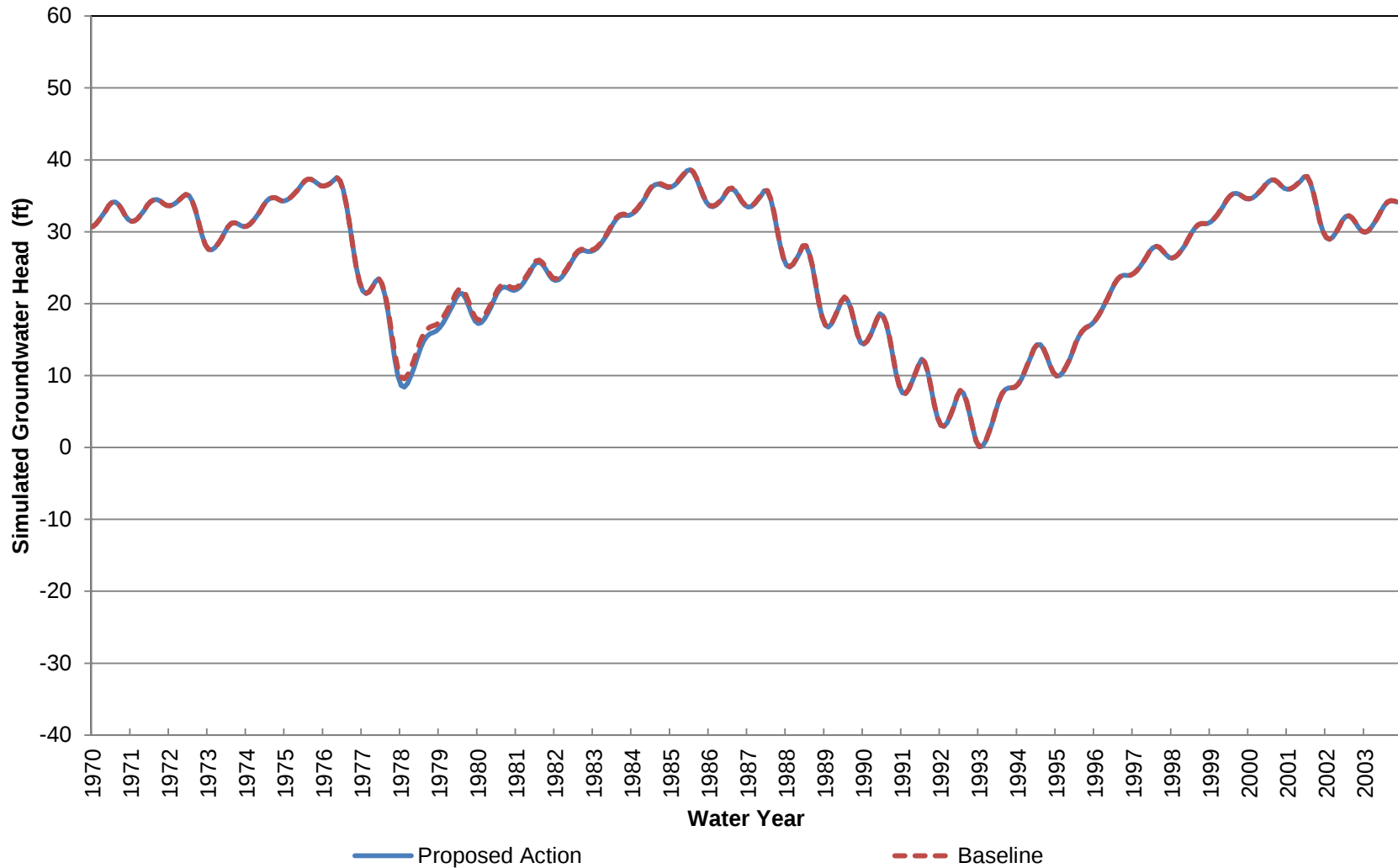
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 440-620 ft bgs)**



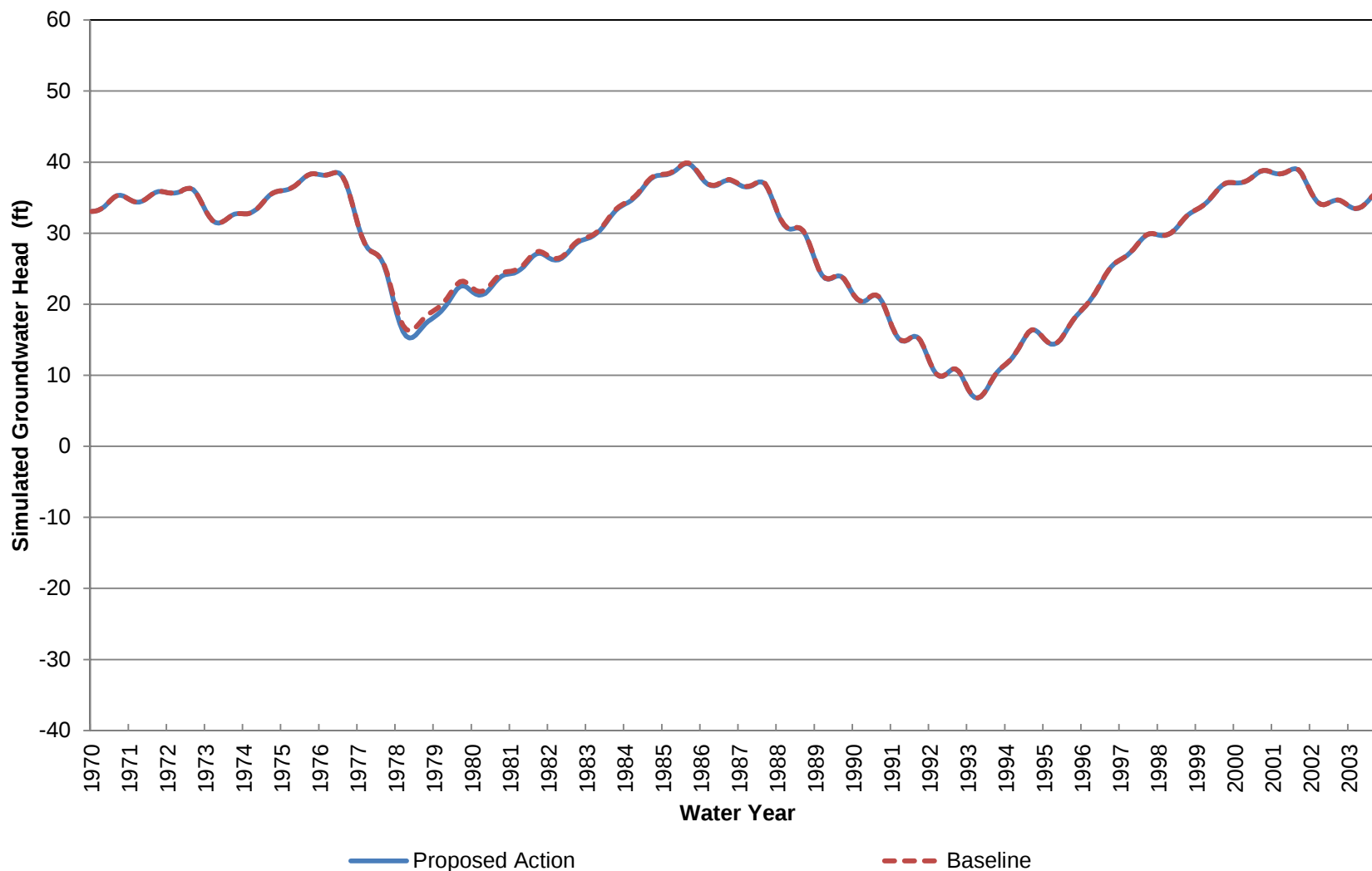
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 620-920 ft bgs)**



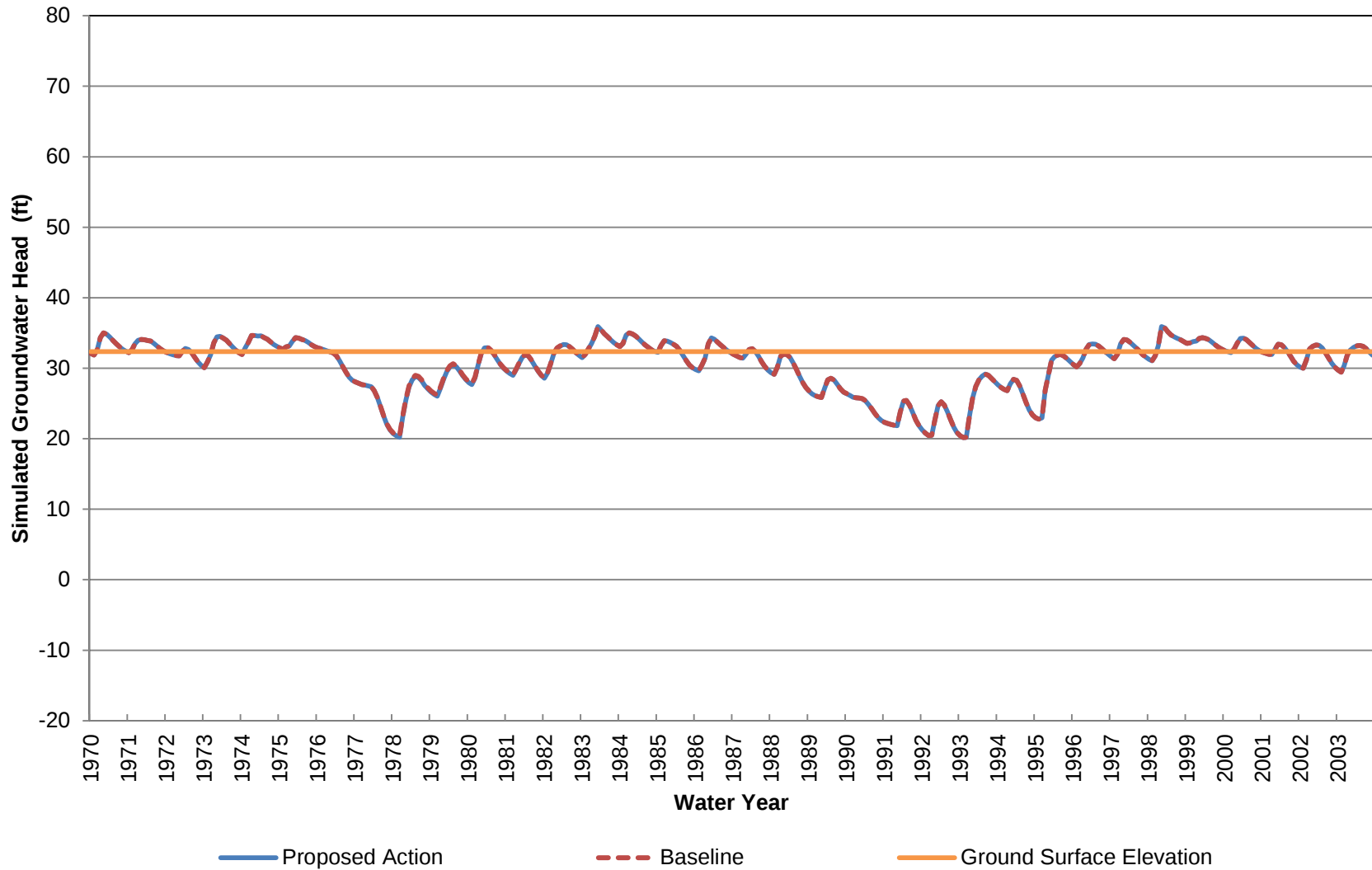
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 920-1220 ft bgs)**



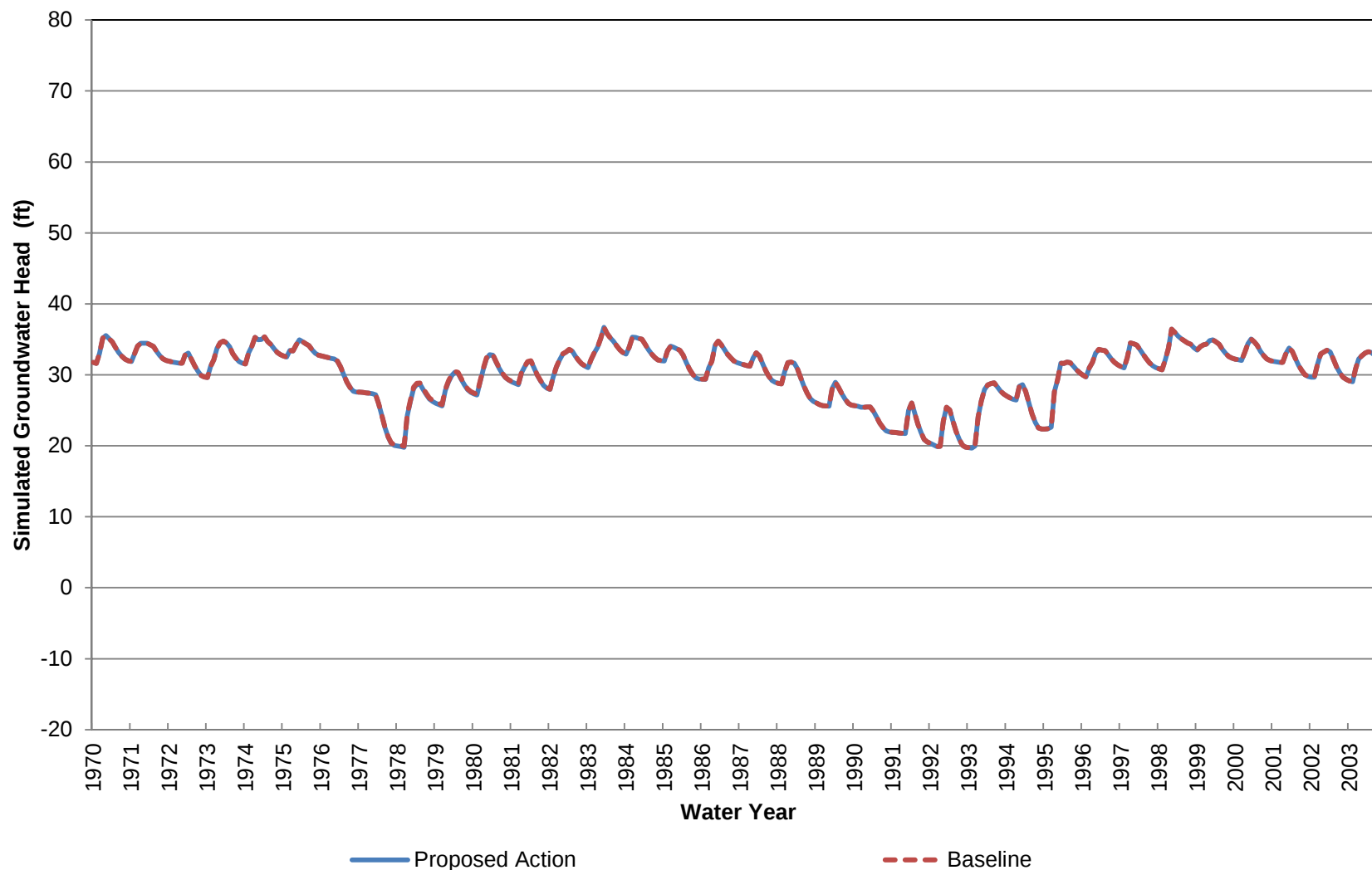
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 17 (Approximately 1220-1680 ft bgs)**



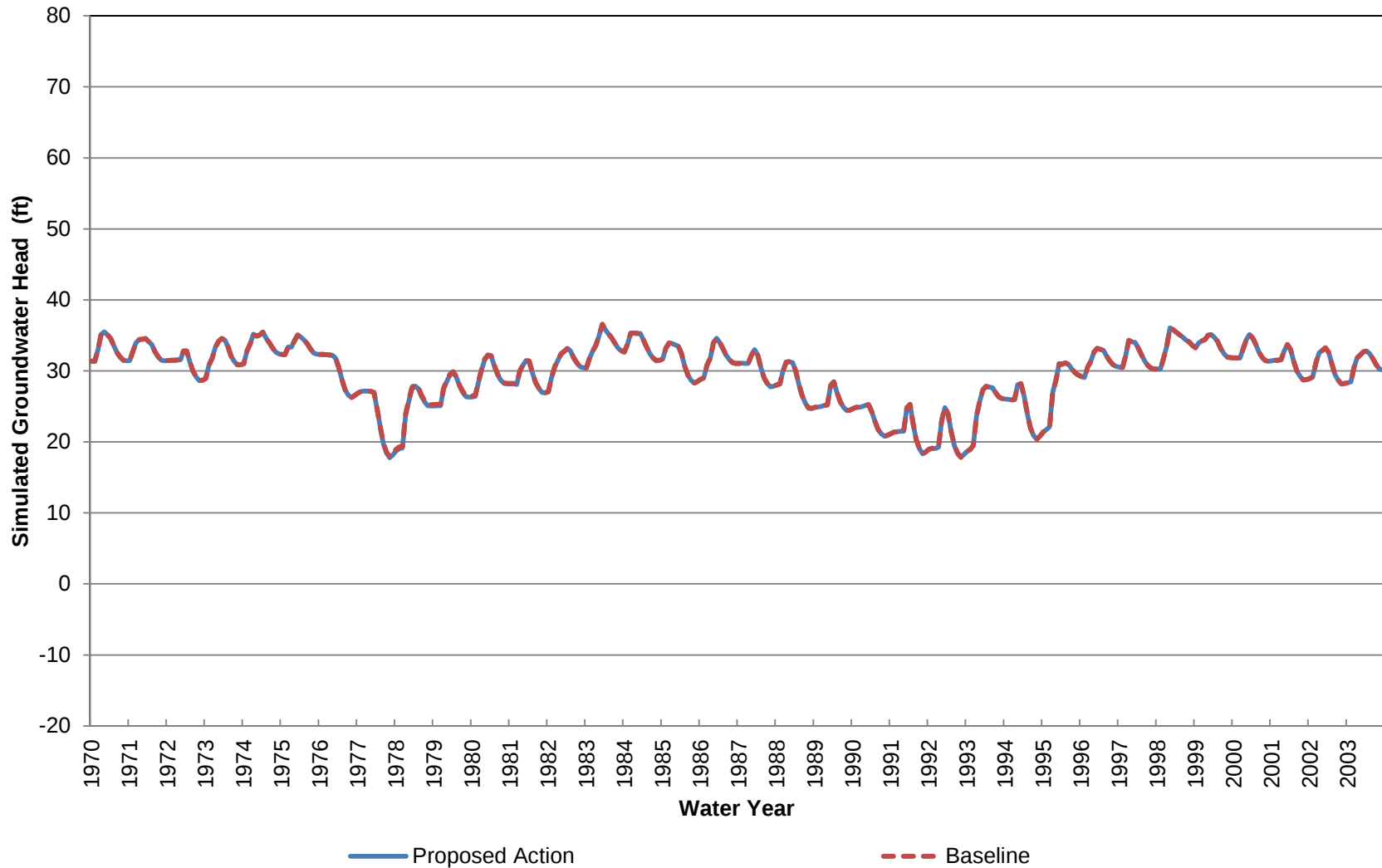
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 18 (Approximately 0-60 ft bgs)**



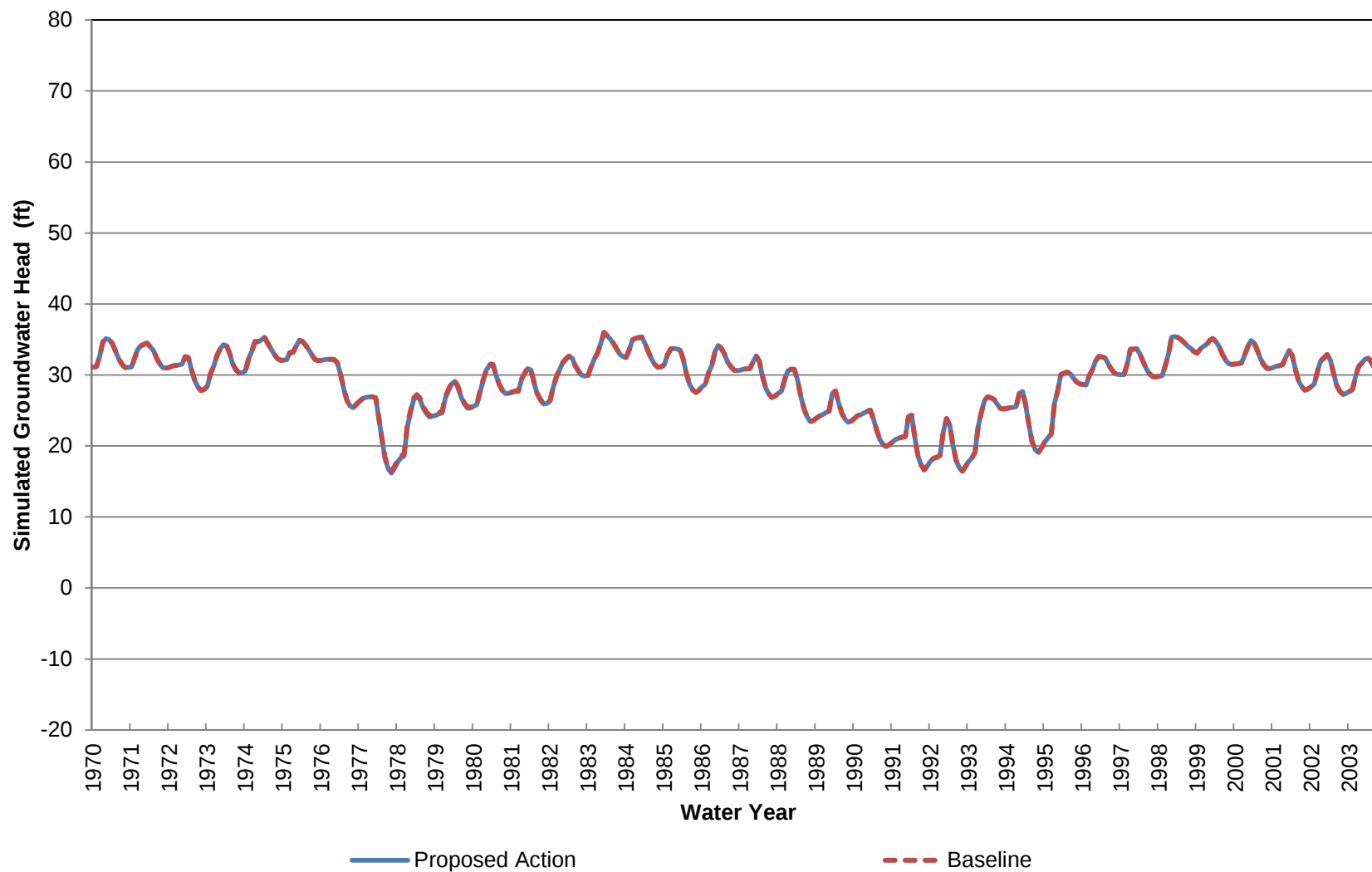
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 60-150 ft bgs)**



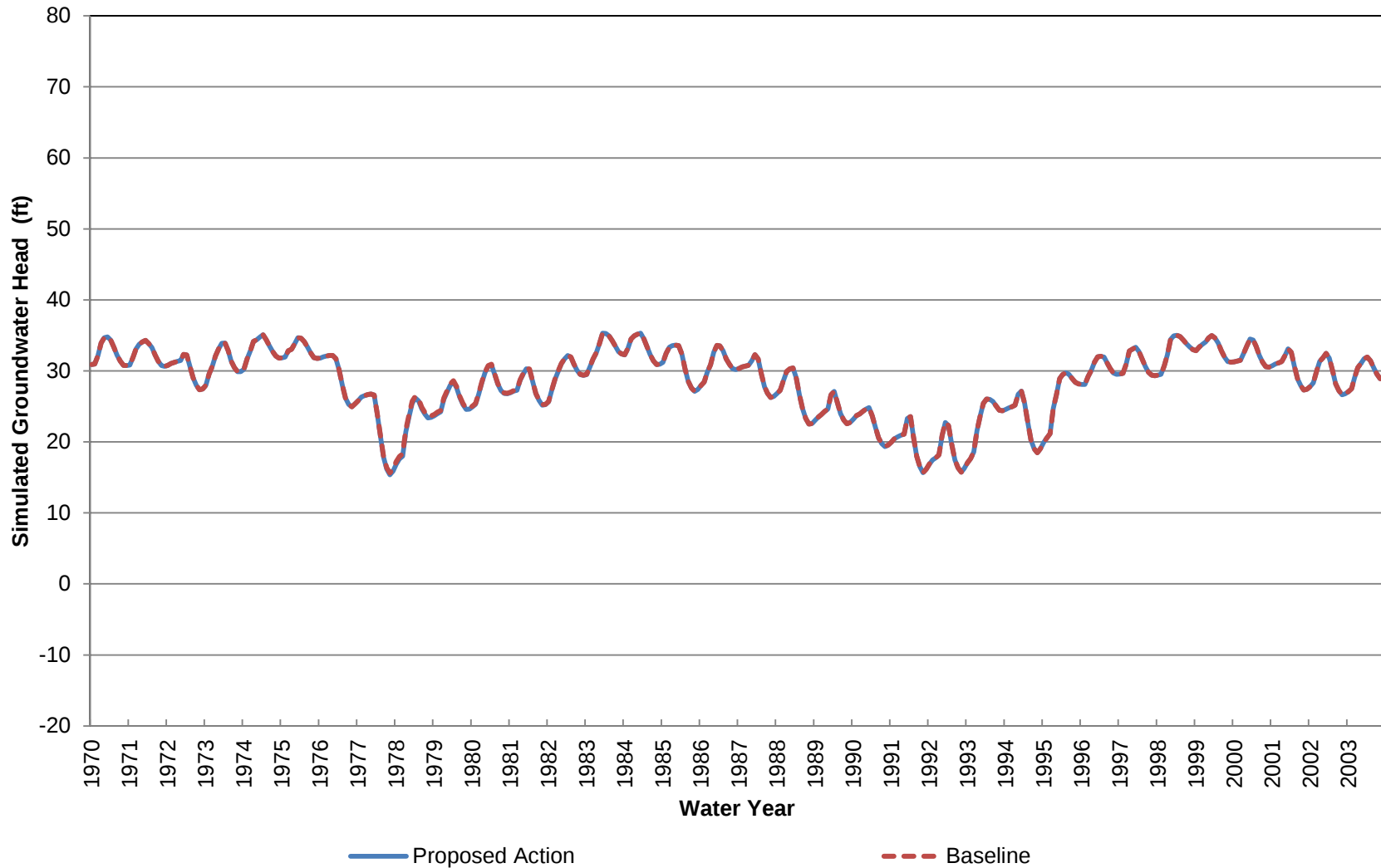
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 150-240 ft bgs)**



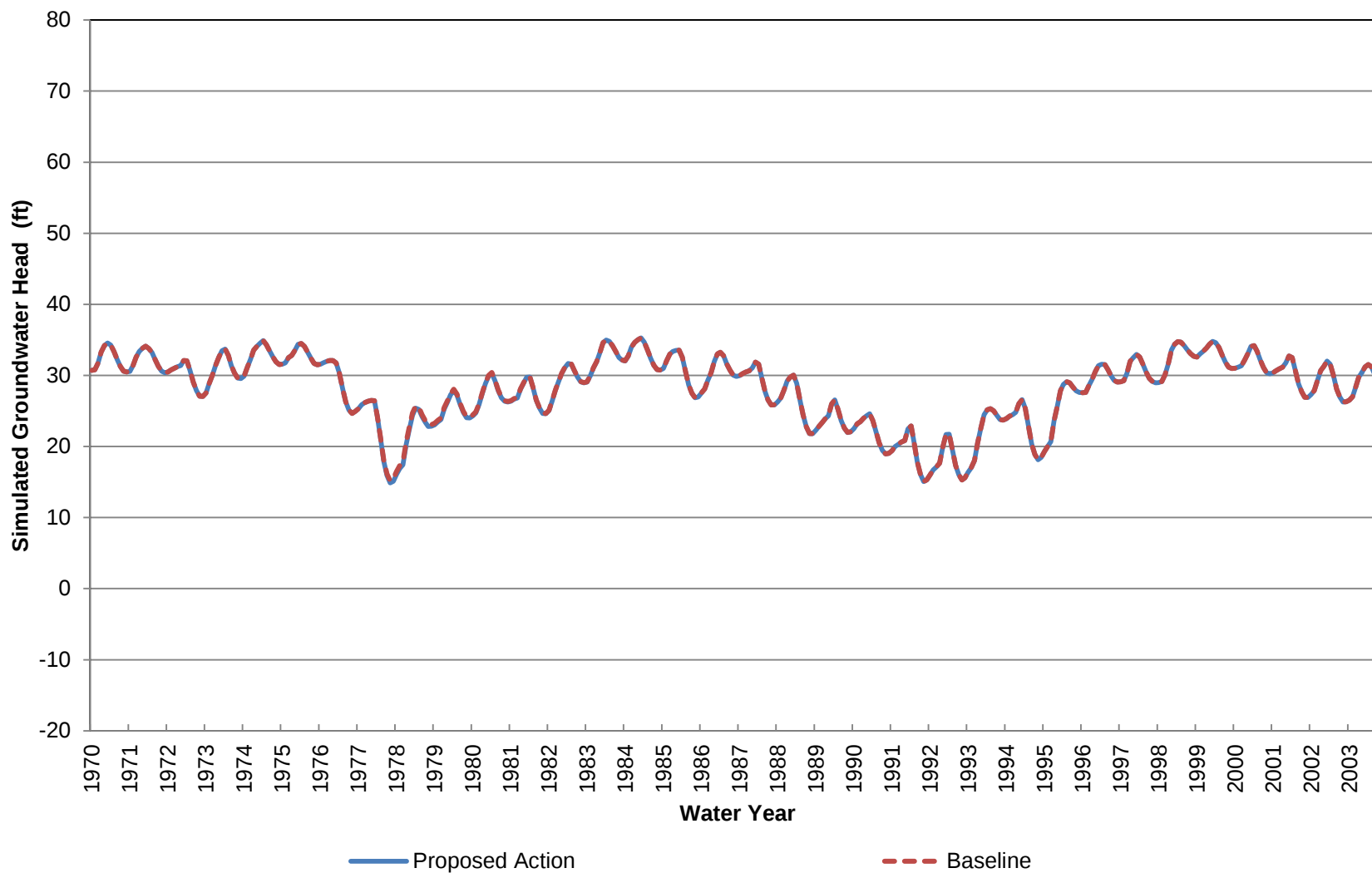
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 240-330 ft bgs)**



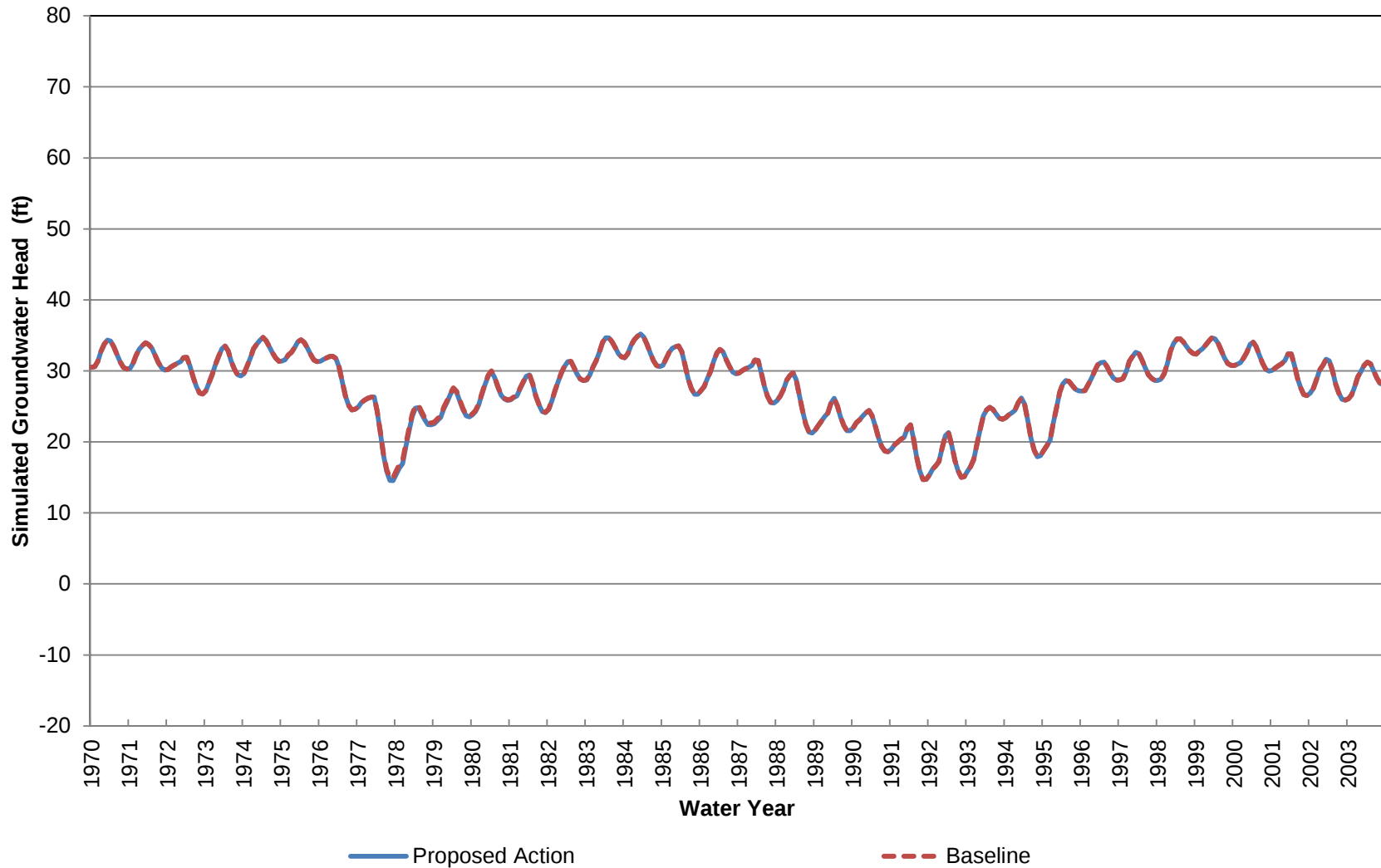
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 330-450 ft bgs)**



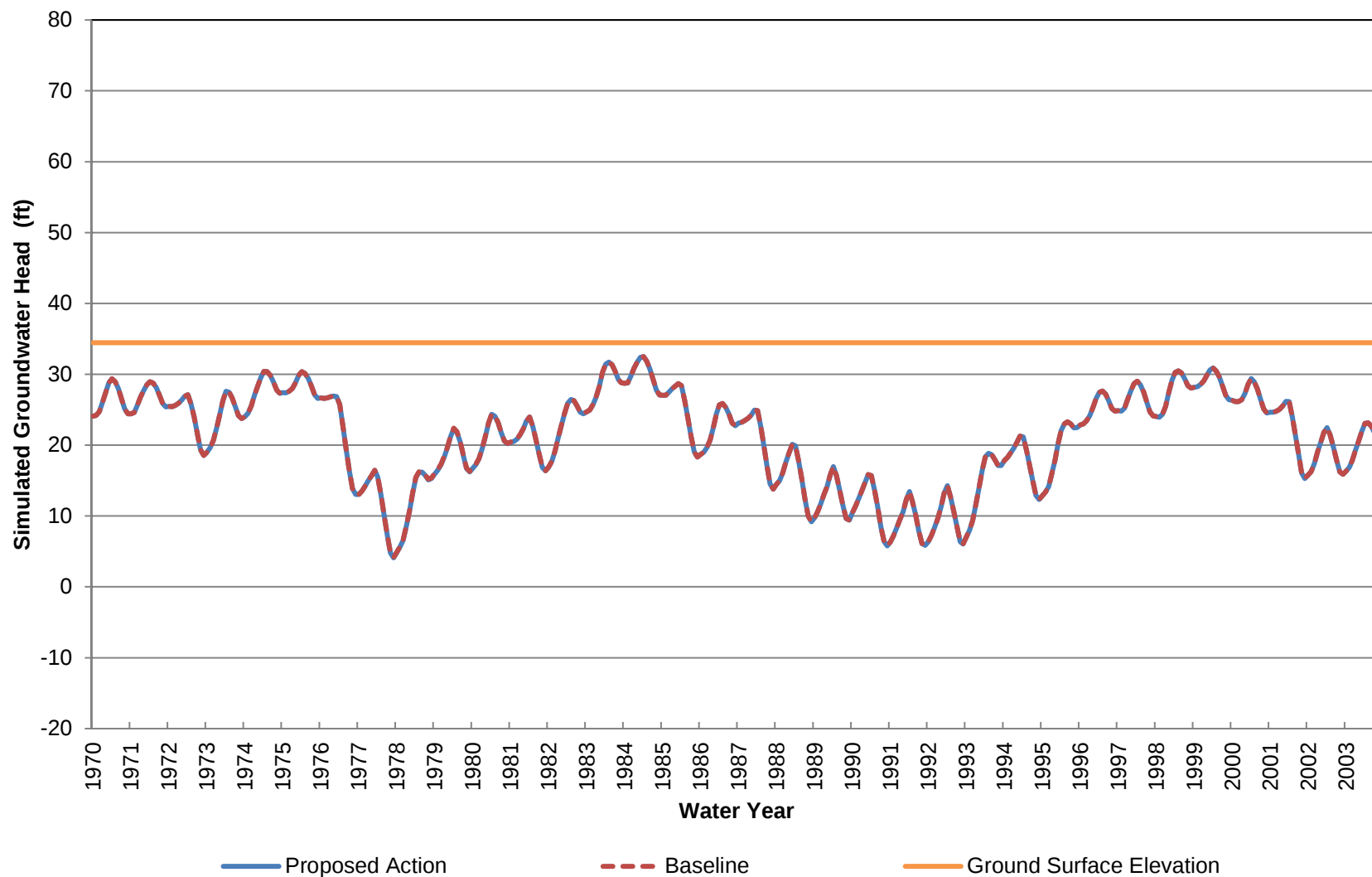
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 450-600 ft bgs)**



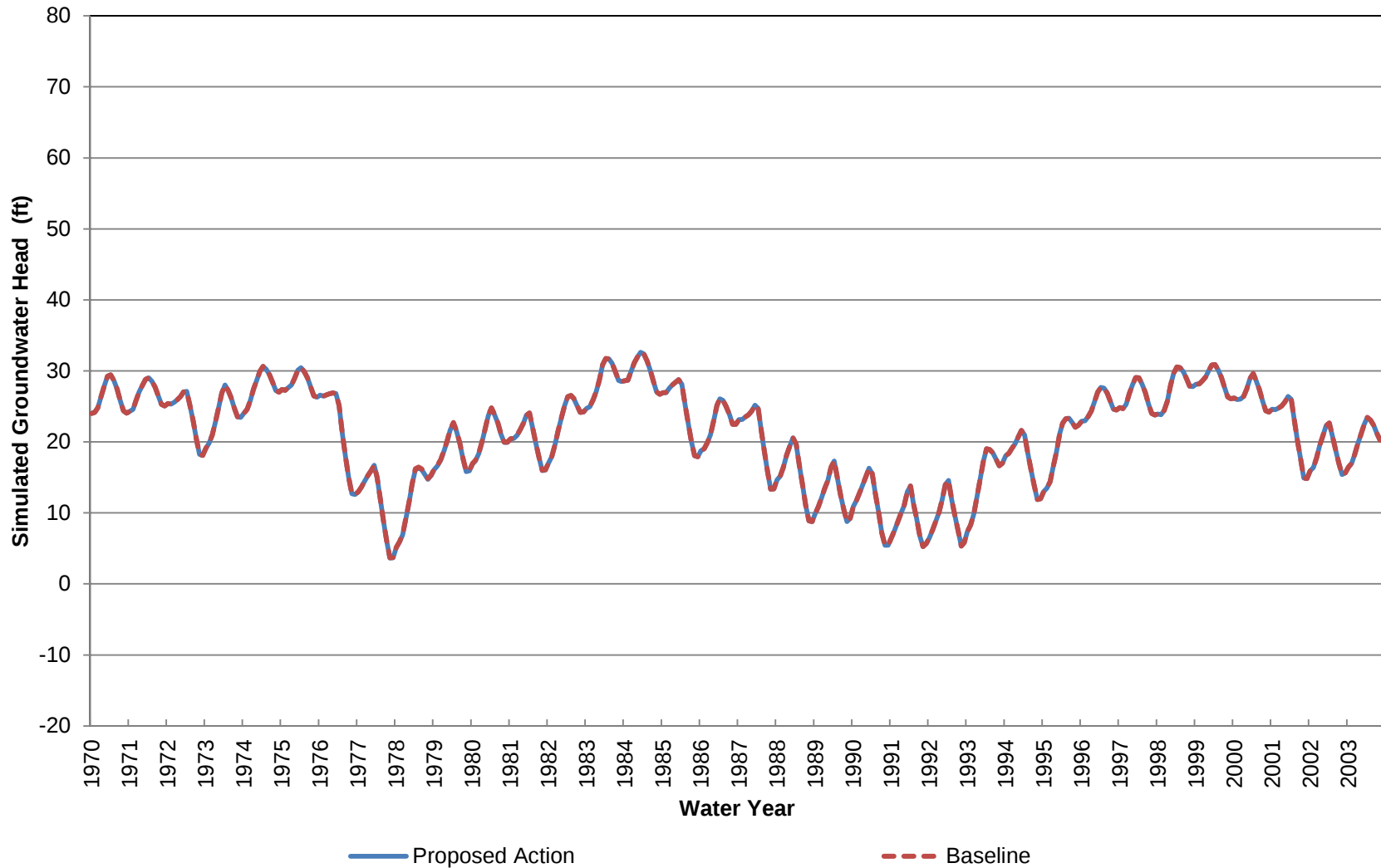
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 18 (Approximately 600-820 ft bgs)**



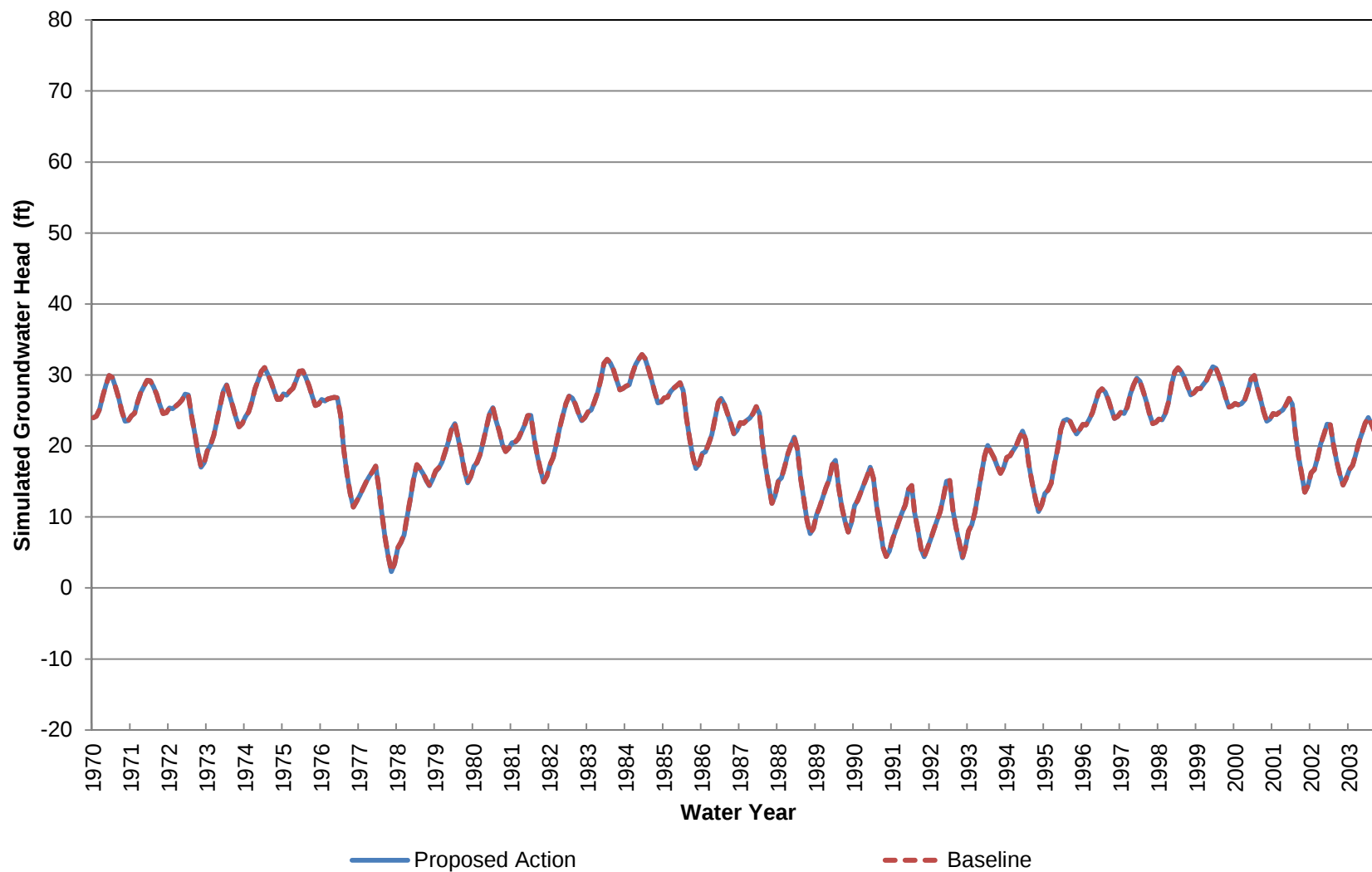
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 19 (Approximately 0-30 ft bgs)**



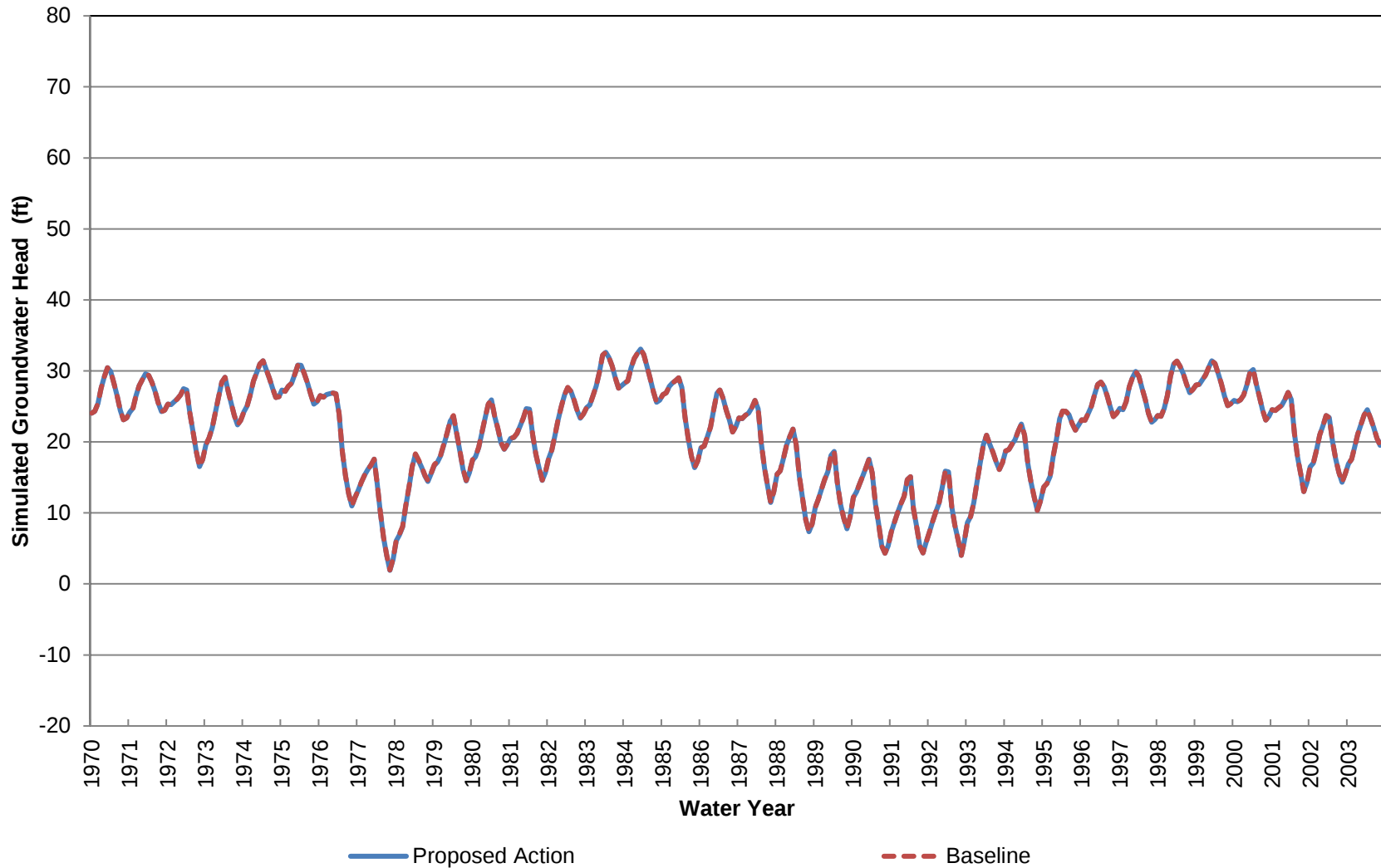
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 19 (Approximately 30-70 ft bgs)**



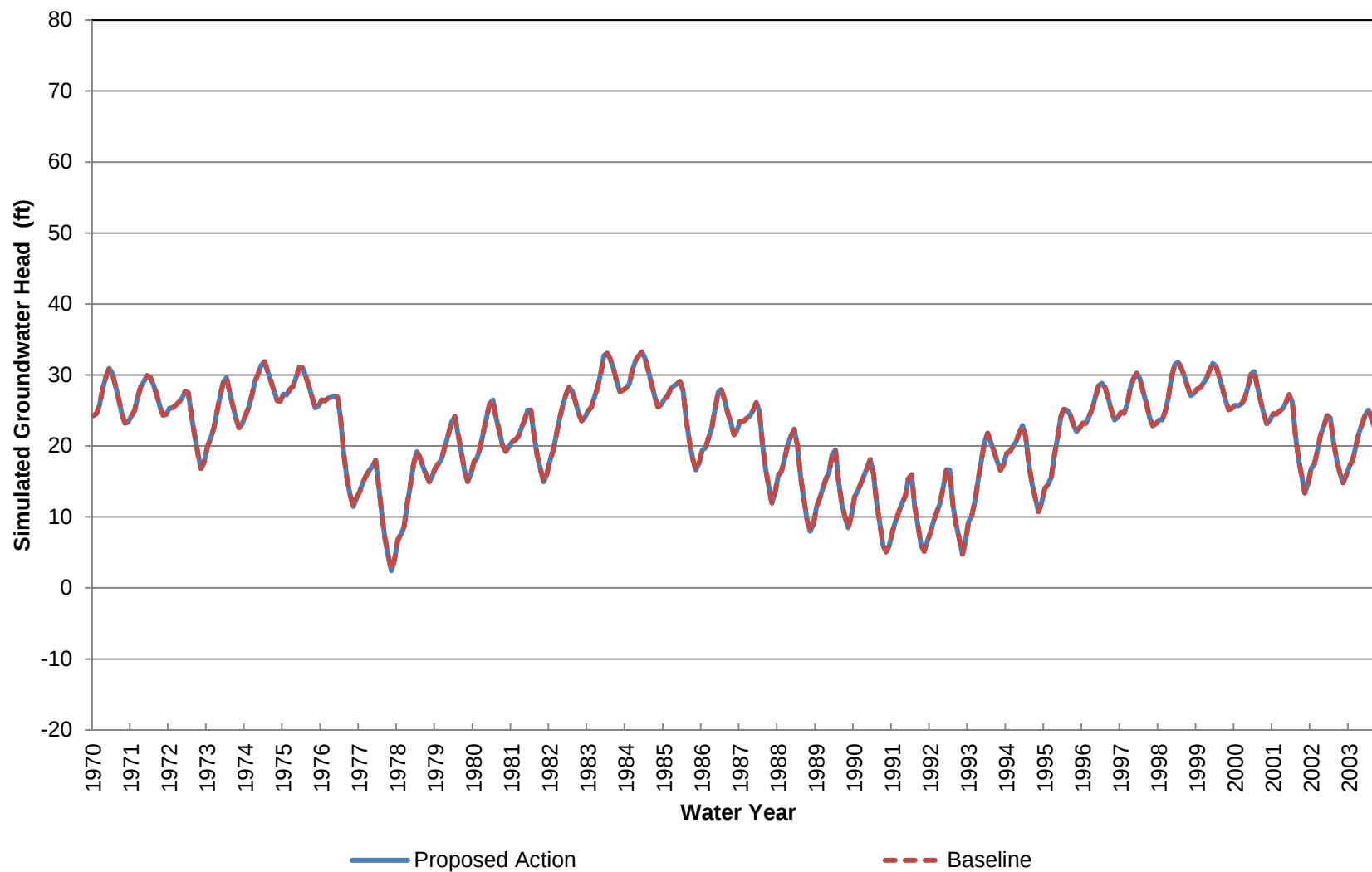
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 19 (Approximately 70-120 ft bgs)**



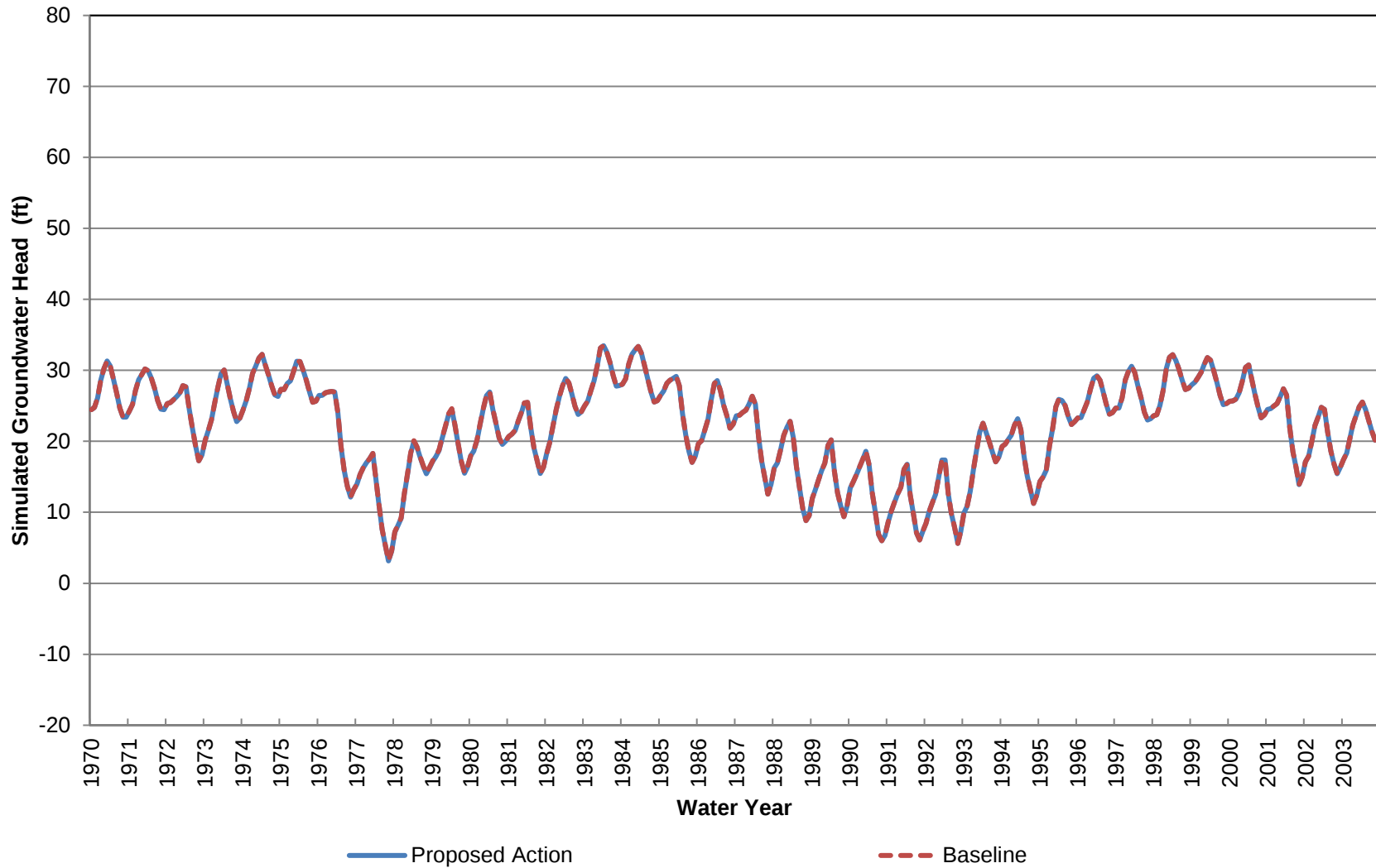
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 19 (Approximately 120-160 ft bgs)**



