Appendix N
Archaeological Survey and Evaluation Report - Redacted Version

Part 2

LEGEND

APE

Eligible/Contributing

Ineligible/Non-Contributing

NORTH

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Kilometers

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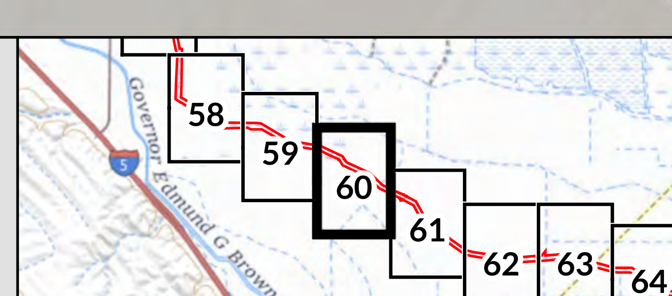
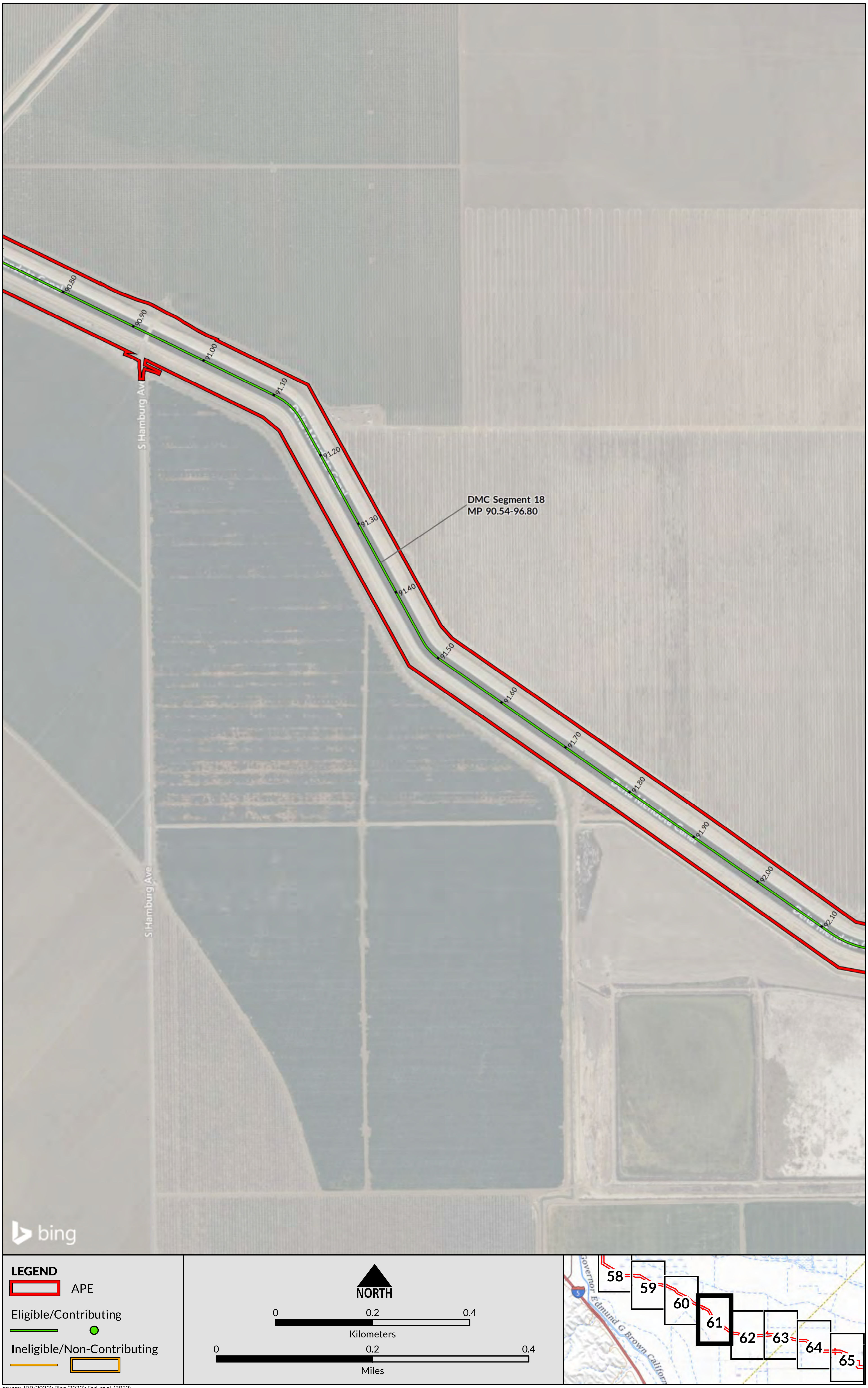
Miles



source: JRP (2022); Bing (2022); Esri, et al. (2022).



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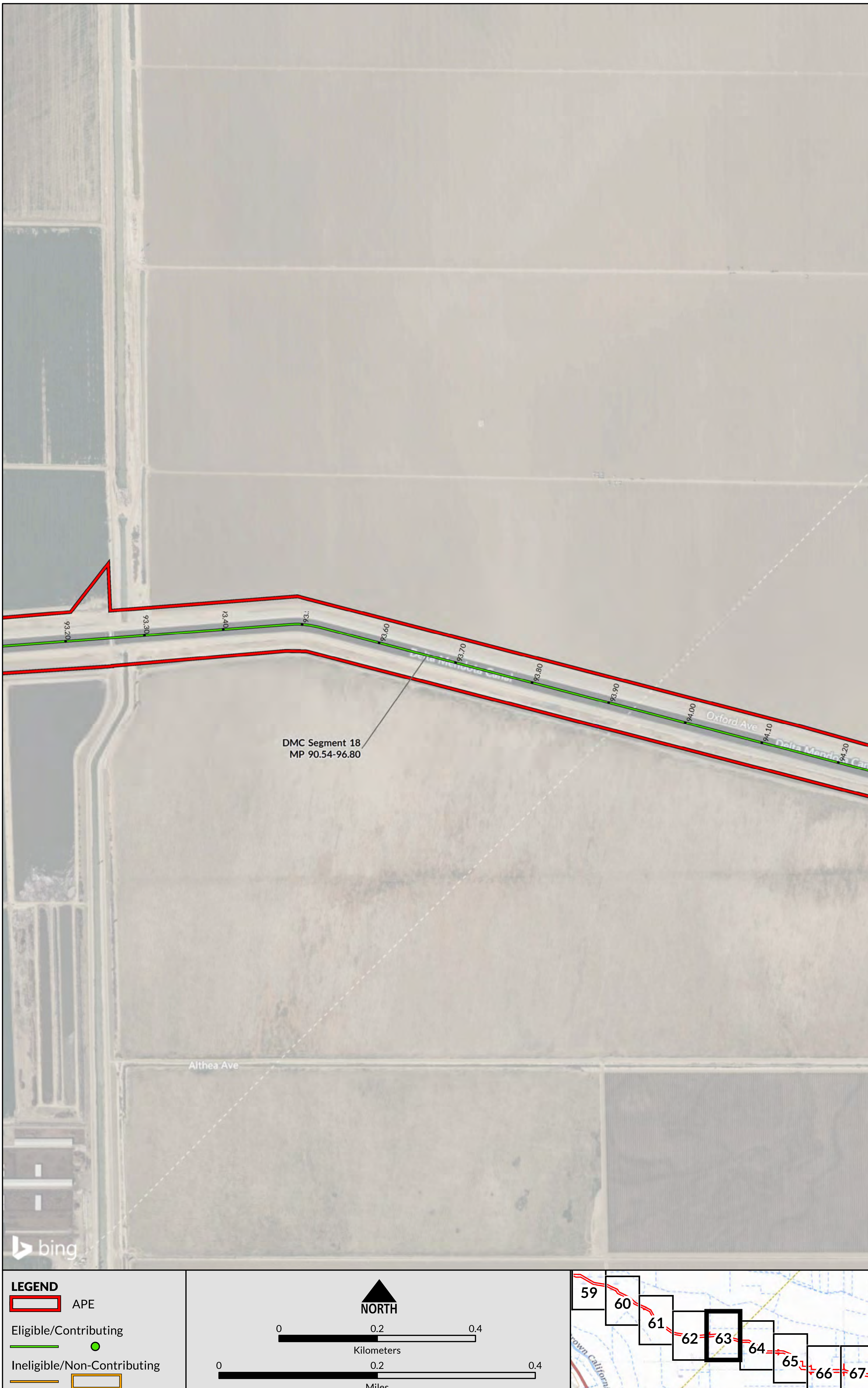

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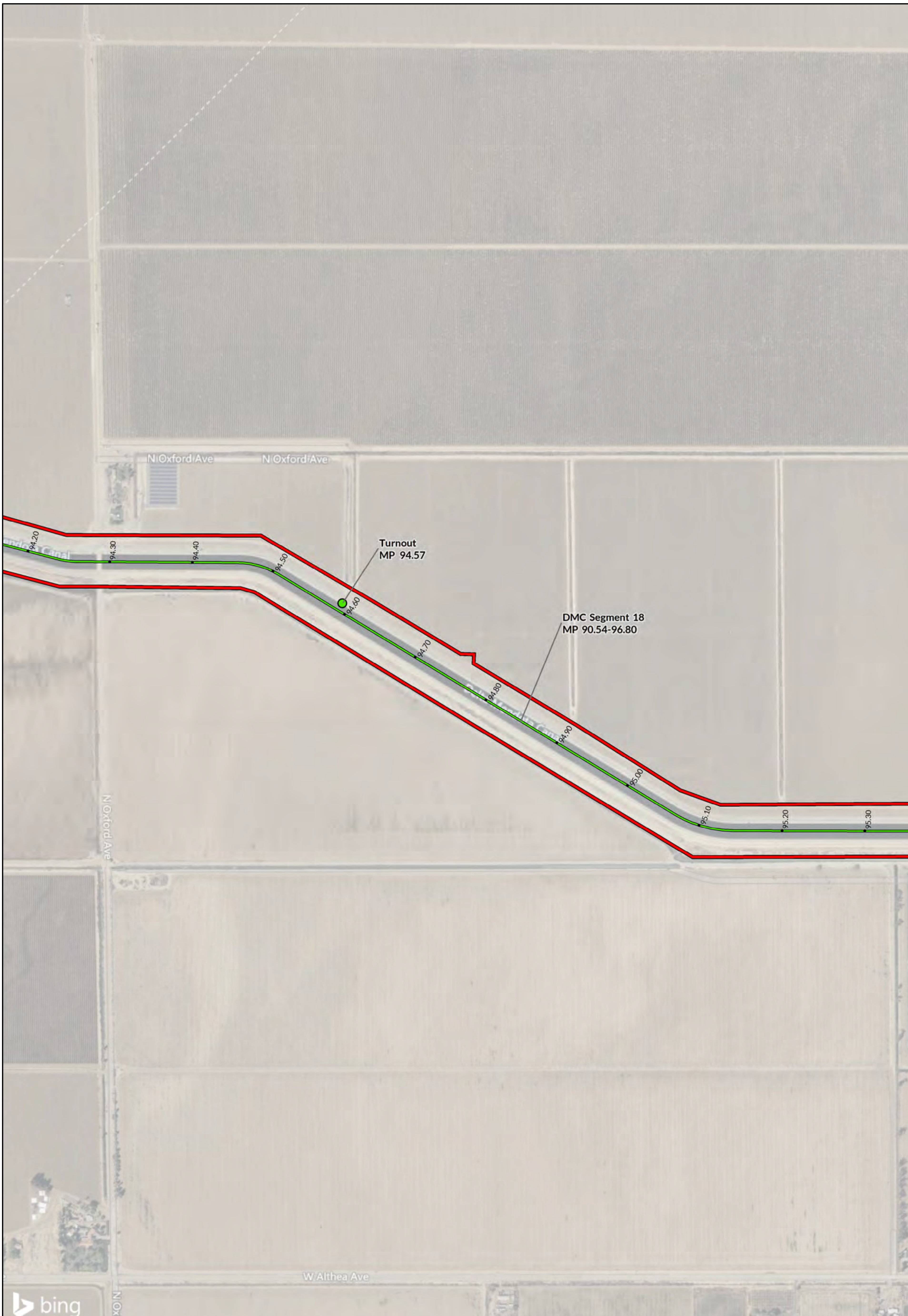

LEGEND

APE

Eligible/Contributing

Ineligible/Non-Contributing

NORTH

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Kilometers

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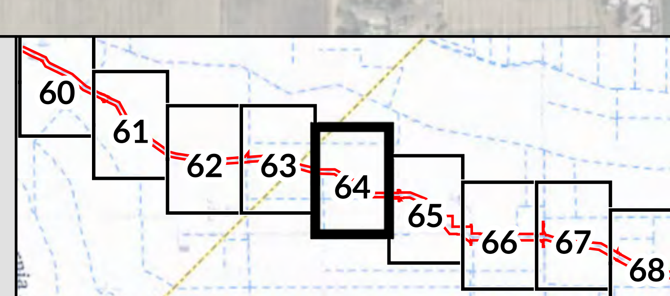
Miles



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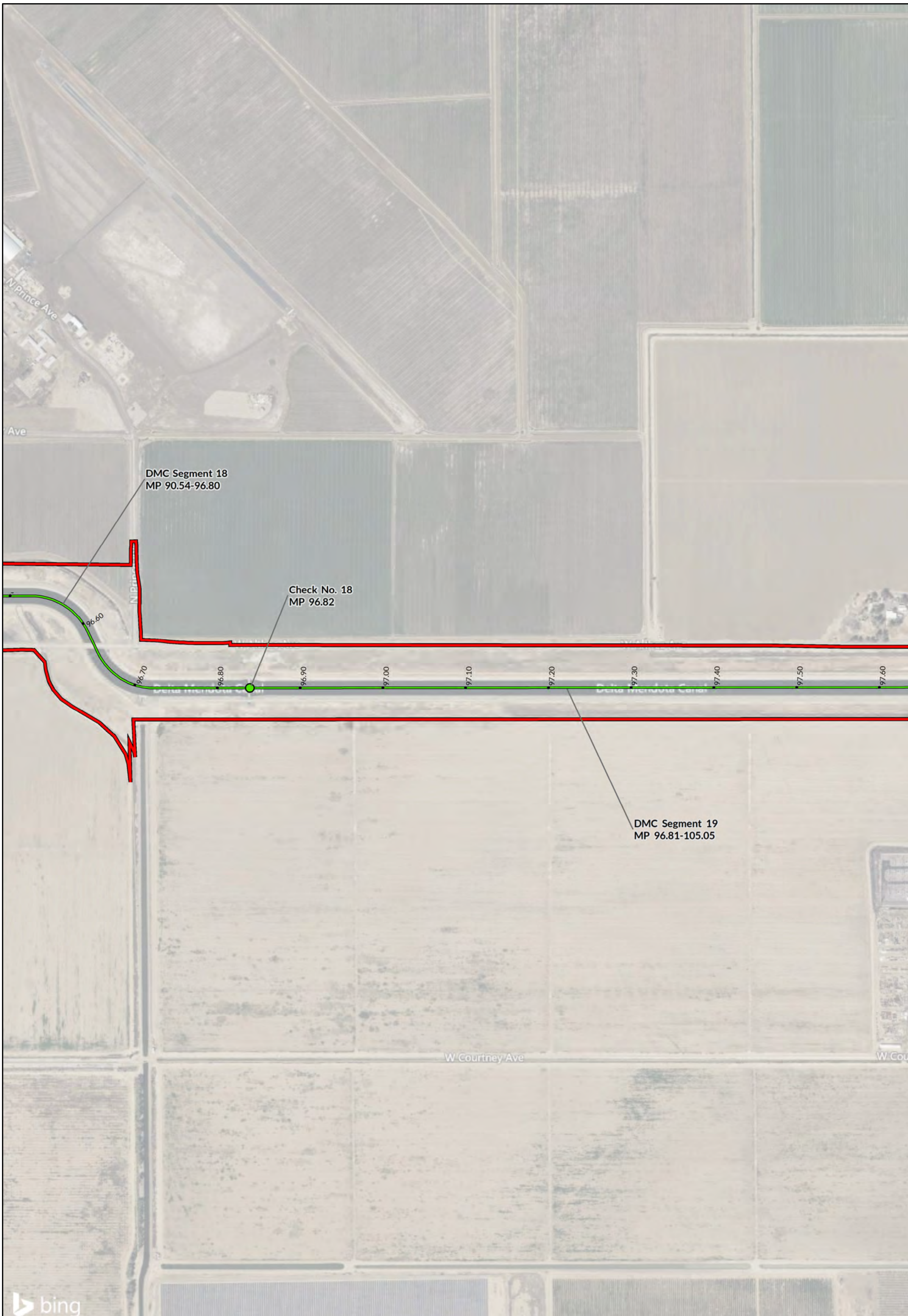

LEGEND

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Eligible/Contributing

Ineligible/Non-Contributing

NORTH

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Kilometers

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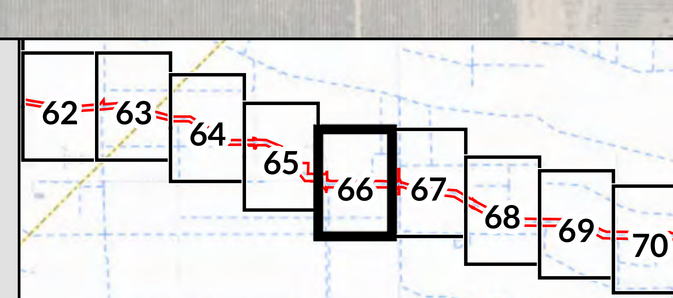

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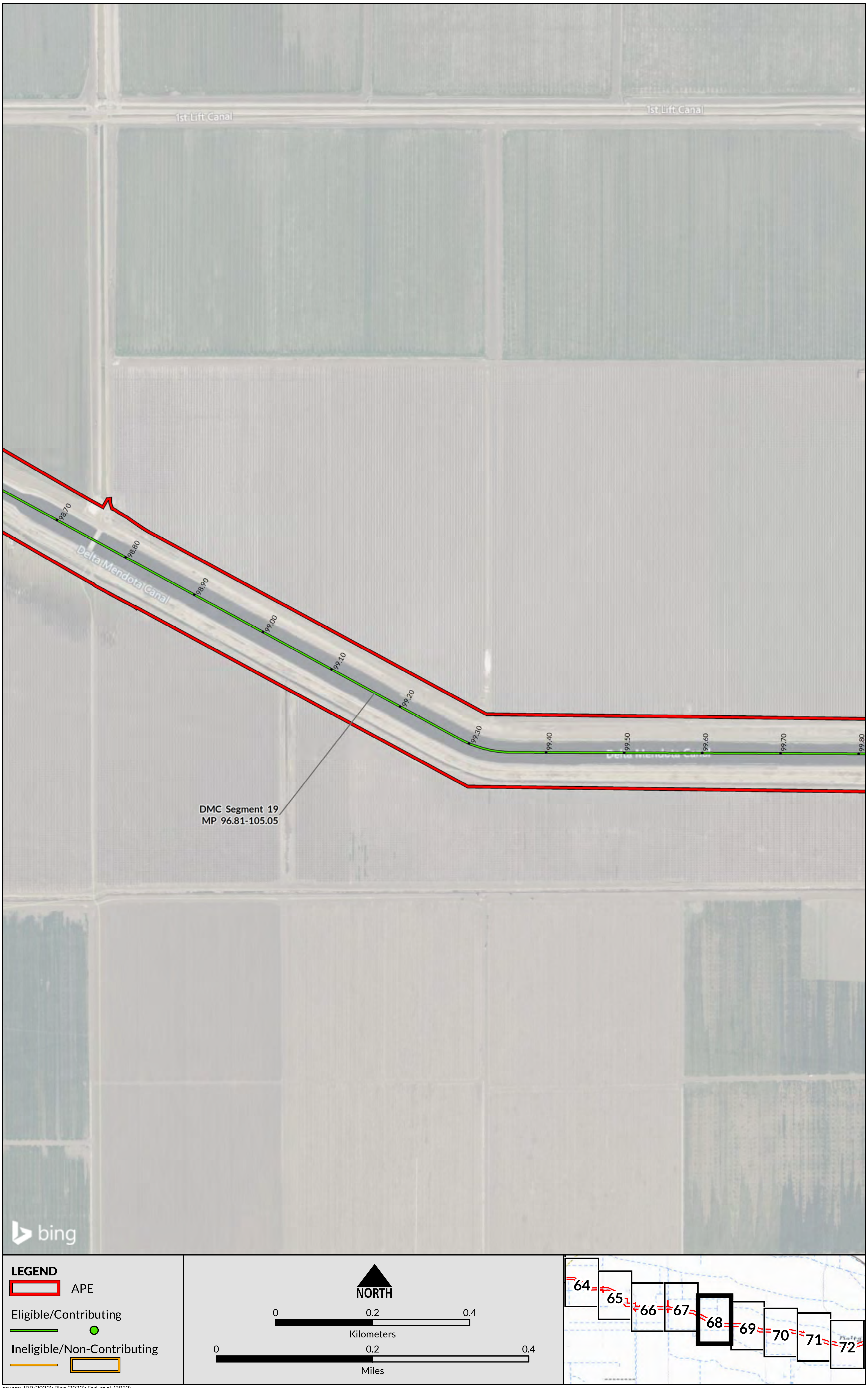

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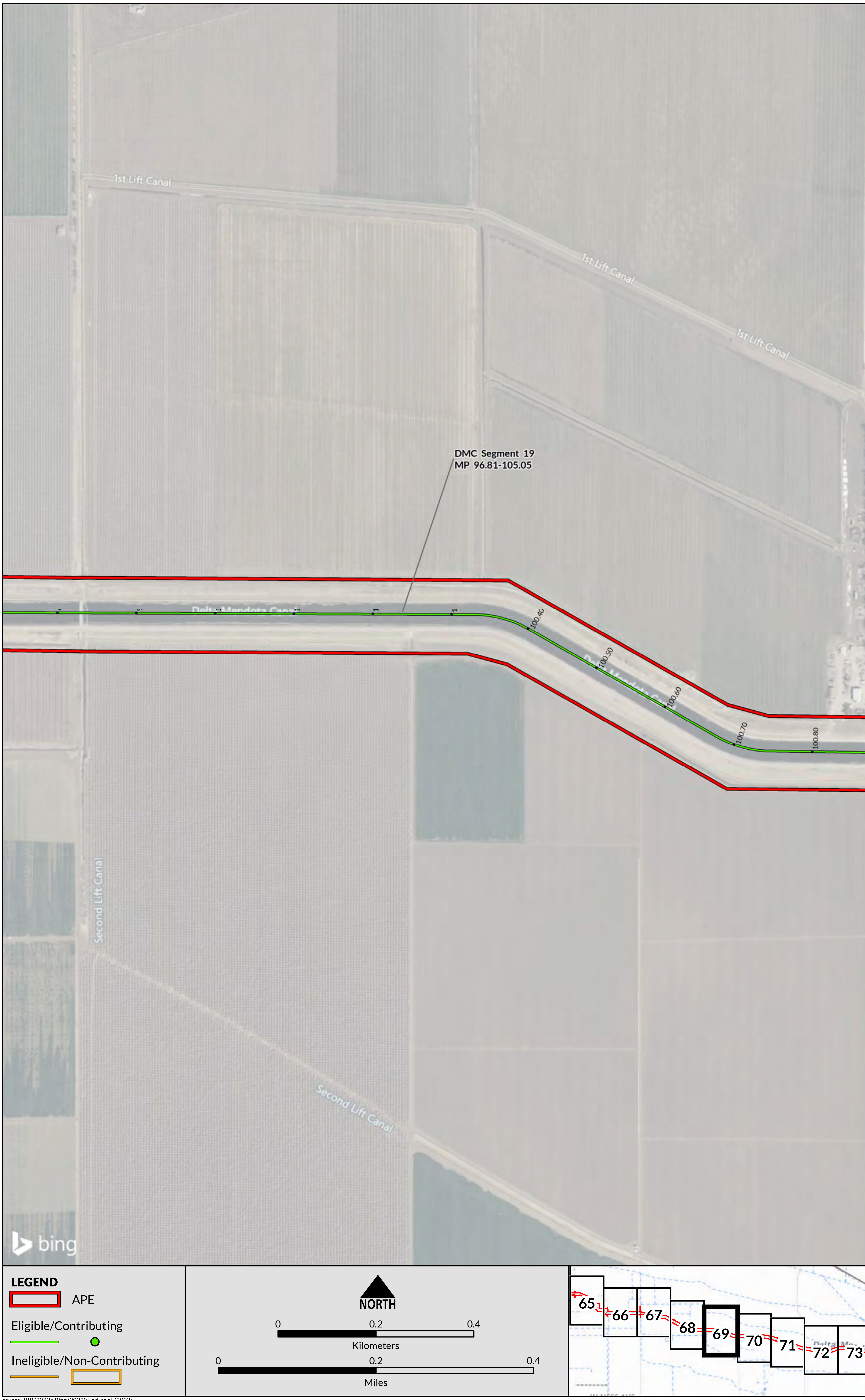

source: JRP (2022); Bing (2022); Esri, et al. (2022).

LEGEND

APE

Eligible/Contributing

Ineligible/Non-Contributing

NORTH

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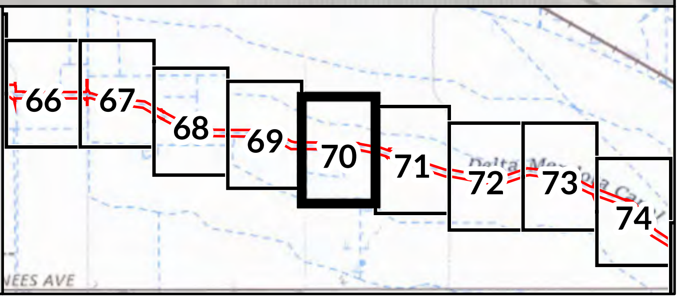
Kilometers

0 0.2 0.4
Miles



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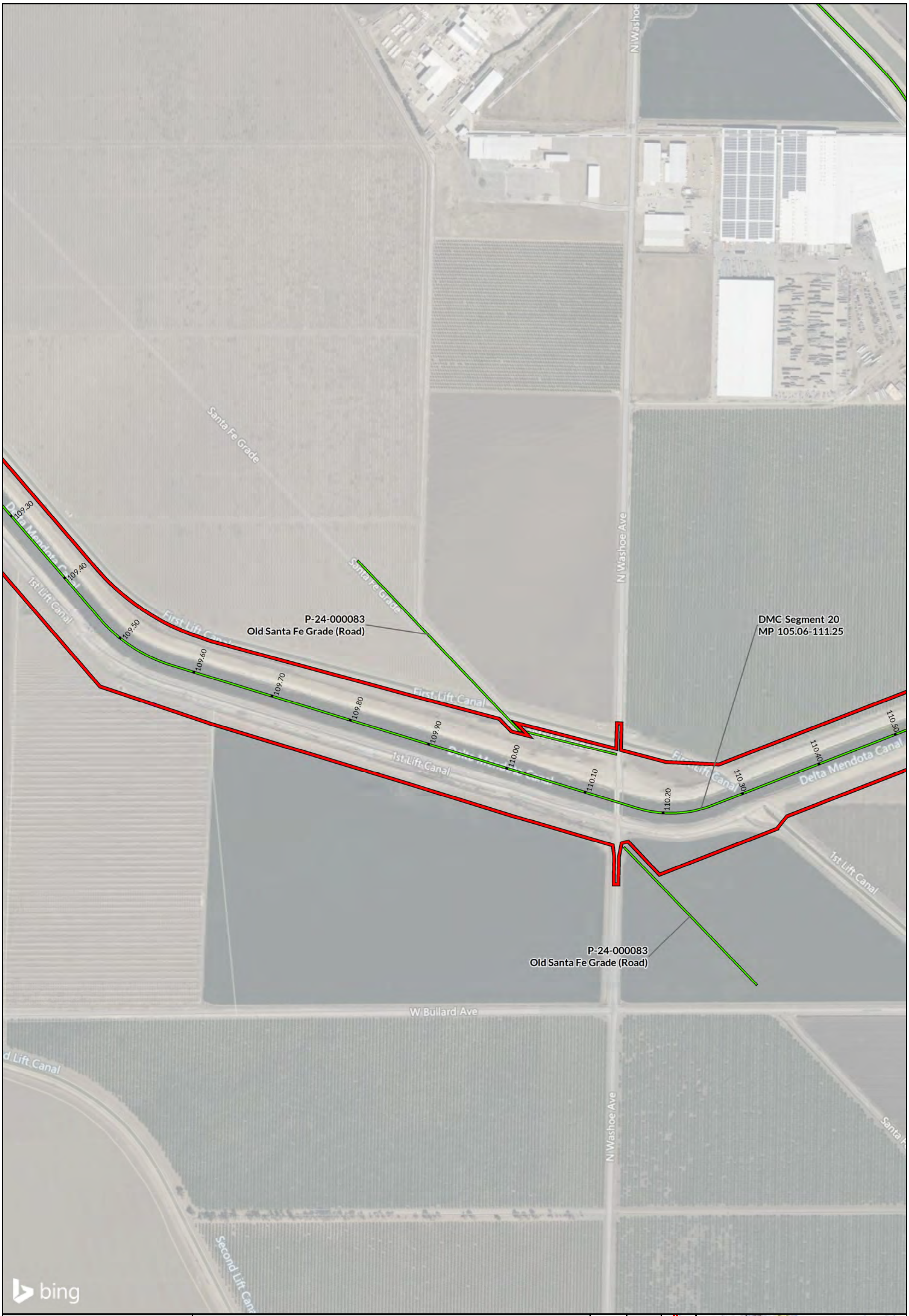

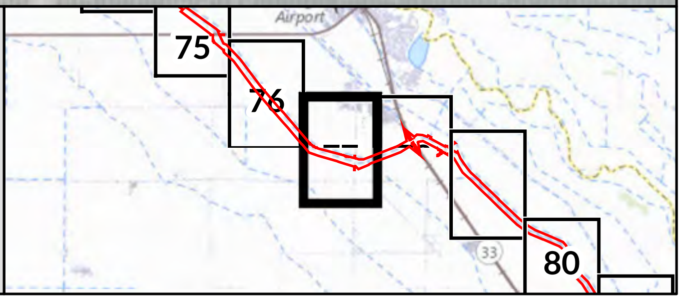

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source: JRP (2022); Bing (2022); Esri, et al. (2022).

source: JRP (2022); Bing (2022); Esri, et al. (2022).

Appendix B: DPR 523 Forms

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # ______
HRI # ______
Trinomial ______
NRHP Status Code 2S2

Other Listings ______
Review Code ______ Reviewer ______ Date ______

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

P1. Other Identifier: Delta-Mendota Canal

***P2. Location:** ☐ **Not for Publication** ☒ **Unrestricted** ***a. County:** Alameda, Contra Costa, San Joaquin, Stanislaus, Merced, Fresno

***b. USGS 7.5' Quad:** See Continuation Sheet

c. Address: _____ City _____ Zip _____

d. UTM: (Northern endpoint): Zone 10S 626724mE 4186397mN; (Southern endpoint): Zone 10S 734677 mE 4073832 mN

e. Other Locational Data: (e.g., parcel #, directions to resource, elevation, etc., as appropriate)

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries)

This form presents an inventory and National Register of Historic Places (NRHP) evaluation of the Delta-Mendota Canal (DMC), a component of the US Bureau of Reclamation's (Reclamation) Central Valley Project (CVP) (**Photograph 1**). Completed in 1951 as a key component of the joint state-federal CVP, the DMC spans 116 miles from just upstream from C.W. Bill Jones Pumping Plant (Tracy Pumping Plan) near Tracy to Mendota Pool in western Fresno County at the south end. DMC conveys water along the west side of the San Joaquin Valley in a southerly direction, delivering water to Mendota Pool and to water users at turnouts along its route. For the purposes of this form, the DMC has been divided into 22 segments (**Table 1**), with each segment roughly spanning the distance between successive check structures from north to south. All DMC segments are recorded on the attached Department of Parks and Recreation (DPR) 523E Linear Features Records, and they have been designated Segments 1 through 22 (see Continuation Sheet). Mileposts (M.P.) indicate locations along the canal from north to south.

***P3b. Resource Attributes:** (List attributes and codes) HP11 – Engineering Structure; HP20 – Canal/Aqueduct

***P4. Resources Present:** ☐ Building ☒ Structure ☐ Object ☐ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)

P5b. Description of Photo: (View, date, accession#) **Photograph 1:** View of the DMC around M.P. 28.96 with Hamilton Road bridge in distance; camera facing downstream from left bank, May 11, 2022 (A00586).

***P6. Date Constructed/Age and Sources:** ☒ Historic ☐ Prehistoric ☐ Both
1951 (U.S. Bureau of Reclamation)

***P7. Owner and Address:**
U.S. Department of the Interior
Bureau of Reclamation
Mid Pacific Regional Office
2800 Cottage Way
Sacramento, CA 95825

***P8. Recorded by:** (Name, affiliation, address)
Heather Norby, Abigail Lawton, & Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

***P9. Date Recorded:** May – June 2022

***P10. Survey Type:** Intensive

***P11. Report Citation:** (Cite survey report and other sources, or enter "none.") Heather K. Norby & Christopher D. McMorris, JRP Historical Consulting, LLC, *Historic Resources Evaluation and Effects Analysis Report for the Delta-Mendota Canal Subsidence Correction Project*, 2022.

***Attachments:** ☐ None ☒ Location Map ☒ Sketch Map ☒ Continuation Sheet ☒ Building, Structure, and Object Record ☐ Archaeological Record ☐ District Record ☒ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record ☐ Artifact Record ☐ Photograph Record ☐Other (list) ______

***NRHP Status Code**: 2S2

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

B1. Historic Name: Delta-Mendota Canal

B2. Common Name: Delta-Mendota Canal

B3. Original Use: water conveyance B4. Present Use: water conveyance

***B5. Architectural Style**: utilitarian infrastructure

***B6. Construction History**: (Construction date, alteration, and date of alterations) Construction of DMC began in 1946 and was completed in 1951. Between 1964 and 1970, numerous alterations were made. In 1965 an open channel to the O'Neill Forebay was added at M.P. 69.3, and the DMC was realigned at that area to accommodate this change. At the same time, the concrete-lined sections of the DMC between M.P. 3.50 – 69.00 were raised approximately 18 inches. Around the entrance to the new channel, M.P. 69.00 – 69.25, the lining was raised approximately 24 inches. Throughout the rest of the 1960s, the timber piers and bents of bridges in this span were replaced with concrete piers and bents for reinforcement and to accommodate the raising of the canal wall. Check structures were not raised at that time. As drainage conditions have changed, some inlets have become obsolete. Modifications have been made, including removal of some flap gates.

***B7. Moved?** ☒ **No** ☐ **Yes** ☐ **Unknown** **Date:** ___ **Original Location:** ___

***B8. Related Features:** Other Central Valley Project structures

B9. Architect: U.S. Department of the Interior (USDI), Reclamation, Central Valley Project – California, Delta Division; and USDI, Reclamation, Denver Office

b. Builder: Multiple (see Continuation Sheet)

***B10. Significance: Theme**: Water Conveyance; Engineering **Area**: California

Period of Significance: 1946-1951 **Property Type**: Canal **Applicable Criteria**: A/1 and C/3

(Discuss importance in terms of historical or architectural context as defined by theme, period, and geographic scope. Also address integrity.)

Delta-Mendota Canal meets National Register of Historic Places (NRHP) Criterion A and California Register of Historical Resources (CRHR) Criterion 1 at the state level because of its primary role in accomplishing the visionary goal of the CVP to transfer water between the Sacramento River and San Joaquin River basins. Delta-Mendota Canal is also individually eligible for listing in the NRHP and CRHR under Criterion C and Criterion 3 because its size and scale demonstrate the magnitude of the engineering and construction accomplishment of the CVP, and because it demonstrates Reclamation engineer Oscar Boden's important contributions to design of the Delta Division of the CVP. This property has been evaluated in accordance with Section 106 of the National Historic Preservation Act of 1966 (as amended) (54 U.S.C. 306108) and its implementing regulations (36 CFR Part 800), and Section 15064.5(a)(2)-(3) of the CEQA Guidelines, using the criteria outlined in Section 5024.1 of the California Public Resources Code (See Continuation Sheet).

B11. Additional Resource Attributes: ___

***B12. References**: USDI, Bureau of Reclamation, Delta-Mendota Canal, Technical Record of Design and Construction (Denver: 1959); USDI, Reclamation, "The Contribution of Irrigation and the Central Valley Project to the Economy of the Area and the Nation," (Government Printing Office: Washington, 1956), also see footnotes.

B13. Remarks:

***B14. Evaluator**: Heather Norby, JRP Historical Consulting, LLC

***Date of Evaluation**: August 2022

(This space reserved for official comments.)

See Continuation Sheet.

P3a. Description (continued):

Table 1. Delta-Mendota Canal Segments Presented in Linear Feature Records

DMC Segment No.	Canal Segment	Milepost Span
1	Just below Fish Collecting Facilities to just above Check No. 1	0.09 – 11.34
2	Check No. 1 to just above Check No. 2	11.35 – 16.18
3	Check No. 2 to just above Check No. 3	16.19 – 20.62
4	Check No. 3 to just above Check No. 4	20.63 – 24.42
5	Check No. 4 to just above Check No. 5	24.43 – 29.81
6	Check No. 5 to just above Check No. 6	29.82 – 34.41
7	Check No. 6 to just above Check No. 7	34.42 – 38.67
8	Check No. 7 to just above Check No. 8	38.68 – 44.25
9	Check No. 8 to just above Check No. 9	44.26 – 48.61
10	Check No. 9 to just above Check No. 10	48.62 – 54.40
11	Check No. 10 to just above Check No. 11	54.41 – 58.27
12	Check No. 11 to just above Check No. 12	58.28 – 63.98
13	Check No. 12 to just above Check No. 13	63.99 – 70.00
14	Check No. 13 to just above Check No. 14	70.01 – 74.39
15	Check No. 14 to just above Check No. 15	74.40 – 79.63
16	Check No. 15 to just above Check No. 16	79.64 – 85.08
17	Check No. 16 to just above Check No. 17	85.09 – 90.53
18	Check No. 17 to just above Check No. 18	90.54 – 96.80
19	Check No. 18 to just above Check No. 19	96.81 – 105.05
20	Check No. 19 to just above Check No. 20	105.06 – 111.25
21	Check No. 20 to just above Check No. 21	111.26 – 116.47
22	Check No. 21 to the canal terminus at the Mendota Pool	116.48 – 116.61

DMC Alignment and Cross Sections

Originating at the inlet canal upstream from C.W. Bill Jones Pumping Plant near Tracy, the DMC conveys Sacramento River water along the west side of the San Joaquin Valley in a southerly direction, traversing approximately 116 miles through San Joaquin, San Benito, Stanislaus, Merced, and Fresno counties before terminating at Mendota Pool in western Fresno County. Numerous major and minor appurtenant structures are distributed throughout its span: check structures control DMC flows; turnouts distribute water to adjacent water users and irrigation districts; wasteways evacuate the canal of all flows during emergencies; siphons transport the DMC below adjacent roadways, railways, and water courses; bridges transport adjacent roadways over the DMC; and siphon undercrossings, culverts, overchutes, pipe crossings, and inlet drains convey adjacent water courses below, above, or into the DMC. For a detailed discussion of these appurtenant structural types and subtypes, see typology discussions for the various structures below.

The DMC has a trapezoidal cross-section. It has a lining of earth, concrete, and compacted-earth in different sections. The first section from M.P. 0.19 to M.P. 2.52 is lined with loose and compacted earth until it ends at the inlet transition to the Tracy Pumping Plant (**Photograph 2 - Photograph 5**). From the Pumping Plant, the water is carried for 4,822 feet through discharge pipes to an outlet transition at M.P. 3.50 where the water is released into the concrete-lined section of the canal which extends for roughly 95 miles to M.P. 98.62 (**Photograph 6 - Photograph 9**). After this point, the DMC transitions to a compacted-earth lining, which continues until the terminus of the canal at M.P. 116.61 (**Photograph 10 - Photograph 12**).[1]

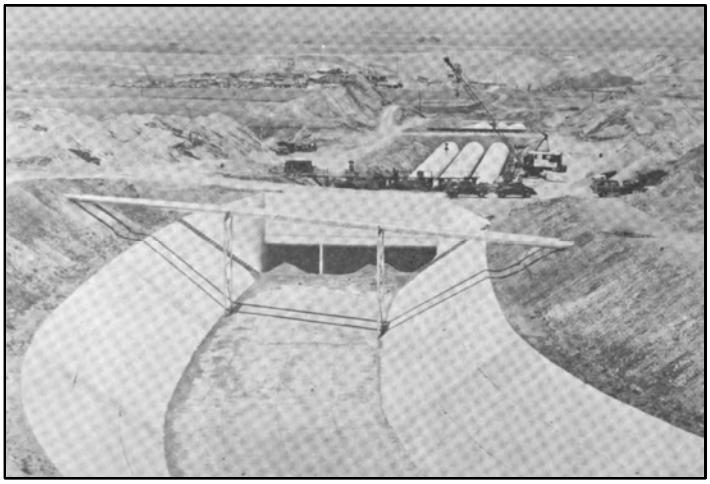
Photograph 2: View of riprap (right) and earth lining (left) at the beginning of Earth Section No. 1 of the Delta Mendota Intake Canal at the Tracy Fish Collection Facility, M.P. 0.09; camera facing upstream from left bank, May 9, 2022 (A00165).

Photograph 3: View of earth lining of Intake Canal at M.P. 0.34, above Bethany-Byron Road siphon; camera facing downstream from left bank, May 9, 2022 (A00166).

Photograph 4: Downstream view of Intake Canal from M.P. 1.41, showing transition from riprap of Bethany-Byron Road siphon outlet (center right foreground) to earth lining, Pumping Station visible in deep background (top center); camera facing downstream from right bank, May 9, 2022 (A00154)

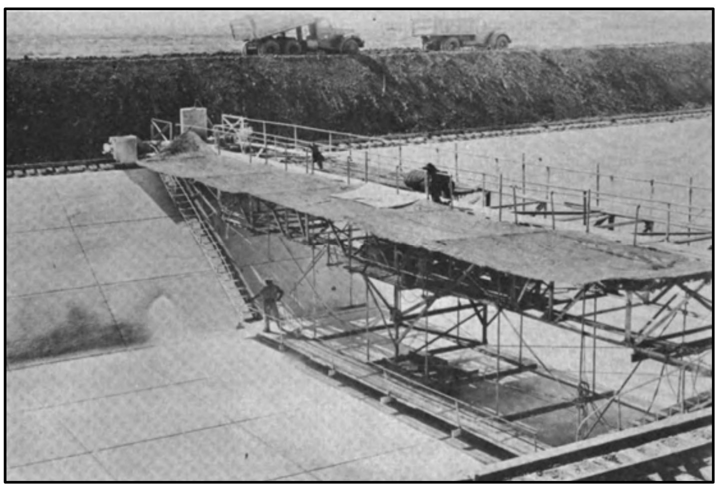
Photograph 5: End of earth lined Section No. 2 at the beginning of the Pumping Station inlet transition, at M.P. 2.52, which marks the end of the Intake Canal; camera facing left bank from right bank, May 9, 2022. (A00089)

[1] USDI, Reclamation, *Delta-Mendota Canal: Structures List*, May 2020: 1-42.

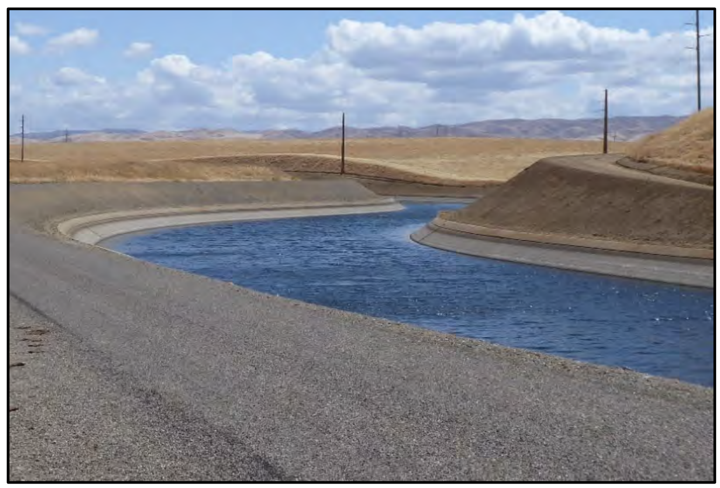


Photograph 6: Historic downstream view of Pumping Station discharge lines and inlet to DMC at M.P. 3.50 (Station L-185+50), ca. 1951.[2].

Photograph 7: Beginning of concrete-lined Section No. 3 at discharge pipes inlet to DMC at M.P. 3.50, raised lining visible at top of canal walls; camera facing west from left bank, May 9, 2022 (A00199).



Photograph 8: Historic view of application of white-pigmented curing compound to finished concrete lining [M.P. unknown]; October 1950.[3]



Photograph 9: View of concrete canal lining and cuts at M.P. 3.78; camera facing downstream from left bank, May 9, 2022 (A00208).

[2] [photograph], DM-534-CV, in USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*, June 1959: Frontispiece.
[3] [photograph], DM-1168-CV, in USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*, June 1959: 136.

Photograph 10: End of concrete lining at 98.62 and riprap transition to beginning of earth-lined Section No. 10 at M.P. 98.64; camera facing downstream from left bank, June 14, 2022 (C0418).

Photograph 11: View of compact-earth lined Section No. 10; camera facing downstream from Farm Bridge at M.P. 99.82, June 14, 2022 (C0430).

Photograph 12: View of Segment 22 from approximately M.P. 116.55, showing the canal's terminus, where it flows into the San Joaquin River; camera facing downstream from right bank, June 15, 2022 (C0537).

The first 3,500 feet of the earthen intake canal are 14.25 feet deep, have a bottom width of 100 feet, and 3:1 side slopes. After the Byron-Bethany Road siphon at M.P. 1.36/1.41, the following 8,600 feet to the inlet transition at the Pumping Station are 16.81 feet deep with a bottom width of 66 feet, to increase the velocity of flow. The concrete-lining is divided into seven sections, each with slightly different dimensions. Overall, the concrete lining originally had a top width of 102.24 feet and depth of 18.08 feet at its start at M.P. 3.50, and gradually narrowed to a top width of 94.62 feet and depth of 15.54 where it terminates at M.P. 98.62.[4]

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[4] USDI, Reclamation, *Tracy Pumping Plant and Intake Canal and Discharge Lines: Technical Record of Design and Construction*, May 1959: 9; USDI, Reclamation, Central Valley Project – California (CVP), "Delta-Mendota Canal Subsidence Correction Project: Lining Raise Cross Section Diagrams," Drawing No. DMC1-C-034, September 28, 2021; USDI, Reclamation, Central Valley Project –

The concrete-lining of the first 70 miles was raised 18 inches in 1965 (**Photograph 13**). Near the O'Neill Forebay, M.P. 69 - 69.25, the lining was raised 24 inches. In 1970, subsidence was evident in the lower reach of the canal and this reach, below Mile 70, was scheduled for a lining raise (**Photograph 14**).[5] See **Table 2** for dimensional variations and alterations throughout the DMC.

Photograph 13: View of concrete canal lining on right bank around double-barrel turnout at M.P. 3.54, lining has been raised on either side of the turnout, but the top of the original canal wall is unchanged immediately surrounding the structure; camera facing right bank from left bank, May 9, 2022 (A00203).

Photograph 14: View of canal lining on right bank at M.P. 93.24-93.25, where lining appears to have been raised around a modern turnout and original farm bridge; camera facing right bank from left bank, June 14, 2022 (C0385).

As drainage conditions have changed, some inlets have become obsolete. Modifications have been made, including removal of some flap gates.

Compacted-earth embankments topped with gravel maintenance roads flank both sides of the DMC along its full length (**Photograph 15**). The embankments were generally designed to be a minimum of 25 feet wide, but their exact width and height varies depending on the surrounding topography. The embankments function as levees in many sections where the surrounding land sits below the DMC's normal water surface (**Photograph 16**). In some areas where the canal traverses through a deep cut, the tops of the embankments are at grade with the surrounding land (**Photograph 17**), and at some locations spoils piles are sited along the embankment's outside toe. The width of each maintenance road varies in tandem with the embankment beneath them, but they generally range from approximately 12 to 20 feet. Access to the DMC's maintenance roads are controlled from adjacent public rights-of-way by various types of gates and fencing.

In addition to the major and minor structures enumerated above, the DMC contains other basic repetitive structures distributed throughout its span like ubiquitous steel utility ladders secured to both the left and right embankment interiors.

Deterioration and cracking regularly occurs along the concrete canal lining as well as erosion along the compacted-earth segments. As part of the life cycle of the canal, these conditions are routinely addressed by Friant Water Authority (FWA) O&M staff, who replace and repair concrete panels and repair earth-lined segments.

California (CVP), "Delta-Mendota Canal Subsidence Correction Project: Typical Riprap Lined Section," Drawing No. DMC1-C-035, September 29, 2021

[5] USDI, Reclamation, *Designer's Operating Criteria*, 1971: 4-5, 26; Grimsley, J. O. and M. L. Barmettlor, *Condition of Major Irrigation Structures and Facilities*, Region 2, 1970, Appendix I – 3, 6.

Photograph 15: View of embankment and maintenance road from approximately M.P. 111.28; camera facing downstream from left bank, June 14, 2022 (C0489).

Photograph 16: View of embankment and maintenance road from approximately M.P. 89.56; camera facing downstream from left bank, June 14, 2022 (C0360).

Photograph 17: View of embankment and maintenance road from approximately M.P. 24.89; camera facing downstream from left bank, May 11, 2022 (A00498).

Table 2: DMC Lining Sections[6]

Milepost Span	Lining Material	Base Width	Side Slope	Depth*	Alterations
0.19 – 0.85	Earth	100	3:1	14.25*	None known
0.87 – 2.52	Earth	66	3:1	16.81*	None known
3.50 – 13.66	Concrete	48	1 ½:1	19.58	Canal lining raised on right and left banks approximately 18 inches in 1965
13.70 – 20.62	Concrete	48	1 ½:1	19.37	Canal lining raised on right and left banks approximately 18 inches in 1965
20.66 – 34.41	Concrete	48	1 ½:1	19.17	Canal lining raised on right and left banks approximately 18 inches in 1965
34.45 – 54.4	Concrete	48	1 ½:1	18.96	Canal lining raised on right and left banks approximately 18 inches in 1965
54.44 – 69.00	Concrete	48	1 ½:1	18.75	Canal lining raised on right and left banks approximately 18 inches in 1965
69.00 – 69.25	Concrete	48	1 ½:1	19.25	Canal lining raised on right and left approximately 24 inches in 1965
69.25 – 69.99	Concrete	48	1 ½:1	19.00	Canal lining raised on right and left banks approximately 18 or 24 inches in 1965
70.04 – 85.08	Concrete	48	1 ½:1	15.75	Canal lining possibly raised sometime after 1970
85.10 – 98.62	Concrete	48	1 ½:1	15.54	Canal lining possibly raised sometime after 1970
98.64 – 111.55	Earth	62	2 ½:1	15.40	None known
111.55 – 114.05	Earth	84	2 ½:1	15.40	None known
114.05 – 116.61	Earth	60	2 ½:1	15.40	None known

1. Conveyance Structures

Siphons

Siphons are enclosed structures placed along the canal where the water must be conveyed under a linear feature such as a waterway, roadway, or railroad. The water enters the siphon, passes under the linear feature by force of gravity, and flows back into the canal on the other side. There are 13 extant siphons along the DMC.

Table 3 lists the siphons by DMC segment number as presented in the Linear Feature Records below.

1. Table 3: Geographic Distribution of DMC Siphons

DMC Segment No.	Siphon Totals	Percent of Totals
1	2	15.39%
2	2	15.39%
3	2	15.39%
4	1	7.69%
5	0	--
6	0	--

* Depth refers to depth of excavation, except in non-compacted, loose earth sections of the Delta-Mendota Intake Canal

[6] All measurements in feet. Dimensions, mileposts, and alterations derived from 1959 Technical Records of Design and Construction, 1985, 1992, and 2020 Structures Inventories, historic and modern engineering drawings, and 2022 field survey.

7	1	7.69%
8	0	--
9	0	--
10	1	7.69%
11	0	--
12	1	7.69%
13	0	--
14	0	--
15	0	--
16	1	7.69%
17	0	--
18	0	--
19	0	--
20	1	7.69%
21	1	7.69%
22	0	--
Total	**13**	**100%**

While individual siphon lengths and slopes are determined principally by the surrounding topography, their basic designs are generally uniform, with only slight dimensional or structural variation. Siphons begin at an inlet transition where the canal walls narrow and gradually shift from sloped to vertical at the siphon inlet headwall. The height of each headwall varies, depending on the natural topography around the canal but generally ranging between approximately 23-30 feet tall. The width of each headwall likewise varies depending on the natural topography as well as the number and type of barrels. Of the thirteen siphons, twelve are multiple-barrel siphons composed of either three or four concrete barrel boxes. The only single-barrel siphon is composed of a cylindrical, monolithic concrete barrel. Most multiple-barrel siphons have barrels that are either 16-by-16-feet or 12-by-16-feet (**Photograph 18 - Photograph 21**). The exceptions include the Byron Bethany Road and Del Puerto Creek siphons. The former has three barrel boxes that are 13 feet and 6 inches by 20 feet while the latter has three barrel boxes that are 15 feet and 6 inches by 15 feet and 6 inches. The Mountain House Road Siphon's single, cylindrical barrel that is 24 feet and 3 inches in diameter (**Photograph 22 - Photograph 23**). The underground barrels convey the canal's flow to outlet transitions, which are approximately the same size as their respective inlet transitions, and from there the canal walls widen and revert from vertical to sloped. See **Table 4** for quantities and proportions among the different barrel groups.[7] As it is comprised entirely of unaltered original structures, the DMC siphon population retains a high degree of historic integrity of design, materials, workmanship, setting, location, association, and feeling.

2. Table 4: Dimensional Variation Among Siphon Barrel Groupings

Type	Siphon Totals	Percent of Total	Photographic Reference
Single-barrel	1	7.69%	Photograph 22 - Photograph 23
Three-barrel	8	61.54%	Photograph 18 - Photograph 19
Four-barrel	4	30.77%	Photograph 20 - Photograph 21
Total	**13**	**100%**	

[7] Bureau of Reclamation, *Delta-Mendota Canal: Technical Record of Design and Construction* (Denver, Colorado: Central Valley Project – California, June 1959), 59-65.

The above table does not include the siphon undercrossings, which transport preexisting waterways under the DMC. For a detailed discussion of these, see the "Siphon Undercrossings" typology discussion on the Continuation Sheet below.

Photograph 18: 3-barrel siphon inlet at M.P. 13.69; camera facing downstream from left bank, May 10, 2022 (A0039).

Photograph 19: 3-barrel siphon outlet at M.P. 79.72; camera facing upstream from right bank, June 14, 2022 (C0293).

Photograph 20: 4-barrel siphon inlet at M.P. 51.18; camera facing downstream from left bank, May 13, 2022 (A00940).

Photograph 21: 4-barrel siphon outlet at M.P. 16.34; camera facing upstream from left bank, May 10, 2022 (B00002).

Photograph 22: Mountain House Road Siphon's inlet headwall at M.P. 4.41; camera facing downstream from left bank, May 9, 2022 (A00216).

Photograph 23: Mountain House Road Siphon's outlet headwall at M.P. 4.49; camera facing upstream from left bank, May 9, 2022 (A00220).

2. Regulating Structures

Check Structures

There are 21 check structures along DMC. These check structures placed across the canal control the flow and depth of water in the upstream section of the canal. They are generally used to raise the water level in the canal in order to divert flow through lateral headgates on the upstream side, or to stop the flow of water further down the canal. All are either trapezoidal in cross section (**Photograph 24**) or rectangular in cross section (**Photograph 25**). Please see Linear Feature Records below for descriptions of each check structure.[8]

Photograph 24: Check No. 16 at M.P. 85.09; camera facing downstream from left bank, June 14, 2022 (C0333).

Photograph 25: Check No. 11 at M.P. 58.28; camera facing downstream from left bank, June 13, 2022 (C0084).

[8] Bureau of Reclamation, *Delta-Mendota Canal: Technical Record of Design and Construction*, 59-63; Bureau of Reclamation, "Concrete Checks," specification, on file at Reclamation Design Construction Library (1948).

3. Common Appurtenant Features

Check Buildings

There are currently 21 extant check buildings along the DMC. These structures house measuring and control equipment to regulate the flow of water through turnouts, wasteways, and check structures to provide consistent and accurate delivery of water to users. Each segment recorded on the Linear Feature Records has one check building. These masonry buildings are located on the left bank adjacent to its associated check structure (**Photograph 28**). Installation of the check buildings began in 1966 when a remote control-telemetering system was installed to control canal flows between the Tracy Pumping Plant and the O'Neill Pumping Plant. The equipment inside check buildings replaced the need for a worker to be stationed at check structures 24 hours a day, 7 days a week to manually monitor water levels and operate the gates and the buildings protect this equipment from the weather, particularly the extreme heat in summer and high humidity in winter.[9]

Built after the initial period of DMC construction (1947-1951), the population of check buildings consists of a single type, constructed of rusticated concrete blocks (**Photograph 26** and **Photograph 27**). These buildings are generally of the same standard design with slight dimensional or structural variation. All concrete-block check buildings have rectangular plans with a metal door and flat or slightly slanted roof. Concrete-block check buildings typically measure 6 feet x 8 feet.

Photograph 26: Check building at Check No. 1; camera facing northwest, May 10, 2022 (A00343).

Photograph 27: View of rusticated concrete block construction of check building at Check No. 2; camera facing northeast, May 10, 2022 (A00451).

[9] USDI, Reclamation, *Designers' Operating Criteria Delta-Mendota Canal and Delta Cross Channel*, September 1971: 27-28.

Photograph 28: View of check building (left) in relation to associated check structure (Check No. 3, right) with a stilling well in the foreground (bottom right), May 10, 2022 (B00084).