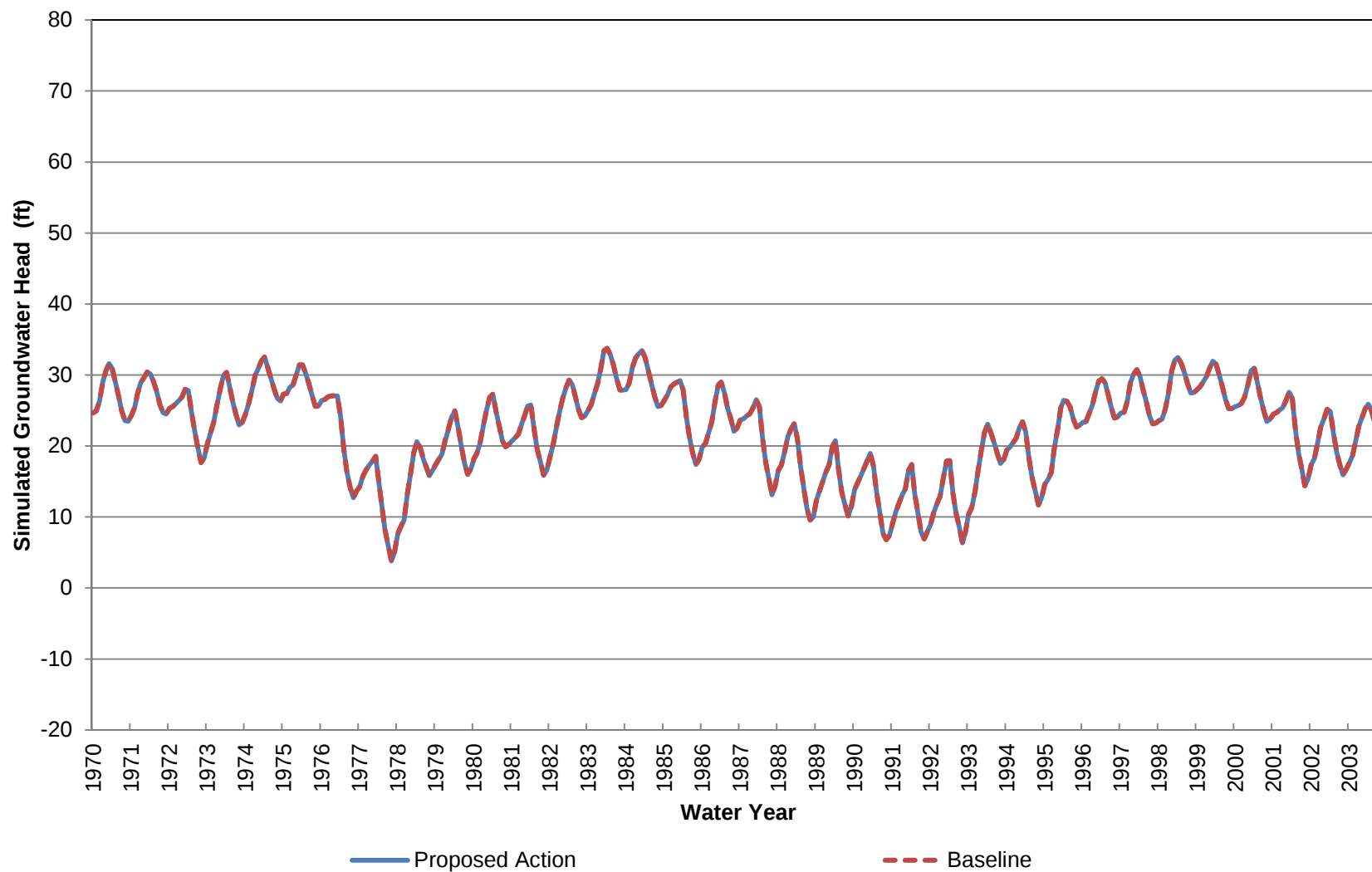
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 19 (Approximately 160-220 ft bgs)**



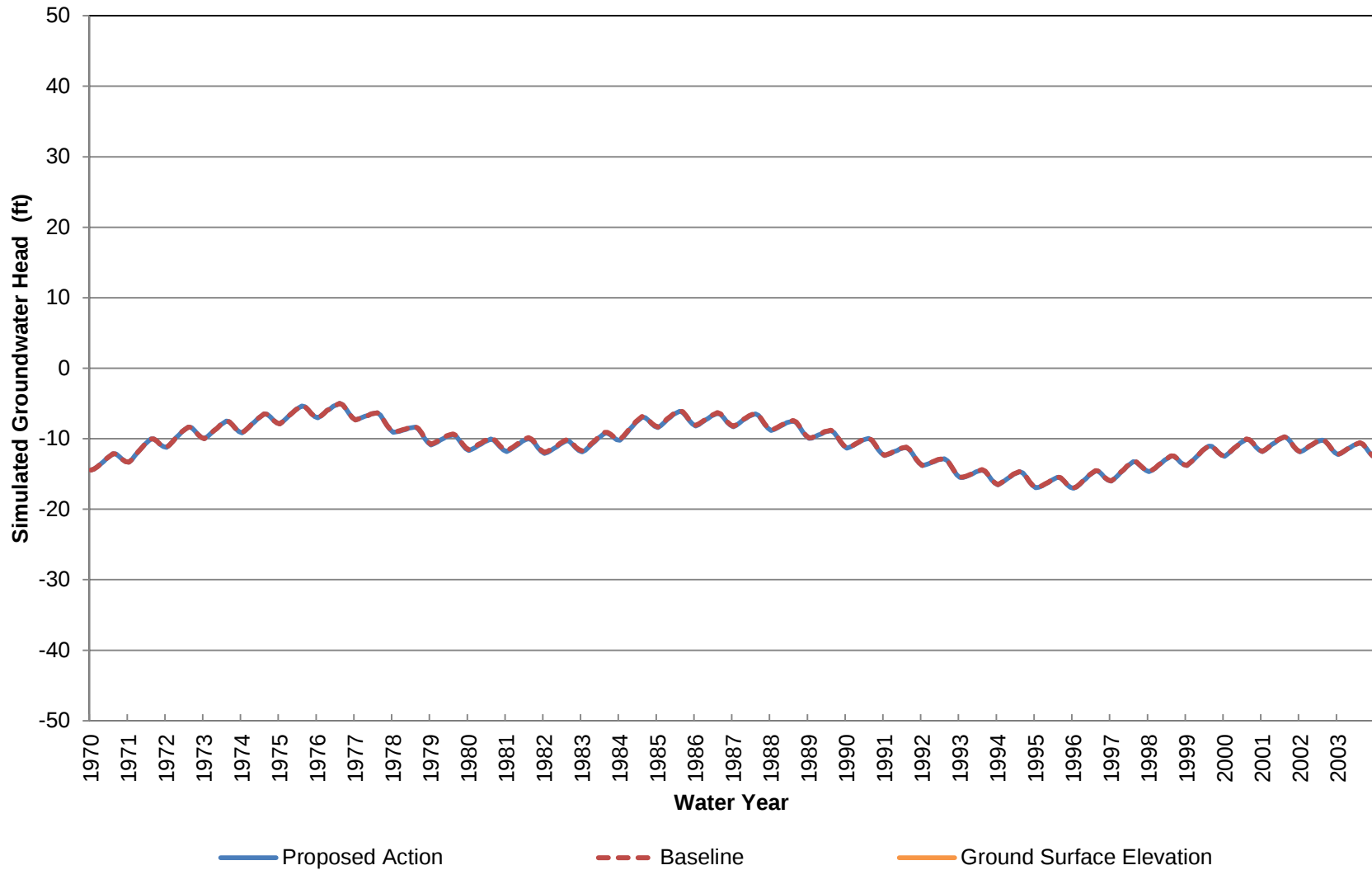
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 19 (Approximately 220-290 ft bgs)**



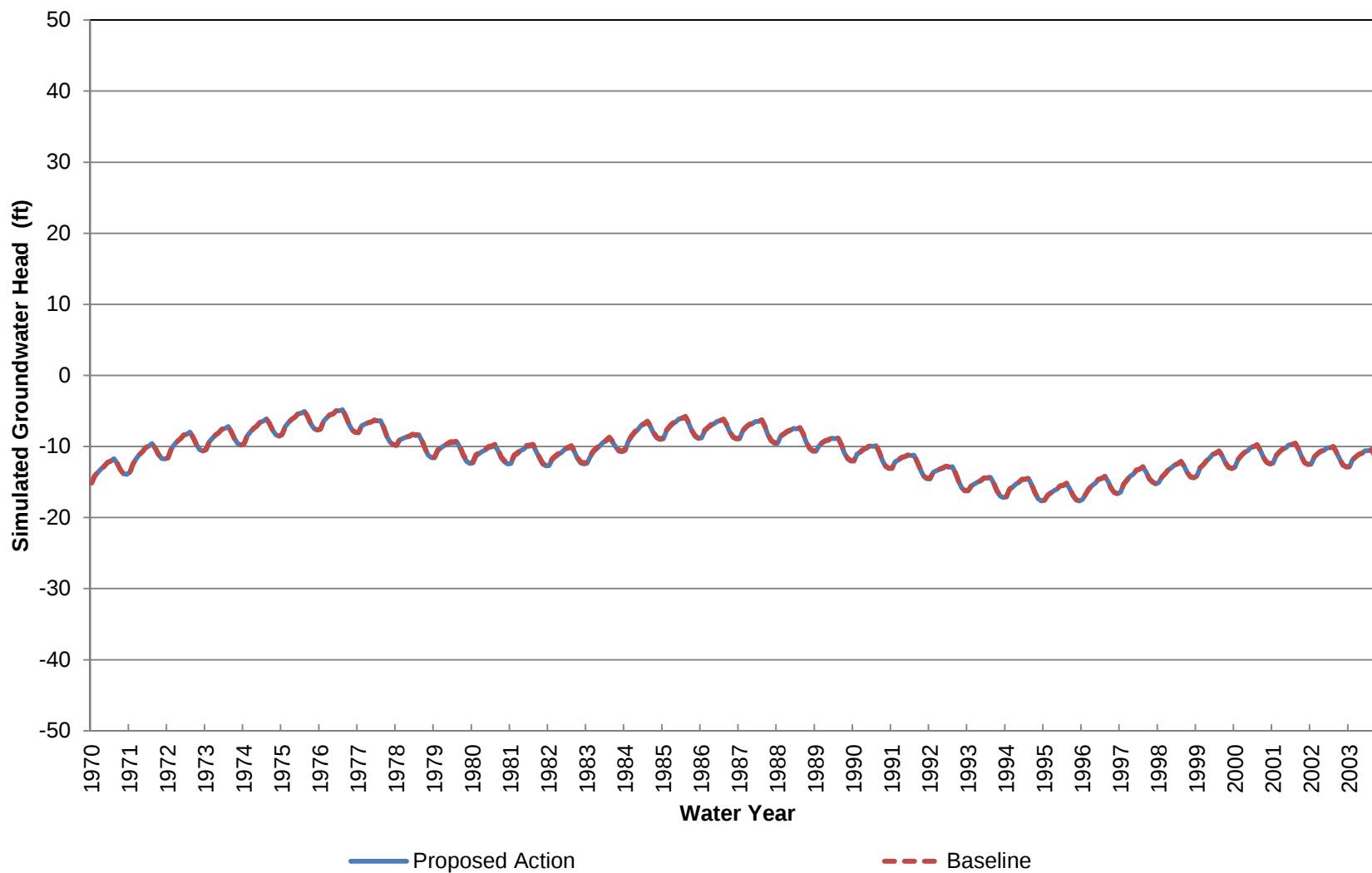
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 19 (Approximately 290-400 ft bgs)**



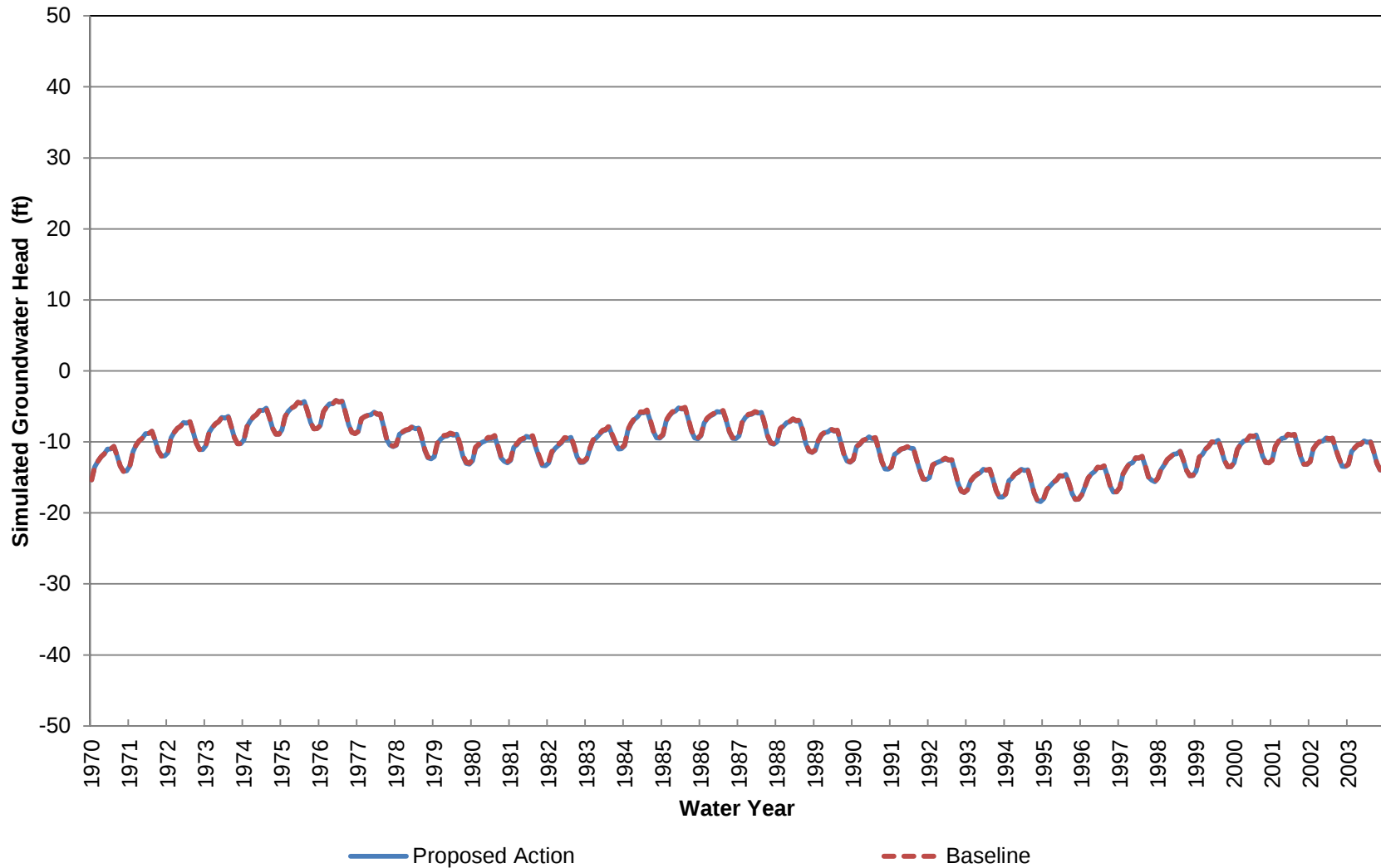
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 20 (Approximately 0-70 ft bgs)**



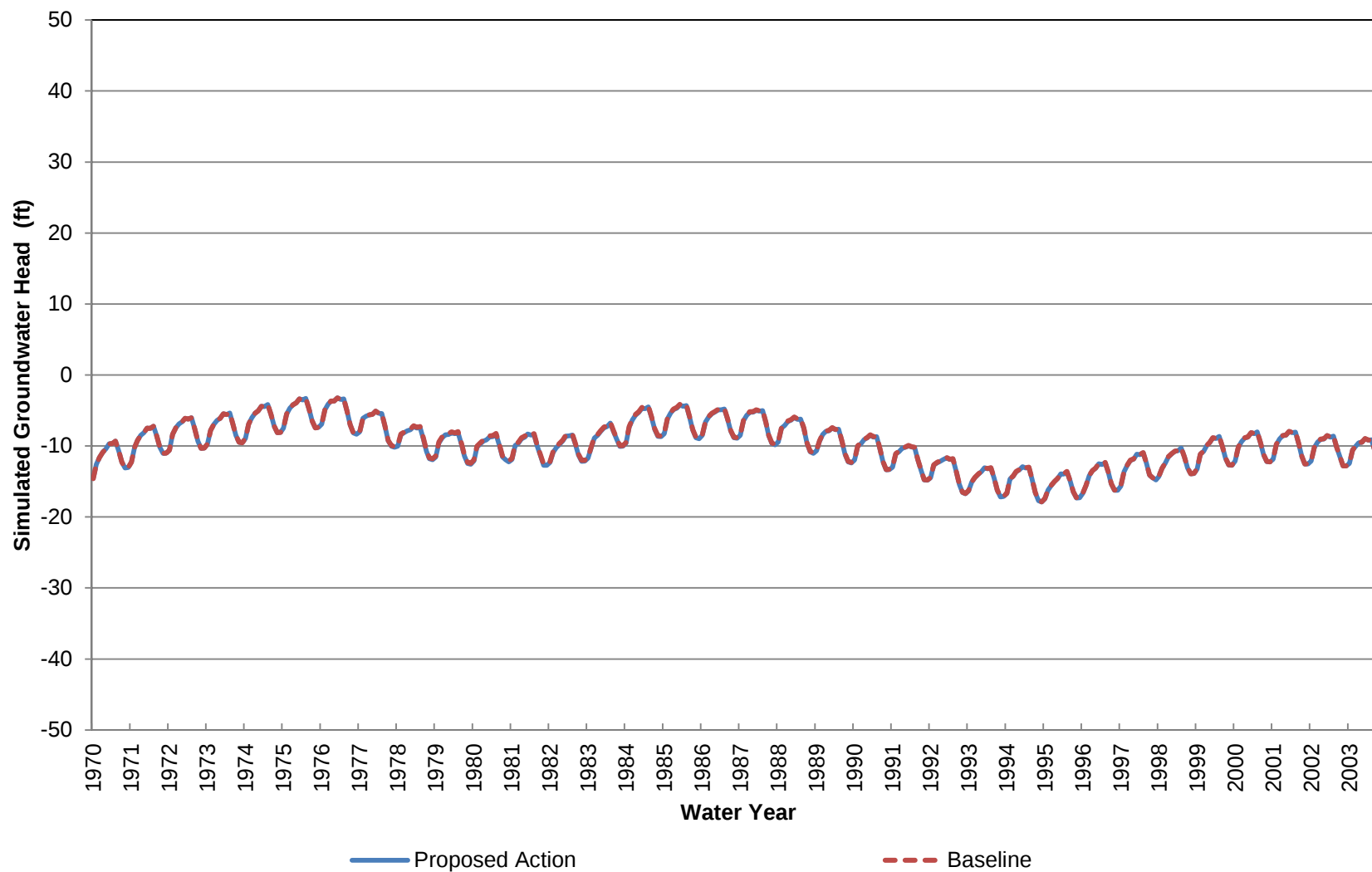
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 70-230 ft bgs)**



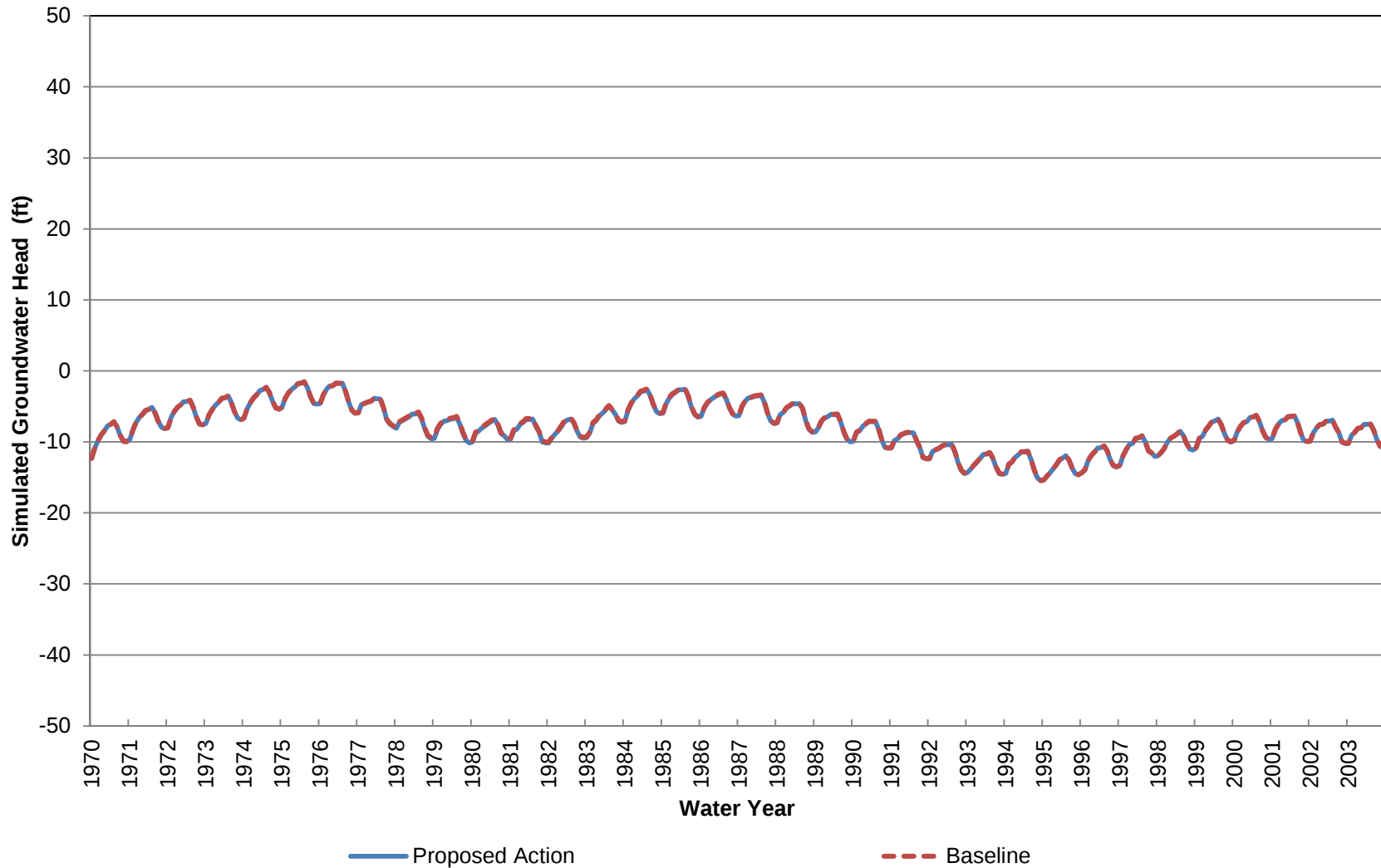
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 230-380 ft bgs)**



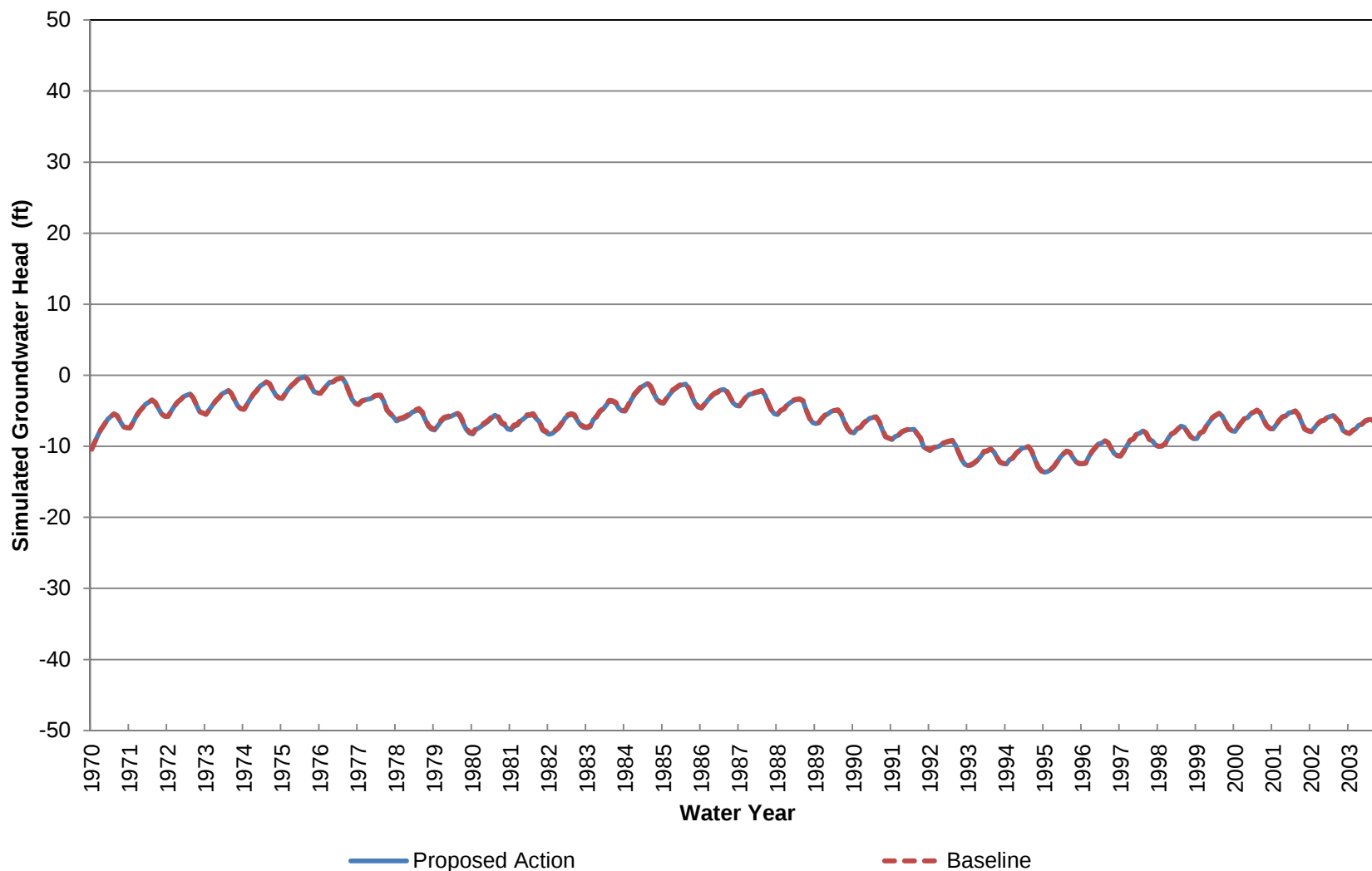
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 380-530 ft bgs)**



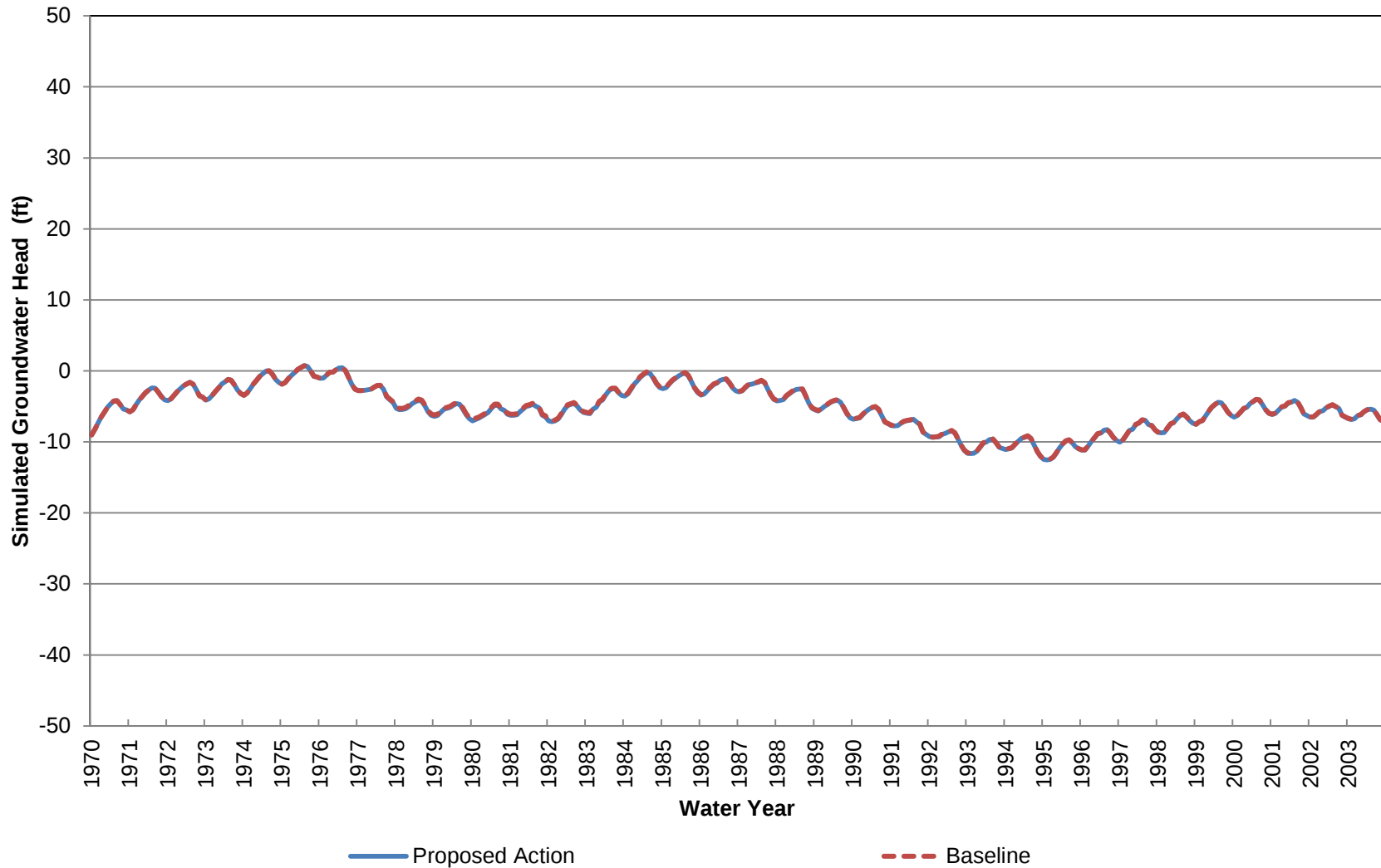
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 530-780 ft bgs)**



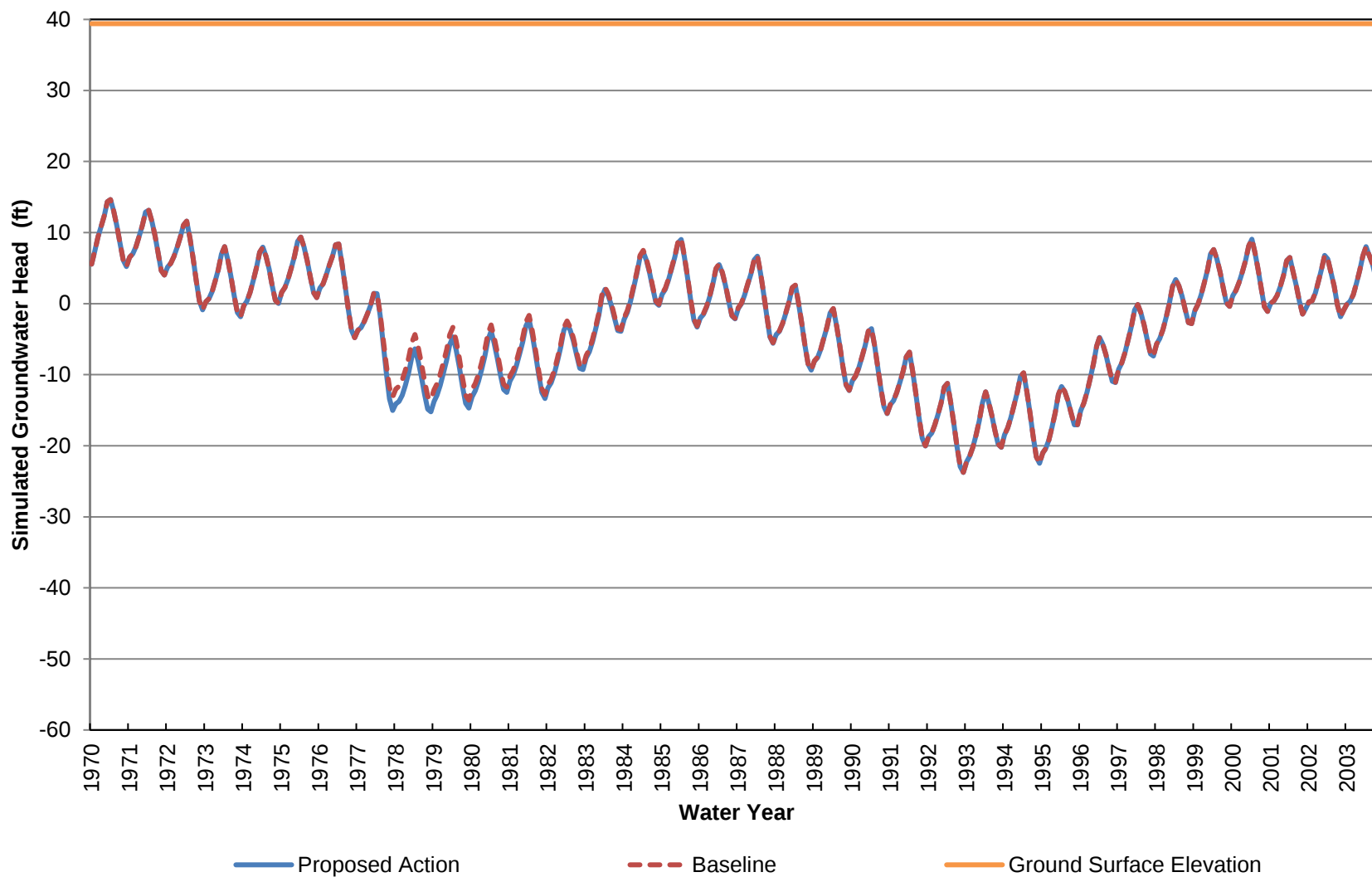
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 780-1030 ft bgs)**



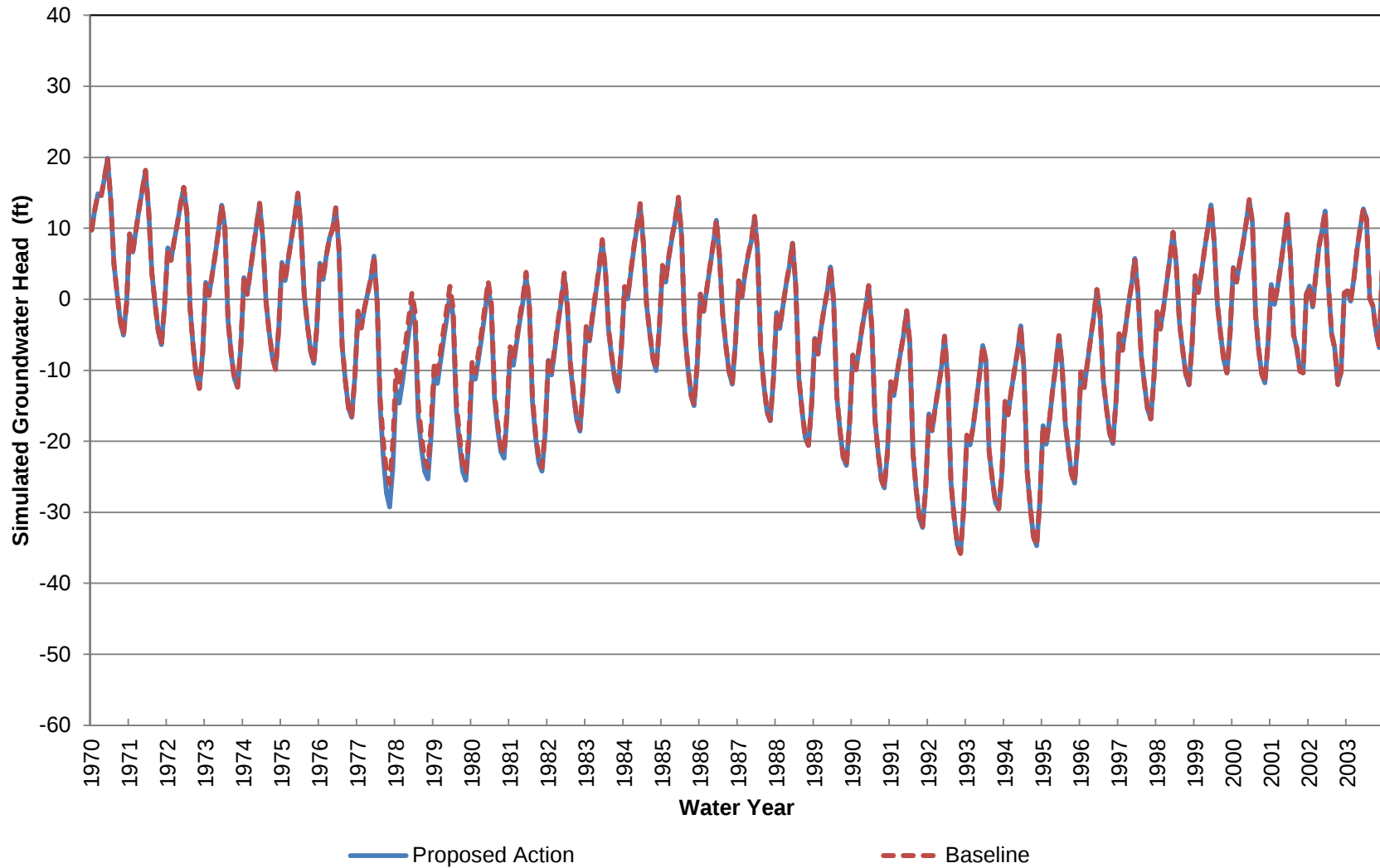
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 20 (Approximately 1030-1420 ft bgs)**



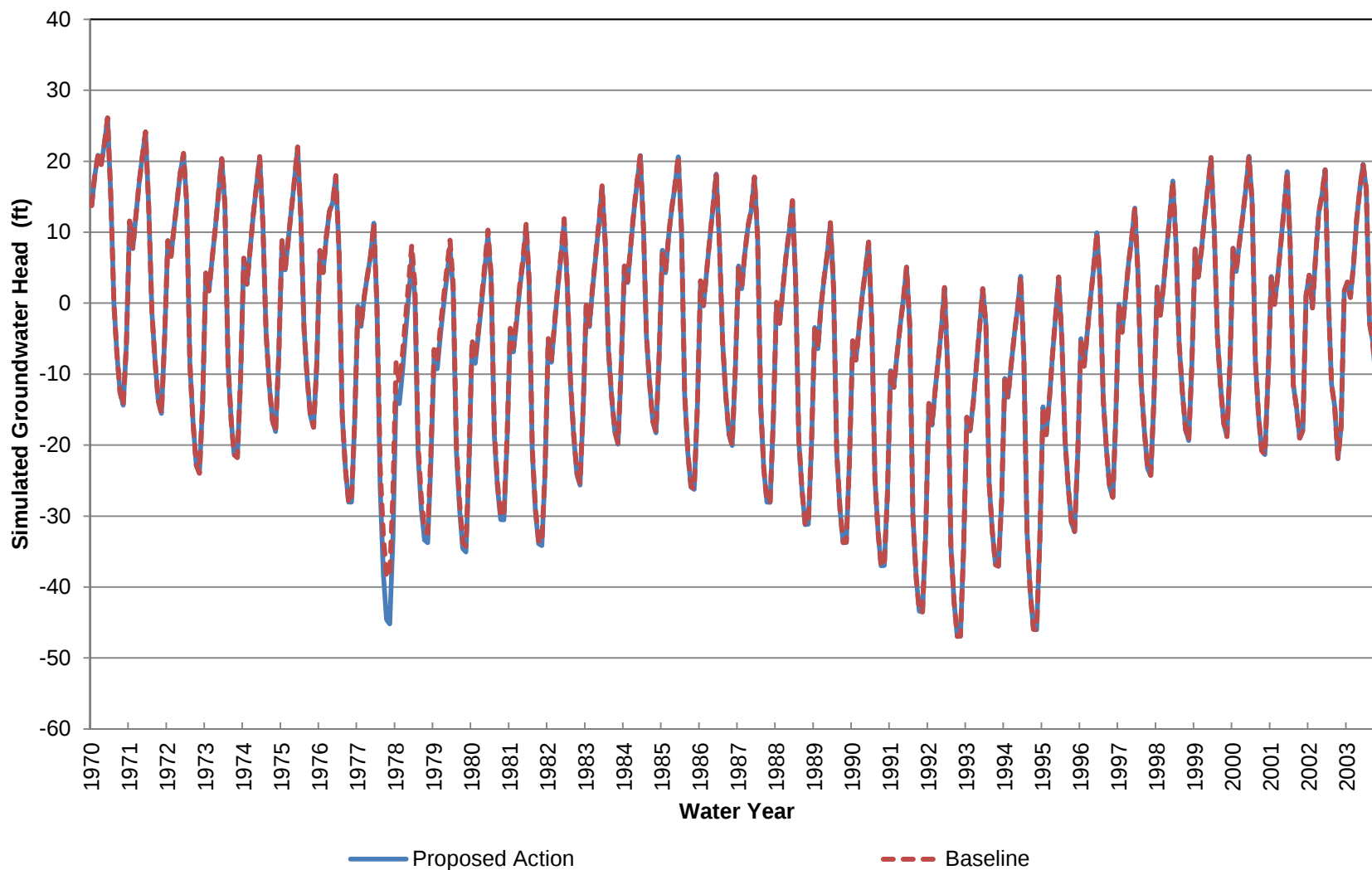
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 21 (Approximately 0-70 ft bgs)**



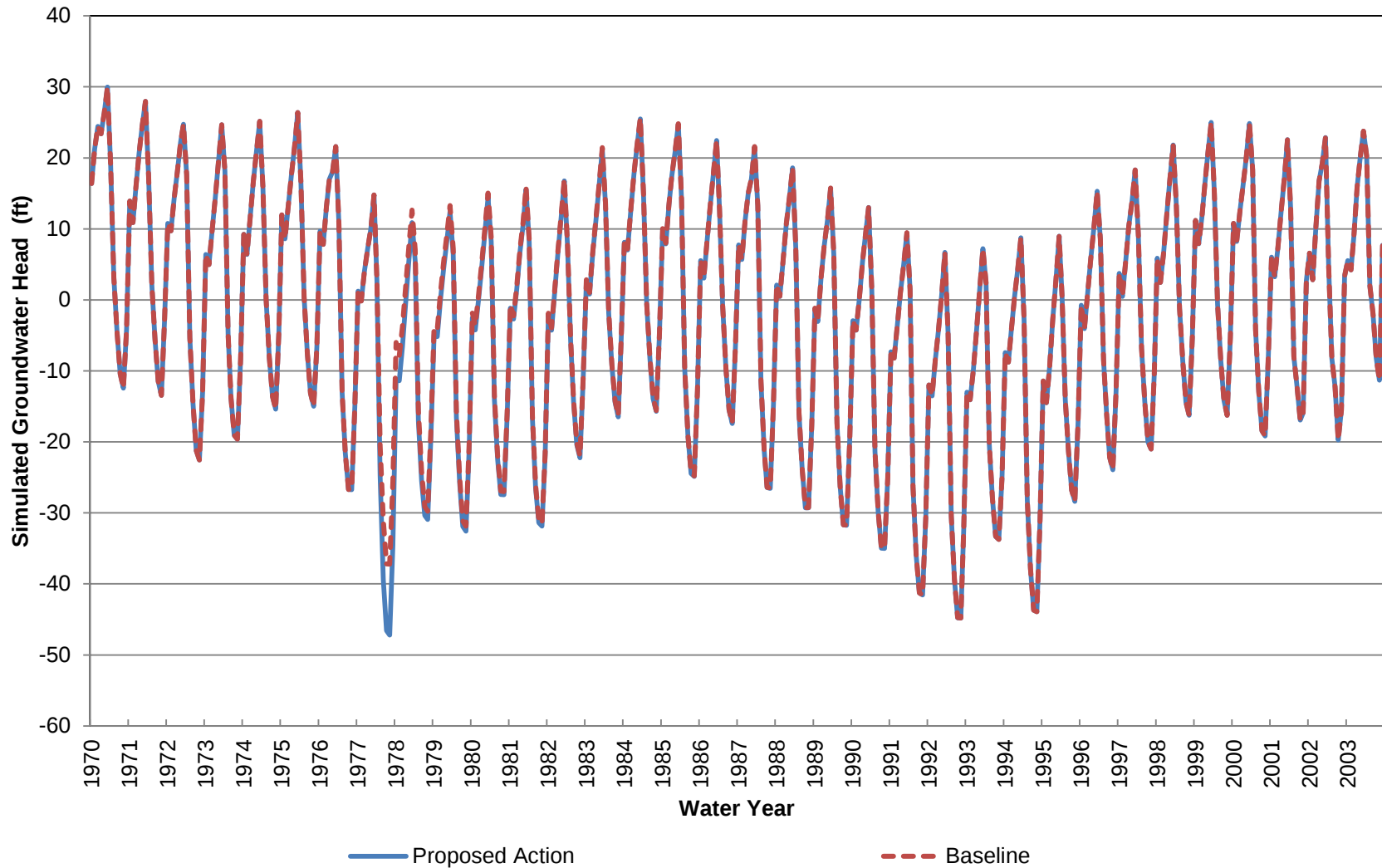
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 70-210 ft bgs)**



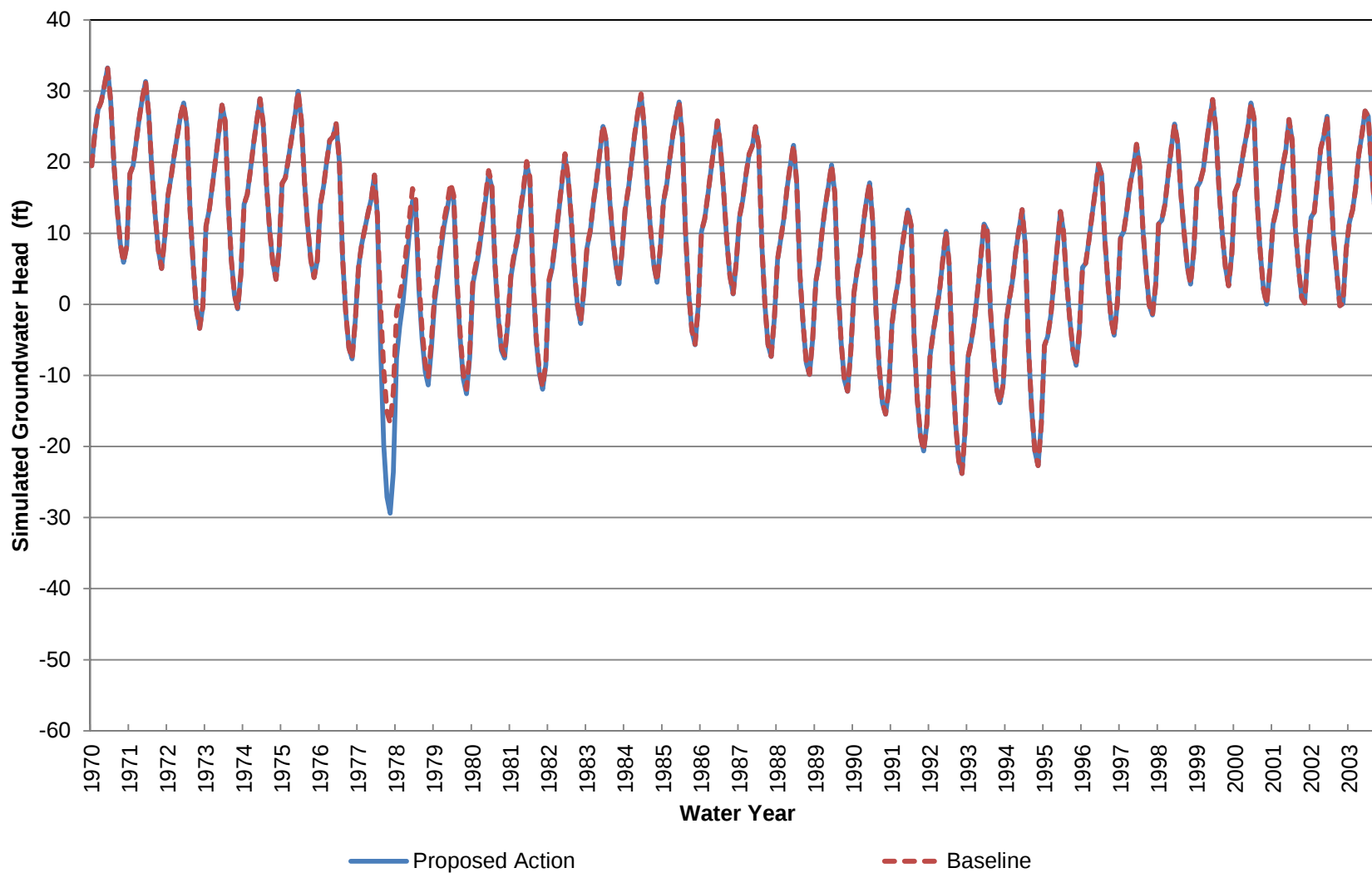
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 210-340 ft bgs)**



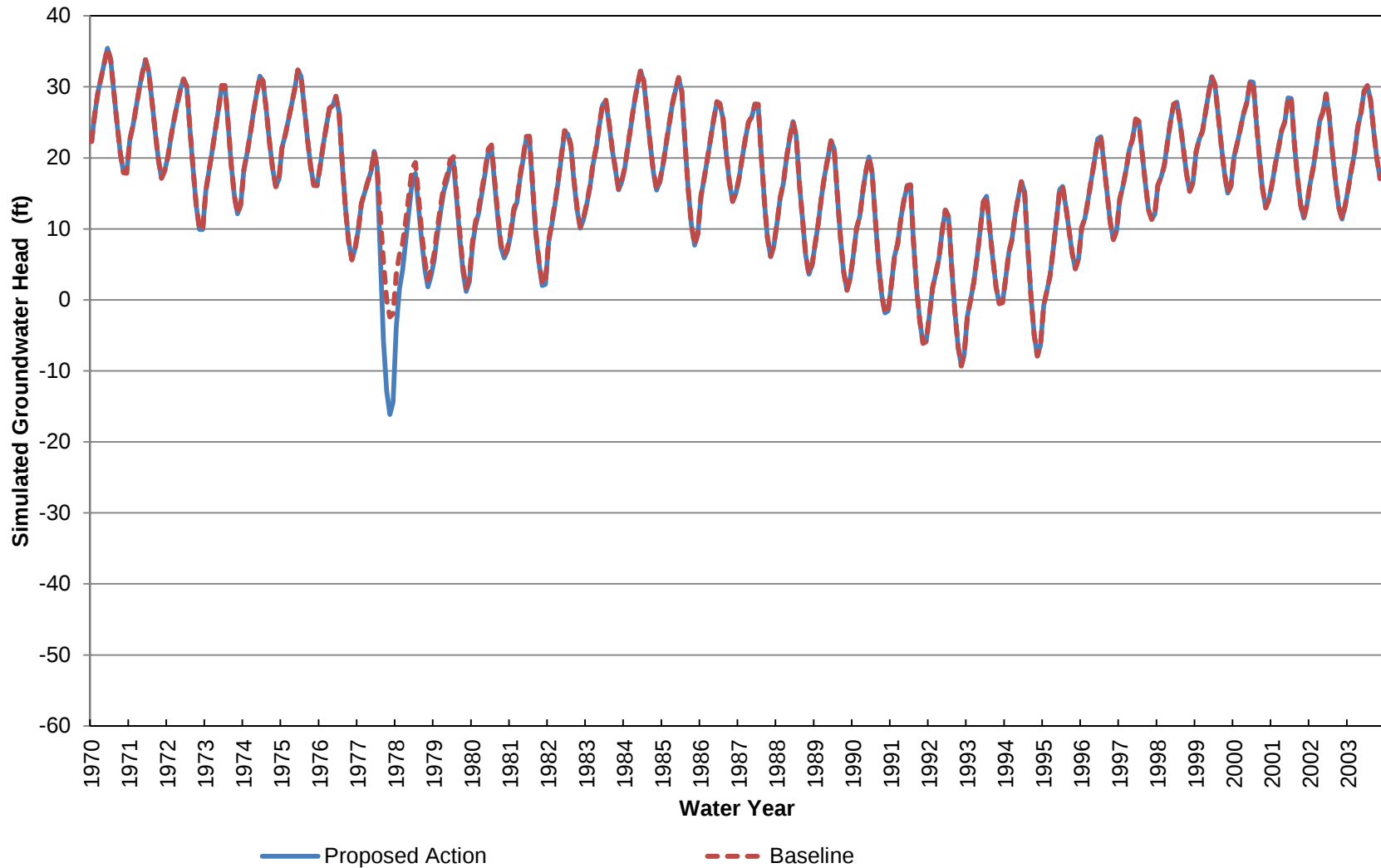
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 340-480 ft bgs)**



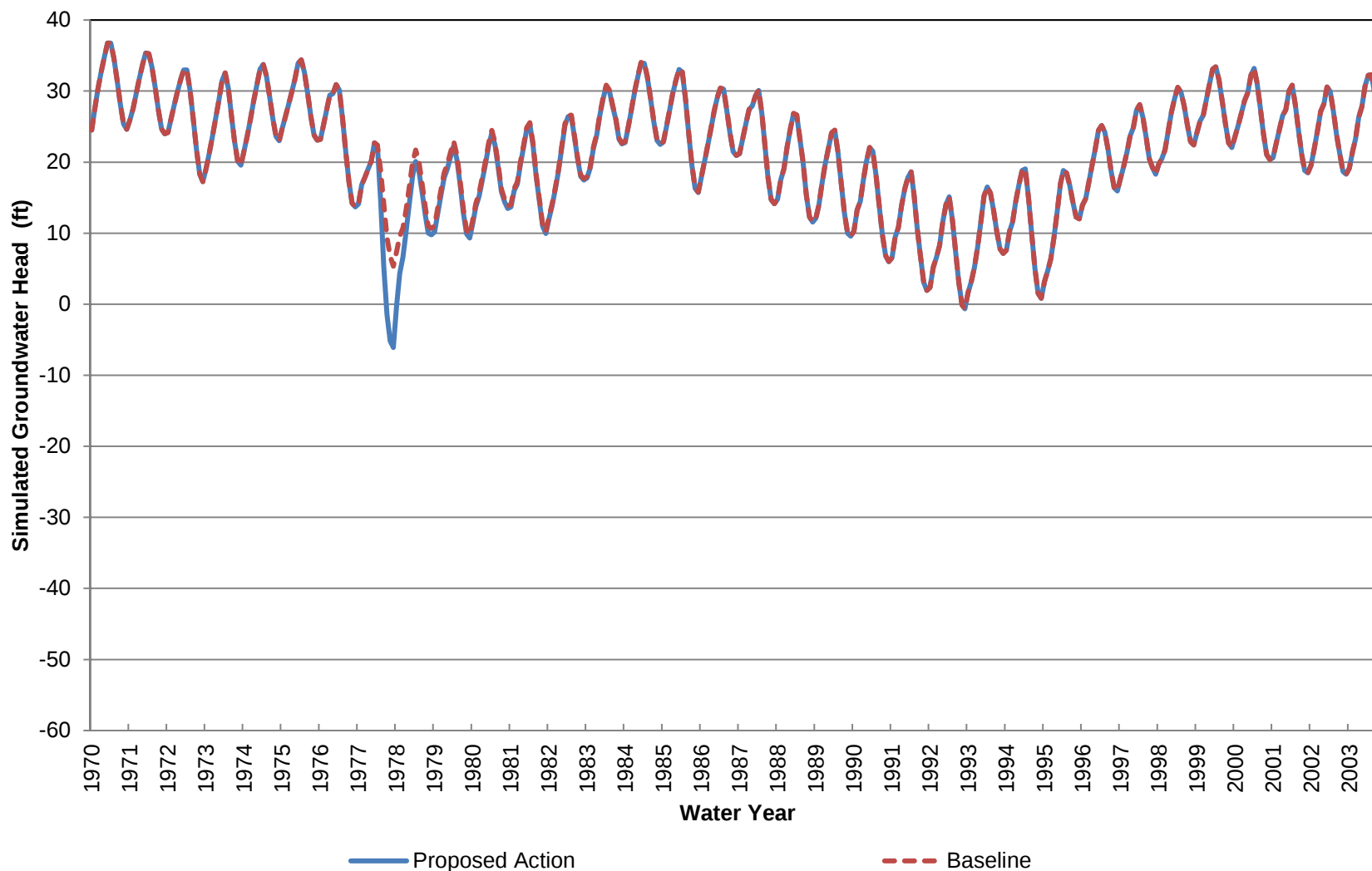
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 480-690 ft bgs)**



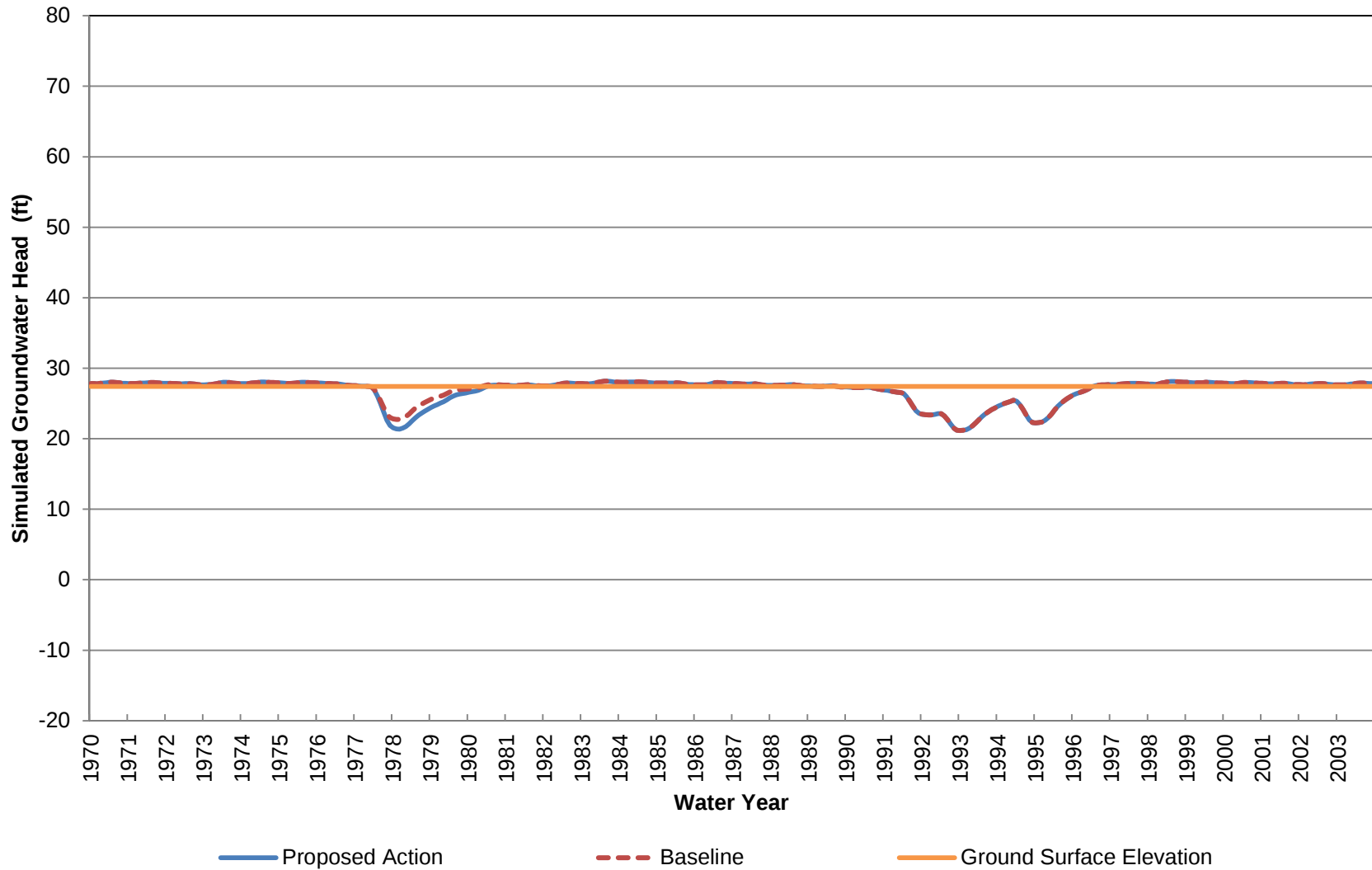
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 690-910 ft bgs)**



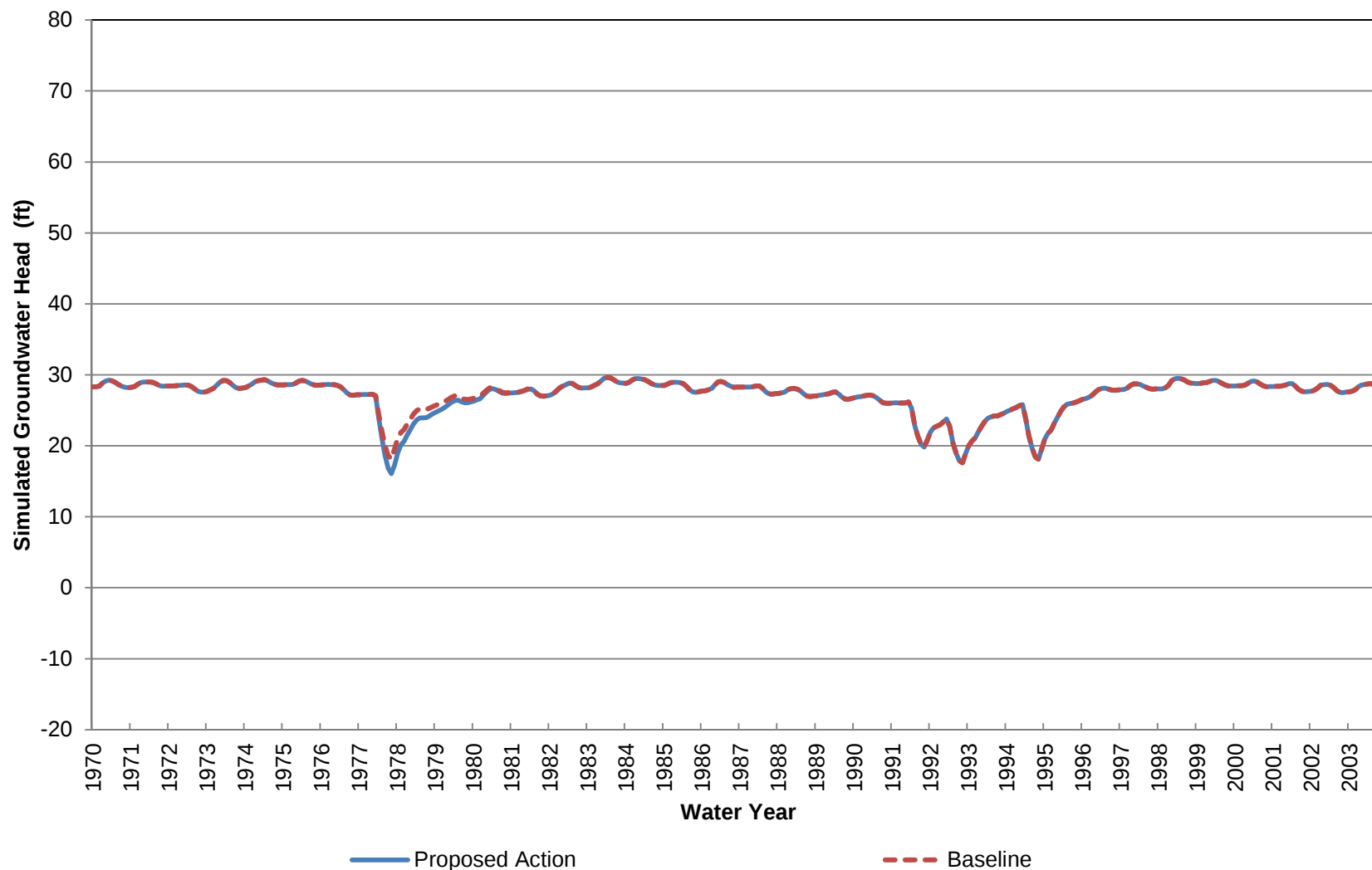
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 21 (Approximately 910-1250 ft bgs)**



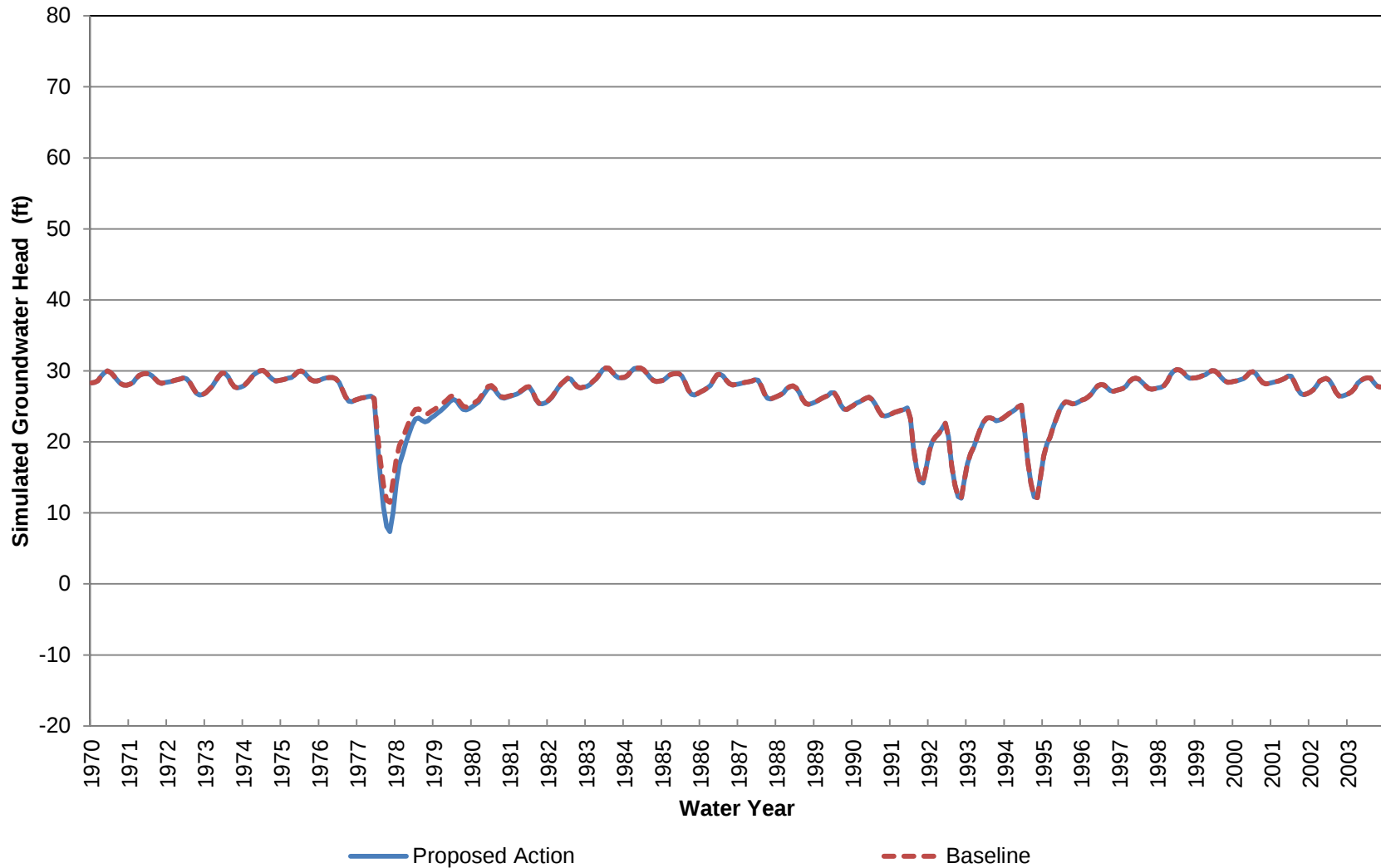
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 22 (Approximately 0-70 ft bgs)**



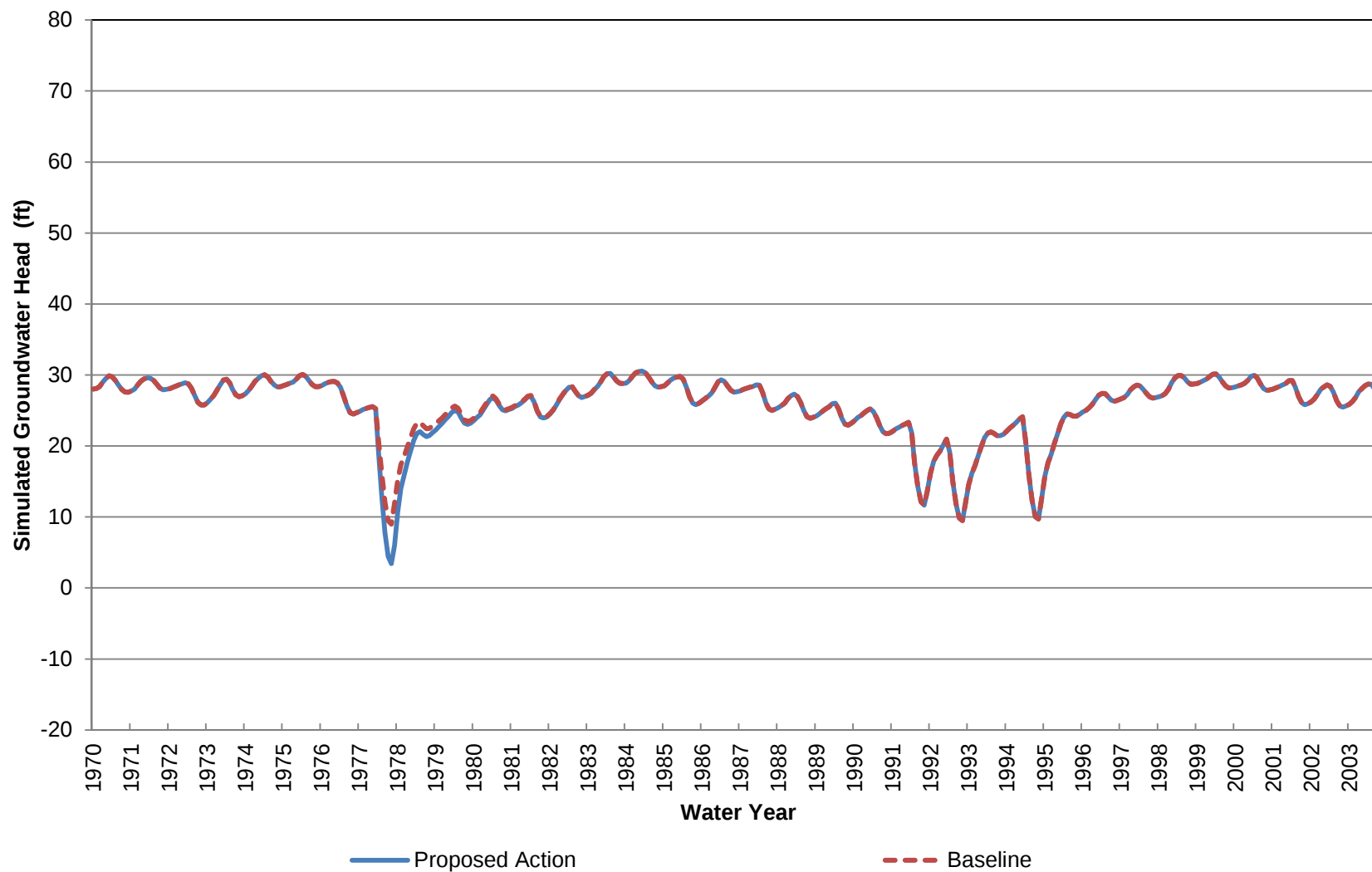
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 70-230 ft bgs)**



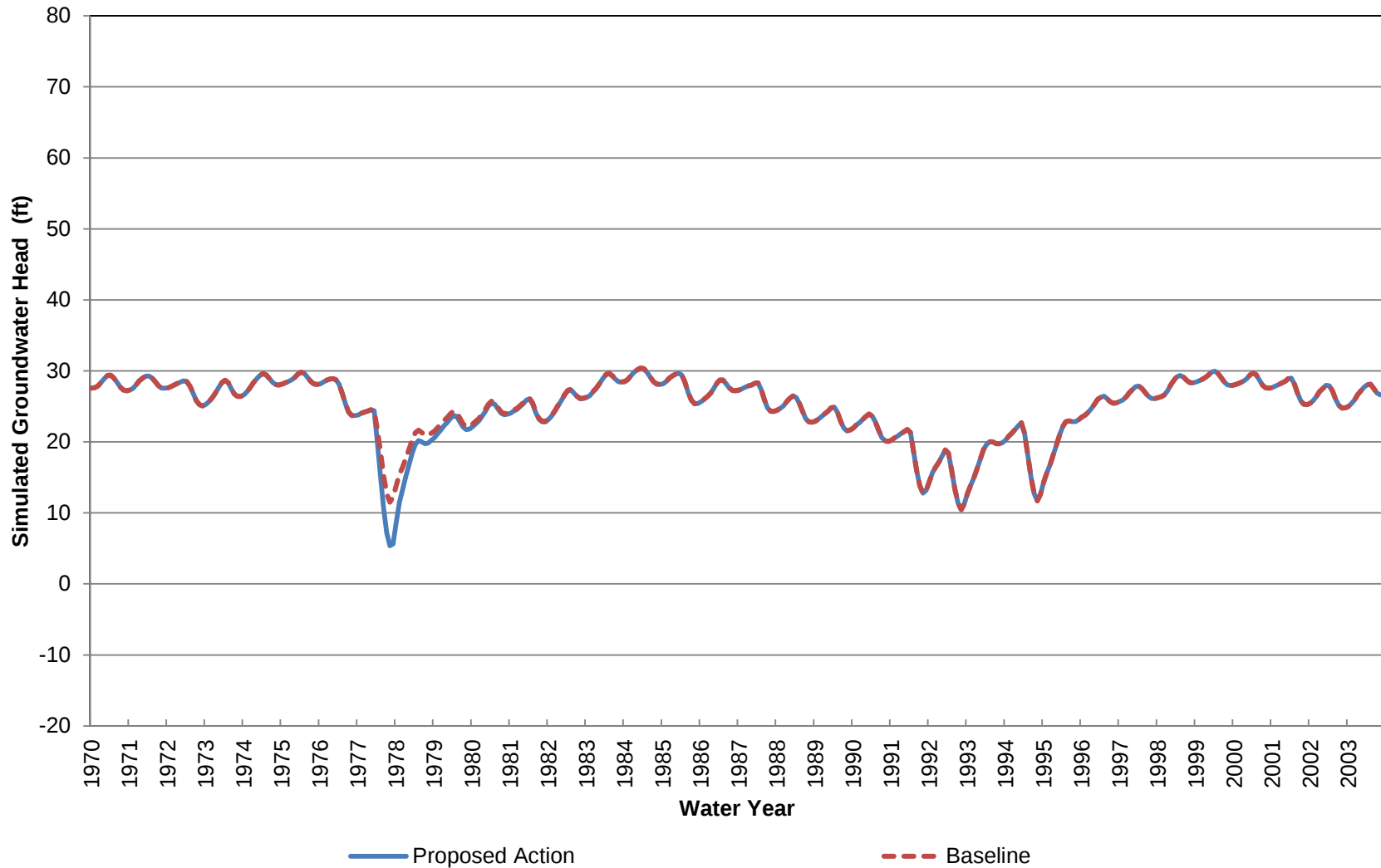
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 230-390 ft bgs)**



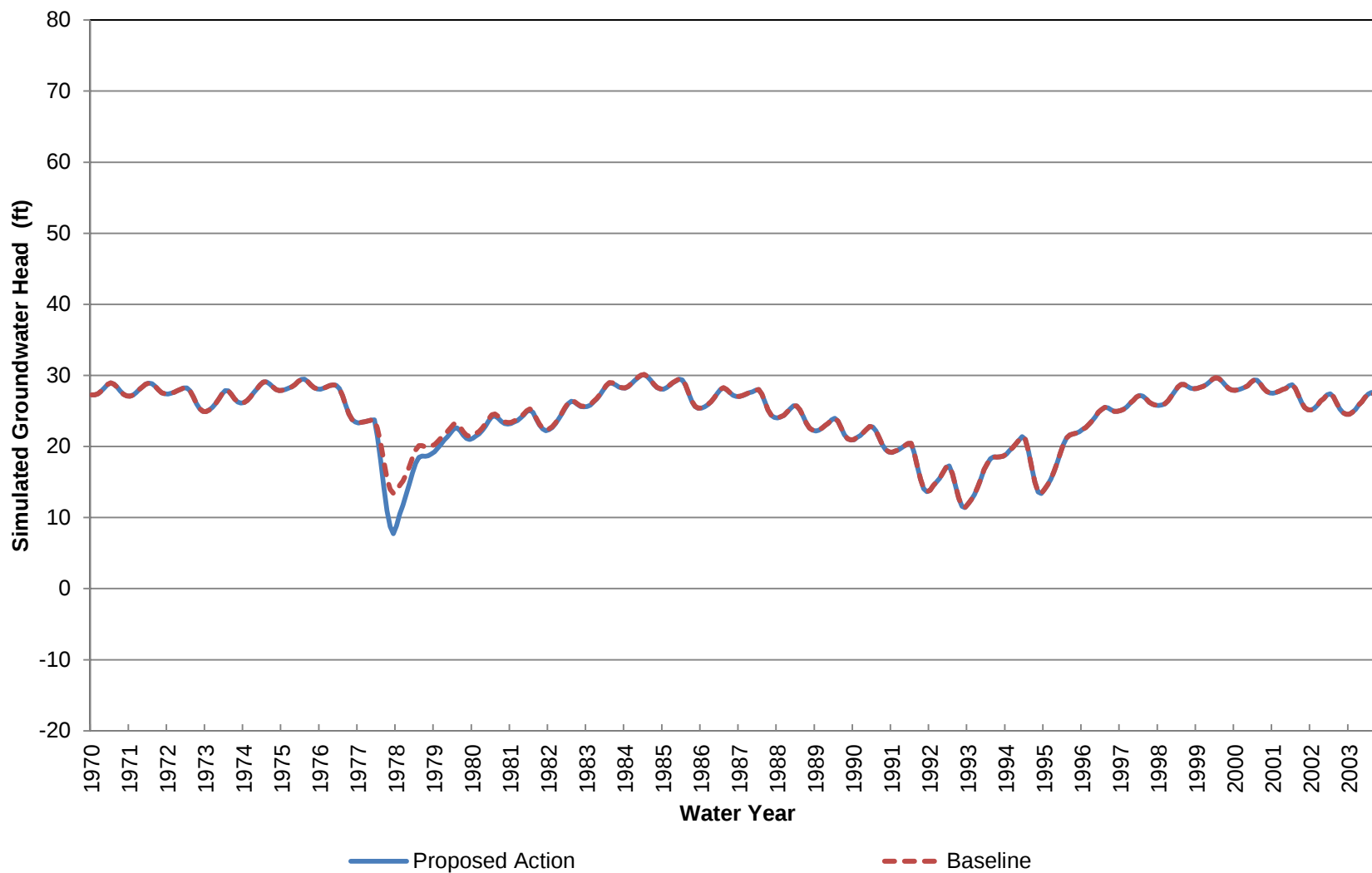
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 390-550 ft bgs)**



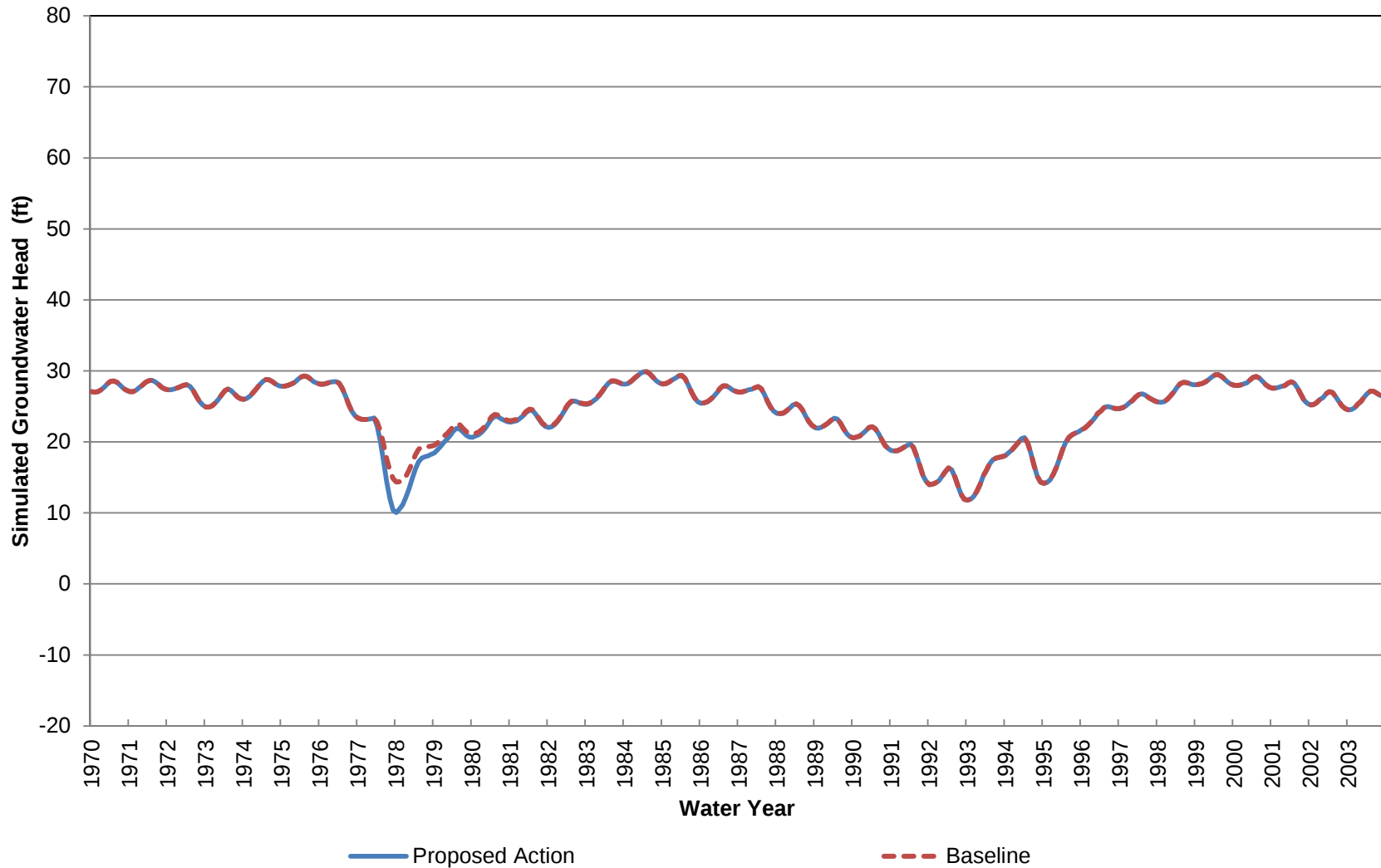
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 550-810 ft bgs)**



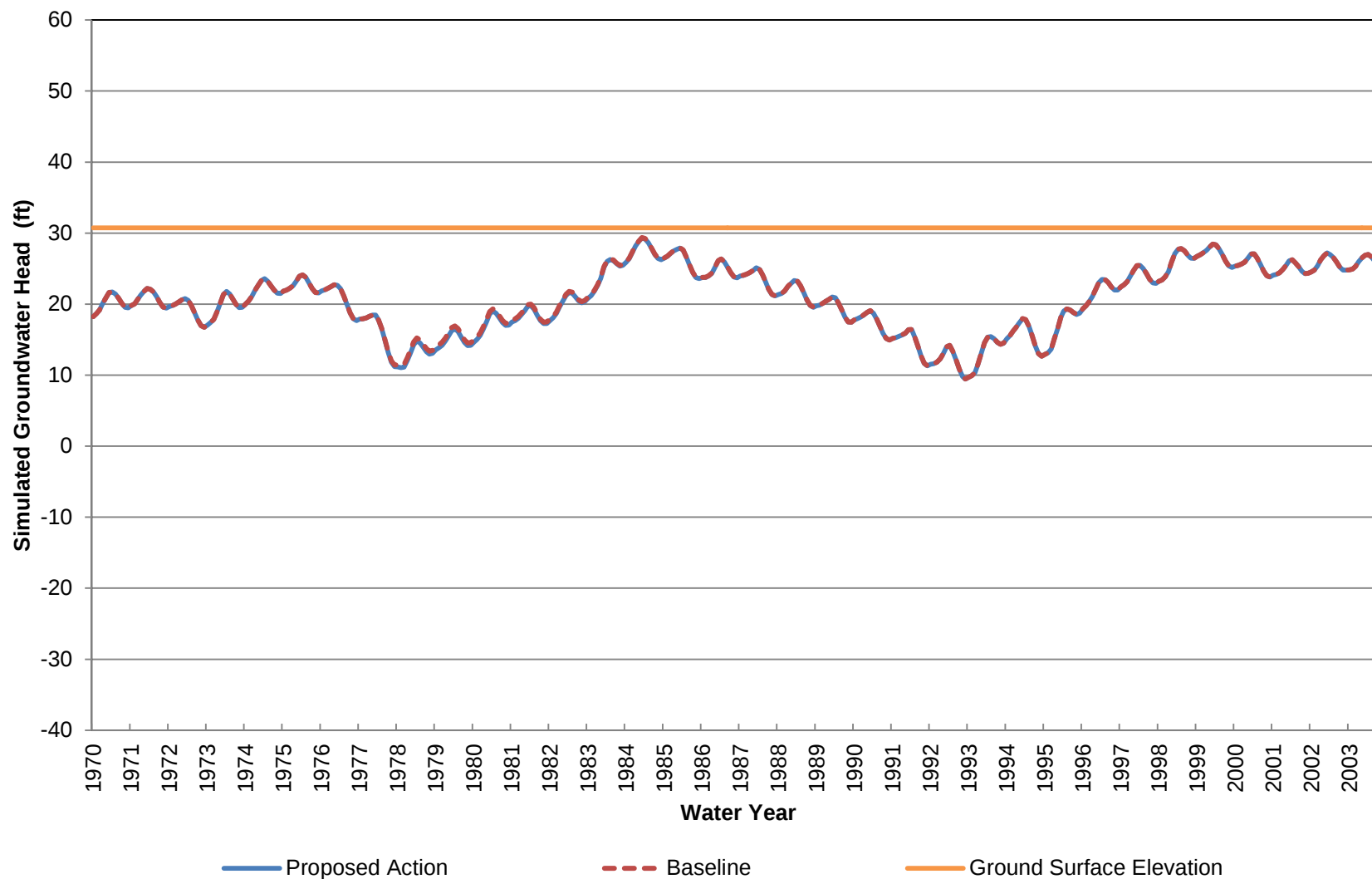
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 810-1080 ft bgs)**



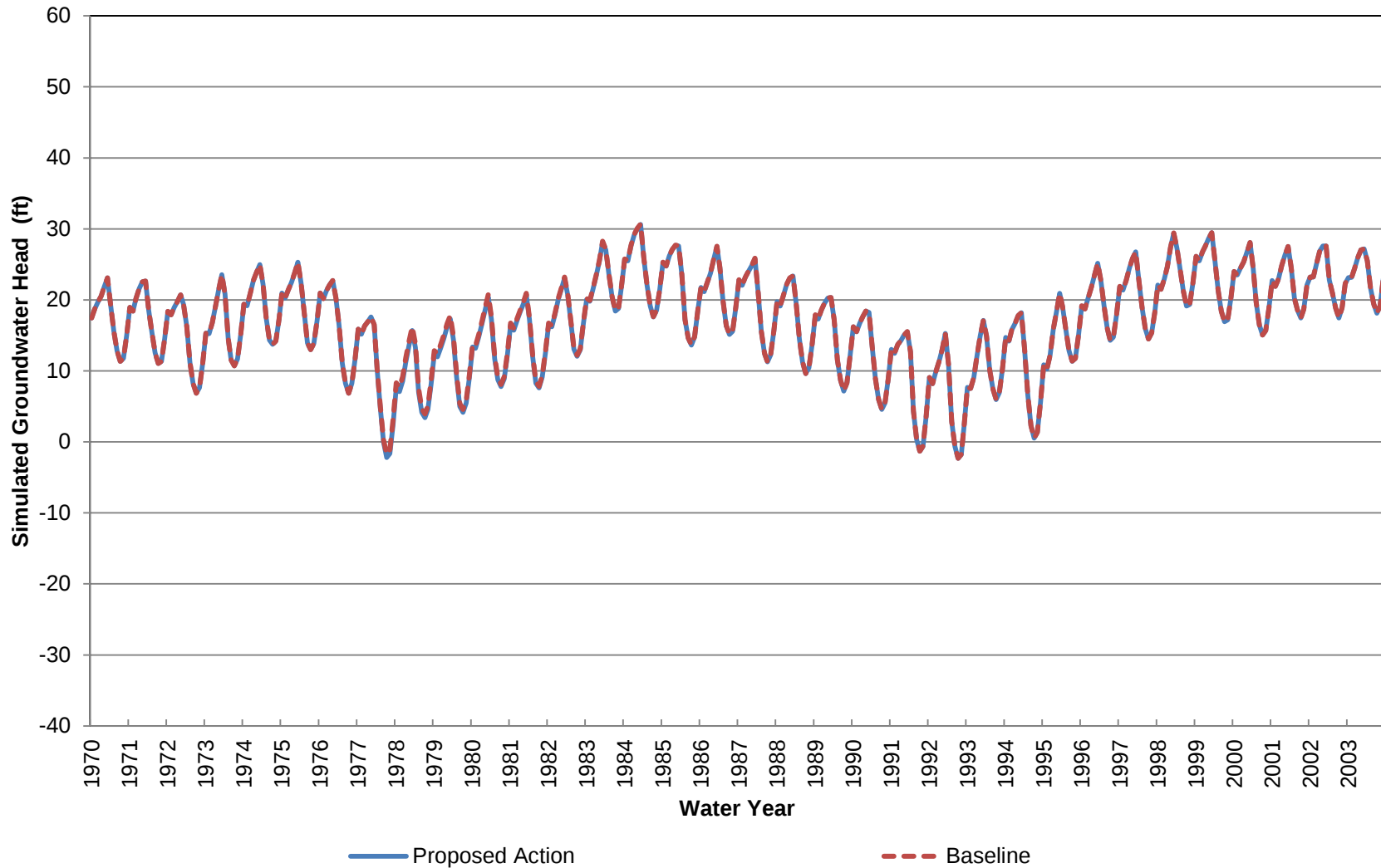
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 22 (Approximately 1080-1480 ft bgs)**



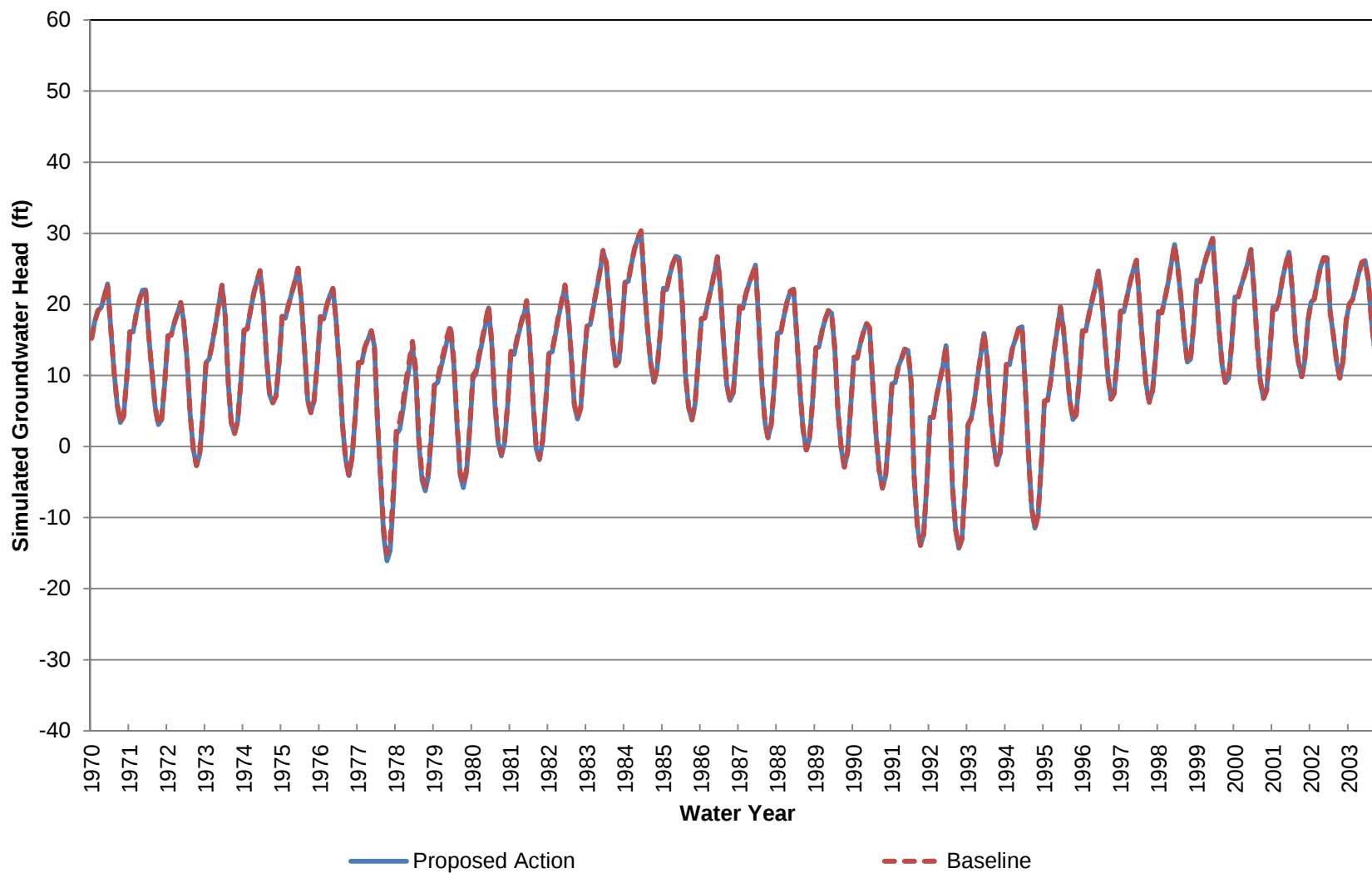
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 23 (Approximately 0-70 ft bgs)**



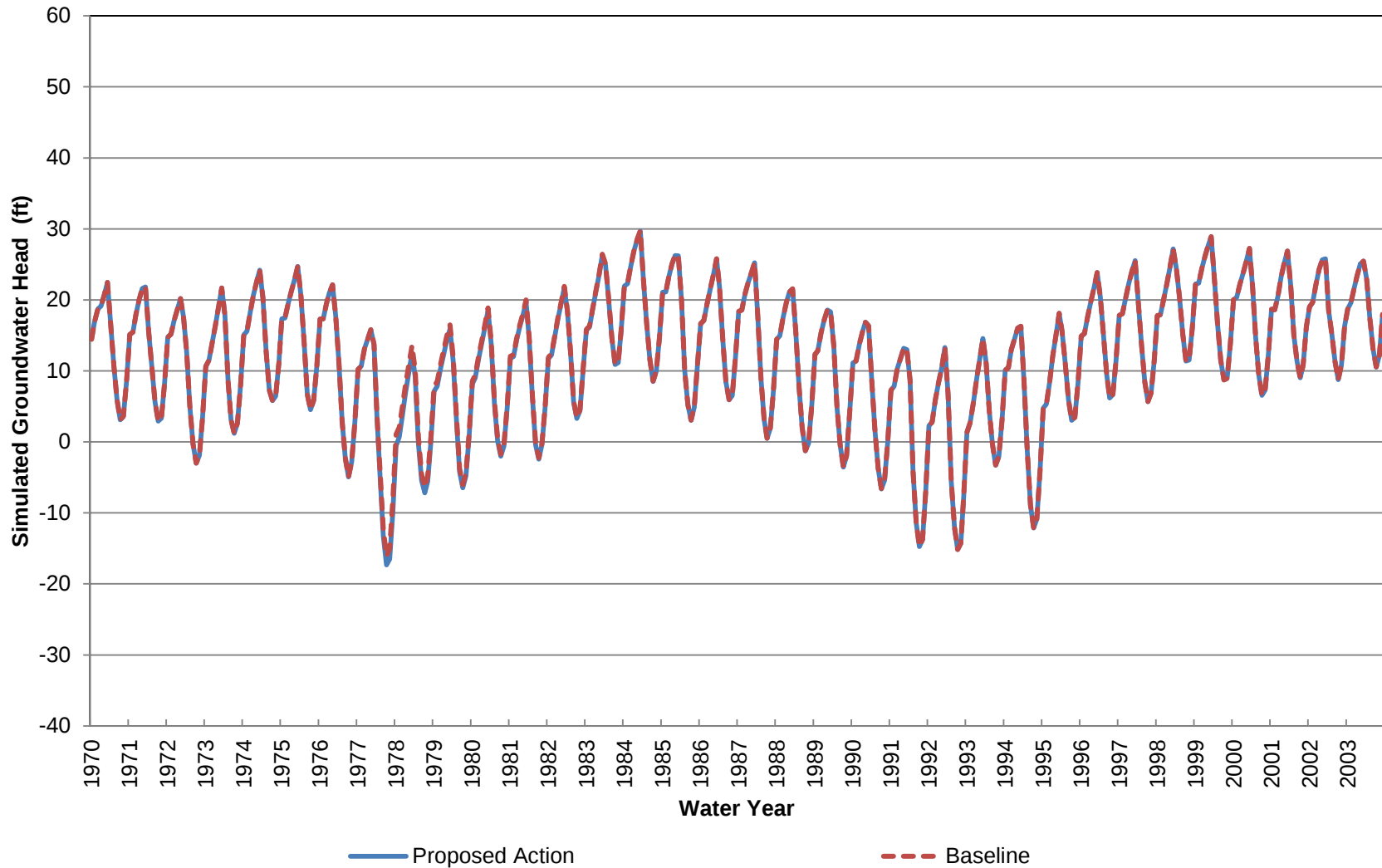
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 70-290 ft bgs)**



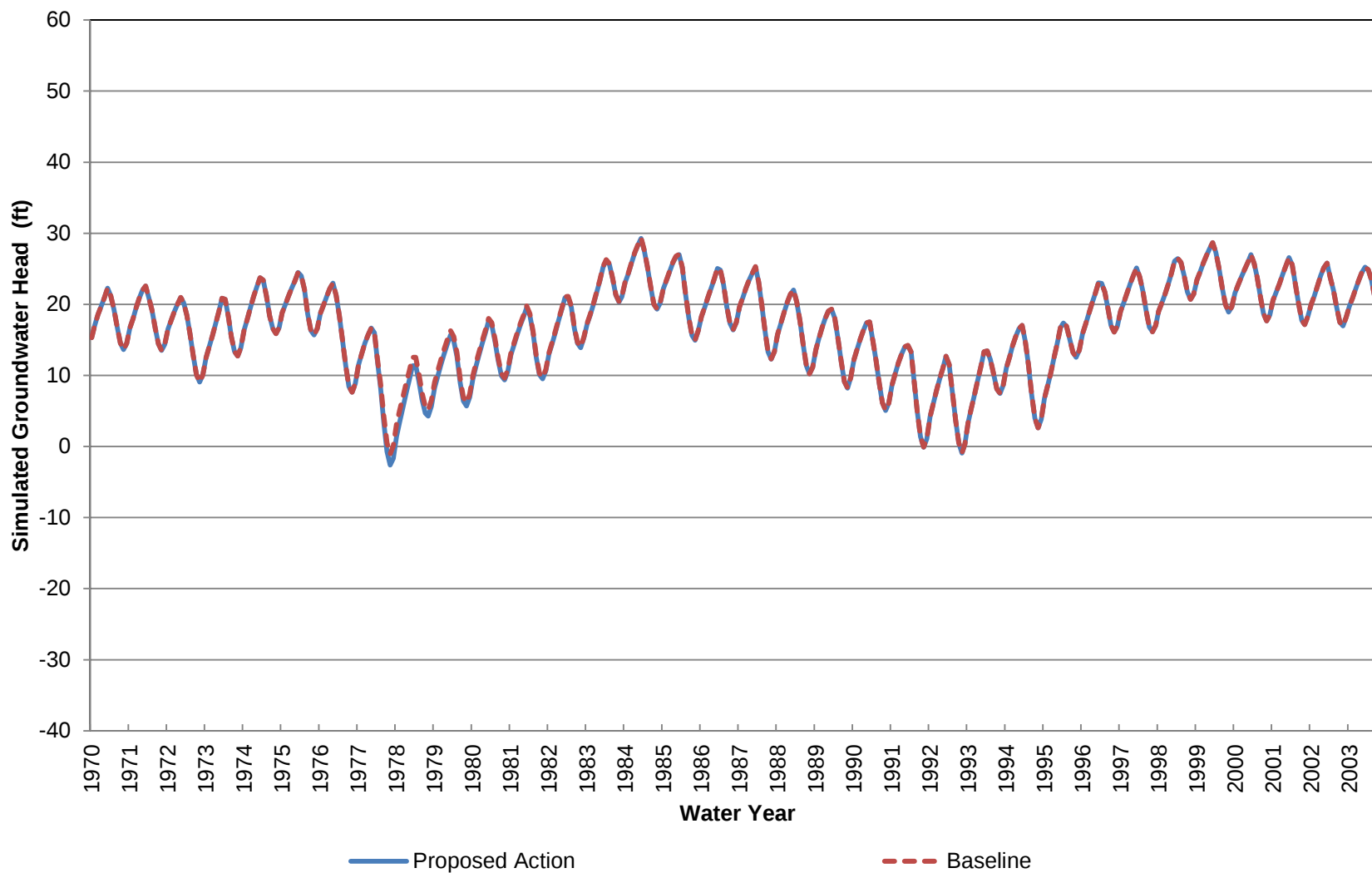
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 290-520 ft bgs)**



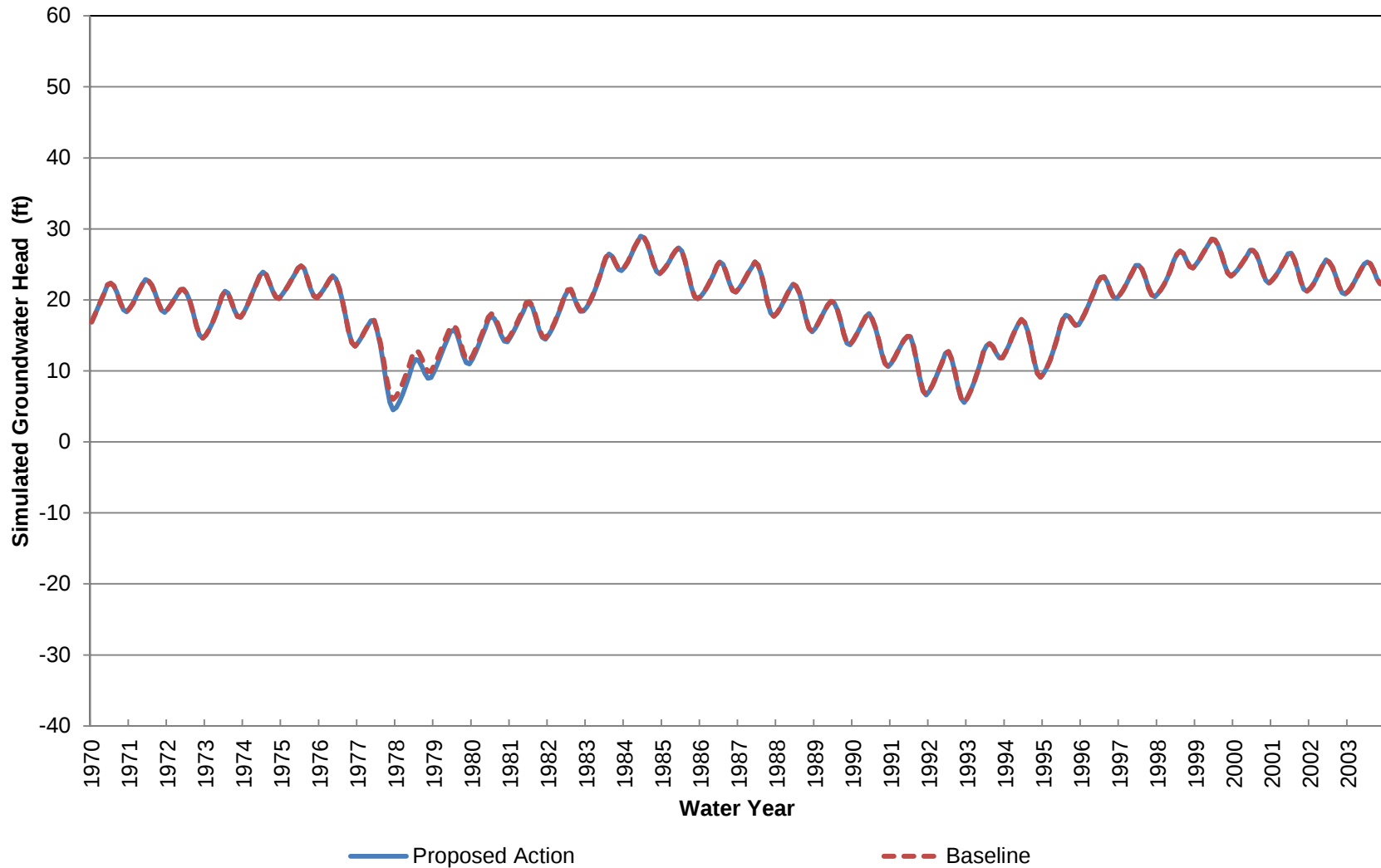
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 520-740 ft bgs)**



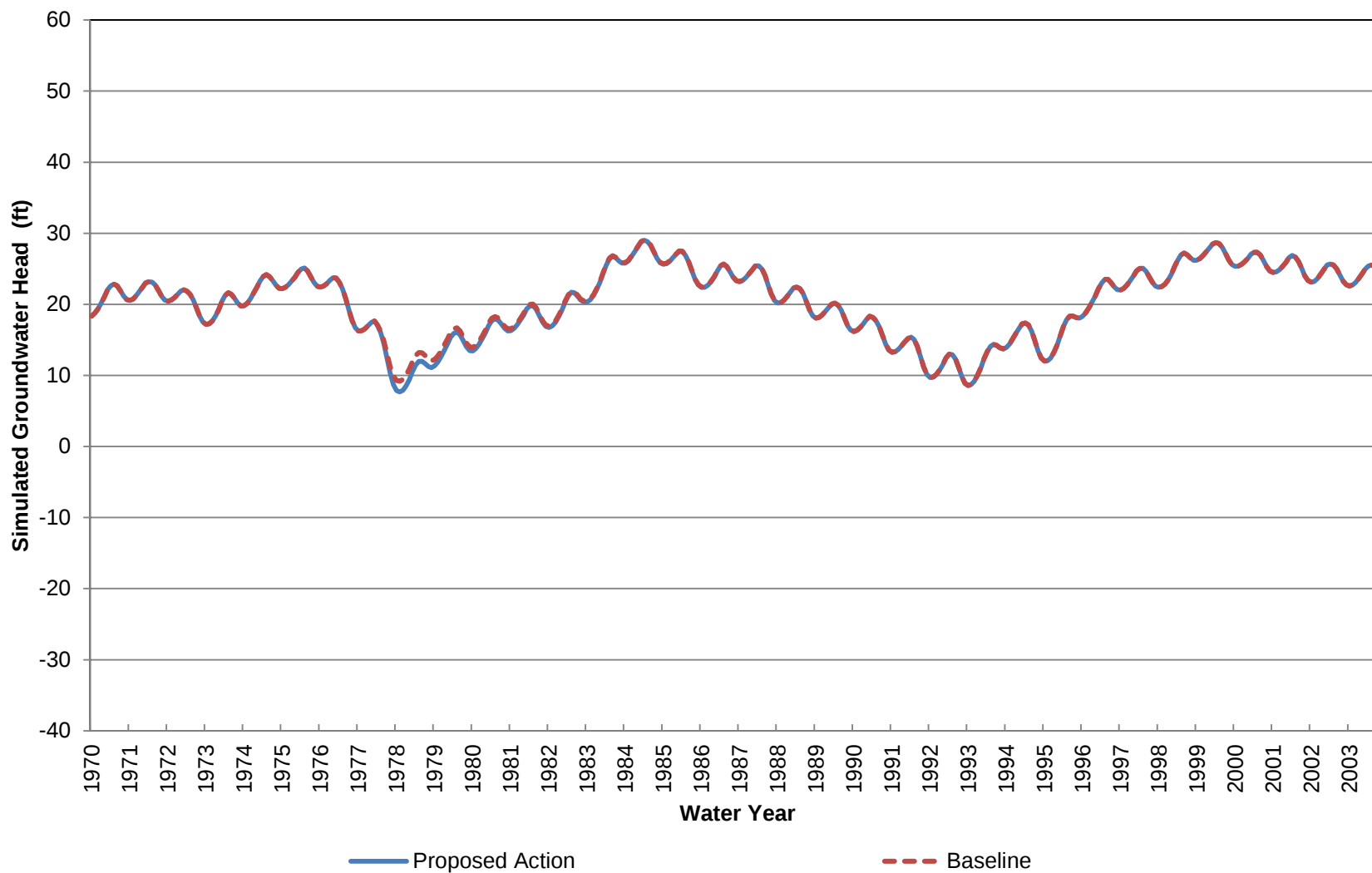
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 740-1120 ft bgs)**



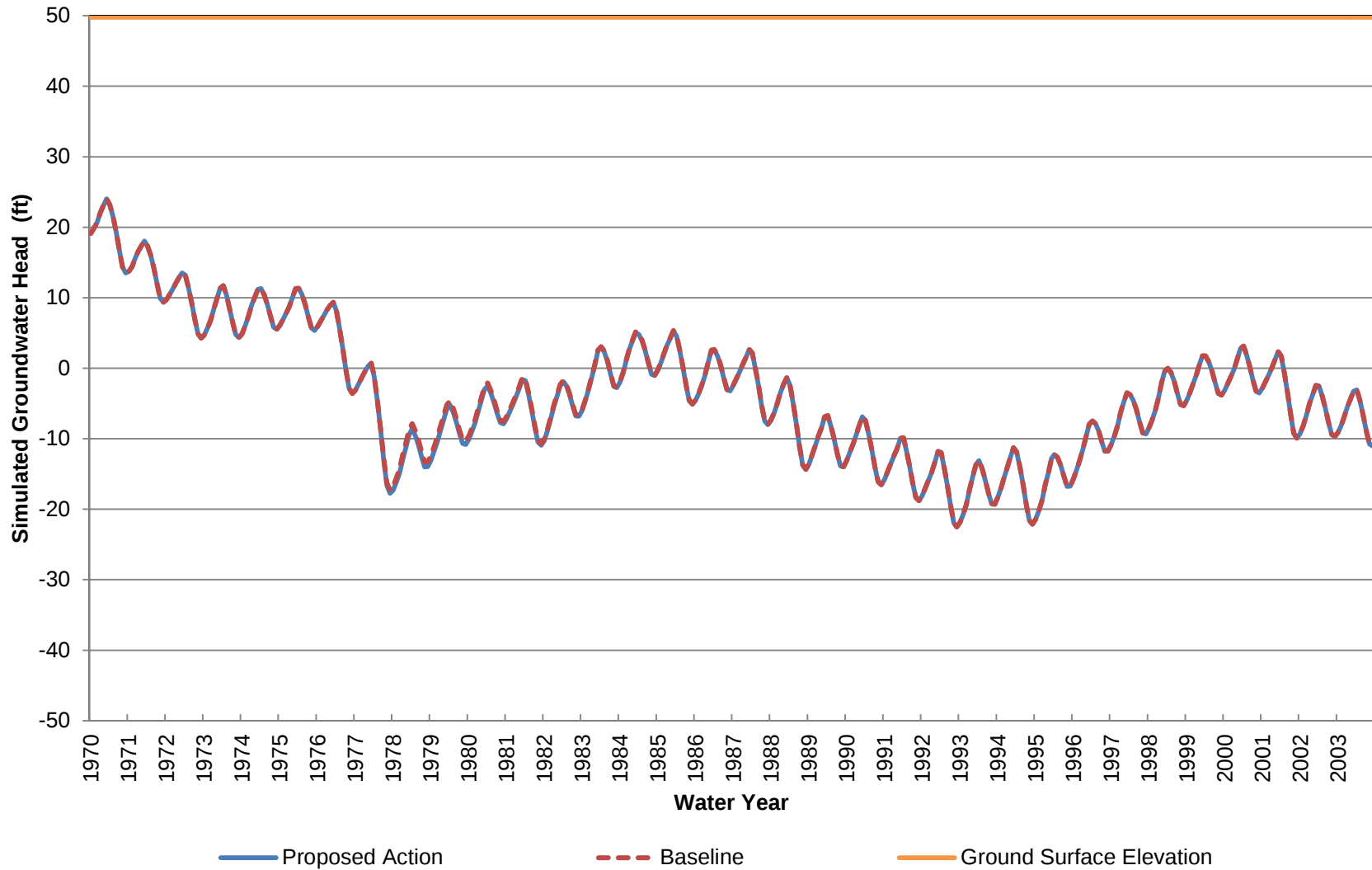
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 1120-1500 ft bgs)**