Stilling Wells

There are 41 stilling wells along the length of the DMC. These features were originally installed in 1966, along with the check buildings, as part of a remote control-telemetering system used to control canal flows between the Tracy Pumping Plant at M.P. 2.53 and O'Neill Pumping Plant near the O'Neill/Volta Forebay facilities at M.P. 69.30. Stilling wells were installed close to the upstream and downstream ends of all check structures (**Photograph 29**). An exception to this is Check No. 1, which only has one stilling well associated with it, on the downstream side. The stilling wells are equipped with telemeter transmitters (digital encoders) and are located upstream and downstream at each check structure to provide water level indication. High and low water level alarm contacts are contained in the stilling wells. To prevent false readings or operations resulting from condensation on transmitter equipment, heater strips are provided in the encoder housings at the stilling wells.[10]

All stilling wells are short, concrete cylinders measuring 42-inches in diameter. Access to the equipment inside is gained through a metal hatch on the top (**Photograph 30**). These wells are set down the bank, close to the top of the canal lining, with a short span of metal-pipe handrailing between the well and the canal. If the bank is sloped there is a set of concrete steps with a metal pipe handrail leading from the road to the well. The vast majority (36 out of 41) are located on the left bank, but five of the stilling wells at the southern end of the canal are located on the right bank.

[10] USDI, Reclamation, *Designers' Operating Criteria Delta-Mendota Canal and Delta Cross Channel*, September 1971: 2, 27-28.

Photograph 29: View of stilling well upstream of Check No; camera facing downstream from left bank June 13, 2022 (C0200).

Photograph 30: View of stilling well, access hatch, and stairs to access the stilling well from the road; camera facing upstream from left bank, May 11, 2022 (A00482).

Wasteways

There are five wasteway structures along the DMC that regulate the flow of water from the canal into creeks and rivers (**Photograph 31 - Photograph 32**). These structures are usually used for one of two purposes, either to protect the canal from overtopping or dewater the canal system below in case of an emergency or for scouring out silt deposited in the canal above. Four of the wasteways (Westley, Newman, Volta, Firebaugh) are channels that receive water by radial gate turnouts from DMC and convey it one to six miles to the San Joaquin River. The other wasteway is an overspill apron on the right bank of the canal. Please see Linear Feature Records below for descriptions of each wasteway.[11]

Photograph 31: Newman Wasteway inlet structure; camera facing upstream from left bank, May 13, 2022 (A00994).

Photograph 32: View of Firebaugh Wasteway, showing where the stilling well transitions into the earth-lined canal; camera facing downstream from right bank, June 14, 2022 (C0484).

[11] Bureau of Reclamation, *Delta-Mendota Canal: Technical Record of Design and Construction*, 65, 70-76.

Turnouts

The DMC has 277 turnouts distributed throughout its course between M.P. 1.05 and 109.45. Turnouts are structures along the canal bank that divert and regulate water from the DMC to various water users. These facilities are operated by designated water and irrigation districts and other official users. See **Table 5** for the number of turnouts along each DMC segment as presented in the Linear Feature Records below. The following typology discussion does not attempt to provide an exhaustive inventory of DMC turnouts, but rather to give an overview of the historic and modern structural types and subtypes as observed during the current survey recordation and as compared with the historical record.

Table 5: Geographic Distribution of DMC Turnouts

DMC Segment No.	Turnouts Totals	Percent of Total
1	17	6.14%
2	15	5.42%
3	18	6.50%
4	12	4.33%
5	19	6.87%
6	16	5.78%
7	14	5.05%
8	18	6.50%
9	14	5.05%
10	13	4.69%
11	13	4.69%
12	12	4.33%
13	18	6.50%
14	10	3.61%
15	12	4.33%
16	13	4.69%
17	15	5.42%
18	14	5.05%
19	10	3.61%
20	4	1.44%
21	0	--
22	0	--
Total	**277**	**100%**

The original turnout population consists almost entirely of concrete barrel types (**Photograph 33 - Photograph 34**). The forms of these barrel-type turnouts slightly vary but overall follow a standard design. The openings and water conduits are either box-shaped or round and vary in size from three to five feet in cross section. The openings are covered by metal grates or trash racks, which are typically angled to match the slope of the canal's walls but sometimes stand vertically. Just inside the openings, vertical or sloping lift gates slide up and down to control the flow of water into the concrete pipe and through the canal banks. A concrete hoist equipment deck sits above the gates, usually on the sloping canal bank just above its concrete lining, and concrete steps with a metal-pipe rail often provide access from the top of the levee while a similar metal railing lines the deck canal edge. Approximately 3-foot-tall cast-iron gate-hoist mechanisms to raise and lower the gates are mounted on the deck. Most have manual gear wheels on top. The bulk of these structures retain their original design features, but there are some common alterations throughout the population (**Photograph 35**). The most common has been replacing the manual gate-hoists with automatic electronic gate-operating systems (**Photograph 36**).[12]

Some turnouts have been added along the DMC since its initial period of construction. Most of these structures have been constructed in accordance with Reclamation's original design specifications, following the basic form of concrete construction and vertical lift gates (**Photograph 37**), though some consist two or three barrels (**Photograph 38 - Photograph 39**). Additionally, some new turnouts consist of a basic steel pipe extending either through or over the canal lining (**Photograph 40**).[13]

Photograph 33: Concrete pipe turnout along the right bank at M.P. 49.56, showing the original, manual gate-hoisting equipment; camera facing from left bank, May 13, 2022 (A00911).

Photograph 34: Concrete pipe turnout along the left bank at M.P. 23.81, showing a slight variation from the turnout in **Photograph 33**; camera facing downstream from left bank, May 11, 2022 (A00465).

[12] Bureau of Reclamation, *Delta-Mendota Canal: Technical Record of Design and Construction*, 78; Bureau of Reclamation, "Concrete Pipe Turnouts," specification, on file at Reclamation Design Construction Library, (1948); Bureau of Reclamation, "18" Dia. Screw Lift Vertical Wedge Gate," specification, on file at Reclamation Design Construction Library, (1948); Bureau of Reclamation, "24" Dia. Screw Lift Vertical Wedge Gate," specification, on file at Reclamation Design Construction Library, (1948); Bureau of Reclamation, "Lateral Turnout," specification, on file at Reclamation Design Construction Library, (1946);

[13] Bureau of Reclamation, "Turnouts Along Delta-Mendota Canal" (n.d.).

Photograph 35: An original turnout that has been altered by a replacement screen at M.P. 38.14 (foreground) and an original concrete pipe turnout along the left bank at M.P. 38.15 (background) along left bank; camera facing downstream from the left bank, May 12, 2022 (B00289).

Photograph 36: Concrete pipe turnout altered by the addition of an automatic, electronic gate-operating system along the right bank at M.P. 61.37; camera facing from left bank, June 13, 2022 (C0118).

Photograph 37: An original turnout altered by the addition of an automatic, electronic gate-operating system (left) and a modern turnout (right) along the right bank at M.P. 90.53; camera facing from left bank, June 14, 2022 (C0365).

Photograph 38: Modern, two-barrel concrete pipe turnout along right bank at M.P. 78.56; camera facing from left bank, June 14, 2022 (C0270).

Photograph 39: Modern, three-barrel concrete pipe turnout along right bank at M.P. 81.08, camera facing left bank, June 14, 2022 (C0304).

Photograph 40: Modern overlining turnout along right bank at M.P. 81.80; camera facing southwest, June 14, 2022 (C0310).

4. Protective Structures

Overchutes

Overchutes are structures that carry water from larger streams and drainages over the DMC to prevent erosion and damage to the canal bank. There are 13 structures on the DMC identified as overchutes. They consist of an open concrete flume with flat bottoms and vertical sides that extends across the canal and concrete inlet and outlet structures constructed on the exterior sides of the canal's banks (
Photograph 41). They are designed so that the bottom of the concrete box sits above the canal's full water elevation. Most are reinforced with concrete crossbeams, but two of the thirteen are not (
Photograph 42 - Photograph 43). Outlets often have a stilling basin or riprap to prevent erosion (**Photograph 44**).[14]

[14] Bureau of Reclamation, *Delta-Mendota Canal: Technical Record of Design and Construction*, 78, 80-81; Bureau of Reclamation, "Quinto Creek Overchute," specification, on file at Reclamation Design Construction Library, (1948); Bureau of Reclamation, "Romero Creek Overchute: Inlet and Flume," specification, on file at Reclamation Design Construction Library, (1948); Bureau of Reclamation, "Quinto Creek Overchute: Outlet," specification, on file at Reclamation Design Construction Library, (1948).

Photograph 41: Concrete overchute at M.P. 7.25 looking downstream; camera facing downstream from left bank, May 9, 2022 (A00253).

Photograph 42: Overchute at M.P. 21.91, showing the reinforced box; camera facing right bank from left bank, May 10, 2022 (B00127).

Photograph 43: Overchute at M.P. 78.59, showing the unreinforced box; camera facing right bank from left bank, June 14, 2022 (C0275).

Photograph 44: Outlet of overchute at M.P. 66.70, with riprap to guard against erosion; camera facing right bank from left bank, June 13, 2022 (C0171).

Inlet Drains

Inlet drains are structures built into the canal wall that allow water to drain into the canal. The DMC currently includes several hundred inlet drains distributed throughout its span. All the DMC inlet drains, originally referred to as "drainage inlets" intercept and channel storm runoff from surrounding drainage areas for release into the canal. The following typology discussion does not attempt to provide an exhaustive inventory of DMC inlet drains, but rather to give an overview of the historic and modern structural types and subtypes as observed during the current survey recordation and as compared with the historical record.

The original population of inlet drains was principally comprised of reinforced concrete structures and, in general, one of two types, free-flowing or flap-gate. Free-flowing inlet drains were designed to drain areas that sit level or above the canal's designed water level. They typically consist of precast concrete pipes or concrete box-culverts that project from the top edge of the canal lining (**Photograph 45 - Photograph 46**). Flap-gate inlet drains were designed to drain areas that sat at or below the expected average operating water level but above its maximum designed water level. They typically consist of concrete box-culverts that pierce through the canal and metal flap gates that open to allow drainage into the canal but mostly remain closed to prevent reverse flow (**Photograph 47 - Photograph 48**). The number of flap gates varies between one and three. As with other minor appurtenant water conveyances, the dimensions of both types varied in consideration of the surrounding topography.[15]

Since its initial construction, the population of DMC inlet drains has been somewhat modified by alterations to the original structures or the addition of new types of inlet drains. Typical alterations included replacing the flap gates on a box-culvert type (**Photograph 49**), rebuilding a deteriorated concrete box-culvert (**Photograph 50**), replacing a deteriorated precast concrete pipe with a corrugated metal pipe (CMP), and deleting original flap-gate inlet drains (**Photograph 51**). Most new types of inlet drains were simple, unadorned corrugated metal pipes embedded in the embankment for discharge into the canal (**Photograph 52**). As with the original structures, these CMPs came in varying sizes, sometimes comprising multiple pipes. While basic CMP structures comprise the majority of new additions to the inlet drain population during this period, a few additional concrete structures were likewise added. Some of these drains resembled earlier reinforced concrete structures, as they feature sidewalls, and are built directly into the canal lining (**Photograph 53**). They are likewise outfitted with CMPs.

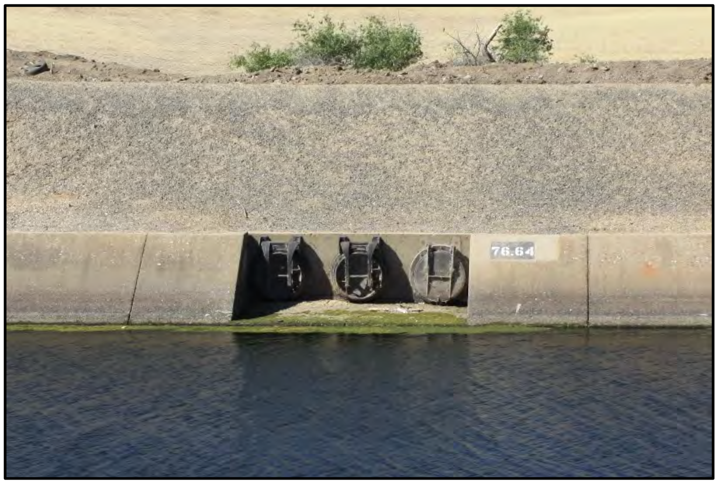
Photograph 45: Free-flowing inlet drain along the right bank at M.P. 67.66; camera facing from left bank, June 14, 2022 (C0349).

Photograph 46: Free-flowing inlet drain along the right bank at M.P. 77.58; camera facing from left bank, June 14, 2022 (C0261).

[15] Bureau of Reclamation, *Delta-Mendota Canal: Technical Record of Design and Construction*, 78, 83-85; Bureau of Reclamation, "Concrete Drainage Inlet," specification, on file at on file at Reclamation Design Construction Library (1946).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby, A. Lawton, & A. Young *__Date__: May - June, 2022 ☒ Continuation ☐ Update



Photograph 47: Triple flap-gate inlet drain along the right bank at M.P. 76.64; camera facing from left bank, June 14, 2022 (C0253).

Photograph 48: Flap-gate inlet drain along the right bank at M.P. 76.64; camera facing from left bank, June 14, 2022 (C0253).

Photograph 49: Altered flap-gate inlet drain along the right bank at M.P. 8.01; camera facing from left bank, May 9, 2022 (A00266).

Photograph 50: Altered flap-gate style, concrete inlet drain along the right bank at M.P. 33.88; camera facing from left bank, May 11, 2022 (A00699).

Photograph 51: Deleted flap-gate inlet drain along the right bank at M.P. 20.71; camera facing from left bank, May 10, 2022 (B00070).

Photograph 52: CMP shoulder drain along the right bank at M.P. 7.29; camera facing from left bank, May 9, 2022 (A00258).

Photograph 53: Modern inlet drain along the right bank at M.P. 28.53; camera facing from left bank, June 14, 2022 (C0472).

5. Miscellaneous

Bridges

There are 120 extant bridge crossings associated with the DMC, including three (3) roadways located above sites where the canal is siphoned underground and 16 bridges constructed after the period of significance, post-1958, as replacements of existing bridges or to establish a bridge crossing where there was none[16]. This total does not include four pairs of bridge abutments where bridges have been demolished, but not replaced. As originally designed and constructed, the DMC included four distinct bridge types: Railroad Bridges, State Highway Bridges, County Highway Bridges, and Miscellaneous Bridges, which included Operating Bridges, Farm Bridges, and County Road Bridges. The only Railroad Bridge associated with the

[16] The three crossings over siphons included in the bridge population are identified as such because they are categorized as bridges within the *DMC Structures List* (2020).

DMC is located on the Westley Wasteway. Because this bridge is not located on the DMC itself, it is not included in the population of DMC bridges, however it is discussed in detail within the Linear Feature Record for DMC segment 6. Each of the original bridge types are still in use along the DMC, although Miscellaneous Bridges have since been reclassified as Farm Bridges or Operating Bridges, and County Road Bridges have been reclassified as County Highway Bridges. Bridges have also been raised in those concrete-lined sections of the DMC where the lining was raised, in the 1960s and 1970s. Most timber bridges crossing the canal were rehabilitated between 1964-70, by replacing their timber piers with concrete piers, while a few bridges were rehabilitated later in 1977.[17] The following discusses bridge typologies, sub-typologies, and common appurtenant features along the DMC as observed during the current survey recordation and as compared with the historical record. See **Table 6** for an inventory of bridge types appurtenant to the DMC.

Table 6: DMC Bridge Inventory

Bridge Type	**Total**	**% of Total**
County Highway Bridge	57	47.50
Farm Bridge	33	27.50
Operating Bridge	10	8.33
State Highway Bridge	4	3.33
Post-1958 Bridge	16	13.34
Total	120	100.00

County Highway Bridges

County Highway Bridges are the most prevalent of the bridge types appurtenant to the DMC, totaling 57 bridges or a plurality of about 47.50% of all bridges included in this inventory. The County Highway Bridge type may be further divided into five subtypes:

- Concrete Bridges with concrete piers or bents, totaling 47 or about 82.46% of all County Highway Bridges
- Wasteway Crossing Bridges integrated into forebay structure, totaling 4 or 7.02% of population; and
- Timber Bridges with replacement concrete piers, totaling 3 or 5.26% of population; and
- Roads crossing siphons, totaling 2 or about 3.51% of population; and
- A single Timber Bridge with timber bents, about 1.75%

Concrete Bridges make up the majority of the County Highway Bridge population. All County Highway Bridges were designed according to the "Standard Specifications for Highway Bridges," published by the American Association of State Highway Officials (AASHO). The Concrete Bridges all have concrete decks covered by asphalt-paved road, measuring from 16-feet-wide to 40-feet-wide, through the vast majority measure 24- or 20-feet-wide (**Photograph 54** and **Photograph 55**). Bridges of this subtype are all supported, as originally designed, by concrete piers or bents: sets of solid-type piers and sets of square, multi-columned bents (**Photograph 54** and **Photograph 56**). Most of the bridges located in the concrete-lined sections of the canal are supported by two piers or bents, while bridges located in the earth-lined and earth sections are supported by a set of three bents (**Photograph 57**). The exception to this is the bridge at M.P. 68.03, which is supported by three concrete solid-type piers (**Photograph 58**). Most of these Concrete County Highway Bridges were originally designed with, and retain, metal guard-rails secured to wooden posts embedded in the concrete curbs. Once again, an exception to this is the bridge at M.P. 68.03, which has concrete parapet walls integrated into the deck construction with short spans of steel guard-railing

[17] USDI, Reclamation, *Designers' Operating Criteria, Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 26; Structures List, 2000.

extending from both ends (**Photograph 58**). Generally, bridges in this subtype retain strong historic integrity of design, materials, workmanship, setting, location, association, and feeling.

Wasteway Crossing bridges are the second most common County Bridge subtype. Although these bridges are not included in the *DMC Structures List*, they are maintained by the County and thus included in the County Highway Bridge population for the purpose of this survey. These four bridges are integrated into the forebays of the Westley Wasteway at M.P. 34.32, the Newman Wasteway at M.P. 54.38, the San Luis Wasteway at M.P. 69.98, and the Firebaugh Wasteway at M.P. 111.22. They have concrete decks measuring approximately 20 feet wide x 120 feet long, supported by a single concrete pier that also divides the two bays of the inlet structures. Their abutments are the walls of the intake forebasy. All of these bridges have metal-pipe handrails, though the bridge at the Firebaugh Wasteway is outfitted with chain-link fencing in addition to these handrails (**Photograph 59** and **Photograph 60**).

The Timber Bridges are the third most common County Highway Bridge subtype. As discussed above, all County Highway Bridges were designed according to specifications drafted by the AASHO, and these Timber Bridges conform to the original design for County Road Bridges for two lanes of H15 loading.[18] These three timber bridges, located at M.P. 62.09, 72.33, and 77.63, were all rehabilitated in 1965-6, at which time the timber members of their decks were replaced, as needed, and the original timber bents were removed and replaced with sets of three solid-type concrete piers (**Photograph 61**). They have retained their timber decks, which measure 18- to 20-feet-wide. For a detailed discussion of the Farm Bridges' attributes, see discussion of "Farm Bridges" below.

This bridge type is comprised of two (2) roadways that traverse DMC siphons. The siphon crossing are asphalt paved roads that run across DMC siphons. The first is at M.P. 23.99, where Blewett Road crosses the DMC (**Photograph 62**). The second is at M.P. 110.99, where State Highway 33 crosses the DMC (**Photograph 63**).

The last subtype consists of a single Timber Bridge supported by timber bents (**Photograph 64**). This bridge is located at M.P. 0.33 along Lindemann Road, adjacent to the Tracy Fish Facility. The deck measures 28 feet wide. It has timber curbs and no handrails, but chain-link fence is secured to both sides along the full length of the deck. This is the only bridge within the whole DMC bridge population to retain its timber bents.

Farm Bridges

The second most prevalent bridge type appurtenant to the DMC is the Farm Bridge, totaling 33 bridges or approximately 27.50% of all bridges included in this inventory. As the DMC traversed vast agricultural acreage throughout its span, Farm Bridges were designed and constructed to allow adjacent farmers continued access to lands that construction of the DMC had bifurcated. Originally, virtually the entire Farm Bridge population was designed by Reclamation as standard timber bridges, with specifications similar to the original timber county road bridges. Their design included wood-plank decks, timber bents, and reinforced concrete abutments. A rehabilitation project from 1964-1970 replaced timber members of the decks, as needed, and replaced all timber bents with solid-type concrete piers. Two bridges within the Farm Bridge population were rehabilitated in 1977.[19] As a result, the modern DMC Farm Bridge type may be divided into three subtypes:

- Farm Bridges with replacement solid-type concrete piers that have retained their timber decks, totaling 29 or about 87.88% of all Farm Bridges;
- Farm Bridges with replacement concrete bents and timber-decks, totaling 3 or 9.09% of the population; and
- a single Farm Bridge with replacement concrete piers and replacement concrete deck, about 3.03%.

The majority of Farm Bridges are those that have retained their timber decks, which measure between 16-feet-wide and 30-feet-wide and are supported by three replacement solid-type concrete piers (**Photograph 65**). The exception to this is the

[18] *Delta-Mendota Canal-Station 2588+40.4, County Road Bridge*, Drawing No. 24, 214-D-15874
[19] USDI, Reclamation, Central Valley Project – California (CVP), "Delta Mendota Canal-Sta.4128+25, Timber Farm Bridge and 20" Irrigation Crossing" dwg. no. 214-215-4149, [date illegible]; USDI, Reclamation, *Designers' Operating Criteria, Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 26; Structures List, 2000.

bridge at M.P. 15.10, the deck of which measures 12 feet wide and is supported by four concrete piers (**Photograph 97**). Originally outfitted with timber handrails many Farm Bridges of this subtype have been subsequently modified by the installation of modern steel guard-railing (**Photograph 65**). A few bridges still retain their timber handrails, but these have been reinforced by the addition of modern steel guard-rails (**Photograph 66**). The timber handrails on one bridge, at M.P. 13.96, have been doubly reinforced by the addition of corrugated steel sheets and modern steel guard-railings **(Photograph 67**). There are also other bridges that do not possess any handrails, only wooden beam curbs, such as those at M.P. 85.47, 88.62, 90.91, 92.73, 95.45 (**Photograph 68**). The bridge at M.P. 93.24 has only one handrail, a modern steel guard-raid, on the upstream side (**Photograph 69**). A fire damaged bridge at M.P. 9.87, which has been cordoned off, still retains one of its original timber handrails (**Photograph 70**).

The second subtype of Farm Bridges also retain their timber decks, but they are supported by five concrete bents, square beams supported by multiple square columns. Two of these bridges, at M.P. 99.82 and M.P. 105.55, both of which were rehabilitated in 1969, measure 20-feet-wide and do not possess any handrails (**Photograph 71**). The bridge at M.P. 100.85, which measures 30-feet-wide, is outfitted with modern steel guard-rails (**Photograph 72**). The date of rehabilitation of this bridge is unknown.

The last subtype among the Farm Bridge population consists of a single Farm Bridge with replacement concrete deck and replacement concrete supports, located at M.P 98.74. The deck of this bridge is 30-feet-wide, supported by five square, multi-columned bents. It does not possess handrails of any kind (**Photograph 73**).

Operating Bridges

There are ten (10) Operating Bridges, or roughly 8.33% of all bridges included in this inventory. Operating Bridges comprise a small population of crossings for maintenance purposes, of which there are four subtypes:

- Timber Operating Bridges, totaling seven (7) or about 70.00% of this population;
- a single Concrete Operating Bridge crossing Del Puerto Creek, about 10.00%; and
- a single Siphon Crossing at Los Banos Creek, about 10.00%; and
- a single Wasteway Intake Bridge crossing the open intake channel to the O’Neill Pumping Plant, about 10.00% of this population.

The most common subtype among this population are the Timber Operating Bridges, which were designed according to similar specifications as the original timber farm and county road bridges. Located at the sites of appurtenant waterway crossings, three bridges of this subtype have 16-foot-wide timber decks, two have 20-foot-wide decks, and one has a deck 30-feet-wide (**Photograph 74, Photograph 75,** and **Photograph 76**). Individual lengths are determined by the width of the traversed waterway. A rehabilitation project from 1964-1970 replaced timber members of the decks, as needed, and replaced all timber bents with solid-type concrete piers (**Photograph 77**). All seven (7) of these bridges were rehabilitated in 1965-6. Every bridge of this subtype has replacement steel guard-railing, with the original timber railing removed at an unknown date (**Photograph 75**).[20] For a detailed discussion of the Farm Bridges’ attributes, see discussion of “Farm Bridges” above.

The single Concrete Operating Bridge is located at M.P. 37.28, where it crosses Del Puerto Creek, adjacent to the siphon at this location (**Photograph 78**). This bridge has a concrete deck supported by concrete two bents. For a detailed discussion of the Concrete Operating Bridge, see Linear Feature Record for DMC Segment 7.

Another subtype is the roadway traversing the DMC siphon at Los Banos Creek, located at M.P. 79.69 (**Photograph 79**). This structure replaced the original Timber Operating Bridge at this location which carried the O&M road over the creek and siphon. Reportedly, the timber bridge burned and was replaced with a three-barrel corrugated metal pipe (CMP) arch culvert in the

[20] USDI, Reclamation, Central Valley Project – California (CVP), “Delta Mendota Canal-Sta.3535+75, Timber Operating Bridge” dwg. no. 214-D-16002, ca. 1949; USDI, Reclamation, *Designers’ Operating Criteria, Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 26; *2020 Structures List*.

late 1970s, with additional modifications in the late-1990s and 2010s.[21] For a detailed discussion of the Los Banos Creek Siphon Crossing, see Linear Feature Record for DMC Segment 16.

The final subtype consists of a single bridge that spans the entrance to the open intake channel at M.P. 69.30, which leads to the O'Neill Pumping Plant and Reservoir (**Photograph 80** and **Photograph 81**). This bridge is concrete, and its deck measures approximately 20 feet wide x 135 feet long. It is supported by a single concrete solid-type pier in the center of the span and has metal guard-rails secured to timber posts embedded in concrete curbs. For a detailed discussion of the Wasteway Intake Operating Bridge, see Linear Feature Record for DMC Segment 13.

State Highway Bridges

State Highway Bridges comprise four (4) structures, or roughly 3.33% of all bridges included in this inventory and have no subtypes. These bridges (originally called "Highway Bridges") were designed according to AASHO standards for an H 20-S 16-44 loading, which called for concrete slab and beam construction with abutments and piers of reinforced concrete on spread footings.[22] Consequently, they feature wider roadways on average, typically measuring 26-feet-wide (**Photograph 82**). State Highway Bridges were originally designed with metal guard-rails, however, all but one State Highway Bridge at M.P. 71.31 (**Photograph 83**) has had their historic railings replaced with concrete parapets at an unknown date (**Photograph 84**). Some of the parapet walls have had metal-pipe railings or fencing added to them (**Photograph 82** and **Photograph 85**). All of the State Highway Bridges are supported by a pair of concrete solid-type piers.

Non-Original Bridge Types

The remainder of the DMC bridge population consists of 16 bridge crossings constructed after 1958 (the end of the period of significance) either to replace existing bridges or to establish a bridge crossing where there was none. This is roughly 13.34% of all bridges included in this inventory. Four (4) replacement County Highway Bridges, at M.P. 9.29, 10.28, 10.62, and 39.81, have concrete decks measuring 30-feet-wide with parapet walls, large abutments and no support piers (**Photograph 86**). The old abutments and footings of the demolished bridges are still present at these locations. Two (2) more replacement County Road Bridges, at M.P. 29.93 and 34.39, have concrete decks measuring 24-feet-wide, supported by three concrete solid-type piers, with steel guard-rails (**Photograph 87**). These two bridges were rebuilt by the County in 1965.

Also in 1965, seven (7) State Highway Bridges were built for Route 132 and Route 5, using the AASHO design standards for an H20-S16-44 loading.[23] Unlike the original State Highway Bridge design, the concrete decks of these bridges are supported by steel stringers reinforced with interior steel trusses (**Photograph 88**). On five (5) of these bridges the deck extends beyond the stringer to abutments set further back in the embankment (**Photograph 89**). The decks of these bridges measure either 26-feet-side (two spans) or 50-feet-wide (4 spans). However, the abutments bridge for Interstate 5 at M.P. 72.80 sit right next to the canal lining and the stringers are embedded in the abutments (**Photograph 90**). At another bridge for Interstate 5, at M.P. 65.89, the abutments on the right bank sit directly next to the canal and support the stringers, while on the left bank, the stringer terminates at a monolithic concrete pier, while the deck extends over the O&M road adjacent to the canal and terminates at an abutment further up the embankment (**Photograph 91**). Both of these bridges have decks measuring 39-feet-8-inches-wide. All of these State Highway Bridges have steel-pipe handrails embedded in concrete curbs.

Two (2) replacement Farm Bridges, at M.P. 102.03 and 106.58, constructed in 2014 and 2004, respectively, have concrete decks that measure 22-feet-wide and 20-feet-wide, respectively, supported by five concrete bents, with steel guard-rails (**Photograph 92**). The last replacement bridge, constructed in 1998 to replace a Timber Operating Bridge, is located at M.P. 33.29, and has a timber deck, measuring 16-feet-wide, supported by three concrete piers, with modern steel guard-rails (**Photograph 93**).

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[21] *Design Summary, Road Crossing Replacement at Los Banos Creek Check and Siphon*, 2001, 2; Google Earth
[22] USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*, 1959: 88.
[23] USDI, Reclamation, *Designer's Operating Criteria*, 1971: 26

Common Appurtenant Features

Metal cattleguards are a common appurtenant feature to the DMC Farm Bridge population. Reclamation adapted designs first employed along the Contra Costa Canal to accompany some Farm Bridges along the northern reaches of the DMC, where hilly ranchland surrounds the winding canal (**Photograph 94**). Cattle guards are simple structures, with each consisting of a shallow, concrete-lined, 12-foot x 8-foot depression in the roadway topped by a grid of steel pipe rails spaced approximately eight inches apart and secured by steel stringers. All cattle guards are flanked on either side by triangular metal sideguards (**Photograph 95**).

The other common feature among the whole DMC bridge population is pipe crossings, appended to bridges where they span the canal width. For a detailed discussion of pipe crossings, including those attached to bridge crossings, see typology discussion of "Pipe Crossings" in P3a. Description on Continuation Sheets.

Photograph 54: View of 20-foot-wide County Highway Bridge with concrete deck and solid-type concrete pier supports at M.P. 24.48 along Koster Road; camera facing downstream from left bank, May 11, 2022 (A00490).

Photograph 55: View of 30-foot-wide County Highway Bridge with concrete deck at M.P. 39.21 along Rogers Road; camera facing upstream from left bank, May 12, 2022 (B00336).

Photograph 56: Detail view of concrete bents supporting County Highway Bridge with concrete deck at M.P. 53.43 along Shiells Road; camera facing upstream from left bank, May 13, 2022 (A00979).

Photograph 57: View of 26-foot-wide County Highway Bridge with concrete deck supported by three (3) concrete bents at M.P. 105.03 in earth-lined section of DMC along Jerrold Avenue; camera facing upstream from left bank, June 14, 2022 (C0454).

Photograph 58: View of 24-foot-wide County Highway Bridge at M.P. 96.28 along McCabe Road, with three concrete piers and concrete parapet walls with metal guard-rail extensions on both ends; camera facing downstream from left bank, June 13, 2022 (C0178).

Photograph 59: Deck of Wasteway bridge at Newman Wasteway forebay, M.P. 54.38; camera facing downstream on left bank, May 13, 2022 (A00988).

Photograph 60: View of chain-link fence and metal-pipe handrails on Firebaugh Wasteway bridge at M.P. 111.22, as well as central pier and left abutment/wall of forebay; camera facing southwest, June 14, 2022 (C0485).

Photograph 61: View of County Highway Bridge with timber deck supported by three concrete piers at M.P. 72.33 along Hilldale Avenue; camera facing downstream from left bank, June 14, 2022 (C0243).

Photograph 62: View of Blewett Road crossing the DMC siphon at M.P. 23.99; camera facing upstream from left bank, May 11, 2022 (A00475).

Photograph 63: View of State Highway 33 crossing the DMC siphon at M.P. 110.99; camera facing upstream from left bank, June 14, 2022 (C0479).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by:** H. Norby, A. Lawton, & A. Young   ***Date:** May - June, 2022   ☒ Continuation ☐ Update

Photograph 64: View of County Highway Bridge with concrete deck supported by timber bents, at M.P. 0.33 along Lindemann Road, next to the Tracy Fish Facility; camera facing upstream from left bank, May 9, 2022 (A00158).

Photograph 65: View of Farm Bridge at M.P. 12.31 with 16-foot-wide timber-deck, replacement concrete piers, and modern steel guard-rails; camera facing upstream from left bank, May 10, 2022 (A00365).

Photograph 66: Detail view Farm bridge with timber deck at M.P. 5.67, with its original timber handrails reinforced by the addition of modern steel guard-rails; camera facing west from the left bank, May 9, 2022 (A00232).

Photograph 67: Detail view of Farm Bridge with timber deck at M.P. 13.96, with its original timber handrails reinforced by the addition of corrugated steel sheets and modern steel guard-railings; camera facing southwest from left bank, May 10, 2022 (A00397).

Photograph 68: View of Farm Bridge with timber deck at M.P. 85.47, where original timber handrails have been removed and not replaced; camera facing downstream from left bank, June 14, 2022 (C0338).

Photograph 69: : View of Farm Bridge with timber deck at M.P. 93.24 which has only one modern steel guard-rail on the upstream side, but no handrail on the downstream side; camera facing downstream from left bank, June 14, 2022 (C0384).

Photograph 70: View of fire-damaged Farm Bridge at M.P. 9.87, with timber deck and timber railing on upstream side; camera facing southwest from left bank, May 9, 2022 (A00297).

Photograph 71: View of 20-foot-wide Farm Bridge at M.P. 99.82, with original timber deck supported by five replacement concrete bents, with no handrails; camera facing downstream from left bank, June 14, 2022 (C0428).

Photograph 72: View of 30-foot-wide Farm Bridge at M.P. 100.85, with original timber deck supported by five replacement concrete bents, with modern steel guard-rails; camera facing downstream from left bank, June 14, 2022 (C0436).

Photograph 73: View of 30-foot-wide Farm Bridge at M.P. 98.74, with replacement concrete deck supported by five replacement concrete bents, with no handrails; camera facing downstream from left bank, June 14, 2022 (C0422).

Photograph 74: View of 16-foot wide Timber Operating Bridge at M.P. 16.65 along with replacement concrete piers and modern steel guard-rails; camera facing upstream from left bank, May 10, 2022 (B00007).

Photograph 75: Detail view of Timber Operating Bridge with 20-foot-wide deck at M.P. 34.89, with modern steel guard-rails; camera facing west from left bank, May 12, 2022 (A00807)

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
CONTINUATION SHEET

Primary # ______
HRI # ______
Trinomial ______

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby, A. Lawton, & A. Young *Date: May - June, 2022 ☒ Continuation ☐ Update

Photograph 76: Detail view of Timber Operating Bridge with 30-foot-wide deck at M.P. 36.81, with steel guard-rails; camera facing west from left bank, May 12, 2022 (B00226).

Photograph 77: Detail view of replacement concrete piers on Timber Operating Bridge at M.P. 36.81; camera facing southwest from left bank, January 16, 1948 (B00225).

Photograph 78: View of Concrete Operating Bridge at M.P. 37.28 crossing over the Del Puerto Creek culvert; camera facing south from left bank, May 12, 2022 (B00257).

Photograph 79: View of Operating Bridge roadway traversing DMC siphon at Los Banos Creek, M.P. 79.69 along Raines Road; camera facing downstream from left bank, June 14, 2022 (C0280).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by:** H. Norby, A. Lawton, & A. Young *Date: May - June, 2022 ☒ Continuation ☐ Update

Photograph 80: View of open O'Neill forebay intake channel with bridge crossing it at M.P. 69.30; camera facing right bank from left bank, June 13, 2022 (C0189)

Photograph 81: View of bridge across open O'Neill forebay intake channel at M.P. 69.30; camera facing right bank from left bank, June 13, 2022 (C0190).

Photograph 82: View of 26-foot-wide State Highway Bridge at M.P. 6.6 along Old Highway 50, with replacement parapet walls with additional metal-pipe railing on top; camera facing upstream from left bank, May 9, 2022 (A00245).

Photograph 83: View of State Highway Bridge at M.P. 71.31 along Jensen Road / State Route 207, with original steel guard-railing; camera facing downstream from left bank, June 13, 2022 (C0210).

Photograph 84: View of State Highway Bridge at M.P. 75.84 along State Highway 152, with replacement concrete parapet walls; camera facing upstream from left bank, June 13, 2022 (D2237).

Photograph 85: Detail view of State Highway Bridge at M.P. 7.67 along Interstate 205, with replacement concrete parapet walls with additional metal fencing on top; camera facing downstream from left bank, May 9, 2022 (A00261).

Photograph 86: View of replacement County Highway Bridge at M.P. 9.29, along International Parkway, with 30-foot-wide concrete deck, original piers and abutments visible just upstream of current bridge; camera facing downstream from left bank, May 9, 2022 (A00287).

Photograph 87: View of replacement County Road Bridge at M.P. 29.93, along McCracken Road, with 24-foot-wide concrete deck, supported by three concrete solid-type piers, and steel guard-railing; camera facing upstream from left bank, May 11, 2022 (A00612).

Photograph 88: Detail view of steel stringers and interior trusses on non-original (post-1958) State Highway Bridge at M.P. 22.73, along State Highway 5 Northbound; camera facing south from left bank, May 10, 2022 (B00165).

Photograph 89: View of non-original (post-1958) State Highway Bridge at M.P. 22.73, along State Highway 5 Northbound, with 50-foot-wide concrete deck supported by a steel stringer strung between two monolithic concrete piers, abutments further back in embankment; camera facing downstream from left bank, May 10, 2022 (B00162).

Photograph 90: View of non-original (post-1958) State Highway Bridge at M.P. 72.8, along Interstate 5 Westbound, 39-foot-8-inch-wide concrete deck on steel stringer strung directly between abutments; camera facing upstream from left bank, June 15, 2022 (D2206).

Photograph 91: View of non-original (post-1958) State Highway Bridge at M.P. 65.89, along Interstate 5, with steel stringers strung between the abutment on the right bank and a monolithic concrete pier on the left bank, while the deck extends over the O&M road adjacent to the canal and terminates at an abutment further up the embankment; camera facing upstream from left bank, June 13, 2022 (C0164).

Photograph 92: View of replacement Farm Bridge built in 2004 at M.P. 106.58, with 20-foot-wide concrete deck, supported by five concrete bents; camera facing downstream from left bank, June 14, 2022 (C0460).

Photograph 93: View of replacement Timber Operating Bridge, constructed in 1998, at M.P. 33.29, with a 16-foot-wide timber deck supported by three concrete piers, with steel guard-rails; camera facing downstream from left bank, May 11, 2022 (A00684).

Photograph 94: View of cattle guards (left) adjacent to Farm Bridge (right) at M.P. 13.96; camera facing downstream on left bank, May 10, 2022 (A00396).

Photograph 95: Detail view of cattle guard adjacent to Farm Bridge at M.P. 50.53; camera facing downstream on left bank, May 13, 2022 (A00927).

Pipe Crossings

The DMC currently includes 67 pipe crossings distributed throughout its span.[24] Pipe crossings transport or divert irrigation water, natural gas, oil, and fuel. The following typology discussion does not attempt to provide an exhaustive inventory of DMC pipe crossings, but rather to give an overview of the historic and modern structural types and subtypes as observed during the current survey recordation and as compared with the historical record.

[24] The DMC Structures List refers to pipe crossings as either irrigation crossings and utility crossings.

The original population of pipe crossings was principally comprised of thin-walled steel pipes ranging from 4 to 20 inches in diameter that moved irrigation water over the canal (**Photograph 96**). This population was originally referred to as irrigation crossings. Most are mounted on support piers rising from the canal, but some are mounted atop check structures or along the sides of bridges (**Photograph 97**). Typically, they consist of a single pipe but a few triple-pipe irrigation crossings span the DMC (**Photograph 98**). Additional pipe crossings for moving natural gas, oil, and fuel were installed either during or after the initial period of construction. This varying population was originally referred to as utility crossings. They, too, principally consist of steel pipes ranging from 18 to 26 inches (**Photograph 99**), and most are mounted on support piers rising from the canal while some are mounted within steel truss structures (**Photograph 100 - Photograph 101**).[25]

Since its initial construction, the population of DMC pipe crossings has been modified by the addition of both metal and PVC pipes. All PVC pipe crossings were added at various dates and are typically attached to bridge curbs. Modern metal pipe crossings were added at various dates after the initial period of construction and typically follow Reclamation's original design specifications.

Photograph 96: Irrigation crossing at M.P. 101.27 (left), shown alongside a well discharge (right); camera facing right bank from left bank, June 14, 2022 (C0439).

Photograph 97: Irrigation crossing attached to the downstream side of bridge at M.P. 15.10; camera facing upstream from left bank, May 10, 2022 (A00426).

[25] Bureau of Reclamation, *Delta-Mendota Canal: Technical Record of Design and Construction* (Denver, Colorado: Central Valley Project – California, June 1959), 74, 77-78; Bureau of Reclamation, "16" Irrigation Pipe Crossing," specification, on file at Reclamation Design Construction Library (1949).

Photograph 98: Triple-pipe irrigation crossing at M.P. 90.57 (right); camera facing right bank from left bank, June 14, 2022 (C0370).

Photograph 99: Two oil utility crossings at M.P. 16.78; camera facing right bank from left bank, May 10, 2022 (B00009).

Photograph 100 Modern, high pressure oil utility crossing at M.P. 71.59; camera facing downstream from left bank, June 14, 2022 (C0237).

Photograph 101: Modern, gas utility crossing at M.P. 71.69, with abandoned oil utility crossing in the foreground; camera facing downstream from left bank, June 14, 2022 (C0238).

Siphon Undercrossings

There are 28 identified siphon undercrossings distributed throughout the DMC. Siphon undercrossings convey natural drainage channels and preexisting water courses underneath the DMC. All siphon undercrossings inventoried here, originally called "siphon crossings" in the *Delta-Mendota Canal Technical Record of Design and Construction* and alternately called "culvert crossings" or "siphon crossings" in the Delta-Mendota Canal Structures List, use gravity to carry established irrigation water conveyances under the canal. See

Table 7 for an inventory of the geographic distribution of siphon undercrossings as sorted by JRP-designated DMC segment numbers.

Table 7: Geographic Distribution of DMC Siphon Undercrossings

DMC Segment No.	Siphon Undercrossing Totals	Percent of Totals
1	5	17.9%
2	1	3.6%
3	0	--
4	0	--
5	0	--
6	1	3.6%
7	0	--
8	1	3.6%
9	1	3.6%
10	2	7.1%
11	3	10.7%
12	0	--
13	2	7.1%
14	2	7.1%
15	0	--
16	0	--
17	0	--
18	0	--
19	6	21.4%
20	4	14.3%
21	0	--
22	0	--
Total	**28**	**100%**

While individual siphon undercrossing lengths and slopes are principally determined by the surrounding topography, their standard designs are generally uniform, with only slight dimensional or structural variation. All the siphon undercrossings inventoried here are either steel pipes encased in concrete, concrete pipes, or reinforced concrete-box siphons that include one, two, or three barrels. The inlets and outlets of the concrete-box siphons are framed by concrete wingwalls, which may consist of either flat or curved walls with angled transitions back to the watercourse (**Photograph 102 - Photograph 103**). The dimensions of the siphon inlets and outlets are likewise determined by the surrounding topography as well as the hydrological properties of the water source being conveyed, with greater water volume necessitating large siphons.[26]

[26] Bureau of Reclamation, *Delta-Mendota Canal: Technical Record of Design and Construction*, 74, 78-79.

Photograph 102: Two-barrel siphon undercrossing outlet at M.P. 45.75 (left); camera facing southeast, May 12, 2022 (B00475).

Photograph 103: Three-barrel siphon undercrossing outlet at M.P. 30.63; camera facing south, May 11, 2022 (A00633).

Culverts

There are 32 identified culverts distributed throughout the DMC. Culverts, along with wash overchutes and drainage inlets, convey natural drainage channels and preexisting water courses underneath the canal. See

Table 8 for an inventory of the geographic distribution of culverts as sorted by DMC segments recorded on Linear Feature Records below.[27]

Table 8: Geographic Distribution of DMC Culverts

DMC Segment No.	Culvert Totals	Percent of Total
1	7	21.87%
2	2	6.25%
3	0	--
4	0	--
5	0	--
6	1	3.12%
7	0	--
8	1	3.12%
9	1	3.12%
10	2	6.25%
11	3	9.38%
12	0	--
13	2	6.25%
14	3	9.38%
15	0	--
16	0	--

[27] Most of the culverts inventoried here were heavily obscured by vegetative overgrowth or otherwise inaccessible from the FKC embankments at the time of recordation. Structural information was chiefly derived from engineering drawings, final reports, and structures inventories.

17	0	--
18	0	--
19	6	18.76%
20	4	12.50%
21	0	--
22	0	--
Total:	**32**	**100%**

While individual culvert lengths and slopes are principally determined by the surrounding topography, their basic designs are generally uniform, with only slight dimensional or structural variation. All of the culverts inventoried here are reinforced concrete box culverts with cutoff collars, which were historically constructed to include one, two, or three barrels (**Photograph 104**). The number of barrels and the dimensions of the box culvert inlets and outlets are likewise determined by the surrounding topography as well as the hydrological properties of the water source being conveyed, with greater hydro volume necessitating large, multi-barreled culverts. Inlets and outlets are framed by concrete wingwalls, which may consist of either flat walls that extend at right angles or curved walls with angled transitions back to the conveyed watercourse.[28]

Photograph 104: Culvert channeling the O'Neill Forebay Wasteway beneath the DMC at M.P. 69.62; camera facing northwest, June 13, 2022 (C0214).

Well Discharges

There are dozens of well discharges along DMC, concentrated primarily in segments 18 to 21. They are all very similar in appearance and consist of metal pipes projecting from the canal wall with an upward bend at its outlet. They are all modern additions.

[28] Bureau of Reclamation, *Delta-Mendota Canal: Technical Record of Design and Construction*, 78.

Photograph 105: Well discharge at M.P. 90.39; camera facing right bank from left bank, June 14, 2022 (C0364).

DMC Signs

There are 6 signs along DMC, typically adjacent to major roadways (**Photograph 106**). They are all very similar in appearance and are either single or double sided, constructed of horizontal wood planks affixed to square wood posts.

Photograph 106: Delta-Mendota Canal, Central Valley Project sign at M.P. 1.41; camera facing west, May 9, 2022 (A00152).

B9b. Builder (continued):

Builder	Canal Segment(s)	Completion Date	Description of Work
Hubert H. Everist, Sr.	M.P. 27.00 – 39.88	November 13, 1948	Earthwork, concrete lining, and structures and Westley wasteway
Morrison-Knudsen Co., Inc., / M. H. Hasler	M.P. 3.51 – 13.66	March 9, 1949	Earthwork, concrete lining, and structures

Morrison-Knudsen Co., Inc. / M. H. Hasler	M.P. 13.66 – 27.00	August 31, 1950	Earthwork, concrete lining, and structures
Hubert H. Everist, Sr.	M.P. 39.88 – 54.45		Earthwork, concrete lining, and structures, and timber operating bridge
Western Contracting Corp.	M.P. 54.43 – 70.04	July 5, 1951	Earthwork, concrete lining, and structures
Morrison-Knudsen Co., Inc./ M.H. Hasler	M.P. 70.04 – 90.54	July 8, 1951	Earthwork, concrete lining, and structures
Morrison-Knudsen Co., Inc./ M.H. Hasler	M.P. 90.54 – 98.64	July 5, 1951	Earthwork, concrete lining, and structures
United Concrete Pipe Corp., and Vinnell Co., Inc.	M.P. 98.64 – 116.59	November 30, 1951	Earthwork and structures, Delta Mendota Canal, and Firebaugh wasteway
A. Teichert and Sons, Inc.	M.P. 0.03 – 1.48	October 27, 1951	Newman wasteway
United Concrete Pipe Corp., and Vinnell Co., Inc.	M.P. 1.48 – 8.20 M.P. 0.027 – 2.81	November 3, 1951	Newman wasteway, earthwork, concrete lining and structures, and service lateral
Western Contracting Corp.	M.P. 0.06 – 11.88	April 9, 1952	San Luis wasteway and holding reservoir dike
Johnson Western Constructors			Columbia Pumping Plant No. 1, Mowry Pumping Plant and delivery systems
Plainview Water District/ Stolte, Inc.		1954	Earthwork, pipelines, and structures including pumping plants, laterals 8.7 to 20.0, inclusive, and sublaterals
Crest Contracting Co.	M.P. 58.18 - 96.62		Pump turnouts
Hubert Sykes	M.P. 12.99 – 25.88		Furnishing, hauling and placing gravel
E.A. Pollard			Erection of right-of-way fence
M.J. Ruddy and Son	M.P. 3.50 – 14.96 M.P. 17.99 – 24.02 M.P. 12.29 – 13.05		Furnishing or processing, hauling and placing gravel
H. Sykes	M.P. 25.80 – 36.56 M.P. 38.16 – 40.72		Furnishing or processing, hauling and placing gravel
Claude C. Wood Co.			Furnishing or processing, hauling and placing gravel

B10. Significance (continued):

Historic Context

When viewing a topographic map of California, one particularly outstanding geographic feature presents itself above all others: an immense oblong alluvial plain in the interior of the state that extends nearly 500 miles from north to south and varies from about 60 to 100 miles in width (Figure 1). This Great Central Valley Basin occupies more than one-third of the entire state. It covers 18,810 square miles and is bounded on the east by a pair of formidable mountain ranges and on the west by a less imposing coastal mountain range. The valley itself contains three major drainage areas. The northern one-third is drained by the southerly flowing Sacramento River and its tributaries. The Sacramento is the longest river in the state and the largest, contributing about one-third of the total outflow of all river systems in the state. The southern and largest portion of the valley is drained by the San Joaquin River and its tributaries. The San Joaquin River flows west and north and drains a larger, but much more arid region. The two major rivers converge in the "Sacramento-San Joaquin Delta," a 153 square-mile labyrinth of reclaimed tule islands, river channels, and sloughs. The Delta also receives freshwater inflows directly from other rivers draining the imposing central region of the Sierra Nevada range to the east. These watercourses include the Cosumnes, Mokelumne and Calaveras rivers along with numerous other minor rivers and creeks. The flow from all of these waterways move westerly through the Delta, entering Suisun Bay and, together with the Sacramento and San Joaquin rivers, flow through Carquinez Straits into San Francisco Bay, a salt water tidal basin, and ultimately through the Golden Gate into the Pacific Ocean.

California's water supply and development challenges stretch back to the mid-nineteenth century gold rush decade when gold miners in the mountains and foothills of the Sierra Nevada began diverting water from streams to expose placer deposits in streambeds and to process gold using a variety of hydraulic methods. The gold rush caused many significant changes in riverine ecosystems of the Central Valley. Hydraulic mining destroyed miles of riparian vegetation and habitat. Debris formed sandbars in streams, impaired navigation, and elevated riverbeds leading to massive flooding and destruction of thousands of acres of agricultural land, while in the mountains and foothills the hydraulic giants left behind barren amphitheaters and miles of waste tailings. Nevertheless, mining remained the most important economic use of water in California for some three decades following the mass migration of gold miners from around the world to California starting in 1849.[29]

Even during the height of the gold rush, some Californians already had begun to dream of converting the Central Valley into an agrarian wonderland. The Central Valley was a phenomenally rich and broad alluvial plain and was destined to become the state's most productive agricultural center. It was watered by streams flowing from the Sierra Nevada on the east and the coastal ranges on the west, but water was in short supply when needed the most during the rainless summer growing season. As a result, during the gold rush decade, open range grazing of sheep and cattle remained the principal land use on the natural pasture lands of the Great Central Valley.

In the middle to late 1860s, wheat culture emerged as an increasingly prominent land use and contributed to the decline, and later demise, of the open range cattle industry in the Central Valley in the ensuing decades. When planted in the fall and harvested in the spring, winter wheat and barley were two of only a handful of crops that could be successfully raised in the Central Valley without irrigation. All that was needed was access to a navigable stream or a railroad line to ship the grain to market and intermittent rainfall from November through April. In the San Joaquin Valley fifteen inches of rain produced bumper crops, although ten inches, if properly distributed, was enough to yield an acceptable harvest. The Great Valley offered rich, flat land that required little preparation, and grain farmers needed little farming experience because wheat or barley was easy to plant and virtually took care of itself. In many cases, grain farming did not even require a house, barn, or quarters. A remarkably diverse group of migrant workers, including down on their luck miners, performed the greatest portion of the required agricultural work. They were needed for only a span of three or four weeks during winter plowing and sowing and again in the summer for threshing and harvest. Most of these workers packed the necessities of life in a bindle and drifted between farms and agricultural districts. The wheat barons themselves mostly resided in the state's urban centers – Sacramento, Stockton, Oakland, and San Francisco – and left the comfort of their homes and families only to supervise the annual harvest or planting.[30]

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[29] Robert Kelley, *Gold vs. Grain: The Hydraulic Mining Controversy in California's Sacramento Valley* (Glendale, CA: Greenwood Press, 1979).

[30] Richard Allen Eigenheer, "Early Perceptions of Agricultural Resources in the Central Valley of California" (PhD dissertation in Social Geography, University of California, Davis, 1976), 325-349; David Igler, *Industrial Cowboys: Miller & Lux and the Transformation of the Far West, 1850-1920* (Berkeley: University of California Press, 2001); Richard S. Street, *Beasts of the Field: A Narrative History of California Farmworkers, 1769-1913* (Stanford, California: Stanford University Press, 2004), 89-177.

Land speculators like E. H. Miller, George D. Roberts, William S. Chapman, Isaac Friedlander, Miller & Lux, and a host of others used generous federal and state land laws to monopolize land ownership in the Central Valley. For about three decades wheat was king in the valley, but its reign ended abruptly in the 1890s. Historians have identified numerous factors that explain the sharp decline of the California wheat industry, among them increasing competition in the international wheat market, soil exhaustion, new superior varieties of wheat, the increasing value of farmland devoted to irrigation and horticulture, and growing opposition to "land monopoly."[31]

As wheat production declined, farmers turned increasingly to irrigated crops. Irrigation grew steadily in California from 60,000 acres in 1860 to nearly 400,000 acres in 1880, and by the early years of the twentieth century it had become the dominant feature of California's agriculture with more than 2,644,000 acres under irrigation.[32] The Central Valley developed a virtual monopoly on several irrigated crops: cotton in the arid southern portion of the San Joaquin Valley; rice in the clay soils of the trough lands of the Sacramento Valley; vineyards or orchards on the alluvial fans on the east side of the Great Valley where water was accessible; truck crops in the Delta peat soils; grapes in eastern Fresno County and nuts and olives in the Sacramento Valley; and orange groves occupied the sheltered coves on alluvial fans up and down the eastern edge of the Great Valley.[33]

The greatest problems with agriculture in the Central Valley were two-fold: the regional unevenness of water supply and the Mediterranean-type of climate characterized by prolonged dry summers that required irrigation of summer maturing crops. The San Joaquin Valley has a hot desert climate, accentuated near the southern end, where there is a mean annual precipitation of less than five inches. Northward, rainfall increases through a transitional zone to a Mediterranean climate in the Sacramento Valley with hot summers. Exposed to cooling summer west winds through Carquinez Straits, the Delta has a cooler Mediterranean climate. A decrease in rainfall from north to south is also a prevailing condition of climate in California and this differential is exaggerated in the Central Valley. A rain shadow is also associated with the Coast Ranges, resulting in the eastern margins of the valley receiving on average 50 percent more precipitation than the west side of the valley. The regional distribution of streamflow is even more unequal because of the high elevation and long slope of the Sierra Nevada on the east side of the valley compared to the short slope of the lower Coast Ranges on the west side. These factors make it imperative that any valley-wide plan for irrigation development needed to store surplus winter water and make it available in the summer months, and that surplus northern and eastern water needed to be made available for use in the southern and western portions of the valley, if irrigation of irrigable land was to be maximized in the Central Valley.[34]

Irrigation developed initially in the Central Valley under private initiative and financing, using the natural flow of local streams. These early projects were concerned with relatively small tracts of land and not with the valley, or even an entire watershed, as a unit. In general, irrigation grew earlier and was more extensive in the southern portion of the San Joaquin Valley where growing crops without the benefits of irrigation was more tenuous. Settlers along the south bank of the Merced River began to irrigate alfalfa land, vineyards, and orchards in the vicinity of Snelling in the early 1850s. Ditches on Mill Creek and the Kaweah River irrigated grain fields and gardens as early as 1853. Settlers along the Tule River constructed several small ditches between 1859 and 1865. Once the Southern Pacific Railroad laid its tracks down the east side of the San Joaquin Valley in the early 1870s more extensive irrigation development ensued and company officials became avid promoters of irrigation as an essential component of economic development and land subdivision. The first large regional diversion project to be constructed was the San Joaquin and Kings River Canal (1871) that ran northwest from the bend of the San

[31] Eigenheer, "Early Perceptions of Agricultural Resources in the Central Valley of California," 325-349; Igler, *Industrial Cowboys*, 60-91; William L. Preston, *Vanishing Landscapes: Land and Life in the Tulare Lake Basin* (Berkeley: University of California Press, 1981), 85-120.

[32] Harding, *Water in California*, 80; Donald J. Pisani, *From the Family Farm to Agribusiness: The Irrigation Crusade in California and the West, 1850-1931* (Berkeley: University of California Press, 1984), 54-77.

[33] Joseph A. McGowan, *History of the Sacramento Valley*, 3 vols. (New York: Lewis Publishing Company,1961); J. J. Haley, "California's Change to Irrigation from Dry Farming," *Western Construction News*, 3 (February 1928): 83-84; William Reich, "King Cotton in California," *Land* 9 (Spring 1950): 65-71; William S. Richards, "Geographical Aspects of Rice Cultivation in California" (M.A. thesis, University of California, Berkeley, 1969).

[34] Peveril Meigs, "Water Planning in the Great Central Valley, California," *Geographical Review* 29, no. 2 (April 1939): 252-273.