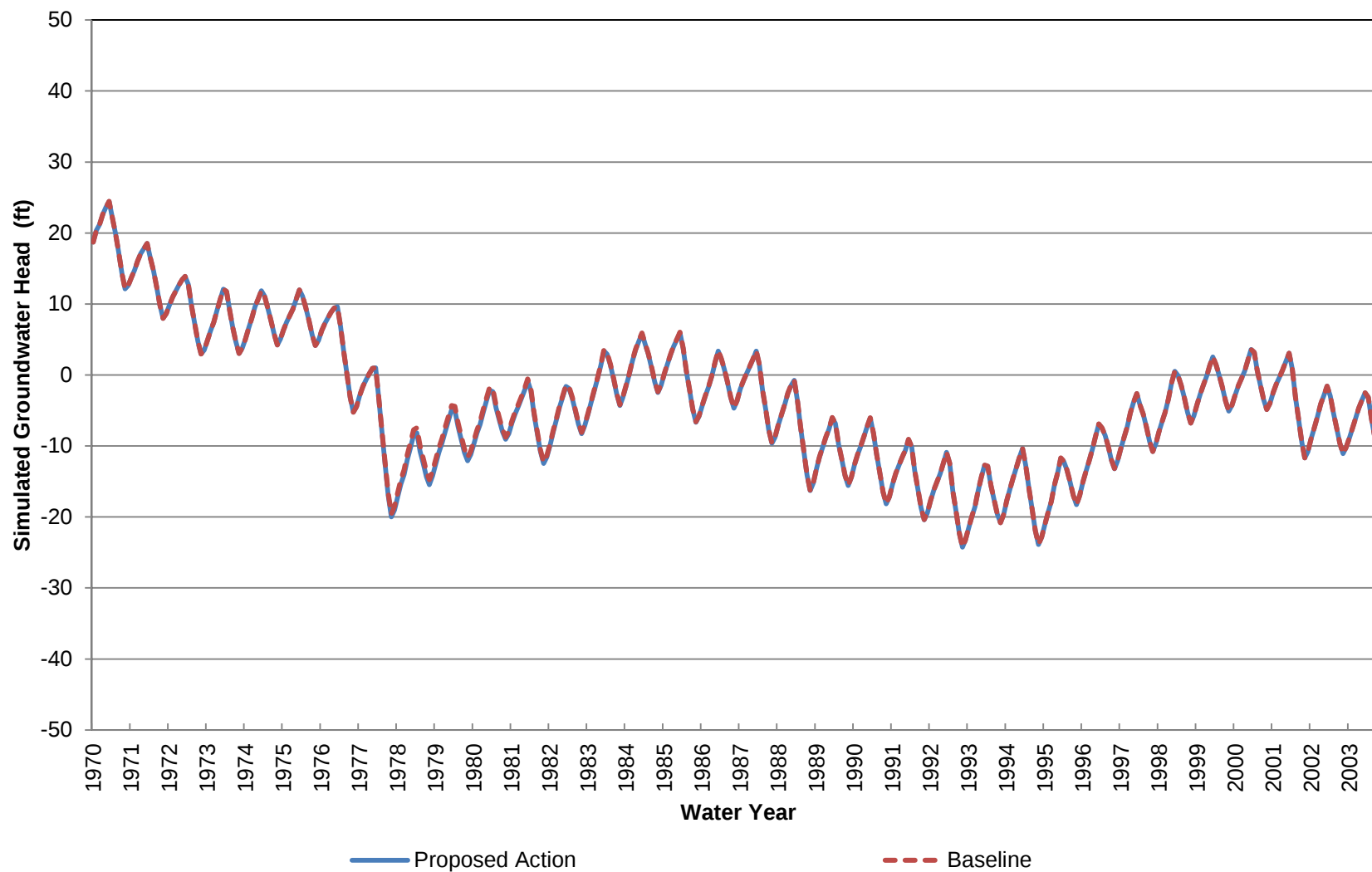
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 23 (Approximately 1500-2050 ft bgs)**



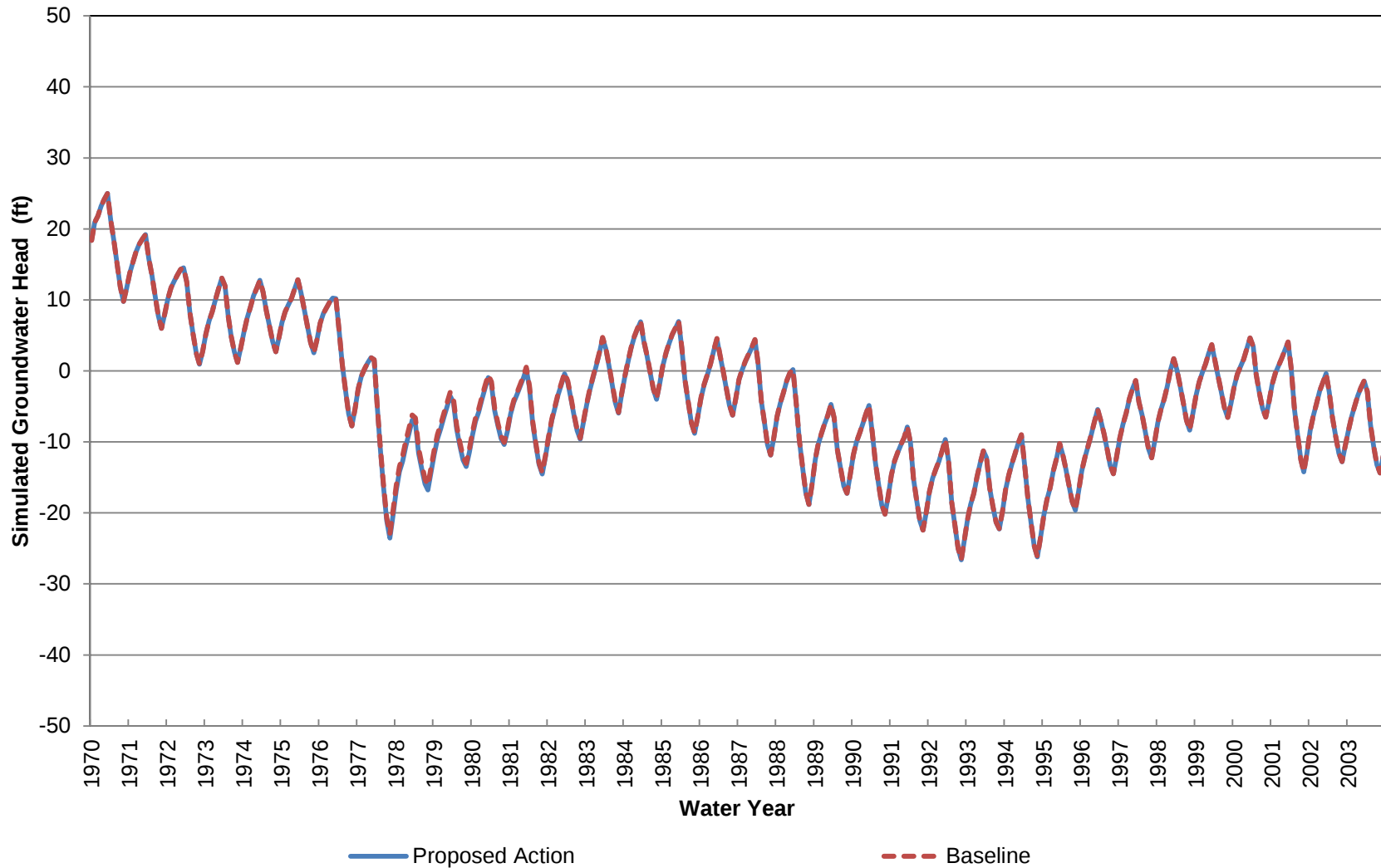
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 24 (Approximately 0-60 ft bgs)**



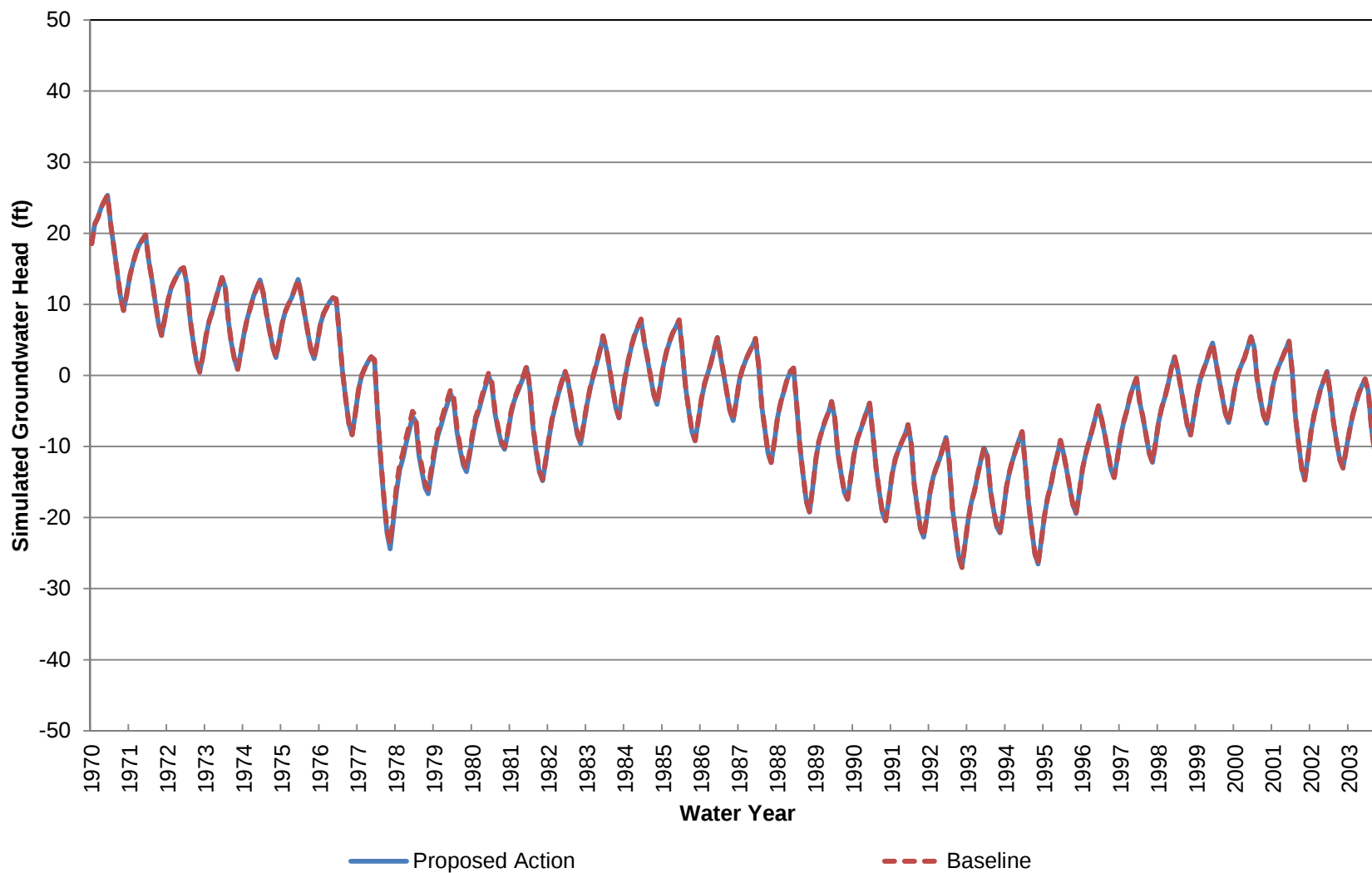
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 60-140 ft bgs)**



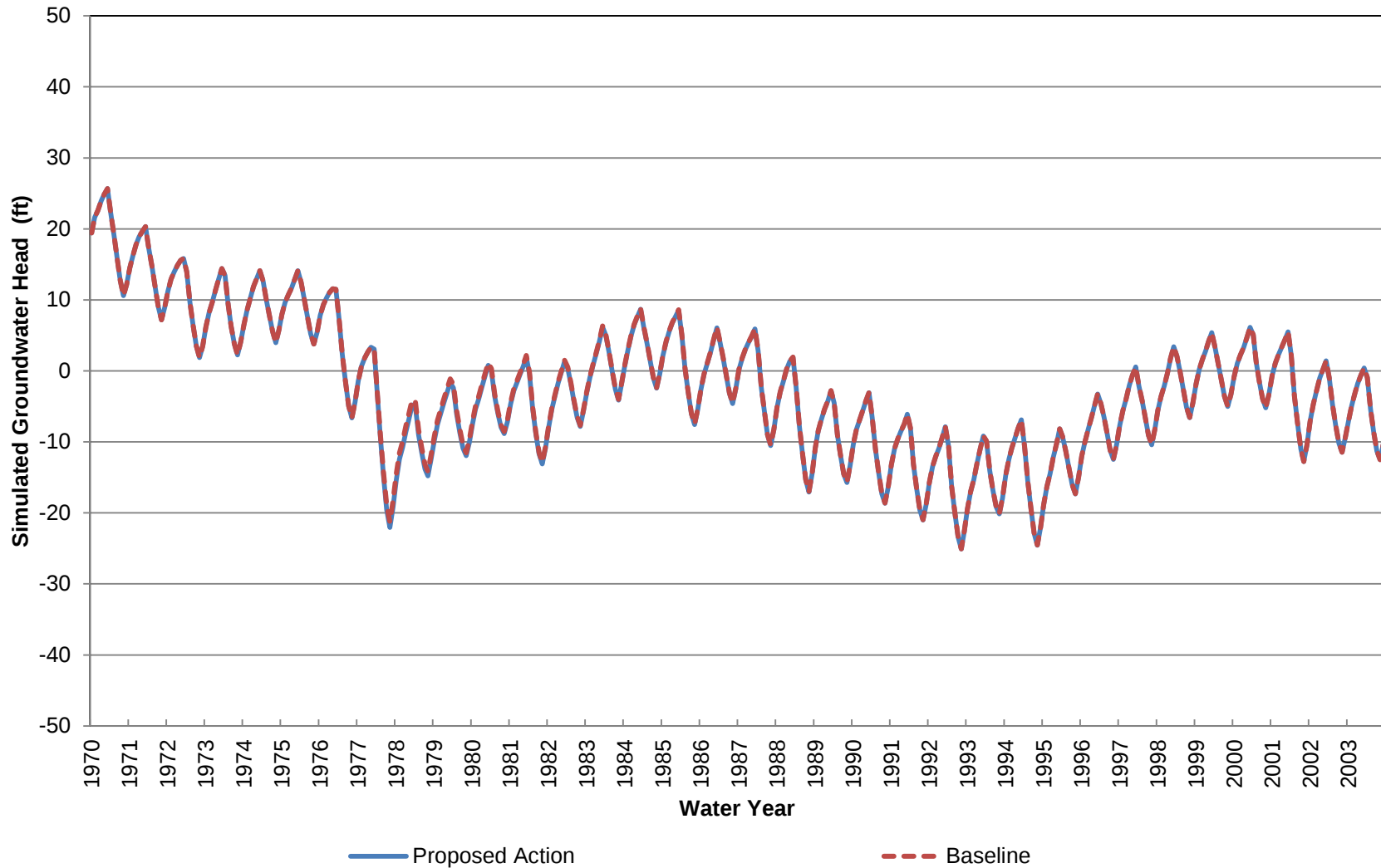
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 140-220 ft bgs)**



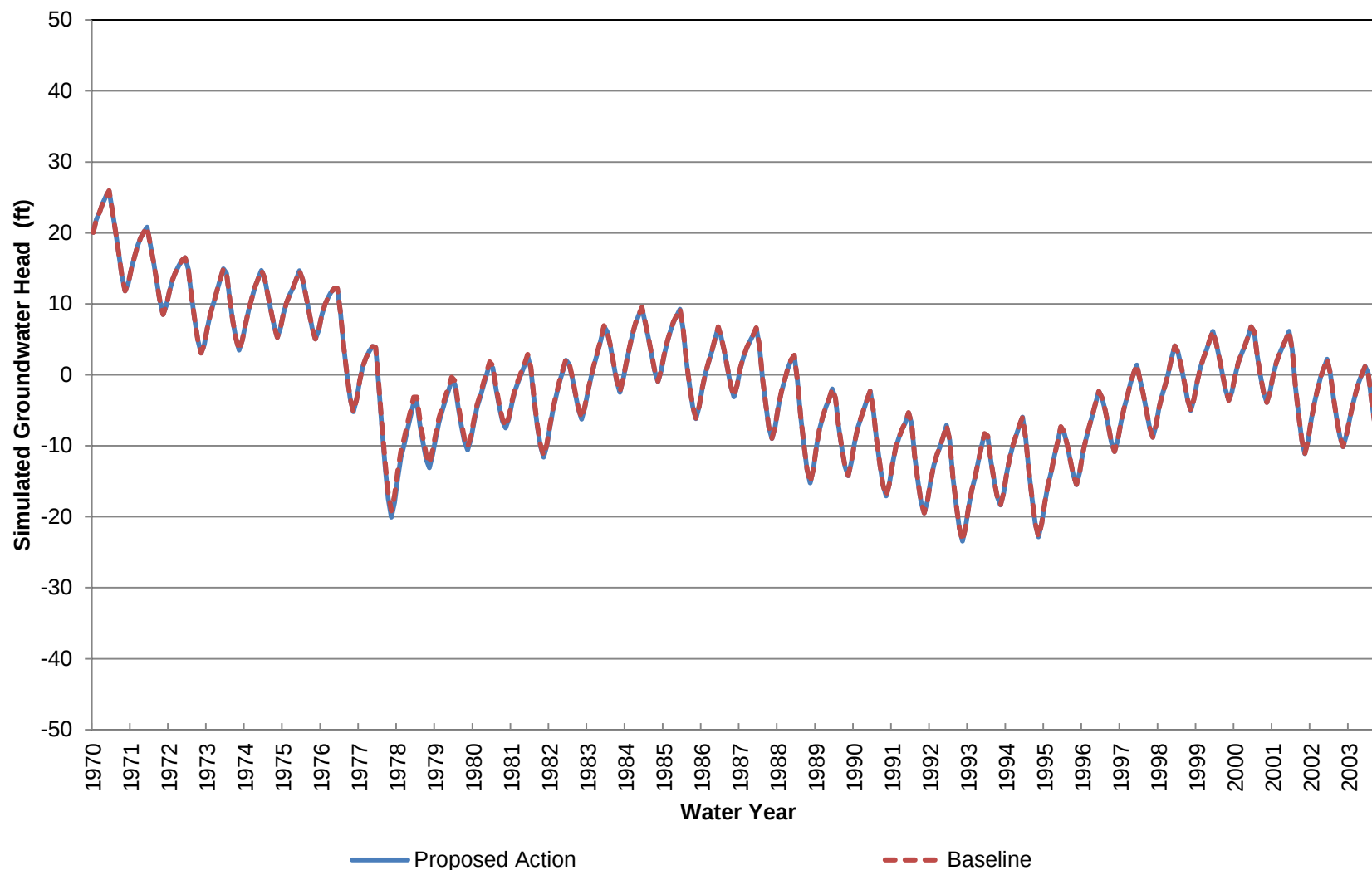
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 220-300 ft bgs)**



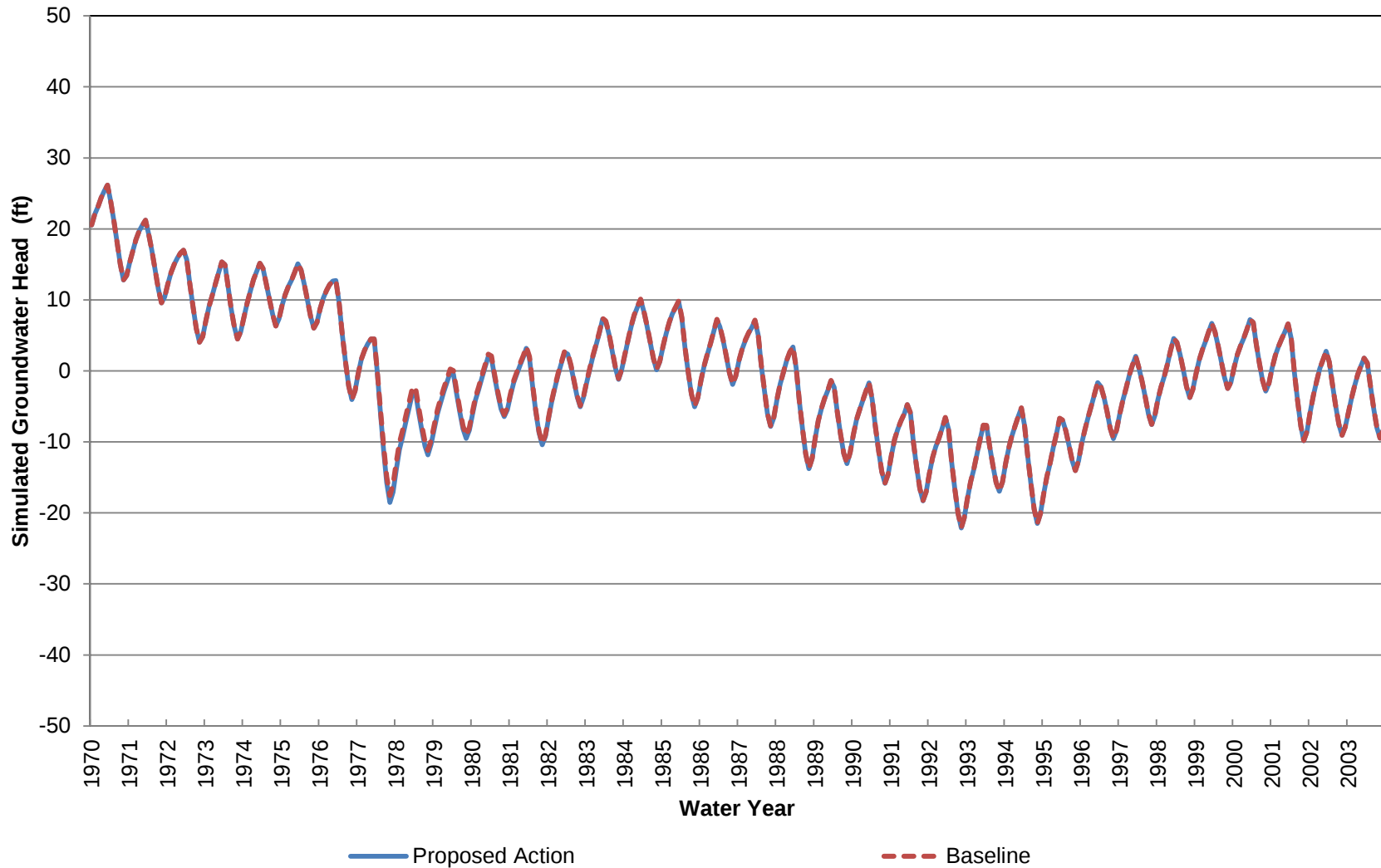
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 300-410 ft bgs)**



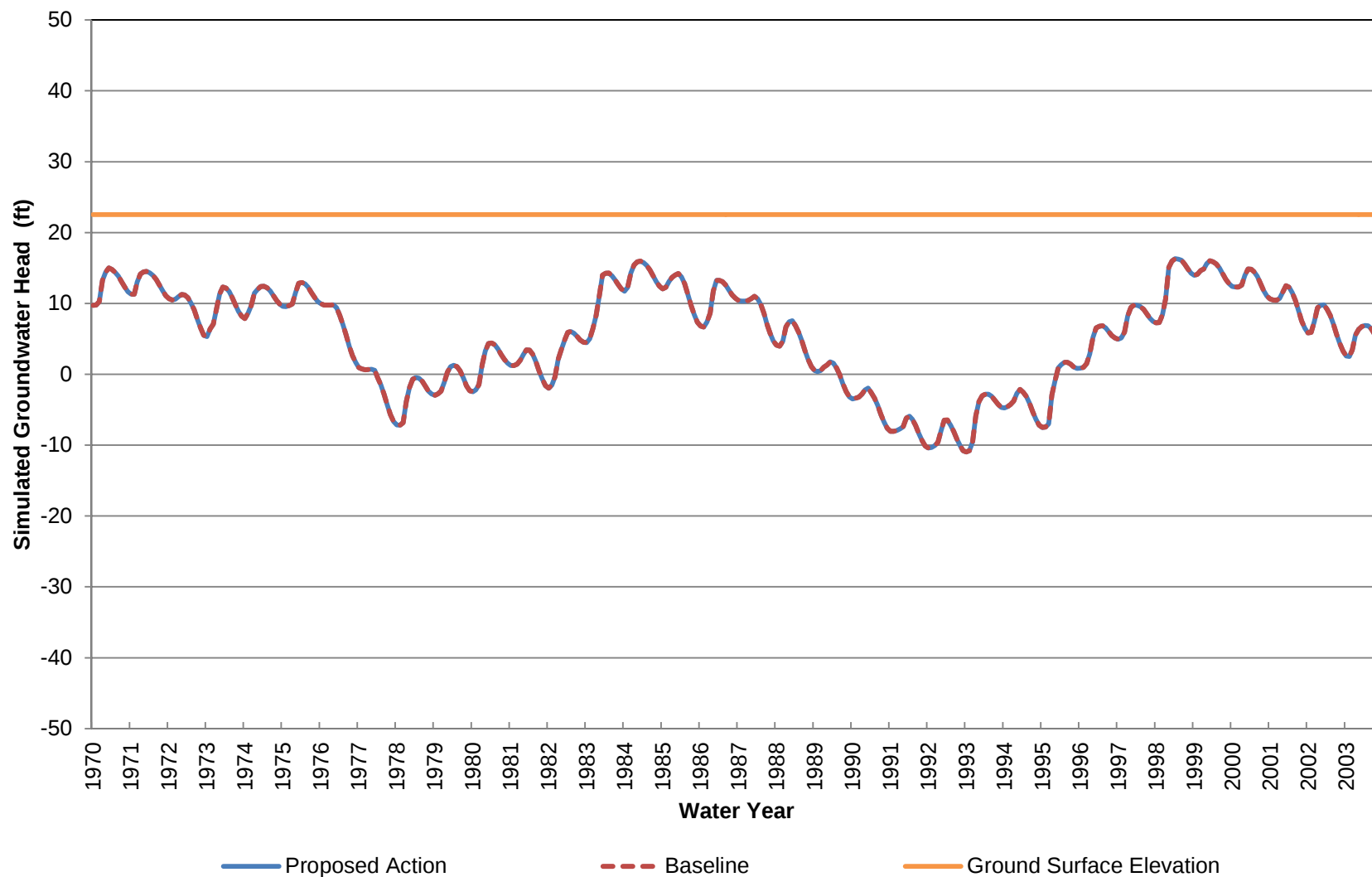
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 410-550 ft bgs)**



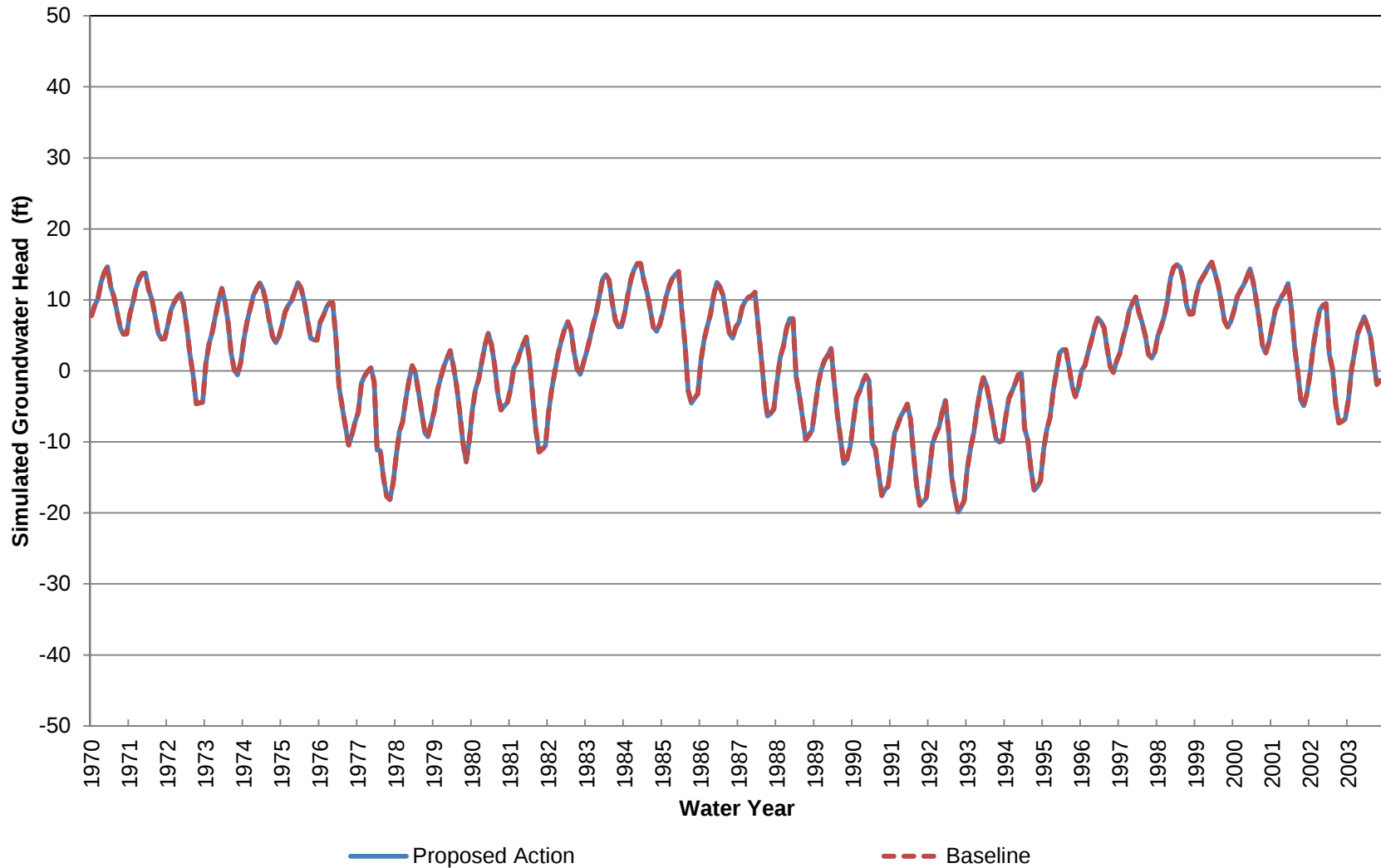
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 24 (Approximately 550-750 ft bgs)**



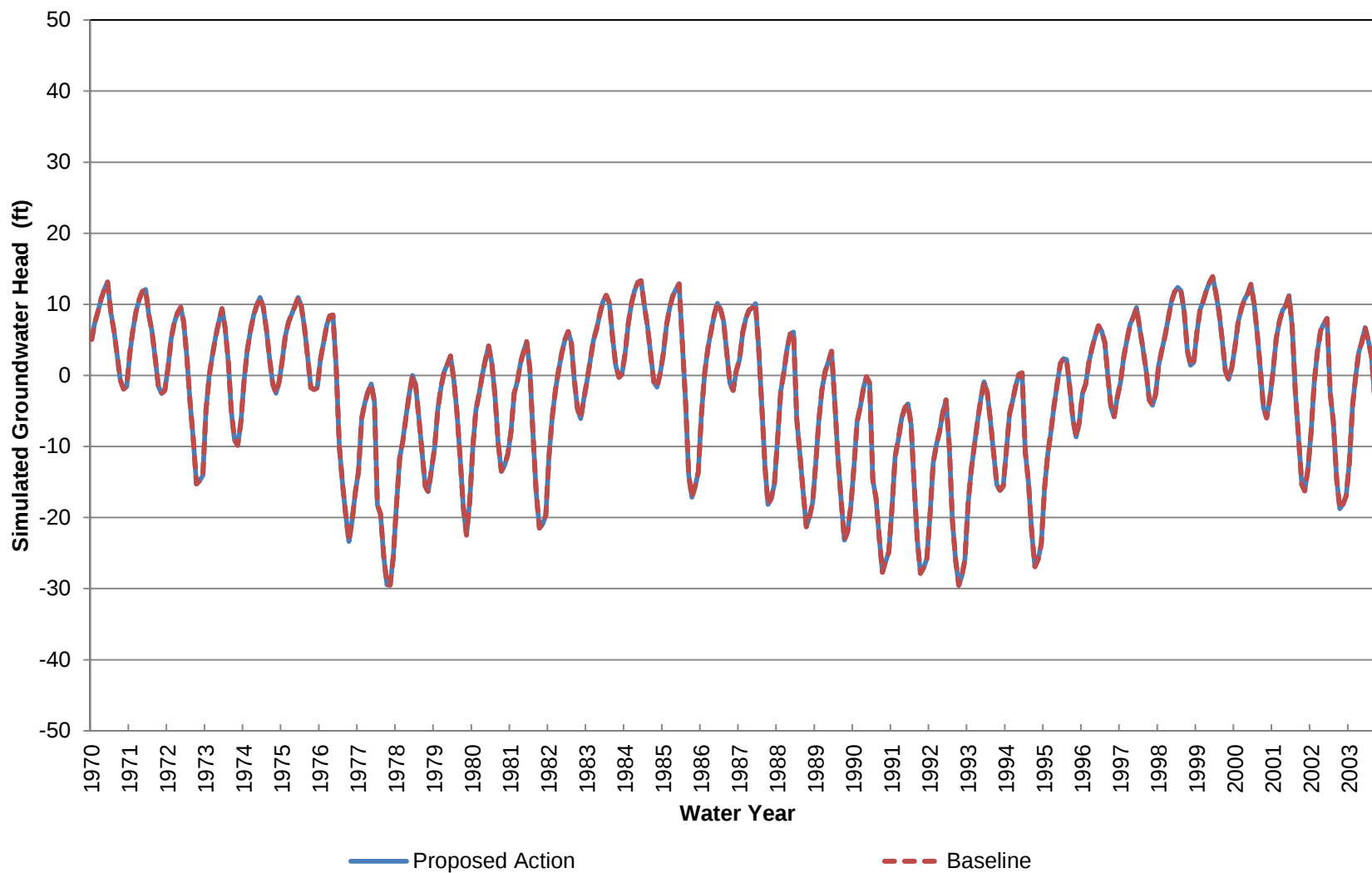
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 25 (Approximately 0-70 ft bgs)**



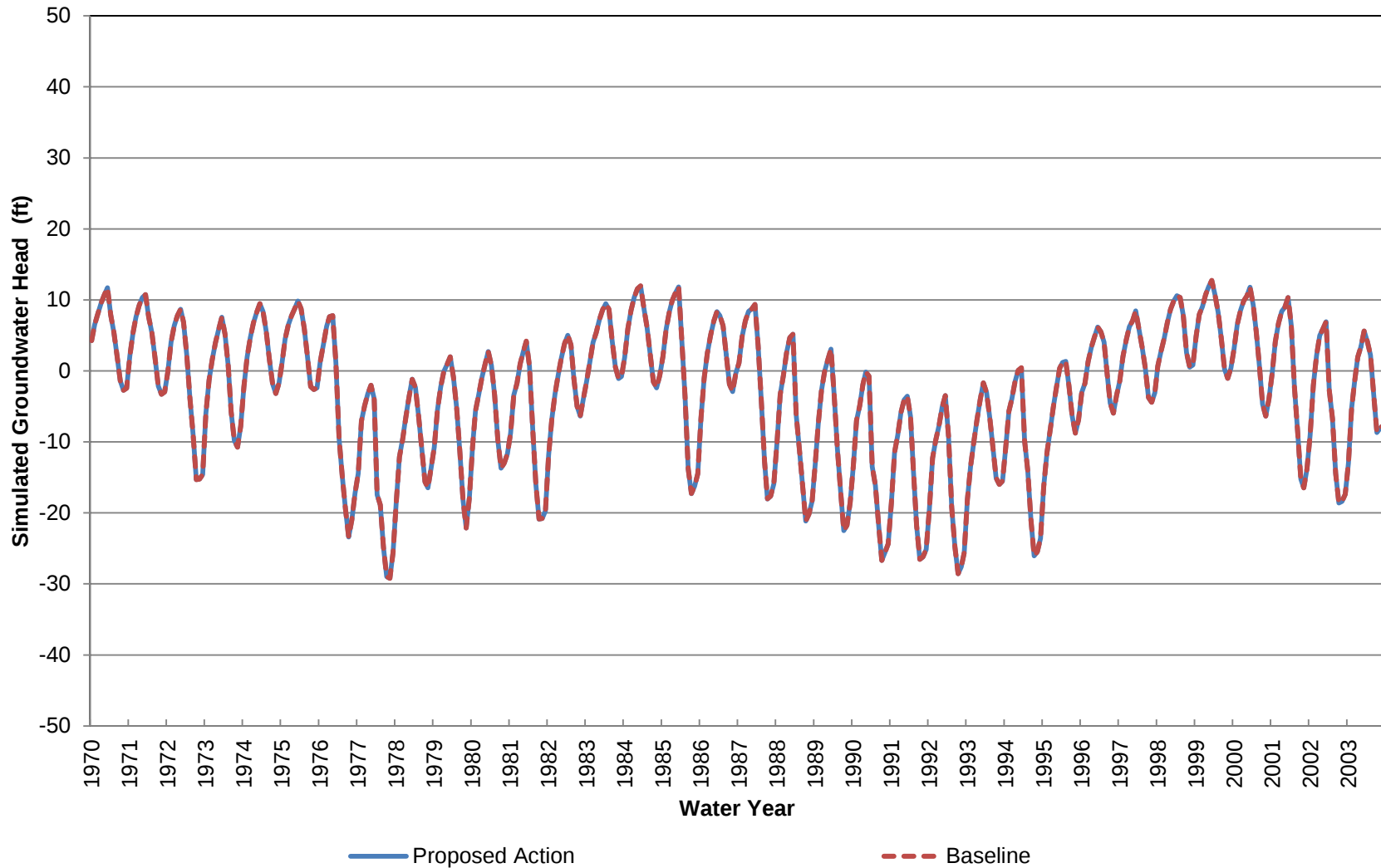
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 70-380 ft bgs)**



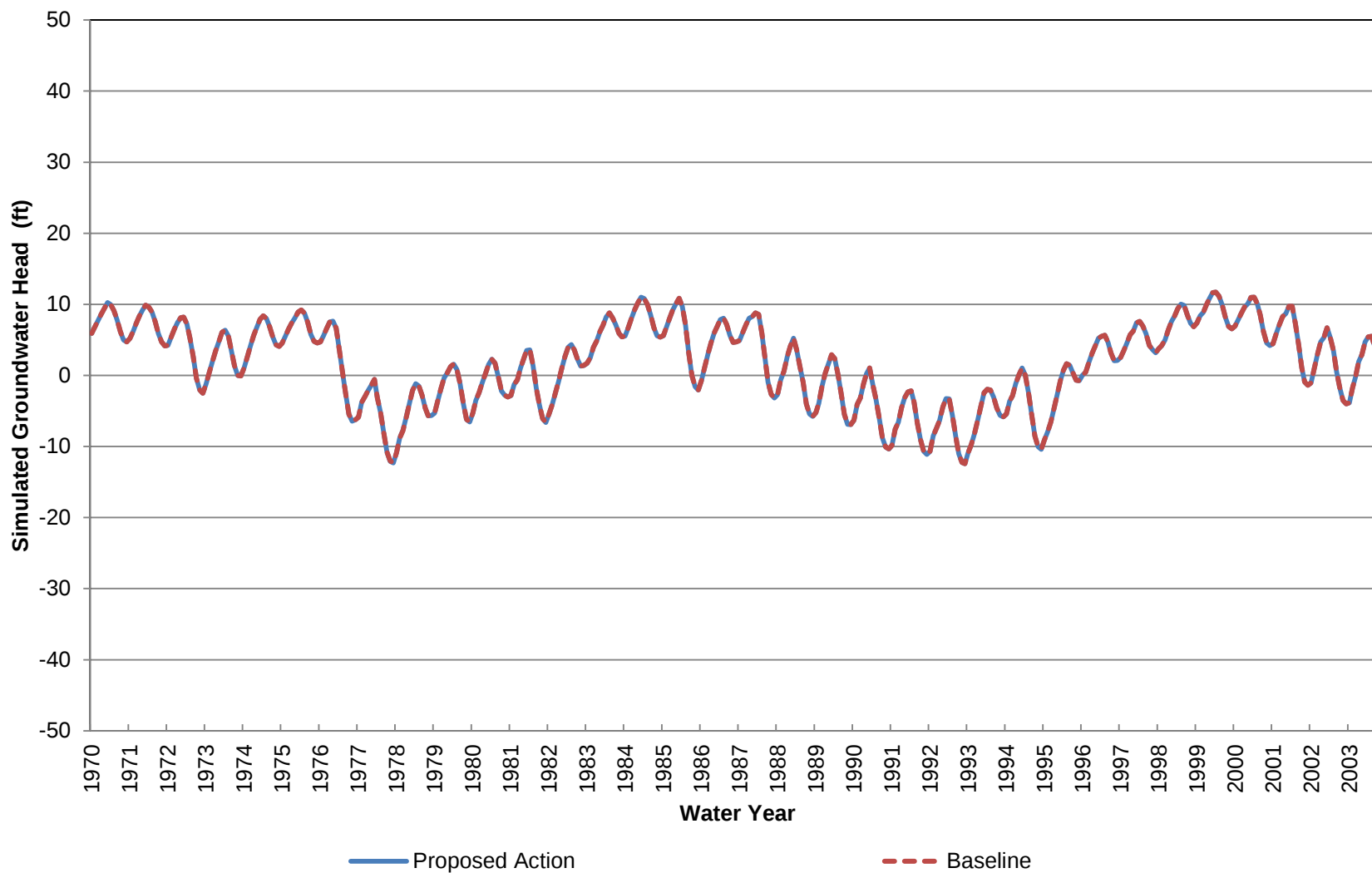
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 380-680 ft bgs)**



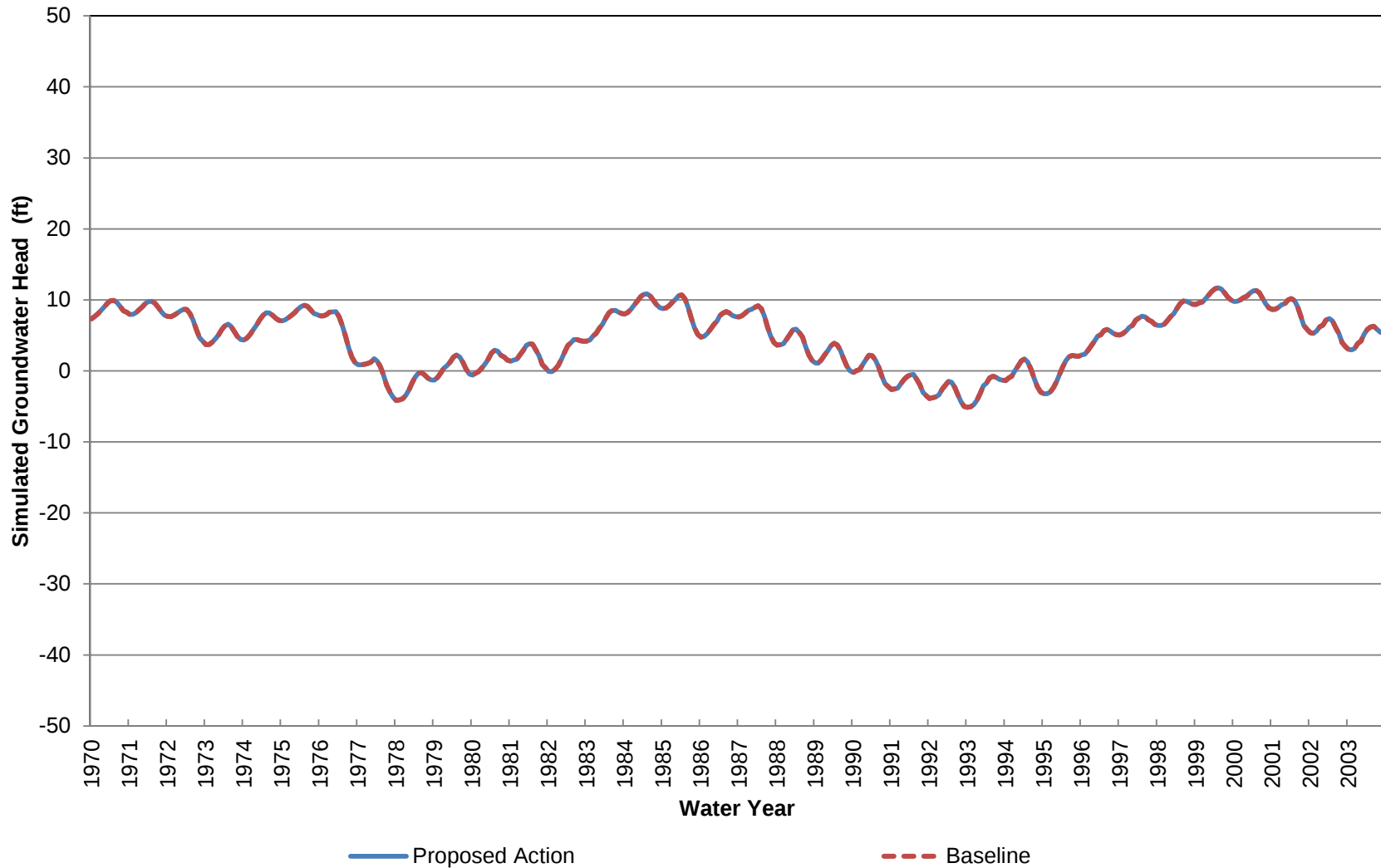
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 680-990 ft bgs)**



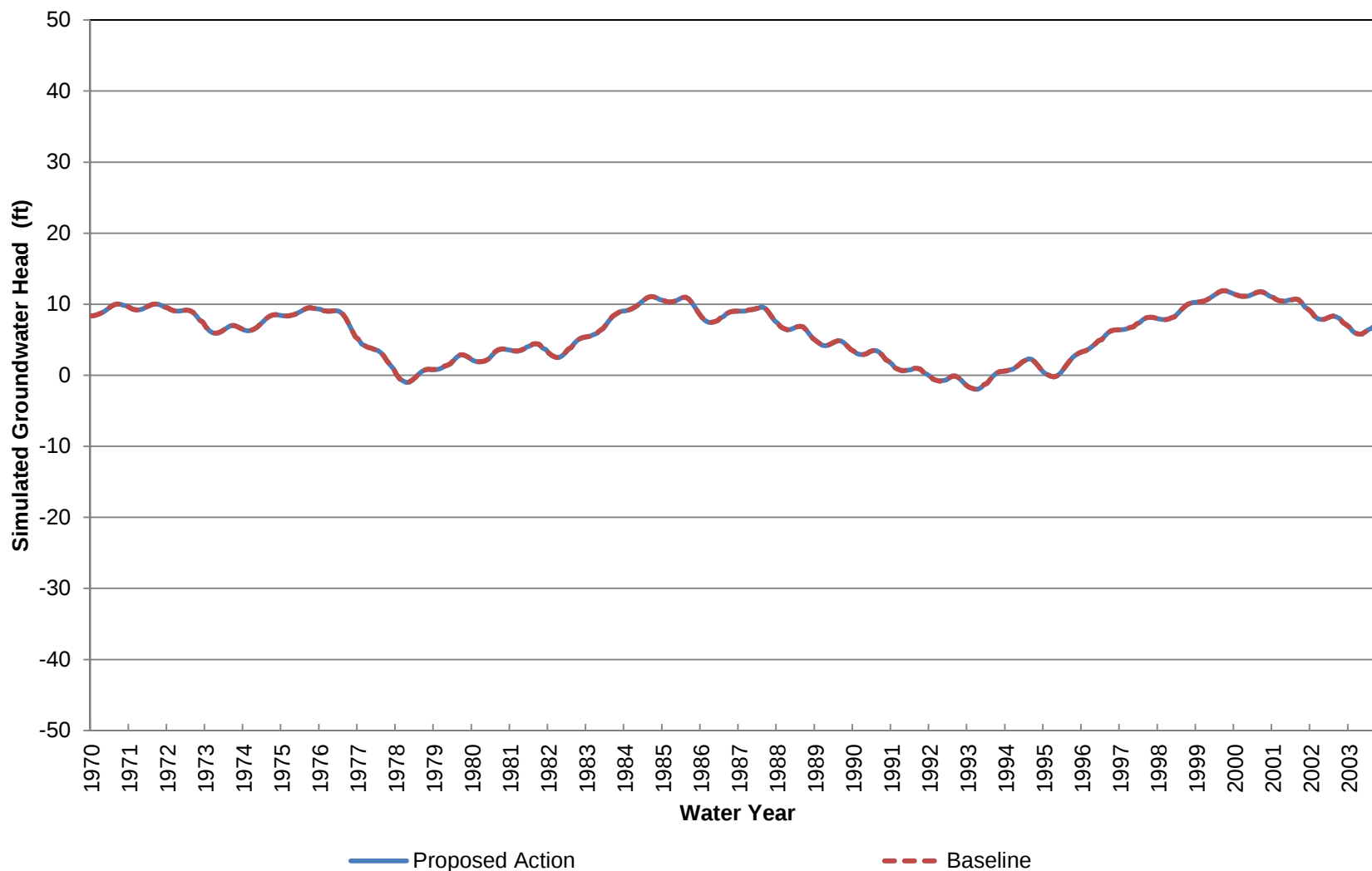
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 990-1530 ft bgs)**



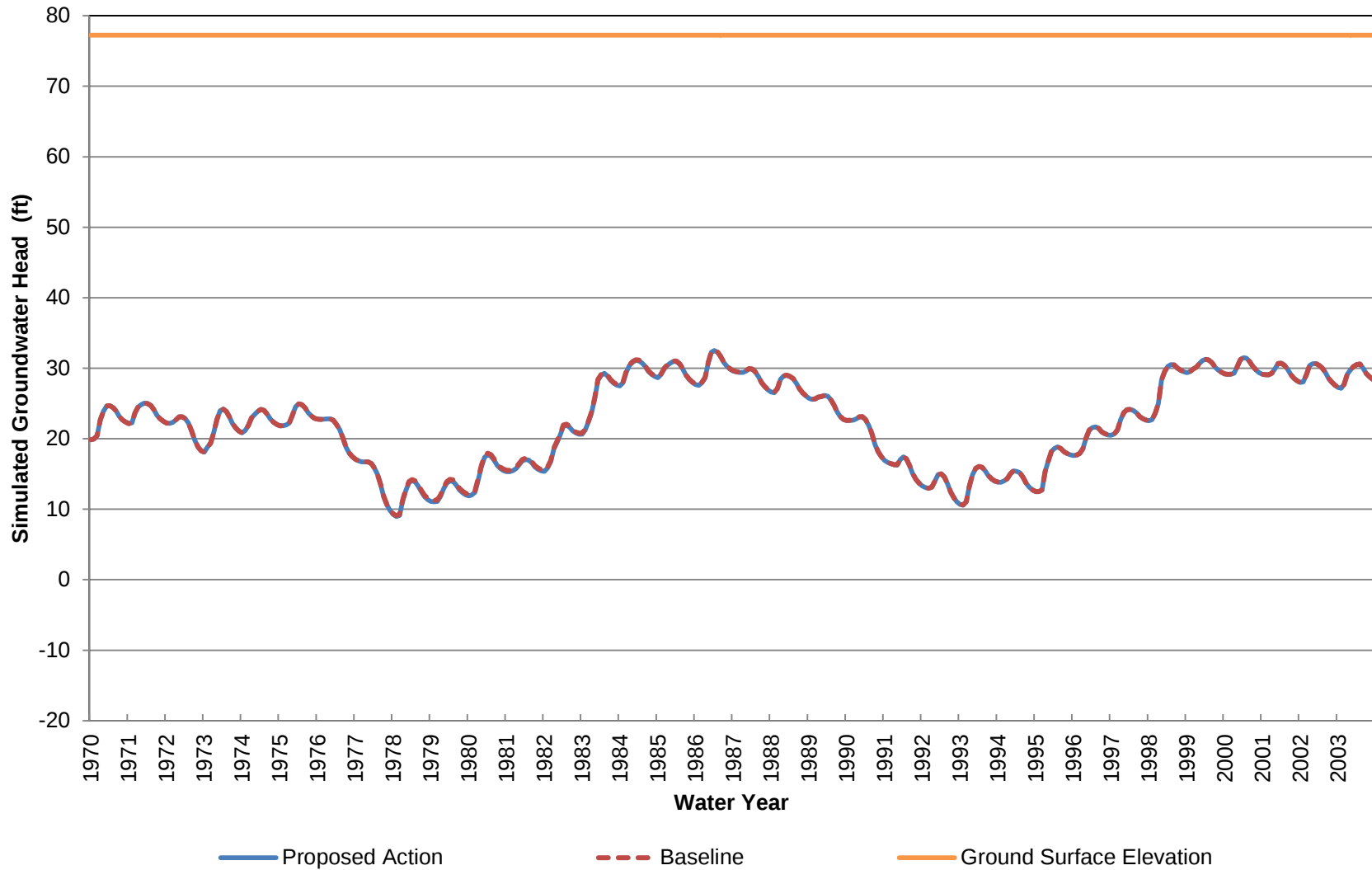
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 1530-2040 ft bgs)**



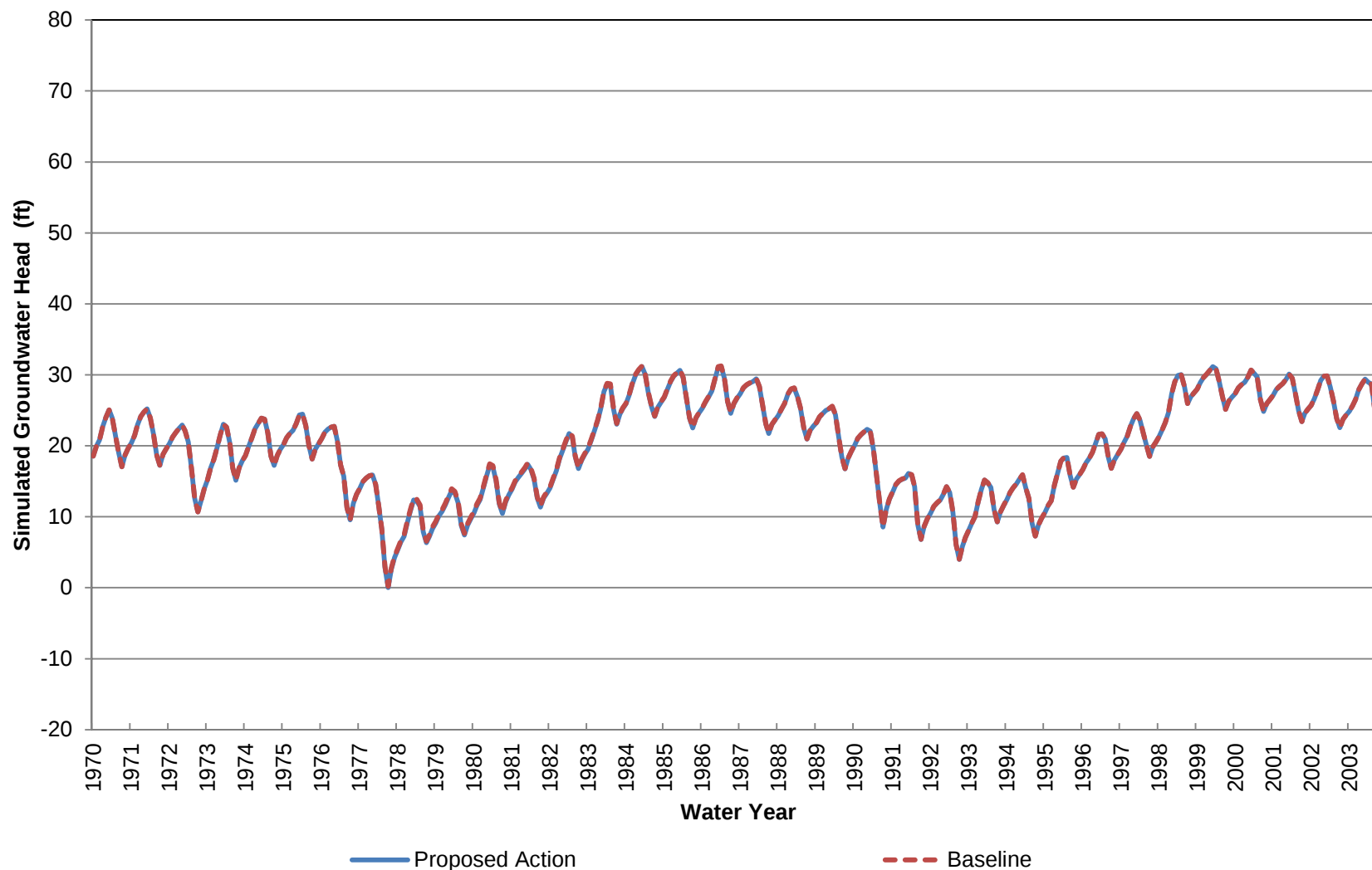
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 25 (Approximately 2040-2800 ft bgs)**



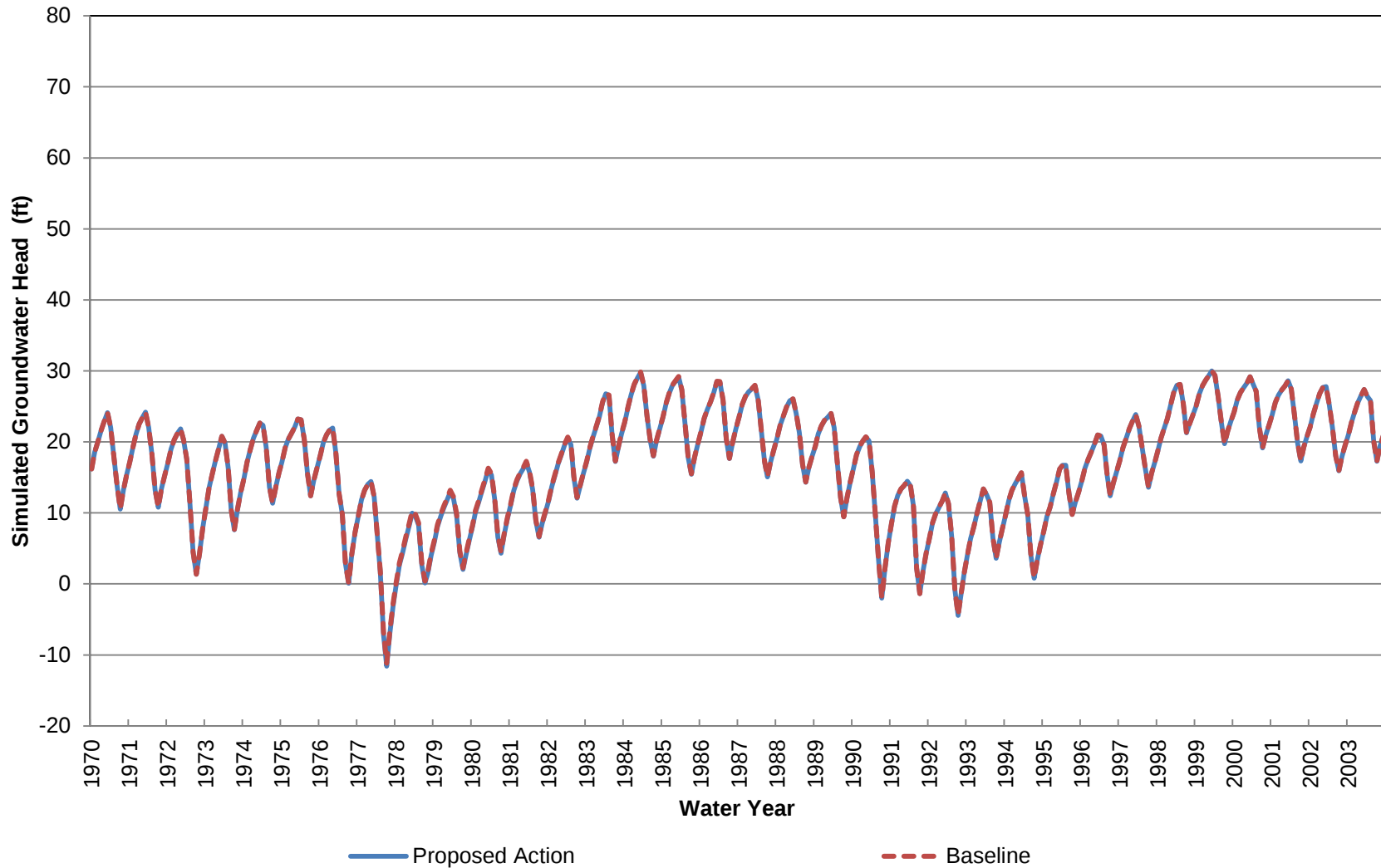
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 26 (Approximately 0-70 ft bgs)**



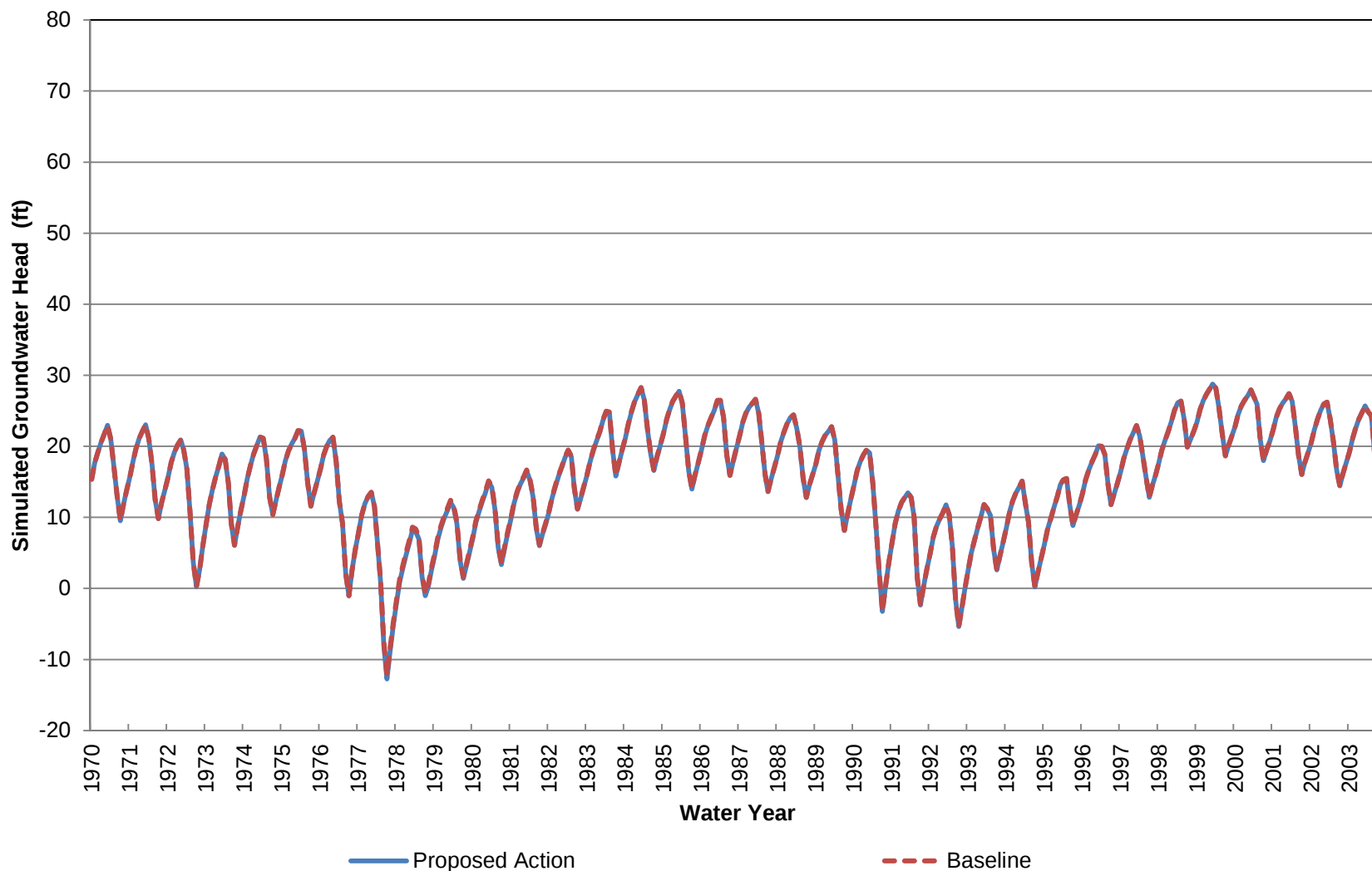
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 70-380 ft bgs)**



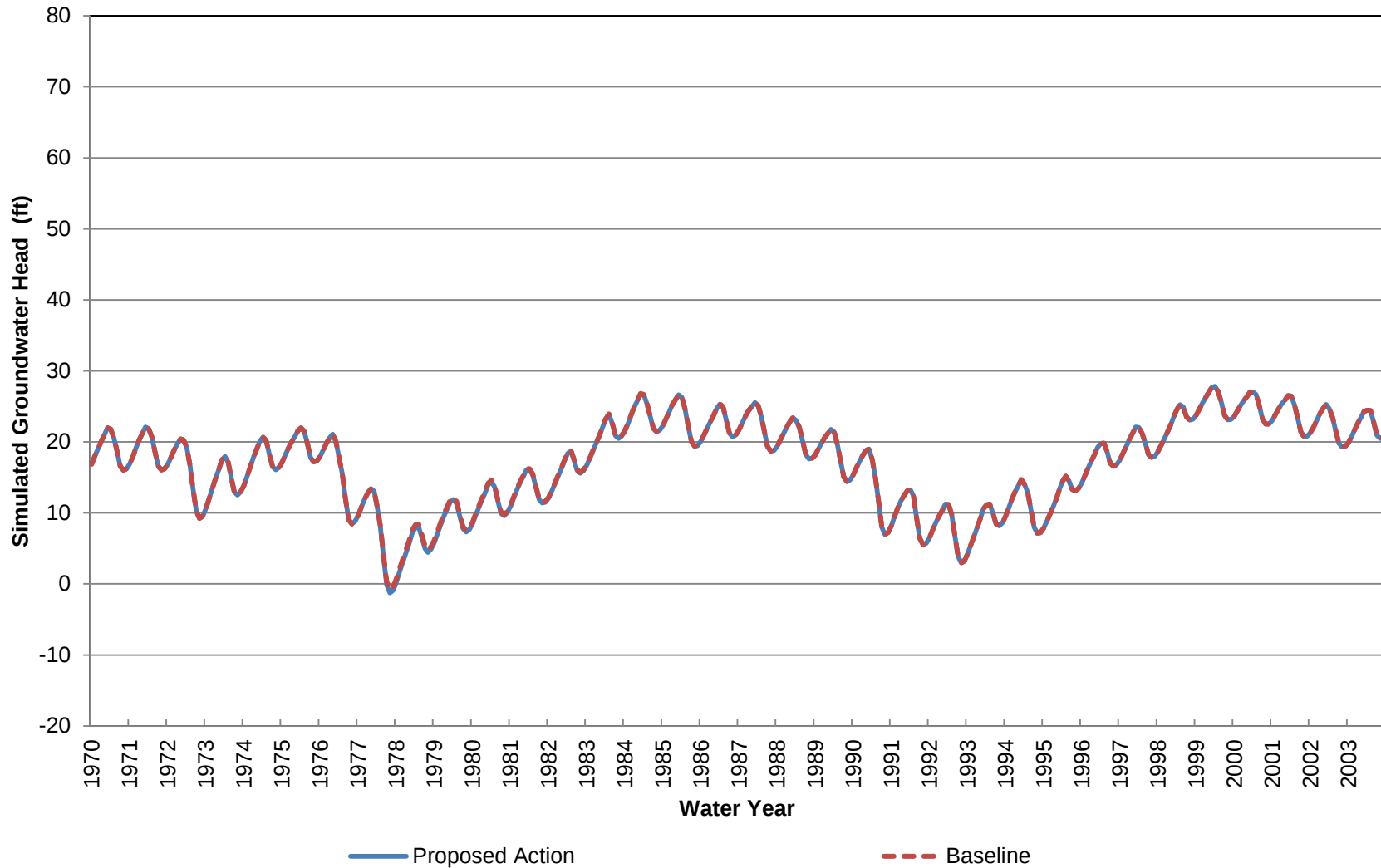
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 380-690 ft bgs)**



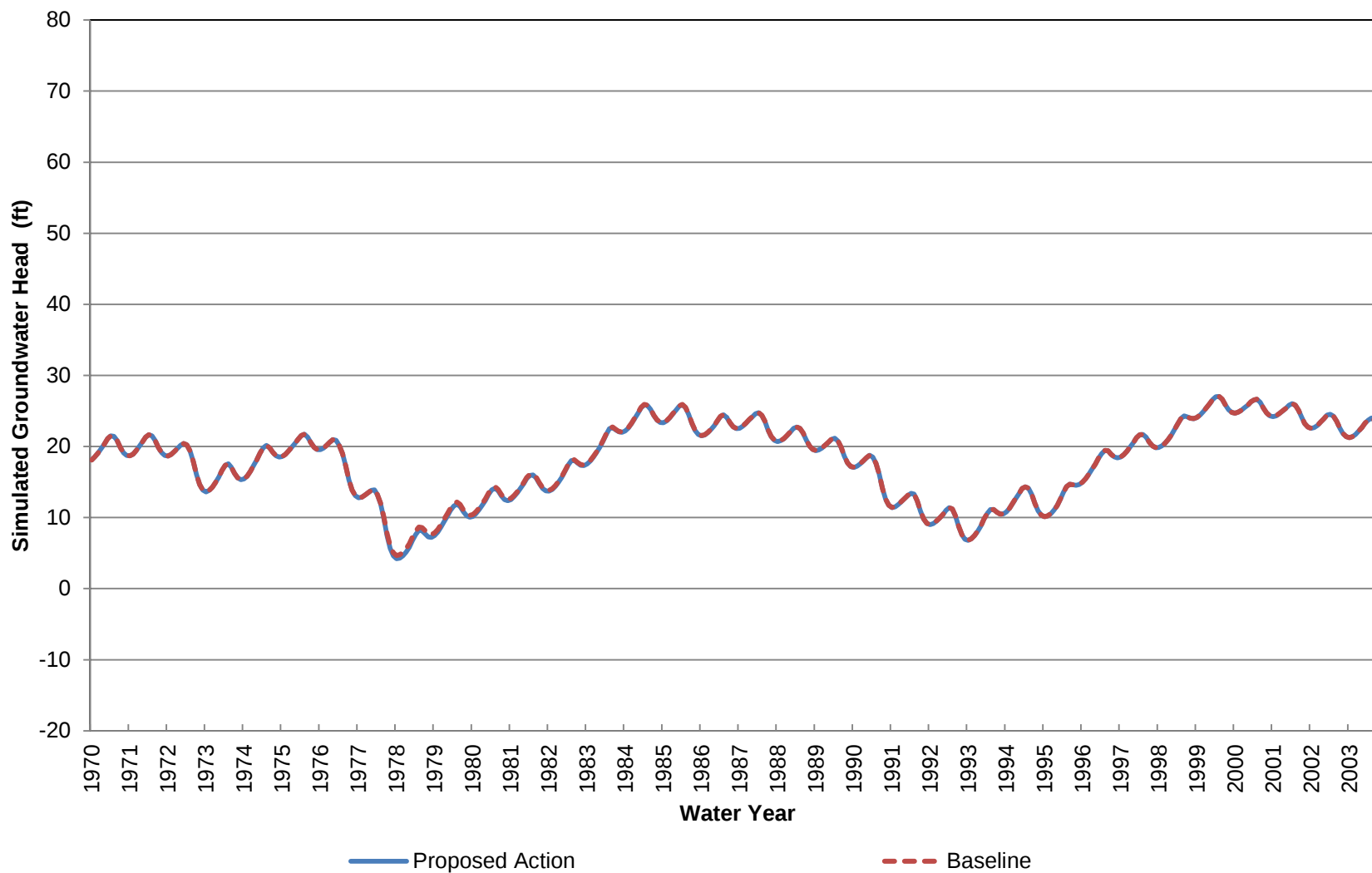
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 690-1000 ft bgs)**



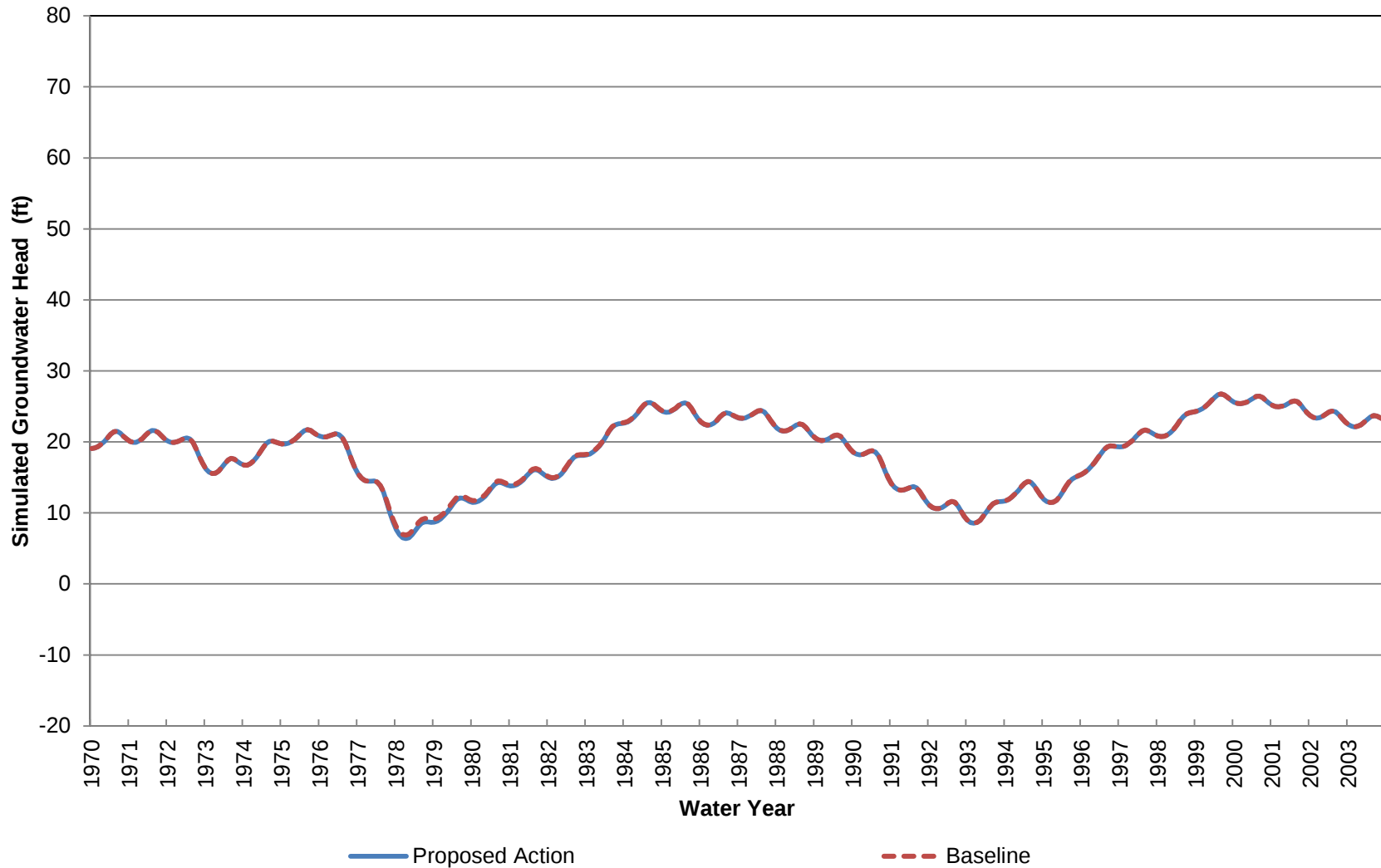
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 1000-1550 ft bgs)**



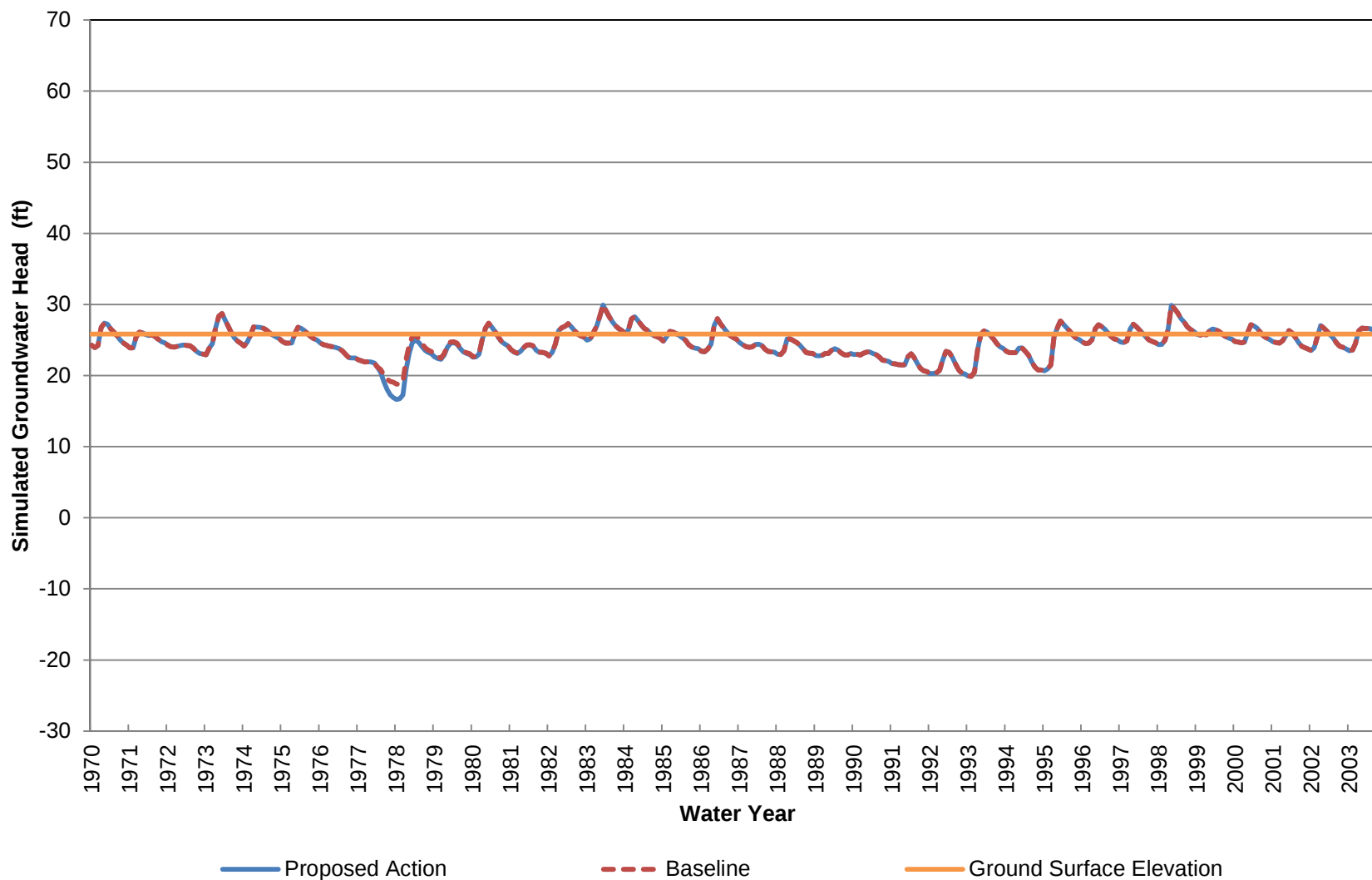
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 1550-2070 ft bgs)**



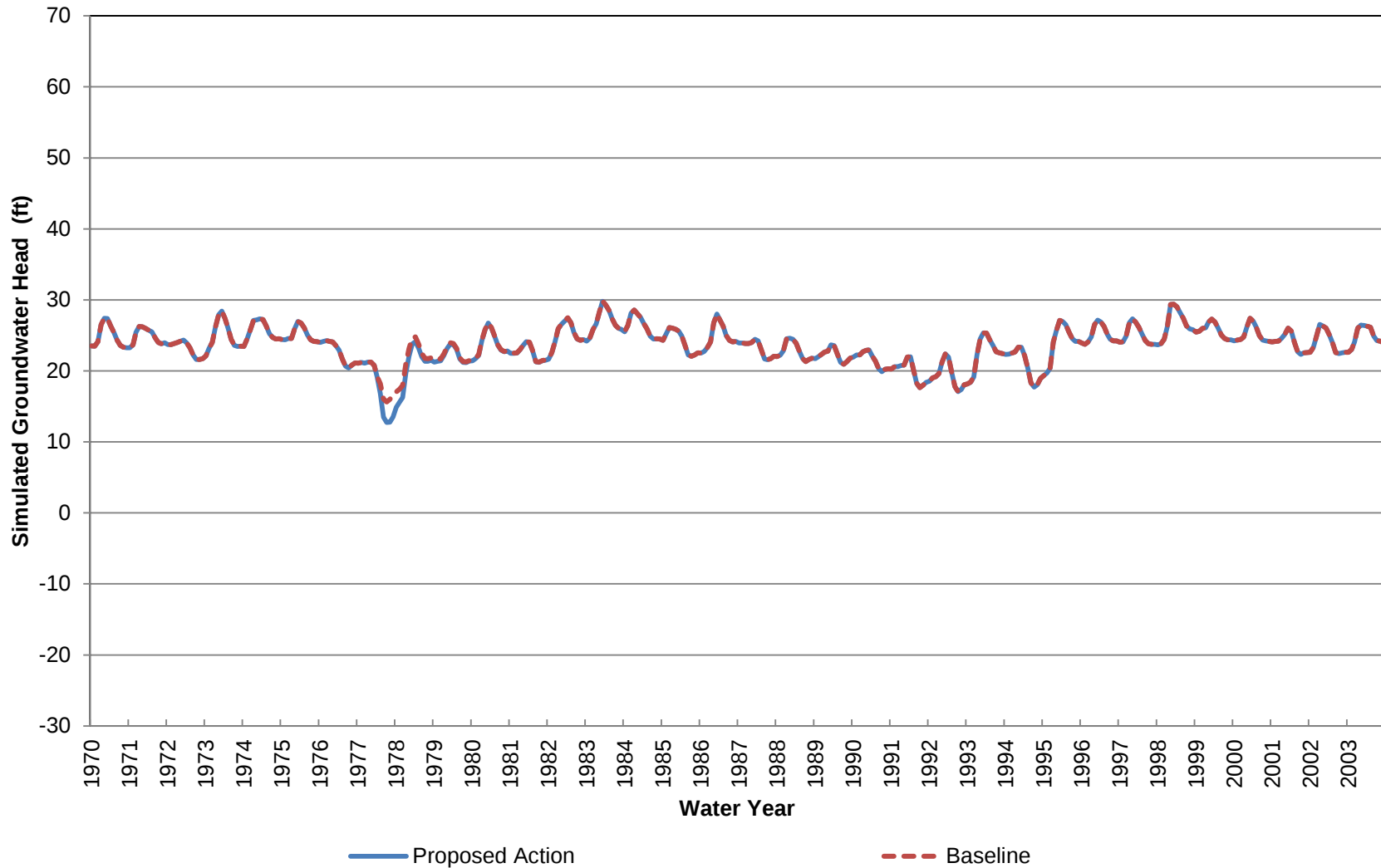
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 26 (Approximately 2070-2840 ft bgs)**



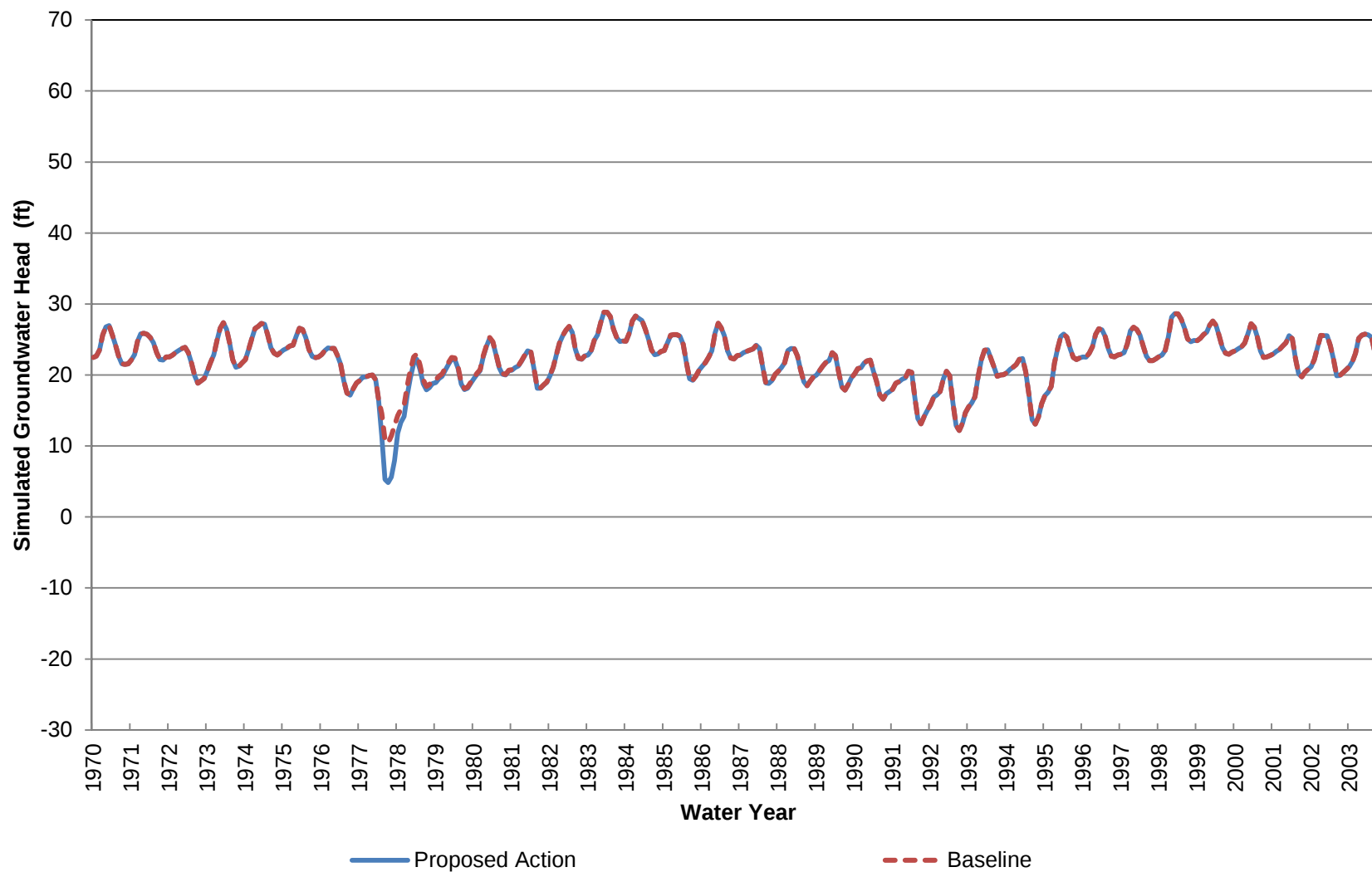
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 27 (Approximately 0-70 ft bgs)**



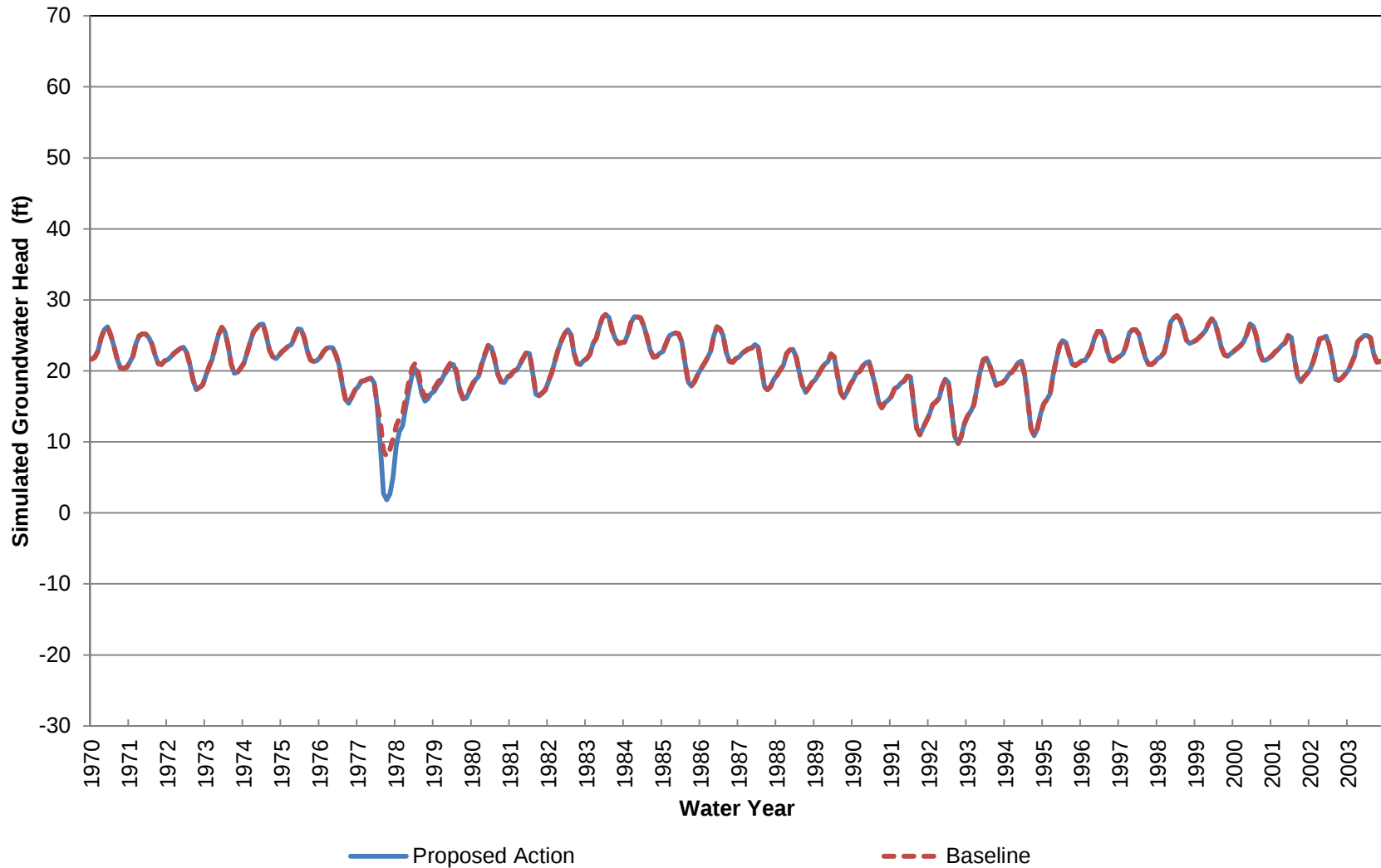
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 70-220 ft bgs)**



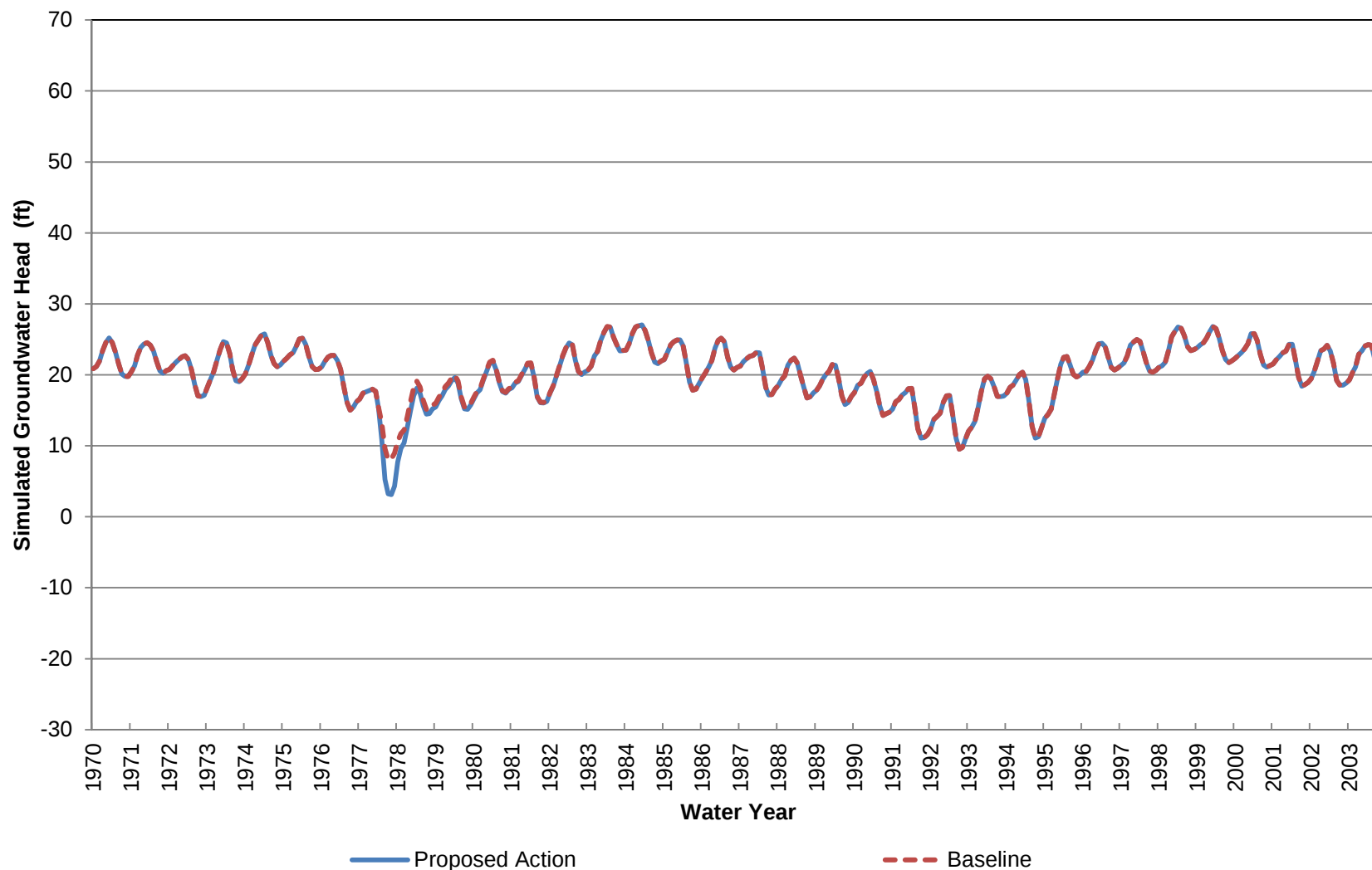
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 220-380 ft bgs)**



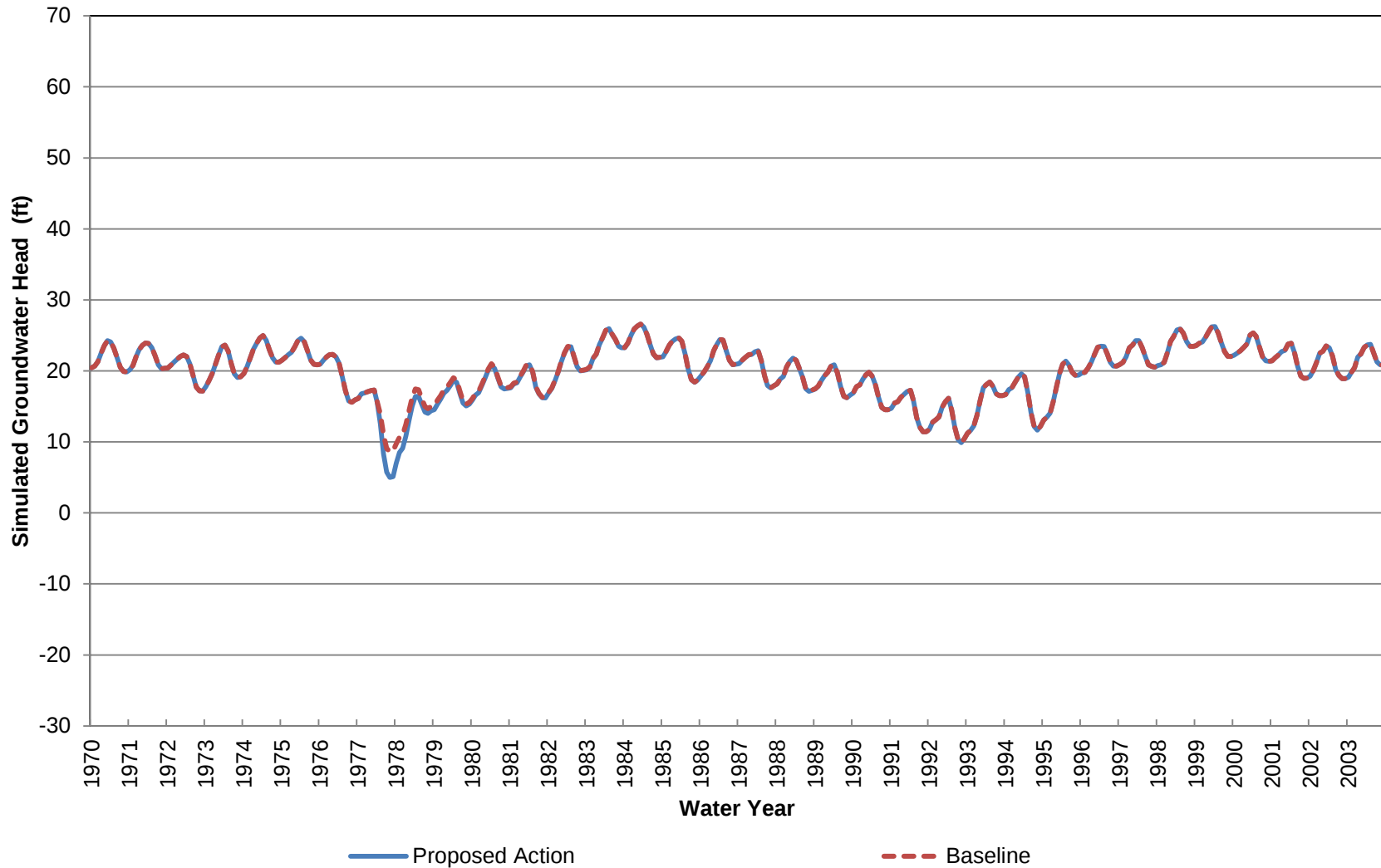
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 380-530 ft bgs)**



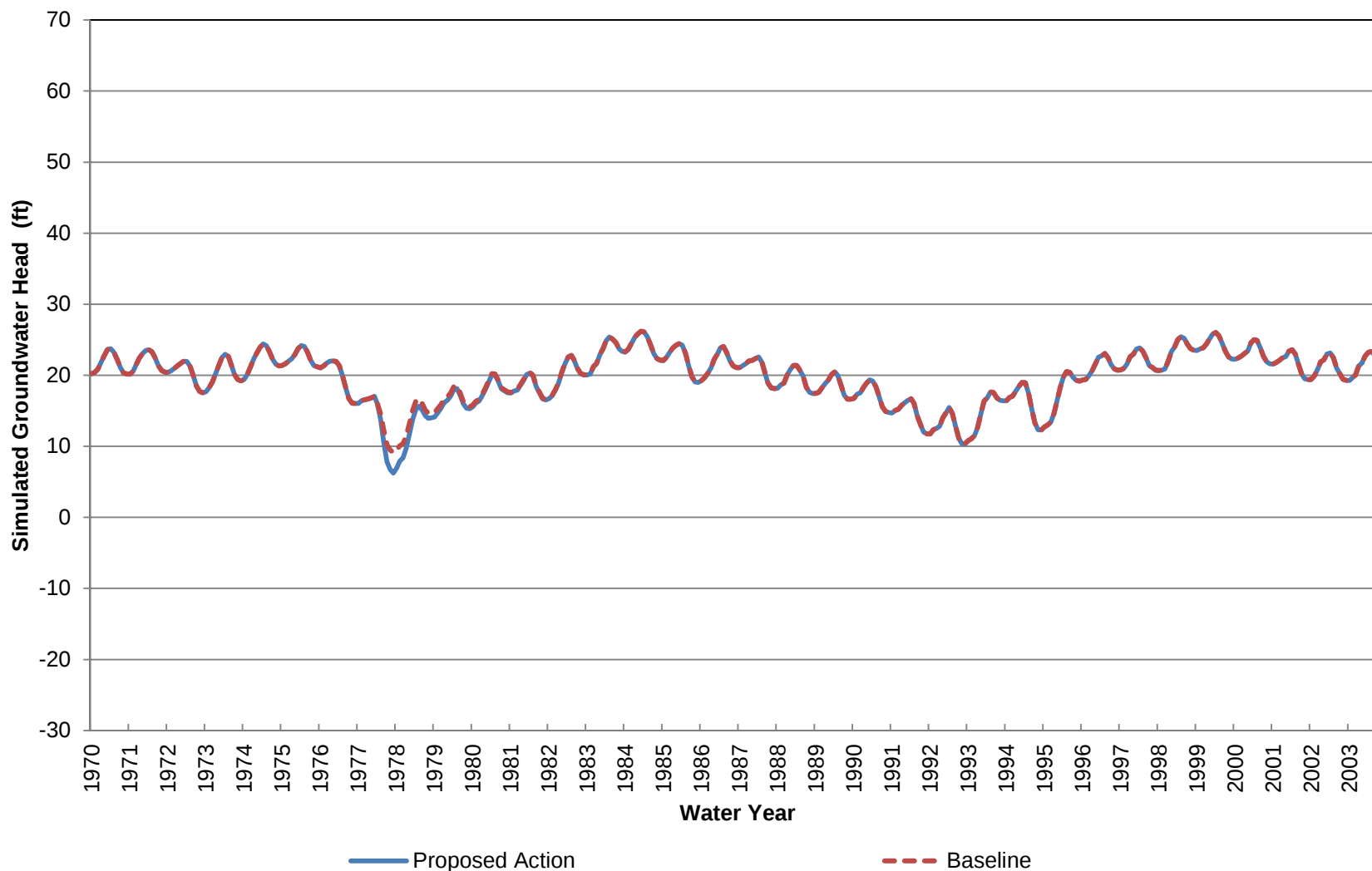
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 530-770 ft bgs)**



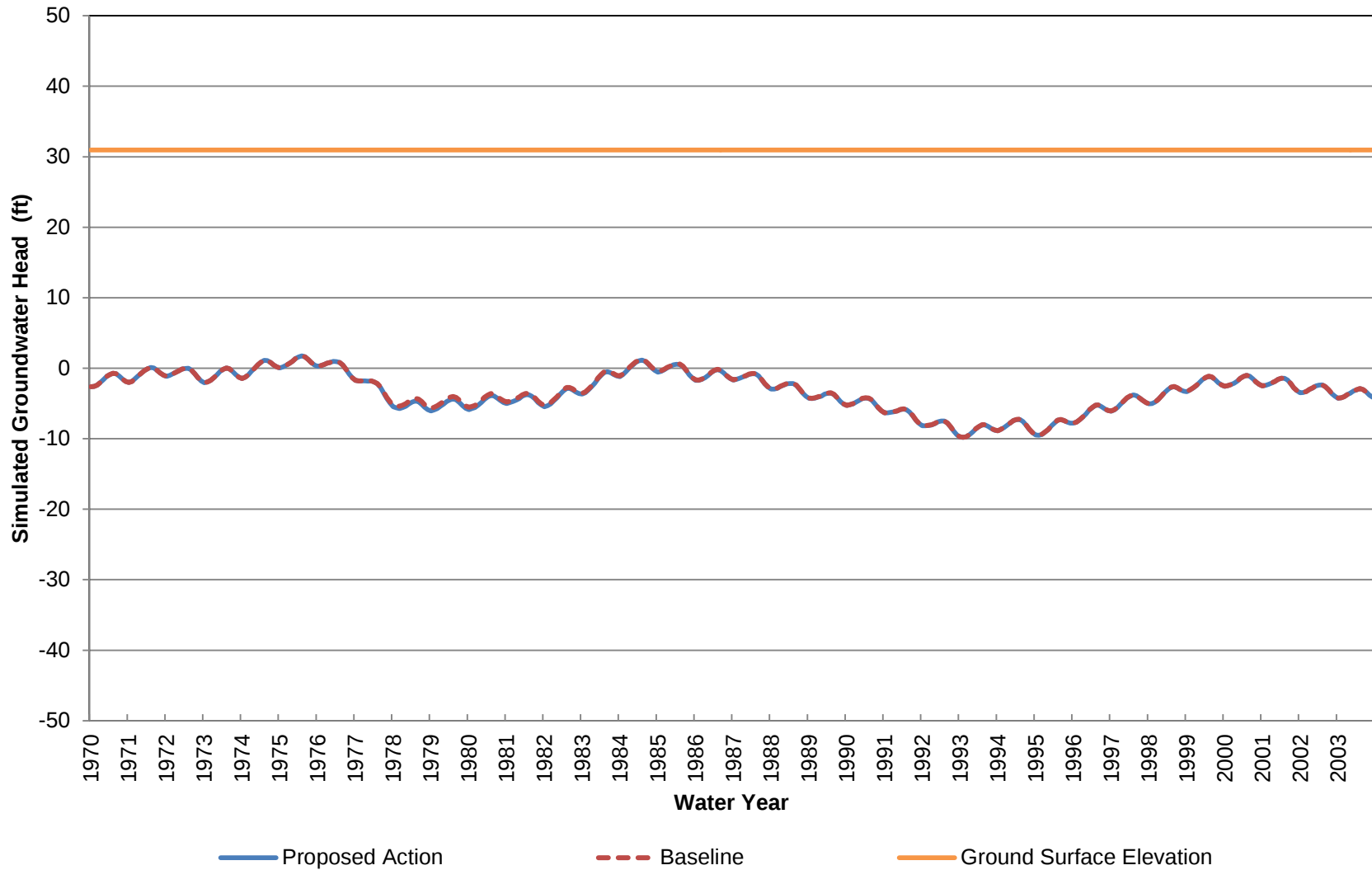
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 770-1030 ft bgs)**



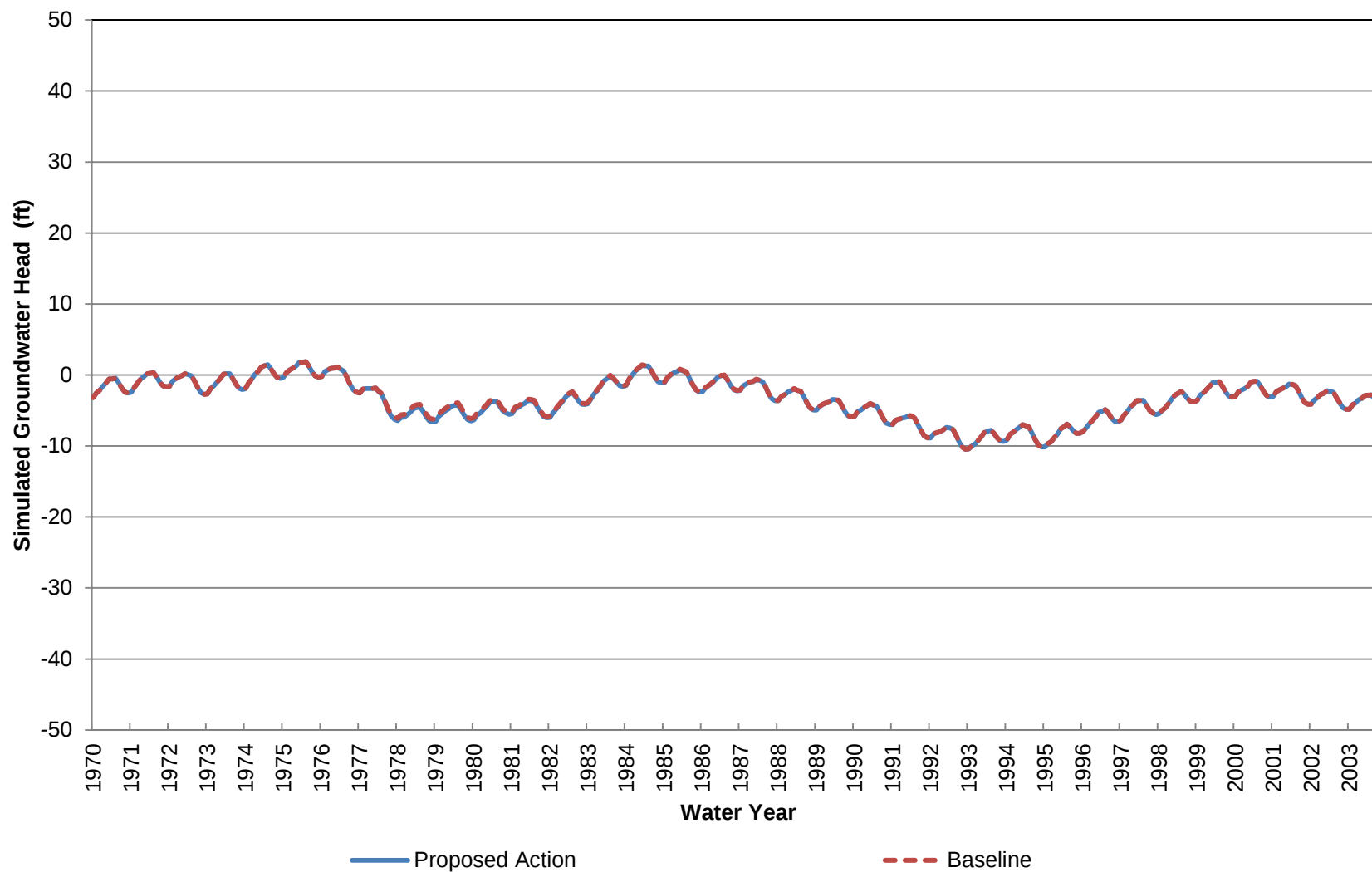
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 27 (Approximately 1030-1410 ft bgs)**



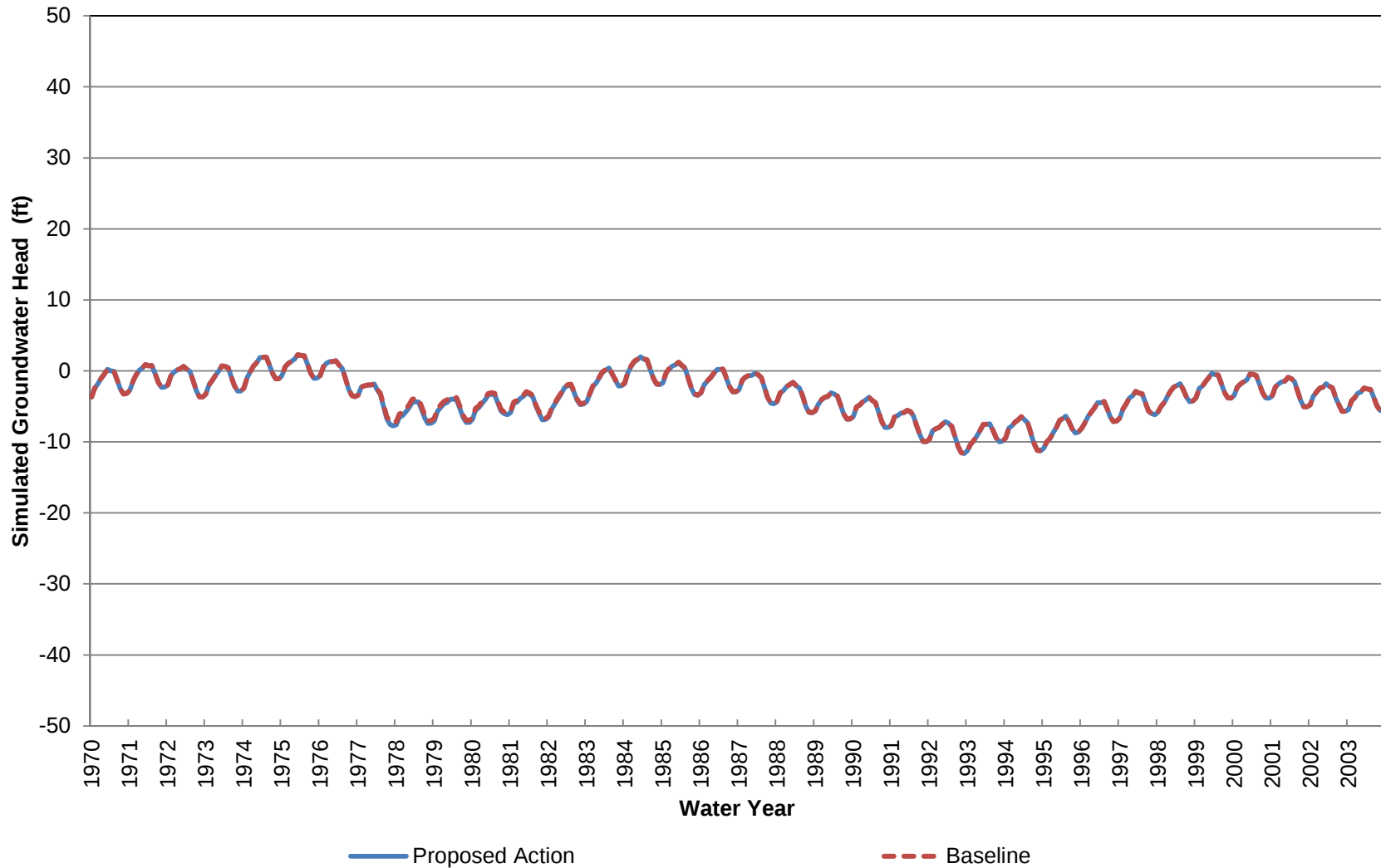
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 28 (Approximately 0-70 ft bgs)**