Joaquin River where it turns northward. The plan included subsequent construction phases that would extend the canal to Suisun Bay and utilize Tulare Lake as a reservoir connecting to the canal by way of Fresno Slough. Just a few years later Charles Crocker, one of the founders of the Central Pacific Railroad that built the western portion of the transcontinental railroad, invested his private capital in the Crocker-Huffman Land & Water Company's irrigation and land subdivision project utilizing water from the Merced River to irrigate more than 20,000 acres in the vicinity of the town of Merced. In 1880 when State Engineer William Hammond Hall conducted the first statewide irrigation survey in California, it showed that the San Joaquin Valley with 188,000 acres was the most heavily irrigated region of the state with forty-seven percent of the irrigated acreage statewide. In contrast, the wetter Sacramento Valley remained mostly dry farmed with only 13,400 acres irrigated.[35]

Irrigation in the San Joaquin Valley proceeded under many forms of organization using surface water supplies flowing in creeks and rivers, artesian waters, and groundwater. While irrigation was achieved on a small scale within land colonies organized by land speculators, large areas of land were also amassed within former Mexican-era land grants, as swamp and overflowed land, railroad grant land, by use of land script, and a host of other methods under the public land laws. In the 1870s and 1880s, private irrigation companies developed the San Joaquin and Kings River Canal along San Joaquin River, along with canals diverting water from the Kern, Kings, and Merced rivers. The companies that succeeded in delivering water to farmers frequently did so at the price of creating unpopular land and water monopolies. Some farmers, with the encouragement of private canal companies, experimented with creation of "mutual water companies," owned by the farmers themselves who raised money and acquired rights to use water through the purchase of company "stock."[36]

Private irrigation companies enjoyed only limited success during the latter decades of the nineteenth century and the largest projects undertaken inevitably failed. These institutional efforts at planning and financing irrigation projects fell into four general categories: private water companies; land colonies, mutual water companies, and irrigation districts.[37] The economic turmoil of the era and high rate of failure of these irrigation efforts helped popularize other institutional alternatives, including a proposal for a unique unified, coordinated, and centralized canal network designed to be built and operated by the state. Efforts by private investors to build mammoth irrigation schemes such as the San Joaquin and Kings River Canal aroused the interest of Congress and in 1873 an act was passed directing the War Department to appoint an investigating committee to examine irrigation. "The Alexander Commission," led by Lieutenant Barton Stone Alexander, an U.S. Army Engineer, was organized in 1873 to conduct the first federally funded irrigation survey and plan for coordinated irrigation development of the Central Valley. This federal irrigation commission carried out what State Engineer Edward Hyatt, "father of the State Water Project," later called "one of the earliest attempts at water resources planning on a regional scale." As detailed surveys were lacking, the report was a mere sketch of a development plan. However, the first state water agency, the State Engineers Office under William Hammond Hall, labored from 1878 to 1888 to implement many of the basic recommendations suggested by the Alexander Commission.[38]

The Alexander Commission's federal irrigation survey was grossly underfunded and was conducted over a scant six weeks in the field, but the report contained much valuable information and captured the imagination of future generations of water resources planners in California. The Commission predicted that 8.5 million acres could be irrigated in the Central Valley and 12 million if the low foothills surrounding the valley were included. The Commission proposed a complex network of canals.

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[35] William Hammond Hall, *The Irrigation Question in California: Appendix to the Report of the State Engineer to His Excellency George C. Perkins, Governor of California* (Sacramento: California State Printing Office, 1881).

[36] Harding, *Water in California*, 79-83; JRP Historical Consulting Services and California Department of Transportation, *Water Conveyance Systems in California: Historic Context Development and Evaluation Procedures* (Sacramento: California Department of Transportation Environmental Program, Cultural Studies Office, December 2000), 8-15.

[37] Of these institutional models, the quasi-public irrigation district proved the most successful in development of large-scale irrigated tracts in California, but only a few of the irrigation districts organized under the original Wright Act of 1887 survived into the twentieth century. Changes in irrigation district law in 1911, gave these districts greater financial stability and irrigation districts had much greater success in the twentieth century.

[38] Edward Hyatt, "National Broadcast on California Agricultural Programs, Under the Auspices of the State Grange, NBC Studios, San Francisco, November 10, 1939," Edward Hyatt Papers 2, Water Resources Collection and Archives, University of California, Riverside.

On the west side of the Central Valley, a north-south canal was suggested leaving the Sacramento River near Red Bluff, following the foot of the Coast Range to Fairfield with several west-east laterals irrigating land as it passed through Yolo County. From Antioch, the canal was to run south along the west side of the San Joaquin Valley connecting to Tulare, Buena Vista, and Kern lakes, three natural bodies of water fed by creeks, sloughs and rivers in Tulare and Kern counties. Because of the many streams flowing out of the Sierra Nevada, the commission did not favor a continuous canal down the east side of the Central Valley as the cost of siphons or aqueducts to bridge these streams was prohibitive. The report also paid little attention to construction of storage reservoirs, but did advocate damming many westerly flowing Sierra streams to raise water over the river bank into east-west distribution ditches running across the valley floor.

Because of the state's limited population and tax base, the Alexander Commission predicted that progress toward full construction of the massive water project would undoubtedly proceed at a slow pace and that it might take as long as 50 years to achieve full implementation. In other respects, the report was also prescient. The commissioners predicted that water conflicts would occur and require settlement before construction of any comprehensive water system and that the state needed to institute legal mechanisms to regulate the acquisition and distribution of water; that farmers be limited to "reasonable use" to reduce water waste; that drainage canals accompany construction of irrigation canals; and that a topographic and hydrologic survey precede adoption of a system of reclamation for the Central Valley. Finally, the Commission was prophetic in recognizing the fundamental principal behind the future State Water Project proposed in the late 1920s and the CVP launched by the federal government in the 1930s -- the need to transfer water from the water rich Sacramento Valley to the water deficient San Joaquin Valley.[39]

At the state level, the California legislature passed an act in 1878 providing for investigation regarding irrigation and appointment of a State Engineer. William Hammond Hall, another former officer in the U.S. Army Engineering Corps with experience as a hydrographer, draftsman and field engineer, was appointed California's first State Engineer. Over the next decade, Hall proposed an increasingly activist stance by the state in navigation improvement projects, flood control, water storage, irrigation and drainage, compilation of statewide data on rainfall and streamflow, public ownership and control of navigable waterways, and proposed regional and statewide water planning for development of water resources. In 1880, Hall published a report on the subject of irrigation that described the principal irrigation districts of the state and made recommendations on legislation to promote irrigation development in California, including recommendations for an "irrigation district bill." Hall also prepared the first detailed map of the Central Valley (like the later one shown in Figure 1) depicting every stream correctly located, the topography of adjacent foothills, and the slope and fall of the plains where irrigation would occur. He also prepared a more detailed map of the San Joaquin Valley in ten sheets displaying every ditch and irrigation canal in the San Joaquin Valley and the extent of actual irrigation.[40]

Hall was reappointed four times as State Engineer serving until his resignation in 1889 when he was appointed Supervising Engineer of the United States Irrigation Investigation (predecessor of Reclamation), within the U.S. Geological Survey. The U.S. Geological Survey carried on the vital work of stream gauging and topographic mapping in the Central Valley. Following Hall's departure, Robert B. Marshall, an experienced California geographer, became the chief champion of a statewide water program during the late nineteenth and early twentieth centuries. Marshall outlined a plan for the coordinated development of the Central Valley with a series of dams, canals, and aqueducts to bring water to twelve million acres of land. Marshall was

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[39] B. S. Alexander, C. H. Mendell, and George Davidson, *Report of the Board of Commissioners on the Irrigation of the San Joaquin, Tulare, and Sacramento Valleys of the State of California,* House Executive Document No. 290, 43rd Cong. 1st Sess. (serial no. 1615) (Washington, D.C.: Government Printing Office, 1874), 16-38; Pisani, *From the Family Farm to Agribusiness,* 102-128; W. Turrentine Jackson, Rand F. Herbert, and Stephen R. Wee, "Introduction," *Engineers and irrigation: Report of the Board of Commissioners on the Irrigation of the San Joaquin, Tulare, and Sacramento Valleys of the State of California, 1873: Engineer Historical Studies No. 5* (Fort Belvoir, Virginia: Office of History, U.S. Army Corps of Engineers, 1990), 1-36.

[40] William Hammond Hall, "Statement of William H. Hall of the U.S. Geological Survey, Supervising Engineer for the Pacific Coast, U.S. Irrigation Survey," Report of the Special Committee of the U.S. Senate on the Irrigation and Reclamation of Arid Lands: Report of Committee and Views of the Minority, 51st Cong., 1st Sess., Senate Report No. 928 (Washington, D.C.: Government Printing Office, 1890), 208-220.

determined to submit a plan that demonstrated its feasibility from an engineering perspective and spent twenty-five years perfecting his comprehensive state water development plan, gathering survey data and mapping proposed canals and reservoir locations.

Marshall arrived in California in 1891 and surveyed continuously in the state for the U.S. Geological Survey until 1903 when he was given administrative charge of topographic work in California. His duties spread to other arid western states working on proposed reclamation projects in Arizona, Oregon, Nevada, Washington, Idaho, and Utah. By 1908, at age 40, he had reached the pinnacle of his profession being appointed Chief Geographer in charge of the Topographic Branch of the U.S. Geological Survey with administrative charge of the entire United States. For years he directed the expenditures of the United States government in its geological surveys of California methodically putting together a plan of construction for his proposed system of canals and reservoir sites. Working co-operatively with the State of California, the U.S. Geological Survey, under Marshall's guidance, precisely mapped the Sacramento and San Joaquin valleys, co-operatively gauged streams, made profiles, and surveyed reservoir sites along the larger principal streams of the state, gathering all the field data necessary to begin the construction work. In the fall of 1919, he announced the main outlines of his one great comprehensive plan for statewide water development, including reclamation of the Central Valley of California:

From a high dam to be built across the Sacramento River near Red Bluff water will be carried in large canals down each side of the Sacramento Valley and thence up each side of the San Joaquin Valley. These main canals will operate by gravity, siphons, or pumps, or through tunnels. . . . On the main West Side Canal . . . a large supply will be diverted for the use of the "San Francisco and Bay Cities Unit.". . . The main East Side Canal will be twice dropped and twice again started at new and higher levels on the east side of the San Joaquin Valley. . . . Separate in construction and operation from the two Valley of California Systems as above referred to, but necessarily co-operative in a State-wide sense, is a third system . . . "the Los Angeles unit." This system must always be dependent upon the Kern River, which will be diverted through a long tunnel for use in southern California. To offset the diversion of the Kern River waters from the San Joaquin Valley the Klamath River will be diverted below Klamath Falls and carried into the upper Sacramento River near Shasta Springs. Above all these grand canals the tributary streams will be drawn upon through reservoirs, to be built along their courses, and further flexibility of the total flow will be provided by additional storage below the canals.[41]

California and planning for irrigation therein changed greatly during the first decades of the twentieth century. Growing migration into the state brought increased tax revenue and an expanded political bureaucracy. Having suffered the effects of a succession of drought years from 1917-1920, California state government exhibited an interest in comprehensive water planning. In 1921, the governor directed the State Engineer to come up with a statewide water management proposal addressing conservation, flood control, storage, distribution, and uses for California water and an estimated cost for implementation of the plan. The legislature appropriated funds to investigate a statewide water resources development and management plan. While the initial report was completed in 1923, it was the more than a dozen detailed engineering reports on various aspects of water management and control made by State Engineer Edward Hyatt between 1920 and 1932 that formed the basis of what became known as "The State Water Plan." During this period, shifts in water use included increasing numbers of water storage and power projects in the Sacramento Valley and the northern portion of the San Joaquin Valley, while further south complex water rights issues and lack of surplus water available for storage led irrigators to substitute groundwater storage for on-stream surface storage in reservoirs.[42]

The expansion of irrigated acreage in the early twentieth century was achieved by using surface water supplies and groundwater. By the mid-1920s water shortages had initiated several privately funded storage projects paid for by the irrigators

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[41] Col. Robert Bradford Marshall, *Irrigation of Twelve Million Acres in the Valley of California* (Sacramento: California State Irrigation Association, 1919), 6-12.
[42] Paul Bailey, *Supplemental Report on Water Resources in California, Bulletin No. 9*, California Department of Public Works, Division of Engineering and Irrigation (Sacramento: California State Printing Office, 1925); Paul Bailey, *Summary Report on the Water Resources in California and a Coordinated Plan for their Development, Bulletin No. 12*, California Department of Public Works, Division of Engineering and Irrigation (Sacramento: California State Printing Office, 1927).

themselves on irrigation projects in the San Joaquin Valley, such as in the Modesto, Turlock and Merced irrigation districts. As a by-product of storage, these districts were able to generate hydroelectric power to pay for construction costs and expansion of their distribution systems. Storage and power development in the 1920s, however, did not extend to the southern portion of the valley. From the San Joaquin River south, the water rights situation was more complicated as streams had been developed early by multiple diverters complicating adjustment of water rights and financing of storage facilities. Furthermore, there was less unused surplus surface water and more of the Sierra Nevada's runoff reached the irrigated lands on the valley floor as groundwater. Realization that productivity of agriculture could be greatly increased by utilization of groundwater, the US Geological Survey and Reclamation issued a preliminary report in 1908 on the quality, occurrence, accessibility, character, and proper use of groundwater in the San Joaquin River basin.[43]

In the early twentieth century, underground water sources were used for an increasing amount of irrigation in California. From 1909 to 1919, land irrigated by these sources increased from 32,539 acres to 299,841 acres in the state. Many of the farms in what later became the Friant Division of the CVP were irrigated using a combination of groundwater and the limited supplies from local rivers and creeks. From 1919 to 1929 groundwater use in the southeastern San Joaquin Valley nearly tripled, increasingly relying on the capacity of pumped wells. With the exception of the Kern River and its alluvial fan, from the Kaweah River south and in the area from Mendota to Kettleman City, available local surface water supplies were negligible. Water for irrigation was primarily achieved through drilling thousands of large and deep irrigation wells. By 1930 overdraft on groundwater supplies and major land subsidence had become widespread along the eastside of the valley. A bit later subsidence became an issue on the westside of the San Joaquin Valley as much of its agricultural land came to rely on groundwater or conjunctive use of surface water and groundwater to meet irrigation needs.[44]

The nearly complete use of natural streamflow and overdraft of groundwater in areas not replenished from streamflow, focused local interests on more comprehensive plans for importing additional water supplies. Water shortages in the San Joaquin and Sacramento valleys had caused the State of California to initiate planning for major reservoir projects on the Kings, Tuolumne, San Joaquin, Kern, Merced, and Sacramento rivers between 1917 and 1924.[45] Legislative investigations of the State Water Plan that had begun in 1921 aimed to obtain a comprehensive inventory of water resources and an estimation of probable future water requirements in the Central Valley. As noted, this plan was first completed in 1923, and after further financial

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[43] W. C. Mendenhall, *Preliminary Report on the Groundwater of the San Joaquin Valley, California: U.S. Geological Survey Water Supply Paper No. 222* (Washington, D.C.: Government Printing Office, 1908); W. C. Mendenhall, *Report on the Groundwater in the San Joaquin Valley, California: U.S. Geological Survey Water Supply Paper No. 398* (Washington, D.C.: Government Printing Office, 1916).

[44] Poland, J. F., and Evenson, R. E., "Hydrology and Land Subsidence, Great Central Valley, California," in Bailey, E. H., ed., *Geology of Northern California*, Vol. 2. (Sacramento: California Division of Mines and Geology, Bulletin 190, 1966), 239-247; Mitten, H. T., *Groundwater Pumpage in San Joaquin Valley, California* (U.S. Geological Survey, Open-file Report, 1967-68); N.P. Prokopovich and D.J. Hebert, "Land Subsidence Along the Delta-Mendota Canal, California," *Journal American Waterworks Association*, 60, n. 8 (Aug. 1968): 915-920. Water levels in wells within the future service area of the Friant Kern Canal declined from 1921 to 1951 but showed signs of substantial recovery over the next two decades as a reduction of pumping within the canal's service area through imported supplies delivered by the canal caused a reduction in groundwater pumping and increased recharge of the aquifer. A number of U.S.G.S. Professional Papers have been published on the land subsidence issue in the San Joaquin Valley. Two examples of investigations valley-wide in scope that address the early beneficial impacts of the Friant Kern Canal are: J. F. Poland, G. H. Davis, and B. E. Lofgren, "Progress Report on Land Subsidence Investigations in the San Joaquin Valley, California, through 1957," (U.S. Geological Survey, 1958) and J. F. Poland, B. E. Lofgren, R. L. Ireland, and R. G. Pugh, *Land Subsidence in the San Joaquin Valley, California, As of 1972. USGS Survey Professional Paper 137-11* (Washington, D.C., United States Printing Office, 1975). Other studies are narrower in scope focusing on specific regions within the valley such as B. E. Lofgren and R. L. Klausing, *Land Subsidence Due to Groundwater Withdrawal, Tulare-Wasco Area, California. USGS Survey Professional Paper 437-B* (Washington, D.C., United States Printing Office, 1969). This study notes that within the southeastern portion of the study area subsidence nearly stopped in the late 1950s, as water levels recovered some 130 feed in response to reduced pumping and groundwater recharge from imported water delivered by the Friant Kern Canal.

[45] William L. Kahrl, *The California Water Atlas* (Sacramento: California Office of Planning and Research, Department of Water Resources, 1979).

studies, the plans were revised in 1925, 1927 and 1929. These investigations led the state to consider plans for a coordinated water management and development program that resulted in the adoption of the CVP in the 1930s.[46]

The story of the development, planning, political background, and construction of the CVP is well known and often told. The CVP is widely recognized as one of the greatest pieces of water planning, engineering, and conservation development ever undertaken and represents one of the most ambitious and successful water development projects ever built. It significantly altered California's natural hydrologic system in order to enhance water supplies for irrigated agriculture, municipalities, and hydroelectric power. Within the contexts of hydraulic engineering, the politics of public works, state-federal conflict over reclamation policy, and the economics of large-scale irrigation, the CVP is recognized as a great achievement on the national and even the international scale, although every component of the CVP is located within the boundaries of California.

The concept of a CVP was originally devised by the State of California to resolve chronic intra-state water shortage problems, but ultimately it was built by the federal government. The "State Water Plan" that resulted from the studies undertaken by State Engineers Edward Hyatt and Paul Bailey between 1927 and 1930 called for a vast system of canals, massive dams, and reservoirs throughout the state, and a massive north to south water transfer plan including most of what became the CVP. The essential units of the Central Valley portion of the plan included Shasta dam and reservoir (originally called Kennett Dam) on the Sacramento River, one of the highest overflow dams in the world with a storage capacity of 4.5 million acre feet; a 50-mile long industrial and irrigation conduit in the Delta diverting water to supply areas in Contra Costa County; a cross canal in the Sacramento-San Joaquin Delta; pumping plants and canals in the San Joaquin River and valley; Friant Reservoir on the San Joaquin River in the foothills north of Fresno and canals running north from the reservoir to supply lands in Madera County and south to irrigate lands between the reservoir and Kern River. To implement the plan the state needed to purchase the so-called "grass land" water rights of riparian owners on the lower San Joaquin River between Friant and the mouth of Merced River. With these water rights of early priority and large quantity satisfied, practically the whole flow of the San Joaquin River at Friant would become available for diversion to other water deficient areas of the valley. Thus, the implementation of the initial Central Valley unit of the State Water Plan entailed these fundamental requirements: regulation of stream flow by means of storage, exportation of water between watersheds, and exchanges of existing water supplies for imported water. Subsequent units of the ultimate State Water Plan would be adopted over time as demand for additional water warranted.[47]

In 1933, California voters approved the "Central Valley Project" portion of the State Water Plan, but the state needed the federal government to bring this project to life. With the depressed financial circumstances of the period, the state was unable to borrow money at a low enough interest rate to market the bonds necessary to fund the plan. California officials responded by lobbying the federal government to undertake the project as a federal reclamation project. Up until this point, federal reclamation had little impact on California agriculture or state water policies. Now after nearly three decades, Reclamation finally got the chance to build the largest integrated water and power project ever undertaken in California. This occurred just as the doctrine of multiple use emerged, wherein federal agencies were mandated to serve various interests simultaneously,

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[46] California Department of Public Works, Division of Engineering and Irrigation, *Water Resources of California: A Report to the Legislature of 1923, Bulletin No. 4* (Sacramento: California State Printing Office, 1923); Bailey, *Supplemental Report on Water Resources of California: A Report to the Legislature of 1925, Bulletin No. 9*; Paul Bailey, State Engineer, *Summary Report on the Water Resources of California and a Coordinated Plan for their Development: A Report to the Legislature of 1927, Bulletin No. 12*, California Department of Public Works, Division of Engineering and Irrigation (Sacramento: California State Printing Office, 1927); Edward Hyatt, State Engineer, *Report to the Legislature of 1931 on State Water Plan, Bulletin No. 25,* California Department of Public Works (Sacramento: California State Printing Office, 1930).

[47] Pisani, *From Family Farm to Agribusiness*, 381-439; Norris Hundley, Jr., *The Great Thirst: Californians and Water, 1770s-1990s* (Berkeley: University of California Press, 1992), 232-248; Hyatt, *Report to the Legislature of 1931 on State Water Plan, Bulletin No. 25,* 177-180; Edward Hyatt, State Engineer, *Sacramento River Basin, 1931, Bulletin No. 26*, California Department of Public Works, Division of Water Resources, Sacramento (Sacramento: California State Printing Office, 1931); Edward Hyatt, State Engineer, *San Joaquin Basin, 1931*, *Bulletin No. 29*, California Department of Public Works, Division of Water Resources (Sacramento: California State Printing Office, 1931).

which freed Reclamation to build and operate the project for a wide variety of water interests both urban and rural. By 1935, the state and federal governments reached an agreement and Reclamation was charged with construction of the CVP.[48]

President Franklin D. Roosevelt, amenable to almost any job creation proposal that would diminish the severity of the Great Depression, was responsive to California's appeal for assistance in funding the proposed CVP. In 1935 President Roosevelt approved the Secretary of the Interior's feasibility report and released federal emergency relief funds in order to initiate survey and investigations of proposed project works.[49] What had begun as a state project now became a federal undertaking under the auspices of the Secretary of the Interior and Reclamation. During 1936 Reclamation established its administrative headquarters at Sacramento and three field division offices at Redding (Kennett Division) covering works on the upper Sacramento River; at Antioch (Contra Costa / Delta Division) covering surveys for the Contra Costa Canal; and Friant (Friant Division), located 20 miles northeast of Fresno, covering the Friant dam/reservoir site and surveys for the Madera and Friant-Kern canals. A year later, Congress gave Reclamation final authority to take over control of the construction of the massive public works project. Construction of the federal project proceeded on a piecemeal basis.[50]

Reclamation designed the CVP with five fundamental units, operating as an integrated system: Shasta Dam, Delta-Mendota Canal, Friant Dam, the Madera and Friant-Kern Canals, and the Contra Costa Canal. The smallest of the canals, the Contra Costa Canal in eastern Contra Costa County, provided irrigation and industrial water for the area south of Suisun Bay between Antioch and Martinez. In 1937, the canal was the first facility to be undertaken and the 48-mile canal was completed by Reclamation in 1939. The core of the system, however, involved the coordinated operation of the other four units for the purposes of delivering Sacramento River water to the arid San Joaquin Valley and to impound the flow of the upper San Joaquin River for distribution on the east side of the San Joaquin Valley.[51]

Reclamation designed the project's main four units to operate in two groups of works. Shasta Dam and Delta-Mendota Canal operated together to store and deliver Sacramento River water on the westside of the San Joaquin Valley as far south as Fresno County, to irrigate new areas and to supply water for San Joaquin River diverters with riparian and senior appropriative water rights. Friant Dam, located on the San Joaquin River 25 miles northeast of Fresno, conserved and stored flood flows in Millerton Lake for release and diversion into the Madera and Friant-Kern canals. These three water-storage and conveyance features operated together to store and divert San Joaquin River water as far as the southern extremes of the San Joaquin Valley near Bakersfield (through the Friant-Kern Canal) and north to Ash Slough near Chowchilla (through the Madera Canal). As noted, these units worked in conjunction with one another, the Shasta Dam/Delta-Mendota Canal system providing "replacement water" to west side "Exchange Contractors" (senior holders of water rights from the San Joaquin and Kings River Canal and Irrigation Company and Miller & Lux's corporate descendants) for that which was transported southward

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[48] Erwin Cooper, *Aqueduct Empire: A Guide to Water in California, Its Turbulent History, and Its Management Today* (Glendale, California: A. H. Clark Co., 1968); Hundley, *The Great Thirst, 243-252.*

[49] The proposed construction project by the federal government stirred up controversies over the Reclamation's 160-acre limitation imposed under the 1902 Federal Reclamation Act, ownership of water rights, public vs. private hydroelectric power generation, as well as state vs. federal ownership and operation of the project. Given the early history of the Central Valley as an area dominated by large cattle ranches and bonanza wheat farms, the 160-acre limitation was deemed as particularly egregious where, as one landowner's attorney noted, "10 per cent of the ranches contain 80 per cent of the land," "Big Water 'Transfusion' Operation Taking Shape: World's Longest Canal to Carry Much Needed Moisture Through Central Valley," *Los Angeles Times," March 16, 1947;* and Bassett, "Water Limit Fight Stirs San Joaquin: Controversy Over How Much Land One Owner May Irrigate Features Valley Project Work," *Los Angeles Times*, March 17, 1947.

[50] Pisani, *From Family Farm to Agribusiness*, 416-438; Hundley, *The Great Thirst*, 252-262; "Active Construction Nears on Central Valley Project," *Western Construction News*, January 1937, 22.

[51] U.S. Department of the Interior (USDI), Reclamation, Central Valley Projects: Issues and Legislation, October 15-2018 – June 21, 2019, https://www.everycrsreport.com/reports/R45342.html#_Toc12259578.

and northward on the east side of the San Joaquin Valley by the Friant Dam/Friant-Kern Canal/Madera Canal system. Reclamation completed these five major units of the CVP by the early 1950s.[52]

Groundwater issues quickly became part of the Delta Division's management. As noted, much of the agricultural land in western San Joaquin Valley had relied upon groundwater or conjunctive use of surface water and groundwater to meet their irrigation needs before the CVP was built. According to one U.S. Geological Survey study in the mid-1950s, about 4,500,000 acres of land in the San Joaquin Valley was irrigated, with 50% of that land supplied solely with groundwater from wells and land subsidence had been noted.[53] Thus, almost immediately after water was turned in the newly completed Delta-Mendota Canal, land subsidence began to impact the structure, especially the downstream 40 miles, causing the need for repairs and extensive modifications to raise the height of canal structures.[54]

Reclamation designed Delta-Mendota Canal to carry out one of the key features of the CVP, exchanging water from the Sacramento River basin to the San Joaquin River basin. Delta-Mendota Canal was built to convey water from the Sacramento-San Joaquin Delta in a southerly direction along the west side of the San Joaquin Valley, replacing flows in the San Joaquin River to permit diversion of San Joaquin River water at Friant Dam for delivery in Madera Canal and Friant-Kern Canal. It was designed to serve a total of approximately one million acres of irrigable land on the west side of the San Joaquin Valley in San Joaquin, San Benito, Stanislaus, Merced, and Fresno counties. Reclamation designed DMC to deliver water to Mendota Pool and the planned San Luis Reservoir, as well as to water users along its route. At the upstream end, the canal was designed with a maximum capacity of 4,600 cubic feet per second, diminishing as it traverses the valley to its southern terminus. Original plans called for a series of lifts to advance the water south up the valley; however, Reclamation modified the design to a single pumping plant that lifted the water approximately 200 feet before discharging it into DMC. The north portion of the canal is lined with concrete and the sound is compacted earth. DMC was built with repetitive structure types like concrete checks, concrete siphons, culverts and overchutes, drainage inlets, irrigation turnouts, canal crossings, wasteway turnouts, highway and farm bridges, and much smaller number of discrete, specialized structures. For most of the major structures like wasteways and siphons, Reclamation engineers prepared site-specific designs and drawings. For structures installed repetitively along the canal like culverts, inlet drains, and farm bridges, Reclamation prepared standardized drawings for multiple applications. Through the DMC, availability of a more reliable water supply to parts of the San Joaquin Valley contributed significantly to the success of agriculture and industry in the region.[55]

When completed, Delta-Mendota Canal was instrumental in accomplishing the goals of the CVP and it was second largest capacity canal in the state after the All-American Canal, which was an 80-mile-long aqueduct built in the 1930s conveying Colorado River water to Imperial Valley and several Southern California cities. Engineering and constructing Delta-Mendota Canal was a monumental task because of the natural and built features it had to traverse over a long distance: the alignment crossed multiple waterways, major roadways, and transmission lines; existing irrigation structures had to be tied in or crossed; and road and farm bridges, and major canal water control features like check structures and wasteways had to be built. In addition to the engineering challenges, Reclamation also had to negotiate the sale of project water delivered by Delta-Mendota Canal with various water users and address a complex right-of-way acquisition. Water first entered the canal for delivery to downstream users in 1951 but was not officially complete until April 9, 1952.[56]

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[52] L. B. Christiansen and R. W. Gaines, *Central Valley Project: Its Historical Background and Economic Impacts* (Sacramento, California: USDI, Reclamation, Mid-Pacific Region, 1981).
[53] G.H. Davis, J. H. Green, F.H. Olmstead, and D. W. Brown, *Groundwater Conditions and Storage Capacity in the San Joaquin Valley California.* Geological Survey Water Supply Paper 1469 (Washington, Government Water Supply Paper No. 1469, 1959), III, 4, 8-10, 114-124, 129-131.
[54] N.P. Prokopovich and D.J. Hebert, "Land Subsidence Along the Delta-Mendota Canal, California," *Journal American Waterworks Association*, 60, n. 8 (Aug. 1968): 915-920.
[55] USDI, Bureau of Reclamation, *Delta-Mendota Canal,* Technical Record of Design and Construction (Denver: 1959), 1 and 13.
[56] "First Contract on Friant-Kern Canal," *Western Construction News* (Sept 1945): 112-113; US Department of the Interior, Bureau of Reclamation, *Delta-Mendota Canal,* Technical Record of Design and Construction (Denver: 1959), 5.

One of the most renowned engineers employed by the Bureau of Reclamation, Oscar Boden spent sixteen years out of his forty-year-long tenure with the Bureau working in the Central Valley. Boden undertook the role of construction engineer for the Delta Division of the Central Valley Project (CVP) from 1935 until his death in June 1951. Born in 1885 in Kellogg, Iowa, Boden studied civil engineering at Iowa State University, graduating in 1910. Boden started at the Bureau of Reclamation in 1911 performing operation and maintenance work for the first five years of his career. From there, he moved on to survey work, lateral design, and lay-out of several irrigation projects in Wyoming and Nebraska. He also worked on projects in Idaho, Oregon, and Washington where he served as head of construction of various irrigation distribution systems. Dubbed "Mr. Canal" for his work supervising the construction of 76 miles of main canal and 200 miles of laterals for the Kittitas Project near Yakima, Washington in 1926, Boden's prowess as a team leader eventually led him to the Central Valley. At the request of the supervising engineer for the CVP, Boden relocated to California in 1935, serving as the project's first government construction engineer. Boden engineered surveys for the Friant-Kern and Contra Costa canals and led the construction of the Contra Costa Conduit. Boden's acclaim increased during his role as engineering administrator who oversaw the construction of Delta-Mendota Canal structures and the Tracy pumping plant. Additionally, Boden took charge of the investigations, planning, and lay-out necessary for Delta-Mendota Canal's features. Posthumously, Boden received nomination into the Reclamation's Hall of Fame. In total, Boden is credited with the construction of 1500 miles of canal.[57]

Delta-Mendota Canal's concrete lining extends down to Milepost 98.64. This portion of the canal has a 48-foot bottom width. The approximately 18 miles of canal between that point and the outfall at Mendota Pool are compacted earth-lined with bottom widths of 60, 62, and 84 feet at different reaches. After Tracy Pumping Plant lifts the water 200 feet, the water is moved down the canal at a gentle grade of 3 inches per mile, controlled by concrete check structures (**Figure 1**).[58] Specifications called for the concrete to be 4 inches thick and placed on the canal's 1 ½:1 side slopes. Check structures, placed an approximately 5-mile intervals along the canal, are composed of two standardized types. Three of the check structures are rectangular and the rest are trapezoidal in cross section.[59]

57 D. L. Goodman, "Oscar G. Boden – Builder of Lifelines," *Reclamation Er*a vol. 38 (February 1952), 30-31, 38; "'Mr. Canal' Builds Miles of Them in His Life Project," *Stockton Record* (California), May 15, 1951; "Pittsburg Ends 3 Dates of Fete," *Stockton Record* (California), October 15, 1940; "Boden Ranked High Among Canal Builders," *Tracy Press* (California), April 9, 1951.
58 Martin H. Blote, "Water Runs Uphill," *Reclamation Era* (October 1947): 213.
59 US Department of the Interior, Bureau of Reclamation, *Delta-Mendota Canal*, Technical Record of Design and Construction (Denver: 1959), 1.

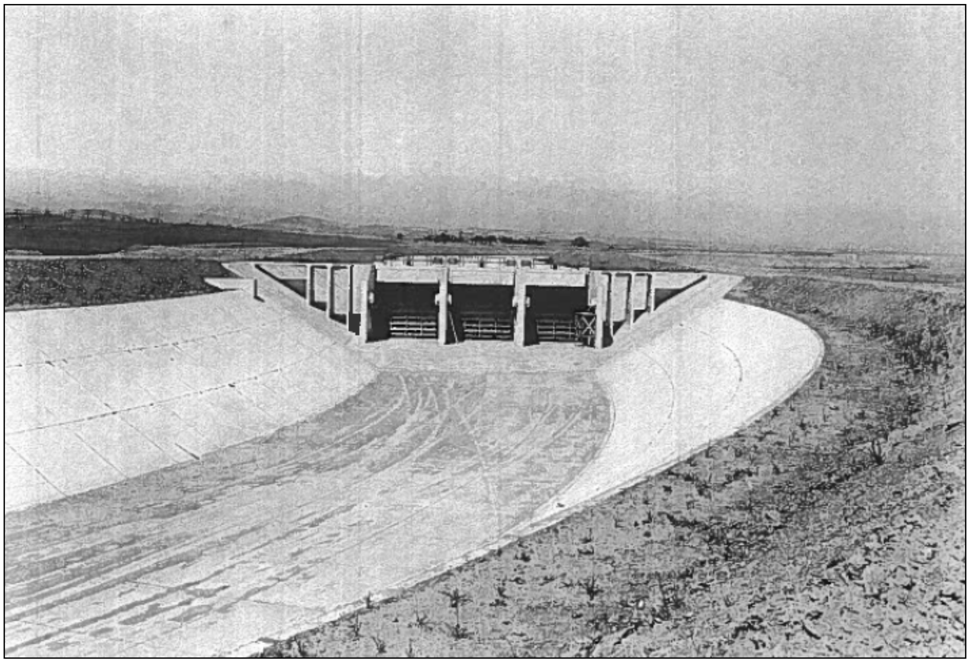

Figure 1: Complete check No. 1 (M.P. 11.35), camera facing upstream, April 18, 1949.[60]

Along its course, Delta-Mendota Canal is siphoned across streams, railroads, and irrigation canals. Siphons convey the water across seven streams, three railroad crossings, two highway crossings, one combined highway and railroad crossing, and one irrigation canal. The single siphon under an existing irrigation canal (Miller & Lux Outside Canal) was unique because all other existing irrigation ditches were siphoned under Delta-Mendota Canal. The Mountain House Road Siphon carried Delta-Mendota Canal 1,200 feet through a monolithic concrete structure with an inside diameter of 24 feet 3 inches (**Figure 2**). Morrison-Knudsen and Hasler constructed the siphon under specifications No. 1435.

Wasteways to carry flood water out of Delta-Mendota Canal and to the San Joaquin River channel are among the largest appurtenant structures to the canal and were designed and constructed as part of the canal. Reclamation designed the canal's four wasteways to handle the full capacity of Delta-Mendota Canal at the turnouts into the wasteways in the event of flooding or canal failure. Studies of the topography and disposal of canal water informed the site selection of the wasteways. The wasteway turnouts were designed with radial gates to allow the flow of water into the channels. Westley Wasteway is a 3.9-mile long, mostly concrete-lined trapezoidal channel. Newman Wasteway is approximately 8.2 miles long, about 1.5 miles of which are concrete lined. Volta Wasteway (originally known as San Luis Wasteway) is 11.9 miles long and Firebaugh Wasteway is the shortest at 1.1 miles long.[61]

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[60] Morrison-Knudsen Company, Inc. and the M. H. Hasler Construction Company, *Final Report Contract No. I2r-16675 – Specifications No. 1435, Delta-Mendota Canal – Central Valley Project*, 1949, 22.
[61] USDI, Reclamation, *Friant-Kern Canal: Technical Record of Design and Construction*, 12; "Friant-Kern Canal – Myriad of Huge Structures Involved," *Western Construction News* (May 1948): 93.

Figure 2: Construction of Mountain House Road Siphon showing concrete placement in progress, October 24, 1948.

Delta-Mendota Canal and all of its appurtenant structures were constructed by five contractors under 10 major construction specifications, starting in 1946 and completed in 1951. Hubert Everist, Sr. won the first contract and began work in June 1946. Each of the major contractors engaged many subcontractors to supplement their own work forces.

On April 30, 1946, bids opened for Specifications No. 1183, which comprised of two schedules including earthwork, concrete lining and structures (schedule one) and the construction of the Westley wasteway (schedule two). Everist placed the lowest bid, winning the contract for both schedules on June 14, 1946. His firm also served as the contractor for Specification 2460, the earthwork, concrete lining and structures from M.P. 25.88 to M.P. 40.72, and the timber operating bridge at M.P. 23.28. Educated as an engineer at Purdue Univeristy, Everist came from a family of leaders in the construction industry. Born in Beardstown, Illinois but raised in Sioux City, Iowa, Everist played an instrumental role in the growth of his family's company, L.G. Everist, Inc., as well as the establishment of two other businesses: Western Contracting Corp. based in Sioux City and Intercontinental Engineering and Manufacturing Corp. of Parkville, MO. Branches of all three businesses existed in the West. At the time of the bidding for Delta-Mendota Canal, Everist lived in San Francisco.[62]

On December 30, 1946, Morrison-Knudsen Company, Inc., partnering with the Los Angeles-based M.H. Hasler Construction Company, won the first of its four contracts for "earthwork, canal lining, and structures" along Delta-Mendota Canal. This first contract included a segment measuring approximately 11.15 miles, completed on April 18, 1949. Between October 1949 and April 1951, Morrison-Knudsen Co. and M.H. Hasler engaged in three other contracts pertaining to Delta-Mendota Canal. All the work involved earthwork, concrete lining and structures (**Figure 3**). The Morrison-Knudsen Company, headquartered

62 US Department of the Interior, Bureau of Reclamation, *Delta-Mendota Canal,* Technical Record of Design and Construction (Denver: 1959), 103; "Hubert H. Everist Sr Obituary," *Sioux City Journal*, July 20, 1990; L.G. Everist, Inc., "Company Overview," https://www.lgeverist.com/companies.php.

in Boise, Idaho, specialized in construction of large civil and military projects. Founded in 1912 by Harry W. Morrison and Morris H. Knudsen, the firm had become the preeminent dam-building company after its successful contribution to the construction of Hoover Dam, contracted in 1931. In the ensuing decades, Morrison-Knudsen emerged as one of America's largest civil engineering contractors. The company's portfolio of work went on to include some of the world's biggest dams and bridges. During World War II, the company was in prime position to take on large contracts for construction of military bases and airfields. After the war, the company embraced opportunities created by the expansion of the American military presence overseas, as well as the push to rebuild and expand American infrastructure at home. By the end of the 1950s, the company had diversified and expanded to various worldwide locations. Morrison-Knudsen's work along Delta-Mendota Canal is illustrative of the company's participation in domestic infrastructure expansion in the post-war period.[63]

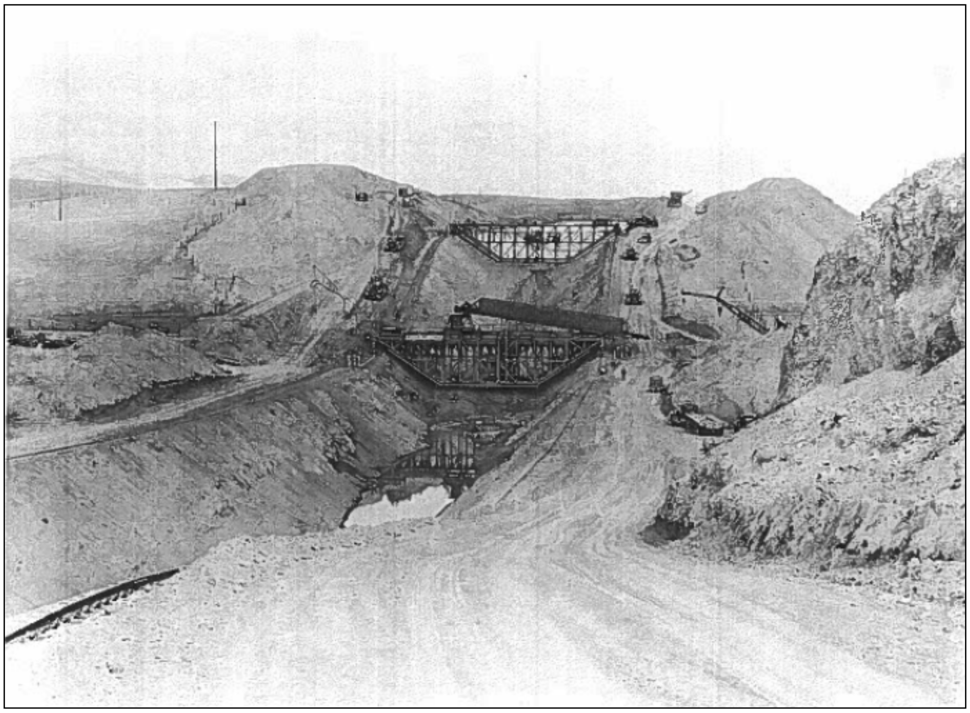

Figure 3: Morrison-Knudsen Company, Inc. and the M. H. Hasler Construction Company operating canal trimmer and slip form at Mountain House Road Siphon excavation, June 10, 1948.[64]

In addition to constructing four segments of Delta-Mendota Canal under Specifications 1435, 2197, 2732, and 2799, the Morrison-Knudsen Company, Inc. and the M.H. Hasler Construction Company also collaborated on multiple segments of the Central Valley Project's Friant-Kern Canal. In the late 1930s, M.H. Hasler also assisted Morrison-Knudsen in the construction of the All-American Canal and its branch Coachella Canal. Morrison-Knudsen and Hasler built over 75 miles of the 122-mile-

[63] Donald E. Wolf, *Big Dams and Other Dreams: The Six Companies Story* (Norman: University of Oklahoma Press, 1996), 204, 254-265; "Earth Mover," *Time* (May 3, 1954): 86, 90-93; "Morrison Knudsen Corporation," Jay P. Pedersen, ed., *International Directory of Company Histories*, vol. 28 (Detroit, Michigan: St. James Press, 1999); "Morrison-Knudsen Company, Inc.," Harvard Business School Baker Library Historical Collections, Lehman Brothers Collection, Twentieth-Century Business Archives; "Top Twelve Hit Over $100 Million," *Engineering News-Record*, July 2, 1964, 53; "Construction's Man of the Year," *Engineering News-Record*, February 17, 1966, 99-106; David P. Billington and Donald C. Jackson, *Big Dams of the New Deal Era: A Confluence of Engineering and Politics* (Norman: University of Oklahoma Press. 2006).
[64] Morrison-Knudsen Company, Inc. and the M. H. Hasler Construction Company, *Final Report Contract No. I2r-16675 – Specifications No. 1435, Delta-Mendota Canal – Central Valley Project*, 1949, 12.

long Coachella Canal between 1939 and 1941, including construction of 14 siphons, 31 double siphon boxes, one round barrel siphon, five checks, four automatic spillways, and five drainage inlets. During World War II, Hasler worked with the U.S. Army Corps of Engineers in building air bases at Blythe, Reno, and Kingman. The company's collaborative work on four segments of Delta-Mendota Canal between 1946 and 1951 appears to be illustrative of the general work performed by the M. H. Hasler Construction Company during this period.[65]

Another of Hubert Everist Sr.'s companies, Western Contracting Corporation, won the contract for earthwork, concrete lining, and structures for a 15.61-mile-long segment of Delta-Mendota Canal on June 22, 1949. The company completed the work on June 1, 1951. Additionally, on June 29, 1950, Western Contracting Corporation bid on and received Contract No. I2r-19060, for construction of the San Luis Wasteway and holding reservoir dike, split into two schedules (**Figure 4**). Western Contracting Corporation completed the work on April 9, 1952, and June 14, 1951, respectively. Everist established Western Contracting in 1917, headquartered in Sioux City, Iowa. For the work on Delta Mendota, the corporation operated out of an office in Westley, California. Today, the company predominantly constructs Army Corps of Engineer flood control, and wetland and river mitigation projects in the Midwest.[66]

In 1946, Reclamation Commissioner Straus authorized a contract of $5,888,000 for the two and a half mile long Delta-Mendota Intake Canal, which included the Tracy Pumping Plant (later renamed C.W. Bill Jones Pumping Plant) (**Figure 5 - Figure 6**). Located nine miles northwest of Tracy, California, the pumping plant was to "lift water from the Delta-Mendota Intake Canal to a height of 200 feet and send it flowing for a distance of 120 miles" through the DMC to the west side of the San Joaquin Valley utilizing six 22,500 horsepower motors (**Figure 7**). With these motors, the plant had the capacity to lift 4,600 cubic feet of water per second. Construction of the pumping plant began September 2, 1947, through a joint venture between Stolte Inc., United Concrete Pipe Corporation, Duncanson-Harrelson Company, and Ralph A. Bell. The companies, all of which consolidated and operated under S.U.H.B. Company, completed the work on December 30, 1949. Construction engineers included Bureau of Reclamation's Oscar Boden and C.H. Spencer, both of whom spent a considerable portion of their careers working on the Central Valley Project. However, the location of the Tracy Pumping Plant created a unique problem for Reclamation; it aligned with the route that young salmon and bass are swept along by the early spring runoff in their migration towards the ocean. To prevent a detrimental loss in fish population, the Bureau of Reclamation and the U.S. Fish and Wildlife Service experimented to find the most promising solution. This experimentation resulted in a diversion using a series of vertical louver structures, which transferred the young fish to holding tanks and then onto tank trucks to be hauled "about 50 miles to waters destined for the ocean" (**Figure 8**). By 1959, the Tracy Pumping Plant operators collected and transported upwards of 250,000 fish a day, and a record 12 million for the entire year.[67]

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[65] Eric A. Stone (edited by Brit Storey), *All-American Canal: Boulder Canyon Project*, (Denver: United States Bureau of Reclamation, December 2009), 6-28; USDI, Reclamation, *Technical Record of Design and Construction, Delta-Mendota Canal: Constructed 1946-1952, Central Valley Project – California* (Denver, June 1959), 103; "M. H. Haslers of Laguna Buy Walter Botthof Home," *Desert Sun (Palm Springs)*, May 19, 1950, 5.

[66] US Department of the Interior, *Delta-Mendota Canal:* Technical Report, 104; Associated General Contractors of Iowa, "Western Contracting Corporation," http://www.agcia.org/memberDetails.asp?memberID=19795.

[67] USDI, Bureau of Reclamation, "Final Construction Report on Delta-Mendota Canal Intake and Tracy Pumping Plant and Discharge Lines," *Specifications No. 1810* – Central Valley Project (Denver: March 1952); USDI, Reclamation, "Commissioner Authorized to Award Top Value Contracts," *Reclamation Era* vol. 33, January 1947; USDI, Reclamation, "Fish and the Tracy Pumping Plant," *Reclamation Era* vol. 36, January 1950; USDI, Reclamation, "Well Worth Celebrating," *Reclamation Era* vol. 37, January 1951; USDI, Reclamation, "Reclamation Pioneers in Fish Conservation Techniques," *Reclamation Era* vol. 42, January 1956; USDI, Reclamation, "C.H. Spencer Succeeded by B.P. Bellport," *Reclamation Era* vol. 43, January 1957; USDI, Reclamation, "A Story about the USBR and Millions of Fish," *Reclamation Era* vol. 46, January 1960; "Construction Begins on Huge Central Valley Pump Plant," *Western Construction* vol. 22, no. 11, November 1947.

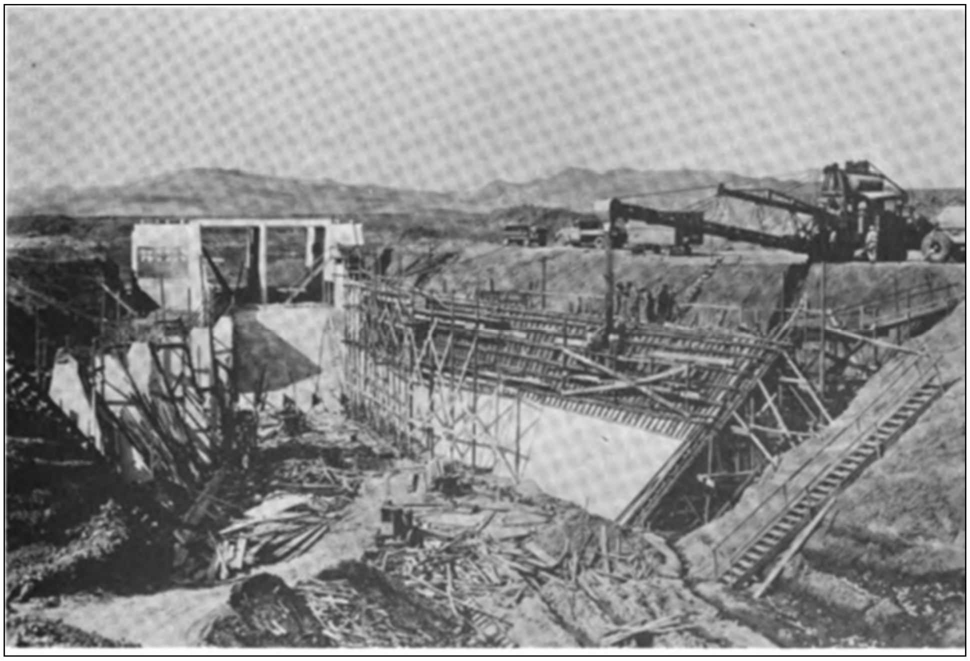

Figure 4: Placing concrete in transition walls of San Luis wasteway turnout, July 26, 1950.[68]

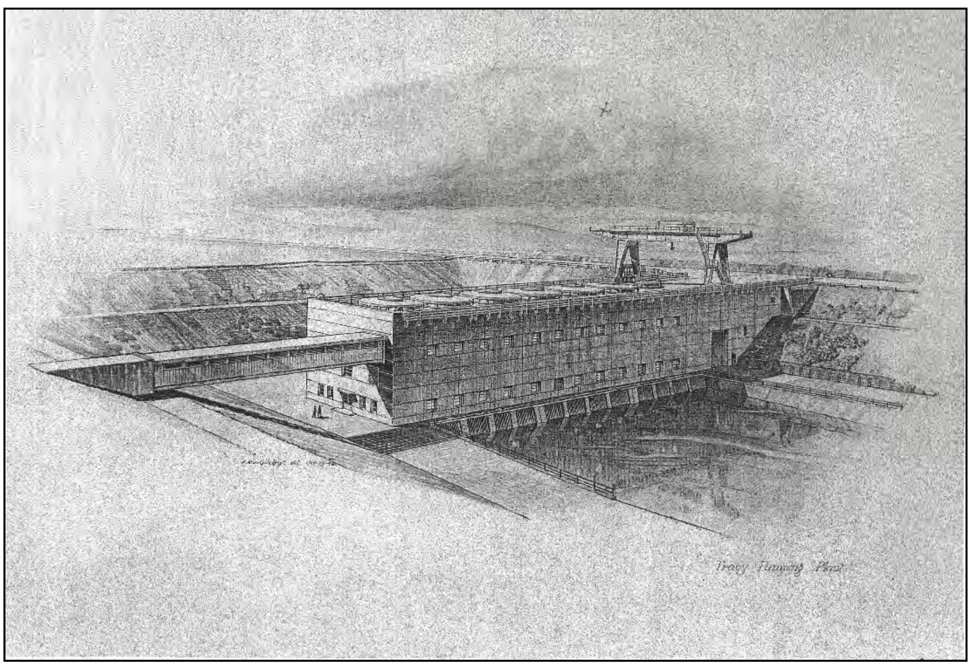

Figure 5: Artist rendering of Tracy Pumping Plant, 1948.

[68] [Photograph], DM-889-CV in USDI, Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 123; At left are counterforts which were placed independently of the warped walls.

Figure 6: Tracy Pumping Plant, January 1951.[69]

Figure 7: One of six 84-in. vertical shaft bottom suction twin volute centrifugal pumps.[70]

[69] [Photograph] USDI, Reclamation, "Well Worth Celebrating," *Reclamation Era* vol. 37, January 1951.
[70] [Photograph] "A Pictorial Review of Tracy Pumping Plant Construction," *Western Construction News* vol. 26, no. 5, May 1951.

On January 18, 1950, United Concrete Pipe Corporation and Vinnell Co. entered a joint contract to construct the earthwork and structures along Delta-Mendota Canal from M.P. 85.89 to M.P. 109.89, which spanned approximately 17.95 miles, and the Firebaugh wasteway, located at M.P. 98.50 (**Figure 9**). The government accepted the completed work on November 30, 1951. The two companies also worked together on the earthwork, concrete lining and structures, and service lateral, and part of the Newman Wasteway. They won this second contract on May 16, 1950 and finished the work on April 4, 1852. United Concrete Pipe Corporation can trace its origins to 1919 in Ventura, California. Serbia native Tom Polich started the company, first naming it Polich Construction Company until 1924, when he partnered with Steve Krai and B.J. Ukropina. Polich came to the United States in 1905 at the age of 17, and first entered the concrete business under the employ of Bent Brothers. Polich's first self-employed contract involved the installation of an irrigation system for the California Packing Corporation at their orchard at Tuttle. United Concrete Pipe Corporation went on to complete projects in Merced County such as the John Muir school building, concrete bridges and highways, sanitary sewers, and irrigation for the Merced Irrigation District. For this project, the Vinnell Company operated from a plant in Baldwin Park. Originally founded in 1931 by Allan S. Vinnell in Alhambra, the company began as a hauling and excavating contractor. The Vinnell Co. also constructed roads, buildings, portions of the Pan-American Highway and the Grand Coulee Dam. By the 1960s, the United States government employed Vinnell as contractors in Vietnam.[71]

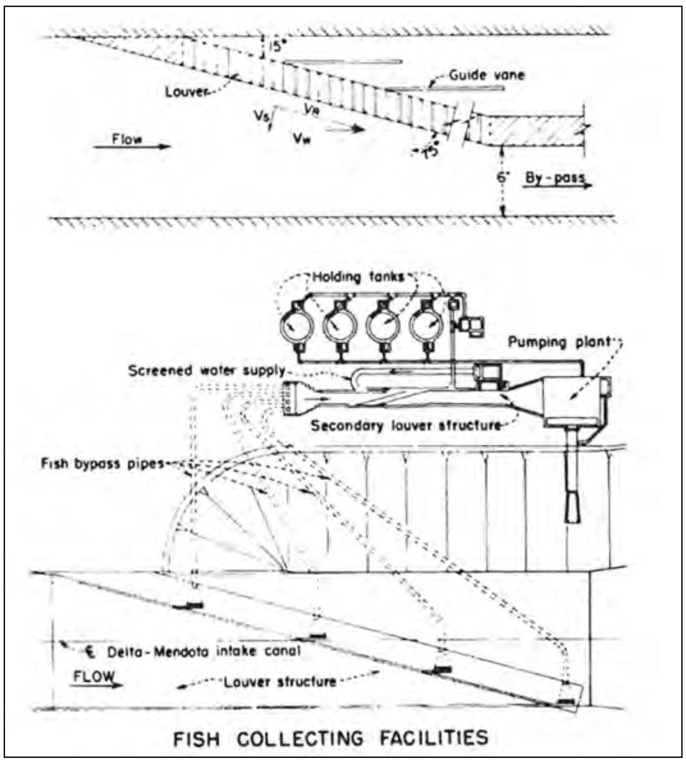

Figure 8: Fish Collecting Facilities at Tracy Pumping Plant, January 1956.[72]

[71]*Delta-Mendota Canal:* Technical Report, 105; John Outcalt, "Merced-Ventura-Los Angeles County CA Archives Biographies: Polich, Tom (Merced: 1925); "Dirt Lined Section of Delta-Mendota Canal Progresses," *Fresno Bee,* November 27, 1950.
[72] [Photograph] USDI, Reclamation, "Reclamation Pioneers in Fish Conservation Techniques," *Reclamation Era* vol. 42, January 1956; drawing at the top shows plan arrangement of louvers or slats; drawing at the bottom shows layout of permanent structure.

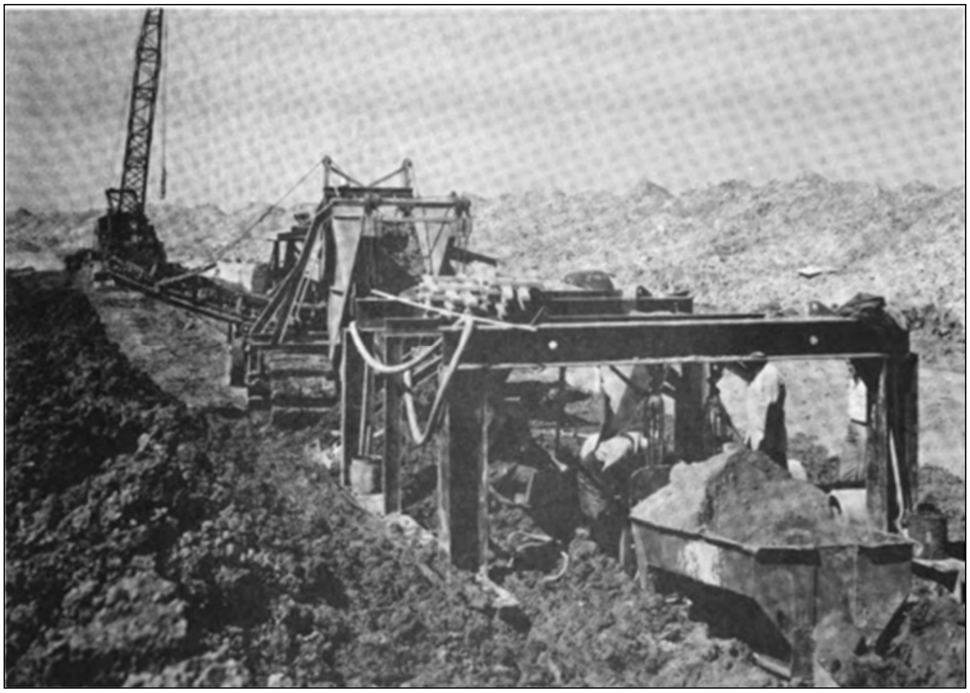

Figure 9: Converted ditcher and pipe laying machine used by United-Vinnell Co., March 1951.[73]

Construction of another small part of Newman wasteway and its service lateral went to A. Teichert and Sons, Inc., of Sacramento, California. The government awarded the contract on May 16, 1950, and Teichert completed the work on June 29, 1951. Both Teichert and United Concrete Pipe Corporation and Vinnell Company's portions of the Newman Wasteway fell under Specification 2951, albeit separate schedules. Teichert lined the wasteway by hand methods given the small size of the job (**Figure 10**). The company's founder, Adolph Teichert, immigrated to the United States in 1866 from Germany, finding success as a craftsman in San Francisco. He started his own business, Artificial Stone: Adolph Teichert, in 1887 in Sacramento. In 1912, Adolph Teichert Jr. joined his father as a partner in the concrete paving business under the name, A. Teichert and Son. The company played an integral role in the development of the road and highway system in Northern California, employed by the likes of the State of California Highway Department (later Caltrans) and the cities of Sacramento, Davis, Woodland, Placerville, and Fresno. In addition to paving roads, Teichert expanded its repertoire to include the production of rock product and ready-mixed concrete and the construction of dams, beginning with the North Fork Dam on the American River in 1938. A. Teichert and Son also partook in joint ventures with companies like United Concrete Pipe and Ralph A. Bell. In 1939, the companies worked together to construct tunnels and relocate telephone and railroad lines around the Shasta Dam. During World War II, A. Teichert and Son supported the war effort through the construction of airports; ammunition storage facilities; runways; and water, light, and fuel systems. By the early 1950s, the company's growth spurred the establishment of district offices in the Woodland/Davis area and in Stockton.[74]

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[73] [Photograph,] DM-1471-CV in USDI, Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 115; Machine used for laying drains in the lower reaches of canal. The machine digs a trench and men working inside shield lay the drain pipe which is covered by gravel from the hopper.

[74] *Delta-Mendota Canal:* Technical Report, 105; "Our History," *Teichert Way*, file:///J:/22-015%20Delta-Mendota%20Canal%20Subsidence/Research/Contractors/A.%20Teichert%20&%20Sons/Our%20History%20-%20Teichert.html.

Figure 10: Placing alternate panels of reinforced concrete in Newman wasteway, April 1951.[75]

On November 8, 1951, Johnson Western Constructors won the bid for construction of structures for distribution to water agencies along the canal rouate. The firm built the Columbia Pumping Plant No. 1, Mowry Pumping Plant, and their respective delivery systems. The work was broken into two schedules under Specification DC-3989. Headquartered in San Pedro, Johnson Western had additional offices in San Diego and Oakland. The company specialized in heavy engineering construction, waterfront construction, and gunite construction. Born in 1885, William Arthur began his career at age 21 at a small pipe company, working on construction projects there until he became president of the National Bank of Riverside. Johnson stayed at the National Bank from 1918 to 1923, at which time he established the Hall Johnson Company. Throughout his career, Johnson started numerous firms, including American Pipe, Johnson, Inc., and Johnson Western Constructors. His companies helped construct the Shasta Dam from 1938 to 1944. At the time of the construction of Delta-Mendota Canal, Larry Sullivan of San Pedro served as president of Johnson Western.[76]

The government awarded Plainview Water District and Stolte Inc. Contract No. 14-06-D-542 which "covered construction of earthwork, pipelines, and structures, including pumping plants, laterals 8.7 to 20.0 inclusive, and sublaterals" on September 1, 1953. Divided into three schedules, the contract with Stolte, Inc. allocated $441, 893.11 for the work, but only "a portion of the costs [$81, 686.99] was chargeable to Delta-Mendota Canal." Plainview Mutual Water Company is based in Strathmore, California, and had been one of the first companies formed with the aim of negotiating with the Central Valley Project for irrigation water. At the time of the bidding, Plainview Water District fell under the Delta-Mendota Canal distribution system. The company formed in 1950, with an irrigation request of about 4,200 acres. Stolte Inc. can trace its origins to Ferdinand Charles Stolte, whose dreams of becoming a gentleman farmer were foiled by the stock market crash of 1929. Based in Alameda, Stolte Inc. began with specializing in homebuilding, but expanded to include work on hotels, medical facilities, high-rise commercial construction, and heavy construction like dams and tunnels. In 1932, engineer George Loorz joined

[75] [Photograph], DM-1496-CV in USDI, Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 128.
[76] Technical Report, 106; "Johnson, Shasta Dam Builder, Dies," *News Pilot*, San Pedro: May 11, 1956; "William A. Johnson, 71, Industrialist, Succumbs," *San Bernadino County Sun* May 11, 1956; "San Pedran Elected President of Johnson Western Company," *News Pilot*, December 2, 1950.

Stolte Inc. as a partner, and the company went on to build Hearst Castle for William Randolph Hearst. In 1976, National Medical Enterprises purchased Stole Inc.[77]

Crest Contracting Company won the contract for construction of pump turnouts from mile 58.18 to mile 96.62 on May 2, 1958. Floyd Hardwick, a former Rio Vista city administrator, owned the company. While working on the Dela-Mendota Canal, Crest Contracting also undertook projects constructing culverts for Merced County.[78]

Contracts for "furnishing, hauling, and placing gravel" from various stations along Delta-Mendota Canal and the Westley wasteway were awarded to H. Sykes Construction Company. Under Specification R2-32, Sykes's company performed work along M.P. 12.99 to M.P. 25.88 and the start of the Westley wasteway to M.P. 0.37. The company specialized in road oiling, paving, and ready-mix concrete. Hubert Sykes headquartered his company in Patterson, California. Born in England in 1895, Sykes came to Patterson in 1919, having become a naturalized US citizen in 1918.[79]

E.A. Pollard won the contract for the "erection of right-of-way fence," which cost the government $5,407. Prior to his work on the Delta Mendota Canal, Pollard and his employees worked in Martinez, constructing a bridge across Marsh Creek on County Road E-44 and in Mendocino, grading and improving roads in Wages Creek. Born in 1897 in Oregon, it is not clear when Pollard came to California and established a home in Richmond. He operated his business out of Fairfax.[80]

To aid in the furnishing, processing, hauling, and placing of gravel along stations, the government also developed contracts with M.J. Ruddy and Son of Modesto, California (**Figure 11**). The company emphasized the "prompt delivery" of sand and gravel, including washed concrete sand and crushed rock. Though the company's establishment dates to the 1930s, it did not file as a stock corporation until October 15, 1954. Other work done by M.J. Ruddy and Son involved highway bridges and overpasses from Firebaugh throughout the San Joaquin Valley, and paving on the Tuolumne-Sonora Road. At the time the government accepted the bid for the Delta Mendota Canal, M.J. Ruddy and Son's managers included M.J. Ruddy, Jr, project manager; Fred Sattler, chief engineer; Warren Shields, project superintendent; and Paul Snyder, office manager.[81]

The Claude C. Wood Company also won a bid for "furnishing or processing, hauling and placing gravel" for Delta-Mendota Canal. Based in Lodi, California, Claude C. Wood Co. operated a gravel plant which manufactured rock, sand, and gravel and offered ready-mix concrete for purchase. The company also provided asphalt road oils to eliminate dust on driveways along farmland. During World War II, the Claude C. Wood Co. supported the war effort by assembling parts for floating drydocks, operating under a sub-contract for the United States Navy. Wood himself led an active role in his community; he served as secretary-treasurer for the Turlock Exchange Club in the 1920s and served on the board of trustees for Galt High School in the 1940s. Trained as an engineer, Wood came to California from Wisconsin in 1905 at the age of 20.[82]

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[77] Technical Report, 106; "County Ok's Tax Rate for New Plainview District," *Tracy Press*, May 4, 1951; "More Acreage Wanted in New Water District," *Tracy Press* October 2, 1950; Evelyn De Wolfe, "San Simeon Builder's Forgotten Notes : Cache Enriches Castle Lore," *LA Times*, January 25, 1985; "Carol Louise Stolte Paden," *Alameda Sun*, May 14, 2020.

[78] Technical Report, 106; "New Southbay Business Licenses," *The Redondo Reflex*, April 16, 1948; "Gasoline, TV Thefts Reported," *Merced Express*, January 29, 1959.

[79] Technical Report, 147; "Advertisement," *West Side Index*, June 2, 1960; United States Federal Census, "Hubert Sykes," 1940 and 1950.

[80] Technical Report, 146; United States Federal Census, "E A Pollard," 1940; "Official Report of the Board of Supervisors," *Contra Costa Gazette*, May 6, 1949; "Mendocino Beacon Files," *Mendocino Coast Beacon*, January 2, 1959.

[81] Technical Report, 146; "Modestan's Bid On Road Work is Low," *Modesto Bee*, February 24, 1939; "Advertisement," *Modesto Bee*, February 26, 1947; "Supervising the Jobs," *Western Construction*, vol. 32 (Cornell: King Publications, Jan. 1957); Gene Phillips, "Obituary- Cirgus H. Rumbaugh," *Rogers County Archives*, November 28, 2006.

[82] Technical Report, 146; "Neel Re-elected Club President," *Modesto Bee*, July 2, 1926; "Farmers and Grape Growers Attention," *Lodi News-Sentinel*, April 27, 1943; "Wood Given Contract to Assist Navy," *Lodi News-Sentinel*, June 18, 1943; United States Federal Census, "Claude C. Wood," 1940; US City Directories, 1822-1995, "Claude C. Wood," 1905.

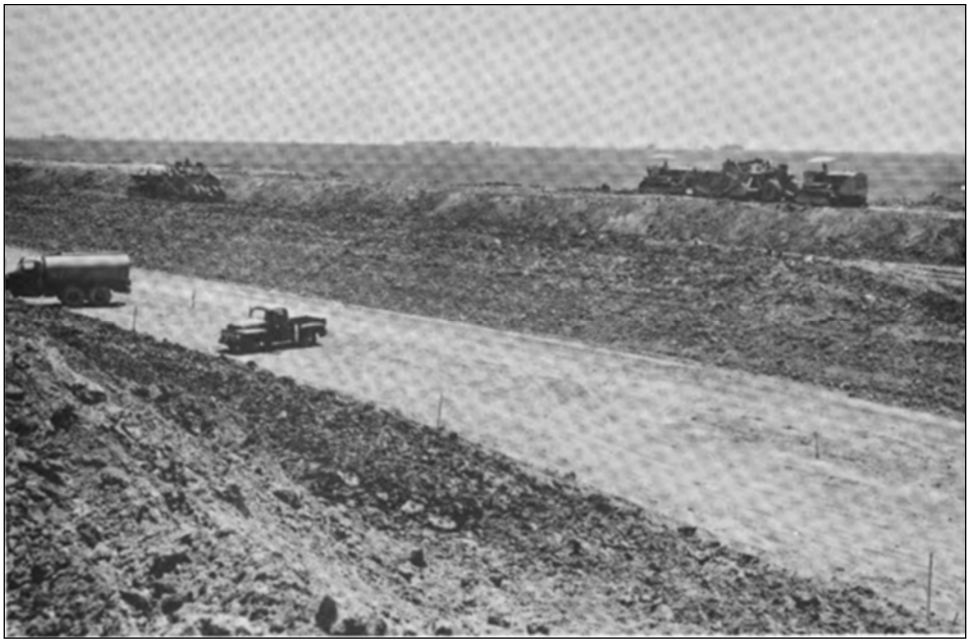

Figure 11: Placing and compacting lining material on side slope of canal, July 26, 1950.[83]

The high groundwater level, some large storms, and labor issues were among the biggest obstacles during construction. The high groundwater table caused water intrusion into the canal excavations and required contractors to de-watered those areas moving the water into a pilot ditch or other drain structures. Heavy storms in November and December 1950 also slowed progress when the deluge caused high water in Los Banos and San Luis creeks, which both breached constructed portions of Delta-Mendota Canal, causing damage to the canal and to some of the siphons. The storms also caused excess water in Garzas Creek to undermine an overchute pier and damaged some of the canal lining. After the delays caused by the storms and the subsequent repairs, a series of labor strikes in May 1951 halted constructed for about two weeks. Once the workforce returned the main branch of the canal was completed in summer 1951, but Delta-Mendota Canal was not considered complete until April 1952 when the San Luis Wasteway was completed (later renamed Volta Wasteway).[84]

Completion of the CVP was an economic boon to the Central Valley. In 1953, two years after the major canals of the project were complete, the project provided 1,500,000 acre-feet to irrigate nearly 720,000 acres of land. That year, the project delivered 134,000 acre-feet of irrigation water along Delta-Mendota Canal to districts composed of almost 120,000 acres. Reclamation planned for ultimate development of 225,000 acres in the Delta-Mendota service areas to be achieved upon the completion of Folsom Dam (1956) on the American River in Sacramento County and the Trinity Division in Trinity County (1959-1967), which transfers water from the Klamath River Basin into the Sacramento River Basin.[85]

Completion of the CVP also came with controversy. The century or so after California's Gold Rush witnessed exploitation of the Delta not only for irrigation purposes, but for other water resources, including chinook salmon. Canneries appeared in Sacramento as early as 1864, but the California Fish Commission noted a severe decline in fish populations by 1880 – attributed to overfishing and the prevalence of sediment in spawning beds from hydraulic mining. As detrimental as overfishing and mining were to the salmon runs, the most adverse effects came from the changes in the Delta landscape and ecosystem from the Central Valley Project and the State Water Project. Delta-Mendota Canal provided water to the west side

[83] [Photograph], DM-895-CV, in USDI, Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 141.
[84] USDI, Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 142-144.
[85] USDI, Reclamation, "The Contribution of Irrigation and the Central Valley Project to the Economy of the Area and the Nation," (Government Printing Office: Washington, 1956), XIII, 21.

of the San Joaquin Valley, but left "the 59-mile stretch of the river from Mendota upstream to Friant Dam with little water, and within this reach, the 23 miles directly above Mendota were completely dewatered." The dry river channel and the 319-foot-high concrete dam rendered the salmon helpless, with no way to continue their traditional migration and spawning runs. Not until 2009 did legislation pass to provide "substantial river channel improvements and sufficient releases from Friant Dam" to sustain the fish population from downstream to the Merced River, allowing water to flow freely through the San Joaquin River. The impacts of this San Joaquin River Restoration Settlement Act are still being observed.[86]

Further negative effects on the fish populations of the San Joaquin River system have been caused by altered hydrology, recirculation of water, and poor water quality caused by polluted runoff and dissolved oxygen. Though fish are entrained at the C.W. Bill Jones Pumping Plant (formerly Tracy Pumping Plant) to mitigate impact on the fish population, increased pumping alters the hydrodynamic conditions of the water, creating problems for fish who rely on habitat condition indicators to make their run. The Central Valley Project Improvement Act of 1992 allocated 800,000 acre-feet per year of CVP water "dedicated for anadromous fish enhancement and wildlife purposes," managed by the Sacramento division of the U.S. Fish and Wildlife department. A portion of this water is reserved to reduce pumping from the Jones plant, as efficient fish diversion via entrainment continues to decrease.[87]

By 1959 when Reclamation published its final report on Delta-Mendota Canal's construction, entitled *Delta-Mendota Canal Technical Record of Design and Construction*, most of the turnouts supplying water to individual water districts had been completed, nearly all according to Reclamation's standardized specifications. A few more, also designed according to specifications, were over the next several decades.[88] Individual water districts are responsible for maintaining turnouts into their own distribution systems and adding turnouts from Delta-Mendota Canal as needed and approved by Reclamation. Most of the physical changes made to Delta-Mendota Canal since its completion fall into five categories 1) maintenance, 2) capacity correction, 3) water district turnout additions and changes, 4) drainage / erosion control, 5) automation. Since October 1992 San Luis & Delta-Mendota Water Authority (Authority) has been responsible for maintenance of Delta-Mendota Canal.

The Authority is responsible for maintaining the concrete lining of the canal. Natural processes including land subsidence and soil characteristics cause deterioration of the concrete panels that line the canal. As noted, land subsidence and the damage it caused to Delta-Mendota Canal became apparent almost as soon as Reclamation turned water into the canal. Writing retrospectively about subsidence in 1968, geologist N.P. Prokopovich, and engineer D.J. Hebert noted that the most widespread soil bed in the upper part of the San Joaquin Valley was an "ancient lake bed known as the Corcoran or Blue Clay," in which a substantial storage of artesian groundwater lays. This groundwater reserve constituted a large portion of the irrigation supply before the CVP and continued to be a source even after the canal was built. Since 1960, the Bureau of Reclamation recognized a phase of subsidence caused by well-developed ground water overdraft, denoting it as "prominent and publicized." However, a different phase of subsidence called "lag," which occurs even when the area experiences little or no pumping of groundwater, and despite a decrease or disappearance of overdraft.[89]

Prokopovich and Hebert explained that the last 30-40 miles of Delta-Mendota Canal offer a remarkable example of lag subsidence (**Figure 12**). Preconstruction and construction surveys had not recognized any land subsidence in the lower reaches of the DMC, and any changes in elevation were attributed to earthquakes. By 1952, however, professionals identified

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[86] Philip Garone, "Managing the Garden: Agriculture, Reclamation, and Restoration in the Sacramento-San Joaquin Delta," in in Delta Protection Commission, Delta Narratives: Saving the Historical and Cultural Heritage of the Sacramento-San Joaquin Delta, prepared by the Center for California Studies, California State University, Sacramento (West Sacramento: Delta Protection Commission, 2015), 77-86.
[87] USDI, Bureau of Reclamation, "Delta-Mendota Canal Recirculation Feasibility Study – Plan Formulation Report," (Sacramento: September 2010), 58-62; USDI, Reclamation, "Delta-Mendota Canal/California Aqueduct Interie – Final Environmental Impact Statement, vol 1: Main Report," (Sacramento: November 2009), 99-102.
[88] USDI, Reclamation, *Delta-Mendota Canal: Technical Record of Design and Construction;* USDI, Reclamation, "Milepost at Structure Sites Delta-Mendota Canal," 1985.
[89] N.P. Prokopovich and D.J. Hebert, "Land Subsidence Along the Delta-Mendota Canal, California," *Journal (American Water Works Association)* vol. 60, no. 8, August 1968.

subsidence as responsible for past changes in elevation. At the time of article, Prokopovich and Hebert noted that 22 miles of the concrete-lined section and all 18 miles of earth-lined section were affected by subsidence, causing the linings to become submerged below the water. Bridges and pipe crossings showed extensive effects of subsidence, where their clearance to the water was reduced sometimes to within inches or none at all. In some cases, the subsidence caused timber bridges and pipe crossings to flood (**Figure 13**). Prokopovich and Hebert stated that subsidence had not negatively affect the capacity of the canal, nor was there damage to either canal linings or structures. Despite the lack of impacts to the canal's capacity and its linings and structures, subsidence caused enough of a maintenance and operations problem to warrant a plan to rehabilitate the canal that was proposed for the 1968-1969 fiscal year. Reclamation staff estimated that the lag subsidence would increase up to two feet a year.[90]

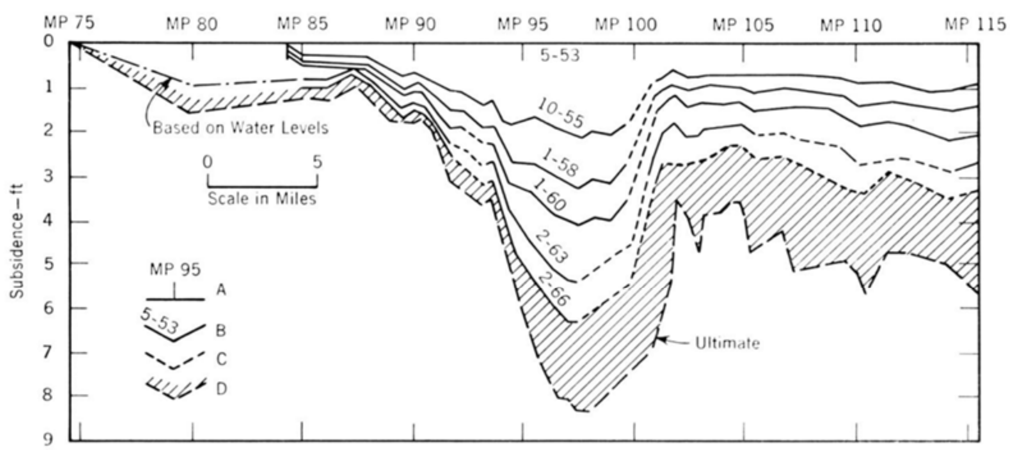

Fig. 5. Past and Future Land Subsidence in Downstream Reaches of the Delta-Mendota Canal

A is mile post (distance from intake); B is date of survey data; C is interpolations to bridge data gaps; D is predicted ultimate subsidence.

Figure 12: From Prokopovich and Hebert, graph showing past and future subsidence, 1968.[91]

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[90] N.P. Prokopovich and D.J. Hebert, "Land Subsidence Along the Delta-Mendota Canal, California," *Journal (American Water Works Association)* vol. 60, no. 8, August 1968.

[91] [Photograph] in Prokopovich and Hebert, "Land Subsidence Along the Delta-Mendota Canal, California," 917.

Fig. 7. Effect of Subsidence on Bridge at Near Capacity Flow

This is a partially submerged timber bridge at Mile Post 98.21, in an area affected by deep subsidence. Concrete lining of the canal is completely flooded.

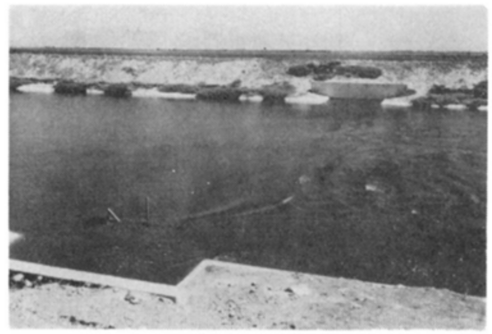

Fig. 9. Effect of Subsidence on Pipe Crossing at Near Capacity Flow

This is a submerged pipe crossing at Mile Post 91.71 in an area affected by deep subsidence.

Figure 13: Effects of subsidence on DMC, 1968.[92]

In December 1952, members of the canal's Central Valley Project Operations and Tracy Operations divisions conducted a biennial inspection of Delta-Mendota Canal, the first of which took place in October 1951, just a few months after the canal first delivered water. The report contained comments on the intake structure and intake canal; concrete and earth lining; and structures. It also provided recommendations and a general remark noting that "this was the first time the upper 100 miles of canal has been [dewatered] since water was turned in the canal in July 1951." The inspectors noted minor bank erosion and beaching on a curve of the canal near M.P. 0.5, no leakage in the discharge lines, and concrete and earth linings in good condition aside from "minor trouble spots" such as bulging and cracking and settlement of berms (**Figure 14**). Concerning the structures, the inspectors observed problems like leakage in the Mountain House Road siphon, canal silting at M.P. 42, drain pumps out of service, and inaccurate measurements from sparling meters.[93]

In June 1965, the Bureau of Reclamation Chief of Engineers received a report on the condition of Delta-Mendota Canal, including Tracy Fish Collecting Facilities and Tracy Pumping Plant. Overall, the canal appeared to be in excellent condition at the time, including its structures, gates, and operating roads. Subsidence was described as "slow and not yet stabilized." At the time of the inspection, no maintenance issues caused by the subsidence presented themselves; therefore, no corrective action occurred. The report also mentioned that several bridges had been replaced, with others needing replacement as well, such as the bridge at M.P. 90.56 (**Figure 15**). The turnouts and gates and wasteways looked to be in good condition, only requiring minor aesthetic maintenance. The inspectors observed the Tracy Pumping Plant to be well-maintained and in excellent condition, but did note a horizontal crack in the wall along the construction joint on the discharge side of the motor room. However, the inspectors found no evidence of leakage. Regarding cross drainage siphons and channels, the examination team noticed some leakage that seems to decrease as the weather and water warm. To mitigate this leakage and degradation, baffled-apron drops were under construction (**Figure 16**). The report concluded with the recommendation that the unwatered canal be watched during the winter of 1965-1966 to determine the necessity of repairing the flap-valve underdrain outlets

[92] [Photograph] in Prokopovich and Hebert, "Land Subsidence Along the Delta-Mendota Canal, California," 918.
[93] United States Department of the Interior, Bureau of Reclamation, Divisions of Design and Construction Operation and Maintenance, *Report on Inspection of Friant-Kern, Madera, Contra Costa, and Delta-Mendota Canals, 1-5.*

because that winter would likely be the last year of the "normal operating procedure" because once the San Luis Unit began operations (built in the early 1960s), the canal would be in continuous use. [94]

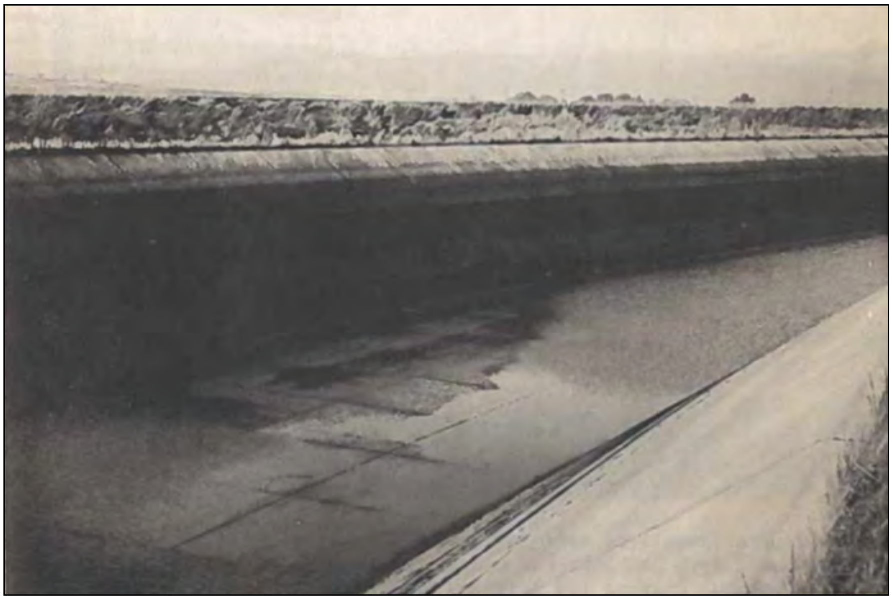

Figure 14: M.P. 11.15, concrete lining and heaving of bottom slab.[95]

Figure 15: Bridge, Mile 90.56, scheduled for replacement. May 14, 1965.[96]

[94] United States Department of the Interior, Bureau of Reclamation, *Condition of Major Irrigation Carriage Systems and Appurtenant Features – Central Valley Project* (Denver: June 21, 1965), 3-8.
[95] [Photograph], DM 2294 in USDI, Divisions of Design and Construction Operation and Maintenance, *Report on Inspection of Friant-Kern, Madera, Contra Costa, and Delta-Mendota Canals.*
[96] [Photograph], Photo No. 5, P214-D-48741 NA, in USDI, Reclamation *Condition of Major Irrigation Carriage Systems and Appurtenant Features*, 20.

Figure 16: Baffled apron drop under construction, May 12, 1965.[97]

The Bureau of Reclamation authored a similar report on June 5, 1970, examining "major irrigation structures and facilities operated and maintained by Tracy Field Division, Central Valley Project." Overall, the structures were found to be in good condition. The most pressing concern was the prevalence of people and expanding use of the canals for recreational activities like fishing. On Delta-Mendota Canal, the inspectors noted some erosion in the earth-lined section, but the concrete-lined sections appeared to be in excellent condition. As stated in previous inspection reports, some cracking in the lining on Mile 75 was evident but did not seem to be increasing. The examination team commented on the disruption of the canal by the public, including agricultural pipe crossings on the canal or farmers who discharged barnyard waste into the canal (**Figure 17**). The report recommended fencing around the checks to prevent fishing and any risk of people falling into the canal and drowning. The team found the overall condition of the canal's radial gates and turnouts and drain inlets to be satisfactory and without need for repair but recommended the removal of cottonwood trees growing in the San Luis wasteway channel.

The 1970 inspection report did, however, note some issues concerning subsidence, seepage, and silt deposits. The team noticed subsidence in the lower reaches of the canal, below M.P. 70. At the time of the inspection, the reach was already scheduled for a lining raise, to alleviate the effects of future subsidence. The team also witnessed significant seepage at two locations

[97] [Photograph], Photo No. 9, P214-D-48732 NA, in USDI, Reclamation *Condition of Major Irrigation Carriage Systems and Appurtenant Features*, 21; baffled apron drop under construction to control retrogression at Coral Hollow Creek Siphon.

along the canal, with the most detrimental between M.P. 56 and 57. According to the report, a prior inspection observed seepage; thus, the maintenance division added a layer of butyl rubber over the concrete lining sometime in 1966. This remedy proved to be insufficient and a plan to completely replace the concrete lining was in development. Silt deposits became more prevalent after the construction of the O'Neill Pumping Plant (at B.F. Sisk Dam and part of the San Luis Unit) and with the "increased operation of the check gates" downstream of the Tracy Pumping Plant (**Figure 18**). Due to a lack of funding for studies, no sufficient method of removing sediment existed in 1970 for the Tracy Field Division.[98]

Figure 17: Discharge of barnyard manure into the canal, May 16, 1970.[99]

[98] United States Department of the Interior, Bureau of Reclamation, *Condition of Major Irrigation Structures and Facilities – Central Valley Project – Report of Examination* (Denver 1970).
[99] [Photograph], 5-70-49D in USDI, Reclamation, *Condition of Major Irrigation Structures and Facilities – Central Valley Project – Report of Examination*, 14; government is starting legal action if this is not stopped by July.

Figure 18: Note rough silty water below gates at Check No. 19, May 16, 1970.[100]

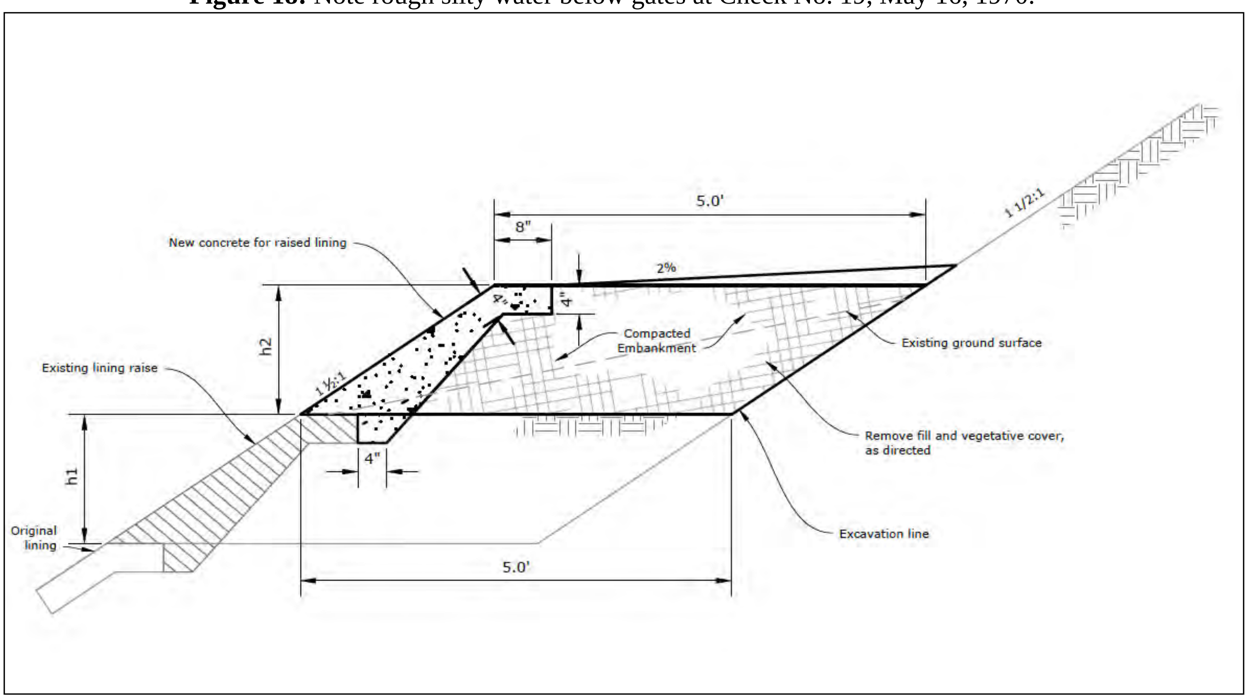

Figure 19: DMC typical cross section showing placement of original concrete lining, previous lining raise, and proposed lining raise.

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[100] [Photograph] 214-D-67155 in USDI, Reclamation, *Condition of Major Irrigation Structures and Facilities – Central Valley Project – Report of Examination*, 16; gate pins partially submerged.

Over time various points along the canal have required modifications to correct the carrying capacity of the canal. Reclamation undertook one of the earliest, and most extensive capacity corrections in 1969, raising approximately 70 miles of the concrete-lined canal 18 inches and 24 inches.[101]

Wet conditions and soil characteristics make drainage and erosion control a perpetual issue that requires maintenance, the placement of drains where needed, and abandonment of drains that have become obsolete. As farming intensified around the canal following its completion, drainage water diminished as it was captured by surrounding farmlands. Many original concrete inlet drains have either become obsolete or have deteriorated.

Other changes have taken place to structures that span the canal like bridges and pipe crossings / overchutes since completion of Delta-Mendota Canal. In the 1960s, Reclamation undertook a bridge rehabilitation project that converted timber farm bridges piers from wood to concrete. Pipe crossings are changed frequently, and Reclamation maintains separate license agreements with utility companies for each crossing of water, oil, gas, transmission lines etc. Pipelines are removed, replaced with a new type of pipe, and added at new locations as dictated by local demand.

The massive length and capacity of Delta-Mendota Canal has largely been an obstacle to execution of a comprehensive modernization or upgrade plan because the cost would be prohibitive. Instead, the original design specifications have continued to serve as the basis for maintaining the canal, which has resulted in a high retention of many of the features and the overall character of Delta-Mendota Canal.

[101] USDI, Reclamation, *Designer's Operating Criteria*, 1971: 4-5, 26; Grimsley, J. O. and M. L. Barmettlor, *Condition of Major Irrigation Structures and Facilities*, Region 2, 1970, Appendix I – 3, 6.

NRHP / CRHR Evaluation

Criteria for Evaluation

The eligibility criteria for designating historic properties under federal and state criteria are essentially the same. The criteria for listing properties in the National Register of Historic Places (NRHP) are codified in 36 CFR 60 and expanded upon in numerous guidelines published by the National Park Service. Buildings, structures, objects, sites, and districts listed in, eligible for listing in, or that appear eligible for listing in the NRHP are considered historic properties under the regulations for Section 106 of the National Historic Preservation Act (NHPA). Eligibility for listing buildings, structures, objects, sites, and districts (i.e., historic properties) in the NRHP rests on twin factors of *historic significance* and *integrity*. A resource must have both significance and integrity to be considered eligible. Loss of integrity, if sufficiently great, will overwhelm the historic significance a property may possess and render it ineligible. Likewise, a property can have complete integrity, but if it lacks significance, it must also be considered ineligible. Historic significance is judged by applying the NRHP criteria, identified as Criteria A through D. The NRHP guidelines state that a historic property's "quality of significance in American history, architecture, archeology, engineering, and culture" must be determined by meeting at least one of the four main criteria. Properties may be significant at the local, state, or national level. The NRHP criteria are:

Criterion A: association with "events that have made a significant contribution to the broad patterns of our history;"

Criterion B: association with "the lives of persons significant in our past;"

Criterion C: resources "that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values;"

Criterion D: resources "that have yielded, or may be likely to yield, information important to history or prehistory."[102]

Integrity is determined through applying seven factors to the historic resource: location, setting, design, workmanship, materials, feeling, and association. These seven can be roughly grouped into three types of integrity considerations. Location and setting relate to the relationship between the property and its environment. Design, materials, and workmanship, as they apply to historic buildings, relate to construction methods and architectural details. Feeling and association are the least objective of the seven criteria and pertain to the overall ability of the property to convey a sense of the historical time and place in which it was constructed.

Central Valley Project Draft Multiple Property Listing

In 2009 Reclamation prepared a *Draft National Register of Historic Places Multiple Property Documentation Form: Central Valley Project* (CVP MPL), and updated it in 2018.[103] The CVP MPL identifies the period of significance for the CVP as 1935 when the project received its first authorizations to 1956 when the last of the major project components was completed. The document provides registration criteria regarding NRHP significance and integrity. The subsections of the registration requirements relied upon for this evaluation of Friant-Kern Canal for individual eligibility for listing in the NRHP are the subsection for "Main Canals," and for "Appurtenant Canal Features," as quoted below. The NRHP and CRHR evaluation of Friant-Kern Canal contained in this report utilizes the framework provided in the CVP MPL.

[102] USDI, National Park Service, *Guidelines for Applying the National Register Criteria for Evaluation, National Register Bulletin 15* (Washington, D.C.: USDI, National Park Service, 1990, rev. 1997).

[103] Jim Bailey, "National Register of Historic Places Multiple Property Documentation Form, Central Valley Project: Planning and Construction of the First Four Divisions, 1935-1956," draft prepared for Reclamation, 2009, updated 2018.

The following is excerpted from the CVP MPL:

Main Canals

Construction on the first main canal of the CVP, the Contra Costa Canal of the Delta Division, commenced in 1937 and was completed in 1948. In 1940, construction began on the Madera Canal of the Friant Division, with construction completed in 1945. In 1945, construction on the Friant-Kern Canal began. The following year, construction on the Delta-Mendota Canal commenced. Finally, in 1950, construction on the Delta Cross Channel began. The Friant-Kern Canal, Delta-Mendota Canal, and Delta Cross Channel were all completed in 1951. The longest main canal is the Friant-Kern Canal at 151.8 miles, while the shortest is the Delta Cross Channel at 1.2 miles. All main canals are located on Reclamation fee title or easement land.[104]

Significance

In conjunction with the storage and diversion dams, canals form the CVP's backbone. They provide the means to transfer, transport, and deliver water through the system and ultimately to the water users. Traversing across hundreds of miles, the canals form a significant feature of the physical landscape and define the geographical limits of the project. In keeping with the original CVP plan of large-scale water transfers, canals are the primary means behind the geographical redistribution of fresh water from the valley's wetter northern reaches to the drier southern stretches.[105]

Registration Requirements for CVP Canals

The period of significance for historic water conveyance structures begins in 1937 with the initial construction of the first CVP canal, the Contra Costa Canal, and ends in 1951 with the completion of the Friant-Kern, Delta-Mendota, and Delta Cross Channel canals. Like the dams, these canals are part of the initial CVP authorizations. The main canals within the period of significance for this historic context are all considered individually eligible because of their primary role in operating the CVP. The main canals can be individually eligible for the National Register under one or more of the criteria, as follows:[106]

Criterion A: They have had a significant impact on the settlement, agricultural economy, or development patterns of the project area; they have been defining elements in the evolution of the cultural landscape; they are directly associated with important events.

Criterion B: They are the result of the direct efforts of a prominent individual associated with the CVP and are the most prominent feature associated with that individual.

Criterion C: They represent the distinctive characteristics of Reclamation canal design and/or methods of construction used on the CVP; they involved challenging engineering design problems due to topography, grade, length, natural obstacles, and resulted in complex or innovative solutions; they are among the best or a rare surviving example of a distinctive type of water conveyance structure; they represent the evolving technology in the engineering, design, and construction of water conveyance structures; they were identified during the construction period as an individually significant feature; or they embody the work of a significant engineer or builder.

Criterion D: They have the ability to yield information important to understanding the history of the CVP.[107]

Integrity

The need for continual maintenance and repairs to canals requires special consideration of integrity. Irrigation systems are constantly evolving as features are upgraded, repaired, or replaced. Alterations made to canals during the period of significance, and even subsequent **thereto**, may not nullify eligibility if a canal retains certain key qualities. Most important are integrity of location, association, and overall design configuration of the conveyance prism (i.e. depth and width) and water

[104] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 106.
[105] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 106.
[106] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 107.
[107] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 108.

control features. A canal which has retained its original form and associated appurtenant features has a high degree of integrity. It is not uncommon for canal lining to be replaced, or for previously unlined segments to be lined. Such changes may not preclude a canal's eligibility if replacement features are in-kind, or they do not significantly damage the canal's historic association or its overall design. If in addition to integrity of association, location, and overall design, the historical setting and feeling of a canal are maintained, then the likelihood is even higher that an altered canal could remain eligible. On the other hand, if an entire canal is piped, it would no longer convey any of its original design, workmanship, materials, or historical association and would not be contributing. Conversely, partial piping of a significant canal may not preclude eligibility if a majority of a canal is still open and intact.[108]

Appurtenant Canal Features

Although appurtenant canal features are all operationally and thematically related to canals, each feature type serves a specific purpose. These features can be divided into five categories of structures: conveyance, regulating, protective, water measurement, and bridges. The first four of these types were built to function as part of the canal, while the bridges were built to function independently of the canal.[109]

1. *Conveyance Structures*

Conveyance structures are features such as inverted siphons, drops, chutes, flumes, tunnels, and pipelines that are used to safely transport water from one location to another traversing various existing natural and manmade topographic features along the way. There are two types of pipelines, those that carry water below ground and those that transport water above ground.[110]

2. *Regulating Structures*

Regulating structures are used to raise, lower, or control the release and volume of the water flow. Regulating structures that are located at the source of the water supply include headworks and turnouts. Headworks control the release of water into the canal, and are often located downstream from a major diversion or storage facility. Regulating structures located along the course of a canal include turnouts, checks, check-drops, radial gates, reservoirs, and diversion structures. The smaller regulating structures like checks and turnouts are basic components of an irrigation system.[111]

3. *Protective Structures*

Protective structures protect the canal system and adjacent property from damage which would result from uncontrolled storm runoff or drainage water, or an uncontrolled excess of flow within the canal. Several different types of structures perform this function, including overchutes, drainage inlets, siphon spillways, and wasteways.[112]

4. *Water Measurement Structures and Objects*

Water measurement structures are used to gauge water flow and ensure its equitable distribution. Many different types of water measurement structures are used in irrigation systems. The type most commonly used in Reclamation's systems are Parshall flumes, weirs, open-flow meters, and constant head orifices.[113]

5. *Miscellaneous Structures*

a. Bridges

Bridges crossing CVP canals range from single lane bridges, multi-lane highway bridges, farm bridges, pedestrian bridges, and maintenance bridges. Most of the bridges constructed within the period of significance were built by Reclamation

[108] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 108-109.
[109] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 109.
[110] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 109.
[111] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 109-110.
[112] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 110.
[113] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 111.

according to standard designs. Ownership of the bridges were turned over upon their completion to other entities, including city, county, or state transportation agencies. There are also many bridges not constructed by Reclamation that have been added over CVP canals and were built outside the period of significance for this historic context. Additionally, some original bridges built by Reclamation have been replaced.[114]

b. Gauging or Recording Stations

Several types of small structures were built in association with gauging or recording stations to measure canal flows. The most common are small circular plan, sheet metal structures called "tin whistles" or "silver bullets" that provide enclosure for recording devices. A second type of shelter is small reinforced concrete "houses." When gauging or recording stations are located over the canal, simple wooden footbridges with wood handrails were constructed to permit the taking of measurements. In some cases, the original bridges have been replaced with concrete or metal ones, which are easier to maintain. Many of the gauging or recording structures are built on concrete pads, adjacent to the canal, on the canal berm.[115]

Significance

Secondary to the canals in distributing water are the thousands of appurtenant features. With the exception of bridges, these appurtenant features are important to the overall operation of the main canals, yet are too small in size and repetitive in design to merit individual eligibility.

Even though bridges cross canals and can be physically tied to the canal prism, bridges have no connection to the operation of the CVP and therefore merit separate evaluation from other appurtenant features. In addition, most of the bridges were either constructed by Reclamation and ownership was turned over to a different entity or they were constructed by a different entity. Because of these reasons, bridges would rarely be individually eligible for the National Register in association with this historic context.[116]

Registration Requirements

The period of significance for historic appurtenant canal features begins in 1937 with the initial construction of the first CVP canal, the Contra Costa Canal, and ends in 1951 with the completion of the Friant-Kern, Delta-Mendota, and Delta Cross Channel canals. CVP appurtenant canal features can be eligible for the National Register for the following reasons:[117]

Criterion A: They are directly associated with important events that occurred along canals;

Criterion B: not applicable;

Criterion C: They are among the best or a rare surviving example of a distinctive type of appurtenant canal feature; they represent the evolving technology in the design of appurtenant canal features; they represent a unique design solution developed in response to a difficult engineering challenge; they were identified during the construction period as an individually significant feature;

Criterion D: They have the ability to yield information important to understanding the history of the CVP.[118]

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[114] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 111.
[115] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 111.
[116] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 112.
[117] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 112.
[118] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 112-113.

Integrity

As with canals, many appurtenant features are upgraded, altered, or even replaced over time due to the constant ongoing maintenance needs. Integrity of a structure's historic materials, workmanship and design is essential for National Register eligibility under any criterion. Because location is of primary importance under Criterion A, a structure will rarely qualify under this criterion if it does not remain on its historic site along its associated canal. Location can also have importance under Criterion C, but this association is less vital.[119]

Evaluation

The following evaluates Delta-Mendota Canal for individual eligibility for listing in the NRHP and CRHR under the theme presented in the draft CVP MPL.

Portions of Delta-Mendota Canal and some of its appurtenant features have been subject to previous NRHP evaluations. In 2009, Reclamation historian Jim Bailey prepared a draft NRHP nomination form that concluded that Delta-Mendota Canal meets NRHP Criterion A with a period of significance from 1946-1951. Bailey also evaluated Tracy Pumping Plant in 2009, concluding that it meets NRHP Criterion A and C with a period of significance of 1951. Other appurtenant features of the canal that have been previously evaluated are listed in Table 9 below with the updated status codes provided by this evaluation.[120]

Table 9: Previously evaluated segments and appurtenant features of Delta-Mendota Canal.

Primary String	Resource Name	Status Code – Previous	Status Code – Updated by this evaluation	County
P-10-005165	Delta-Mendota Canal Bridge	3D	6Z	Fresno
P-10-006215	Sierra Avenue Bridge (42C0281); Sierra Avenue Bridge over Delta-Mendota Canal	3D	6Z	Fresno
P-10-006649	Bridge 42C0074; Nees Avenue Bridge over Delta-Mendota Canal	3D	6Z	Fresno
P-24-001703	Delta Mendota Canal	2S2	2S2	Merced
P-24-001848	San Luis Wasteway (part of Delta-Mendota Canal)	2S2	2S2	Merced
P-39-000089	Delta Mendota Canal	3D	2S2	San Joaquin
P-50-001904	Delta Mendota Canal	2S2	2S2	Stanislaus

[119] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 113.
[120] California Historical Resource Status Codes.
2S2: Individual Property determined eligible determined eligible for NR by a consensus through Section 106 process. Listed in the CR.
3D: Appears eligible for NR as a contributor to a NR eligible district through survey evaluation.
3S: Appears eligible for NR as an individual property through survey evaluation.
6Z: Found ineligible for NR, CR, or Local designation through survey evaluation.

Primary String	Resource Name	Status Code – Previous	Status Code – Updated by this evaluation	County
P-01-010442	Tracy Pumping Station (No. 11a)	3S	2S2	Alameda
P-07-002983	Tracy Fish Collection Facility	6Z	6Z	Contra Costa

The following presents the evaluation of Delta-Mendota Canal for individual eligibility for listing in the NRHP and CRHR under the theme presented in the draft CVP MPL.

Criteria A and 1

The CVP fundamentally altered California's landscape and economy by moving water over a long distance from basin to basin and providing more reliable irrigation water to regions previously prone to scarcity of both surface water and groundwater. Delta-Mendota Canal, an integral component of the Delta Division of the CVP, allowed continued delivery of water to irrigators on the San Joaquin River so that water could be diverted further south to areas with a lower water supply. While its benefits to agriculture cannot be overstated, Delta-Mendota Canal is also at the center of the controversy over replacing impounded and re-routed San Joaquin River water that no longer flows through historic salmon and steelhead spawning grounds.

Whether viewed as beneficial or harmful, Delta-Mendota Canal is an instrumental component in accomplishing the objective of the CVP, bringing irrigation water from the wetter northern state to the arid regions of the San Joaquin Valley. At 116 miles long, stretching from C.W. Bill Jones Pumping Plant (Tracy Pumping Plant) in the Delta to Mendota Pool on the San Joaquin River, Delta-Mendota Canal demonstrates the purpose of the CVP, and the scale of the transformation it generated. The canal has had a lasting legacy on California agriculture, providing a reliable water source to support immensely successful agricultural enterprises. Delta-Mendota Canal meets NRHP Criterion A and CRHR Criterion 1 at the state level because of its primary role in accomplishing the visionary goals of the CVP to transfer a substantial portion of the San Joaquin River water supply from its historical route to the arid lands of the southern San Joaquin Valley. Delivery of San Joaquin River water away from its historical water users was not a tenable proposition without the provision for replacement water delivered by Delta-Mendota Canal. The period of significance under these criteria is from the awarding of the first construction contract in 1946 to 1951 when water was first turned down the canal to provide a replacement supply of water.

Criteria B and 2

The CVP was the result of the efforts of many individuals and agencies over many years and no one person or group of people rises in the historical record as playing a direct role in its implementation in a way that would be best demonstrated by Delta-Mendota Canal; therefore, Delta-Mendota Canal is not individually eligible for listing in the NRHP under Criterion B or in the CRHR under Criterion 2.

Criteria C and 3

Delta-Mendota is individually eligible for listing in the NRHP and CRHR under Criterion C and Criterion 3 because its size, scale, and purpose demonstrate the magnitude of the CVP's engineering and construction accomplishment. The largesse of the vision required an outsized engineering effort and no other component part of the CVP better demonstrates the vision than Delta-Mendota Canal, designed to provide water to replace the flow of the San Joaquin River. Construction of any long-distance linear infrastructure requires extensive planning and engineering, large-scale construction, and coordination among jurisdictions and agencies. As one contemporary observer noted, the "quantity of earth moved is equivalent in mass to more than three times that of Grand Coulee Dam – world's largest concrete structure – and the quantity [*sic.*] of concrete placed for the 97-mi. concrete-lined portion of the canal is more than sufficient to build a sidewalk 3 ft. wide and 4in. thick between San

Francisco and New York City."[121] The scale of the project and the sheer number of obstacles present along the 116-mile alignment made its design and construction a monumental undertaking. The canal's significance, however, is not tied to the engineering or construction of any of its individual components or appurtenant parts, but rather to its ability to demonstrate the scale of the project by the long-distance conveyance of water for the purpose of transferring water between watersheds. Delta-Mendota Canal is individually eligible at the state level under NRHP Criterion C and CRHR Criterion 3 because it demonstrates the visionary engineering achievement that redistributed the flows of major rivers between basins in California. The period of significance under these criteria is the period of construction of Delta-Mendota Canal, 1945-1951.

Morrison-Knudsen Company, Inc., who won four construction contracts for Delta-Mendota Canal in partnership with M.H. Hasler Construction Company, built the largest share of the canal. Morrison-Knudsen should be considered a master builder for their large body of work and extensive experience with large infrastructural construction projects both in the United States and worldwide since the 1930s that included among other civil and military works, very large dam projects like Hoover Dam on the Colorado River. While construction of Delta-Mendota Canal was a large undertaking for the company, it does not best represent their body of work. They were most known during the pre- and post-World War II period for construction of military installations, bridges, and large dams. Delta-Mendota Canal would not best represent the work of any of the other contractors who won contracts for the canal because their contributions to the project were only to a small fraction of the overall project.

Delta-Mendota Canal also meets NRHP Criterion C and CRHR Criterion 3 because of its direct association with the contributions of renowned Reclamation engineer Oscar Boden who headed the investigation, planning, and siting of the Delta Division of the CVP, including Delta-Mendota Canal. Delta-Mendota Canal, a principal element of the CVP, is an historically important example of this master engineer's work. The period of significance for this canal is its period of construction, 1946-1951.

Criteria D and 4

Delta-Mendota Canal is not eligible under NRHP Criterion D or CRHR Criterion 4 for information potential because it was designed and built according to well-documented practices, and the project is well documented through drawings, textual records, and photographs.

In general, the character-defining features of Delta-Mendota Canal are its location, its relationship to C.W. Bill Jones Pumping Plant (Tracy Pumping Plant), the size, shape, and dimensions of the canal prism, its lining material (approximately 95 miles of concrete and 18 earthen miles), and the direction of water flow from C.W. Bill Jones Pumping Plant downstream to Mendota Pool. Individual elements that contribute to the significance of Delta-Mendota Canal along its 116.4 miles are those structures that are directly related to its significance under NRHP Criterion A / CRHR Criterion 1 and NRHP Criterion C / CRHR Criterion 3, i.e., structures that directly relate to the conveyance of CVP water from the pumping plant to Mendota Pool. Structures like C.W. Bill Jones Pumping Plant, check structures and siphons that convey and control the water's southerly flow from the pumping plant, and structures like turnouts that direct the water to users along its route and wasteways the control excess flows all relate directly to the canal's significance and purpose and therefore contribute to the significance of the historic property. Structures that accommodate pre-existing uses or conditions like pipe crossings, siphon undercrossings, culverts, drains, overchutes, and most bridges do not contribute to the historic significance of this linear historic property because they are not directly related to the conveyance of CVP water, and instead serve ancillary purposes. Similarly, ancillary features like gauging stations or salinity stations do not relate to the historic significance and are not character defining. Operating bridges that are used specifically for the operation of the canal, as opposed to farm bridges or county road bridges that simply cross the canal and have no relationship to its functioning as a CVP water conveyance, have potential to contribute to Delta-Mendota Canal's significance; however, none of this category of bridges crossing Delta-Mendota Canal retain historic integrity. See **Table 5** below and **Appendix C** for contributing status of component elements of Delta-Mendota Canal.

[121] "Concrete Lining Complete for Delta-Mendota Canal," *Western Construction* 25, n. 12 (Dec. 1950), 81.

Table 10: Contributing Status of Component Parts of Delta-Mendota Canal.

Structure Type	Contributing Status
Farm Bridges	Non-Contributing
Railroad Bridge	Non-Contributing
Pipe Crossings	Non-Contributing
County Highway Bridges	Non-Contributing
Overchutes	Non-Contributing
Inlet Drains	Non-Contributing
Road Drains	Non-Contributing
Culverts	Non-Contributing
Cattle Guards	Non-Contributing
Pumps	Non-Contributing
Ladders	Non-Contributing
Gauging Stations	Non-Contributing
Gates	Non-Contributing
Check Structures	All are Contributing
Siphons	All are Contributing
Wasteways	4 are Contributing, 1 is not – see Master Table in **App. D**
CVP Signs	All are Contributing
Lining / Prism	Lining to original specifications is Contributing
O&M Roads	Contributing (roads on canal embankments)
Operating Bridges	Non-contributing; integrity loss
Turnouts	Some are contributing – see Master Table in **App. D**
Pumping Plants	C.W. Bill Jones Pumping Plant is Contributing

The character-defining features and integrity of contributing elements are discussed below, followed by a discussion of the overall integrity of Delta-Mendota Canal. See **Appendix C** for the contributing status of individual components of the historic property.

Canal Prism, Embankments, Maintenance Roads

The character-defining features of Delta-Mendota Canal prism are its original material composition, and original design. Specifically, this includes: its concrete- and earth-lined construction; its original dimensions – height, width, and shape, side slopes, embankments, and O&M roads; and its alignment (**Figure 20- Figure 23**).

Those sections of Delta-Mendota Canal prism that have a high degree of integrity and, therefore, contribute to the significance of the historic property are those that retain all or most of their character-defining features. While some concrete-lined stretches of the canal have been altered by the raising of the lining, this modification only constitutes a minor loss of integrity of design, as the work included appropriate materials (concrete) and the elevated extensions were clearly differentiated from the original by a concrete seam above the original lining. As such, these alterations were made in accordance with standards set forth by the *Secretary of the Interior's Standards for the Treatment of Historic Properties* and do not disqualify those sections with raised concrete lining from contributing to the significance of Delta-Mendota Canal.[122] Similarly, those originally earth-lined

[122] Kay D. Weeks and Anne E. Grimmer, *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings*, revised by Anne E. Grimmer (Washington D.C.: USDI, National Park Service, Technical Preservation Services, 2017).

sections that have been altered by the addition of rip-rap only suffer slightly diminished loss of integrity of designs or materials; however, the rip-rap itself is considered a non-contributing element.[123] While the majority of the surrounding setting remains rural in nature as it was at the time of Delta-Mendota Canal's period of significance, 1946-1951, suburban development radiating out from Mountain House, Tracy, and Patterson have started to alter the characteristic setting. The canal itself in these areas retains its other character-defining features and thus contributes to the significance of Delta-Mendota Canal as a whole. As Delta-Mendota Canal has remained in its original alignment, it retains a high degree of integrity of location throughout the entirety of its alignment.

Figure 20: View of concrete-lined section of canal from approximately M.P. 91.36; camera facing upstream from left bank, June 14, 2022.

[123] The *Secretary of the Interior's Standards for the Treatment of Historic Properties* favor protecting historic properties with temporary materials while planning for repairs that meet the standards.

Figure 21: View of earth-lined section of canal from approximately M.P. 104.22; camera facing downstream from left bank, June 14, 2022.

Figure 22: View of embankment and concrete-lined section of canal; camera facing downstream from left bank, June 14, 2022.

Figure 23: View of embankment and maintenance road along earth-lined section; camera facing downstream from left bank, June 15, 2022.

C.W. Bill Jones Pumping Plant (Tracy Pumping Plant)

The Tracy Pumping Plant complex is made up of the Delta-Mendota Intake Canal (M.P. 0.0-2.52), the Tracy Pumping Plant facility (now called “C.W. Bill Jones Pumping Station”) (M.P. 2.53), three (3) 15-foot (inside) diameter, 4,822-foot long concrete discharge pipes, a concrete-block siphon breaker house with a flat, overhanging roof at the end of the discharge lines (M.P. 3.49), and a concrete inlet structure that releases the water from the Plant into the concrete-lined section of the DMC, at M.P. 3.50. Each of these features is character defining of the Tracy Pumping Plant.

The Delta-Mendota Intake Canal contains fish collection facilities (M.P. 0.09) and a three-barrel siphon under Byron-Bethany Road and a single track for Union Pacific Railroad (formerly Southern Pacific Railroad) (M.P. 1.36/ M.P. 1.41). The character-defining features of the Intake Canal include: the fish collection facilities; the three-barrel siphon; and its loose-earth construction.