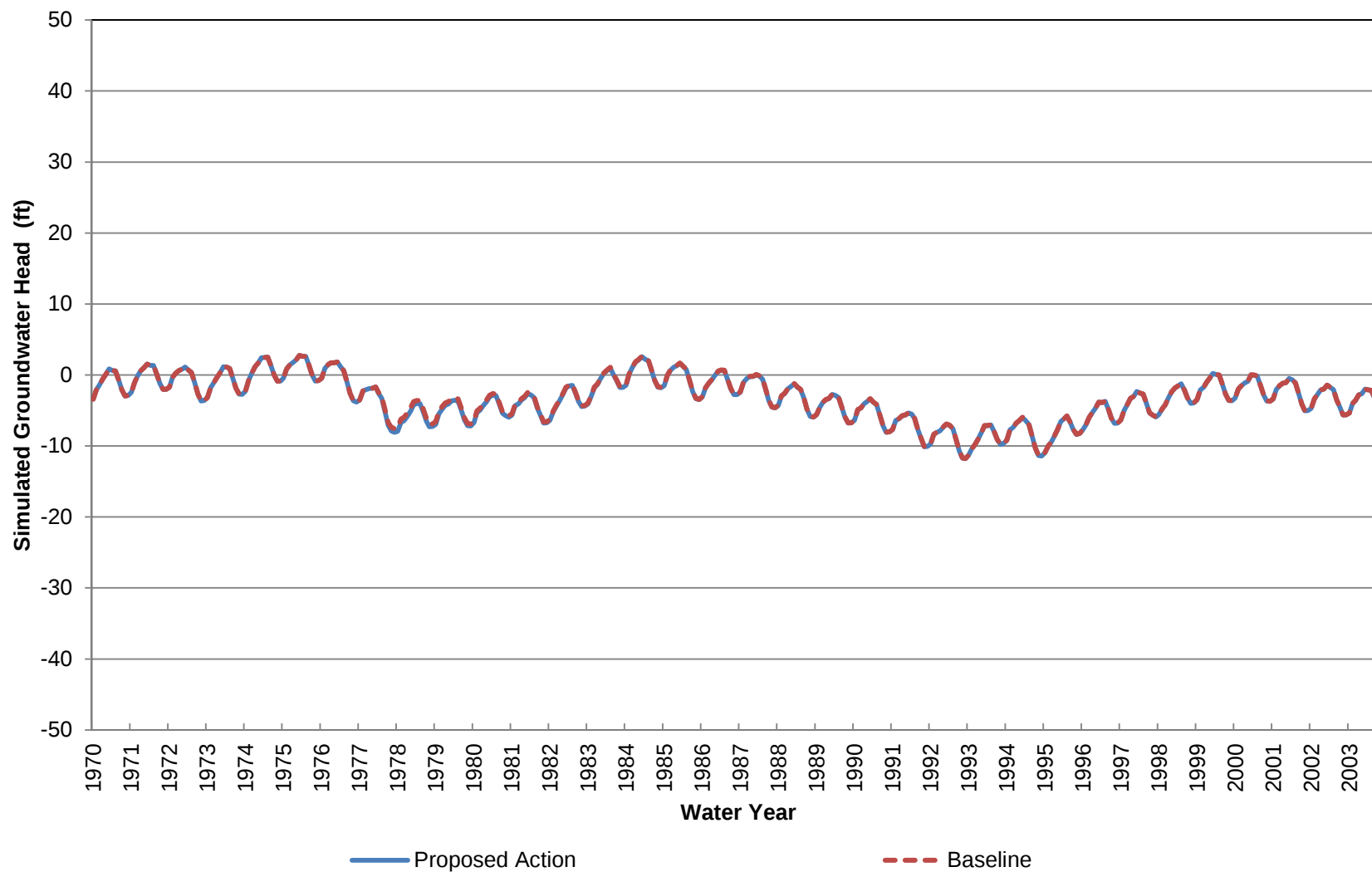
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 70-250 ft bgs)**



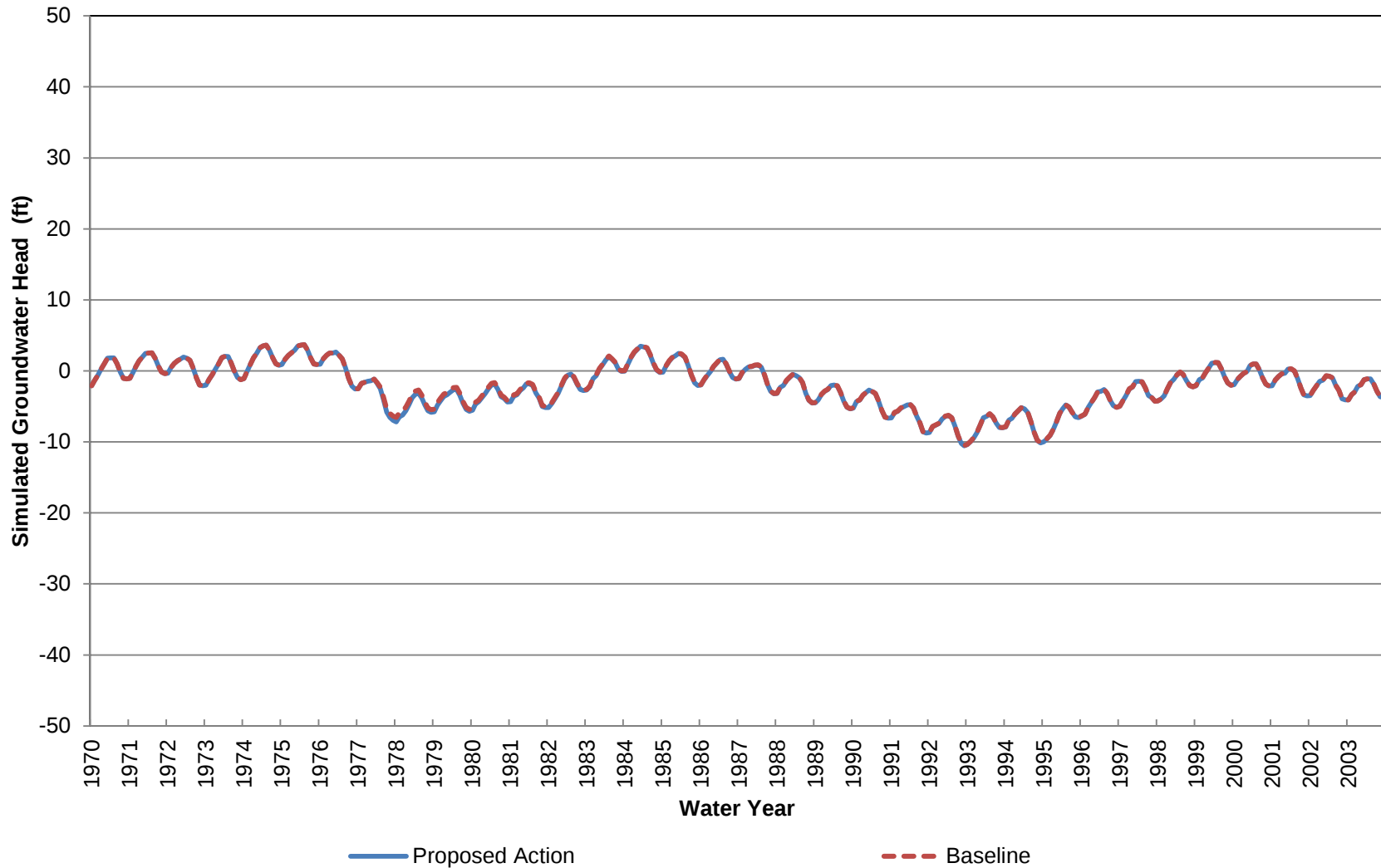
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 250-440 ft bgs)**



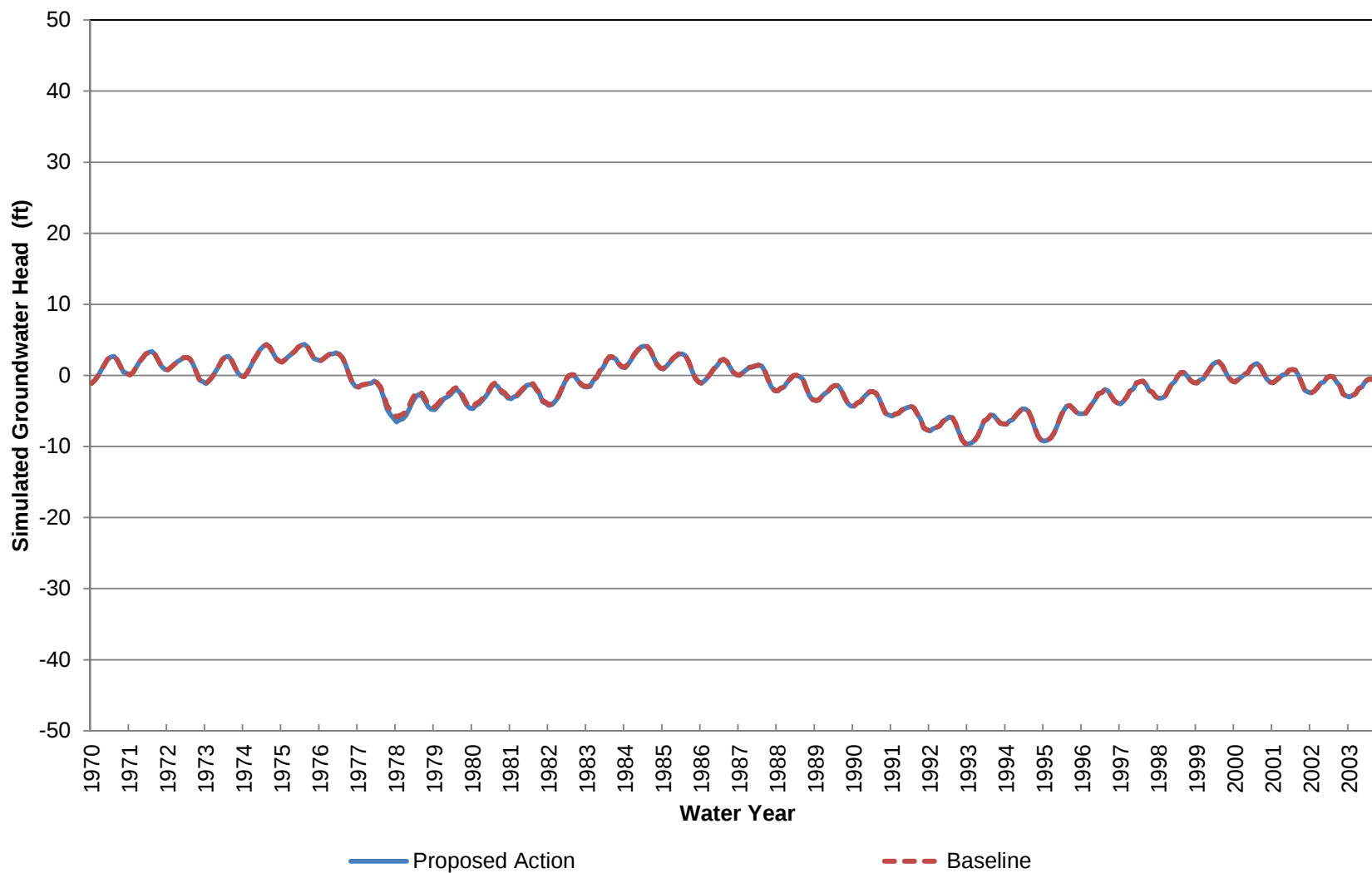
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 440-620 ft bgs)**



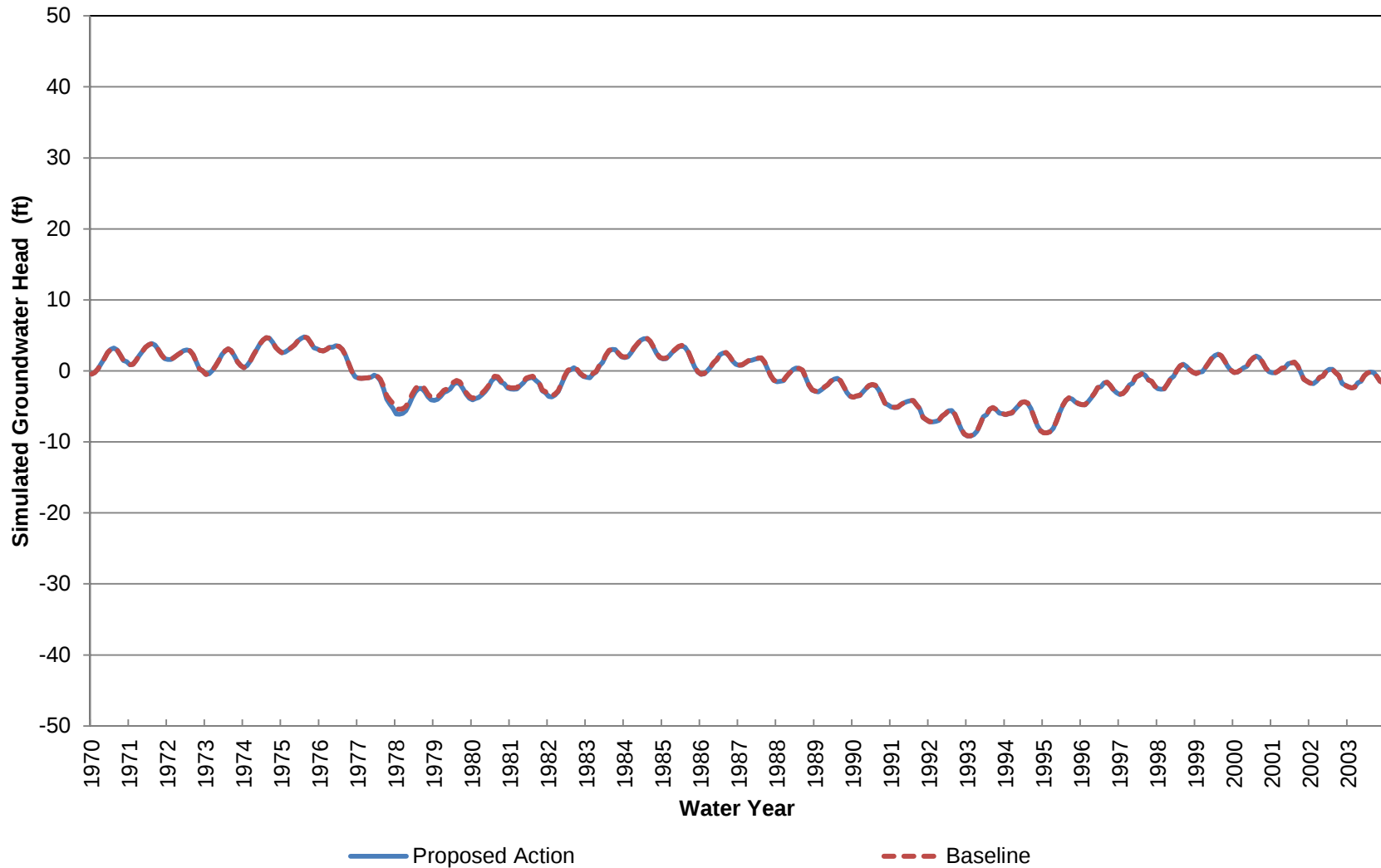
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 620-920 ft bgs)**



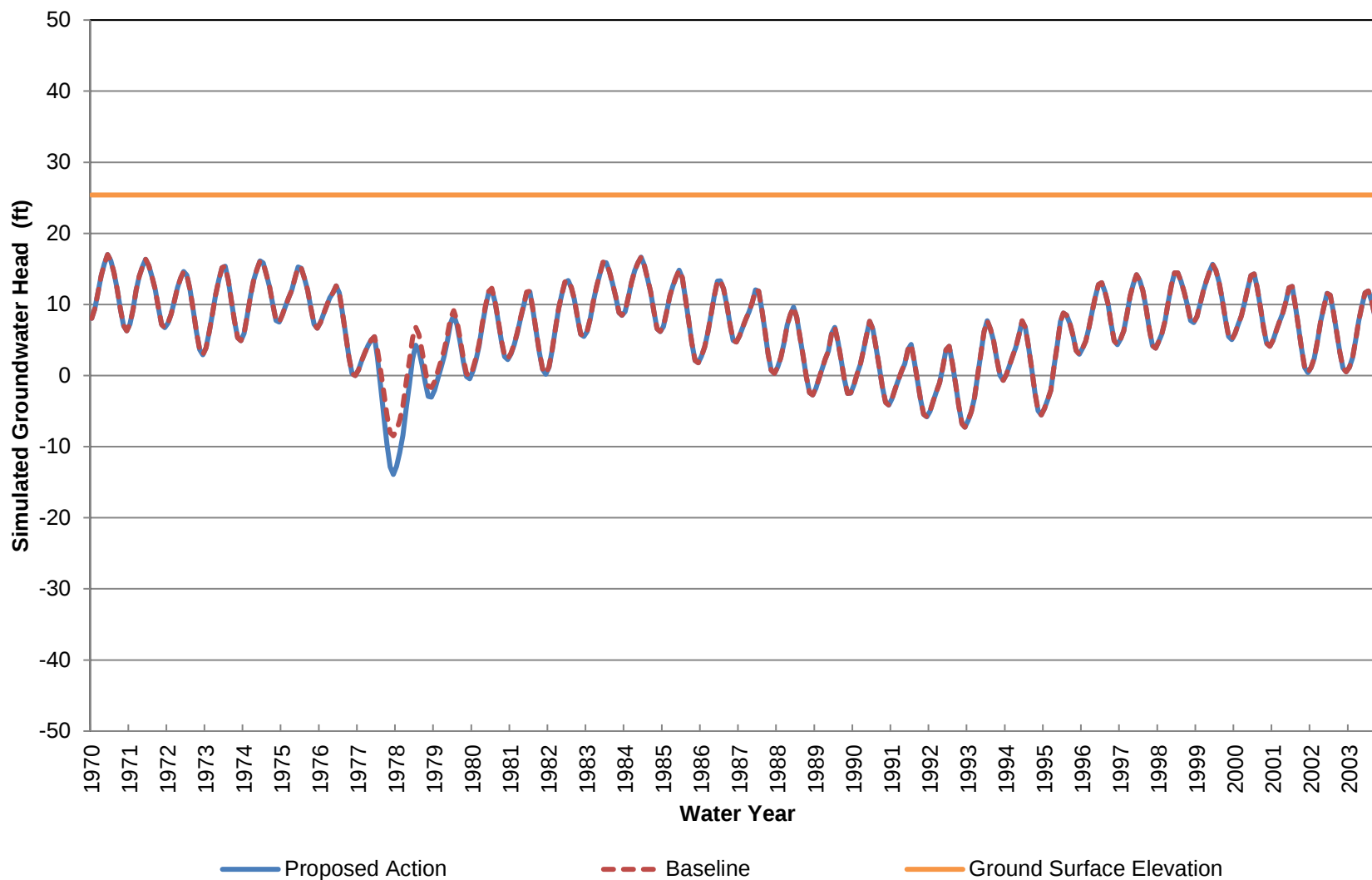
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 920-1220 ft bgs)**



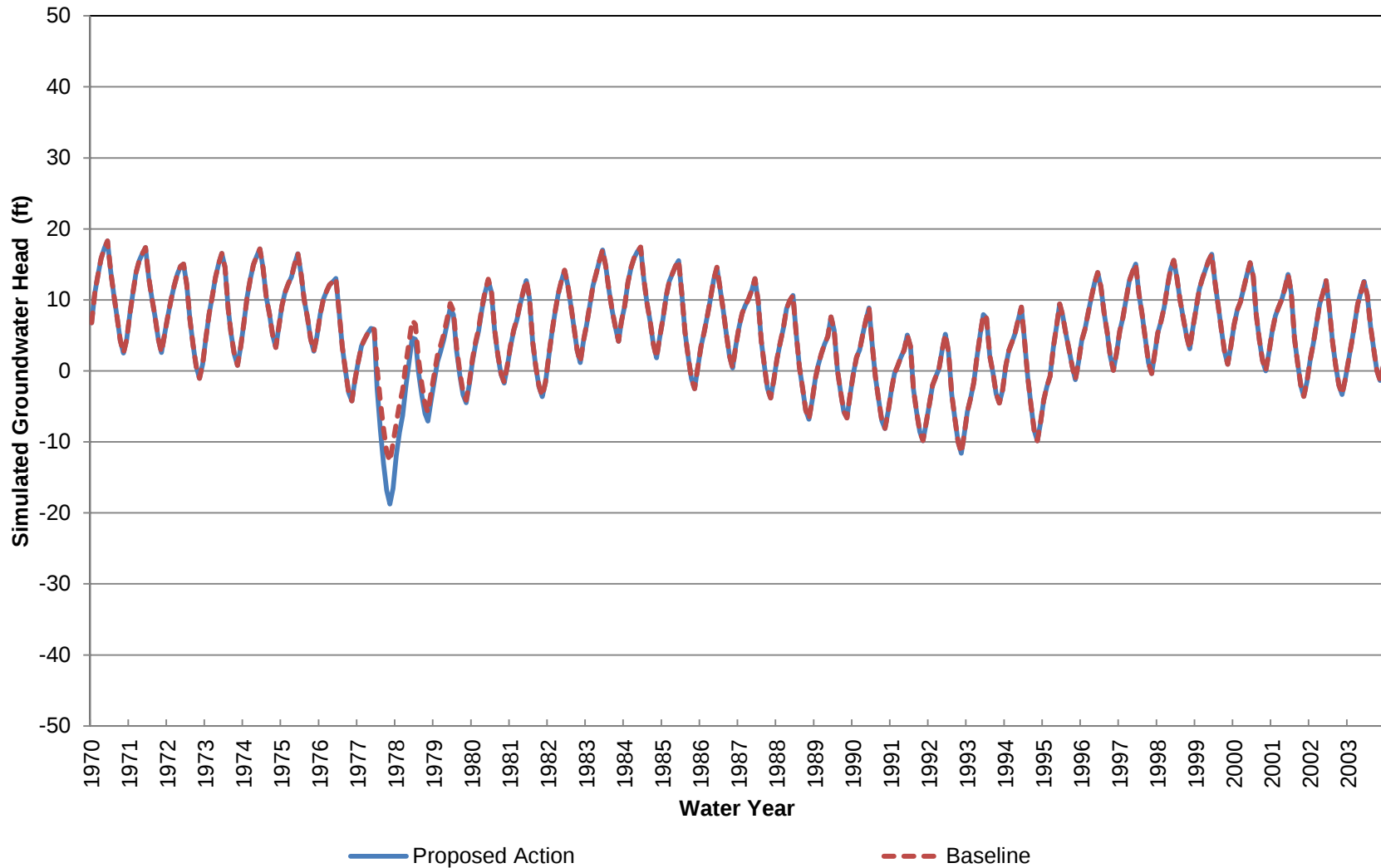
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 28 (Approximately 1220-1680 ft bgs)**



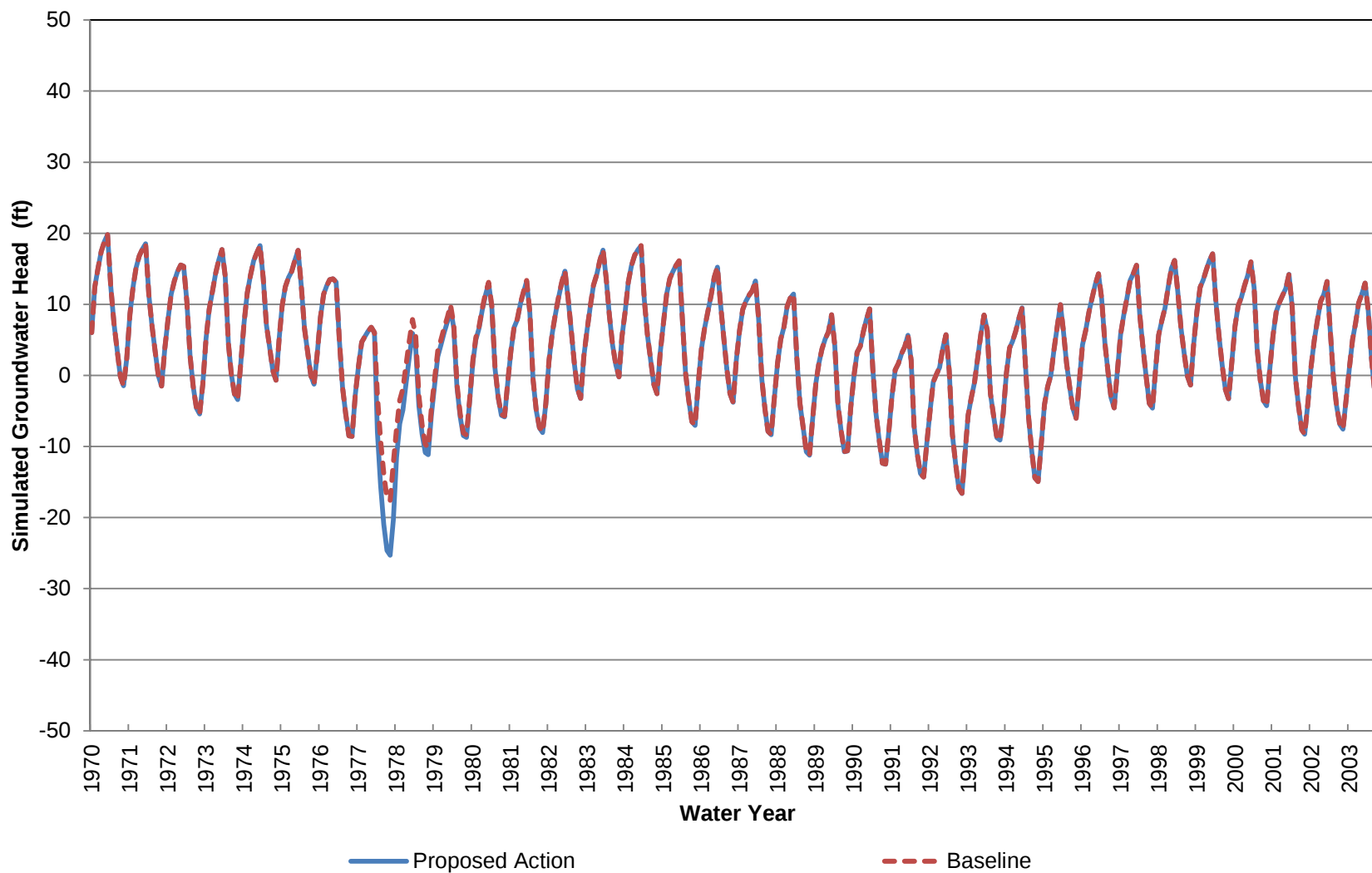
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 29 (Approximately 0-70 ft bgs)**



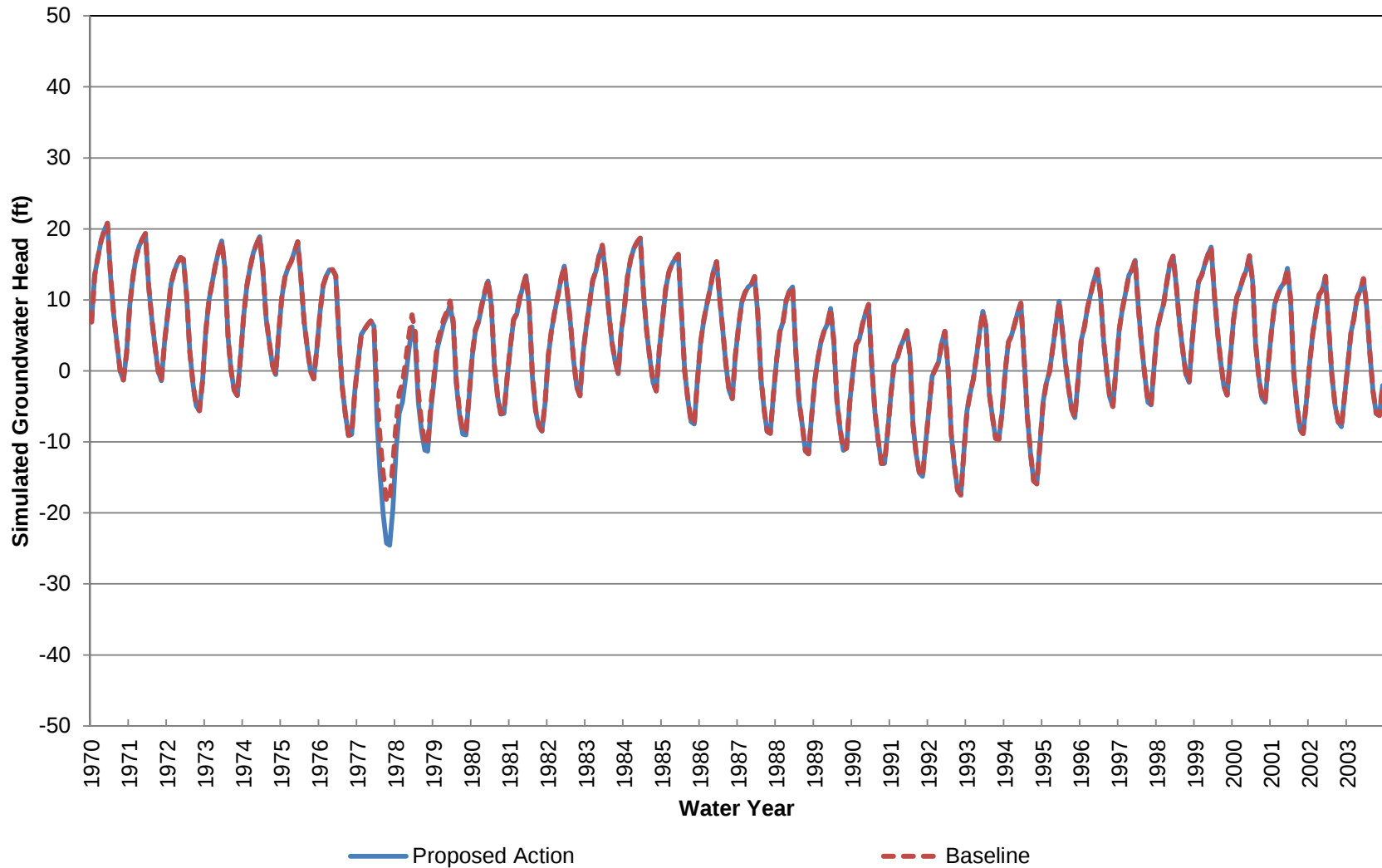
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 70-200 ft bgs)**



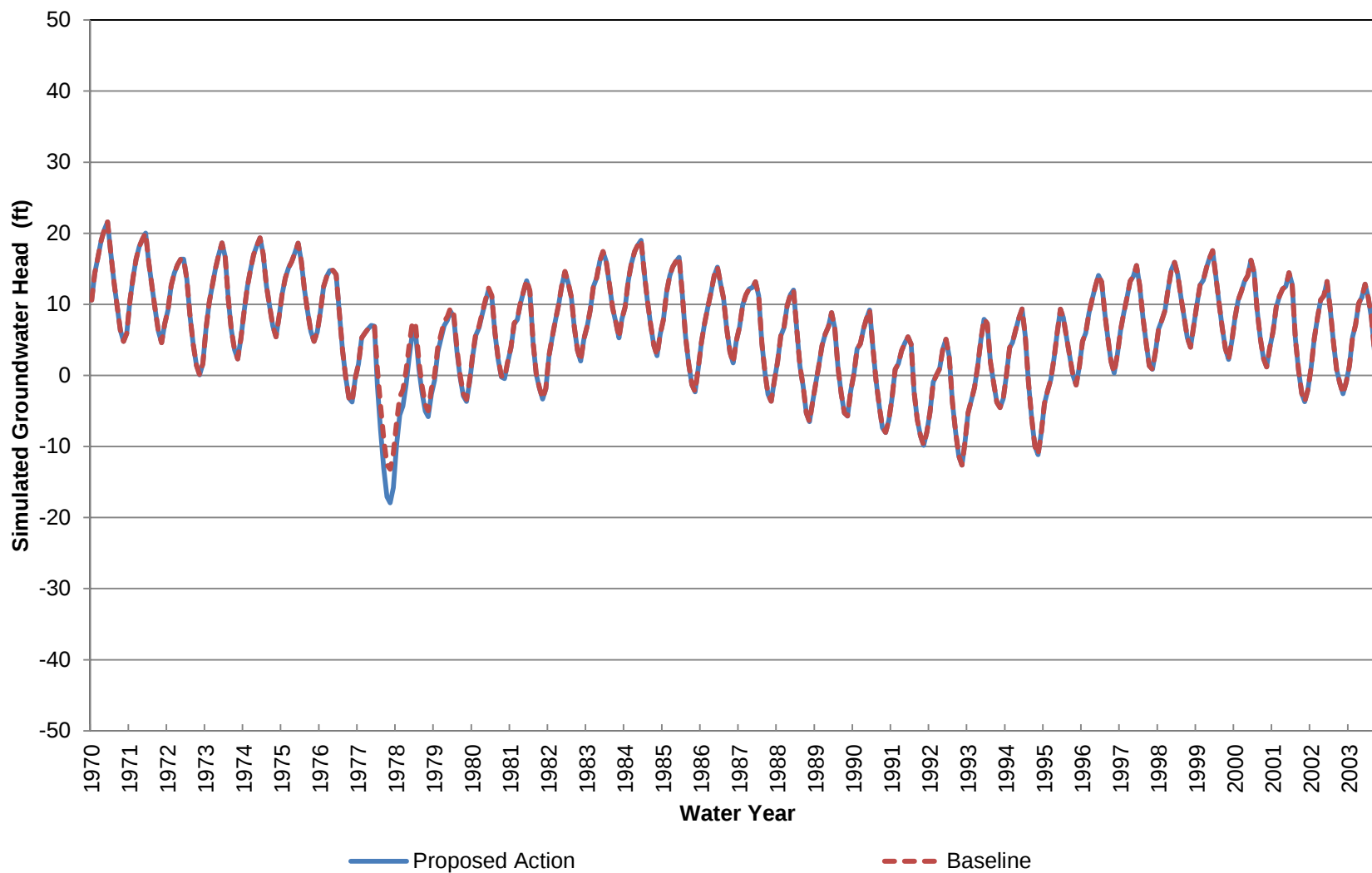
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 200-330 ft bgs)**



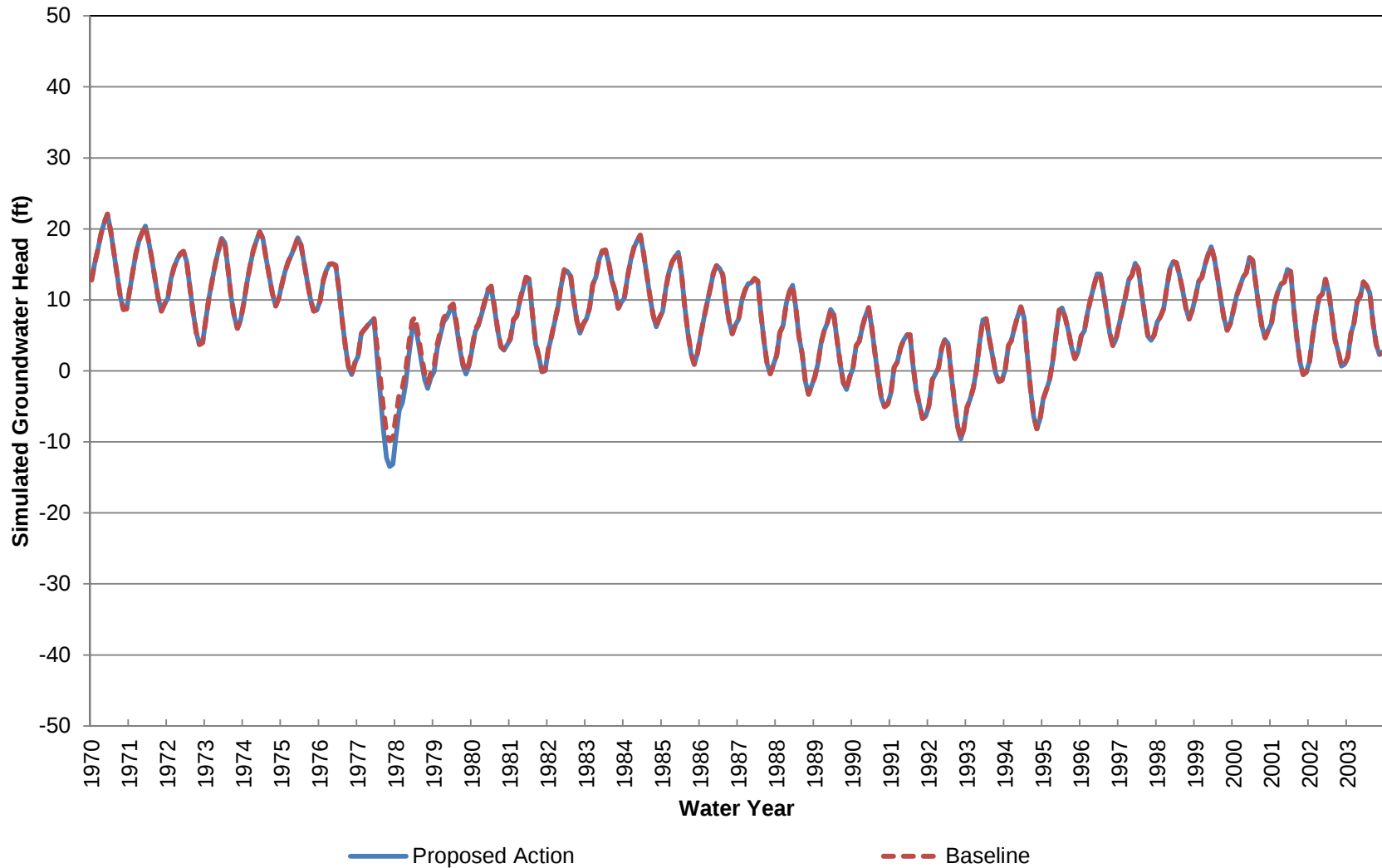
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 330-470 ft bgs)**



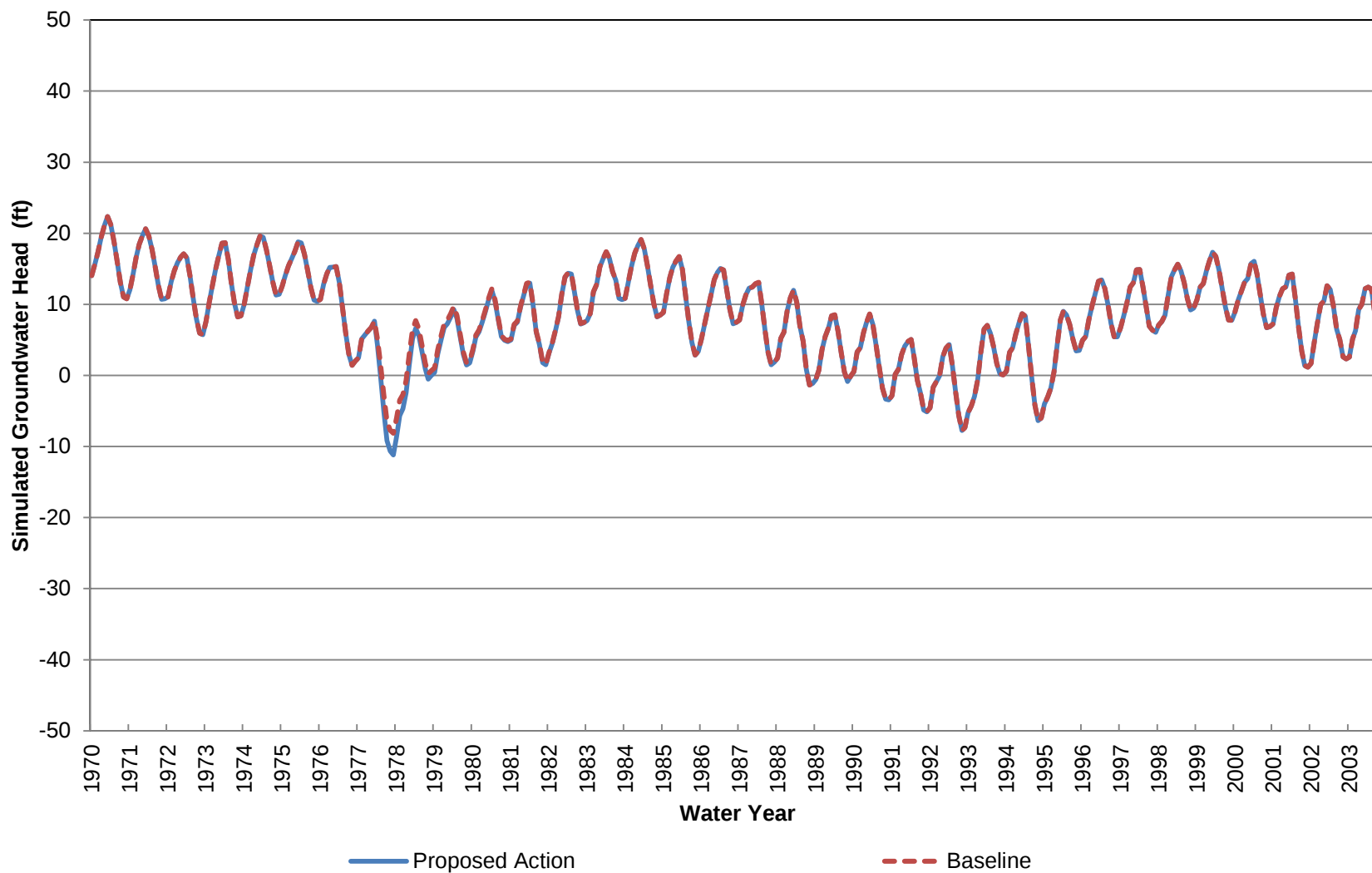
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 470-660 ft bgs)**



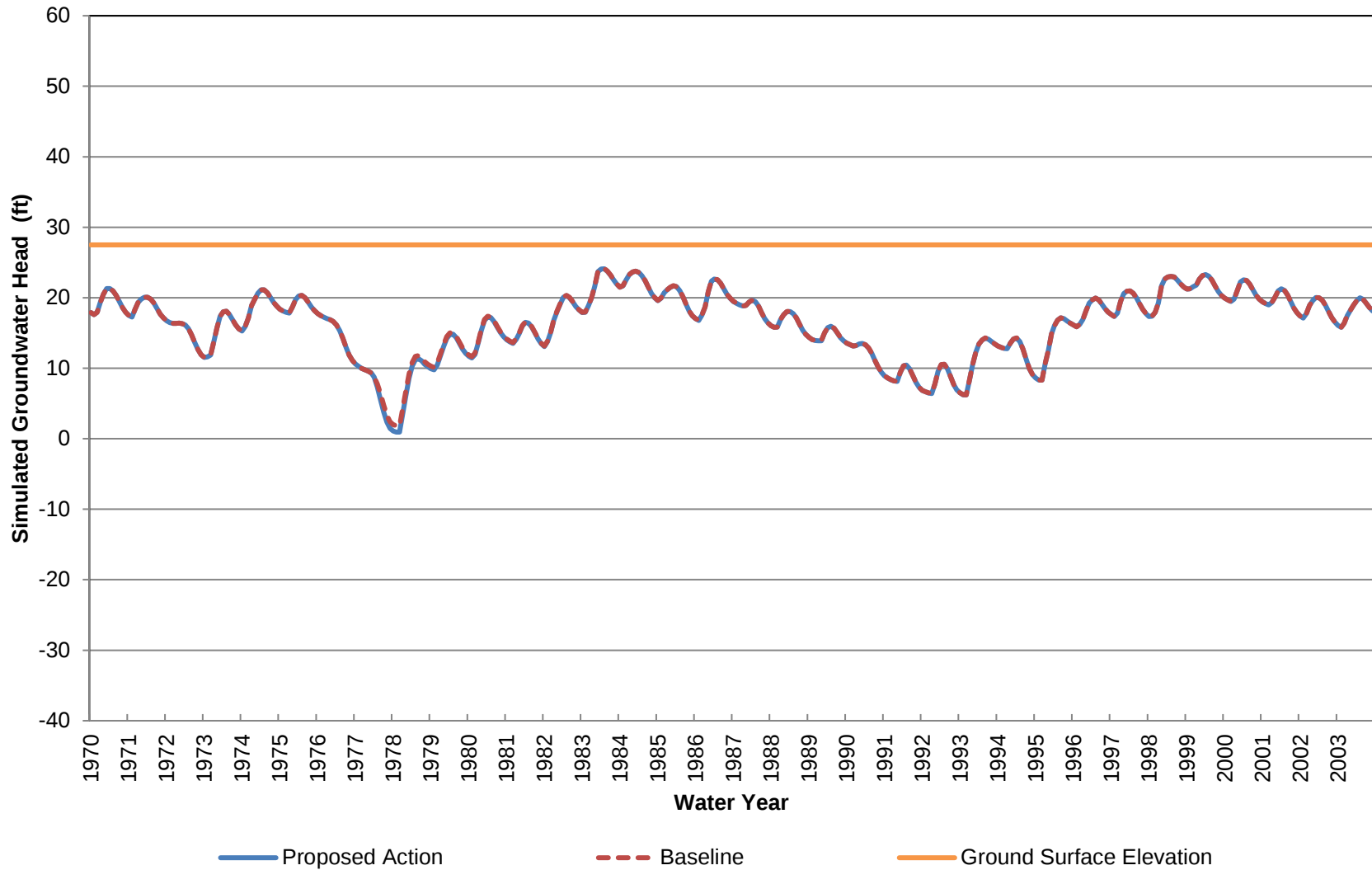
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 660-880 ft bgs)**



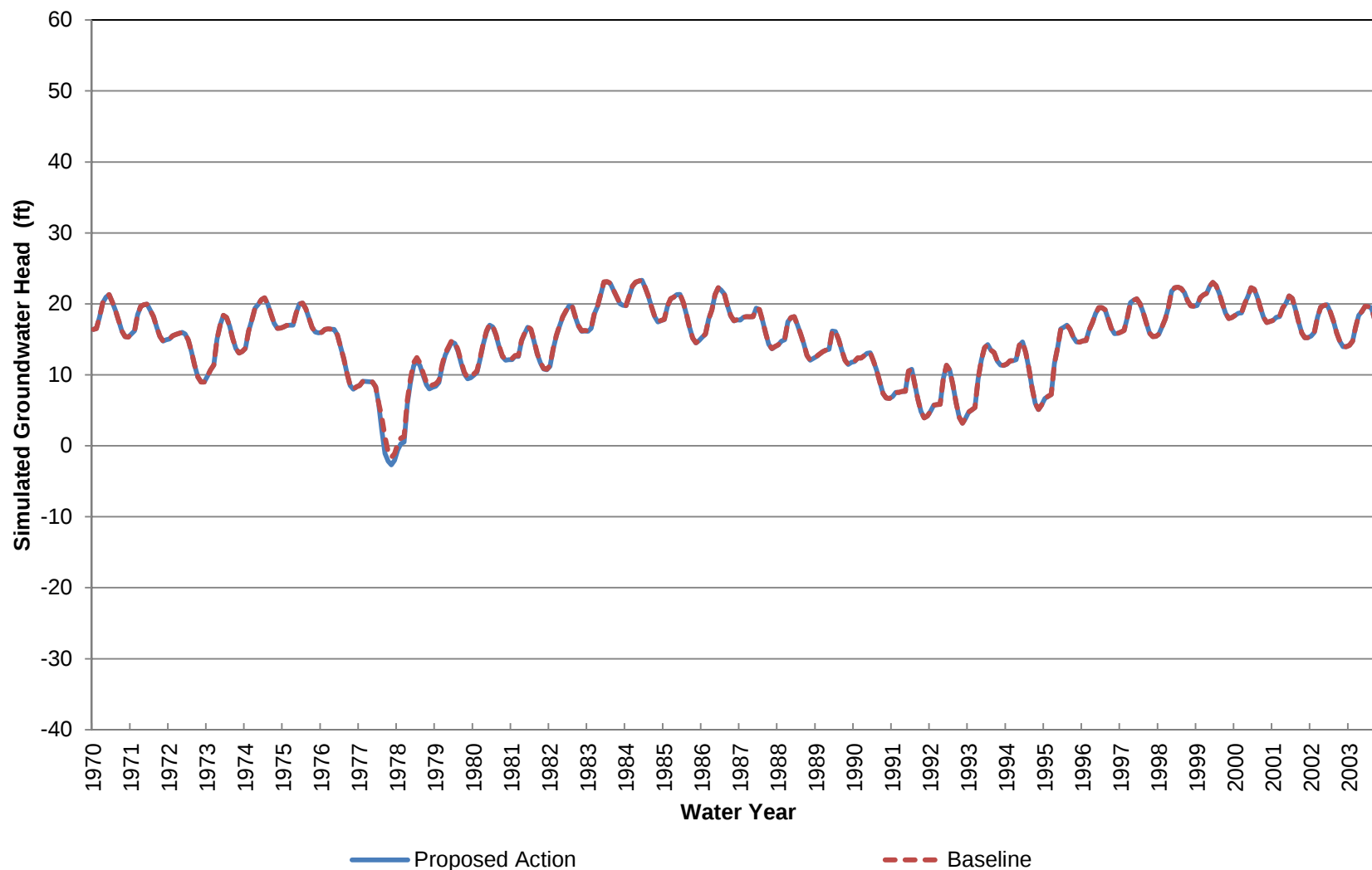
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 29 (Approximately 880-1210 ft bgs)**



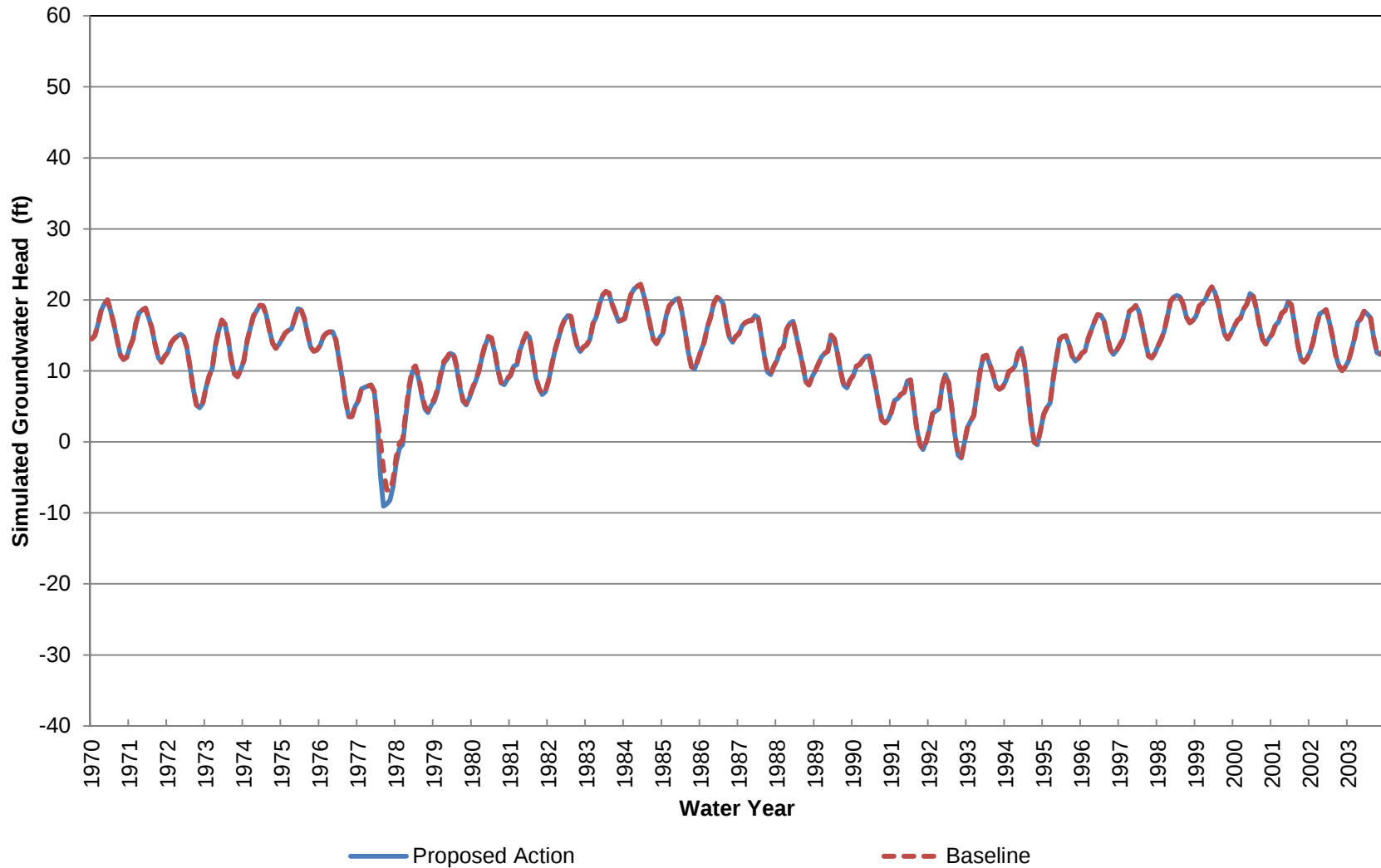
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 30 (Approximately 0-70 ft bgs)**



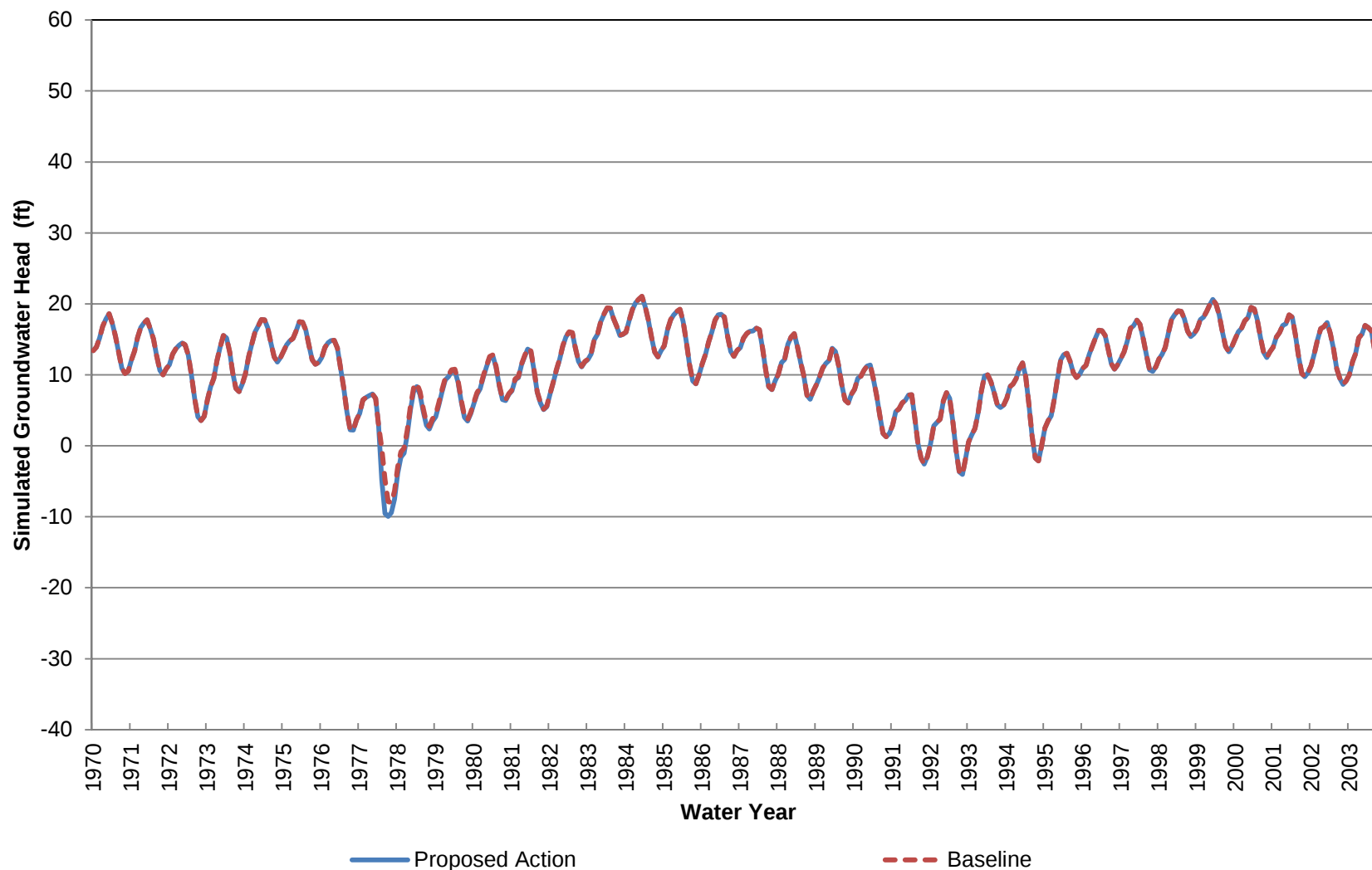
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 70-340 ft bgs)**