The Pumping Plant is a semi-outdoor facility. The building has a two-story rectangular plan, made of concrete, with a flat, parapet roof with inset handrails. The treatment of the concrete walls creates a rectangular pattern on the north, south, and east façades and the windows and doors of the north and south façades are symmetrically arranged and centered on their respective sides. The character-defining features of the Pumping Plant include: the aforementioned form and massing; concrete construction; the windows on the north façade; the accordion doors on the south façade; the inset handrails on the roof and north façade; the six circular, removable hatches on the roof; the six vertical-shaft pumping units symmetrically arranged in pairs within the three eastern sections of the building; and the inlet transition walls.

Figure 24: Tracy Pumping Plant; camera facing southwest, May 9, 2022.

Figure 25: Tracy Pumping Plant; camera facing east, May 9, 2022.

Siphons

The population of Delta-Mendota Canal siphons comprises 13 concrete structures (see **Appendix C** for a listing of all appurtenant DMC structures). Siphons are defined by their concrete construction, with sloped-to-vertical transitional wingwalls, concrete box inlets and outlets, and one-, two-, three, or four-barrel underground concrete channels that transport Delta-Mendota flows beneath waterways, railroads, highways, and an irrigation canal.

The Delta-Mendota Canal siphons retain historic integrity to their period of significance, 1946-1951, and therefore appear eligible for inclusion in the NRHP and CRHR as contributing features of Delta-Mendota Canal. In terms of integrity of design and setting, the Delta-Mendota Canal siphons all remain in their original locations—at the sites of waterways, roadways, railroad crossings, and an irrigation canal. These locations and settings appear largely unaltered. In terms of design, materials, and workmanship, research did not reveal that any substantial modifications have been made to any of the character-defining features of the siphons that would reduce their integrity. The siphons all retain their basic concrete construction, single- and multiple-barrel conveyance structure, and transitional wingwalls, and they all continue to transport Delta-Mendota Canal flows beneath major appurtenant crossings.

Figure 26: Three-barrel siphon inlet headwall at M.P. 13.67; camera facing downstream from left bank, May 10, 2022.

Figure 27: Four-barrel siphon outlet headwall at M.P. 16.34; camera facing upstream from left bank, May, 10, 2022.

Check Structures

The population of Delta-Mendota Canal check structures consists of 21 concrete structures composed of two types (see **Table 1** in DMC DPR 523 form in **Appendix B** for list of DMC check structures, and **Appendix C** for listing for all appurtenant DMC structures). Check structures are characterized by their predominately poured-in-place concrete construction, with sloped transitional wingwalls that contract and expand as Delta-Mendota Canal leads into and away from the check. All checks feature narrow equipment platforms with mechanical gate-hoisting equipment in metal encasements; the concrete platforms are framed with metal pipe railing and most have metal lampposts with umbrella shades. Concrete block check structure houses are later additions after the period of significance and are not character defining of the historic-era canal.

The character-defining features of the Delta-Mendota Canal check structure population retain historic integrity to their period of significance, 1946-1951, and therefore appear eligible for inclusion in the NRHP and CRHR as contributing features of Delta-Mendota Canal. In terms of integrity of design and setting, the Delta-Mendota Canal check structures all remain in their original locations in a setting characterized by adjacent San Joaquin Valley farmlands. Moreover, those check structures constructed near siphon inlets and wasteway turnouts retain their spatial relationships with other components of the canal. In terms of design, materials, and workmanship, research and field observations did not reveal that substantial modifications have been made to any of the character-defining features that would reduce the integrity of these structures. The later addition of the concrete block check houses does not constitute a loss of historic integrity because the structures are small and unobtrusive into the setting of the canal. Moreover, the historic-period population of Delta-Mendota Canal check structures continues to regulate Delta-Mendota Canal flows throughout the span of the canal.

Figure 28: Check No. 16 at M.P. 85.09; camera facing downstream from left bank, June 14, 2022.

Figure 29: Check No. 11 at M.P. 58.28; camera facing downstream from left bank, June 13, 2022.

Wasteways

Wasteways function as escape structures to protect the canal system by diverting water out of the canal and preventing it from overtopping the banks of the canal, minimize the damage resulting from a break in the canal, or by preventing additional damage from a washout or failure of the canal. This class of structures requires an accompanying waste channel from the canal to a point of discharge into a natural drainage channel. The wasteway channels are not in the APE for this project; however, the turnouts into the wasteways are integrated into Delta-Mendota Canal and are within the APE.

There are four primary wasteways and associated wasteway turnout structures along Delta-Mendota Canal and one overspill apron wasteway on the right bank of the canal (see **Appendix C** of report citied in *P11. for a listing of all appurtenant DMC structures). Wasteways turnouts are defined by poured-in-place concrete construction, two rectangular gate sections, two equally sized radial gates, and narrow equipment platforms with mechanical gate-hoisting equipment in metal encasements. The size of the gates is dictated by the capacity of the canal at the turnout. The concrete platforms are framed with metal pipe railing and feature metal lampposts with umbrella shades, though some umbrella shades are missing.

The four wasteway channels – Westley, Newman, Volta, and Firebaugh – are defined by their locations, size and shape of the excavation, concrete and earth lining, and outfalls into the San Joaquin River channel. Culverts and bridges along the wasteway are not directly related to the historical significance of Delta-Mendota Canal and are not character-defining features.

The Delta-Mendota Canal wasteway turnouts and turnout channels retain a good degree of historic integrity of design, materials, workmanship, setting, location, association, and feeling.

The character-defining features of the Delta-Mendota Canal wasteway turnouts and wasteway channels retain historic integrity to their period of significance, 1946-1951, and therefore are contributing features of Delta-Mendota Canal. In terms of integrity of design and setting, the Delta-Mendota Canal wasteways all remain in their original locations, the setting of which remains defined by adjacent San Joaquin Valley farmlands. Moreover, all wasteway turnouts retain their spatial relationships with other components of the canal, which include the canal lining, and the wasteway channels. In terms of design, materials, and workmanship, research and field observations did not reveal that any substantial modifications have been made to the character-defining features that would reduce the integrity of these structures. The population of Delta-Mendota Canal wasteways continues to function as it did historically to regulate Delta-Mendota Canal flows into natural waterways.

Figure 30: Radial gates at Firebaugh Wasteway's inlet structure; camera facing upstream from wasteway's right bank, June 14, 2022.

Figure 31: View of Newman Wasteway; camera facing upstream from right bank, June 13, 2022.

Turnouts

Turnouts function to deliver water into the local distribution systems of water users along the canal and those that have a high degree of integrity and, therefore, contribute to the significance of Delta-Mendota Canal are those that retain all or most of their character-defining features (**Figure 32**). Minor alterations to some of these turnouts such as conveyor-type debris screens across the channel openings, replacement gear mechanisms, and modern railing or fencing do not prevent the turnouts from conveying significance and they contribute to the canal's historical significance. Those turnouts added to the DMC after the initial period of construction that were designed in accordance with Reclamation's original design specifics and possess those character-defining features enumerated above may also be considered contributors to the DMC's significance. However, those turnouts that have been so heavily altered from their original design that they no longer have sufficient integrity to convey their significance are those that have had the original pedestal and geared hoist mechanism removed and replaced, or the concrete equipment decks raised or entirely replaced. These substantial alterations have diminished the integrity of design, materials, workmanship, and feeling to such a degree that these structures no longer convey the significance of the canal. Additionally, those turnouts that have been added that were designed divergently from Reclamation's original design specifications—such as steel-pipe turnouts and turnouts with automated electronic gate-hoisting equipment—are likewise not considered contributors to the DMC's significance (**Figure 33**).

The character-defining features of the turnouts are those materials, equipment, and design aspects that are part of the original construction of these structures, built according to the original design specifications. Specifically, this includes the concrete construction of the structure; shape and size of the water channels or barrels; metal grate debris screens over the openings; original gate hoisting mechanism; gates; concrete deck, railing, and steps; and the position of the turnout deck just above the canal lining.

Figure 32: Turnout at M.P. 45.35; camera facing downstream from left bank, May 12, 2022.

Figure 33: Two turnouts at M.P. 38.14; camera facing downstream from left bank, May 12, 2022.

Because the vast majority of the contributing elements of Delta-Mendota Canal retain historic integrity of the character-defining features, overall Delta-Mendota Canal retains integrity to its period of significance, 1946-1951, and is eligible for listing in the NRHP and CRHR under Criteria A / C and 1 / 3. The boundary of the historic property is from outside toe to outside toe from the inlet canal at M.P. 0.09 to the outlet at Mendota Pool at M.P. 116.61 because this encompasses all of the features of Delta-Mendota Canal that contribute to its significance.

Primary #
HRI #
Trinomial

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton

***Date**: May 9-10, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-1

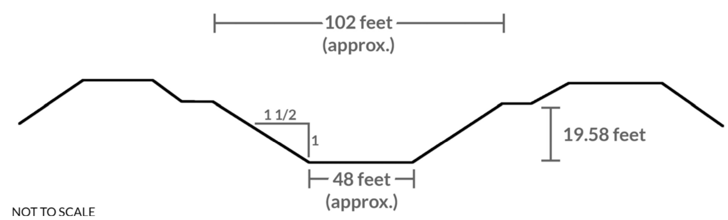
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 1 spans 11.25 miles between canal mileposts 0.09 and 11.34, from the Tracy Fish Collection Facility to a point just upstream of Check No. 1. This segment traverses the western edge of the San Joaquin Valley in Contra Costa, Alameda, and San Joaquin counties and the western edge of the city of Tracy. See **Sketch Map** and **Location Map** on Continuation Sheets.
UTM: Zone 10S, 626724.65mE / 4186399.55mN (north endpoint); 631965.67mE / 4174954mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
DMC Segment 1 is a trapezoidal shaped canal with the first approximately 2.5-mile section between the Tracy Fish Collection Facility and the C.W. Bill Jones Pumping Station (known as the Delta-Mendota Intake Canal) being a loose earth channel, while the remainder is concrete lined (**Photograph 107** and **Photograph 131**) (see Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 102.24 feet (original)
- **b. Bottom Width**: 100 feet - 48 feet
- **c. Height or Depth**: 14.25 feet – 19.58 feet
- **d. Length of Segment**: 11.25 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel, Mendota Canal, and O'Neill Forebay

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
This segment of the DMC passes through flat farmland, foothills, and an industrial area on the western edge of Tracy.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: The canal has been altered in this segment by raising the concrete lining, modifications to appurtenant bridges, turnouts, and inlets, and the addition of a stilling well, pumphouse, and multiple pipe crossings.

L8b. Description of Photo, Map, or Drawing:
Photograph 107: View of Segment 1 showing beginning of Intake Canal (left) along the right abutment wall of the fish collection facilities (center), with Tracy Fish Collection Facility (right); camera facing north, May 9, 2022 (A00165).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Abigail Lawton
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

In Segment 1, the trapezoidal DMC is made of compacted-earth from M.P. 0.09 to 2.52, then lined with concrete from M.P. 3.50 to 11.34. The concrete lining was raised by 18 inches in 1965 (**Photograph 13**).[124] Flanking both sides of the canal are gravel maintenance roads approximately 20 feet wide. Another gravel maintenance road about 15 feet wide runs above the 4,822-foot long C.W. Bill Jones Pumping Station discharge pipes. For a detailed discussion of canal cross sections, see the typology discussion in Section P3a.

The major structures on this section of the DMC are the Tracy Fish Collection Facility, C.W. Bill Jones Pumping Station and discharge pipes, and the Mountain House Siphon.

The Bureau of Reclamation's Tracy Fish Collection Facility is located at 6525 Lindemann Road, adjacent to the right bank abutment of the DMC at M.P. 0.90 (**Photograph 107**). Fish collecting facilities were constructed at the head of the Delta-Mendota Intake Canal on Old River in 1947-51. Their purpose is to collect young fish in spring and summer and transport them further down the San Joaquin River. These facilities consist of a row of vertical louver vanes set one (1) inch apart and directed at right angles to the flow in a structure which extends about 340 feet diagonally across a concrete channel 83.5 feet wide and about 25 feet deep. As the fish approach the louvers they swim to one side to avoid the disturbing eddies and vibrations created by the louvers, and readily enter by-passes placed at intervals in the louvered barrier. The bypasses carry the fish to holding tanks. From the holding tanks the fish are transported by trucks 40 miles to the Suisun Bay area where they can swim safely to the ocean.[125]

Water from the Sacramento River flows through the Delta Cross Channel into Old River slough, where it is diverted through the Delta-Mendota Intake Canal, about 2.3 miles long, to C.W. Bill Jones Pumping Station (**Photograph 109**). The Pumping Station (originally known as the "Tracy Pumping Plant") was constructed in 1947-51 and is an original and integral feature of the DMC (ref Historic Photo – **Photograph 109**). It contains six vertical-shaft pumping units. The pumping plant is of the semioutdoor type. The architectural style is Brutalist with Streamline Moderne details (**Photograph 110 – Photograph 117**). The superstructure has a rectangular plan with a flat, parapet roof inset with handrails. The building measures about 360 feet long, 60 feet wide, and 50 feet high. Expansion joints divide the north and south façades into four sections. Horizontal grooves in the board-formed concrete intersect with vertical control and expansion joints to create a rectangular pattern on the façade. Two rows of small steel windows on the intake (north) side are evenly spaced and centered on the building (**Photograph 110**). On the discharge (south) side, instead of windows, there are evenly spaced large accordion doors, which provide gantry crane access to the pumps (**Photograph 116**). There is a 100-ton movable gantry crane affixed to the roof. The roof is also outfitted with large removable hatches that allow the crane access to handle pumping-plant equipment. The three eastern sections of the building house the six pumping units, spaced symmetrically in pairs. The fourth section, at the west end, houses the service bay. A small portion of the east section contains public facilities, stairs, and two offices. Each pumping unit has a rate capacity of 767 second-feet under a head of 197 feet. Each pump is driven by a 22,500-horsepower motor above the pump. The pumps lift a maximum of 4,600 second-feet of water up 197 feet and then through three 15-foot (inside) diameter, concrete discharge pipes for 4,822 feet to a concrete outlet structure that releases the water into the concrete-lined section of the DMC, at M.P. 3.50 (**Photograph 117**).[126]

Three irrigation canals cross the alignment of the discharge pipes. These laterals generally cross the DMC in an east-west orientation. The first, at M.P. 2.68, runs through a siphon under the DMC discharge pipes (**Photograph 120**). The second and third, at M.P. 2.92 and M.P. 3.33, cross over the discharge pipes and under the O&M road, which is carried over them by short concrete bridges with timber decks (**Photograph 121** and **Photograph 122**). Neither of these bridges possess handrails. They are not included within the general DMC bridge population and not part of the total count of extant bridges.

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[124] USDI, Reclamation, *Designers' Operating Criteria Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 2, Appendix I-3.
[125] USDI, Reclamation, *Tracy Pumping Plant and Intake Canal and Discharge Lines: Technical Record of Design and Construction*, May 1959: 14-17.
[126] USDI, Reclamation, *Tracy Pumping Plant and Intake Canal and Discharge Lines: Technical Record of Design and Construction*, May 1959: 1-4, 23, 28.

Near the siphon outlet, at M.P. 3.49, is a siphon breaker house and two 64-gallon water storage tanks. The breaker house is a square-plan, concrete block building with a flat, overhanging roof, single metal personnel door, and eight screen-covered, rectangular windows (**Photograph 123**). There is a metal ladder on the east side, giving access to the roof. The water storage tanks are large steel cylinders with slightly pitched roofs (**Photograph 124**). These tanks hold water for the SLDMWA, USBR, and WAPA compound.

The siphon at Mountain House Road is unique among the DMC siphon population. Located at M.P. 4.41/4.63, it extends a distance of 1,200 feet (**Photograph 126**). This single-barrel siphon is a monolithic concrete structure with an inside diameter of 24 feet 3 inches, and a shell thickness of 24 inches. Mountain House Road runs across the siphon at M.P. 4.46 and a blowoff box is located at M.P. 4.49 (**Photograph 127**). The one other siphon in Segment 1 is located at M.P. 1.36/1.41, along the intake canal section, conveying the DMC under Byron-Bethany Road and a single track for Southern Pacific Railroad. It is a three-barrel siphon of standard design, as described above in Section P3a.

At M.P. 7.20 there is a large, modern side-gable pumphouse with metal roof on the right bank constructed in 2011 which is not recorded in the *DMC Structures List* (2020). On the canal bank is an eight-barrel, concrete turnout structure covered by a metal debris screen (**Photograph 128**). On the opposite side of the building are four large pipes that appear to be metal. Adjacent to the pumphouse is a small electrical substation to power the pumps (**Photograph 129**). The pumphouse conveys water to the nearby California Aqueduct.

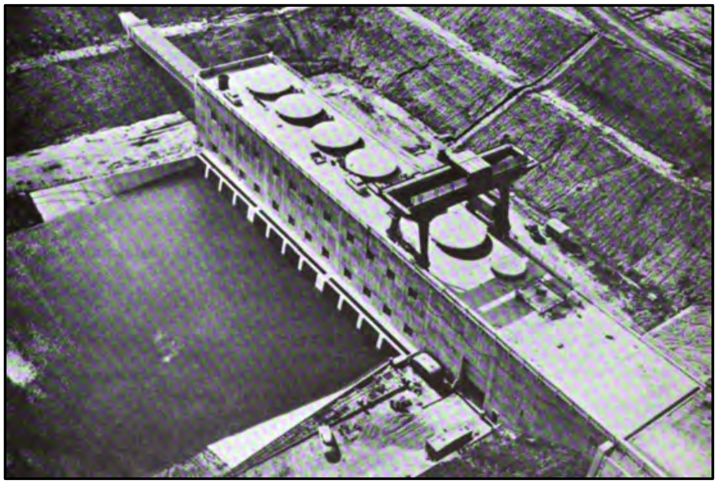
In addition to the major structures along DMC Segment 1 described above, this segment contains nine (9) bridges, 16 turnouts, one pump-in pipe (**Photograph 125**), one recorder house, two wash overchutes, 6 culverts, one stilling well, inlet and shoulder drains, safety ladders, cattle guards, and two Delta-Mendota Canal signs.

The Gage House salinity recorder is located at M.P. 3.65. This standing-seam metal building has a rectangular plan, measuring roughly 9 feet x 10 feet, with a metal door and low-pitched front-gable roof (**Photograph 130**). It is accessed by a set of concrete steps with a metal pipe handrail (**Photograph 131**).

The nine (9) bridges in this segment include: one County Highway Bridge, two State Highway Bridges, three non-original (post-1958) replacement bridges, and four Timber Farm Bridges. The County Highway Bridge at M.P. 0.33 along Lindemann Road is unique within the DMC bridge population. It has a concrete deck measuring 28 feet wide, supported by timber bents (**Photograph 64**). It is the only bridge along the DMC which retains a timber support structure. The three non-original bridges—at M.P. 9.29 along International Parkway / Mountain House Parkway, M.P. 10.28 along W. Schulte Road, and M.P. 10.62 along Hansen Road—are modern, concrete replacements of original County Highway Bridges. All other bridges in the segment are of standard design, although the farm bridge at M.P. 6.95 is barricaded on the right bank (**Photograph 132**) and the farm bridge at M.P. 9.87 has been damaged by fire and is barricaded on both banks (Error! Reference source not found.).

The 16 turnouts along this segment are all of standard design. One is a double-barrel (**Photograph 133**), while the remining 15 are single-barrel box or pipe types. Many of these have modern trash grates covering their inlets. All remaining features on this segment are of standard design. For a detailed discussion of standard repeating types, see the typology discussion in Section P3a.

Photographs (continued):



Photograph 108: Aerial view of Tracy Pumping Plant and inlet transition, April 1951.[127]

Photograph 109: View of water intake (north side) at C.W. Bill Jones Pumping Station; camera facing downstream from left bank, May 9, 2022. (A00106)

Photograph 110: North elevation of Pumping Station; camera facing south, May 9, 2022. (A00144)

Photograph 111: South elevation of Pumping Station; camera facing east, May 9, 2022. (A00095)

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127 [photograph], DM-1536-CV, in USDI, Reclamation, *Tracy Pumping Plant and Intake Canal and Discharge Lines: Technical Record of Design and Construction*, May 1959: 21.

Photograph 112: Suspended walkway on east side of Pumping Station; camera facing north, May 9, 2022. (A00099)

Photograph 113: East elevation of Pumping Station; camera facing west, May 9, 2022. (A00145)

Photograph 114: Roof access to Pumping Station from Road; camera facing northeast, May 9, 2022. (A00082)

Photograph 115: Detail view of removable hatches on roof of Pumping Station with gantry in background (left); camera facing east, May 9, 2022. (A00091)

Photograph 116: View of accordion doors on south façade; camera facing northeast, May 9, 2022. (A00098)

Photograph 117: View of windows on north façade of Pumping Station; camera facing west, May 9, 2022 (A00107).

Photograph 118: Detail view of east elevation and trusses on underside of suspended walkway; camera facing southwest, May 9, 2022. (A00102)

Photograph 119: Detail view of personnel door on east side of Pumping Station; camera facing west, May 9, 2022. (A00104)

Photograph 120: View of irrigation canal at M.P. 2.92; camera facing east, May 9, 2022. (A00176)

Photograph 121: View of bridge crossing over Irrigation Canal 120, around M.P. 3.12; camera facing east, May 9, 2022. (A00181)

Photograph 122: View of Irrigation Canal 155, around M.P. 3.33, with detail view of timber deck of bridge (bottom right); camera facing west, May 9, 2022. (A00188)

Photograph 123: View of concrete-block siphon breaker house at M.P. 3.49; camera facing south, May 9, 2022. (A00194)

Photograph 124: View of 64-gallon water storage tanks at M.P. 3.49; camera facing north, May 9, 2022. (A00192)

Photograph 125: View of BBID pump-in for Tracy Hills at M.P. 3.50, adjacent to discharge pipes inlet headwall (right); camera facing right bank from left bank, May 9, 2022. (A00199)

Photograph 126: View of Mountain House Road siphon inlet at M.P. 4.41; camera facing downstream from left bank, May 9, 2022. (A00216)

Photograph 127: View of blowoff box (M.P. 4.49, center foreground) on top of Mountain House Road siphon (M.P. 4.41/4.63); camera facing southwest, May 9, 2022. (A00219)

Photograph 128: View of pumphouse at M.P. 7.50 with eight-barrel concrete turnout structure covered by metal debris screen; camera facing right bank from left bank, May 9, 2022. (A00252)

Photograph 129: View of electrical substation adjacent to pumphouse at M.P. 7.50; camera facing downstream from left bank, May 9, 2022. (A00250)

Photograph 130: View of Gage House salinity recorder house at M.P. 3.65; camera facing upstream from left bank, May 9, 2022. (A00205)

Photograph 131: View of Gage House salinity recorder house and access stairs at M.P. 3.65 and concrete canal lining; camera facing downstream from left bank, May 9, 2022. (A00206)

Photograph 132: Detail view of barricade on right bank entrance to Farm Bridge at M.P. 6.95; camera facing downstream from left bank, May 9, 2022. (A00246)

Photograph 133: View of original double-barrel turnout at M.P. 3.54; camera facing right bank from left bank, May 9, 2022. (A00203)

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # ______
HRI # ______
Trinomial ______

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal
***Recorded by**: H. Norby & A. Lawton
***Date**: May 10, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-2

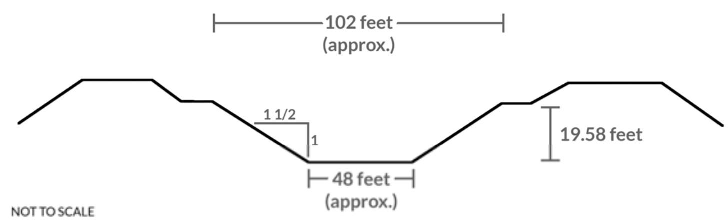
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 2 spans 4.83 miles between canal mileposts 11.35 and 16.18, from the Check No. 1 to a point just upstream of Check No. 2. This segment traverses the western edge of the San Joaquin Valley in San Joaquin County. See **Sketch Map** and **Location Map** on Continuation Sheets.
UTM: Zone 10S, 631988.99mE / 4174947.30mN (north endpoint); 637996.38mE / 4171388.27mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
Beginning at Check No. 1 (**Photograph 134**), this segment of the DMC ends just upstream of Check No. 2 (**Photograph 146**) (see Continuation Sheet). This segment is concrete-lined with a trapezoidal cross section.

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- a. **Top Width**: 102 (original)
- b. **Bottom Width**: 48 feet
- c. **Height or Depth**: 19.58 feet – 19.37 feet
- d. **Length of Segment**: 4.83 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel, Mendota Canal, and O'Neill Forebay

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
This segment of DMC traversed flat agricultural lands, orchards, hilly grasslands, and skirts an industrial area on the western edge of Tracy.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: The canal has been altered in this segment by raising the concrete lining, modifications to appurtenant bridges, turnouts, and inlets, and the addition of stilling wells and multiple pipe crossings.

L8b. Description of Photo, Map, or Drawing:
Photograph 134: Beginning of Segment 2, showing Check No. 1; camera facing upstream from left bank, May 10, 2022 (A00335).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Abigail Lawton
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

In Segment 2, the trapezoidal DMC is lined with concrete, which was raised by 18 inches in 1965 (**Photograph 13**).[128] The canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank. The width of the roads seems to vary based on topography (**Photograph 135 - Photograph 136**).

The upstream end of DMC Segment 2 begins at Check No. 1, the site of which contains the check structure and check building (**Photograph 134**). Check No. 1, located at M.P. 11.35, is a concrete structure with a total length of 137 feet (**Photograph 137**), a width of approximately 102 feet at the upstream end, 123 feet at the check gates, and then narrowing again to about 102 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same slope angle as the canal. Spanning the top of structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge (**Photograph 138**). On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms 19 feet, 9.5 inches that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 11.35 on the left bank, is a concrete block structure, measuring approximately 9 feet by 7 feet. A stilling well is located just below Check No. 1, at M.P. 11.38, while a second stilling well is located just above Check No. 2 at M.P. 16.15. Both stilling wells are located on the left bank and are the typical cylindrical concrete type.[129]

In addition to the structures located at Check No. 1, DMC Segment 2 contains 15 turnouts, five (5) bridges, one wash overchute, two siphons, culverts, inlet drains, and cattle guards. The two siphons convey the DMC below single tracks for the Southern Pacific Railroad, at M.P. 11.49/11.51 (**Photograph 140** and **Photograph 141**), and Western Pacific Railroad, at M.P. 13.66/13.69 (**Photograph 142** and **Error! Reference source not found.**). Of the 15 Turnouts, 14 are concrete pipe types and one, at M.P. 15.95, is an overlining type for the City of Tracy and located adjacent to the Tracy Water Treatment Plant (**Photograph 144** and **Photograph 145**). This multi-component structure appears to have been modified (possibly enlarged) between 2005-2006.[130] All remaining turnouts are of standard design. Of the five (5) bridges, there are three Timber Farm Bridges, and two concrete County Highway Bridges, all of standard design, though the farm bridge at M.P. 15.10 is the only bridge with a timber deck measuring 12 feet wide and supported by four concrete piers, rather than the typical three piers (**Photograph 97**). All other features in this segment are of standard design. For a detailed discussion of standard repeating types, see the typology discussion in Section P3a.

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[128] USDI, Reclamation, *Designers' Operating Criteria Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 2, Appendix I-3.
[129] USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*: 59, 62, 93, 97-99.
[130] USDI, Reclamation, *Milepost at Structure Sites: Delta-Mendota Canal*, December 1985: 17; USDI, Reclamation, *Delta-Mendota Canal Structures List*, May 2020: 8; Google Earth, historic views: 1985-2020

State of California – The Resources Agency **DEPARTMENT OF PARKS AND RECREATION** **CONTINUATION SHEET**	**Primary #** ______ **HRI #** ______ **Trinomial** ______

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton ***Date**: May 10, 2022 ☒ Continuation ☐ Update

Photographs (continued):

Photograph 135: Downstream view from the top deck of Check No. 1 at M.P. 11.35; camera facing downstream from left bank; May 10, 2022 (A00337).

Photograph 136: Downstream view of deep excavation cuts at approximately M.P. 15.50; camera facing downstream from left bank, May 10, 2022 (A00431).

Photograph 137: Upstream view of Check No.1; camera facing upstream from left bank; May 10, 2022 (A00344).

Photograph 138: Top deck of Check No. 1; camera facing right bank, May 10, 2022 (A00342).

Photograph 139: *C*heck building on left bank at Check No. 1; camera facing northwest, May 10, 2022 (A00343).

Photograph 140: South Pacific Railroad Siphon inlet headwall at M.P. 11.49; camera facing downstream from left bank, May 10, 2022 (A00351).

Photograph 141: South Pacific Railroad Siphon outlet headwall at M.P. 11.51; camera facing upstream from left bank, May 10, 2022 (A00353).

Photograph 142: Western Pacific Railroad Siphon inlet headwall at M.P. 13.67; camera facing downstream from left bank, May 10, 2022 (A00392).

Photograph 143: Western Pacific Railroad Siphon outlet headwall at M.P. 13.69; camera facing upstream from left bank, May 10, 2022 (A00394).

Photograph 144: View of overlining type turnout at M.P. 15.95, for the City of Tracy; camera facing right bank from the left bank, May 10, 2022 (A00435)**.**

Photograph 145: View of overlining type turnout at M.P. 15.95, for the City of Tracy, Tracy Water Treatment Plant visible in background (upper right corner); camera facing upstream from left bank, May 10, 2022 (A00436).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton ***Date**: May 10, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation:** DMC-3

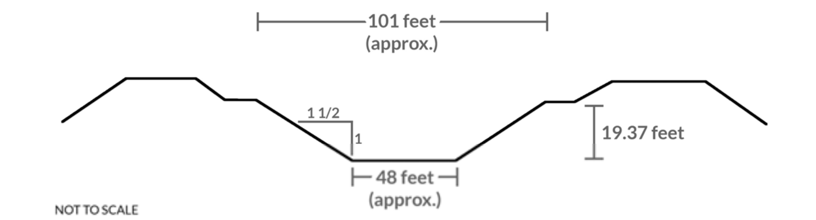
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 3 spans 4.43 miles between mileposts 16.19 and 20.62 of the Delta-Mendota Canal, from Check No. 2 complex to just upstream of Check No. 3. This segment traverses the western edge of the San Joaquin Valley in San Joaquin County. See **Sketch Map** and **Location Map** on Continuation Sheets.
UTM: Zone 10S, 638014.15mE / 4171373.00mN (north endpoint); 643252.37mE / 4167485.02mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
Beginning at Check No. 2 (**Photograph 146**), this segment of the DMC traverses the grass-covered hillsides and flat agricultural lands of the western San Joaquin Valley to a downstream point located just upstream of Check No. 3. (see Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 101.6 feet (original)
- **b. Bottom Width**: 48 feet
- **c. Height or Depth**: 19.37 feet
- **d. Length of Segment**: 4.43 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel, Mendota Canal, and O'Neill Forebay

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
This segment of the DMC is located primarily in the flat agricultural lands of the San Joaquin Valley in southwestern San Joaquin County. Hillside vegetation to the east largely consists of tall grasses, while the surrounding agricultural lands are principally planted with orchards. Four public roadways cross this segment – S. Tracy Boulevard, Durham Ferry Road, McArthur Road, and Chrisman Road.

L7. Integrity Considerations: The canal has been altered in this segment by raising the concrete lining, patches to the canal lining, modifications to appurtenant bridges, turnouts, and inlets, and the addition of stilling wells and multiple pipe crossings.

L8a. Photograph, Map, or Drawing.

L8b. Description of Photo, Map, or Drawing:
Photograph 146: Beginning of Segment 3, showing Check No. 2; camera facing downstream from left bank, May 10, 2022 (A00446).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Abigail Lawton
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

In Segment 3, the trapezoidal DMC is lined with concrete, which was raised by 18 inches in 1965 (**Photograph 13**).[131] Deterioration, cracking, and erosion are evident along some stretches of the canal lining (**Photograph 156**). Sandbags line the top of the canal wall in multiple locations (**Photograph 157 - Photograph 160**). The canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank. The width of the roads seems to vary based on topography (**Photograph 147** and **Photograph 148**). For a detailed discussion of DMC cross sections, see typology discussion in P3a. Description on Continuation Sheets.

The upstream end of DMC Segment 3 begins at Check No. 2, the site of which contains the check structure and check building; a siphon at M.P. 16.20/16.25 that carries the DMC under Tracy Blvd.; a short, narrow span of canal that runs from M.P. 16.25 to 16.31, approximately 310 feet long, with a non-transitioned siphon outlet and inlet; and a second siphon at M.P. 16.31/16.34 that conveys the DMC under a culvert that diverts Corral Hollow Creek across the canal (**Photograph 146, Photograph 150, - Photograph 153**). The outlet of this siphon, at M.P. 16.34, transitions back to the full-width canal (**Photograph 154**). Both siphons have four barrels and are of standard design, apart from their non-transitioned outlet/inlet, respectively.

Check No. 2 at M.P. 16.19 is a concrete structure with a total length of approximately 70 feet from its canal transition to the beginning of the siphon inlet (**Photograph 149**). It is approximately 101 feet wide at the widest upstream point where it meets the canal, then tapers as it transitions downstream to its narrowest point of approximately 62 feet wide. The walls of the check/inlet siphon structure transition from sloped, where it meets the canal, to vertical at the control gates. The canal narrows further between the check structure and the siphon inlet headwall, from approximately 62 feet to 50 feet (**Photograph 151**). The check structure is rectangular in cross section and divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms 19 feet, 9.5 inches that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. No provision was made for an overflow section. Spanning the top of structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge (**Photograph 149**). On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. One metal lamp post with an umbrella-shaped shade is also present on the deck. The transitional concrete siphon outlet at M.P. 16.34 is approximately 70 feet long and 50 feet wide at the upstream end where it connects with the below-grade siphon (**Photograph 154**). The outlet walls are vertical at this point and flare out downstream as the outlet transitions to the canal, at which point the structure is 101 feet wide where it meets the canal. A stilling well is located just below this transition, at M.P. 16.39, while a second stilling well is located just above Check No. 3 at M.P. 20.60. Both stilling wells are located on the left bank and are the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[132]

In addition to the canal features described above, DMC Segment 3 contains other major appurtenant structures in its span, including one wash overchute, four bridges, and 17 turnouts. The wash overchute at M.P. 18.59 is the typical reinforced concrete box type and carries the Corral Hollow Creek across the DMC. The four bridge crossings in this span, consist of: one Timber Operating Bridge and three Concrete County Highway Bridges, all of standard design. There are three types of turnouts in this segment: one overlining, one concrete box, and the rest are the typical concrete pipe type.

DMC Segment 3 also contains numerous minor appurtenant structures, including ladders, well discharges, and inlet and shoulder drains, virtually all constructed of metal and PVC pipes. The drain inlets consist of three types: concrete box, metal or PVC pipes, and pipes with a flap gate cover. For a detailed discussion of repeating major and minor appurtenant structures along the DMC, including siphon, overchute, bridge, turnout, culvert, inlet drain, stilling well, and check building types, see typology discussion in P3a. Description on Continuation Sheets.

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[131] USDI, Reclamation, *Designers' Operating Criteria Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 2, Appendix I-3.
[132] USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*: 59-61, 93, 98-99; *2020 Structures List*: 8.

Photographs (continued):

Photograph 147: Downstream view from approximately M.P. 16.39; camera facing downstream from left bank; May 10, 2022 (B00003).

Photograph 148: Downstream view from approximately M.P. 20.37, with Check No. 3 in the distance; camera facing downstream from left bank, May 10, 2022 (B00076).

Photograph 149: View of Check No. 2, showing its transition into the Tracy Boulevard Siphon; camera facing downstream from left bank; May 10, 2022 (A00448).

Photograph 150: Check building at Check No. 2; camera facing northeast, May 10, 2022 (A00451).

Photograph 151: Transition between Check No. 2 and Tracy Boulevard Siphon, showing the siphon's inlet headwall; camera facing right bank from left bank, May 10, 2022 (A00452).

Photograph 152: Tracy Boulevard Siphon outlet headwall at M.P. 16.25; camera facing upstream from left bank, May 10, 2022 (A00454).

Photograph 153: Corral Hollow Creek Siphon inlet headwall at M.P. 16.31; camera facing right bank from left bank, May 10, 2022 (A00455).

Photograph 154: Corral Hollow Creek Siphon outlet headwall at M.P. 16.34; camera facing upstream from left bank, May 10, 2022 (B0002).

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
CONTINUATION SHEET

Primary # ______
HRI # ______
Trinomial ______

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton ***Date**: May 10, 2022 ☒ Continuation ☐ Update

Photograph 155: Upstream view of Corral Hollow Creek where it crosses over the Corral Hollow Creek Siphon; camera facing southwest, May 10, 2022 (B00001).

Photograph 156: New cracking at a repair to the canal lining at M.P.; camera facing right bank from left bank, May 10, 2022. (B00029)

Photograph 157: View of sandbags lining the top of the canal wall at a turnout at M.P. 19.59; camera facing right bank from left bank, May 10, 2022. (B00069)

Photograph 158: View of sandbags lining the top of the canal wall at turnout site at M.P. 19.85; camera facing right bank from left bank, May 10, 2022. (B00070)

Photograph 159: View of sandbags lining the top of the canal wall at a turnout on the left bank at M.P. 20.42; camera facing right bank from left bank, May 10, 2022. (B00079)

Photograph 160: View of sandbags lining the top of the canal wall at a turnout on the left bank at M.P. 20.59; camera facing right bank from left bank, May 10, 2022. (B00085)

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton ***Date**: May 10-11, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation:** DMC-4

***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 4 spans 3.79 miles between mileposts 20.63 and 24.42 of the Delta-Mendota Canal, from just above the Check No. 3 to just above Check No. 4 in San Joaquin County along the western edge of the San Joaquin Valley. See **Sketch Map** and **Location Map** on Continuation Sheets.

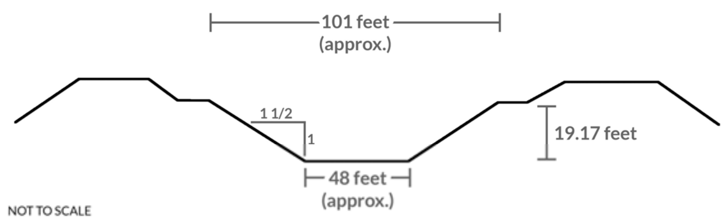
UTM: Zone 10S, 643262.92mE / 4167471.29mN (north endpoint); 647820.49mE / 4164770.17mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
Beginning immediately upstream of the Check No. 3 (**Photograph 161**), this segment of the DMC traverses the flat agricultural lands of the western San Joaquin Valley to a downstream point located just north of Check No. 4 (**Photograph 174**) (see Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 101 feet (original)
- **b. Bottom Width**: 48 feet
- **c. Height or Depth**: 19.17 feet
- **d. Length of Segment**: 3.79 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel, Mendota Canal, and O'Neill Forebay

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
This segment of the DMC is located primarily in the flat agricultural lands of the San Joaquin Valley in southwestern San Joaquin County. Surrounding agricultural lands are principally planted with orchards. Four public roadways cross the segment – S. Bird Road, Highway 132, Interstate 5, and Blewett Road.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: The canal has been altered in this segment by raising the concrete lining, patches to the canal lining, modifications to appurtenant bridges, turnouts, and inlets, and the addition of stilling wells and multiple pipe crossings.

L8b. Description of Photo, Map, or Drawing:
Photograph 161: Beginning of Segment 4, showing Check No. 3 and check building with a turnout and stilling well in the foreground; camera facing downstream from left bank, May 10, 2022 (B00084).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Abigail Lawton
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

In Segment 4, the trapezoidal DMC is lined with concrete, which was raised by 18 inches in 1965 (**Photograph 13**).[133] Repairs and new cracking are evident along some stretches in this segment (**Photograph 171** and **Photograph 172**). Sandbags have been placed along the top of the canal lining in some areas (**Photograph 173**). The canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank. The width of the roads seems to vary based on topography (**Photograph 162** and **Photograph 163**). For a detailed discussion of DMC cross sections, see P3a. Description on Continuation Sheets.

The upstream end of DMC Segment 4 begins at Check No. 3, which includes the check structure and check building (**Photograph 161**). Check No. 3, at M.P. 20.63, is a concrete structure with a total length of 137 feet. It is approximately 101 feet wide at the upstream end, widens to about 123 feet at the check gates, and then narrows again to 101 feet where it rejoins the canal walls on the downstream side (**Photograph 164** and **Photograph 165**). The banks of the check structure maintain the same slope angle as the canal. Spanning the top of structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge (**Photograph 166**). On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. One metal lamp post with an umbrella-shaped shade is also present on the deck. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms 19 feet, 9.5 inches that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 20.63 on the left bank, is a rusticated concrete block structure, measuring approximately 9 feet by 7 feet. A stilling well is located just below Check No. 3, at M.P. 20.69, while a second stilling well is located just above Check No. 4 at M.P. 24.40 (**Photograph 167**). Both stilling wells are located on the left bank and are standard design.[134]

In addition to the canal features located at Check No. 3, DMC Segment 4 contains other major appurtenant structures in its span, including nine (9) bridges, twelve turnouts, one wash overchute, one CVP sign, and one siphon. The nine bridge crossings in this span consist of five non-original (post-1958) State Highway bridges, two timber Farm Bridges, and one concrete County Highway bridge, and one County Road crossing a siphon. Blewett Road crosses over the DMC siphon at M.P. 23.95/24.01 and is included in the bridge population of this inventory because it is categorized as a Bridge in the *DMC Structures List* (**Photograph 168** and **Photograph 169**). This siphon is a three-barrel type, of standard design. Of the segment's twelve turnouts, one is a steel pipe turnout (**Photograph 170**), while the rest are the typical concrete pipe type all with modern trash racks. The wash overchute at M.P. 21.91 is a reinforced concrete box type, carrying Lone Tree Creek north across the DMC.

DMC Segment 4 contains numerous minor appurtenant structures, including pipe crossings, inlet and shoulder drains, and ladders.

For a detailed discussion of DMC siphon, bridge, turnout, culvert, pipe crossings, inlet drain, CVP signs, stilling well, and check building types, see typology description in P3a. Description on Continuation Sheets.

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[133] USDI, Reclamation, *Designers' Operating Criteria Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 2, Appendix I-3.
[134] USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*: 59, 62, 93, 97-99.

Photographs (continued):

Photograph 162: Upstream view from approximately M.P. 21.65; camera facing camera facing upstream from left bank, with a turnout in the foreground; May 10, 2022 (B00124).

Photograph 163: Downstream view from approximately M.P. 23.41; camera facing camera facing downstream from left bank, May 10, 2022 (A00459).

Photograph 164: Check No. 3; camera facing camera facing downstream from left bank, May 10, 2022 (B00092).

Photograph 165: Check No. 3; camera facing upstream from left bank, May 10, 2022 (B00091).

Photograph 166: Deck of Check No. 3; camera facing right bank from left bank, May 10, 2022 (B00090).

Photograph 167: View of stilling well, M.P. 20.69, and Check No. 3 outlet transition; camera facing upstream from left bank, May 10, 2020 (B00096.)

Photograph 168: Blewett Road Siphon inlet headwall; camera facing downstream from left bank; May 11, 2022 (A00471).

Photograph 169: Blewett Road Siphon outlet headwall; camera facing upstream from left bank; May 11, 2022 (A00475).

Photograph 170: The one steel pipe turnout in this segment at M.P. 20.97; camera facing right bank from left bank, May 10, 2022 (B00104).

Photograph 171: Cracking in canal lining at right abutment of BRIDGE at M.P.; camera facing downstream from left bank, May 10, 2022 (B00116).

Photograph 172: View of repair to concrete lining around M.P 22.90., with sandbags on top of wall downstream; camera facing right bank from left bank, May 10, 2022 (B00180).

Photograph 173: Sandbags lining the concrete wall above the turnout at M.P.; camera facing right bank from left bank, May 10, 2022 (B00097

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # ____________
HRI # ____________
Trinomial ____________

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by:** H. Norby & A. Lawton

***Date:** May 11, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation:** DMC-5

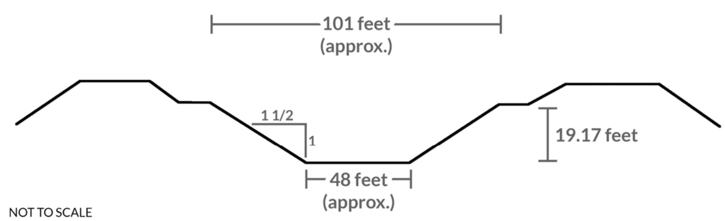
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) FKC Segment 5 spans 5.38 miles between mileposts 24.43 and 29.81 of the Delta-Mendota Canal, from just above Check No. 4 in San Joaquin County to just above Check No. 5 in Stanislaus County along the western edge of the San Joaquin Valley. See **Sketch Map** and **Location Map** on Continuation Sheets.
UTM: Zone 10S, 647821.03mE / 4164752.13mN (north endpoint); 652704.37mE / 4158413.08mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
Beginning immediately upstream of Check No. 4 (**Photograph 174**), this segment of the DMC traverses the grass-covered hillsides and flat agricultural lands of the western San Joaquin Valley to a downstream point located just upstream of Check No. 5 (**Photograph 181**) (see Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width:** 101 feet (original)
- **b. Bottom Width:** 48 feet
- **c. Height or Depth:** 19.17 feet
- **d. Length of Segment:** 5.83 miles

L4e. Sketch of Cross-Section (not to scale) **Facing:** Northeast



L5. Associated Resources: Delta Cross Channel, Mendota Canal, and O'Neill Forebay

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
This segment of the DMC is located primarily in the flat agricultural lands of the San Joaquin Valley in southwestern San Joaquin County and northwestern Stanislaus County. The surrounding agricultural lands are principally planted with orchards. The canal is traversed by four public roadways – Koster Road, Gaffery Road, Welty Road, and Hamilton Road.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: The canal has been altered in this segment by raising the concrete lining, patches to the canal lining, modifications to appurtenant bridges, turnouts, and inlets, and the addition of stilling wells and multiple pipe crossings.

L8b. Description of Photo, Map, or Drawing:
Photograph 174: Beginning of Segment 5, showing Check No. 4 and recorder house; camera facing downstream from left bank, May 11, 2022 (A00484).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Abigail Lawton
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: July 2022

L3. Description (continued):

In Segment 5, the trapezoidal DMC is lined with concrete, which was raised by 18 inches in 1965 (**Photograph 13**).[135] Cracking is evident along some stretches in this segment (**Photograph 180**). The canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank. The width of the roads seems to vary based on topography (**Photograph 175** and **Photograph 176**). For a detailed discussion of DMC cross sections, see P3a. Description on Continuation Sheets.

The upstream end of DMC Segment 5 begins immediately above Check No. 4, the site of which contains the check structure and building (**Photograph 174**). Check No. 4, at M.P. 24.42, is a concrete structure with a total length of 137 feet (**Photograph 177**). It is approximately 101 feet wide at the upstream end, widens to about 123 feet at the check gates, and then narrows again to 101 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same slope angle as the canal. Spanning the top of structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge (**Photograph 178**). On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. One metal lamp post with an umbrella-shaped shade is also present on the deck. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms 19 feet, 9.5 inches that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 24.42 on the left bank, is a rusticated concrete block structure, measuring approximately 9 feet by 7 feet. A stilling well is located just below Check No. 4, at M.P. 24.48, while a second stilling well is located just above Check No. 5 at M.P. 29.79. Both stilling wells are located on the left bank and are of standard design.[136]

In addition to the canal features located at the Check No. 4 site, DMC Segment 5 contains other major appurtenant structures in its span, including 19 turnouts, five (5) bridges, and two wash overchutes. There are 18 active turnouts, of which 16 are the typical concrete pipe type, and 2 are steel pipes. There is an additional concrete pipe turnout listed in the Structures List at M.P. 25.61, but this appears to have been deactivated and its pump removed (**Photograph 179**). There are five bridge crossings, consisting of four concrete County Highway bridges and one Timber Farm bridge, all of standard type. Both overchutes are the reinforced concrete box type. The overchute at M.P. 25.20 carries Hospital Creek across the DMC and the overchute at M.P. 25.62 conveys Little Hospital Creek.

DMC Segment 5 contains numerous minor appurtenant structures, including ladders, and inlet and shoulder drains, virtually all of which are made of metal or PVC.

For a detailed discussion of DMC bridge, turnout, siphon undercrossing, inlet drain, and recorder house types, see typology discussion in P3a. Description on Continuation Sheets.

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[135] USDI, Reclamation, *Designers' Operating Criteria Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 2, Appendix I-3.
[136] USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*: 59, 62, 93, 97-99.

Photographs (continued):

Photograph 175: Downstream view from approximately M.P. 24.89; camera facing downstream from left bank, May 11, 2022 (A00498).

Photograph 176: Downstream view from approximately M.P. 27.22; camera facing downstream from left bank, May 11, 2022 (A00548).

Photograph 177: Check No. 4; camera facing downstream from left bank, May 11, 2022 (A00485).

Photograph 178: Check No. 4; camera facing right bank from left bank, May 11, 2022 (A00489).

Photograph 179: Site where a concrete pipe turnout listed at M.P. 25.61, appears to have been deactivated and its pump removed; camera facing downstream from left bank, May 11, 2022 (A00515).

Photograph 180: Cracking on concrete lining around turnout at M.P. 26.69; camera facing right bank from left bank, May 11, 2022 (A00535).

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # ___
HRI # ___
Trinomial ___

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton

***Date**: May 11, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-6

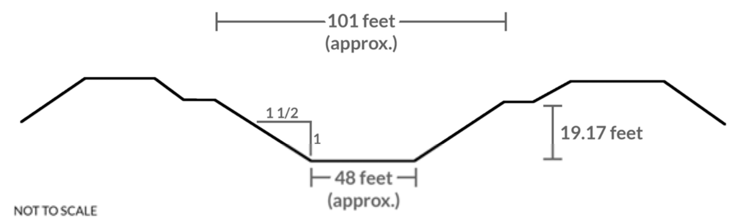
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 6 spans 4.59 miles between canal mileposts 29.82 and 34.41, from Check No. 5 to just above Check No. 6 along the western edge of the San Joaquin Valley in Stanislaus County. See **Sketch Map** and **Location Map** on Continuation Sheets.
UTM: Zone 10S, 652727.27mE / 4158408.47mN (north endpoint); 657414.47mE / 4154272.19mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
Beginning at Check No. 5 (**Photograph 181)**, this segment of the DMC is 4.59 miles long and ends just upstream of Check No. 6 (**Photograph 182**). This segment of the DMC is concrete-lined and has the same trapezoidal cross section as elsewhere on the canal. Along both sides of the conduit are gravel maintenance roads approximately 12 to 20 feet wide (see Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 101 feet (original)
- **b. Bottom Width**: 48 feet
- **c. Height or Depth**: 19.17 feet
- **d. Length of Segment**: 4.59 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel, Mendota Canal, and O'Neill Forebay

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
This segment of DMC passes through flat agricultural lands planted principally with orchards.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: The canal has been altered in this segment by raising the concrete lining, modifications to appurtenant bridges, turnouts, and inlets, and the addition of stilling wells and multiple pipe crossings.

L8b. Description of Photo, Map, or Drawing:
Photograph 181: Beginning of Segment 6, showing the Check No. 5 and recorder house with a stilling well in the foreground; camera facing downstream from left bank, May 11, 2022 (A00602).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Abigail Lawton
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

 *Required Information

L3. Description (continued):

In Segment 6, the trapezoidal DMC is lined with concrete, which was raised by 18 inches in 1965 (**Photograph 13**).[137] Deterioration, cracking, and erosion are evident along some stretches in this segment and sandbags line the top of the canal wall in some locations (**Photograph 198 - Photograph 203**). The canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank. The width of the roads seems to vary based on topography (**Photograph 182 - Photograph 184**). For a detailed discussion of DMC cross sections, see P3a. Description on Continuation Sheets.

The upstream end of DMC Segment 6 begins immediately above Check No. 5, the site of which contains the check structure and building (**Photograph 181**). Check No. 5 at M.P. 29.81 is a concrete structure with a total length of 137 feet. It is approximately 101 feet wide at the upstream end, widens to about 123 feet at the check gates, and then narrows again to 101 feet where it rejoins the canal walls on the downstream side (**Photograph 185** and **Photograph 186**). The banks of the check structure maintain the same slope angle as the canal. Spanning the top of structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge (**Photograph 185**). On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. One metal lamp post with an umbrella-shaped shade is also present on the deck. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms 19 feet, 9.5 inches that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 29.81 on the left bank, is a rusticated concrete block structure, measuring approximately 9 feet by 7 feet. A stilling well is located just below Check No. 5, at M.P. 29.88, while a second stilling well is located just above Check No. 6 at M.P. 34.39. Both stilling wells are located on the left bank and are the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[138]

Downstream of Check No. 5 is the Westley Wasteway on the east side of the canal at M.P. 34.32 (**Photograph 187**). The wasteway allows water to flow from the canal northeast about 3.9 miles to the San Joaquin River. The wasteway begins with a concrete inlet structure on the left bank of the canal consisting of two waterways, each with a steel radial gate—measuring 20 feet wide and 17 feet tall—controlling the water flow (**Photograph 188** and **Photograph 189**). Both radial gates each have two gate arms, each measuring 19 feet, 9.5 inches long, with the pivot points bolted to a concrete headwall. The gates' arms all have truss designs, and the arched gate faces are all reinforced by a grid pattern of steel beams. The gates are raised and lowered by a row of electric motors, hoists, pulleys, and a manual handle mounted on a concrete platform on top of the structure. This top deck includes a service walkway with pipe railing along the edge, and it also features a metal electrical box.[139]

Water passing through the wasteway control structure flows into a concrete chute on the east side of the canal levee (**Photograph 190** and **Photograph 191**). About 3.8 miles of the wasteway are concrete-lined and of trapezoidal chute section with vertical top walls, and 0.1 mile is unlined earth (**Photograph 192 - Photograph 195**). The concrete sidewalls quickly narrow from about 47 feet wide where the water emerges from the control structure to about 23 feet wide where the water is siphoned into the main chute of the wasteway, which quickly expands to a width of about 42 feet. After the concrete transitions to earth the wasteway continues for approximately 0.1 miles until it terminates at an inlet to the San Joaquin River

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[137] USDI, Reclamation, *Designers' Operating Criteria Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 2, Appendix I-3.
[138] USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*: 59, 62, 93, 97-99.
[139] USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*, "Table 1.—Design data for gates and hoists installed at structures on Delta-Mendota Canal," 99; USDI, Reclamation, Central Valley Project – California (CVP), "Delta Mendota Canal-Sta.625+00-Check, Radial Gate and Hoist Installation" dwg. no. 214-D-13893, ca. 1947.

(**Photograph 196**). The only Railroad Bridge associated with the DMC crosses over the Westley Wasteway at M.P. 2.06 (station 108+85.20). It is a single-span bridge originally provided for the Southern Pacific Railroad. It has a concrete deck supported on steel stringer, with metal pipe railings (**Photograph 193**). It was designed for a single track, but abutments were designed to accommodate two tracks. It was designed for an E-72 loading in accordance with "Specifications for Steel Railway Bridges" of the American Railway Engineering Association, 1946 edition.[140]

In addition to the canal features located at or near the Check No. 5 site and Westley Wasteway, DMC Segment 6 contains other major appurtenant structures in its span, including 16 turnouts and eight (8) bridges. The 16 turnouts consist of 15 of the concrete pipe type, and one concrete box type (**Photograph 197**). The eight bridge crossings include: two Timber Farm bridges, one concrete County Highway bridge, one County Highway Wasteway Crossing bridge, one Timber Operating bridge, and three non-original bridges built post-1958. The three non-original bridges consist of two concrete county road bridges that were rebuilt in 1965, at M.P. 29.93 along McCracken Road and at M.P. 34.39 along Needham Road, and one timber operating bridge at M.P. 33.29 that was replaced in 1998. All other bridges are of standard design. There are also three siphon undercrossings that convey irrigation laterals under the DMC at M.P. 31.65, 33.72, and 34.1

DMC Segment 6 contains numerous minor appurtenant structures, including ladders, and inlet and shoulder drains, virtually all of which are made of metal or PVC. These all follow the standard design type.

For a detailed discussion of DMC bridge, turnout, siphon undercrossing, inlet drain, stilling well and check building types, see typology discussion in P3a. Description on Continuation Sheets.

[140] USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*: 13, 88.

Photographs (continued):


Photograph 182: Upstream view from approximately M.P. 30.33; camera facing upstream from left bank, May 11, 2022 (A00615).


Photograph 183: Downstream view from approximately M.P. 30.33; camera facing downstream from left bank, May 11, 2022 (A00614).


Photograph 184: Downstream view from approximately M.P. 32.38; camera facing downstream from left bank, May 11, 2022 (A00666).


Photograph 185: Detail view of Check No. 5 deck, camera facing right bank from left bank, May 11, 2022 (A00606).

Photograph 186: Upstream view of Check No. 5; camera facing upstream from left bank, May 11, 2022 (A00607).

Photograph 187: Downstream view of inlet to Westley Wasteway at M.P. 34.32, including wasteway bridge; camera facing downstream from left bank from left bank, May 11, 2022 (A00709).

Photograph 188: Detail view of Westley Wasteway's inlet structure's top deck and gate-hoisting equipment; camera facing upstream from left bank, May 11, 2022 (A00713).

Photograph 189: Detail view of the radial gates in Westley Wasteway's inlet structure; camera facing west, May 11, 2022 (A00712).

Photograph 190: View of beginning of concrete-lined chute of Westley Wasteway from inlet at M.P. 34.32; camera facing east from left bank, May 11, 2022 (A00710).

Photograph 191: View of Westley Wasteway inlet from approximately M.P. 34.32; camera facing upstream from left bank of the Westley Wasteway, May 11, 2022 (A00728).

Photograph 192: View of wasteway concrete chute and missing bridge around M.P. 0.35 on the Westley Wasteway; camera facing downstream from right bank, May 11, 2022 (A00730).

Photograph 193: View of Railroad Bridge at M.P. 2.06 on the Westley Wasteway; camera facing upstream from right bank, May 11, 2022 (A00756).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton ***Date**: May 11, 2022 ☒ Continuation ☐ Update

Photograph 194: "Drop" structure at the end of concrete lined section of Westley Wasteway at wasteway M.P. 3.84; camera facing upstream from wasteway's right bank, May 11, 2022 (A00775).

Photograph 195: Upstream view of earth section of Westley Wasteway around wasteway M.P. 3.85; camera facing upstream from wasteway's right bank, May 11, 2022 (A00778).

Photograph 196: End of earth section of Westley Wasteway where it natural water feature connected to the San Joaquin River at wasteway M.P. 4.01; camera facing downstream from wasteway's right bank, May 11, 2022 (A00785).

Photograph 197: Concrete box turnout at M.P. 31.31; camera facing downstream from left bank, May 11, 2022 (A00645).

Photograph 198: View of a new crack on a repair to the canal wall near M.P. 30.63; camera facing right bank from left bank, May 11, 2022 (A00634).

Photograph 199: View of sandbags lining the top of the concrete wall around turnout at M.P. 33.53; camera facing right bank from left bank, May 11, 2022 (A00690).

Photograph 200: View of large patch on right embankment above concrete lining at approximately M.P. 33.71; camera facing downstream from left bank, May 11, 2022 (A00693).

Photograph 201: View of sandbags lining the top of the concrete wall around features at M.P. 33.71; camera facing downstream from left bank, May 11, 2022 (A00694)

Photograph 202: View of patch to canal wall transitioning to bags laid on top of the concrete lining at approximately M.P. 33.71; camera facing right bank from left bank, May 11, 2022 (A00697).

Photograph 203: View of sandbags lining the top of the concrete wall around features on both side of the canal at M.P. 33.90; camera facing upstream from left bank, May 11, 2022 (A00703).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby, A. Lawton & A. Young ***Date**: May 11-12, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-7

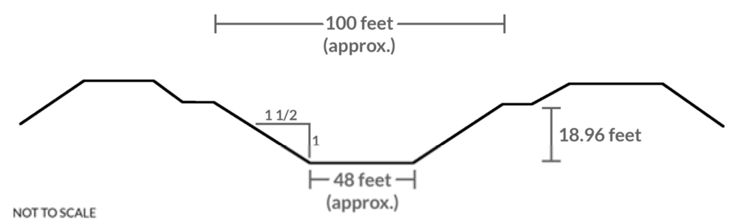
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 7 spans 4.25 miles between canal mileposts 34.42 and 38.67, from just above Check No. 6 to just above Check No. 7. See **Sketch Map** and **Location Map** on Continuation Sheets.
UTM: Zone 10S, 657420.14mE / 4154251.96mN (north endpoint); 660474.74mE / 419242.05mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
This segment begins at a point just upstream of Check No. 6 and continues to a point just upstream of Check No. 7 (**Photograph 204**) (see Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 100.38 feet (original)
- **b. Bottom Width**: 48 feet
- **c. Height or Depth**: 18.96 feet
- **d. Length of Segment**: 4.25 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel, Mendota Canal, and O'Neill Forebay

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
The setting of Segment 7 is the flat agricultural lands of the western San Joaquin Valley surrounded largely by orchards. This segment terminates at the northwest corner of the City of Patterson.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: The canal has been altered in this segment by raising the concrete lining, modifications to appurtenant bridges, turnouts, and inlets, and the addition of stilling wells and multiple pipe crossings.

L8b. Description of Photo, Map, or Drawing:
Photograph 204: Beginning of Segment 7, showing the Check No. 6 and check building; camera facing downstream from left bank, May 11, 2022 (A00720).

L9. Remarks:

L10. Form prepared by:

Heather Norby & Abigail Lawton
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

In Segment 7, the trapezoidal DMC is lined with concrete, which was raised by 18 inches in 1965 (**Photograph 13**).[141] The canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank. The width of the roads seems to vary based on topography (**Photograph 206 and Photograph 207**).

The upstream end of DMC Segment 7 begins at Check No. 6, the site of which contains the check structure and building (**Photograph 204**). Check No. 6, at M.P. 34.42, is a concrete structure with a total length of 137 feet (**Photograph 208** and **Photograph 209**). It is approximately 100 feet wide at the upstream end, widens to about 123 feet at the check gates, and then narrows again to 100 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same slope angle as the canal. Spanning the top of structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge (**Photograph 208**). On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. One metal lamp post with an umbrella-shaped shade is also present on the deck. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms 19 feet, 9.5 inches that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 34.42 on the left bank, is a rusticated concrete block structure, measuring approximately 9 feet by 7 feet. A stilling well is located just below Check No. 6, at M.P. 34.47, while a second stilling well is located just above Check No. 7 at M.P. 38.64. Both stilling wells are located on the left bank and are of standard design.

In addition to the canal features located at Check No. 6 and described above, DMC Segment 7 contains other major appurtenant structures in its span, including 13 turnouts, five (5) bridges, two siphon undercrossing, one siphon, one pump-in structure, and one "underdrain." Of the 13 turnouts, 12 are the typical concrete pipe type, and one is a fiberglass pipe. The five bridges in this segment include: two timber Operating Bridges, two Timber Farm Bridges, and one concrete Operating Bridge (**Photograph 205**). Most of these bridges are of the standard type, except for the concrete Operating Bridge at M.P. 37.28, adjacent to the Del Puerto Creek siphon. This is the only operating bridge with a concrete deck on concrete bents (**Photograph 210** and **Photograph 211**). Its deck measures 16 feet wide and has modern steel guard-rails. The date of construction of this bridge is unknown. Original design drawings show that, initially, all DMC operating bridges were of timber construction, therefore it is likely that this concrete bridge replaced an original timber bridge at or near this location, at a date unknown. The siphon under Del Puerto Creek, at M.P. 37.24/37.31, is a three-barrel siphon of standard design (**Photograph 213** and **Photograph 214**). The two siphon undercrossings carry irrigation lines under the DMC at M.P. 34.64 and 35.05. The Modesto Irrigation District pump-in is included in the DMC Structures List at M.P. 37.33, however it was observed as being slightly further downstream (**Photograph 215** and **Photograph 216**).

DMC Segment 7 contains numerous minor appurtenant structures, including ladders, and inlet and shoulder drains, virtually all comprised of metal and PVC pipes. This segment also contains one stairway for fishing at M.P. 38.11. This structure is a four-step concrete stairway on the canal bank with a metal pipe railing and a short metal pipe railing at the canal edge to stand along (**Photograph 212**).

For a detailed discussion of repeating major and minor appurtenant structures along the DMC, including bridge, turnout, culvert, inlet drain, stilling well, and check building types, see typology discussion in P3a. Description on Continuation Sheets.

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[141] USDI, Reclamation, *Designers' Operating Criteria Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 2, Appendix I-3.

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
CONTINUATION SHEET

Primary # ______
HRI # ______
Trinomial ______

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton ***Date**: May 11-12, 2022 ☒ Continuation ☐ Update

Photographs (continued):

Photograph 205: Upstream view of Segment 7, showing farm bridge at M.P. 35. 39 with a tractor crossing it; camera facing upstream from left bank, May 12, 2022 (A00834).

Photograph 206: Downstream view of Segment 7 from approximately M.P. 35.10, showing a well discharge (left bank) and inlet drain (right bank); camera facing downstream from left bank, May 12, 2022 (A00815).

Photograph 207: View from the deck of a farm bridge a M.P. 38.14; camera facing upstream, May 12, 2022.

Photograph 208: View of Check No. 6; camera facing downstream from left bank, May 11, 2022 (A00722).

Photograph 209: Upstream view of Check No. 6; camera facing upstream from left bank, May 11, 2022 (A00723).

Photograph 210: View of concrete deck on Operating Bridge at M.P. 37.28; camera facing right bank from left bank, May 12, 2022 (B00255).

Photograph 211: Detail view of concrete bents on Operating Bridge at M.P. 37.28; camera facing northwest, May 12, 2022 (B00256).

Photograph 212: Fishing stairs at M.P. 38.11; camera facing downstream from left bank, May 12, 2022 (B00266).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton ***Date**: May 11-12, 2022 ☒ Continuation ☐ Update

Photograph 213: Downstream view of siphon inlet headwall at M.P. 37.31; camera facing downstream from left bank, May 12, 2022 (B00234).

Photograph 214: Upstream view of siphon outlet headwall at M.P. 37.31; camera facing upstream from right bank, May 12, 2022 (B00252).

Photograph 215: Modesto Irrigation District pump-in near M.P. 37.33, camera facing upstream from right bank, May 12, 2022 (B00245).

Photograph 216: Modesto Irrigation District pump-in, reportedly at M.P. 37.33, but here shown upstream of an inlet drain marked at M.P. 37.34, camera facing upstream from right bank, May 12, 2022 (B00245).

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # ____
HRI # ____
Trinomial ____

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton ***Date**: May 12, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-8

***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) FKC Segment 8 spans 5.57 miles between canal mileposts 38.68 and 44.25, from just above Check No. 7 to just above Check No. 8 along the western edge of the San Joaquin Valley in Stanislaus County. See **Sketch Map** and **Location Map** on Continuation Sheets.

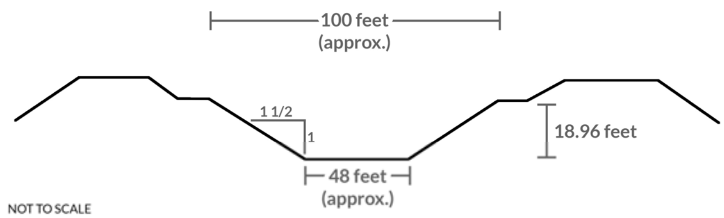
UTM: Zone 10S, 660487.43mE / 4149239.14mN (north endpoint); 665394.03mE / 4143148.06mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
Beginning at Check No. 7 (**Photograph 217**), this segment of the DMC ends just upstream of Check No. 8 (**Photograph 240**) (see Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

a. **Top Width**: 100.38 feet (original)
b. **Bottom Width**: 48 feet
c. **Height or Depth**: 18.96 feet
d. **Length of Segment**: 5.57 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel, Mendota Canal, and O'Neill Forebay

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
This segment of DMC is located in the flat agricultural lands of the San Joaquin Valley principally planted with orchards. The canal skirts the commercial zones at the western edge of the City of Patterson.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: The canal has been altered in this segment by raising the concrete lining, patches to the canal lining, modifications to appurtenant bridges, turnouts, and inlets, and the addition of stilling wells and multiple pipe crossings.

L8b. Description of Photo, Map, or Drawing:
Photograph 217: Beginning of Segment 8, showing Check No. 7, check building, and stilling well; camera facing downstream from left bank, May 12, 2022 (B00297).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Abigail Lawton
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

In Segment 8, the trapezoidal DMC is lined with concrete, which was raised by 18 inches in 1965 (**Photograph 13**).[142] Heavy deterioration, cracking, erosion, and subsidence are evident along some stretches in this segment (**Photograph 233 - Photograph 239**). The canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank. The width of the roads seems to vary based on topography (**Photograph 218 - Photograph 220**).

The upstream end of DMC Segment 8 begins at Check No. 7, the site of which contains the check structure and building (**Photograph 217**). Check No. 7, at M.P. 38.68, is a concrete structure with a total length of 137 feet (**Photograph 221 - Photograph 223**). It is approximately 100 feet wide at the upstream end, widens to about 123 feet at the check gates, and then narrows again to 100 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same slope angle as the canal. Spanning the top of structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge (**Photograph 222**). On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. One metal lamp post with an umbrella-shaped shade is also present on the deck. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms 19 feet, 9.5 inches that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 36.68 on the left bank, is a rusticated concrete block structure, measuring approximately 9 feet by 7 feet. A stilling well is located just below Check No. 7, at M.P. 38.74, while a second stilling well is located just above Check No. 8 at M.P. 44.24. Both stilling wells are located on the left bank and are the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[143]

In addition to the canal features located at Check No. 7, DMC Segment 8 contains other major appurtenant structures in its span, including one wasteway, one culvert, one overchute, one overflow inlet structure, one set of fishing stairs, seven (7) bridges, and 18 turnouts. This segment also includes the Patterson O&M storage yard on the east side of the O&M road, at M.P. 40.00, which consists of a fenced in yard containing two single-story standing-seam metal buildings of rectangular plan, with low-pitched gable roofs. (**Photograph 224** and **Photograph 225**). The prefabricated metal construction of these buildings was common and ubiquitous throughout the CVP. They are no longer in use and have suffered heavy deterioration, such as missing roofing and siding panels and many missing doors and windows. Remaining metal siding and roofing has been subject to heaving rusting.

The wasteway is a concrete overspill apron, the only one of its type on DMC, located at M.P. 39.32/39.42 on the right bank (**Photograph 226** and **Photograph 227**). Just downstream of this, at M.P. 39.46, is the culvert crossing that carries Black Gulch under the DMC. The overchute, at M.P. 41.93, is the typical reinforced concrete box type and carries Salado Creek across the DMC. Just downstream of the overchute is the City of Patterson's overflow inlet structure for Salado Creek. This structure consists of three 60-inch concrete pipes at M.P. 41.94 (**Photograph 228** and **Photograph 229**). Fishing stairs were observed around M.P. 38.75, although they are not included in the DMC Structures List (2020) (**Photograph 230**). They consist of a set of four concrete steps, with a metal pipe handrail, leading from the road to the canal with another short span of metal pipe railing along the top of the canal wall. The seven bridge crossings in this segment include: three concrete County Highway bridges, two Timber Farm bridges, one Timber Operating bridge, and one non-original (post-1958) county highway bridge. The non-original county highway bridge at M.P. 39.81 carries Sperry Road/Hwy 130 across the DMC. It is a concrete bridge, deck measuring 30 feet wide, that stretches between two large abutments with no support piers (**Photograph 231** and **Photograph 232**). The footings of the original bridge are still evident underneath the current bridge. All other bridges in this

[142] USDI, Reclamation, *Designers' Operating Criteria Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 2, Appendix I-3.
[143] USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*, 59, 62, 93, 97-99.

segment are of standard designs. Of the 18 turnouts in this span, 15 are the typical concrete pipe type, two are the concrete box type, and one is a steel pipe.

DMC Segment 8 contains numerous minor appurtenant structures, including ladders, well discharges, and inlet and shoulder drains, virtually all constructed of metal and PVC pipes.

For a detailed discussion of repeating major and minor appurtenant structures along the DMC, including bridge, turnout, overchute, culvert, inlet drain, stilling well, and check building types, see typology discussion in P3a. Description on Continuation Sheets.

Photographs (continued):

Photograph 218: Downstream view from the deck of Check No. 7; camera facing downstream, May 12, 2022 (B00318).

Photograph 219: Downstream view from approximately M.P. 38.74; camera facing downstream from left bank, May 12, 2022 (B00321).

Photograph 220: Downstream view from approximately M.P. 43.73; camera facing downstream from left bank, May 12, 2022 (B00449).

Photograph 221: Downstream view of Check No. 7; camera facing downstream from left bank, May 12, 2022 (B00298).

Photograph 222: Detail view of Check No. 7's deck and gate-hoisting equipment; camera facing right bank from left bank, May 12, 2022 (B00300).

Photograph 223: View of downstream side of Check No. 7; camera facing upstream from left bank, May 12, 2022 (B00320).

Photograph 224: Patterson O&M storage yard on the east side of the O&M road, at M.P. 40.00 containing two deteriorated and unused buildings; camera facing southeast, May 12, 2022 (B00364).

Photograph 225: Patterson O&M storage yard at M.P. 40.00 where buildings are no longer in use and have suffered heavy deterioration; camera facing southwest, May 12, 2022 (B00368).

Photograph 226: Concrete overspill apron wasteway at M.P. 39.32/39.42 on the right bank is the only one of its type on the DMC; camera facing downstream from left bank; May 12, 2022 (B00338).

Photograph 227: Concrete overspill apron wasteway at M.P. 39.32/39.42 on the right bank, the only one of its type on the DMC; camera facing upstream from left bank; May 12, 2022 (B00342).

Photograph 228: City of Patterson's overflow inlet structure for Salado Creek at M.P. 41.94, just below overchute; camera facing upstream from left bank, May 12, 2022 (B00412).

Photograph 229: City of Patterson's overflow inlet structure for Salado Creek at M.P. 41.94, consists of three 60-inch concrete pipes; camera facing right bank from left bank, May 12, 2022 (B00413).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton

***Date**: May 12, 2022

☒ Continuation ☐ Update

Photograph 230: Fishing stairs around M.P. 38.75; camera facing southwest from left bank, May 12, 2022 (B00323).

Photograph 231: Non-original replacement county highway bridge at M.P. 39.81 along Sperry Road/Hwy 130, concrete deck measuring 30 feet wide, that stretches between two large abutments with no support piers; camera facing downstream from left bank, May 12, 2022 (B00343).

Photograph 232: Non-original replacement county highway bridge at M.P. 39.81 along Sperry Road/Hwy 130, with footings of the original bridge still evident underneath the current bridge; camera facing upstream from left bank, May 12, 2022 (B00350).

Photograph 233: Subsidence on right bank around M.P. 42.30; camera facing right bank from left bank, May 12, 2022 (B00417).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton ***Date**: May 12, 2022 ☒ Continuation ☐ Update

Photograph 234: Repair to the right bank canal lining around M.P. 42.3; camera facing right bank from left bank, May 12, 2022 (B00417).

Photograph 235: Repairs to the right bank canal lining around M.P. 42.53; camera facing right bank from left bank, May 12, 2022 (B00426).

Photograph 236: Patches to right bank canal lining with fresh cracks visible around turnout at M.P. 43.08; camera facing right bank from left bank, May 12, 2022 (B00434).

Photograph 237: Patches to right bank canal wall and subsidence just above Marshall Road bridge at M.P. 43.24; camera facing right bank from left bank, May 12, 2022 (B00442).

*Resource Name or # (Assigned by recorder): Delta-Mendota Canal

*Recorded by: H. Norby & A. Lawton *Date: May 12, 2022 ☒ Continuation ☐ Update

Photograph 238: Large repair to right bank canal wall between Marshall Road bridge and inlet drain at M.P. 43.24; camera facing right bank from left bank, May 12, 2022 (B00447).

Photograph 239: Cracking in right bank canal lining between a large repair to canal wall just below Marshall Road bridge at M.P. 43.24 and drain inlet with flap gate on right bank at M.P. 43.26; camera facing right bank from left bank, May 12, 2022 (B00448).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton ***Date**: May 12-13, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-9

***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 9 spans 4.35 miles between canal mileposts 44.26 and 48.61, from just above Check No. 8 to just above Check No. 9 along the western edge of the San Joaquin Valley in Stanislaus County. See **Sketch Map** and **Location Map** on Continuation Sheets.

UTM: Zone 10S, 665395.16mE / 4143126.94mN (north endpoint); 667851.60mE / 4137214.23mN (south endpoint)

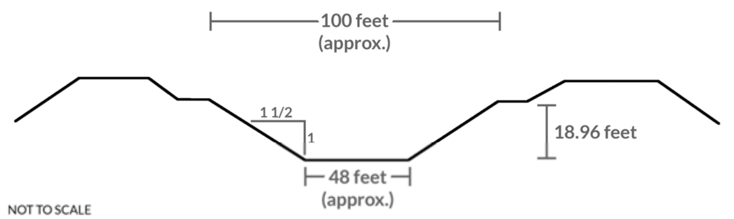
L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)

This segment begins at a point just upstream of Check No. 8 and continues to a point just upstream of Check No. 9 (**Photograph 240**). The canal has a trapezoidal cross-section and is lined with concrete (see Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 100.38 feet (original)
- **b. Bottom Width**: 48 feet
- **c. Height or Depth**: 18.96 feet
- **d. Length of Segment**: 4.35 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel, Mendota Canal, and O'Neill Forebay

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)

This segment of DMC passes through the flat agricultural lands of the western San Joaquin Valley. Surrounding agricultural lands are principally planted with orchards.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: The canal has been altered in this segment by raising the concrete lining, modifications to appurtenant bridges, turnouts, and inlets, and the addition of stilling wells and multiple pipe crossings.

L8b. Description of Photo, Map, or Drawing:

Photograph 240: Beginning of Segment 9, showing Check No. 8 and check building; camera facing downstream from left bank, May 12, 2022 (B00456)

L9. Remarks:

L10. Form prepared by:

H. Norby & A. Lawton
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

In Segment 9, the trapezoidal DMC is lined with concrete, which was raised by 18 inches in 1965 (**Photograph 13**).[144] Subsidence and cracking are evident along some stretches of this segment and sandbags line the top of the canal wall in some locations (**Photograph 243** and **Photograph 244**). The canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank. The width of the roads seems to vary based on topography (**Photograph 241**). For a detailed discussion of DMC cross sections, see typology discussion in P3a. Description on Continuation Sheets.

DMC Segment 9 begins at Check No. 8 at M.P. 44.26, the site of which contains the check structure and building (**Photograph 240**). The check is a concrete structure with a total length of 137 feet (**Photograph 242**). It is approximately 100 feet wide at the upstream end, widens to 123 feet at the check gates, and then narrows again to 100 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same slope angle as the canal. Spanning the top of structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge. On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. One metal lamp post with an umbrella-shaped shade is also present on the deck. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms 19 feet, 9.5 inches that rotate on pin bearings supported by brackets attached to the structure sidewalls. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 44.26 on the left bank, and is of standard design. A stilling well is located just below Check No. 8, at M.P. 44.32, while a second stilling well is located just above Check No. 9 at M.P. 48.59. Both stilling wells are located on the left bank and are of standard design.[145]

In addition to the structures located at Check No. 8, DMC Segment 9 contains one overchute, one culvert, one pipe crossing, six (6) bridges, and 14 turnouts. The Crow Creek overchute at M.P. 48.43 and the Little Salado Creek culvert crossing at M.P. 45.75 are of standard design. The six bridge crossings in this span include: three concrete County Highway bridges and three timber Farm Bridges, all of standard design. Additionally, the concrete abutments from a no longer extant farm bridge are still evident at M.P. 46.36 (**Photograph 244**).

DMC Segment 9 also contains numerous minor appurtenant structures, including ladders, well discharges, and inlet and shoulder drains, virtually all constructed of metal and PVC pipes.

For a detailed discussion of repeating major and minor appurtenant structures along the DMC, including bridge, turnout, overchute, culvert, inlet drain, stilling well, and check building types, see typology discussion in P3a. Description on Continuation Sheets.

[144] USDI, Reclamation, *Designers' Operating Criteria Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 2, Appendix I-3.
[145] USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*, 59, 62, 93, 97-99.

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton ***Date**: May 12-13, 2022 ☒ Continuation ☐ Update

Photographs (continued):

Photograph 241: Downstream view from the deck of the farm bridge at M.P. 47.38; camera facing downstream, May 13, 2022 (A00862).

Photograph 242: Upstream view of Check No. 8; camera facing upstream from left bank, May 13, 2022 (B00457).

Photograph 243: Downstream view of DMC from approximately M.P. 46.02 showing sandbags lining the top of the canal wall; camera facing downstream from left bank, May 13, 2022 (A00838).

Photograph 244: Right abutment from a no longer extant farm bridge at M.P. 46.36, with cracking visible along the canal lining; camera facing right bank from left bank, May 13, 2022 (A00848).

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # ___
HRI # ___
Trinomial ___

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby, A. Lawton, & A. Young

***Date**: May 13 & June 13, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-10

***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 10 spans 5.78 miles between canal mileposts 48.62 and 54.40, from Check No. 9 to just above Check No. 10 along the western edge of the San Joaquin Valley in Stanislaus County. See **Sketch Map** and **Location Map** on Continuation Sheets.

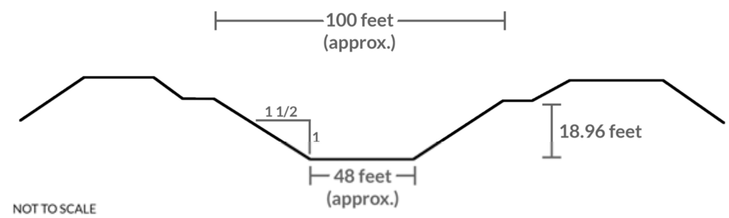
UTM: Zone 10S, 667851.77mE / 4137192.11mN (north endpoint); 669484.97mE / 4128831.84mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
Segment 10 begins at a point just upstream of Check No. 9 and continues to a point just upstream of Check No. 10 (**Photograph 245)**. (See Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 100.38 feet (original)
- **b. Bottom Width**: 48 feet
- **c. Height or Depth**: 18.96 feet
- **d. Length of Segment**: 5.78 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel, Mendota Canal, and O'Neill Forebay

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
This segment of DMC is located primarily in the flat agricultural lands of the San Joaquin Valley in southwestern Stanislaus County. Surrounding agricultural lands are principally planted with orchards. This segment is crossed by four public roadways – Bell Road, Stuhr Road, Orestimba Road, and Shiells Road.

L7. Integrity Considerations: The canal has been altered in this segment by raising the concrete lining, modifications to appurtenant bridges, turnouts, and inlets, and the addition of stilling wells and multiple pipe crossings.

L8a. Photograph, Map, or Drawing.

L8b. Description of Photo, Map, or Drawing:
Photograph 245: Downstream view of Segment 10's northern end, showing Check No. 9 and check building with a stilling well in the foreground; camera facing downstream from left bank, May 13, 2022 (A00885).

L9. Remarks:

L10. Form prepared by:
Heather Norby, Abigail Lawton, & Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

In Segment 10, the trapezoidal DMC is lined with concrete, which was raised by 18 inches in 1965 (**Photograph 13**).[146] The canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank. The width of the roads seems to vary based on topography (**Photograph 246 - Photograph 248**). For a detailed discussion of DMC cross sections, see typology discussion in P3a. Description on Continuation Sheets.

The upstream end of DMC Segment 10 begins at Check No. 9, the site of which contains the check structure and building (**Photograph 245**). Check No. 9, at M.P. 48.62, is a concrete structure with a total length of 137 feet (**Photograph 249 - Photograph 251**). It is approximately 100 feet wide at the upstream end, widens to about 123 feet at the check gates, and then narrows again to 100 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same slope angle as the canal. Spanning the top of structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge (**Photograph 250**). On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. One metal lamp post with an umbrella-shaped shade is also present on the deck. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms 19 feet, 9.5 inches that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 48.62 on the left bank and is of standard design. A stilling well is located just below Check No. 9, at M.P. 48.69, while a second stilling well is located just above Check No. 10 at M.P. 54.39. Both stilling wells are located on the left bank and are of standard design.[147]

In addition to the canal features located at Check No. 9, DMC Segment 10 contains other major appurtenant structures in its span, including the Newman Wasteway, one siphon, two culverts, six (6) bridges, and 13 turnouts.

The Orestimba Creek siphon at M.P. 51.18/51.27 is a four-barrel siphon conveying the DMC 330 feet under Bell Road, at M.P. 51.21, and the Orestimba Creek culvert, at M.P. 51.31, which provides an outlet for the Orestimba Water District (**Photograph 252 - Photograph 255**). A retaining wall on the east side of the Orestimba Creek siphon was repaired in 1995 after experiencing severe storm damage. Damaged steel sheet piles were removed or cut off and new Government supplied AZ 18 sheet piles were installed (**Photograph 254**).[148]

The second culvert in this segment crosses below the DMC at M.P. 50.49 to facilitate drainage. The six bridge crossings in this span include: three concrete County Highway bridges, one County Highway Wasteway Crossing bridge, and two timber Farm bridges, all of standard design. All 13 turnouts are the concrete pipe type and are of standard design.

The Newman Wasteway is on the left bank (east side) of the canal at M.P. 54.38 (**Photograph 256 - Photograph 263**). The wasteway extends generally northeast about 8.2 miles to the San Joaquin River. The wasteway begins with a concrete inlet structure on the left bank of the canal consisting of two waterways, each with a steel radial gate—measuring 20 feet wide and 17 feet tall—controlling the water flow. Both radial gates each have two gate arms, each measuring 19 feet, 9.5 inches long, with the pivot points bolted to a concrete headwall (**Photograph 258**). The gates' arms all have truss designs, and the arched gate faces are all reinforced by a grid pattern of steel beams. The gates are raised and lowered by a row of electric motors, hoists, pulleys, and a manual handle mounted on a concrete platform on top of the structure. This top deck includes a service

[146] USDI, Reclamation, *Designers' Operating Criteria Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 2, Appendix I-3.
[147] USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*, 59, 62, 93, 97-99.
[148] Welsh, Richard A., USDI, Reclamation, *Technical Report of Construction: Orestimba Creek Siphon Repairs*, September 28, 2001: 1-8, Appendix B, Central Valley Project – California (CVP), "Delta-Mendota Canal, Orestimba Creek Siphon Repair, Sheet Pile Drop and Impact Basin Plan", dwg. no. 214-D-22675, 1995.

walkway with pipe railing along the edge, and it also features a metal electrical box. Water passing through the wasteway control structure is channeled into a concrete-line trapezoidal chute with vertical top walls (**Photograph 259** and **Photograph 260**). This concrete-lined section of the wasteway extends about 1.5 miles and the remaining 6.7 miles are earth-line (**Photograph 261** and **Photograph 262**).[149]

DMC Segment 10 also contains numerous minor appurtenant structures, including ladders, well discharges, cattle guards, and inlet and shoulder drains, virtually all constructed of metal and PVC pipes. In this segment, some inlet drains were observed at locations not included in the *2020 DMC Structures List*, while other inlet drains included in that document were not observed at the specified locations. There were also three large pipes observed at approximately M.P. 54.39 on the right bank, however they did not appear to be connected/operable (**Photograph 264**). A review of archival photographs on Google Earth showed the pipes present at this location beginning in 2015. No photographs appear to show them operational.

For a detailed discussion of repeating major and minor appurtenant structures along the DMC, including bridge, turnout, culvert, inlet drain, stilling well, cattle guards, and check building types, see typology discussion in P3a. Description on Continuation Sheets.

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[149] USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*, 53.

Photographs (continued):

Photograph 246: Downstream view from the deck of a farm bridge at M.P. 49.55; camera facing downstream, May 13, 2022 (A00909).

Photograph 247: View of deep excavations on the right bank of the DMC from approximately M.P. 50.00; camera facing downstream from left bank, May 13, 2022 (C20400).

Photograph 248: Downstream view of DMC from approximately M.P. 53.15, Shiells Road bridge visible in distance (left background); camera facing downstream from left bank, May 13, 2022 (A00973).

Photograph 249: Detail view of Check No. 9 from the deck of Diehl Road Bridge; camera facing downstream from left bank, May 13, 2022 (A00883).

Photograph 250: Detail view of Check No. 9, showing its top deck and a pipe crossing mounted atop its support piers; camera facing right bank from left bank, May 13, 2022 (A00889).

Photograph 251: View of downstream side of Check No. 9; camera facing upstream from left bank, May 13, 2022 (A00893).

Photograph 252: Inlet headwall for Orestimba Creek siphon at M.P. 51.18; camera facing downstream from left bank, May 13, 2022 (A00940).

Photograph 253: Bell Road crossing over the 330-foot long Orestimba Creek siphon at M.P. 51.21; camera facing southeast, May 13, 2022 (A00941).

Photograph 254: Retaining wall around siphon and culvert that was repaired in 1995 after sheet piles were damaged in severe storm, fence around siphon outlet visible on elevated embankment in background (top center); camera facing south, May 13, 2022 (A00946).

Photograph 255: Outlet headwall of Orestimba Creek siphon, at M.P. 51.27, repaired retaining wall visible in background (far right); camera facing upstream from left bank, May 13, 2022 (A00948).

Photograph 256: View of Newman Wasteway inlet structure, looking upstream; camera facing downstream from left bank, May 13, 2022 (A00994).

Photograph 257: Newman Wasteway inlet structure, showing automatic-siphon spillways; camera facing downstream from left bank, May 13, 2022 (A00990).

Photograph 258: Detail view of Newman Wasteway inlet structure, showing the top deck, gate-hoisting equipment, and a radial gate's backside; camera facing right bank from left bank, May 13, 2022 (A00992).

Photograph 259: Downstream view of Newman Wasteway showing the start of the concrete-lined section at M.P. 54.38; camera facing east from left bank, May 13, 2022 (A00993).

Photograph 260: Upstream view of Newman Wasteway, showing concrete-lined section; camera facing upstream from wasteway's right bank, June 13, 2022 (C10778).

Photograph 261: Upstream view of Newman Wasteway, showing earth-lined section; camera facing upstream from wasteway's right bank, June 13, 2022 (C10778).

***Recorded by**: H. Norby, A. Lawton, & A. Young ***Date**: May 13 & June 13, 2022 ☒ Continuation ☐ Update

Photograph 262: Upstream view of Newman Wasteway from approximately M.P. 8.15, showing earth-lined section; camera facing upstream from wasteway's right bank, June 13, 2022 (C0025).

Photograph 263: Downstream view of Newman Wasteway's terminus where it joins the San Joaquin River; camera facing dowstream from wasteway's right bank, June 13, 2022 (C0026).

Photograph 264: Three (uninstalled) large pipes just above Check No. 10 at M.P. 54.41 on the right bank; camera facing downstream from left bank, May 13, 2022 (A00989).

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # ______
HRI # ______
Trinomial ______

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton

***Date**: May 13, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-11

***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) Segment 11 spans 3.86 miles between canal mileposts 54.41 and 58.27, from Check No. 10 in southwestern Stanislaus County to the just above Check No. 11 in northwestern Merced County. See **Sketch Map** and **Location Map** on Continuation Sheets.

UTM: Zone 10S, 669490.56mE / 412888.06mN (north endpoint); 670531.47mE / 4123389.25mN (south endpoint)

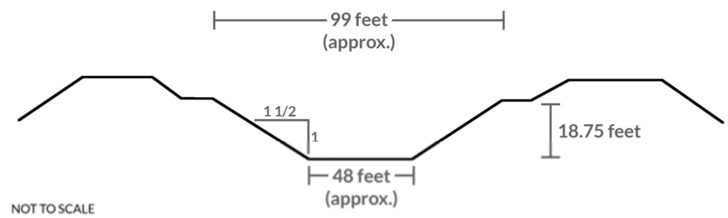
L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)

This segment begins at a point just upstream of Check No. 10 and continues to a point just upstream of Check No. 11 (**Photograph 265**). (See Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

a. **Top Width**: 99.75 feet (original)
b. **Bottom Width**: 48 feet
c. **Height or Depth**: 18.75 feet
d. **Length of Segment**: 3.86 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel, Mendota Canal, and O'Neill Forebay

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)

Segment 11 skirts along the junction of the low-hilled grasslands and flat agricultural lands of the western San Joaquin Valley. The agricultural lands are principally planted with orchards.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: The canal has been altered in this segment by raising the concrete lining, modifications to appurtenant bridges, turnouts, and inlets, and the addition of stilling wells and multiple pipe crossings.

L8b. Description of Photo, Map, or Drawing:

Photograph 265: Beginning of Segment 11, showing Check No. 10 (center right), check building (left), and a stilling well (bottom right); camera facing downstream from left bank, May 13, 2022. (A00995)

L9. Remarks:

L10. Form prepared by:

Heather Norby, Abigail Lawton, & Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

In Segment 11, the trapezoidal DMC is lined with concrete, which was raised by 18 inches in 1965 (**Photograph 13**).[150] The canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank. The width of the roads seems to vary based on topography (**Photograph 266** and **Photograph 267**). For a detailed discussion of DMC cross sections, see typology discussion in P3a. Description on Continuation Sheets.

DMC Segment 11 begins at Check No. 10, the site of which contains the check structure and building (**Photograph 265**). Check No. 10, located at M.P. 54.4is a concrete structure with a total length of 137 feet. Its width is approximately 100 feet wide at the upstream end, widens to about 123 feet at the check gates, and then narrows back to 100 feet where it rejoins the canal walls on the downstream side (**Photograph 268** and **Photograph 269**). The banks of the check structure maintain the same slope angle as the canal. Spanning the top of structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge (**Photograph 268**). On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms 19 feet, 9.5 inches that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 54.41 on the left bank, is of standard design. A stilling well is located just below Check No. 10, at M.P. 54.49, while a second stilling well is located just above Check No. 11 at M.P. 58.25. Both stilling wells are located on the left bank and are of standard design.[151]

In addition to the structures located at Check No. 10 and described above, DMC Segment 11 contains three culverts, three (3) bridges, and 13 turnouts. The three bridge crossings in this segment include: two concrete County Highway bridges and one timber Operating Bridge, however this operating bridge, at M.P. 56.02, is currently barricaded at both ends and shows evidence of fire damage (**Photograph 270**). The two concrete County Highway bridges are of standard design, though the bridge at M.P. 56.60 along Pete Miller Road has parapet concrete walls, rather than the typical steel guard-rails (**Photograph 271**). Of the 13 turnouts, eleven are the typical concrete pipe type while two are the concrete box type. All of these are of standard design. The three drainage culverts are all of standard design.

DMC Segment 11 also contains numerous minor appurtenant structures, including ladders and inlet and shoulder drains, virtually all constructed of metal and PVC pipes.

For a detailed discussion of repeating major and minor appurtenant structures along the DMC, including bridge, turnout, culvert, inlet drain, stilling well, cattle guards, and check building types, see typology discussion in P3a. Description on Continuation Sheets.

[150] USDI, Reclamation, *Designers' Operating Criteria Delta-Mendota Canal and Delta Cross Channel*, Sept. 1971: 2, Appendix I-3.
[151] USDI, Reclamation, *Delta-Mendota: Technical Record of Design and Construction*, 59, 62, 93, 97-99.

Photographs (continued):

Photograph 266: Downstream view of DMC from approximately M.P. 55.07, with spoil piles flanking both banks; camera facing downstream from left bank, May 13, 2022 (A01010).

Photograph 267: Upstream view of DMC from approximately M.P. 56.18; camera facing upstream from left bank, May 13, 2022 (A01012).

Photograph 268: Check No. 10; camera facing downstream from left bank, May 13, 2022 (A00997).

Photograph 269: Check No. 10; camera facing right bank from left bank, May 13, 2022 (A00998).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Lawton   ***Date**: May 13, 2022   ☒ Continuation ☐ Update

Photograph 270: Detail view of fire damaged deck of Operating Bridge at M.P. 56.02; right bank from left bank, May 13, 2022 (A01020)

Photograph 271: View of concrete County Highway bridge at M.P. 56.60 along Pete Miller Road with parapet concrete walls, rather than the typical steel guard-rails; downstream from left bank, May 13, 2022 (A01027).

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # ____________________
HRI # ____________________
Trinomial ____________________

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young
***Date**: June 13, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-12

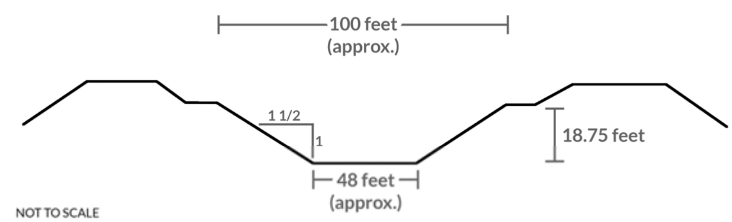
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) Segment 12 of the canal spans 5.70 miles between canal mileposts 58.28 and 63.98, from Check No. 11 to a point just above Check No. 12 in northwestern Merced County. See **Sketch Map** and **Location Map** on Continuation Sheets.
UTM: Zone 10S, 670530.32mE / 4123386.32mN (north endpoint); 673476.73mE / 4115507.16mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
DMC Segment 12 begins at Check No. 11 (**Photograph 272**) and ends at a point just upstream of Check No. 12 (

Photograph 273). It has the same concrete lining and trapezoidal cross section as elsewhere along the canal, and it is flanked with unpaved maintenance roads on both banks that are approximately 12 to 20 feet wide. (See Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)
- **a. Top Width**: 100 feet
- **b. Bottom Width**: 48 feet
- **c. Height or Depth**: 18.75 feet
- **d. Length of Segment**: 5.70 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel and Mendota Dam

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
Segment 12 skirts along the junction of the low-hilled grasslands and flat agricultural lands of the western San Joaquin Valley. The agricultural lands are principally planted with orchards.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: This segment has been altered by raising the concrete lining, alterations to bridges and turnouts, and the addition of stilling wells, well discharges, and modern turnouts.

L8b. Description of Photo, Map, or Drawing:
Photograph 272: Beginning of Segment 12 showing Check No. 11 and check building (left) with a turnout and stilling well (foreground); camera facing downstream from the left bank, June 13, 2022 (C0080).

L9. Remarks:

L10. Form prepared by:
Heather Norby and Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

Segment 12 of the canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank (**Photograph 273 - Photograph 275**). The width of the roads seems to vary based on topography.

Segment 12 begins at Check No. 11, located at M.P. 58.28. The check is a concrete structure with a total length of approximately 100 feet. Its width approximately is 100 feet at the upstream end, narrows to 60 feet at the check gates, and then narrows again to 40 feet where it transitions into the inlet of Garzas Creek Siphon (**Photograph 276**). The check structure is rectangular in cross section and divided into three bays of equal size, each with a radial gate for regulation and closure. The banks of the canal transition from sloped to vertical at the control structure. Spanning the top of the structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge (**Photograph 277**). On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The check building, at M.P. 58.28 on the left bank, is of concrete block construction, measuring approximately 9 feet by 7 feet. A stilling well is located just above Check No. 11 at M.P. 58.25 while a second stilling well is located just below the siphon's outlet at M.P.58.40. Both stilling wells are located on the left bank and are the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[152]

The Garzas Creek Siphon begins immediately downstream from Check No. 11 (**Photograph 278**). The concrete structure consists of inlet and outlet headwalls that are connected by four 12-by-16-feet barrels. The inlet headwall at M.P. 58.29 is 51 feet wide and approximately 23.75 feet tall. The outlet headwall at M.P. 58.35 is 48 feet wide and approximately 22.5 feet tall (**Photograph 279**). The barrels are 225 feet long and buried beneath Garzas Creek (**Photograph 280**). A concrete weir (**Photograph 281**) sits in the Garzas Creek streambed approximately in line with the canal's left bank.[153]

The four bridge spans in this segment include: three concrete county highway bridges and one timber-deck county highway bridge, at M.P. 62.09. All these bridges are of standard design.

In addition to the structures discussed above, DMC Segment 12 contains one pipe crossing, twelve turnouts, and inlet drains. All the other structures are of standard design or have standard alterations as discussed in the above typology discussion in Section P3a.

[152] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59, 62, 93, 97-99.
[153] "Garzas Creek Check and Siphon: Profile and Siphon Details," on file at the Bureau of Reclamation Design Construction Library; "Garzas Creek Check and Siphon: Details of Check and Siphon Inlet," on file at the Bureau of Reclamation Design Construction Library; Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59, 64-65.

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young *__Date__: June 13, 2022 ☒ Continuation ☐ Update

Photographs (continued)

Photograph 273: View of Segment 12 from approximately M.P. 63.64, with a spoils pile flanking the right bank; camera facing downstream from left bank, June 13, 2022 (C0137).

Photograph 274: View of Segment 12 from approximately M.P. 63.34; camera facing upstream from left bank, June 13, 2022 (C0135).

Photograph 275: View of Segment 12 from the deck of Gravel Pit Road at M.P. 58.46; camera facing downstream, June 13, 2022 (C0094).

Photograph 276: Transition between Check No. 11 and Garzas Creek Siphon; camera facing right upstream from left bank, June 13, 2022 (C0087).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young *Date: June 13, 2022 ☒ Continuation ☐ Update

Photograph 277: Detail view of Check No. 11's gate hoisting equipment; camera facing upstream from left bank, June 13, 2022 (C0088).

Photograph 278: Garzas Creek Siphon's inlet headwall; camera facing downstream from left bank, June 13, 2022 (C0085).

Photograph 279: Garzas Creek Siphon's outlet headwall from the deck of Gravel Pit Road bridge at M.P. 58.46; camera facing upstream, June 13, 2022 (C0080).

Photograph 280: View across the Garzas Creek Siphon, with its outlet in the background; camera facing downstream, June 13, 2022 (C0086).

Photograph 281: Upstream view of Garzas Creek, showing the weir that sits approximately adjacent to the DMC centerline; camera facing west, June 13, 2022 (C0090).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young

***Date**: June 13, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-13

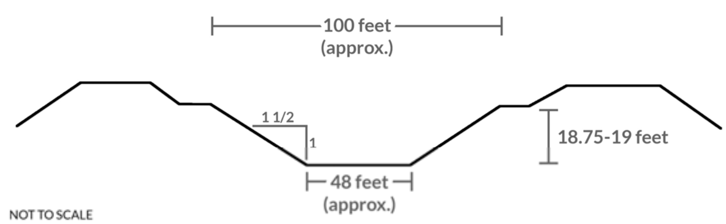
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 13 of the canal spans 6.01 miles between canal mileposts 63.99 and 70.00, from Check No. 12 to a point just upstream from Check No. 13.
UTM: Zone 10S, 673489.44mE / 4115478.07mN (north endpoint); 674434.29mE / 4106749.78mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
DMC Segment 13 begins at Check No. 12 (**Photograph 282**) and ends at a point just upstream of Check No. 13. It has the same concrete lining and trapezoidal cross section as elsewhere along the canal, and it is flanked with unpaved maintenance roads on both banks that are approximately 12 to 20 feet wide.

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 100 feet
- **b. Bottom Width**: 48 feet
- **c. Height or Depth**: 18.75 feet – 19.00 feet
- **d. Length of Segment**: 6.01 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel and Mendota Dam

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
Segment 13 skirts along the junction of the low-hilled grasslands and flat agricultural lands of the western San Joaquin Valley. The agricultural lands are principally planted with orchards.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: This segment has been altered by raising the concrete lining, alterations to bridges, turnouts and inlet drains, and the addition of stilling wells, pipe crossings, and modern turnouts.

L8b. Description of Photo, Map, or Drawing:
Photograph 282: Beginning of Segment 13 showing Check No. 12 and check building (left), with a turnout and stilling well (foreground); camera facing south, June 13, 2022 (C0140)

L9. Remarks:

L10. Form prepared by:
Heather Norby & Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

(west) bank and approximately 12-18 feet wide on the left (east) bank (**Photograph 283 - Photograph 284**). The width of the roads seems to vary based on topography.

Segment 13 begins at Check No. 12 located at M.P. 63.99 (**Photograph 285 - Photograph 286**). The check is a concrete structure with a total length of 180 feet. Its width approximately is 100 feet wide at the upstream end, widens to 135 feet at the check gates, and then narrows back to 100 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same slope angle as the canal. Spanning the top of the structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge. On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 63.99 on the left bank, is a concrete block structure, measuring approximately 9 feet by 7 feet. A stilling well is located just above Check No. 12 at M.P. 63.95 while a second stilling well is located just below it at M.P. 64.06. Both stilling wells are located on the left bank and are the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[154]

The O'Neill Forebay intake channel extends from the canal's right bank at M.P. 69.30 (**Photograph 287**). It is approximately 125 feet wide and extends approximately one-half mile from the canal to the forebay intake.

The Volta Wasteway extends from the canal's left bank at M.P. 69.98 (**Photograph 288**). It is approximately six miles in total length, ending where it transitions into the San Luis Wasteway. It begins with a concrete inlet structure consisting of two 15-foot-wide channels, each with a steel radial gate to control the flow of water. The arced gate faces are 16.5 feet tall and 15 feet wide and reinforced on the back by a grid of steel members. Each has two steel arms of a truss design that pivot from pins fixed into the central support pier and channel sidewalls. Supported by the pier and sidewalls is a concrete top deck on which electric gate-hoisting equipment and a concrete bridge are mounted. A replacement automatic-siphon spillway passes beneath the south radial gate (**Photograph 289**). Water passing through the inlet structure flows down a chute, into a stilling pool, and then into the wasteway lined with compacted earth (**Photograph 290 - Photograph 291**). The O'Neill Forebay Wasteway, which passes beneath the DMC through a culvert at M.P. 69.85 (**Photograph 292**), joins the Volta Wasteway approximately 850 feet downstream from the inlet structure (**Photograph 293**).[155]

A Bureau of Reclamation O&M yard is sited on the east side of the canal at approximately M.P. 69.90 and flanked by the Volta and O'Neill wasteways on its northeast and southeast sides (**Photograph 294**). It consists of two Quonset huts sited parallel to each other. The approximately 4,000-square-feet buildings have rectangular footprints, semi-cylindrical forms, and they are clad in metal. Access to each is provided through double garage doors at both ends. Fenestration on the west building includes sliding aluminum windows flanking the garage doors while the east building includes no fenestration.

The five extant bridge crossings in this segment include two concrete county highway bridges, one county highway wasteway crossing bridge, one non-original (post-1958) state highway bridge, and the O'Neill intake channel operating bridge. All county highway bridges are of standard design, although the bridge at M.P. 68.03, along McCabe Road, has concrete parapet walls, instead of the typical steel guard-rails, and is supported by three concrete piers, rather than the typical two piers (**Photograph 295**). The non-original bridge at M.P. 65.89 consists of two spans that carry Interstate 5 north and south. This

[154] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59, 62, 97-99.
[155] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 65, 70-74.

bridge, constructed in 1965, has paved concrete decks, each measuring 39 feet, 8 inches wide, and supported by steel stringers. The abutments on the right bank sit directly next to the canal and support the stringers, while on the left bank, the stringers terminate monolithic concrete piers, while the decks extend over the O&M road adjacent to the canal and terminate at abutments further up the embankment.[156] The O'Neill intake channel operating bridge has a paved concrete deck supported by a single support pier. Additionally, the abutments of a non-extant farm bridge remain at M.P. 67.15.

In addition to the structures discussed above, DMC Segment 13 contains two overchutes, two culverts, three pipe crossings, 18 turnouts, and inlet drains. All these structures are of standard design or have standard alterations as discussed in the above typology discussion in Section P3a.

[156] USDI, Reclamation, *Designer's Operating Criteria*, 1971: 26.

Photographs (continued):

Photograph 283: View of Segment 13 from approximately M.P. 64.44, with spoils piles along the right bank; camera facing downstream from left bank, June 13, 2022 (C0158).

Photograph 284: View of Segment 13, showing the canal's left bank and a turnout at M.P. 65.89; camera facing downstream from left bank, June 13, 2022 (C0165).

Photograph 285: Check No. 12, with a turnout at M.P. 63.96 visible in the foreground; camera facing downstream from left bank, June 13, 2022 (C0142).

Photograph 286: Check No. 12; camera facing upstream from left bank, June 13, 2022 (C0147).

Photograph 287: The O'Neill Forebay Intake Channel; camera facing right bank from left bank, June 13, 2022 (C0189).

Photograph 288: Volta Wasteway's inlet structure at M.P. 69.98, with Check No. 13 in the background; camera facing downstream from left bank, June 13, 2022 (C0194).

Photograph 289: Automatic-siphon spillway; camera facing northeast from left bank, June 13, 2022 (C0198).

Photograph 290: Upstream view of the Volta Wasteway, with its inlet structure in the background; camera facing upstream from wasteway's left bank, June 13, 2022 (C0219).

Photograph 291: View of Volta Wasteway with a pipe crossing at approximately M.P. 1.5; camera facing upstream from wasteway's left bank, June 13, 2022 (C0225).

Photograph 292: Culvert channeling the O'Neill Forebay Wasteway beneath the DMC at M.P. 69.62; camera facing upstream from wasteway's right bank, June 13, 2022 (C0214).

Photograph 293: View of the O'Neill Forebay Wasteway, showing its junction with the Volta Wasteway in the distance; camera facing downstream from wasteway's right bank, June 13, 2022 (C0215).

Photograph 294: Quonset huts in O&M yard approximately at M.P. 69.90; camera facing northeast, June 13, 2022 (C0223).

Photograph 295: Bridge at M.P. 68.03; camera facing downstream from left bank, June 13, 2022 (C0178).

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # ____________
HRI # ____________
Trinomial ____________

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young

***Date**: June 13-14, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-14

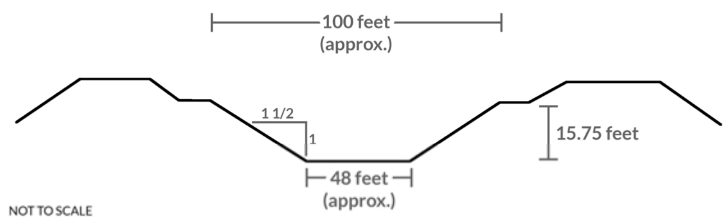
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 14 of the canal spans 4.38 miles between canal mileposts 70.01 and 74.39, from Check No. 13 to a point just above Check No. 14 in Merced C3ounty.
UTM: Zone 10S, 674462.32mE / 4106744.51mN (north endpoint); 680767.62mE / 4104237.10mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
DMC Segment 14 begins at Check No. 13 (**Photograph 296**) and ends at a point just upstream of Check No. 14. It has the same concrete lining and trapezoidal cross section as elsewhere along the canal, and it is flanked with unpaved maintenance roads on both banks that are approximately 12 to 20 feet wide. (See Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 100 feet
- **b. Bottom Width**: 48 feet
- **c. Height or Depth**: 15.75 feet
- **d. Length of Segment**: 4.38 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel and Mendota Dam

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
Segment 14 skirts along the junction of the low-hilled grasslands and flat agricultural lands of the western San Joaquin Valley. The agricultural lands are principally planted with orchards.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: This segment has been altered by raising the concrete lining, alterations to bridges, turnouts, and inlet drains, and the addition of stilling wells, pipe crossings, and modern turnouts.

L8b. Description of Photo, Map, or Drawing:
Photograph 296: Beginning of Segment 14 showing Check No. 13 with the Volta Wasteway in the foreground; camera facing downstream from left bank, June 13, 2022 (C0192).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

Segment 14 of the canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank (**Photograph 297 - Photograph 298**). The width of the roads seems to vary based on topography.

Segment 14 begins at Check No. 13 (**Photograph 299**), located at M.P. 70.00. The check is a concrete structure with a total length of 180 feet. Its width approximately is 100 feet at the upstream end, widens to 135 feet at the check gates, and then narrows back to 100 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same sloped angle as the canal. Spanning the top of the structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge. On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 70.00 on the left bank, is of concrete block construction, measuring approximately 9 feet by 7 feet. A stilling well is located just above Check No. 13 at M.P. 69.99 while a second stilling well is located just below it at M.P. 70.04. Both stilling wells are located on the left bank and are the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[157]

The salinity station building on the right bank at M.P. 70.01 has a 7-by-7-feet, square footprint (**Photograph 300**). Its roof and walls are covered in corrugated metal. A metal door provides access on its northwest side.

The three bridge crossings in this segment include one state highway bridge, one timber county highway bridge, and one non-original (post-1958) state highway bridge. The state highway bridge at M.P. 71.31 along Jenson Road/State Route 207 and the timber county highway bridge at M.P. 72.33 along Hilldale Avenue are of standard design. The non-original bridge at M.P. 72.80 consists of two spans that carry Interstate 5's north and south bound lanes. This bridge, constructed in 1965, has paved concrete decks, each measuring 39 feet, 8 inches wide, and supported by steel stringers. The abutments of this bridge sit right next to the canal lining and the stringers are strung directly between the abutments (**Photograph 301**).[158]

In addition to the canal structures discussed above, Segment 14 contains two siphon undercrossings, two culverts, five pipe crossings, two siphon undercrossings, ten turnouts, and inlet drains. Of the eight turnouts, all are concrete pipe types. All these structures are of standard design or have standard alterations as discussed in the above typology discussion in Section P3a.

[157] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59, 62, 93, 97-99.
[158] USDI, Reclamation, *Designer's Operating Criteria*, 1971: 26.

Photographs (continued)

Photograph 297: View of Segment 14 from approximately M.P. 74.20, with Check No. 14 visible in the distance; camera facing downstream from left bank, June 14, 2022 (D2214).

Photograph 298: View of Segment 14 from approximately M.P. 73.87; camera facing upstream from left bank, June 14, 2022 (D2211).

Photograph 299: Check No. 13; camera facing upstream from left bank, June 13, 2022 (D0203).

Photograph 300: Salinity station building along the right bank at M.P. 70.01; camera facing right bank from left bank, June 13, 2022 (D0201).

Photograph 301: Bridge at M.P. 72.80; camera facing upstream from left bank, June 14, 2022 (D0206).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young ***Date**: June 14, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-15

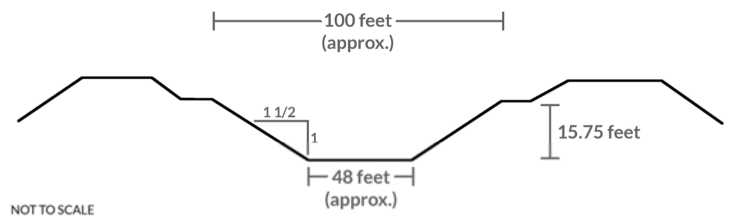
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 15 spans 5.23 miles between canal mileposts 74.40 and 79.63, from Check No. 14 to a point just above Check No. 15.
UTM: Zone 10S, 680778.56mE / 4104215.13mN (north endpoint); 686746.73mE / 4099027.25mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
DMC Segment 15 begins at Check No. 14 (**Photograph 302**) and ends at a point just upstream of Check No. 15. It has the same concrete lining and trapezoidal cross section as elsewhere along the canal, and it is flanked with unpaved maintenance roads on both banks that are approximately 12 to 20 feet wide. (See Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 100 feet
- **b. Bottom Width**: 48 feet
- **c. Height or Depth**: 15.75 feet
- **d. Length of Segment**: 5.23 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel and Mendota Dam

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
Segment 15 skirts the junction of the low-hilled grasslands and flat agricultural lands of the western San Joaquin Valley. The agricultural lands are principally planted with orchards.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: This segment has been altered by raising the concrete lining, alterations to bridges, turnouts, and inlet drains, and the addition of stilling wells, pipe crossings, and modern turnouts.

L8b. Description of Photo, Map, or Drawing:
Photograph 302: Beginning of Segment 15's northern end showing Check No. 14, check building (left), and a stilling well (foreground); camera facing downstream from left bank, June 14, 2022 (D2215).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

Segment 15 of the canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank (**Photograph 303 - Photograph 304**). The width of the roads seems to vary based on topography.

Segment 15 begins at Check No. 14 (**Photograph 305**), located at M.P. 74.44. The check is a concrete structure with a total length of approximately 135 feet. Its width approximately is 100 feet wide at the upstream end, widens to 135 feet at the check gates, and then narrows back to 100 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same slope angle as the canal. Spanning the top of the structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge (**Photograph 306**). On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below (**Photograph 307**). The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms 19 feet, 9.5 inches that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 74.40 on the left bank, is of concrete block construction, measuring approximately 9 feet by 7 feet. A stilling well is located just above Check No. 14 at M.P. 74.36 while a second stilling well is located just below it at M.P. 74.45. Both stilling wells are located on the left bank and are the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[159]

The Wolfsen Bypass extends from the canal's left bank at M.P. 76.04 (**Photograph 308**). It begins at a concrete inlet structure that consists of two four-by-five-feet turnouts that are the box barrel type (**Photograph 309**), and it extends approximately 900 feet until it transitions into another canal that runs alongside and generally parallel to DMC Segment 15 (**Photograph 310**).