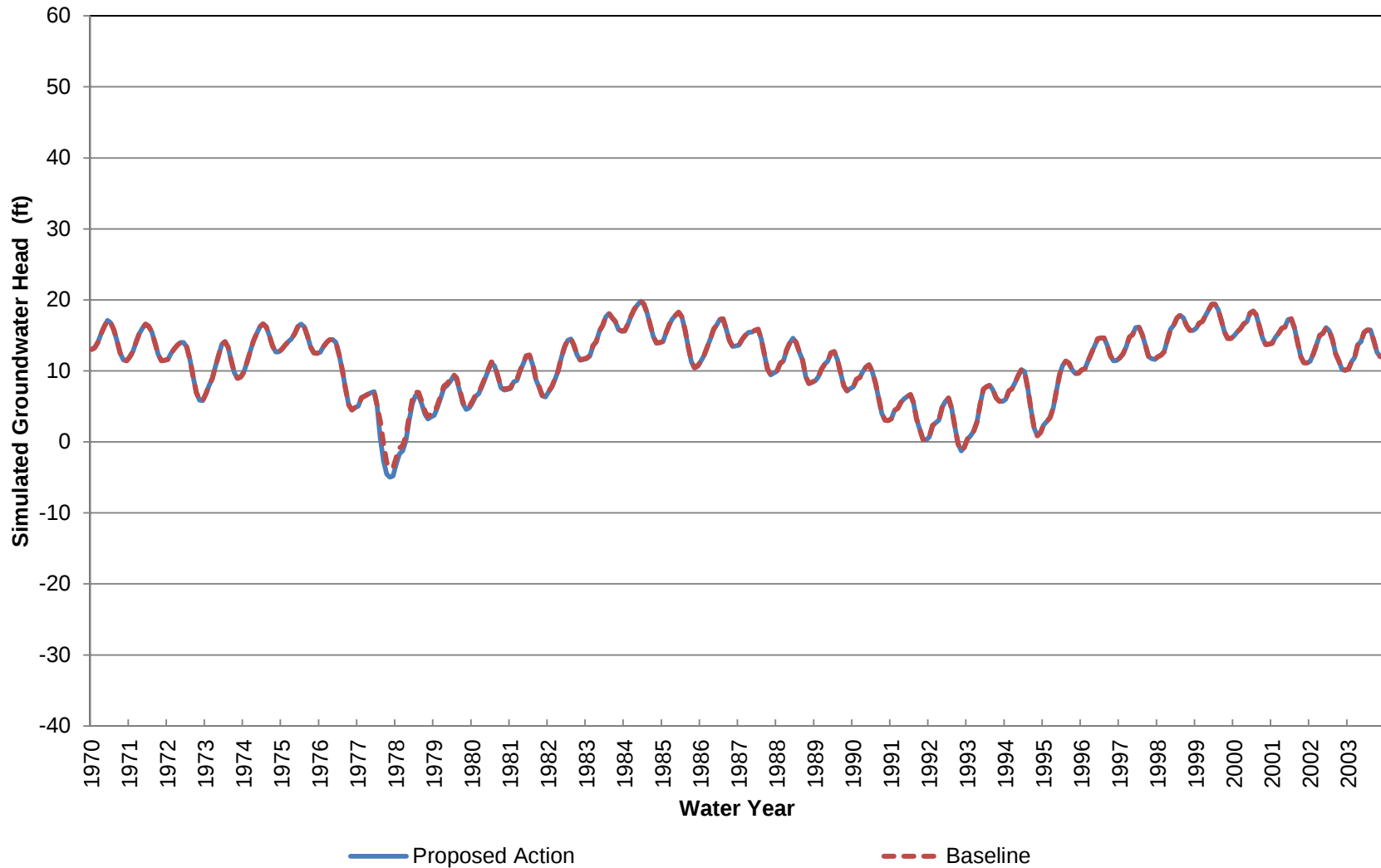
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 340-600 ft bgs)**



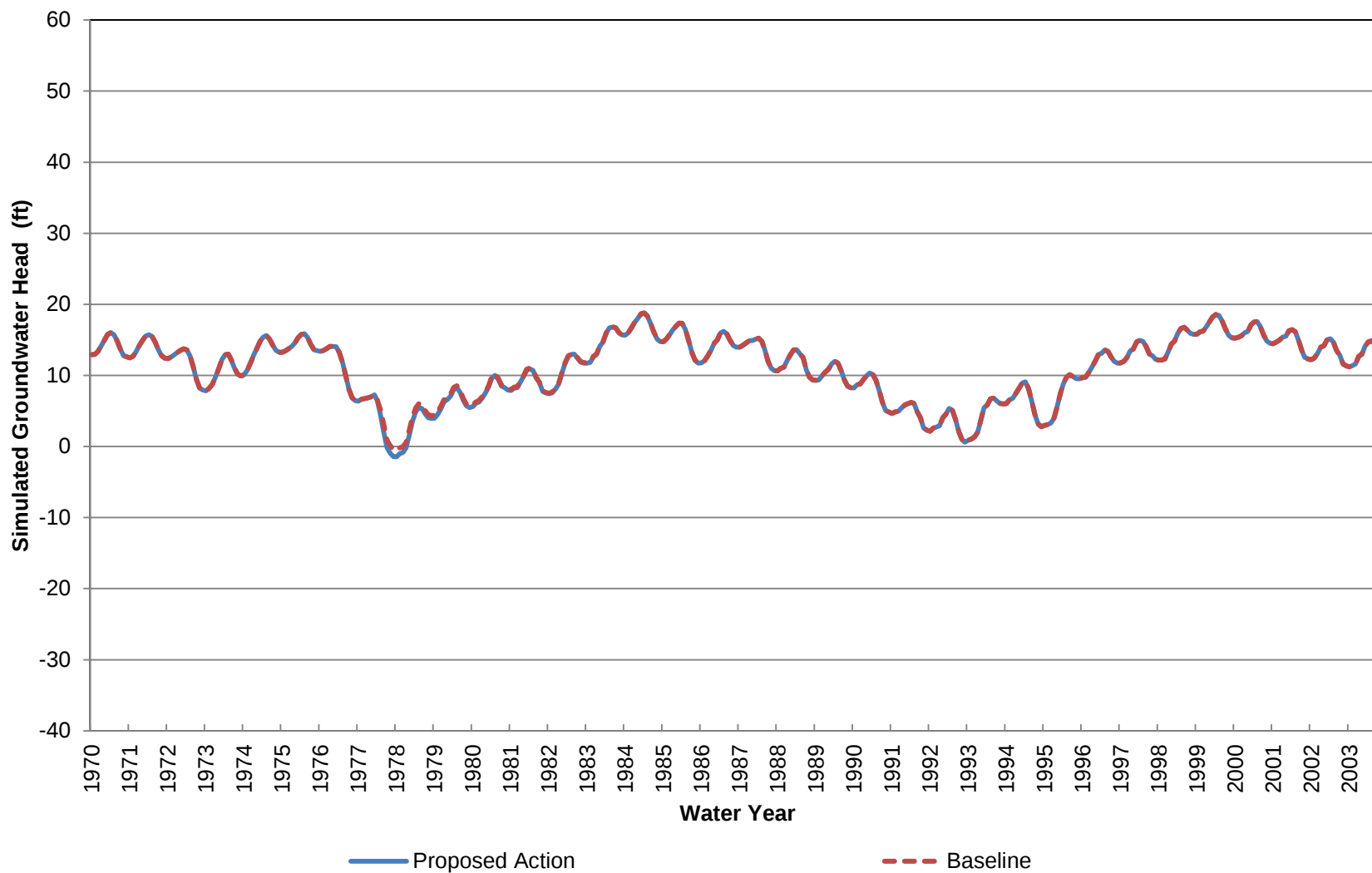
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 600-860 ft bgs)**



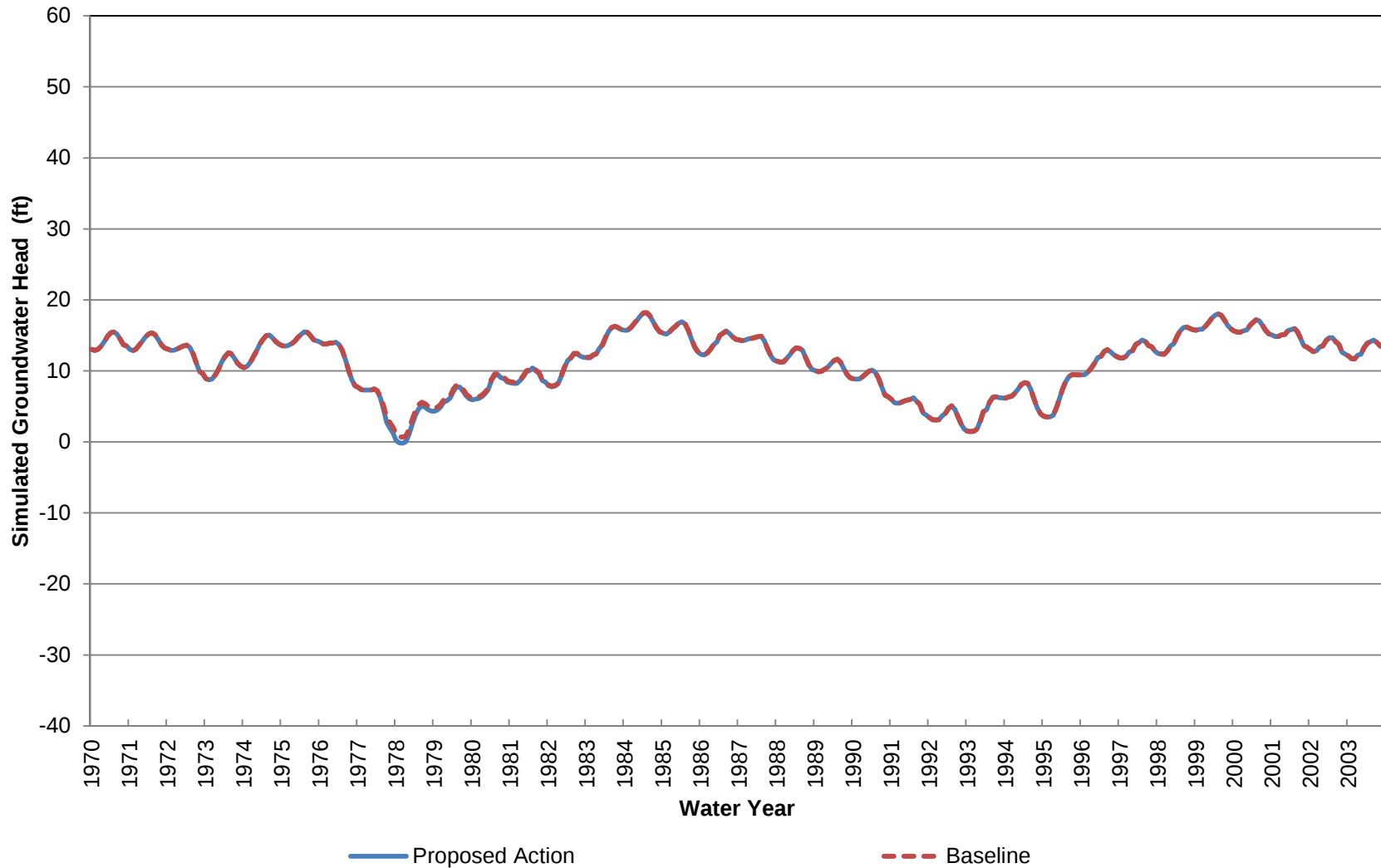
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 860-1330 ft bgs)**



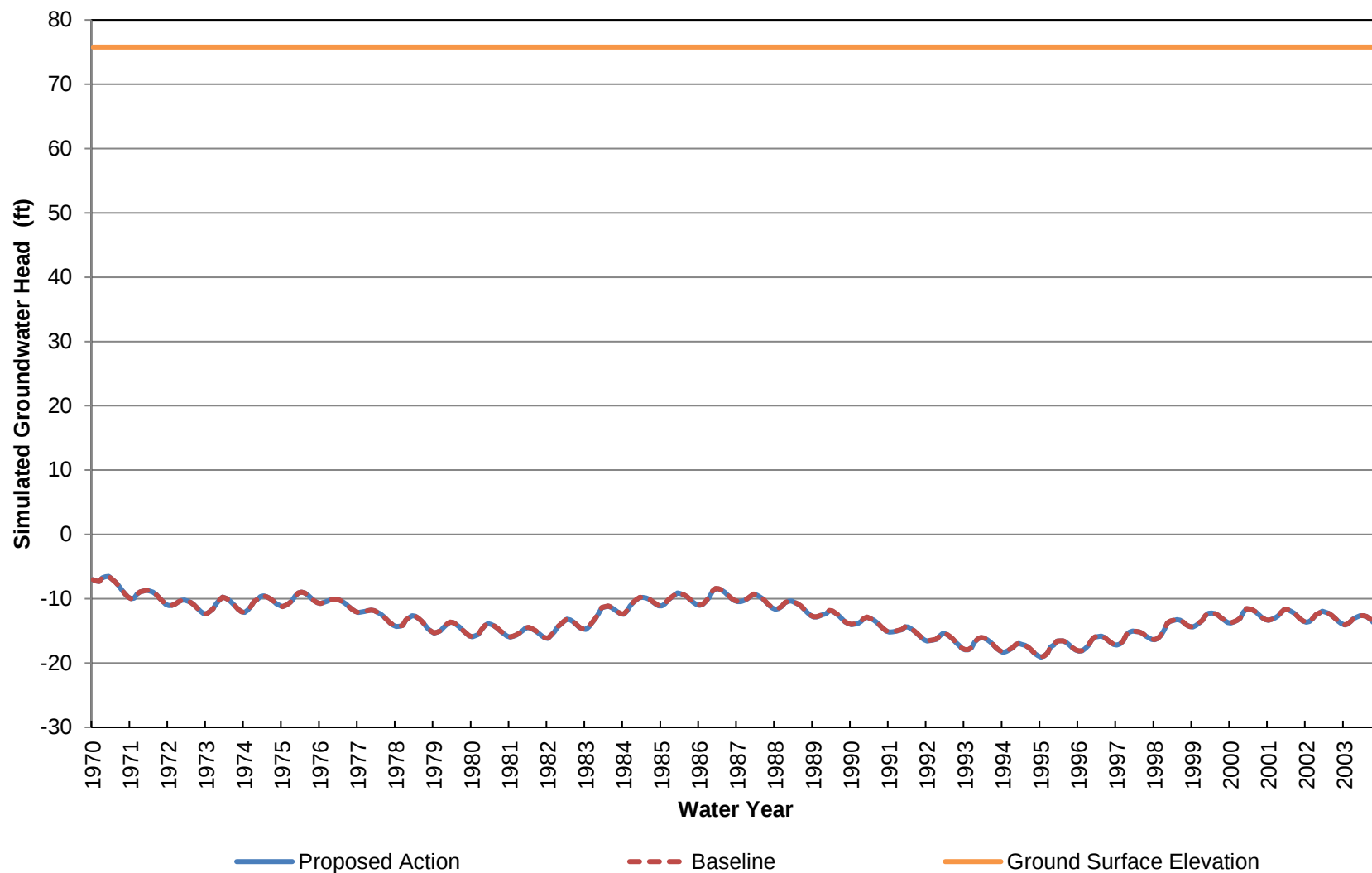
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 1330-1770 ft bgs)**



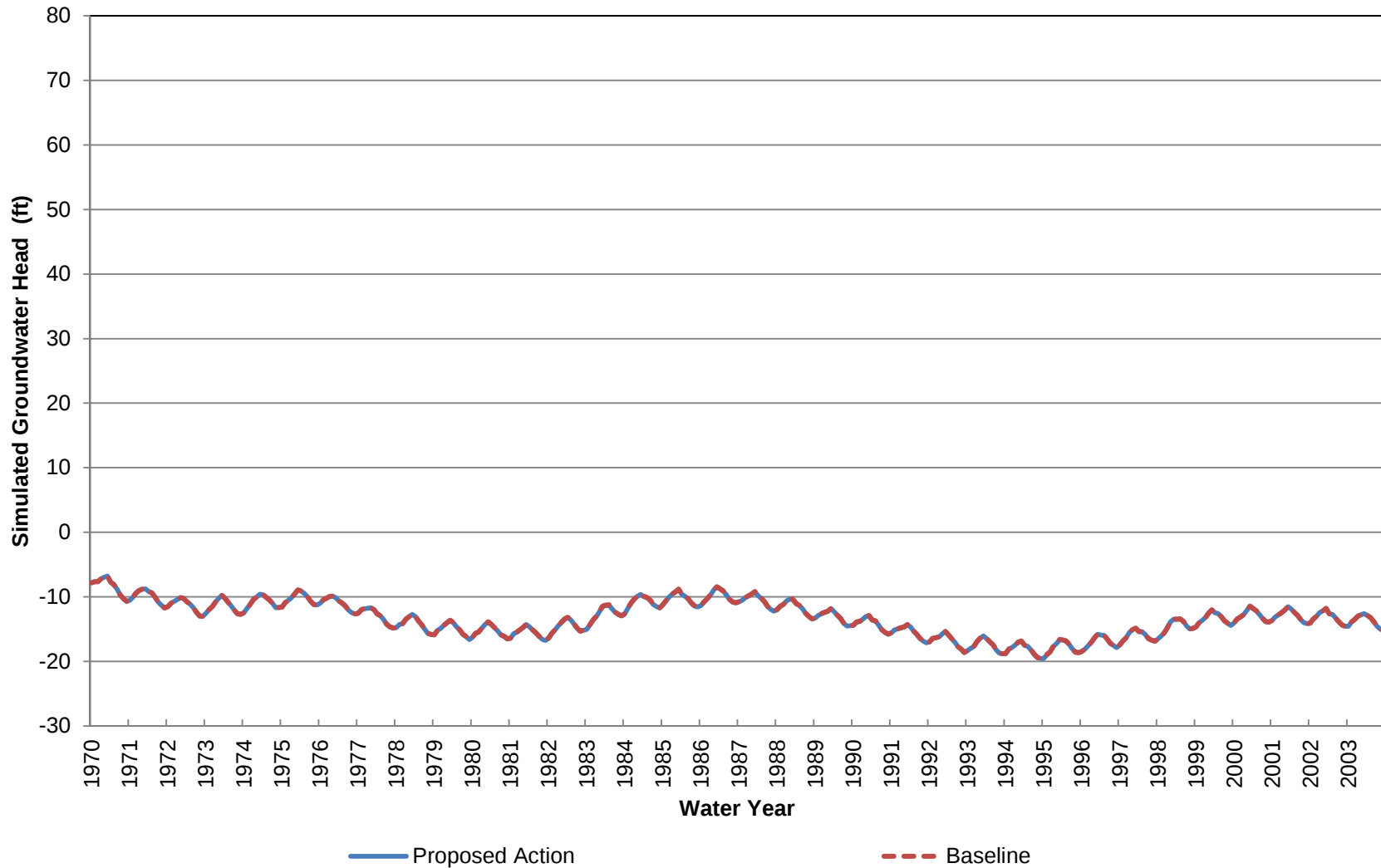
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 30 (Approximately 1770-2430 ft bgs)**



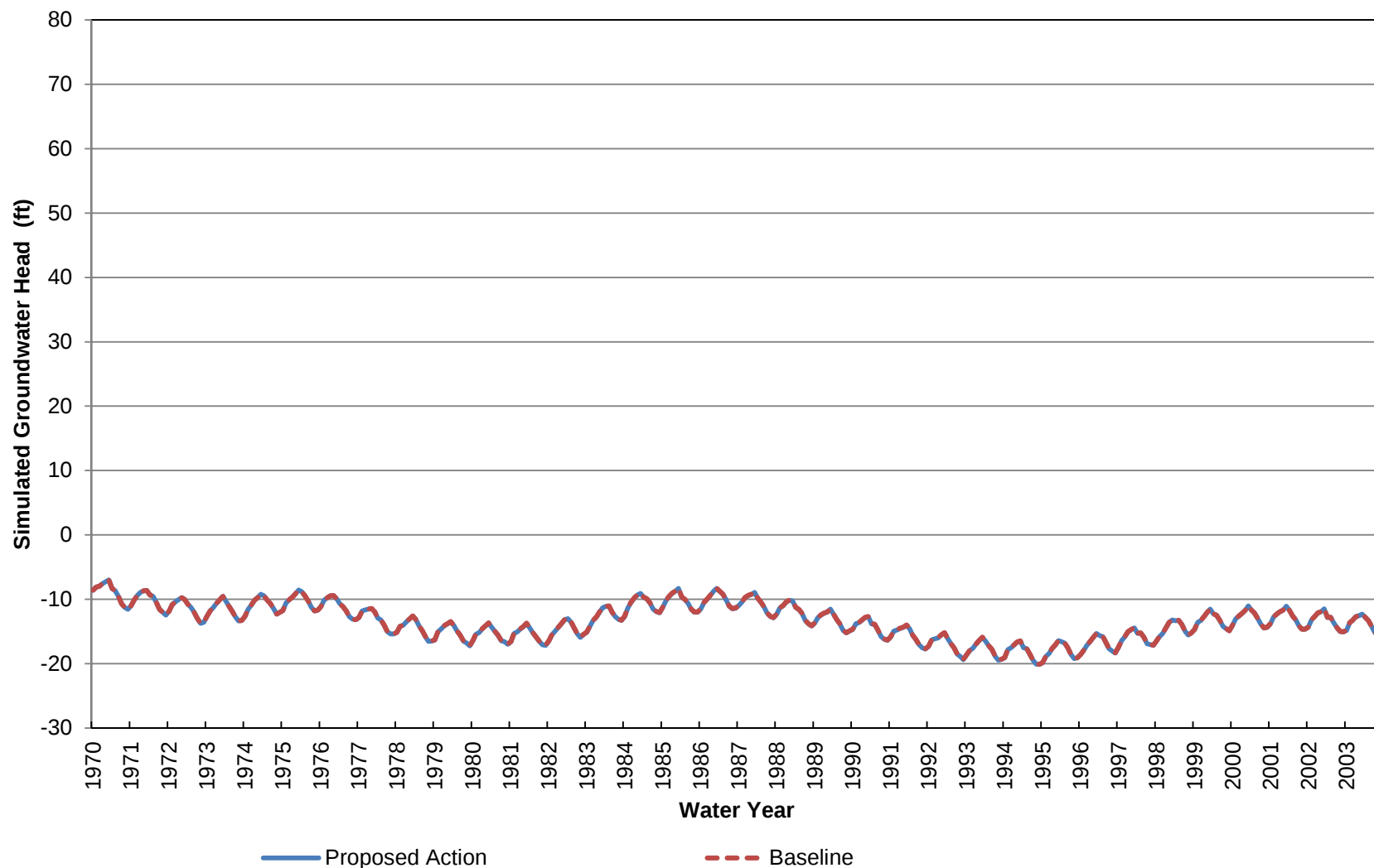
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 31 (Approximately 0-70 ft bgs)**



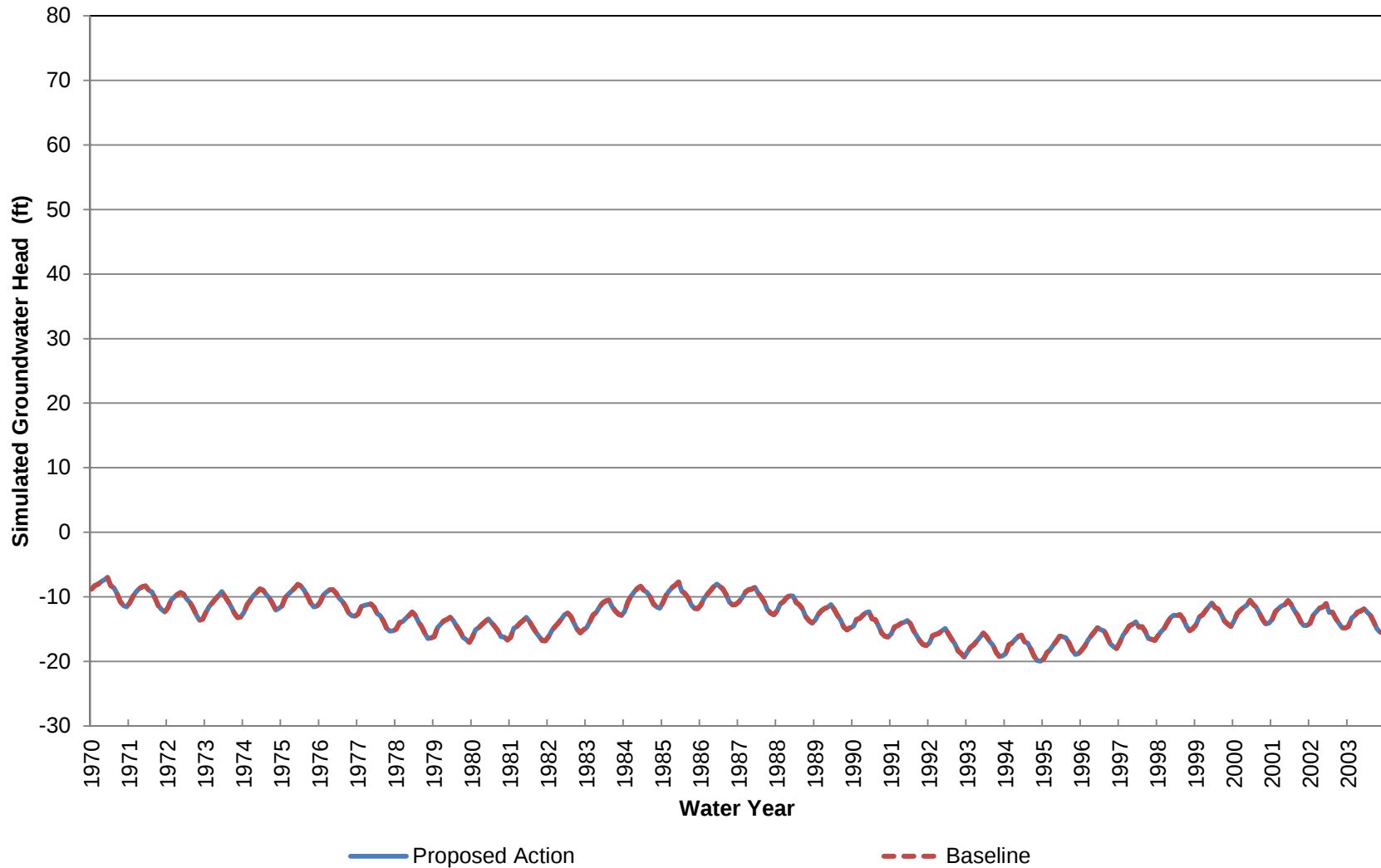
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 70-200 ft bgs)**



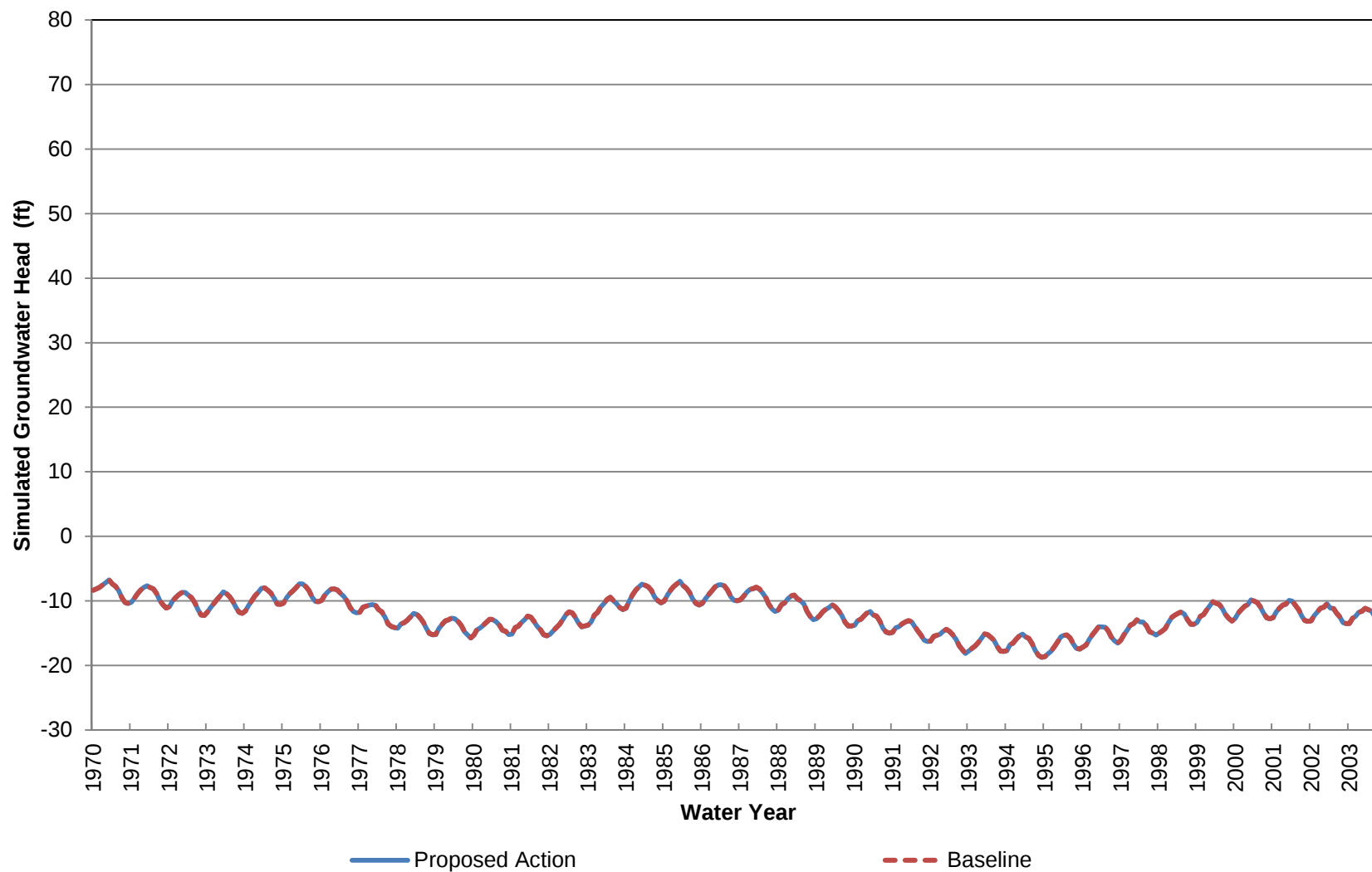
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 200-330 ft bgs)**



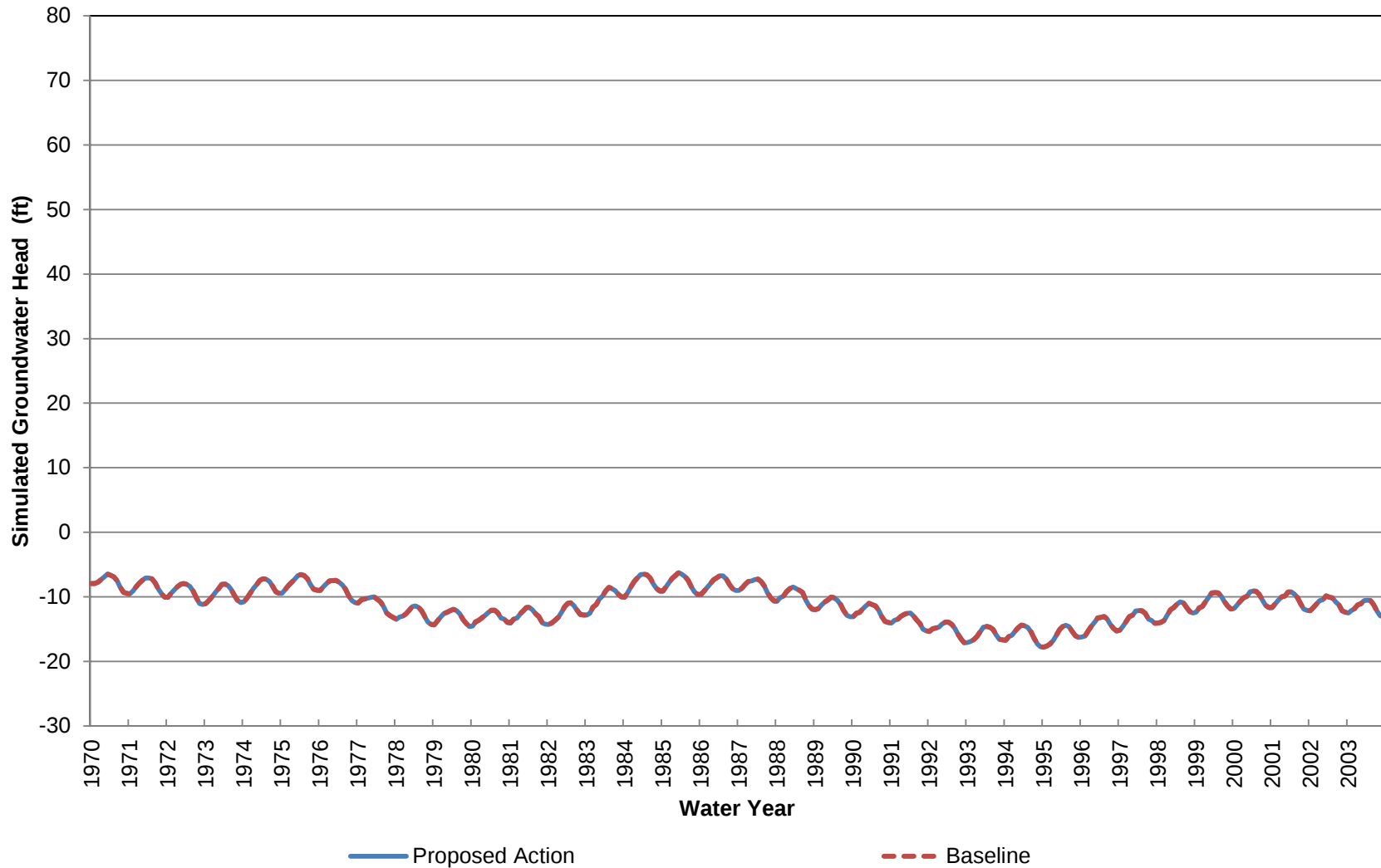
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 330-460 ft bgs)**



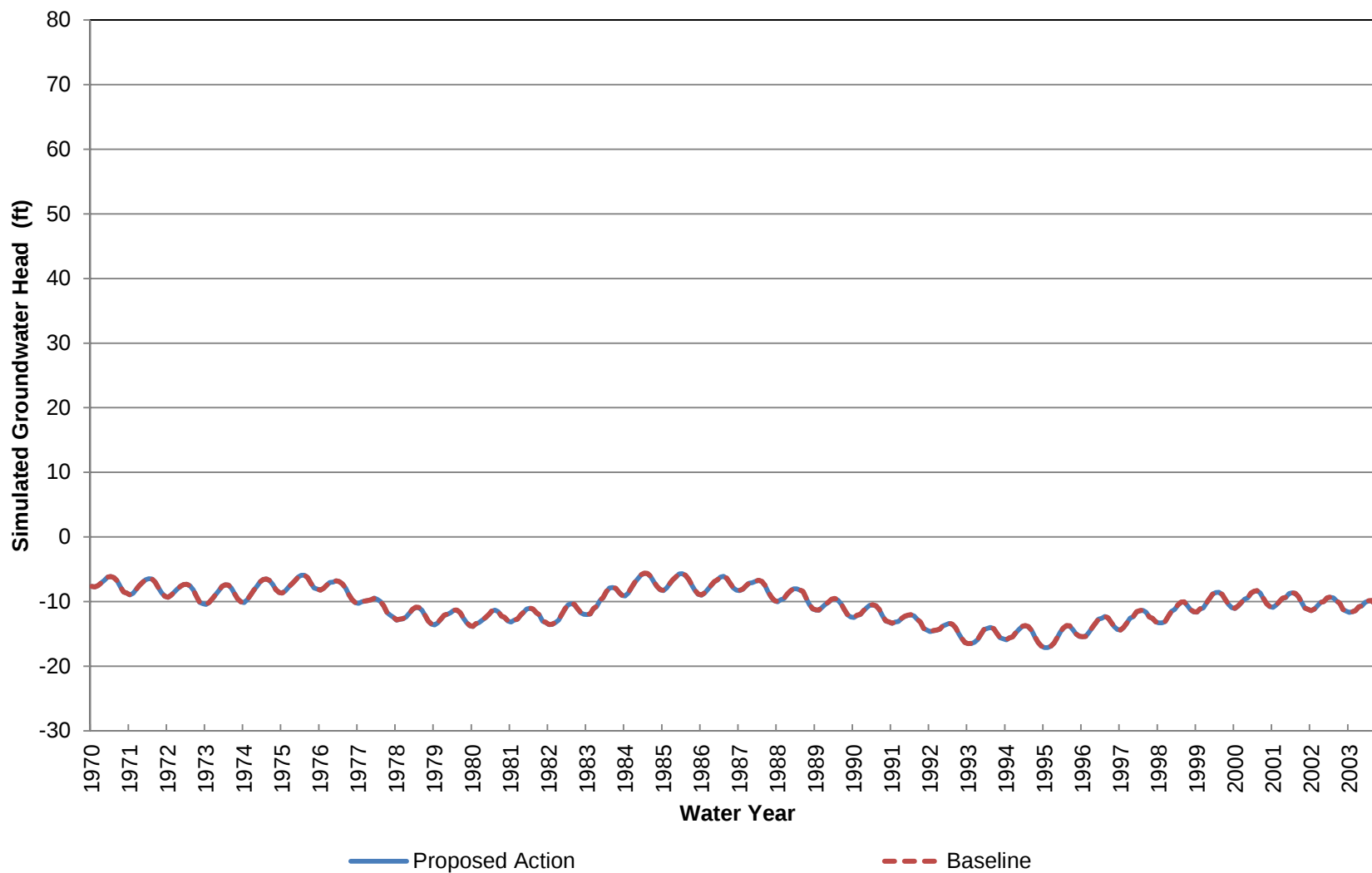
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 460-650 ft bgs)**



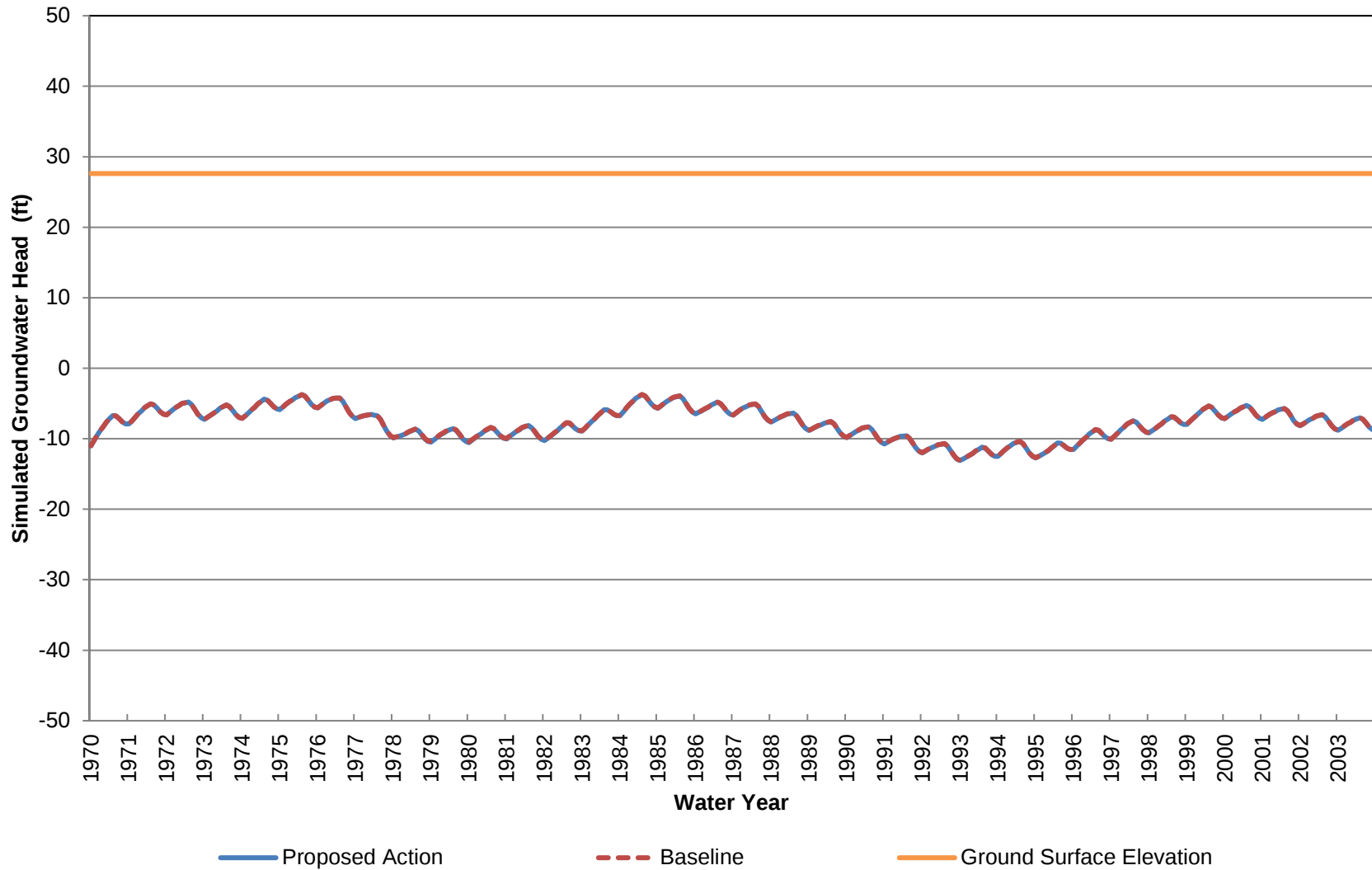
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 650-870 ft bgs)**



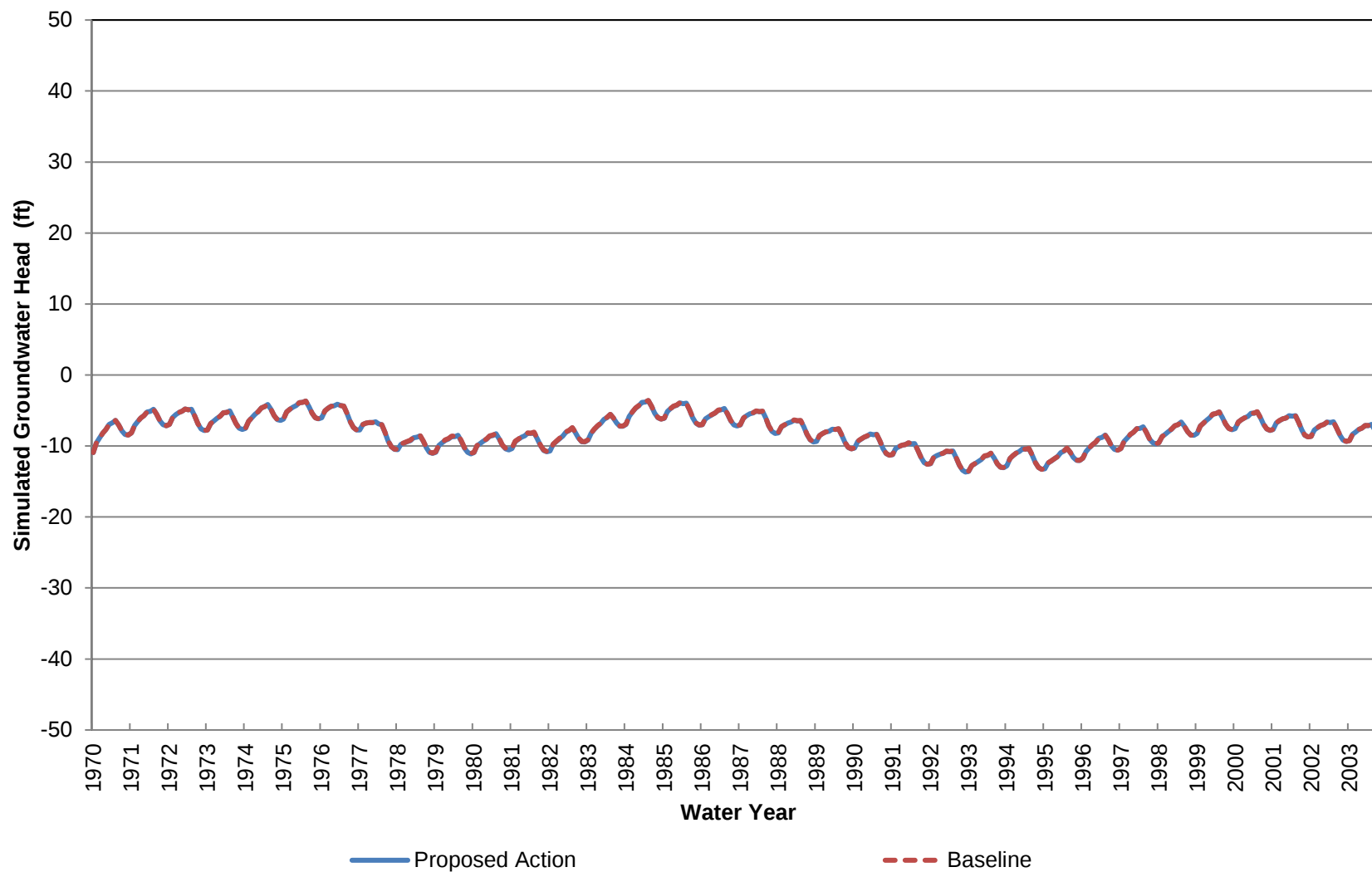
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 31 (Approximately 870-1190 ft bgs)**



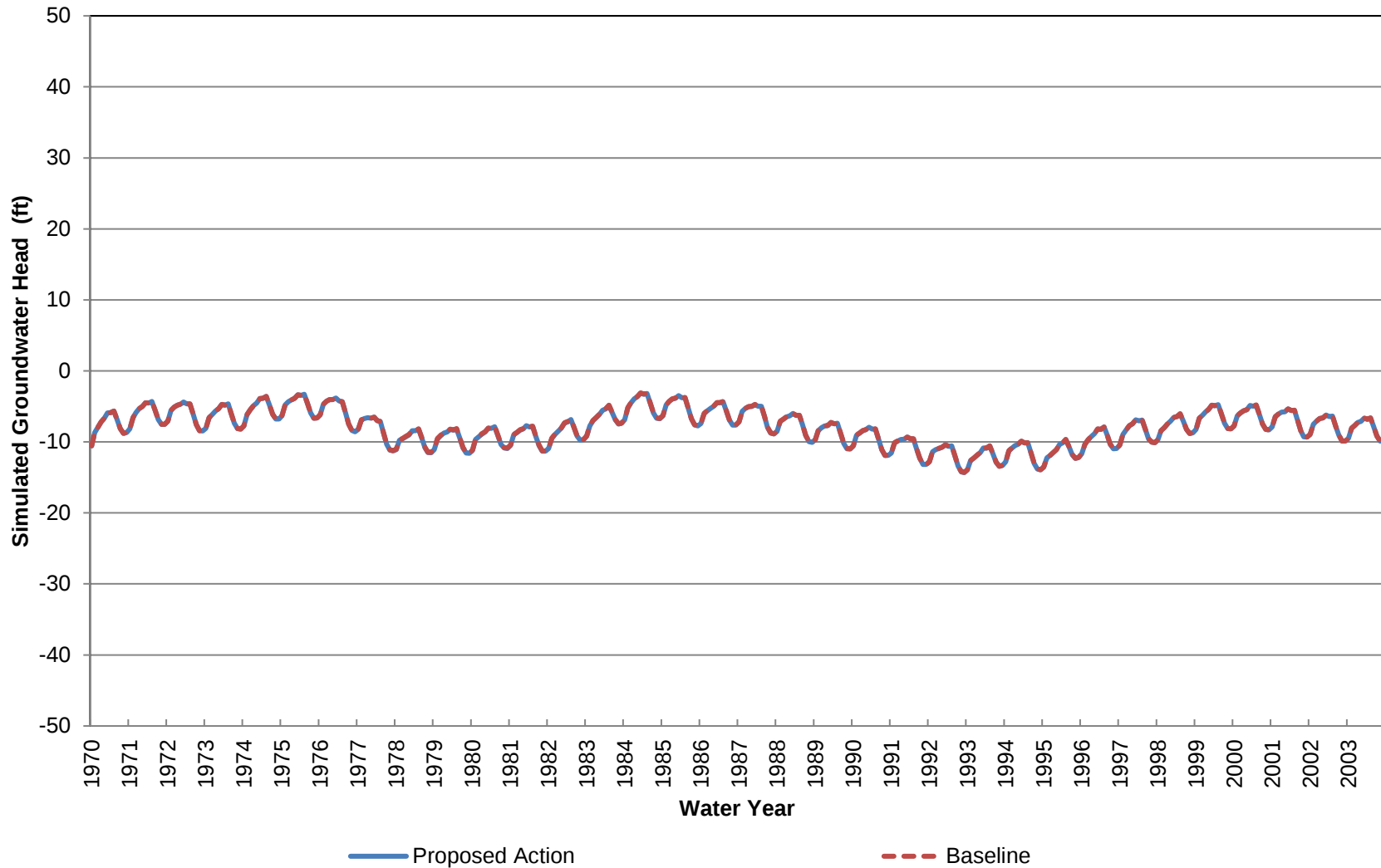
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 32 (Approximately 0-70 ft bgs)**



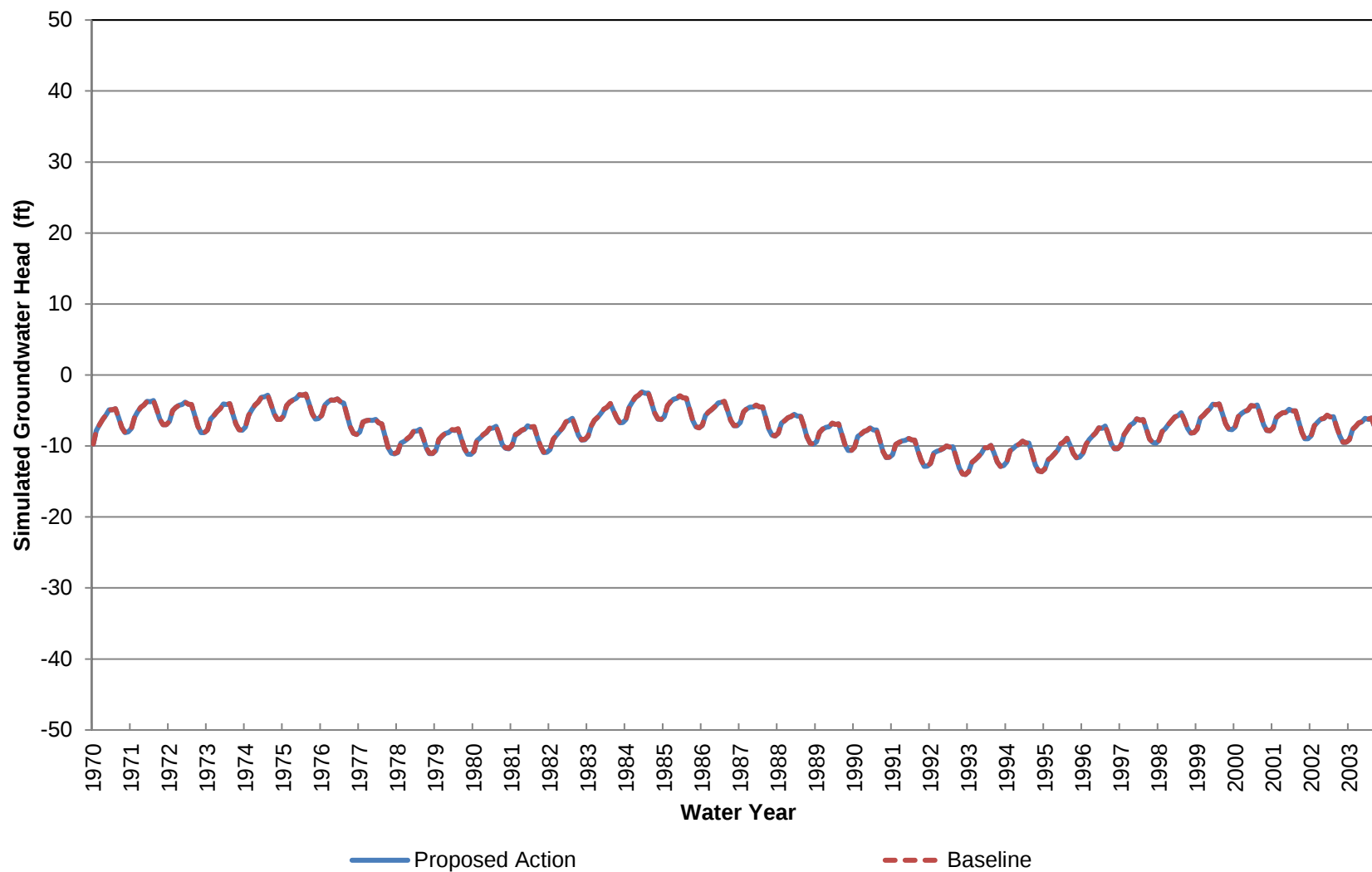
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 70-240 ft bgs)**



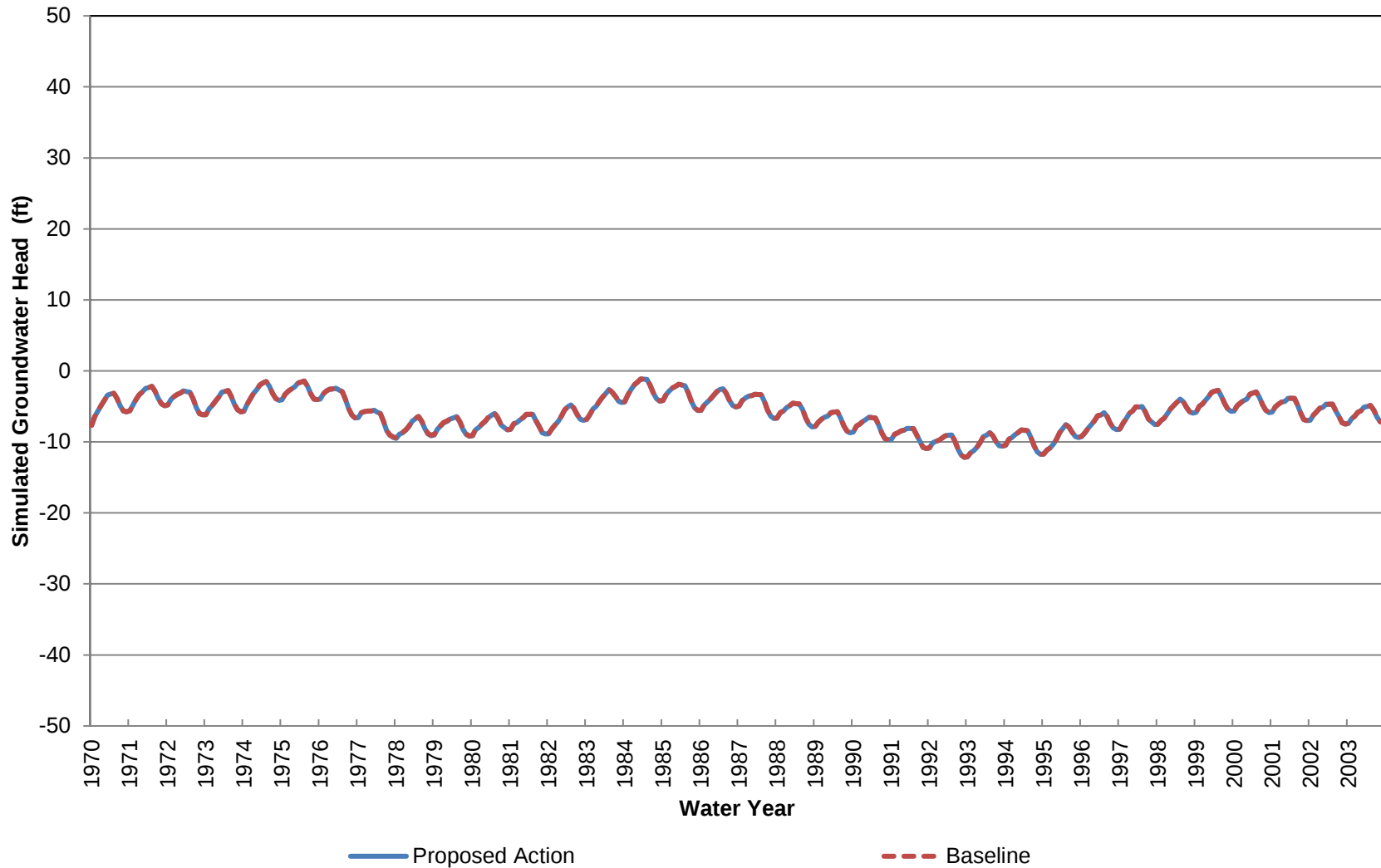
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 240-410 ft bgs)**