The Los Banos Creek inlet, located along the right bank at M.P. 79.63, consists of a 10-by-6-foot concrete double-box-barrel with lift gates (**Photograph 311**). Manual gate hoisting equipment raises and lowers the gates.

The five bridge crossings in this segment include three concrete county highway bridges, one timber county highway bridge, and one state highway bridge. Most of these bridges are of standard design, however the deck of the county highway bridge at M.P. 77.20 appears different from the typical concrete decks (**Photograph 312**). It does not possess any curbs and an examination report from 1971 notes: "Many timber bridges have been replaced or repaired. Most of the replacements have used a treated-timber superstructure; however, the bridge at Mile 77.20 was replaced using prestressed precast slabs. This bridge looks very good."[160]

In addition to the canal structures discussed above, Segment 15 contains two overchutes, five pipe crossings, twelve turnouts, and inlet drains. All these structures are of standard design or have standard alterations as discussed in the above typology discussion in Section P3a.

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[159] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59, 62, 93, 97-99.
[160] USDI, Reclamation, *Condition of Major Irrigation Structures and Facilities, Region 2*, 1970: 6.

Photographs (continued)

Photograph 303: View of Segment 15 approximately from M.P. 76.64; camera facing upstream from left bank, June 14, 2022 (C0254).

Photograph 304: View of Segment 15, showing a well discharge and remnants of a deleted pipe crossing at M.P. 78.31; camera facing downstream from left bank, June 14, 2022 (C0267).

Photograph 305: Check No. 14; camera facing downstream from left bank, June 14, 2022 (D2216).

Photograph 306: Check No. 14, with a pipe crossing mounted on its piers; camera facing upstream from left bank, June 14, 2022 (D2218).

Photograph 307: Detail view of Check No. 14's top deck; camera facing right bank from left bank, June 14, 2022 (D2217).

Photograph 308: Wolfsen Bypass inlet structure along left bank at M.P. 76.04; camera facing downstream from left bank, June 14, 2022 (C0250).

Photograph 309: Detail view of Wolfsen Bypass inlet structure along left bank at M.P. 76.04, showing the gates for each box-barrel-type turnout; camera facing east, June 14, 2022 (C0251).

Photograph 310: Downstream view of Wolfsen Bypass at M.P. 76.04; camera facing northwest from left bank of DMC, June 14, 2022 (C0252).

Photograph 311: Los Banos Creek inlet at M.P. 79.63; camera facing right bank from left bank, June 14, 2022 (C0282).

Photograph 312: Bridge at M.P. 77.20; camera facing downstream from left bank, June 14, 2022 (C0259).

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # _____
HRI # _____
Trinomial _____

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young

***Date**: June 14, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-16

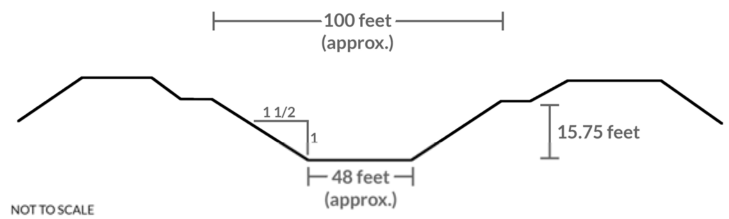
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 16 of the canal spans 5.44 miles between canal mileposts 79.64 and 85.08, from Check No. 15 to a point just above Check No. 16 in Merced County.
UTM: Zone 10S, 686757.91mE / 4099011.75mN (norther endpoint); 693000.31mE / 4093641.06mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
DMC Segment 16 begins at Check No. 15 (**Photograph 313**) and ends at a point just upstream of Check No. 16. It has the same concrete lining and trapezoidal cross section as elsewhere along the canal, and it is flanked with unpaved maintenance roads on both banks that are approximately 12 to 20 feet wide. (See Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- a. **Top Width**: 100 feet
- b. **Bottom Width**: 48 feet
- c. **Height or Depth**: 15.75 feet
- d. **Length of Segment**: 5.44 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel and Mendota Dam

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
Segment 16 traverses through the flat agricultural lands of the western San Joaquin Valley principally planted with orchards.

L7. Integrity Considerations: This segment has been altered by raising the concrete lining, alterations to bridges, turnouts, and inlet drains, and the addition of stilling wells, pipe crossings, and modern turnouts.

L8a. Photograph, Map, or Drawing.

L8b. Description of Photo, Map, or Drawing:
Photograph 313: Beginning of Segment 16 showing Check No. 15, check building (left), turnout (right), and well discharge (foreground); camera facing downstream from left bank, June 14, 2022 (C0279).

L9. Remarks:

L10. Form prepared by:

Heather Norby & Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

Segment 16 of the canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank (**Photograph 314 - Photograph 316**). The width of the roads seems to vary based on topography.

Segment 16 begins at Check No. 15 (**Photograph 317**), located at M.P. 79.64. The check is a concrete structure with a total length of approximately 100 feet. Its width approximately is 100 feet wide at the upstream end, narrows to 60 feet at the check gates, and then narrows again to 40 feet where it transitions into the Los Banos Creek Siphon. The banks of the canal transition from sloped to vertical at the control structure. Spanning the top of the structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge (**Photograph 318**). On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. The check structure is rectangular in cross section and divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The check building, at M.P. 79.64 on the left bank, is of concrete block construction, measuring approximately 9 feet by 7 feet. A stilling well is located just above Check No. 15 at M.P. 79.63 while a second stilling well is located just below the Los Banos Siphon's outlet at M.P. 80.01. Both stilling wells are located on the left bank and are the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[161]

The Los Banos Creek Siphon begins immediately downstream of Check No. 15. The concrete structure consists of inlet and outlet headwalls that are connected by three 12-feet by 16-feet barrels. The barrels are 250 feet long and buried beneath Los Banos Creek. The inlet headwall at M.P. 79.64 is 41 feet wide and approximately 25 feet tall. The outlet headwall at M.P. 79.72 is 41.5 feet wide and approximately 23 feet tall (**Photograph 319**). The barrels are 250 feet long and buried beneath Los Banos Creek. A bridge extends across Los Banos Creek along the DMC centerline, and a modern check+ structure sits in Los Banos Creek directly upstream from the bridge (**Photograph 320 - Photograph 321**).[162]

The San Luis and Delta-Mendota Water Authority Field Office is sited on the west side of the canal at M.P. 80.00 (**Photograph 322**). It consists of a generally triangular-shaped lot containing a modern office building, two original garages, one modern garage, and several outbuildings. As originally developed, the two original garages likely functioned as Bureau of Reclamation O&M buildings. The approximately 2,700-square-feet, modern office building is sited toward the lot's southeast corner (**Photograph 323**). It has a rectangular footprint, side gable roof of crimped metal, and walls clad in metal. The main entrance is located on its north side and consists of double metal doors sheltered beneath a metal canopy. An additional entrance is comprised of a metal door on the east side. Fenestration includes sliding windows. Two approximately 2,500-square-feet, five-bay garages are sited in the lot's southwest corner next to each other facing north (**Photograph 324**). Both have rectangular footprints and side-gable metal roofs. The west garage is original and of a prefabricated metal construction that was common and ubiquitous throughout the CVP. Of its five bays, four are open while the bay at its west end has been enclosed by the addition of a metal roll-up garage door. The east garage is modern but of a similar prefabricated metal construction. Of its five bays, the two at its east end are open while the rest are enclosed and accessed by metal roll-up garage doors, and the bay at its west sits above grade, atop a concrete foundation. An additional entryway to the above-grade bay is provided by a metal door accessed by a metal staircase on the garage's east side. The second original garage is sited in the middle of the lot's west edge. It is approximately 4,700-square-feet, has a rectangular footprint, and walls clad in metal. An addition was constructed onto the original section's east side. Primary and secondary side-gable metal roofs cover both sections, with the secondary roof over the addition sitting slightly higher than the primary. Both sections are accessed by metal roll-up garage doors.[163]

The nine bridge crossings in this segment include six concrete county highway bridges, two timber farm bridges, and one operating bridge, which consists of a road with steel guard-rails along the Los Banos Creek siphon. This structure replaced the

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[161] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59-61, 93, 97-99.
[162] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59-61, 64-65.
[163] Cartwright and Co., Flight ABF-1957, Frame 11T-90, 1:20,000 (April 9, 1957) flown for USDA; USGS, Flight NAPP, Frame 462-23, 1:40,000 (June 17, 1987) flown for USGS.

original timber operating bridge at this location and is included in the bridge inventory because it possesses a Caltrans bridge number. All other bridges in this segment are of standard design.

In addition to the canal structures discussed above, Segment 16 contains two overchutes, 14 pipe crossings, 13 turnouts, and inlet drains. All these structures are of standard design or have standard alterations as discussed in the above typology discussion in Section P3a.

Photographs (continued)

Photograph 314: View of Segment 16 from approximately M.P. 82.17; camera facing upstream from left bank, June 14, 2022 (C0312).

Photograph 315: View of Segment 16 from approximately M.P. 82.17; camera facing downstream from left bank, June 14, 2022 (C0313).

Photograph 316: View of Segment 16 from at M.P. 84.65, showing a pipe crossing; camera facing right bank from left bank, June 14, 2022 (C0330).

Photograph 317: Check No. 15, showing where it transitions into the Los Banos Creek Siphon inlet; camera facing downstream from left bank, June 14, 2022 (C0280).

Photograph 318: Detail view of Check No. 15's top deck; camera facing right bank from left bank, June 14, 2022 (C0284).

Photograph 319: Los Banos Creek Siphon outlet at M.P. 79.69; camera facing upstream from right bank, June 14, 2022 (C0293).

Photograph 320: Check structure in Los Banos Creek from the deck of the operating bridge at M.P. 79.69; camera facing west, June 14, 2022 (C0288).

Photograph 321: Check structure in Los Banos Creek at the Los Banos Creek Siphon; camera facing southwest, June 14, 2022 (C0287).

Photograph 322: San Luis and Delta-Mendota Water Authority Field Office; camera facing right bank from left bank, June 14, 2022 (C0294).

Photograph 323: Office building at San Luis and Delta-Mendota Water Authority Field Office; camera facing right bank from left bank, June 14, 2022 (C0295).

Photograph 324: Both two 5-bay garages at San Luis and Delta-Mendota Water Authority Field Office; camera facing right bank from left bank, June 14, 2022 (C0296).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young ***Date**: June 14, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-17

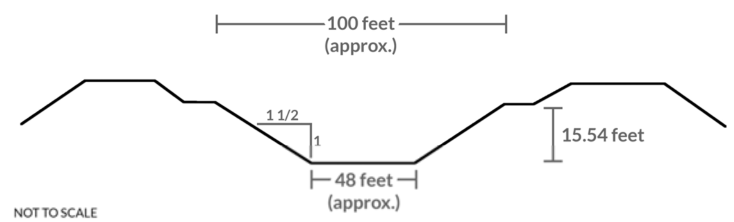
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 17 spans 5.44 miles between canal mileposts 85.09 and 90.53, from Check No. 16 to a point just above Check No. 17 in Merced County.
UTM: Zone 10S, 693007.86mE / 4093625.13mN (north endpoint); 698602.59mE / 4088374.85mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
DMC Segment 17 begins at Check No. 16 (**Photograph 325**) and ends at a point just upstream of Check No. 17.
It has the same concrete lining and trapezoidal cross section as elsewhere along the canal, and it is flanked with unpaved maintenance roads on both banks that are approximately 12 to 20 feet wide. (See Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- a. **Top Width**: 100 feet
- b. **Bottom Width**: 48 feet
- c. **Height or Depth**: 15.54 feet
- d. **Length of Segment**: 5.44 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel and Mendota Dam

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
Segment 17 traverses through the flat agricultural lands of the western San Joaquin Valley principally planted with orchards.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: This segment has been altered by raising the concrete lining, alterations to bridges, turnouts, and inlet drains, and the addition of stilling wells and modern turnouts.

L8b. Description of Photo, Map, or Drawing:
Photograph 325: Beginning of Segment 17 showing Check No. 16 and check building (left); camera facing downstream from left bank, June 14, 2022 (C0333).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

Segment 17 of the canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank (**Photograph 326 - Photograph 327**). The width of the roads seems to vary based on topography.

Segment 17 begins at Check No. 16 (**Photograph 328 - Photograph 329**), located at M.P. 85.09. The check is a concrete structure with a total length of approximately 145 feet. Its width approximately is 100 feet at the upstream end, widens to 130 feet at the check gates, and then narrows back to 100 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same slope angle as the canal. Spanning the top of the structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge. On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 85.07 on the left bank, is of concrete block construction, measuring approximately 9 feet by 7 feet. A stilling well is located just above Check No. 16 at M.P. 85.09 while a second stilling well is located just below the Los Banos Siphon's outlet at M.P. 85.14. Both stilling wells are located on the left bank and are the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[164]

The four bridge crossings in this segment include two timber farm bridges and two concrete county highway bridges. All are standard design.

In addition to the canal structures located at Check No. 16, Segment 17 contains eight pipe crossings, 15 turnouts, and inlet drains. All these structures are of standard design or have standard alterations as discussed in the above typology discussion in Section P3a.

[164] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59, 62, 93, 97-99.

Photographs (continued)

Photograph 326: View of Segment 17 approximately from M.P. 90.16, showing two well discharges and an inlet drain; camera facing downstream from left bank, June 14, 2022 (C0363).

Photograph 327: View of Segment 17 approximately from M.P. 86.51; camera facing downstream from left bank, June 14, 2022 (C0344).

Photograph 328: Check No. 16 at M.P. 85.09; camera facing downstream from left bank, June 14, 2022 (C0333).

Photograph 329: Check No. 16 at M.P. 85.09; camera facing downstream from left bank, June 14, 2022 (C0336).

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # ______
HRI # ______
Trinomial ______

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young

***Date**: June 14, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-18

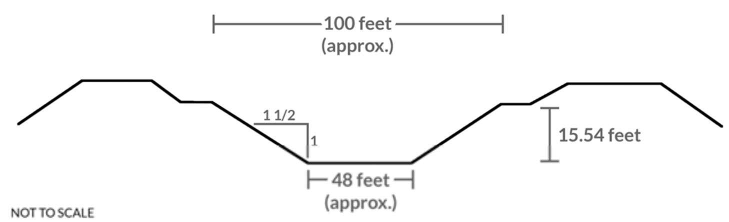
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 18 of the canal spans 6.26 miles between canal mileposts 90.54 and 96.80, from Check No. 17 in Merced County to a point just above Check No. 18 in Fresno County.
UTM: Zone 10S, 698618.86mE / 4088361.11mN (north endpoint); 707625.65mE / 4085198.89mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
DMC Segment 18 begins at Check No. 17 (**Photograph 330**) and ends at a point just upstream of Check No. 18 (**Photograph** 297). It has the same concrete lining and trapezoidal cross section as elsewhere along the canal, and it is flanked with unpaved maintenance roads on both banks that are approximately 12 to 20 feet wide. (See Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 100 feet
- **b. Bottom Width**: 48 feet
- **c. Height or Depth**: 15.54 feet
- **d. Length of Segment**: 6.26 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel and Mendota Dam

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
Segment 18 traverses through the flat agricultural lands of the western San Joaquin Valley principally planted with orchards.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: This segment has been altered by raising the concrete lining, alterations to bridges, turnouts, and inlet drains, and the addition of stilling wells, well discharges, and modern turnouts.

L8b. Description of Photo, Map, or Drawing:
Photograph 330: Beginning of Segment 18 showing Check No. 17 and check building (left); camera facing downstream from left bank, June 14, 2022 (E0366).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

Segment 18 of the canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank (**Photograph 331 - Photograph 334**). The width of the roads seems to vary based on topography.

Segment 18 begins at Check No. 17 (**Photograph 335**), located at M.P. 90.54. The check is a concrete structure with a total length of approximately 145 feet. Its width approximately is 100 feet at the upstream end, widens to 120 feet at the check gates, and then narrows back to 100 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same slope angle as the canal. Spanning the top of the structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge. On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 90.54 on the left bank, is of concrete block construction, measuring approximately 9 feet by 7 feet. A stilling well is located just above Check No. 17 at M.P. 90.53 while a second stilling well is located just it at M.P. 90.61. Both stilling wells are located on the left bank and are the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[165]

The seven bridge crossings in this segment include five timber farm bridges, one concrete county highway bridge, and one timber operating bridge. All of these bridges are of standard design.

In addition to the canal structures discussed above, Segment 18 contains 7 pipe crossings, one siphon undercrossing, 14 turnouts, well discharges, and inlet drains. All the bridges are of standard design. All these structures are of standard design or have standard alterations as discussed in the above typology discussion in Section P3a.

[165] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59, 62, 93, 97-99.

Photographs (continued)

Photograph 331: View of Segment 18 from approximately M.P. 91.36, with Check No. 17 in the distance; camera facing upstream from left bank, June 14, 2022 (C0376).

Photograph 332: View of Segment 18 approximately from M.P. 91.77; camera facing upstream from left bank, June 14, 2022 (C0381).

Photograph 333: View of Segment 18 from the deck of a farm bridge at M.P. 95.45; camera facing downstream, June 14, 2022 (C0398).

Photograph 334: View from approximately from M.P. 91.77; camera facing right bank from left bank, June 14, 2022 (C0404).

Photograph 335: Check No. 17, with an operating bridge in the background; camera facing downstream from left bank, June 14, 2022 (C0368).

Photograph 336: View from approximately M.P. 90.57, showing a pipe crossing, operating bridge, and Check No. 17 in the background; camera facing upstream from left bank, June 14, 2022 (C0371).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young ***Date**: June 14, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-19

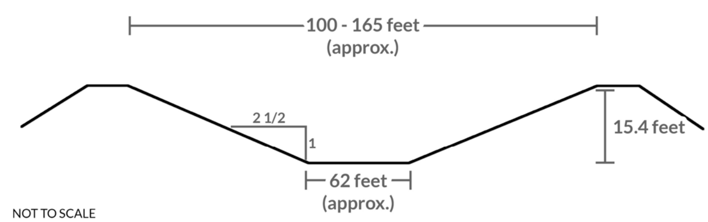
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 19 of the canal spans 8.24 miles between canal mileposts 96.81 and 105.05, from Check No. 19 to a point just above Check No. 19 in Fresno County.
UTM: Zone 10S, 707647.78mE / 4085198.79mN (north endpoint); 720476.64mE / 4083384.47mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
DMC Segment 19 begins at Check No. 18 (**Photograph 337**) and ends at a point just upstream of Check No. 19. It the same trapezoidal cross section as elsewhere along the canal. The northern approximately one-quarter of this segment is concrete-lined while the remainder is lined with compacted earth. On both sides of the canal are unpaved maintenance roads approximately 12 to 20 feet wide. (See Continuation Sheet.)

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 100 - approximately 165 feet
- **b. Bottom Width**: 48-84 feet
- **c. Height or Depth**: 15.54 feet – 15.40 feet
- **d. Length of Segment**: 8.24 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel and Mendota Dam

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
Segment 19 traverses through the flat agricultural lands of the western San Joaquin Valley principally planted with orchards.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: This segment has been altered by alterations to bridges, turnouts, and inlet drains and the addition of stilling wells, well discharges, and modern turnouts.

L8b. Description of Photo, Map, or Drawing:
Photograph 337: Beginning of Segment 19's northern end showing Check No. 18 and check building (right); camera facing downstream from left bank, June 14, 2022 (C0409).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

Segment 19 of the canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank (Error! Reference source not found. - Error! Reference source not found.). The width of the roads seems to vary based on topography. The canal is lined with concrete from its beginning to M.P. 98.62, after which it is lined with compacted earth **(**Error! Reference source not found. - Error! Reference source not found.).

Segment 19 begins at Check No. 18 (Error! Reference source not found.), located at M.P. 96.81. The check is a concrete structure with a total length of approximately 135 feet. Its width approximately is 100 feet at the upstream end, widens to 130 feet at the check gates, and then narrows back to 100 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same slope angle as the canal. Spanning the top of the structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge. On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 96.81 on the left bank, is of concrete block construction, measuring approximately 9 feet by 7 feet. A stilling well is located just above Check No. 18 at M.P. 96.71 while a second stilling well is located just below it at M.P. 96.88. Both stilling wells are located on the left bank and are the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[166]

The six bridge crossings in this segment include three concrete county highway bridges, two timber farm bridges, and one non-original (post-1958) replacement farm bridge. The farm bridge at M.P. 102.03 was reconstructed in 2014 with a concrete deck, measuring 22 feet wide, supported by five concrete bents, with steel guard-rails (**Photograph 345**). All other bridges are of standard design.

In addition to the canal structures discussed above, Segment 19 contains nine pipe crossings, one siphon undercrossing, ten turnouts, well discharges, and inlet drains. All these structures are of standard design or have standard alterations as discussed in the above typology discussion in Section P3a.

[166] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59, 62, 93, 97-99.

Photographs (continued)

Photograph 338: View of Segment 19's concrete-lined section from approximately M.P. 98.62; camera facing upstream from left bank, June 14, 2022 (C0419).

Photograph 339: Deteriorated concrete lining along right bank at approximately M.P. 96.82; camera facing right bank from left bank, June 14, 2022 (C0411).

Photograph 340: View of Segment 19 from approximately M.P. 98.62, showing where it transitions from concrete-lined to earth-lined; camera facing downstream from left bank, June 14, 2022 (C0418).

Photograph 341: View of Segment 19's transition from concrete-lined to earth-lined at M.P. 98.74; camera facing upstream, June 14, 2022 (C0423).

Photograph 342: View of Segment 19's earth-lined section from approximately M.P. 104.22; camera facing downstream from left bank, June 14, 2022 (C0449).

Photograph 343: Check No. 18; camera facing right bank from left bank, June 14, 2022 (C0413).

Photograph 344: Check No. 18; camera facing upstream from left bank, June 14, 2022 (C0412).

Photograph 345: Bridge at M.P. 102.03; camera facing downstream from left bank, June 14, 2022 (C0440).

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young ***Date**: June 14, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-20

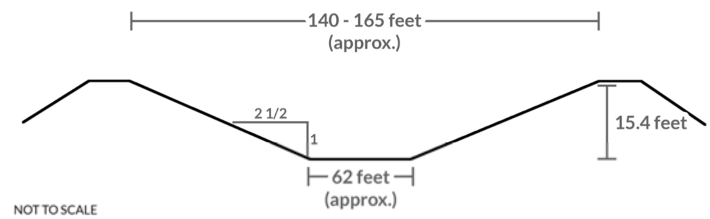
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 20 of the canal spans 6.19 miles between canal mileposts 105.06 and 111.25, from Check No. 19 to a point just above Check No. 20 in Fresno County.
UTM: Zone 10S, 720497.39mE / 4083377.60mN (north endpoint); 728358.55mE / 4079053.51mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
DMC Segment 20 begins at Check No. 19 (**Photograph 346**) and ends at a point just upstream of Check No. 20. It has the same trapezoidal cross section as elsewhere on the canal and is lined with compacted earth. It is flanked with unpaved maintenance roads on both banks that are approximately 12 to 20 feet wide. (See Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: Approximately 140-165 feet
- **b. Bottom Width**: 60-84 feet
- **c. Height or Depth**: 15.40 feet
- **d. Length of Segment**: 6.19 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel and Mendota Dam

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
Segment 20 traverses through the flat agricultural lands of the western San Joaquin Valley principally planted with orchards.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: This segment has been altered by alterations to bridges and inlet drains and the addition of stilling wells, pipe crossings, well discharges, and modern turnouts.

L8b. Description of Photo, Map, or Drawing:
Photograph 346: Beginning of Segment 20 showing Check No. 19 and check building (right); camera facing downstream from left bank, June 14, 2022 (C0453).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

Segment 20 of the canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank (**Photograph 347 - Photograph 349**). The width of the roads seems to vary based on topography.

Segment 20 begins at Check No. 19 (**Photograph 350**), located at M.P. 105.06. The check is a concrete structure with a total length of approximately 125 feet and a width that approximately is 145 feet at the upstream end, narrows to 125 feet at the check gates, and then widens again to 145 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same slope angle as the canal. Spanning the top of the structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge. On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 96.81 on the left bank, is of concrete block construction, measuring approximately 9 feet by 7 feet. A stilling well is located just above Check No. 19 at M.P. 105.05 while a second stilling well is located just below it at M.P. 105.09. Both stilling wells are located on the left bank and are the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[167]

The Southern Pacific Railroad and State Highway 33 Siphon (**Photograph 351 - Photograph 352**) begins approximately one quarter mile upstream from Check No. 20. The concrete structure consists of inlet and outlet headwalls that are connected by three 16-by-16-feet barrels. The inlet headwall at M.P. 110.96 is approximately 39 feet wide while the outlet headwall at M.P. 111.02 is approximately 38 feet wide. The barrels are 305 feet long and buried beneath the Southern Pacific Railroad and State Highway 33.[168]

The Firebaugh Wasteway extends from the canal's left bank at M.P. 111.22 (**Photograph 353**). It is approximately 1.1 miles in total length, ending where it flows into the San Joaquin River. It begins with a concrete inlet structure consisting of two 15-foot-wide channels, each with a steel radial gate to control the flow of water. The arced gate faces are 15 feet tall and 13 feet wide and reinforced on the back by a grid of steel members (**Photograph 354**). Each has two steel arms of a truss design that pivot from pins fixed into the central support pier and channel sidewalls. Supported by the pier and sidewalls is a concrete top deck on which electric gate-hoisting equipment is mounted and a concrete bridge. Double automatic-siphon spillways flank the gates (**Photograph 355**). Water passing through the inlet structure flows down a chute, into a stilling pool, and then into the wasteway lined with compacted earth.[169]

A siphon undercrossing at M.P. 111.24 consists of two one-foot pipes that convey the Master Drain beneath the DMC.

The six bridge crossings in this segment include two concrete county highway bridges, one county highway wasteway crossing bridge, one timber farm bridge, one non-original (post-1958) replacement farm bridge, and one crossing over a siphon. The farm bridge at M.P. 106.58 was replaced in 2004 and now has a concrete deck, measuring 20 feet wide, supported by five concrete bents, with steel guard-rails (**Photograph 356**). The crossing at M.P. 110.99 carries State Highway 33 and a single track for the Southern Pacific Railroad across the siphon at M.P. 110.96/111.02 (**Photograph 357**). It is included in the bridge population because it is categorized as a bridge in the DMC Structures List (2020). All other bridges are of standard design.

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[167] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59, 62, 93, 97-99.
[168] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59, 64-65.
[169] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 53, 65, 72-73.

In addition to the structures discussed above, Segment 20 contains nine pipe crossings, four siphon undercrossings, well discharges, turnouts, and inlet drains. Of the three turnouts, two are overlining types, and one is a concrete pipe type. All these structures are of standard design or have standard alterations as discussed in the above typology discussion in Section P3a.

Photographs (continued)

Photograph 347: View of Segment 20 from the deck of the bridge at M.P. 106.58 Check No. 19; camera facing downstream, June 14, 2022 (C0462).

Photograph 348: View of Segment 20 from approximately M.P. 107.43; camera facing upstream from left bank, June 14, 2022 (C0464).

Photograph 349: View of Segment 20 from approximately M.P. 107.65; camera facing downstream from left bank, June 14, 2022 (C0466).

Photograph 350: Check No. 19; camera facing upstream from left bank, June 14, 2022 (C0456).

Photograph 351: Siphon inlet headwall at M.P. 110.96; camera facing downstream from left bank, June 14, 2022 (C0477).

Photograph 352: Siphon outlet headwall at M.P. 111.02; camera facing upstream from left bank, June 14, 2022 (C0479).

Photograph 353: Firebaugh Wasteway inlet structure at M.P. 111.22, with Check No. 20 visible in the background; camera facing downstream from left bank, June 14, 2022 (C0480).

Photograph 354: Firebaugh Wasteway inlet structure at M.P. 106.58, showing the radial gates (center) and an outlet to one of the automatic-siphon spillways (bottom, right); camera facing upstream from the wasteway's right bank, June 14, 2022 (C0485).

Photograph 355: Detail view of the Firebaugh Wasteway inlet structure at M.P. 111.22; camera facing downstream from left bank, June 14, 2022 (C0482).

Photograph 356: Bridge at M.P. 106.58; camera facing upstream from the wasteway's right bank, June 14, 2022 (C0460).

Photograph 357: Bridge at M.P. 1106.96; camera facing upstream from the left bank, June 14, 2022 (C0479).

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # ______
HRI # ______
Trinomial ______

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young

***Date**: June 14-15, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-21

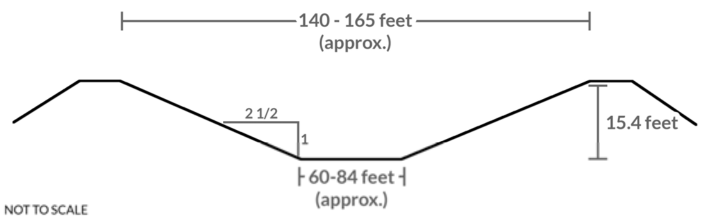
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 21 spans 5.22 miles between canal mileposts 111.26 and 116.48, from the Check No. 20 complex to a point just above Check No. 21 in Fresno County, near the city of Mendota.
UTM: Zone 10S, 728376.12mE / 4079046.33mN (north endpoint); 734438.24mE / 4073782.25mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
DMC Segment 21 begins at Check No. 20 (**Photograph 358**) and ends at a point just upstream of Check No. 21. It has the same trapezoidal cross section as elsewhere on the canal and is lined with compacted earth. The canal is flanked by gravel access roads on both banks that are approximately 12 to 20 feet wide. (See Continuation Sheet.)

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- a. **Top Width**: Approximately 140-165 feet
- b. **Bottom Width**: 60-84 feet
- c. **Height or Depth**: 15.40 feet
- d. **Length of Segment**: 5.22 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel and Mendota Dam

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
Segment 21 traverses through the flat agricultural lands of the western San Joaquin Valley principally planted with orchards.

L7. Integrity Considerations: This segment has been altered by alterations to bridges and inlet drains and the addition of stilling wells, well discharges, and modern turnouts.

L8a. Photograph, Map, or Drawing.

L8b. Description of Photo, Map, or Drawing:
Photograph 358: Beginning of Segment 21 showing Check No. 20, the Firebaugh Wasteway inlet structure (foreground), and check building (distance left), camera facing downstream from left bank, June 14, 2022 (C0480).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

Segment 21 of the canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank (**Photograph 359 - Photograph 362**). The width of the roads seems to vary based on topography.

Segment 21 begins at Check No. 20 (**Photograph 363**), located at M.P. 111.26. The check is a concrete structure with a total length of approximately 105 feet and a width that approximately is 145 feet wide at the upstream end, narrows to 125 feet at the check gates, and then widens again to 145 feet where it rejoins the canal walls on the downstream side. The banks of the check structure maintain the same slope angle as the canal. Spanning the top of structure is an 8-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge (**Photograph 364**). On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates below. The check structure is trapezoidal in cross section. A central, rectangular section is divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 20 feet tall by 17 feet wide, and each has two steel arms that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. The triangular section on each side is divided into a series of short bays. The lower or triangular part of each of these bays is closed with a concrete curtain wall. The top of the curtain wall in the outside bay on each side is set one inch above the designed maximum water surface elevation. Stop plank grooves are provided for all interior bays to permit closure from the top of the curtain wall to the designed water surface elevation. The check building, at M.P. 111.26 on the left bank, is of concrete block construction, measuring approximately 9 feet by 7 feet. A stilling well is located just above Check No. 20 at M.P. 111.24 while a second stilling well is located just below it at M.P. 111.28. Both stilling wells are located on the left bank and are the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[170]

The Miller & Lux Outside Canal Siphon (**Photograph 365**) begins approximately one mile upstream from Check No. 20. The concrete structure consists of inlet and outlet headwalls that are connected by three 16-by-16-feet barrels. The inlet headwall at M.P. 115.57 is approximately 36 feet wide while the outlet headwall at M.P. 115.59 is approximately 38 feet wide. The barrels are 156 feet long and buried beneath the Miller & Lux Outside Canal.[171]

The single extant bridge crossing in this segment is a concrete county highway bridge at M.P. 111.51, along Sierra Avenue, and is of standard design. The bents and abutments of a non-extant operating bridge are still evident at M.P. 115.58 (**Photograph 366**).

In addition to structures discussed above, Segment 21 contains two pipe crossings, one siphon undercrossing, well discharges, and inlet drains. All these structures are of standard design as discussed above in Section P3a.

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[170] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59, 62, 93, 97-99.
[171] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59, 64-65.

Photographs (continued)

Photograph 359: View of Segment 21 from M.P. 113.72, with a well discharge in the foreground; camera facing upstream from left bank, June 14, 2022 (C0509).

Photograph 360: View of Segment 21 from approximately M.P. 111.55, with the Miller & Lux Outside Canal (left) running parallel to the Delta-Mendota Canal; camera facing downstream from left bank, June 14, 2022 (C0508).

Photograph 361: View of Segment 21 from atop the outlet of the siphon at M.P. 115.59, with two well discharges visible in the background; camera facing downstream, June 15, 2022 (C0566).

Photograph 362: View of Segment 21 from approximately M.P. 116.45 showing the canal bank functioning as a levee; camera facing upstream from left bank, June 15, 2022 (C0558).

Photograph 363: Check No. 20; camera facing downstream from left bank, June 14, 2022 (C0487).

Photograph 364: View of Check No. 20; camera facing upstream from left bank, June 14, 2022 (C0487).

Photograph 365: Miller & Lux Outside Canal Siphon outlet headwall at M.P. 115.59; camera facing upstream from left bank, June 15, 2022 (C0562).

Photograph 366: Remnants of no-longer extant operating bridge that previously spanned the Miller & Lux Outside Canal where it crosses over the DMC at M.P. 115.58; camera facing upstream, June 15, 2022 (C0565).

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # ___
HRI # ___
Trinomial ___

***Resource Name or #** (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young

***Date**: June 15, 2022

L1. Historic and/or Common Name: Delta-Mendota Canal

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: DMC-22

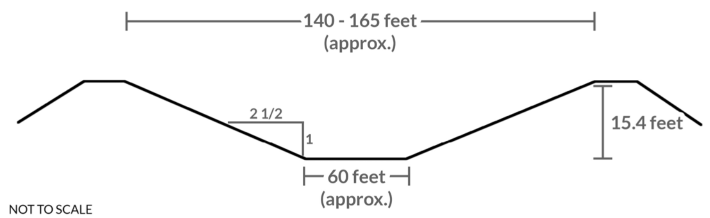
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) DMC Segment 22 spans 0.13 miles between canal mileposts 116.48 and 116.61, from the Check No. 21 complex to the canal's terminus at the San Joaquin River in Fresno County, near the city of Mendota.
UTM: Zone 10S, 734475.93mE / 4073788.85mN (north endpoint); 734675.53mE / 4073828.97mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
DMC Segment 22 begins at Check No. 21 (**Photograph 367**) and ends at canal's terminus at the San Joaquin River in Fresno County, near the city of Mendota. It has the same trapezoidal cross section as elsewhere on the canal and is lined with compacted earth. The canal is flanked by gravel access roads on both banks that are approximately 12 to 20 feet wide. (See Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: Approximately 140-165 feet
- **b. Bottom Width**: 60-84 feet
- **c. Height or Depth**: 15.40 feet
- **d. Length of Segment**: 5.22 miles

L4e. Sketch of Cross-Section (not to scale) **Facing**: Northeast



L5. Associated Resources: Delta Cross Channel and Mendota Dam

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
Segment 22 traverses through the flat agricultural lands of the western San Joaquin Valley principally planted with orchards.

L8a. Photograph, Map, or Drawing.

L7. Integrity Considerations: The canal has not been altered in this segment.

L8b. Description of Photo, Map, or Drawing:
Photograph 367: Beginning of Segment 22 showing Check No. 21 and check building (background, center), with a pipe crossing (foreground); camera facing southeast, June 15, 2022 (C0550).

L9. Remarks:

L10. Form prepared by:
Heather Norby & Andrew Young
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

L11. Date: August 2022

L3. Description (continued):

The canal is flanked by gravel access roads on both banks, which are approximately 15-20 feet wide on the right (west) bank and approximately 12-18 feet wide on the left (east) bank (**Photograph 368 - Photograph 369**). The width of the roads seems to vary based on topography.

Segment 22 begins at Check No. 21 (**Photograph 370**), located at M.P. 116.48. The check is a concrete structure with a total length of approximately 300 feet and a width that is approximately 150 feet wide at the upstream end, narrows to 60 feet at the check gates, and then widens again to approximately 160 feet where it rejoins the canal walls on the downstream side. The banks of the canal transition from sloped to vertical at the control structure. The check structure is rectangular in cross section and divided into three bays of equal size, each with a radial gate for regulation and closure. The arced gate faces are 18 feet tall by 18 feet wide, and each has two steel arms that rotate on pin bearings supported by brackets attached to the structure sidewalls. The gate arms have a truss design, and the gate faces are all reinforced by a grid pattern of steel beams on the back side. Spanning the top of the structure is a 10-foot-wide concrete gate hoist equipment deck and walkway with a pipe railing along the edge. On the platform is electric gate-hoisting equipment in waterproof steel enclosures used to raise and lower the three steel radial gates that face downstream. The check building, at M.P. 116.48 on the right bank, is of concrete block construction, measuring approximately 12 feet by 11 feet. A stilling well is located just above Check No. 21 at M.P. 116.45. It is located on the right bank and is the typical cylindrical concrete type, accessed by a set of concrete steps with a metal handrail.[172]

The single bridge crossing in this segment is a concrete County Highway Bridge at M.P. 116.48, along Bass Avenue and is of standard design (**Photograph 371**).

The Bureau of Reclamation maintenance yard is located at M.P. 116.50, along the right bank (**Photograph 372**). It consists of a generally rectangular lot containing a garage, a storage building, and an intermodal shipping container. The approximately 1,850-square-feet, three-bay garage is sited in the lot's northwest corner and faces east (**Photograph 373 - Photograph 374**). It has a rectangular footprint, a side-gable roof of crimped metal, and walls clad in metal. The bay at its north end is fully enclosed. It is accessed by a doorway piercing its east side, and its fenestration consists of original divided-light awning windows and a replacement aluminum sliding window. The other two bays are fully open along the garage's east side. The approximately 1,050-square-feet storage building is sited toward the lot's southeast corner (**Photograph 375**). It has a rectangular footprint, a side-gable roof of crimped metal, and walls clad in metal. It is accessed by a metal door its south side, and fenestration consists of a sliding window concealed behind a screen. The intermodal shipping container is sited parallel to the storage building's east side, approximately 40 feet away. Metal chain-link fencing fully encloses the lot's southern half while its northern half is enclosed by metal chain-link fencing that extends onto and along the canal's right bank to enclose the check building at Check No. 21 as well.

[172] Bureau of Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal*, 59, 86-87, 93, 97-99.

Photographs (continued)

Photograph 368: View of Segment 22 from approximately M.P. 116.55, showing the canal's terminus, where it flows into the San Joaquin River; camera facing downstream from right bank, June 15, 2022 (C0537).

Photograph 369: View of Segment 22 from approximately M.P. 116.55, with Check No. 21 in the background; camera facing upstream from right bank, June 15, 2022 (C0538).

Photograph 370: Check No. 21, showing the radial gates fully open; camera facing upstream from left bank, June 15, 2022 (C0555).

Photograph 371: Check No. 21 and Bass Avenue Bridge, showing radial gates' backside; camera facing downstream from left bank, June 15, 2022 (C0551).

Photograph 372: View of maintenance yard at M.P. 116.50 (left), with Check No. 21 visible in the distance (right); camera facing west, June 15, 2022 (C0540).

Photograph 373: Front (east) side of three-bay garage; camera facing west, June 15, 2022 (C0542).

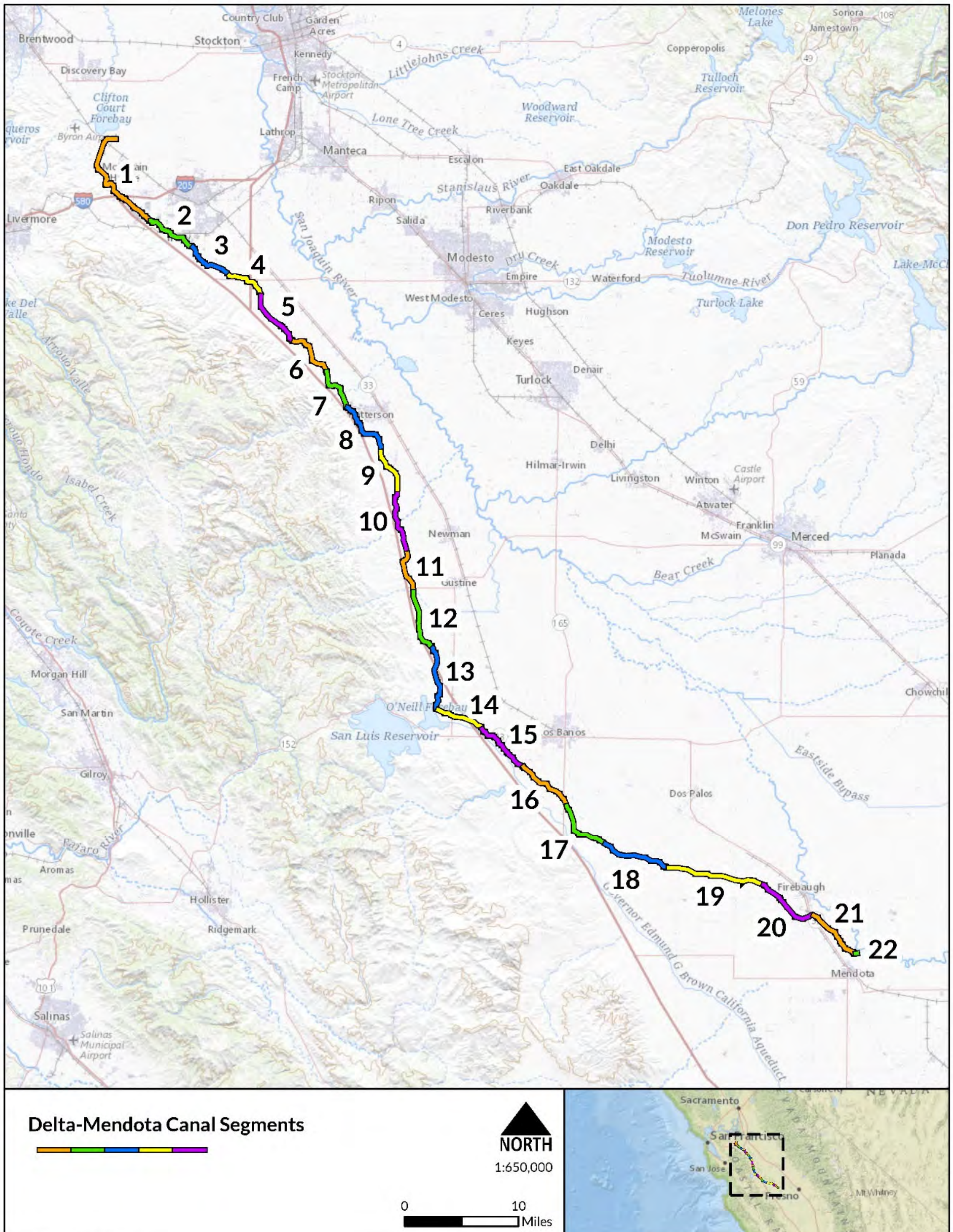
Photograph 374: West and south sides of three-bay garage; camera facing northeast, June 15, 2022 (C0548).

Photograph 375: South and east sides of storage building; camera facing northwest, June 15, 2022 (C0545).

source Name or # (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young

***Date**: June 15, 2022 ☒ Continuation ☐ Update



source: JRP (2022); Esri et al. (2022).

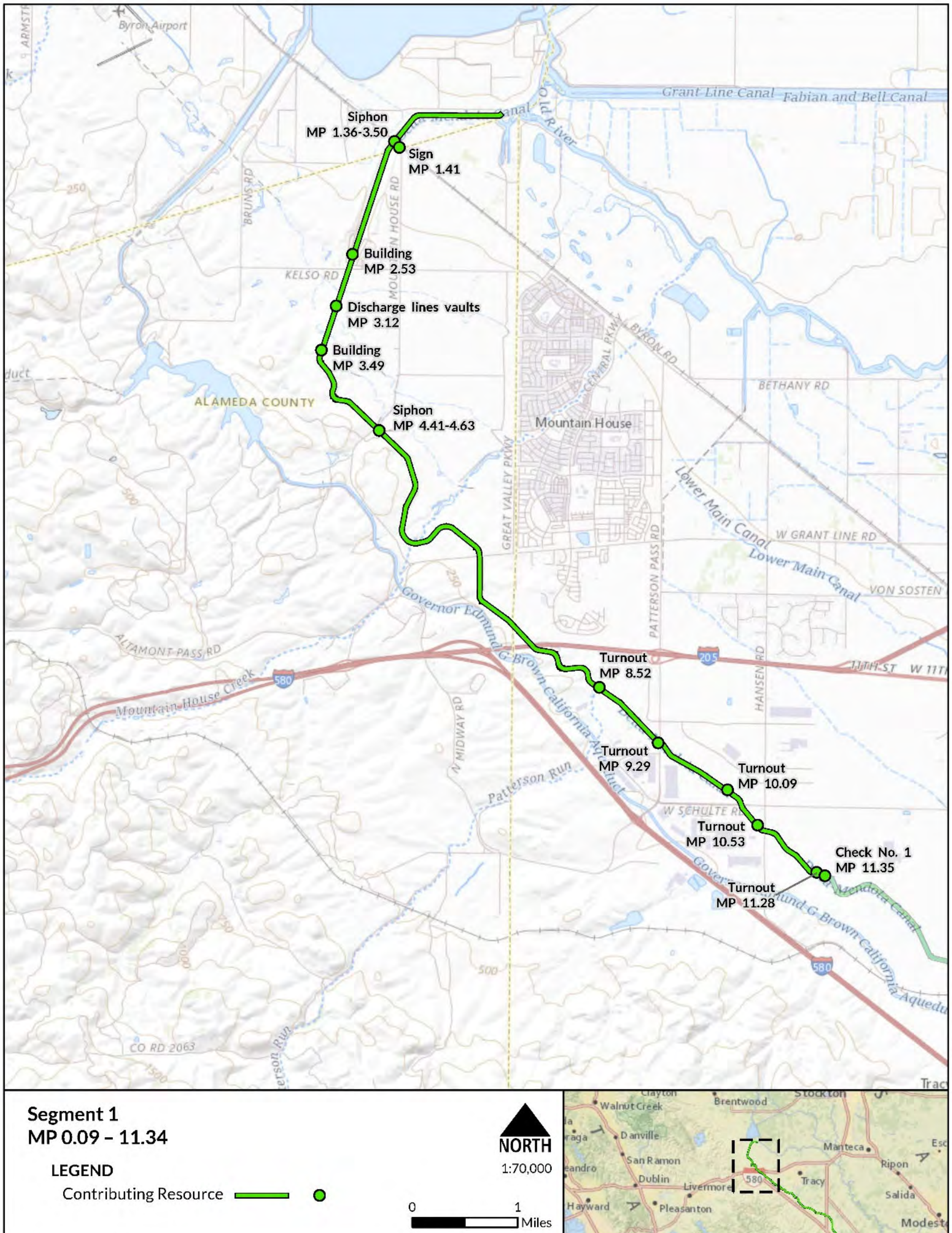
State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
CONTINUATION SHEET

Primary # ___
HRI # ___
Trinomial ___

Resource Name or # (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young

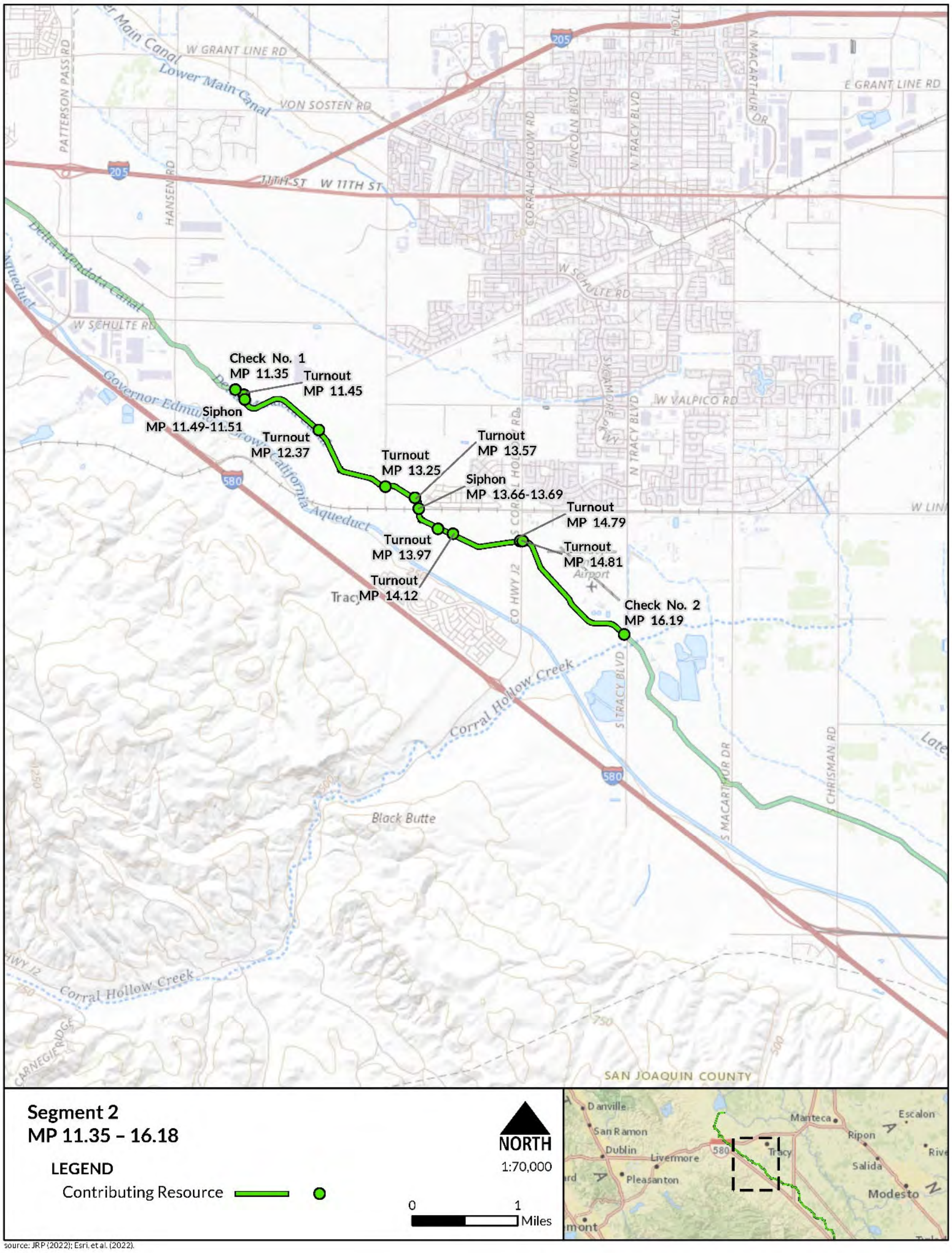
***Date**: June 15, 2022 ☒ Continuation ☐ Update



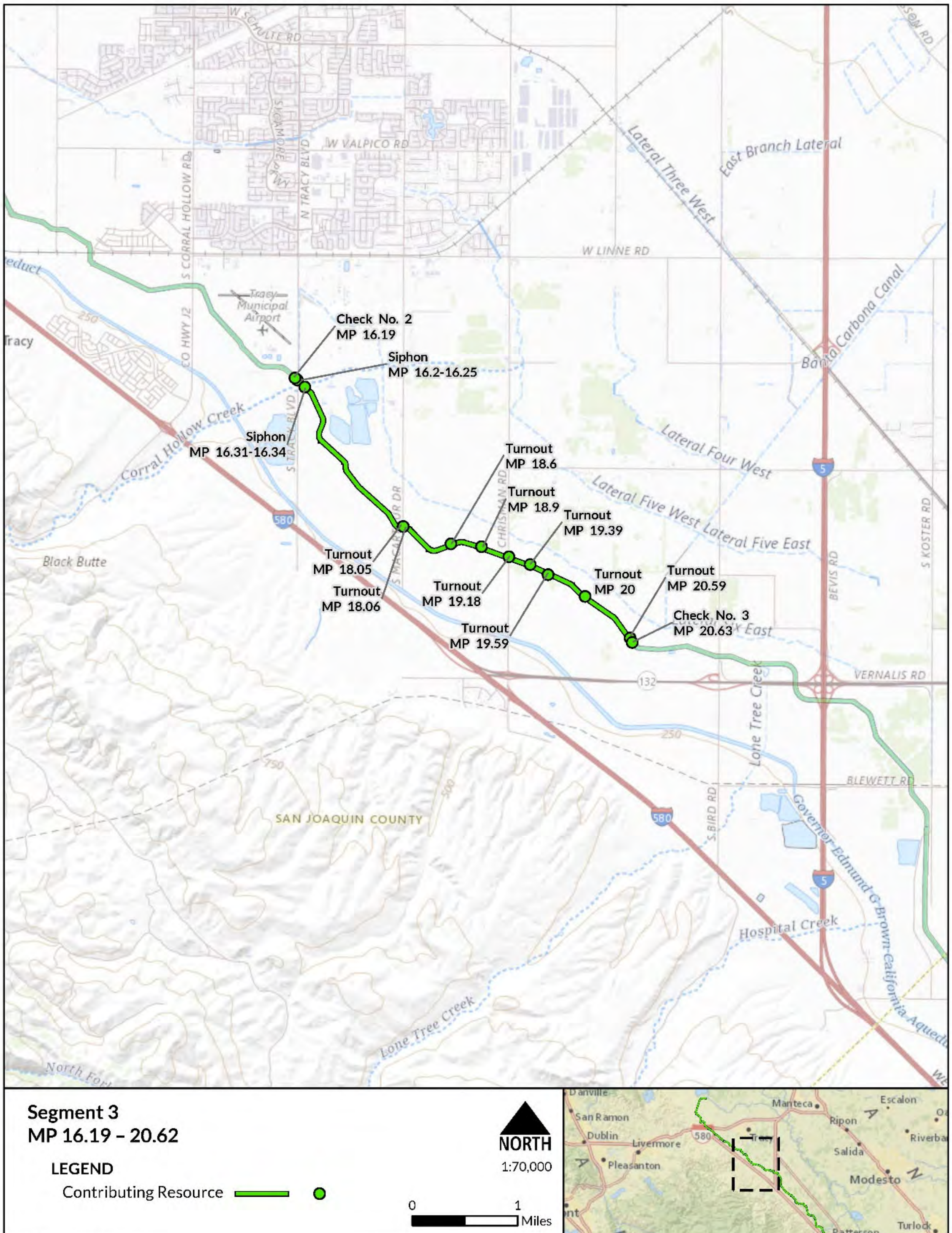
source: JRP (2022); Esri et al. (2022).