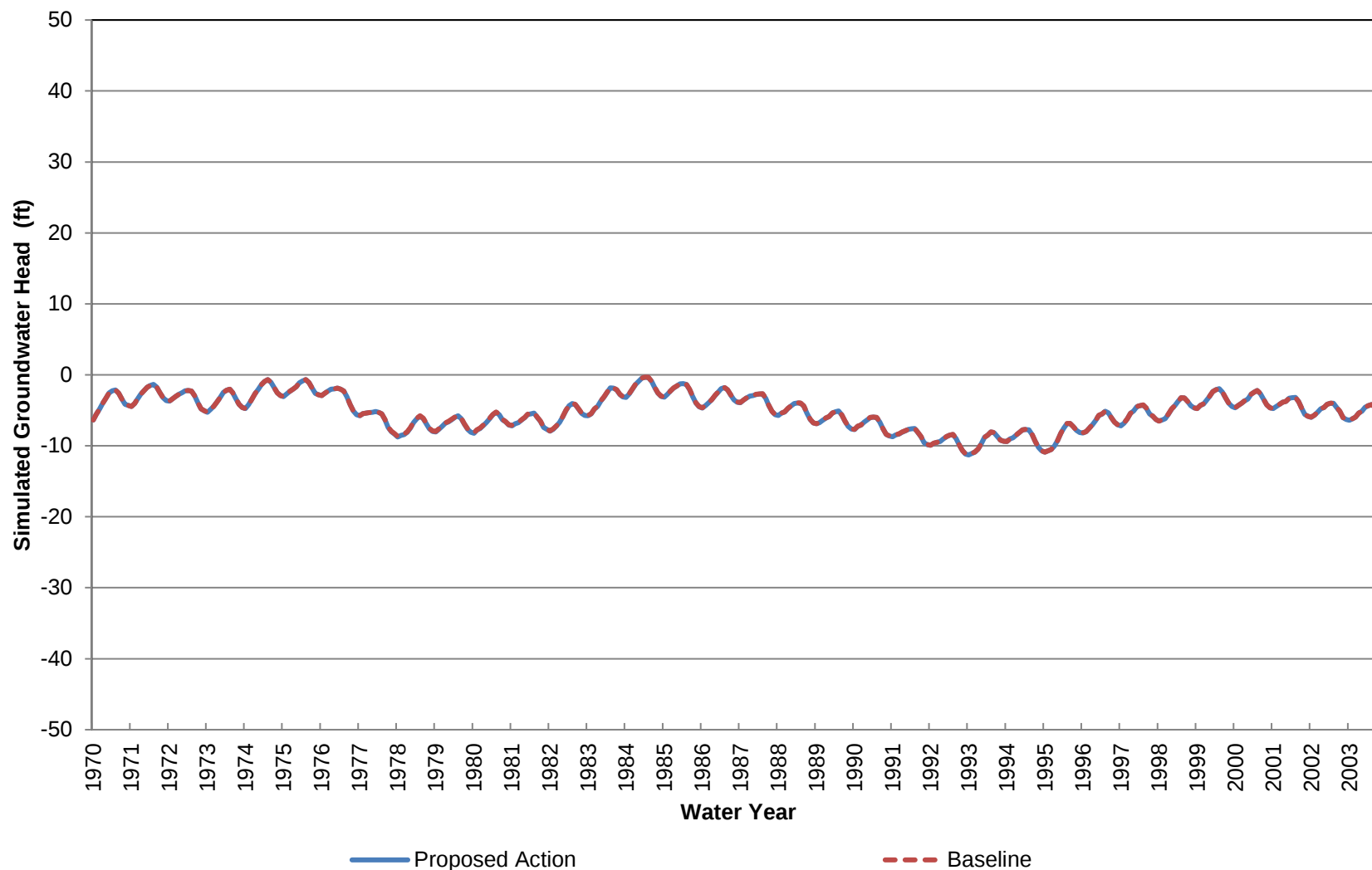
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 410-580 ft bgs)**



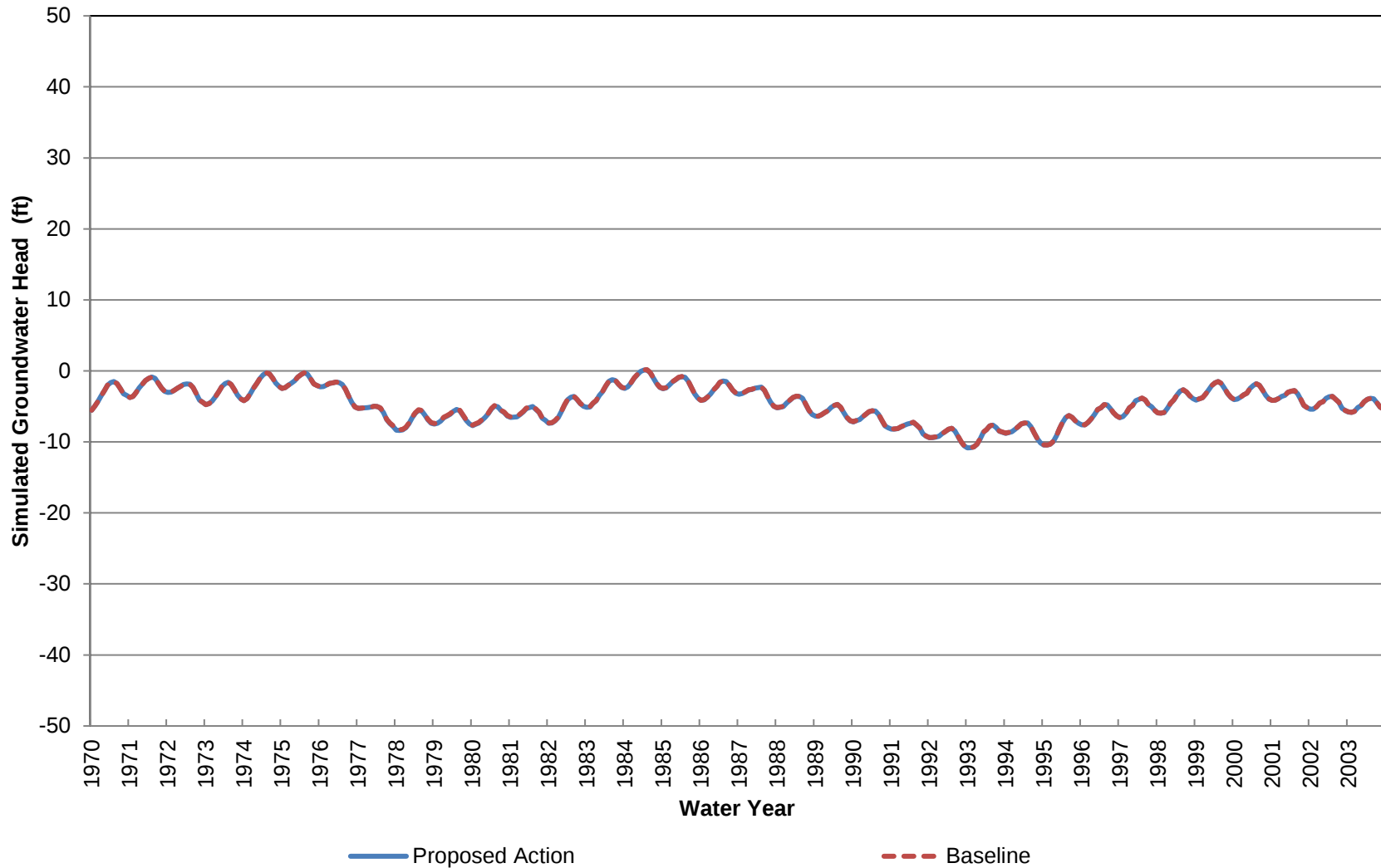
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 580-850 ft bgs)**



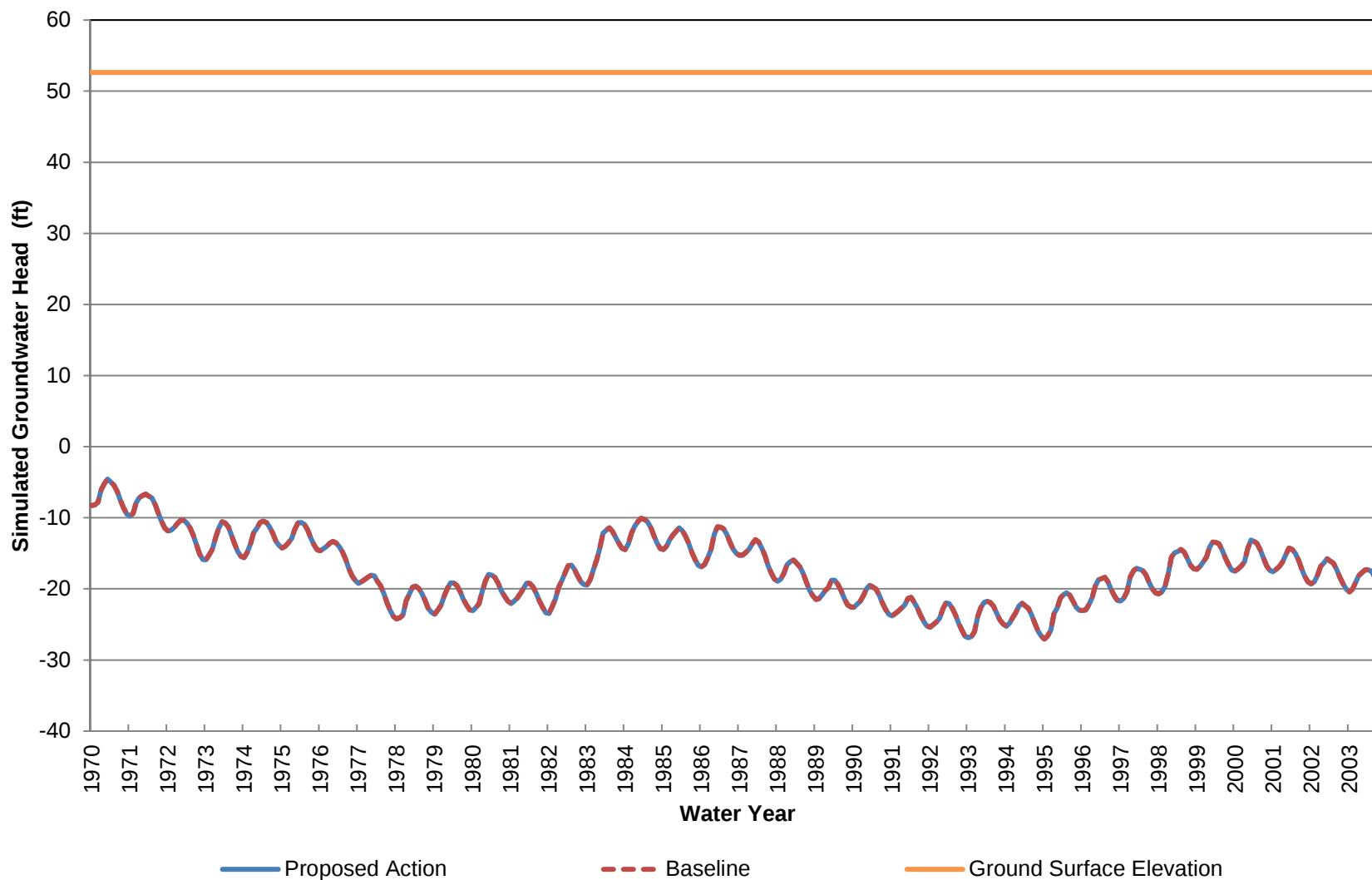
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 850-1140 ft bgs)**



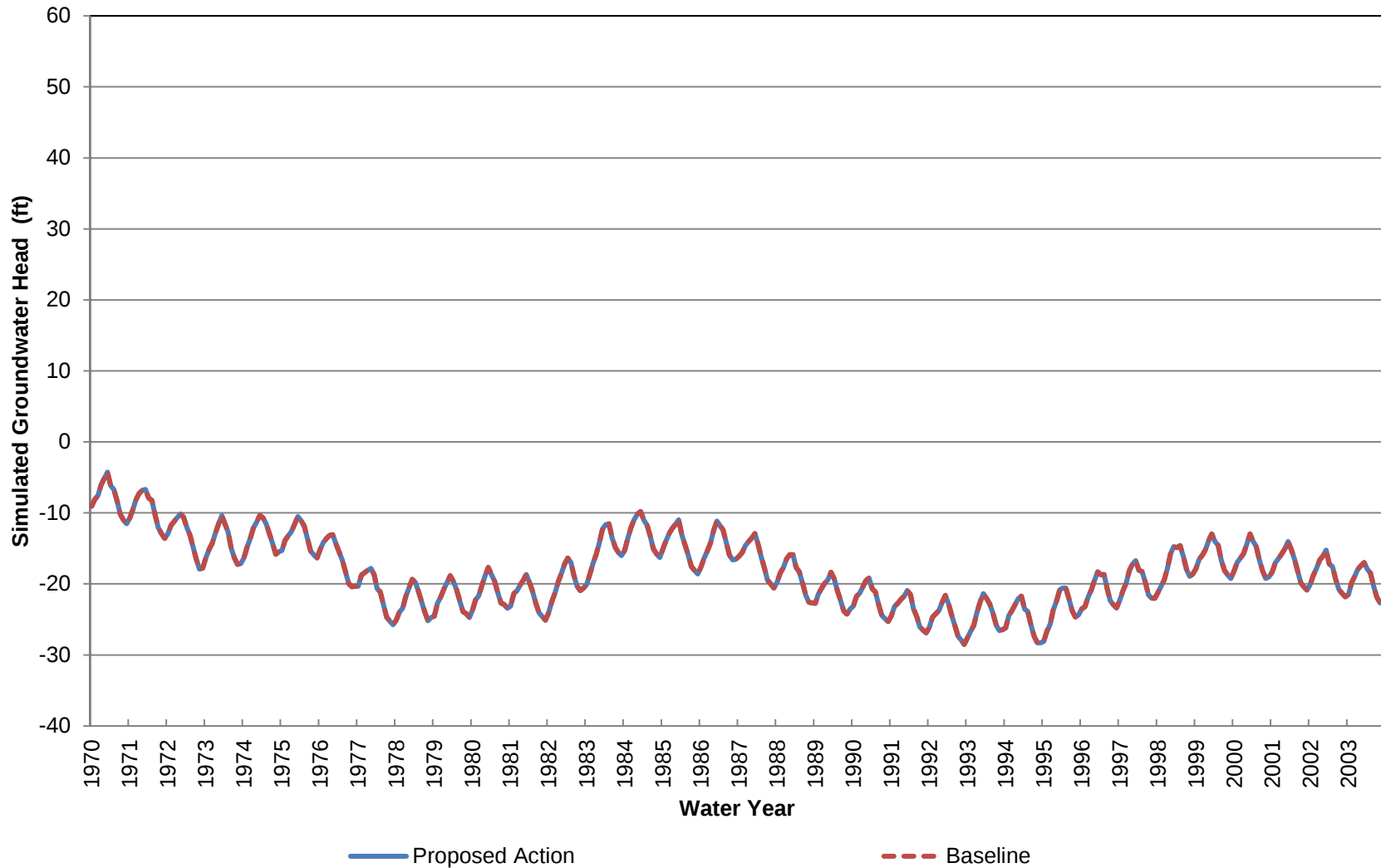
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 32 (Approximately 1140-1560 ft bgs)**



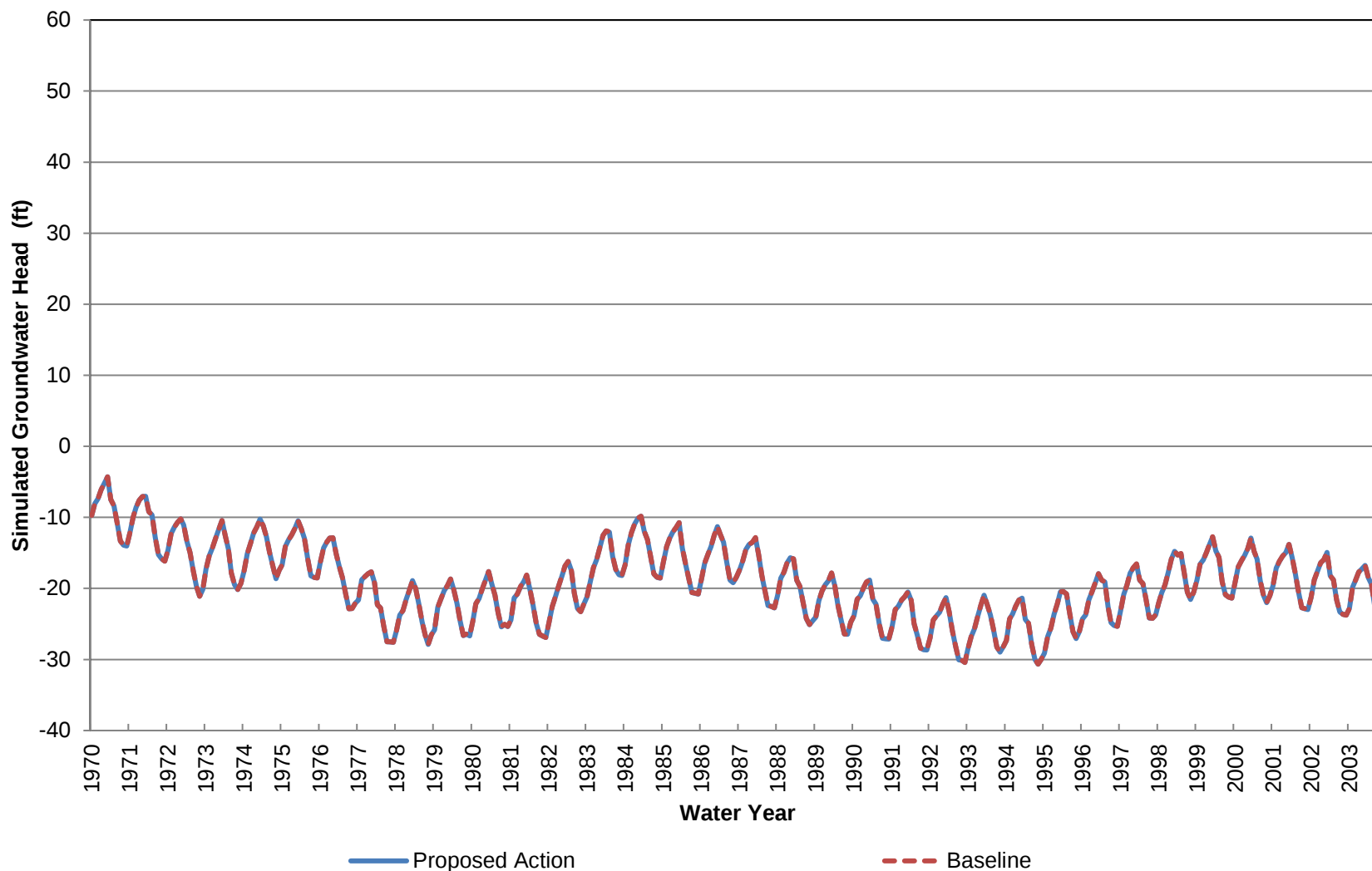
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 33 (Approximately 0-70 ft bgs)**



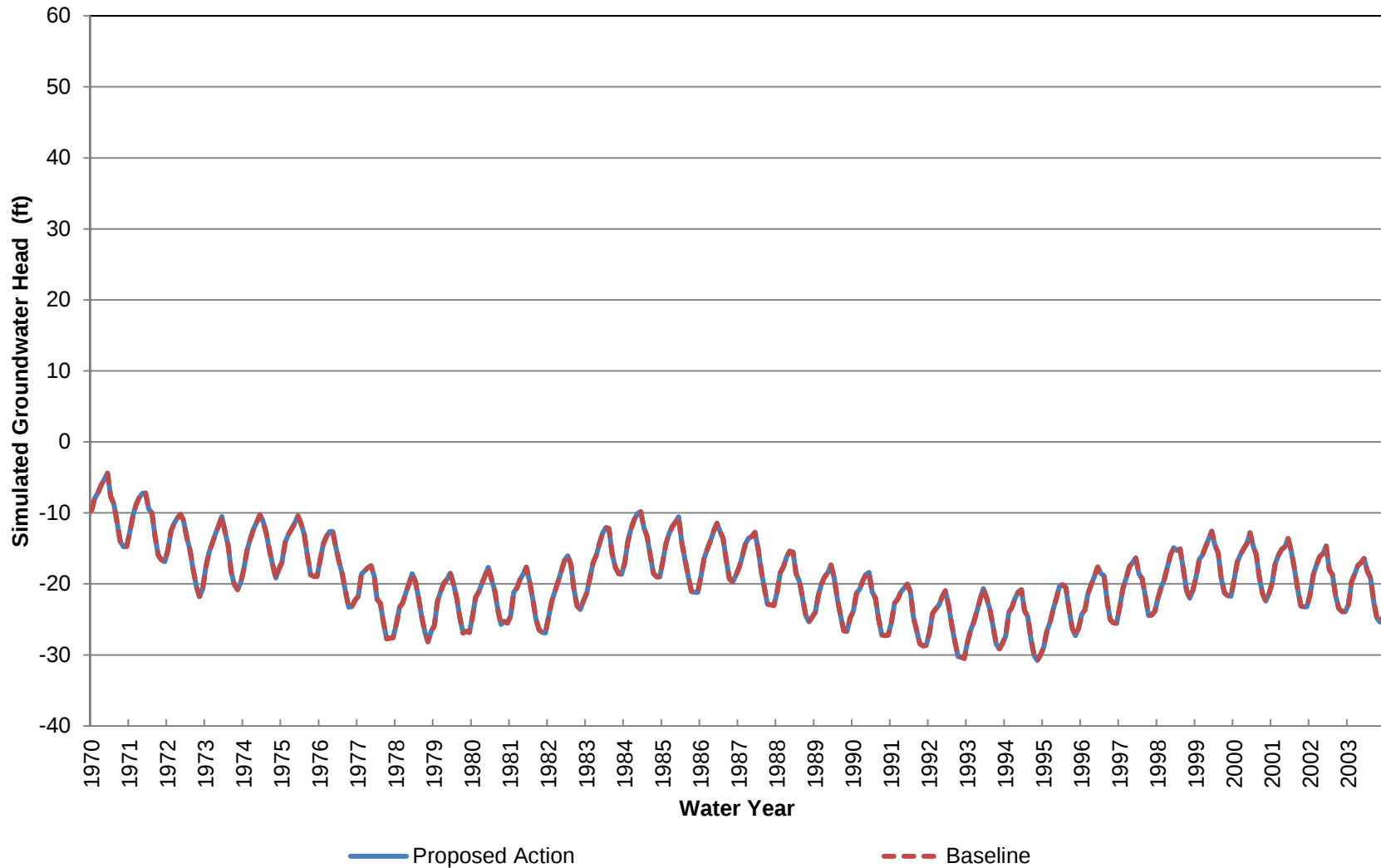
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 70-240 ft bgs)**



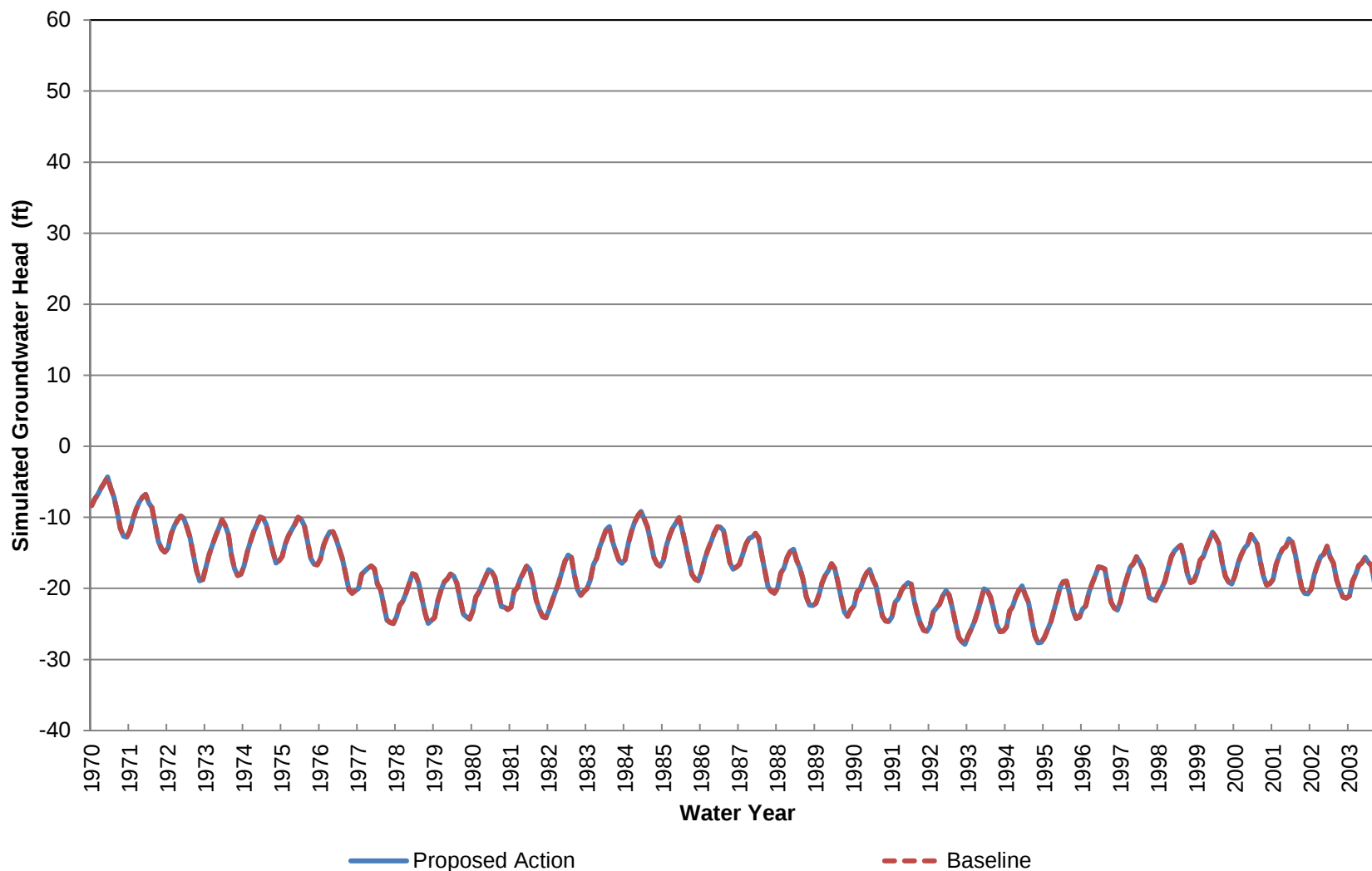
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 240-410 ft bgs)**



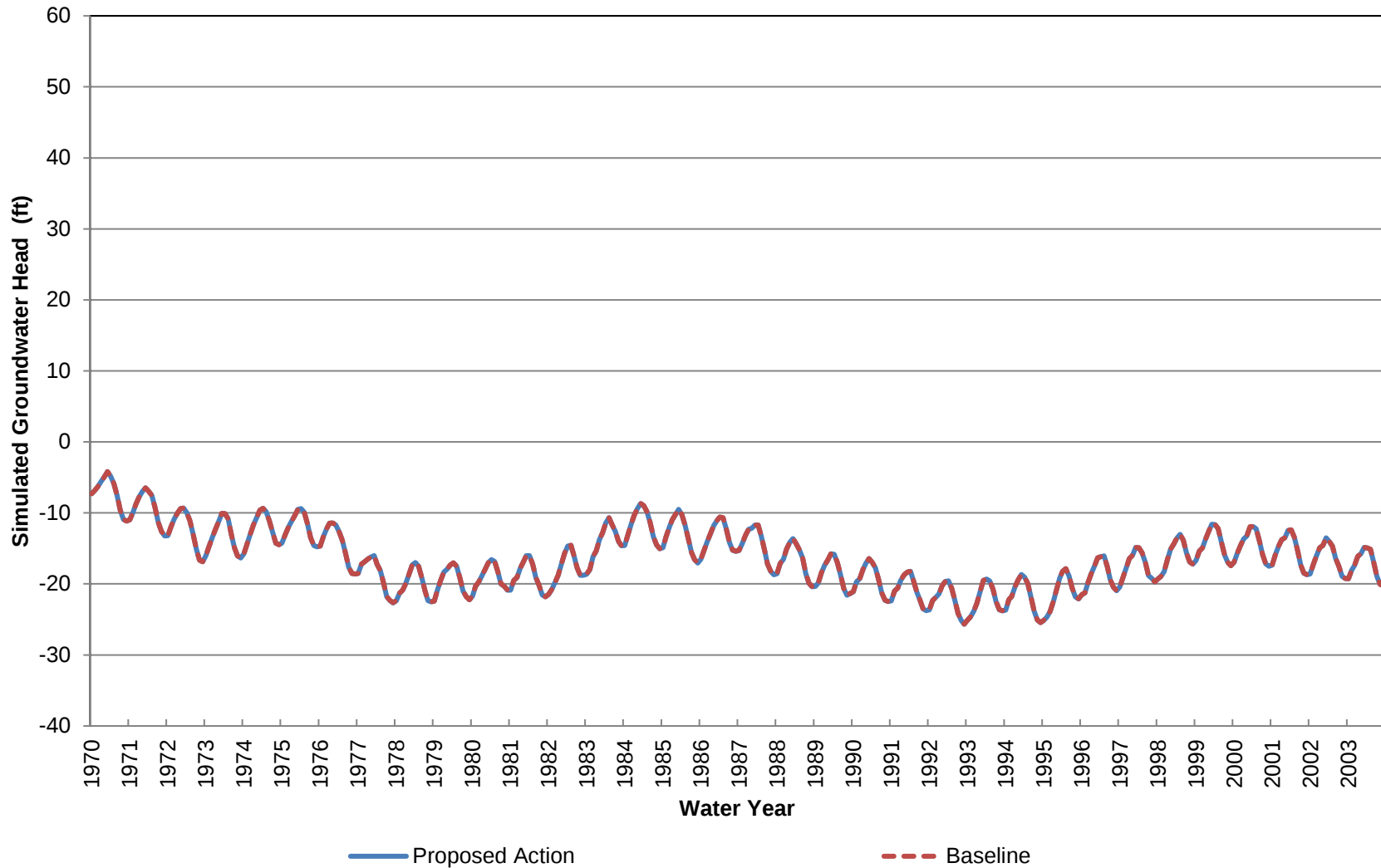
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 410-570 ft bgs)**



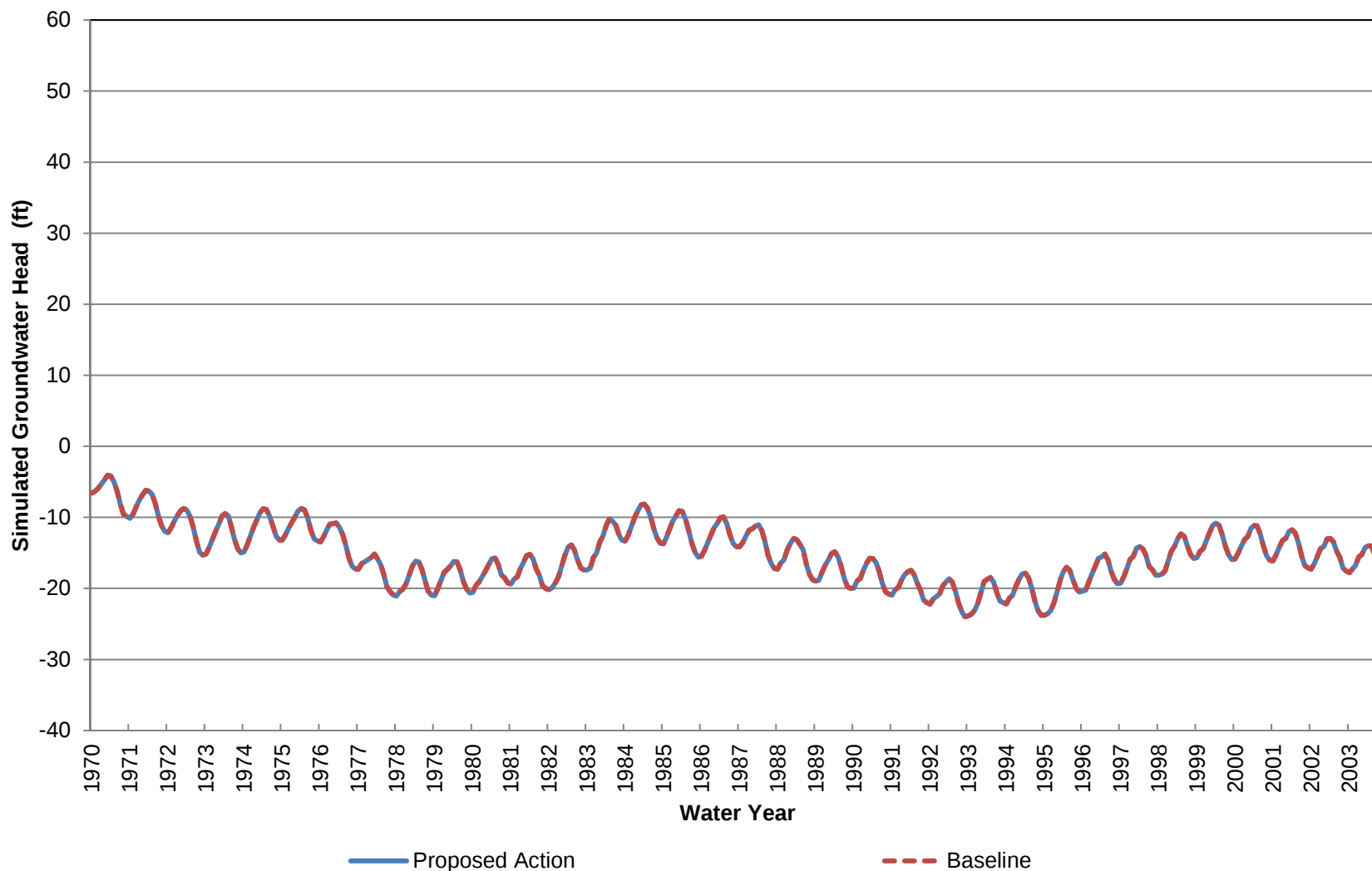
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 570-840 ft bgs)**



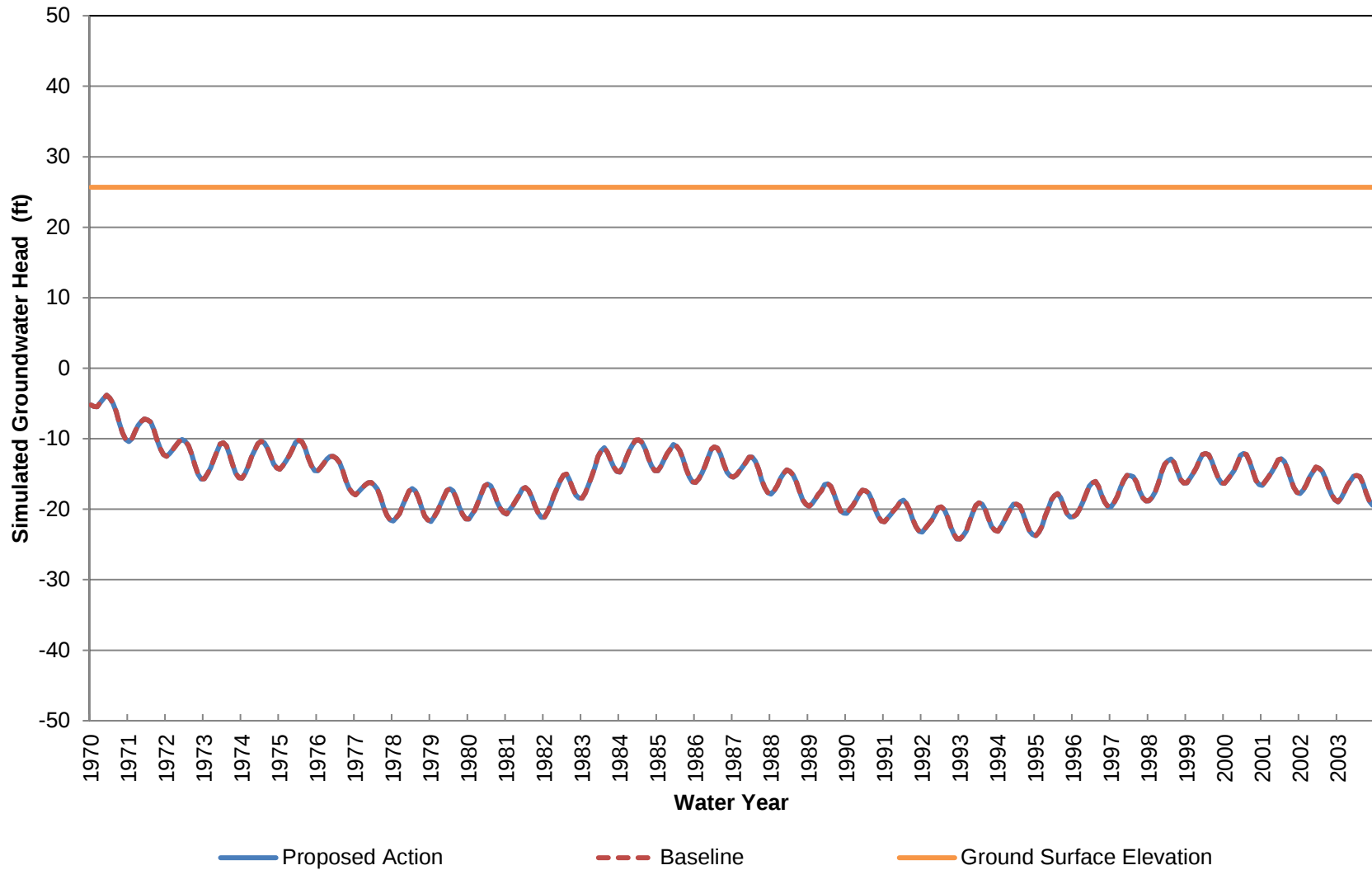
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 840-1120 ft bgs)**



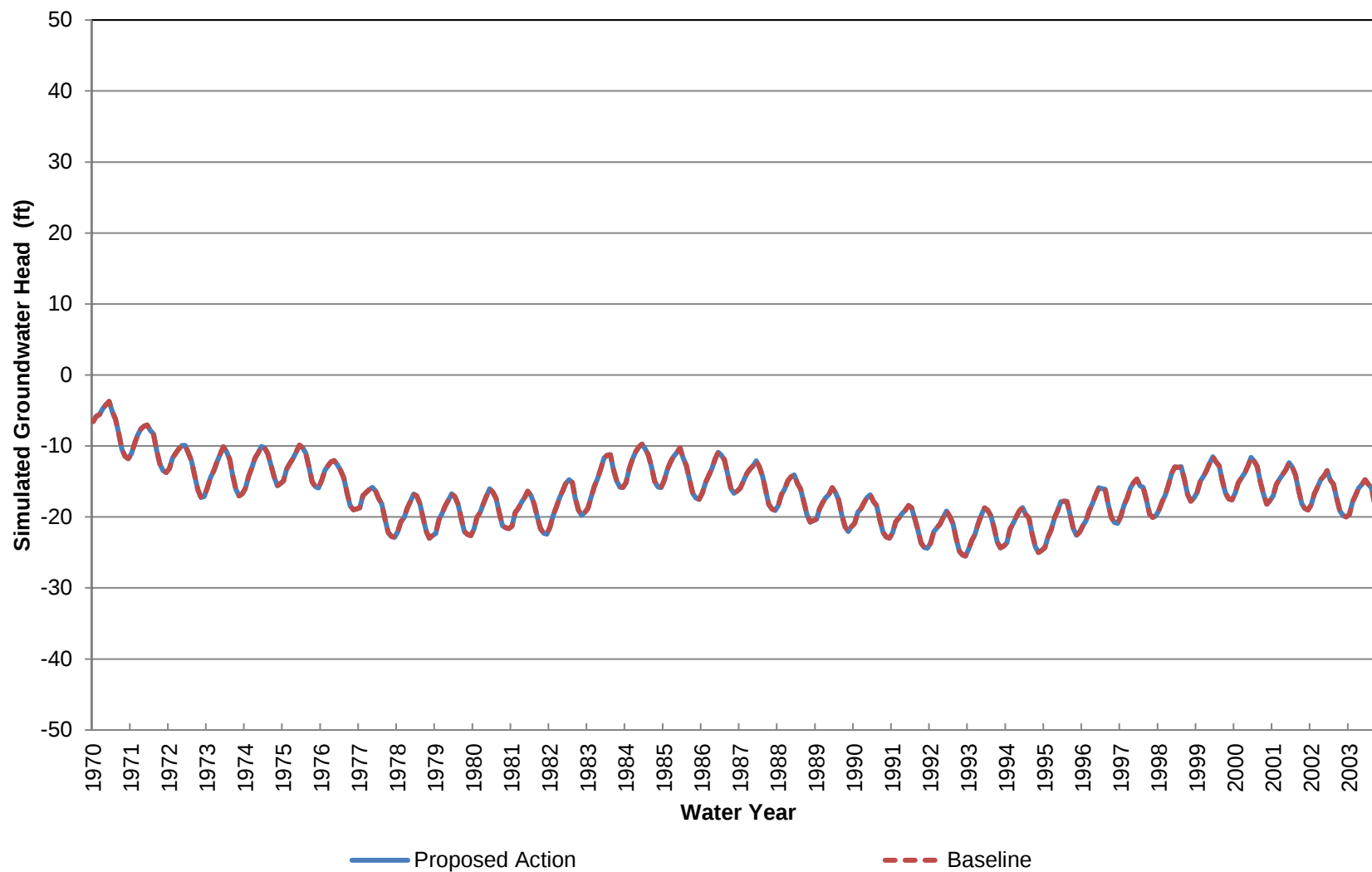
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 33 (Approximately 1120-1540 ft bgs)**



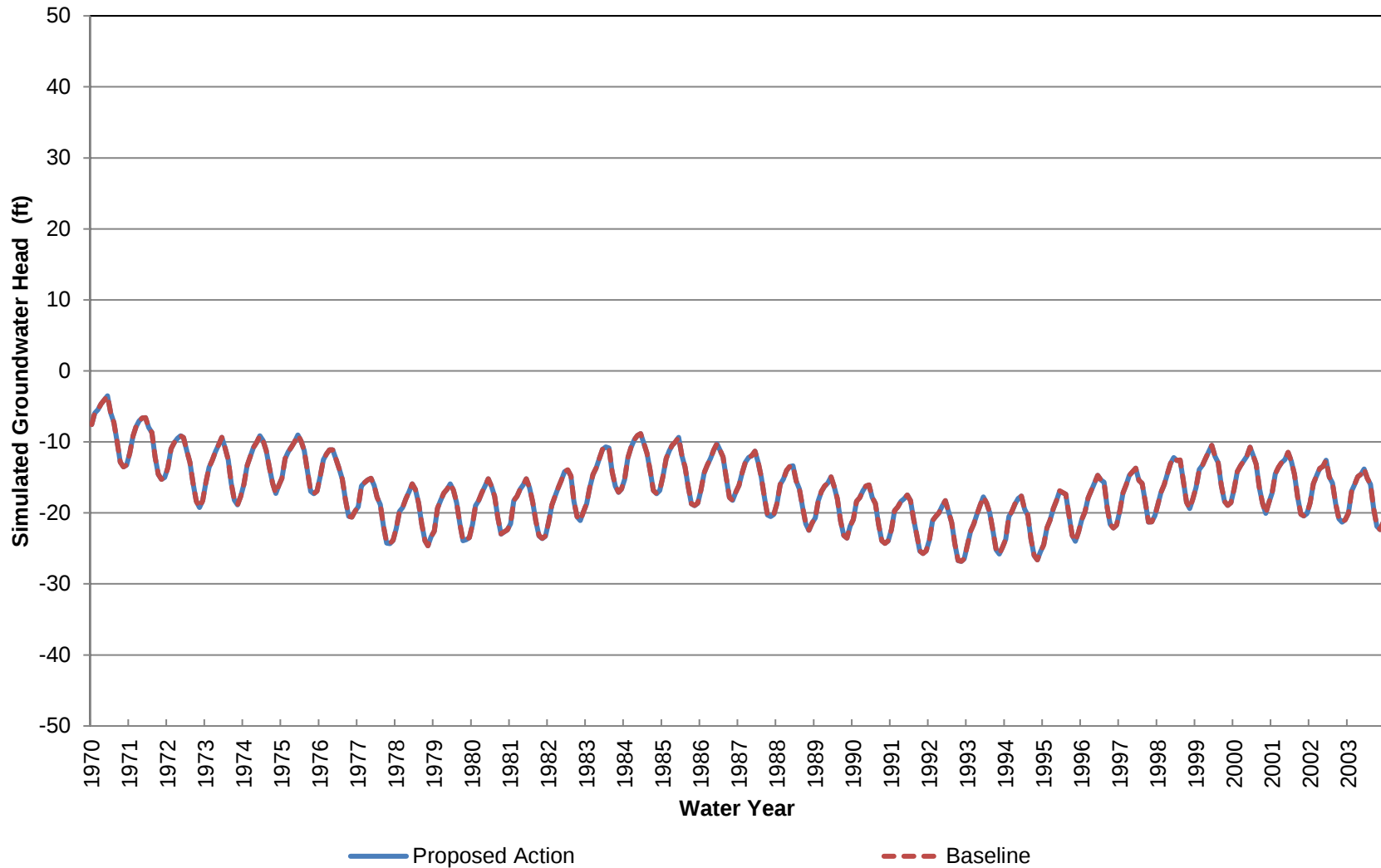
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Elevation at Location 34 (Approximately 0-70 ft bgs)**



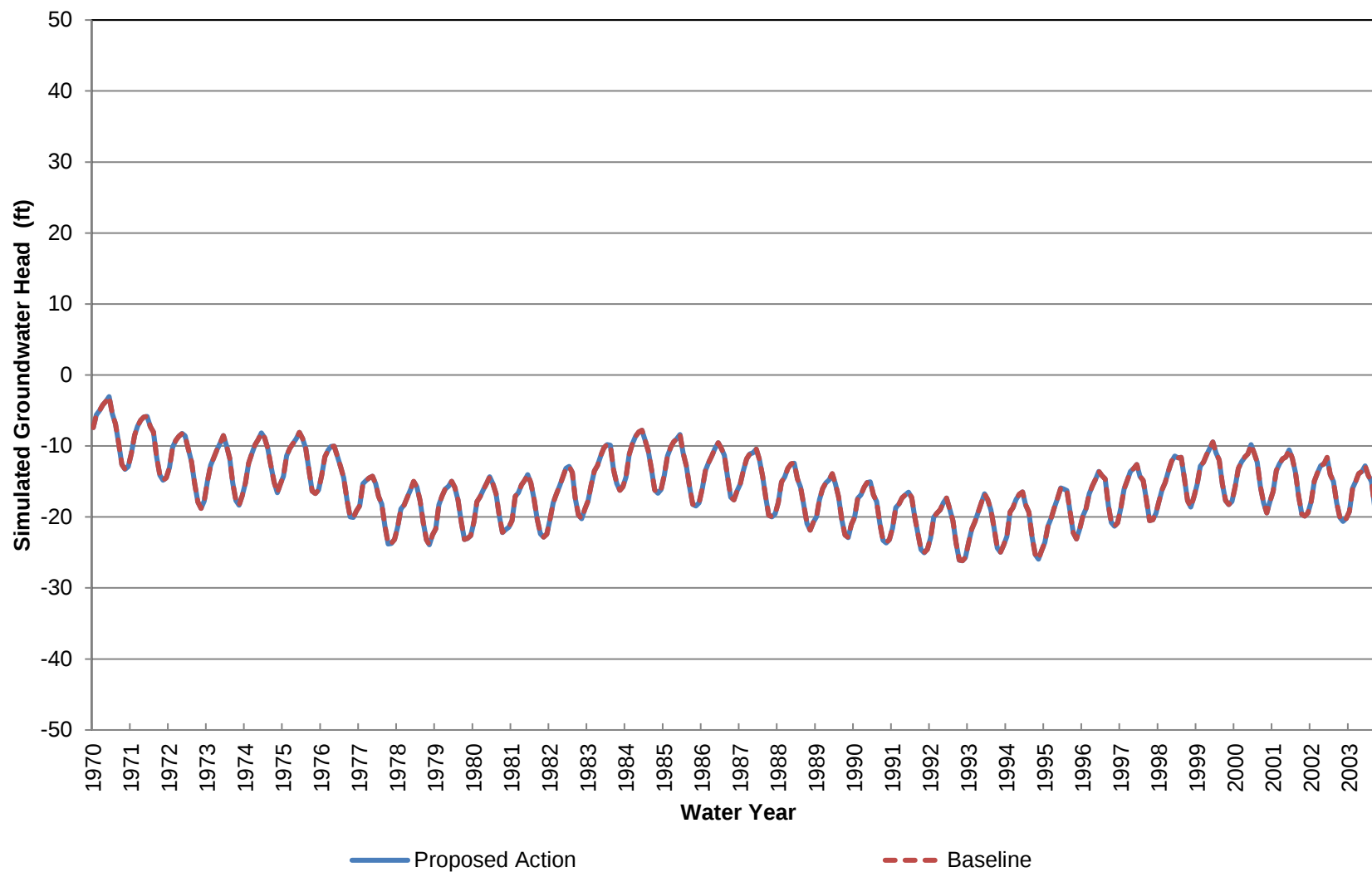
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 70-230 ft bgs)**



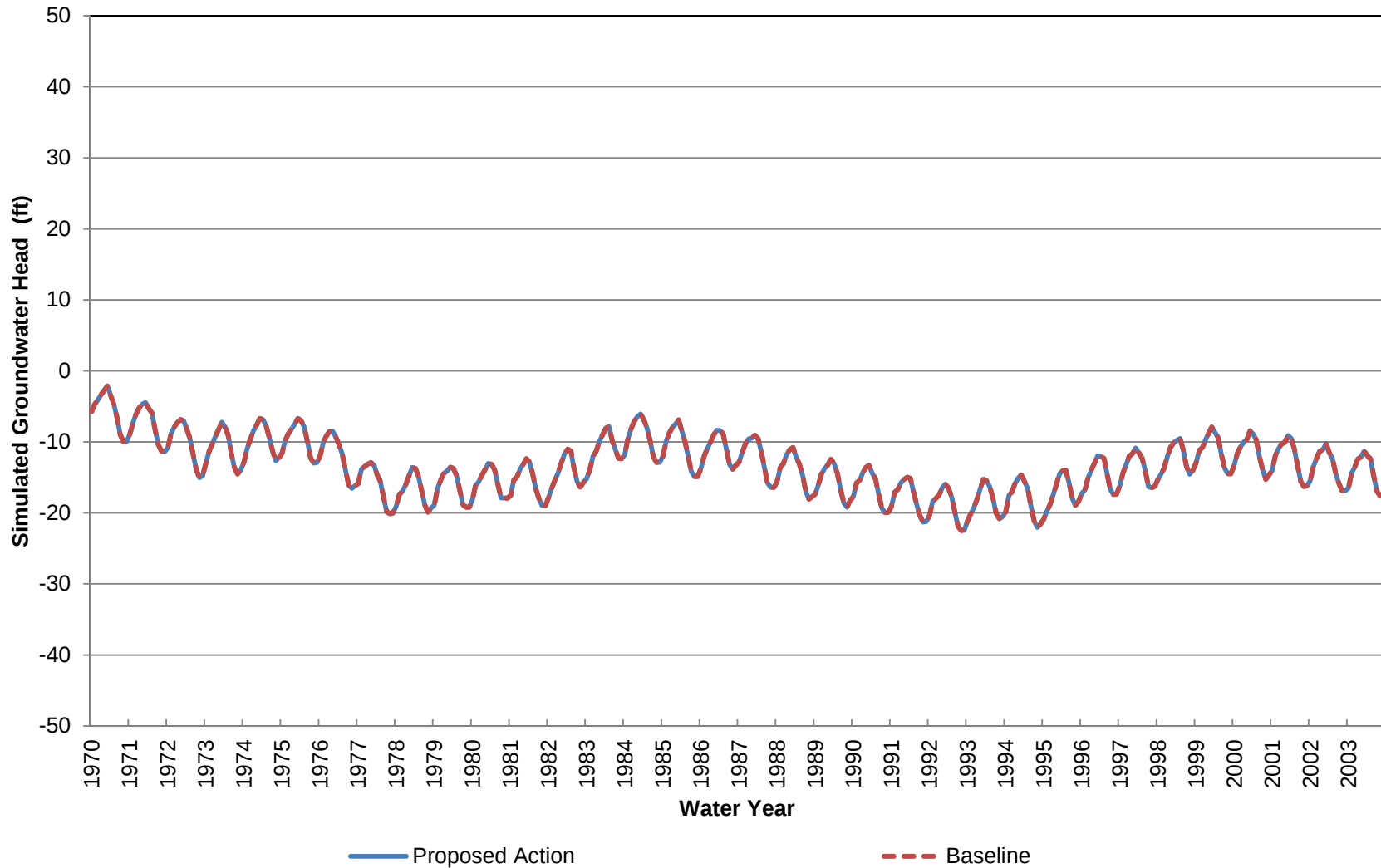
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 230-380 ft bgs)**



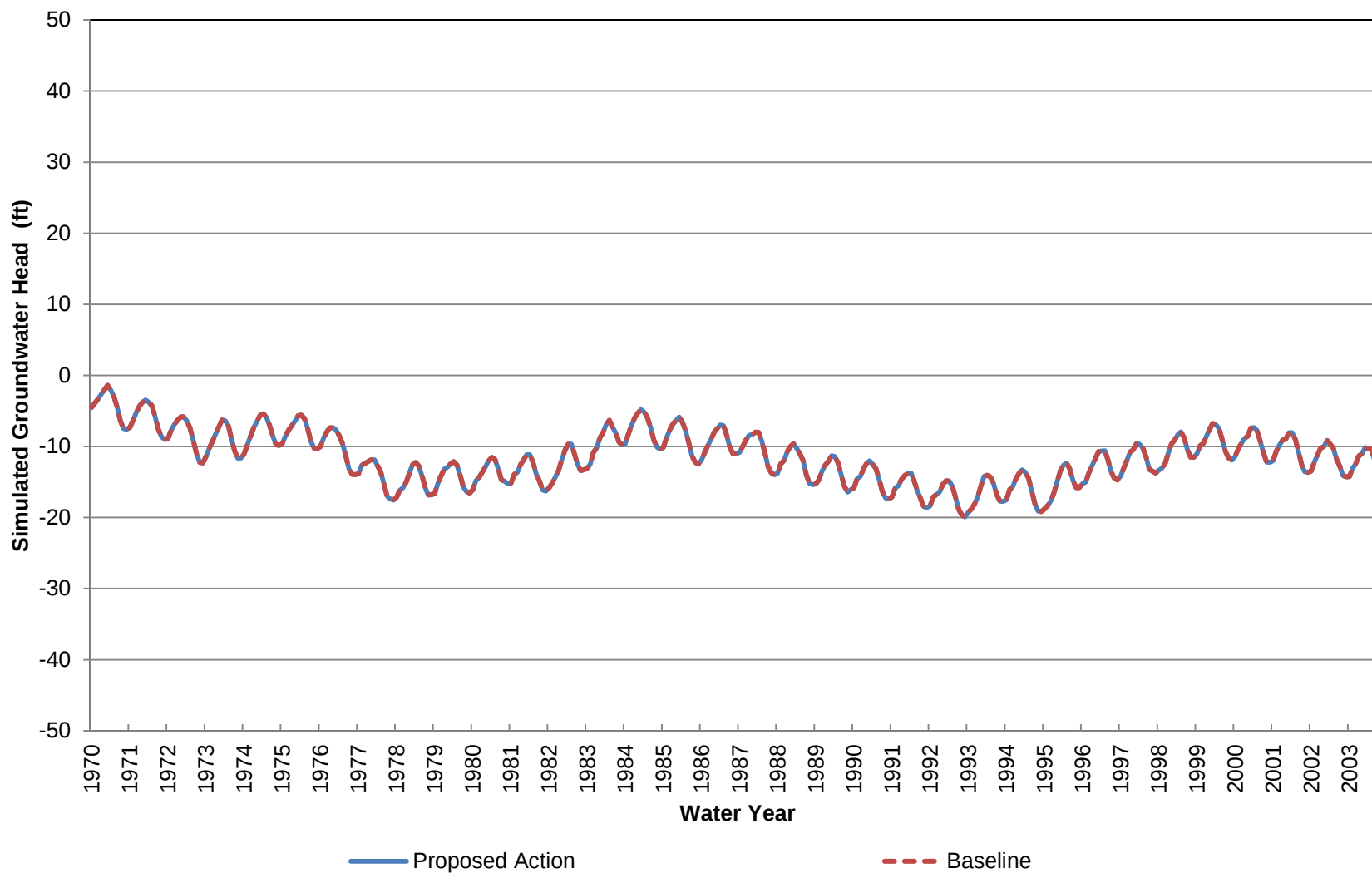
**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 380-540 ft bgs)**



**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 540-780 ft bgs)**



**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 780-1040 ft bgs)**



**2015 Tehama-Colusa Canal Authority Water Transfers
Simulated Groundwater Head at Location 34 (Approximately 1040-1430 ft bgs)**