DPR 523J (1/95) *Required Information

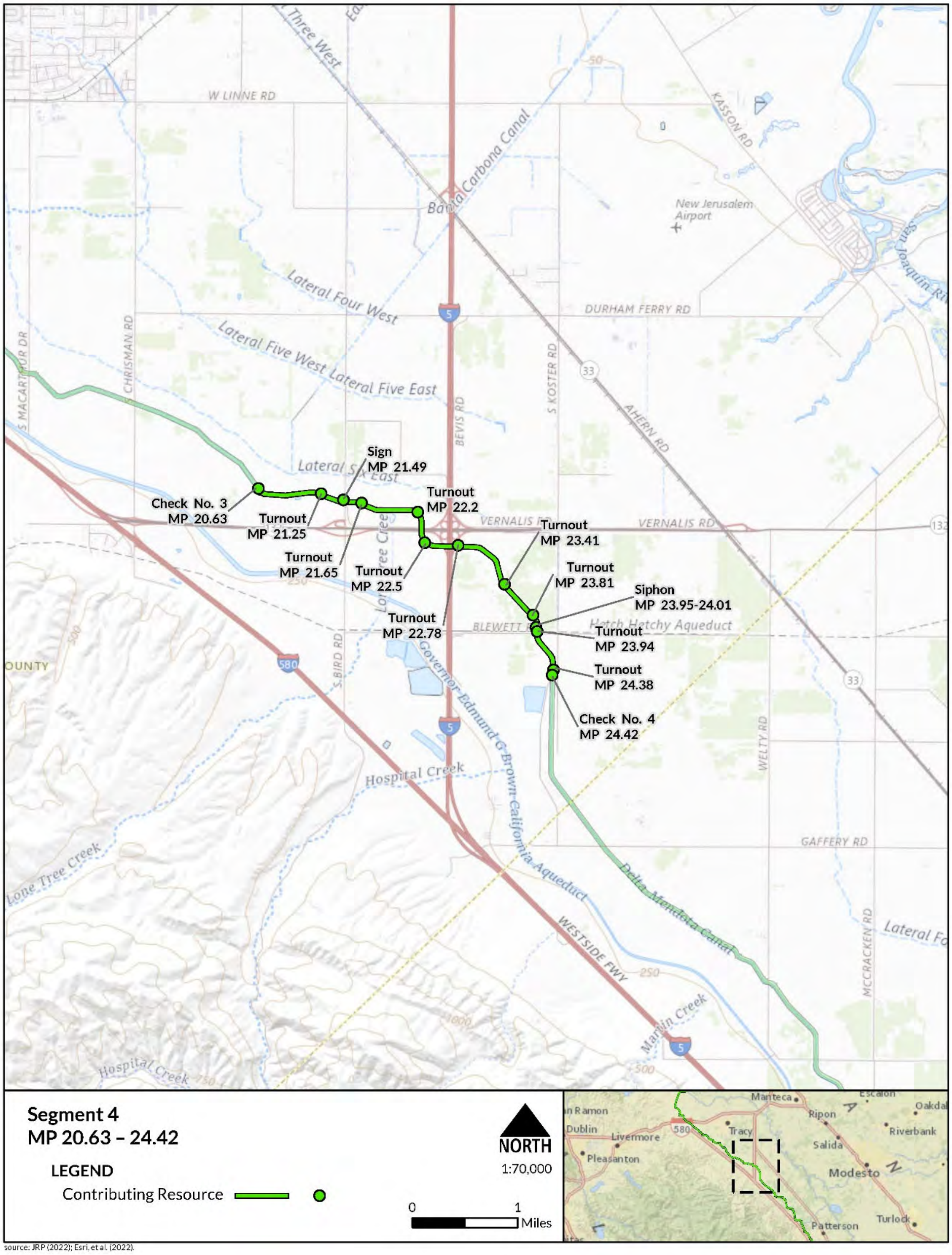
***Recorded by**: H. Norby & A. Young
***Date**: June 15, 2022 ☒ Continuation ☐ Update

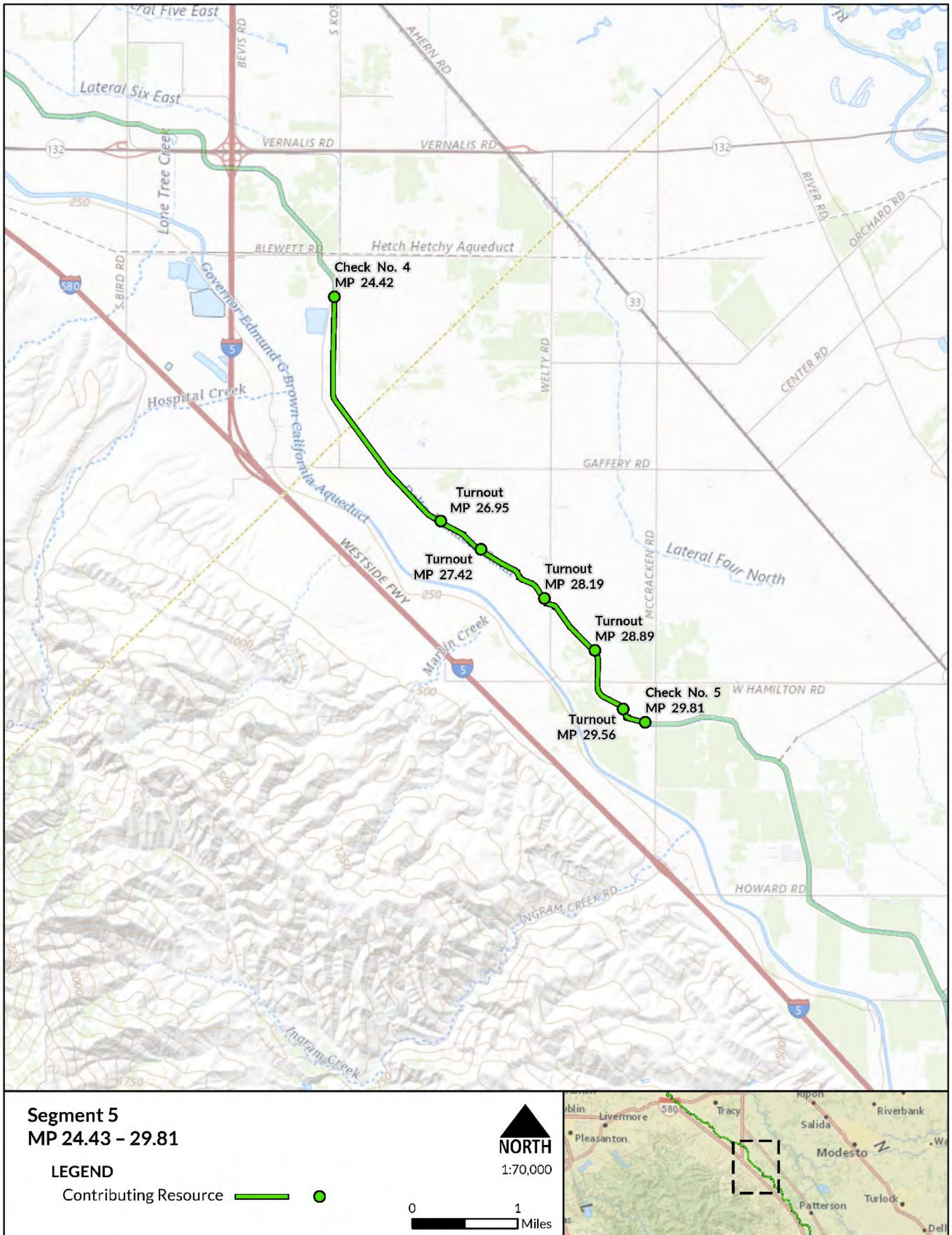


***Recorded by**: H. Norby & A. Young
***Date**: June 15, 2022 ☒ Continuation ☐ Update



source: JRP (2022); Esri et al. (2022).


Sign
MP 21.49
Check No. 3
MP 20.63
Turnout
MP 21.25
Turnout
MP 21.65
Turnout
MP 22.2
Turnout
MP 22.5
Turnout
MP 22.78
Turnout
MP 23.41
Turnout
MP 23.81
Siphon
MP 23.95-24.01
Turnout
MP 23.94
Turnout
MP 24.38
Check No. 4
MP 24.42
W LINNE RD
Banta Carbona Canal
New Jerusalem Airport
Lateral Four West
Lateral Five West
Lateral Five East
Lateral Six East
DURHAM FERRY RD
VERNALIS RD
BLEWETT RD
Hetch Hetchy Aqueduct
Governor Edmund G Brown California Aqueduct
Delta-Mendota Canal
Hospital Creek
Lone Tree Creek
Marlin Creek
WESTSIDE FWY
GAFFERY RD
KASSON RD
AHERN RD
BEVIS RD
S KOSTER RD
WELTY RD
MCCRACKEN RD
CHRISMAN RD
S MACARTHUR DR
S BIRD RD
San Joaquin River
Segment 4
MP 20.63 – 24.42
LEGEND
Contributing Resource
NORTH
1:70,000
0
1
Miles
Manteca
Ripon
Tracy
Dublin
Livermore
Pleasanton
Salida
Modesto
Riverbank
Oakdale
Escalon
Turlock
Patterson
source: JRP (2022); Esri, et al. (2022).



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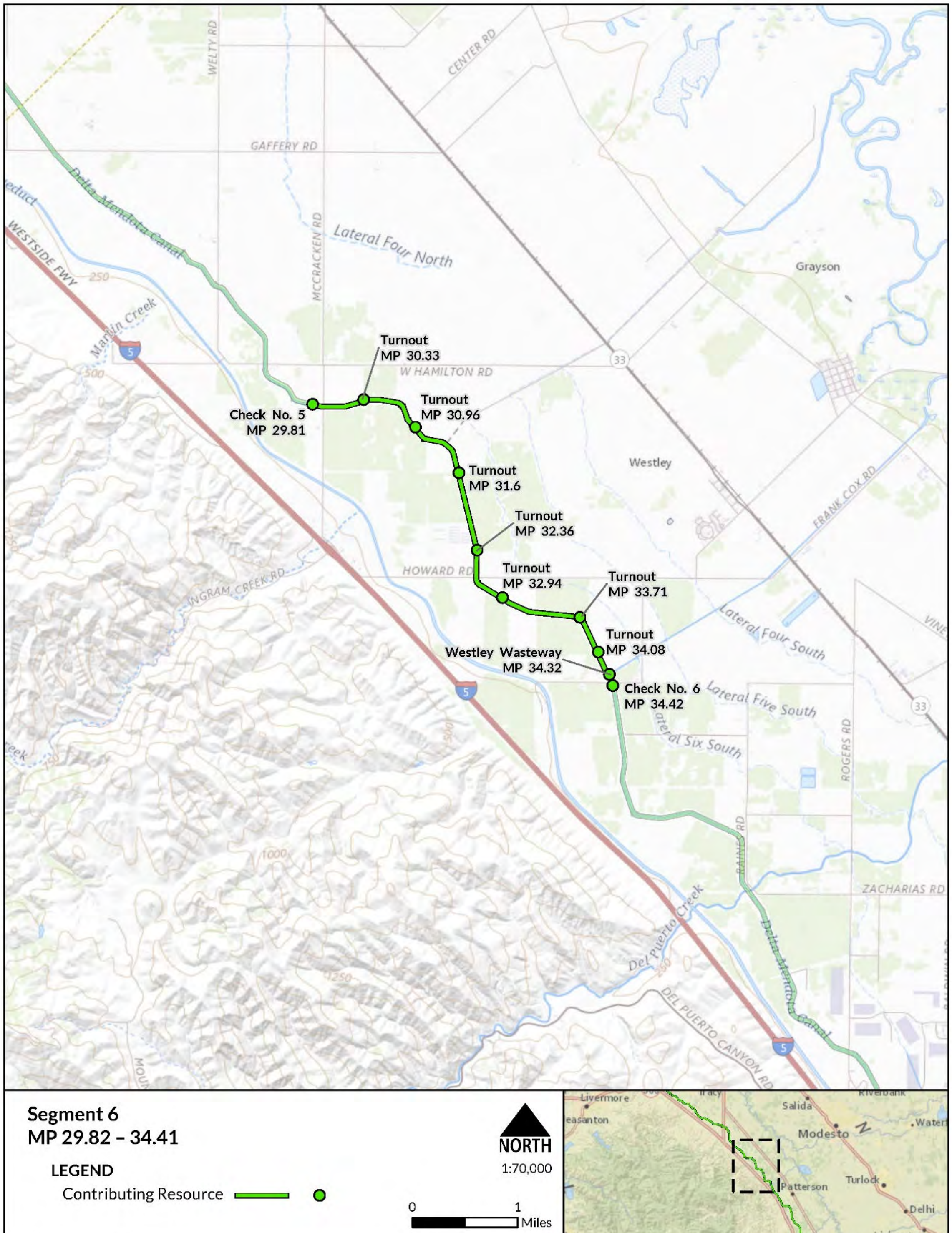
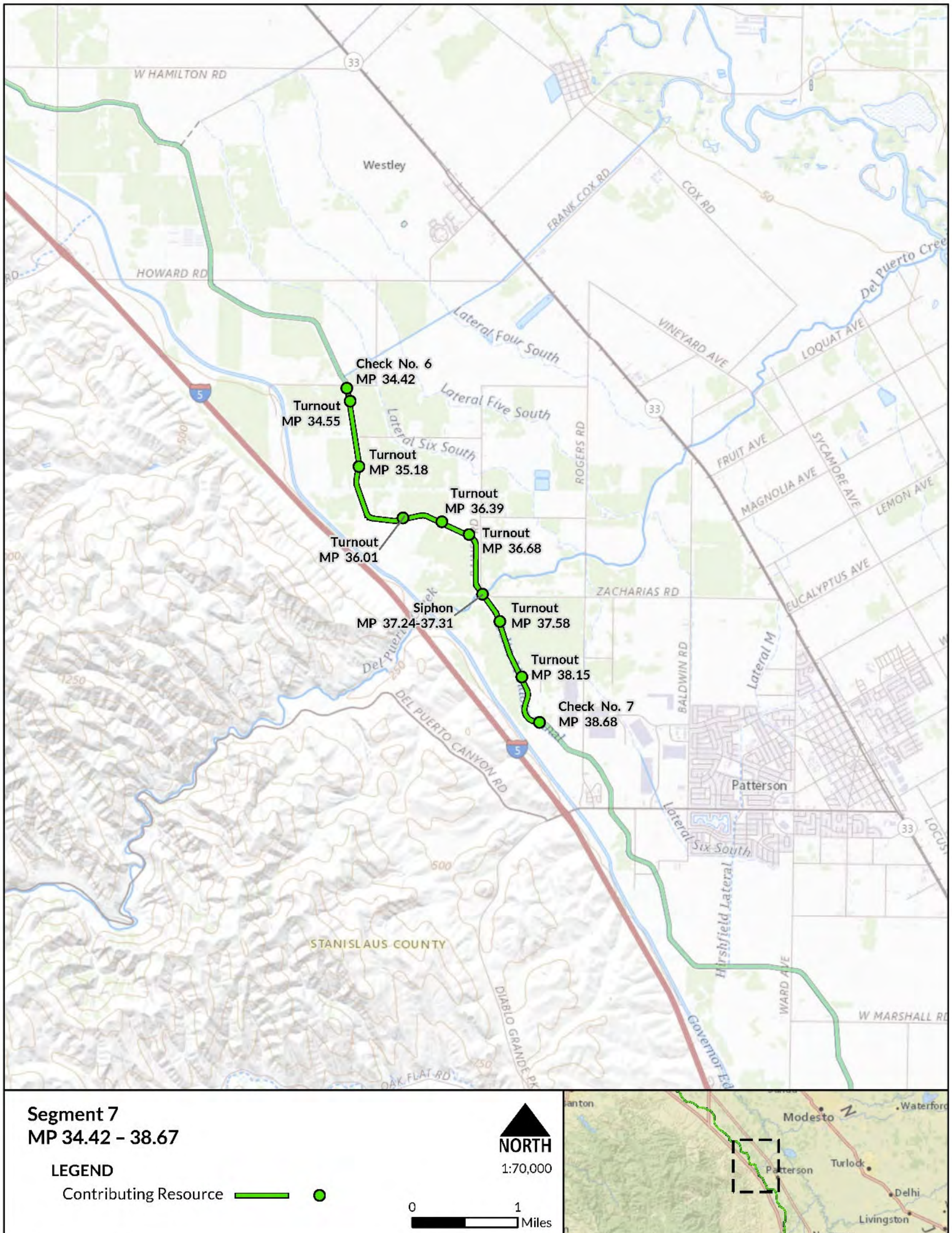
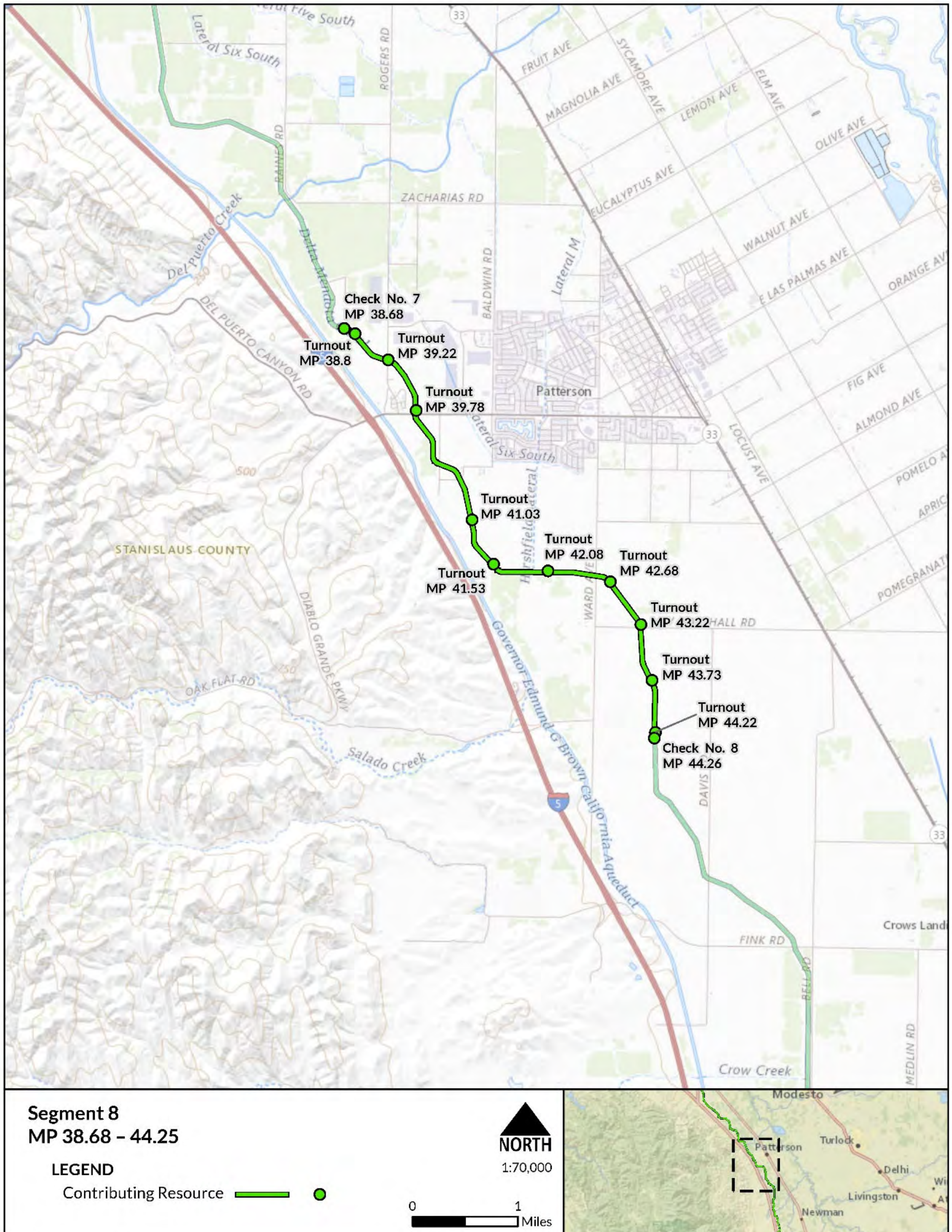


source: JRP (2022); Esri, et al. (2022).

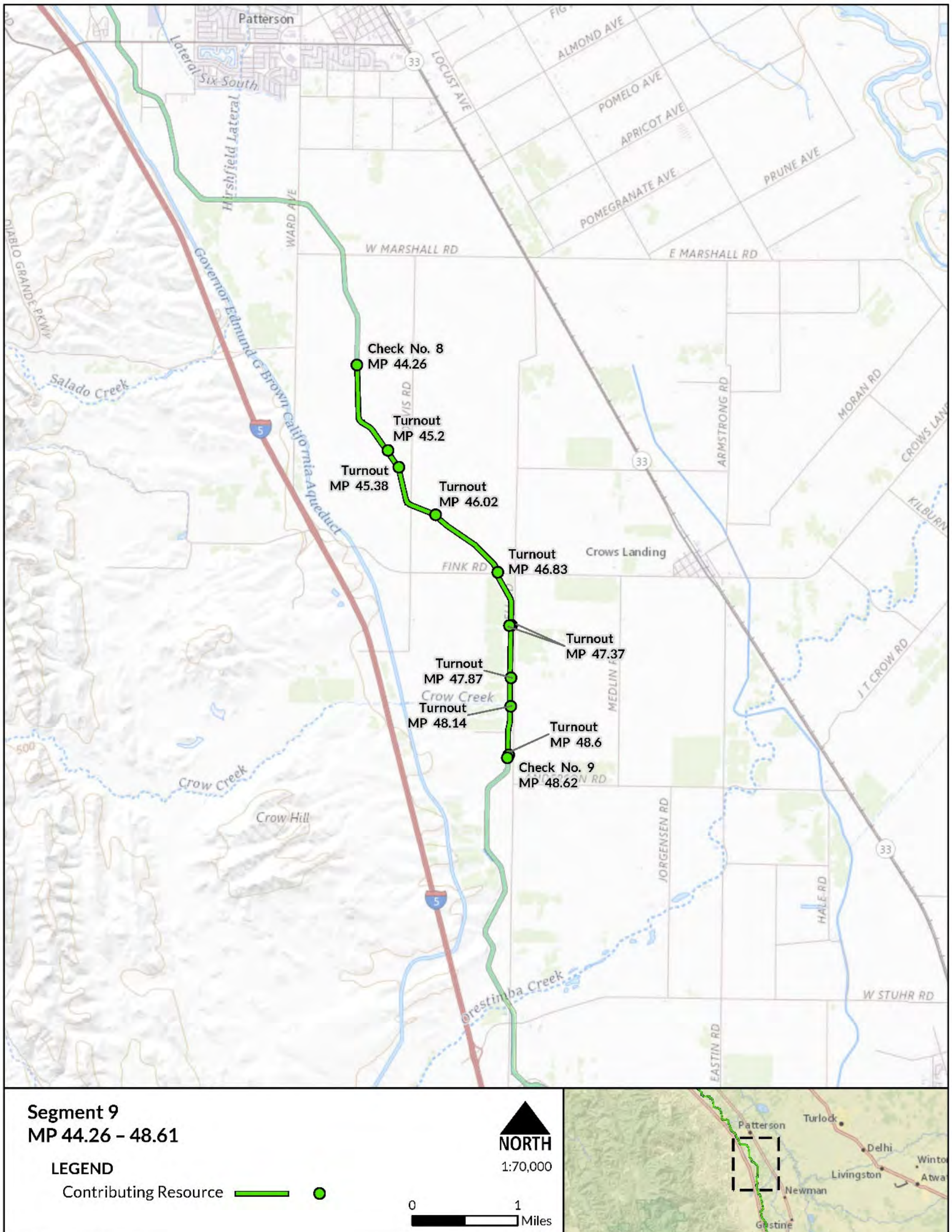


source: JRP (2022); Esri et al. (2022).



source: JRP (2022); Esri, et al. (2022).

***Recorded by**: H. Norby & A. Young
***Date**: June 15, 2022
☒ Continuation ☐ Update



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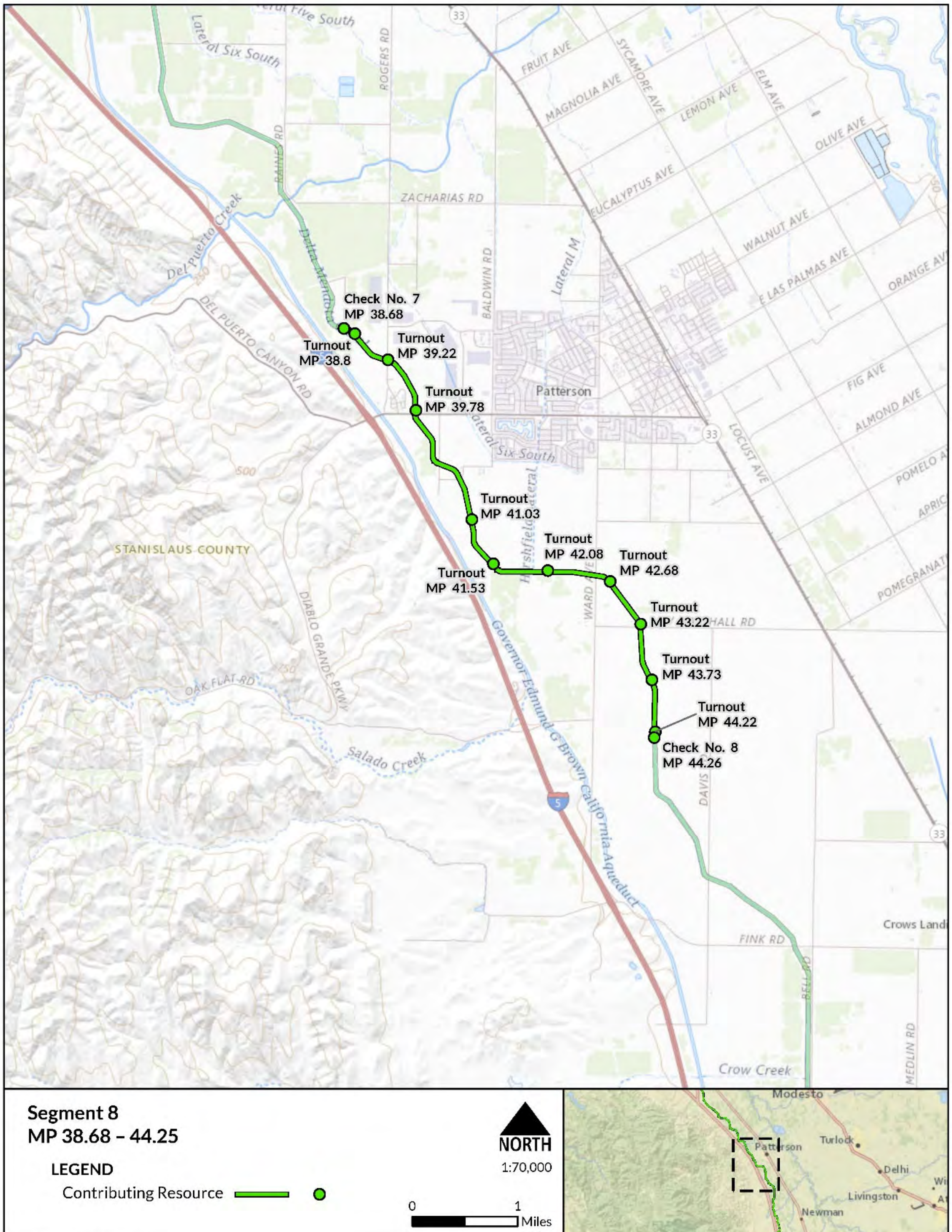

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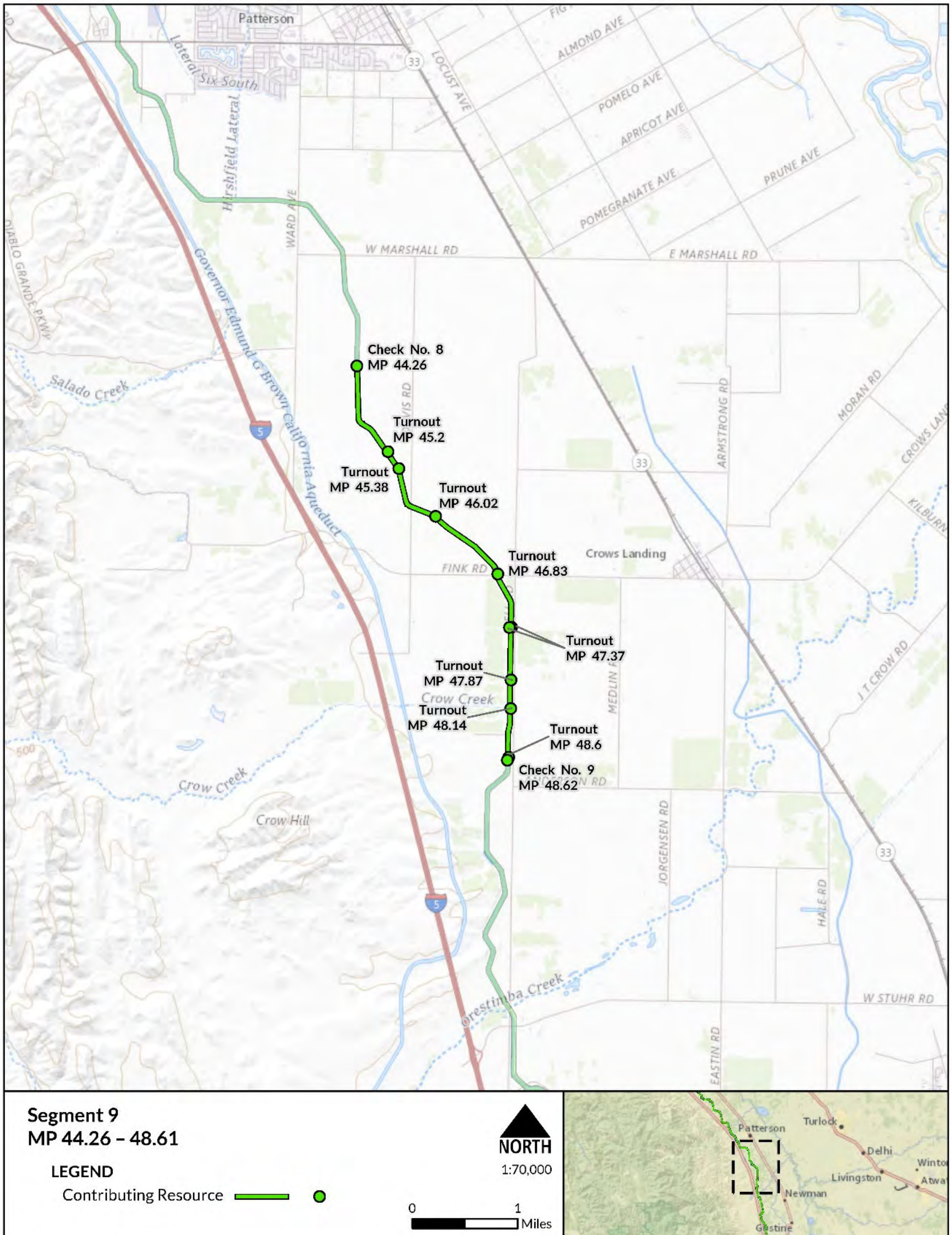
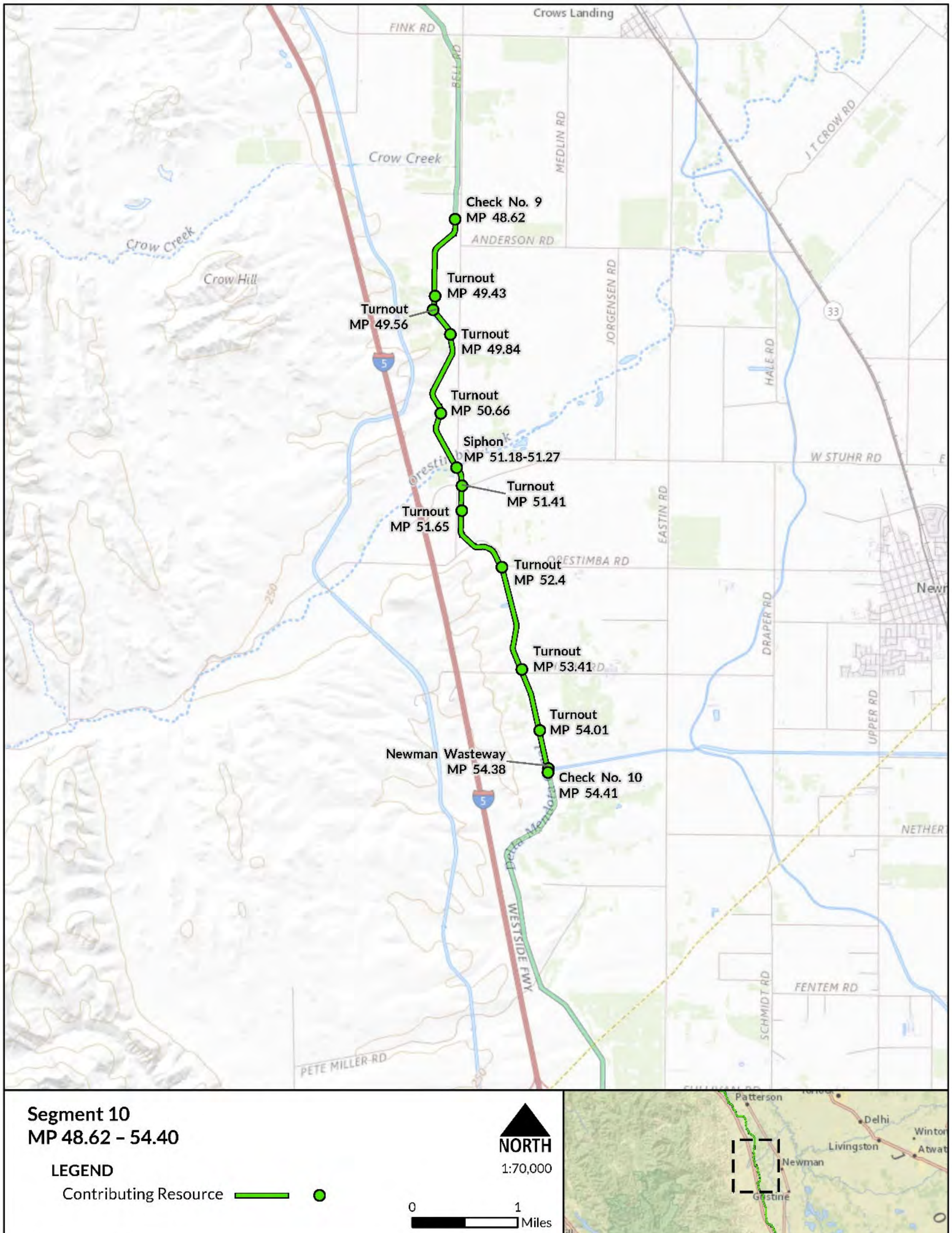


source: JRP (2022); Esri, et al. (2022).

Resource Name or # (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young

***Date**: June 15, 2022 ☒ Continuation ☐ Update

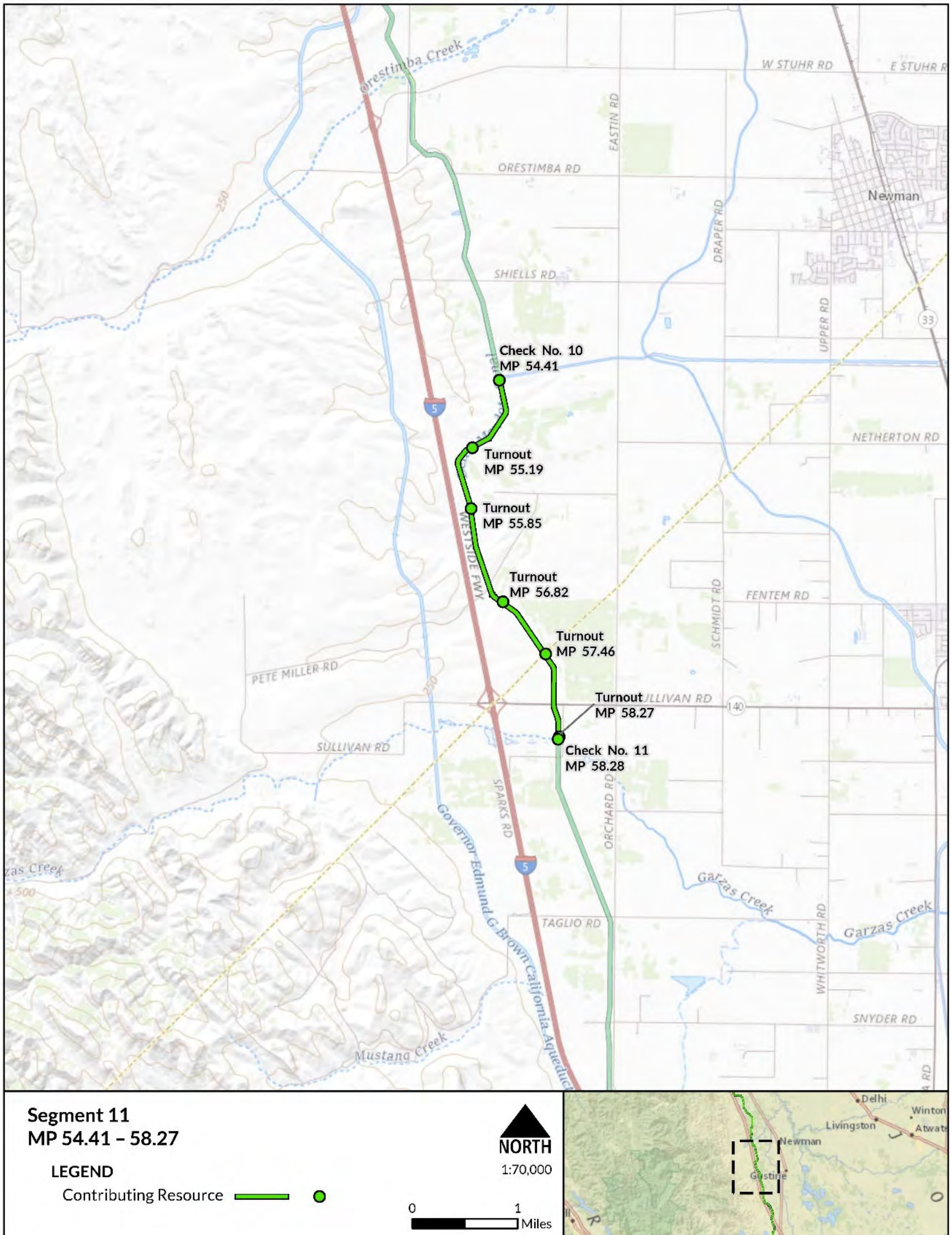


source: JRP (2022); Esri, et al. (2022).

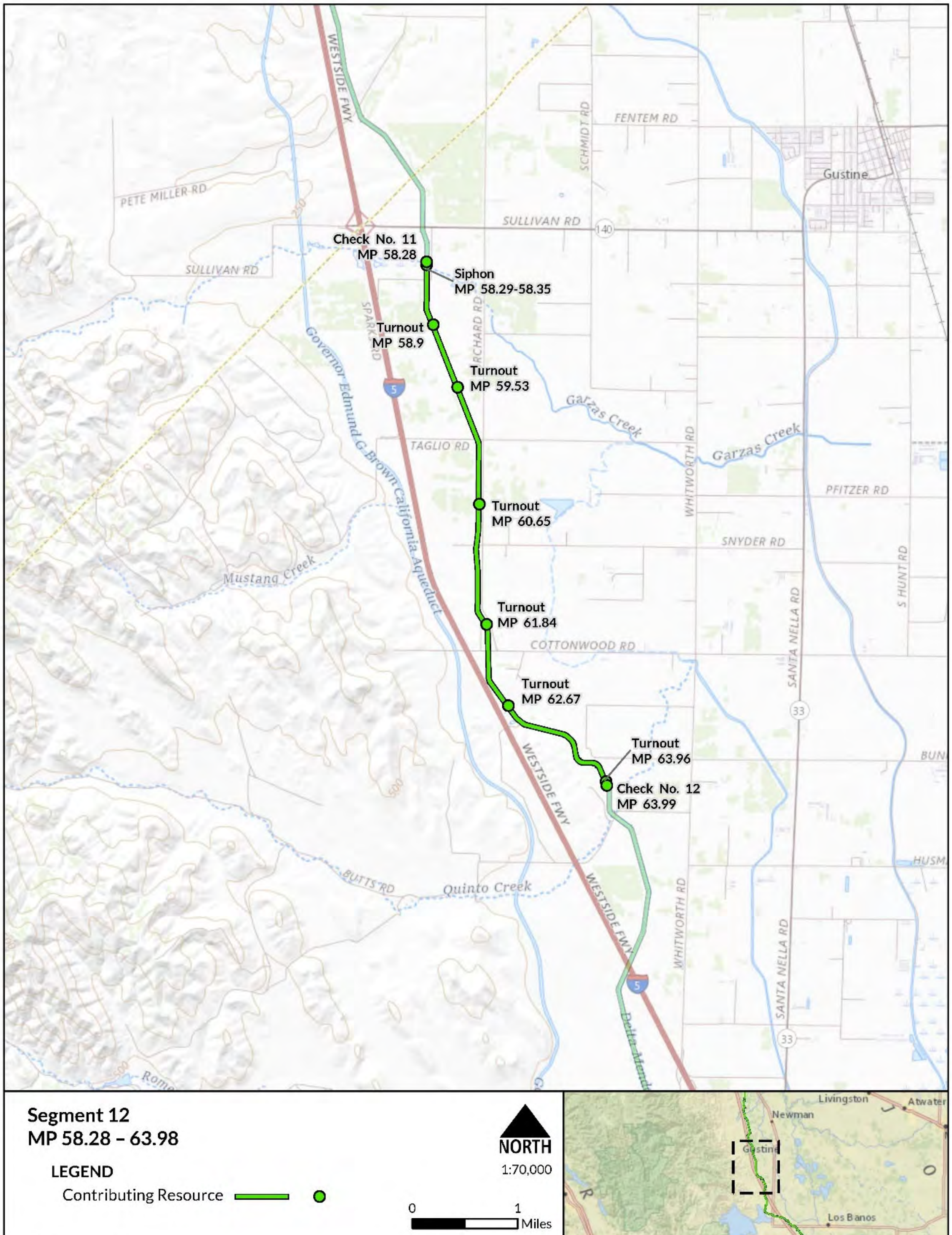
State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
CONTINUATION SHEET

Primary # ______
HRI # ______
Trinomial ______

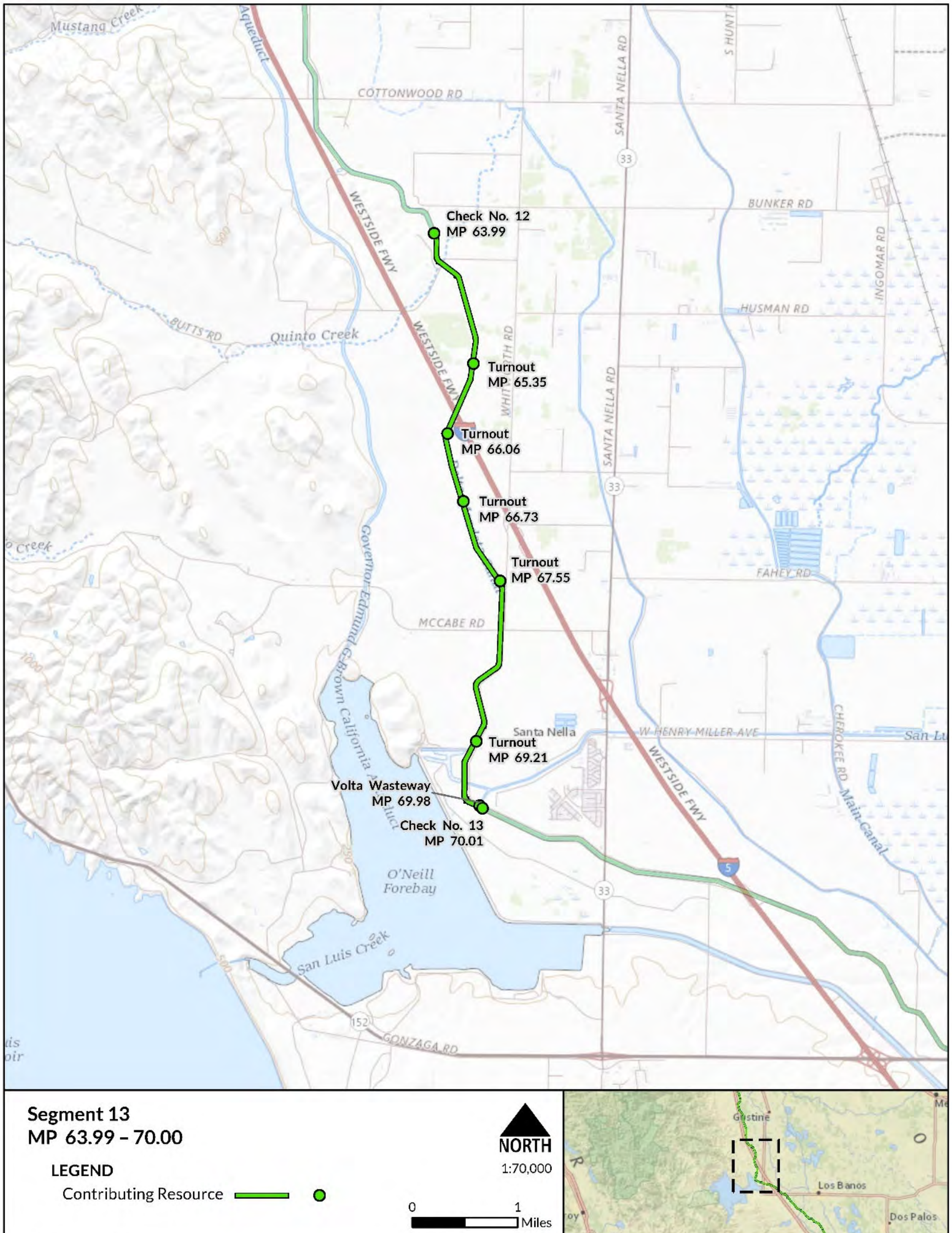
source Name or # (Assigned by recorder): Delta-Mendota Canal
***Recorded by**: H. Norby & A. Young
***Date**: June 15, 2022 ☒ Continuation ☐ Update



source: JRP (2022); Esri et al. (2022).



source: JRP (2022); Esri, et al. (2022).



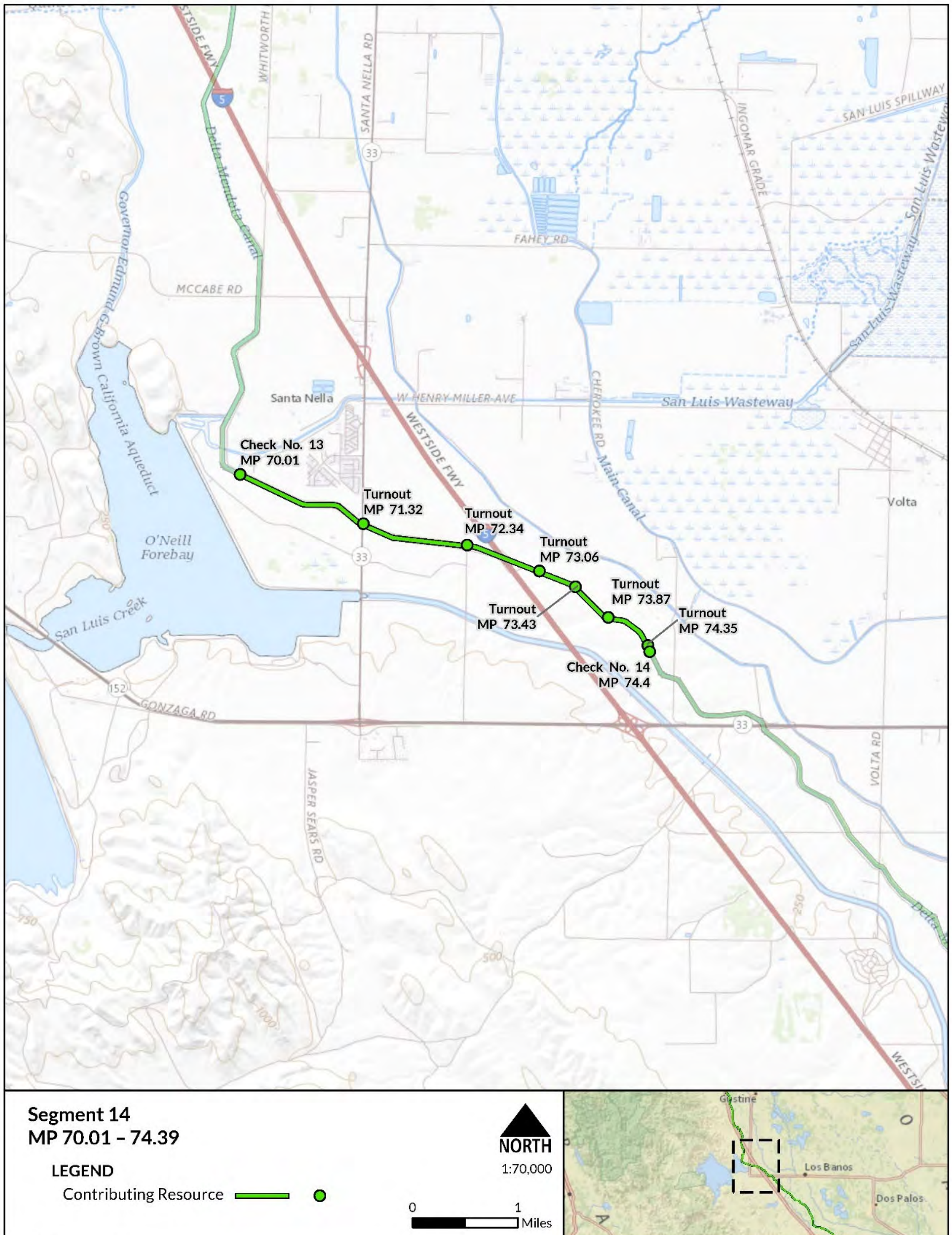
source: JRP (2022); Esri et al. (2022).

Resource Name or # (Assigned by recorder): Delta-Mendota Canal

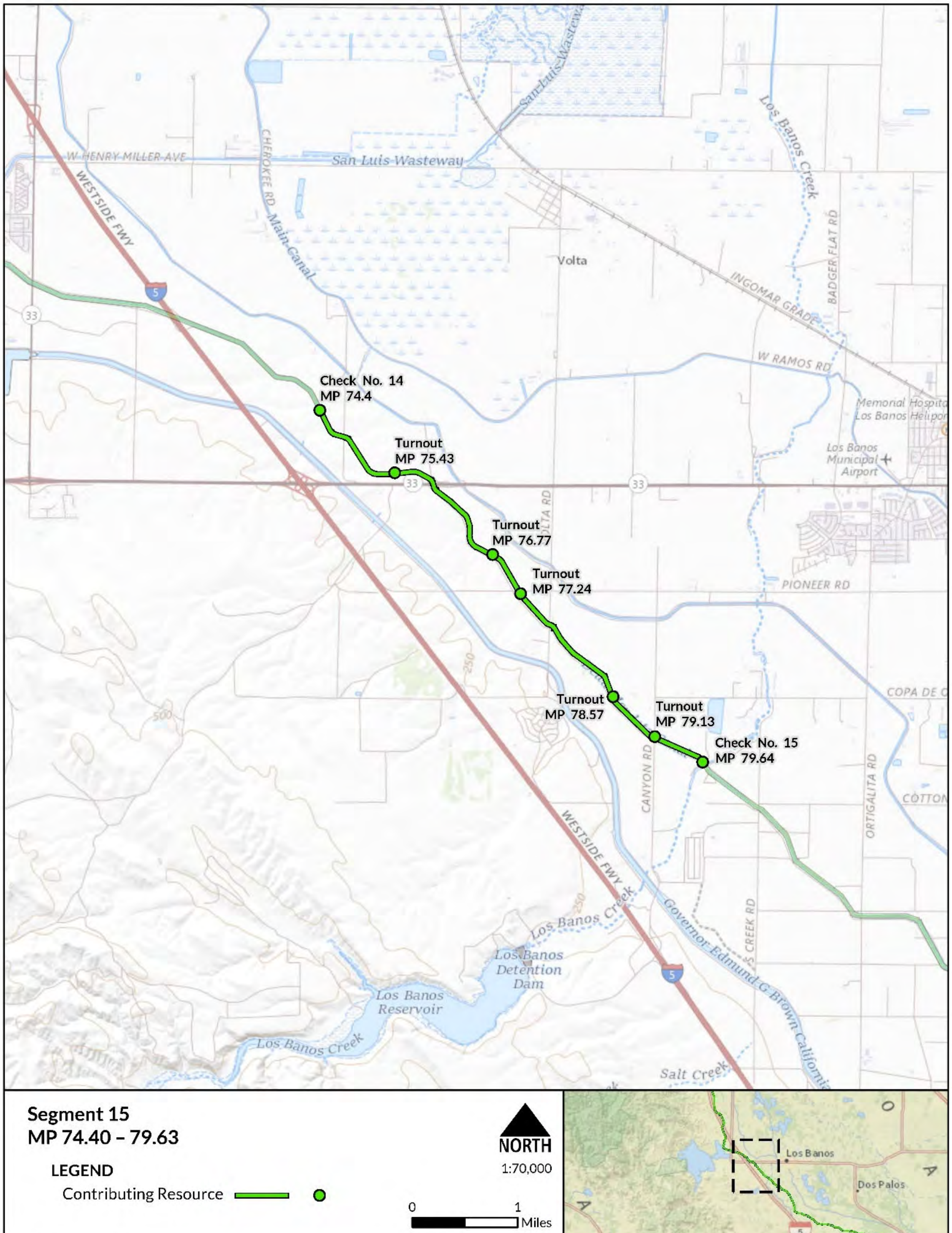
***Recorded by**: H. Norby & A. Young

***Date**: June 15, 2022

☒ Continuation ☐ Update



source: JRP (2022); Esri et al. (2022).

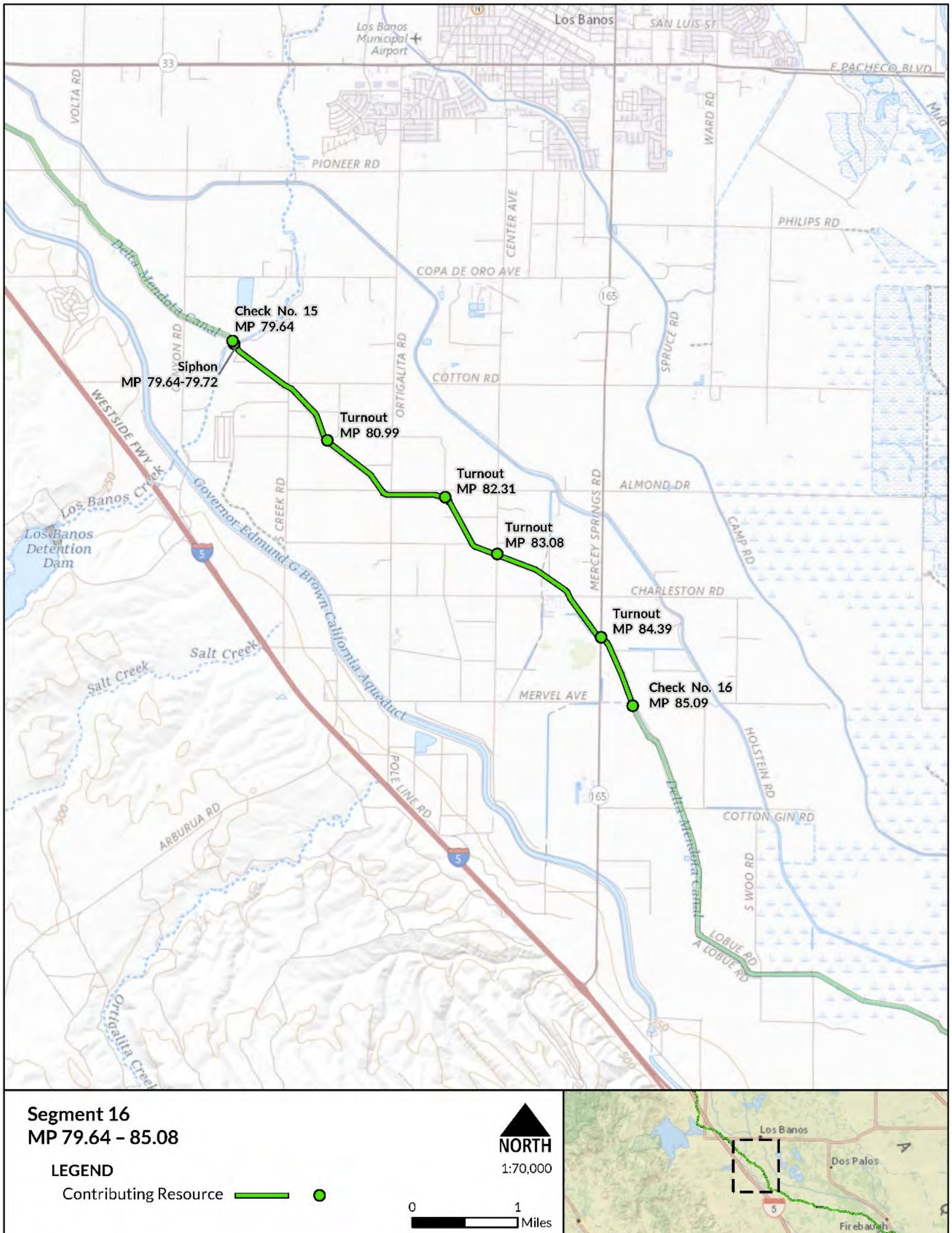


source: JRP (2022); Esri et al. (2022).

Resource Name or # (Assigned by recorder): Delta-Mendota Canal

***Recorded by**: H. Norby & A. Young

***Date**: June 15, 2022 ☒ Continuation ☐ Update

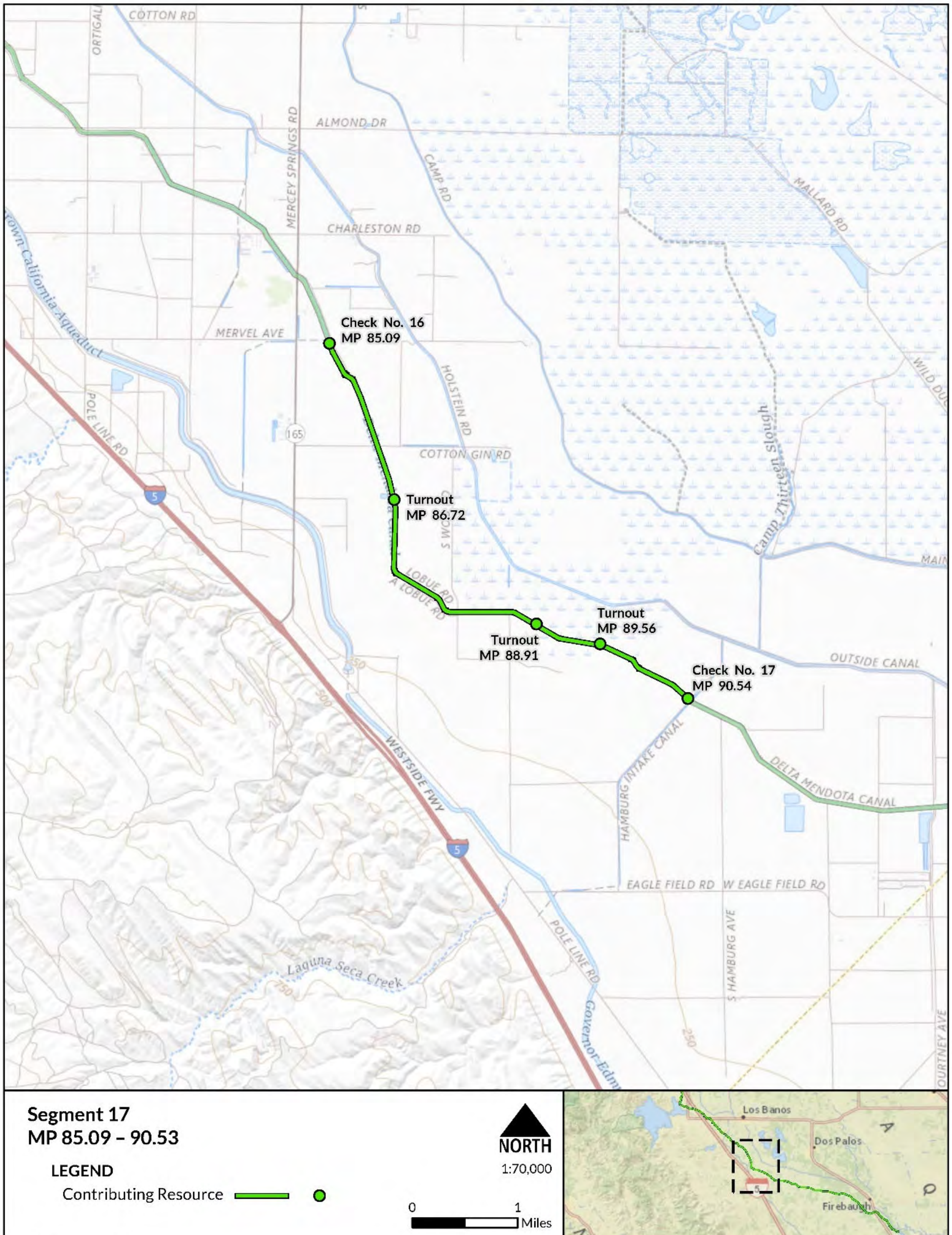


source: JRP (2022); Esri et al. (2022).

source Name or # (Assigned by recorder): Delta-Mendota Canal

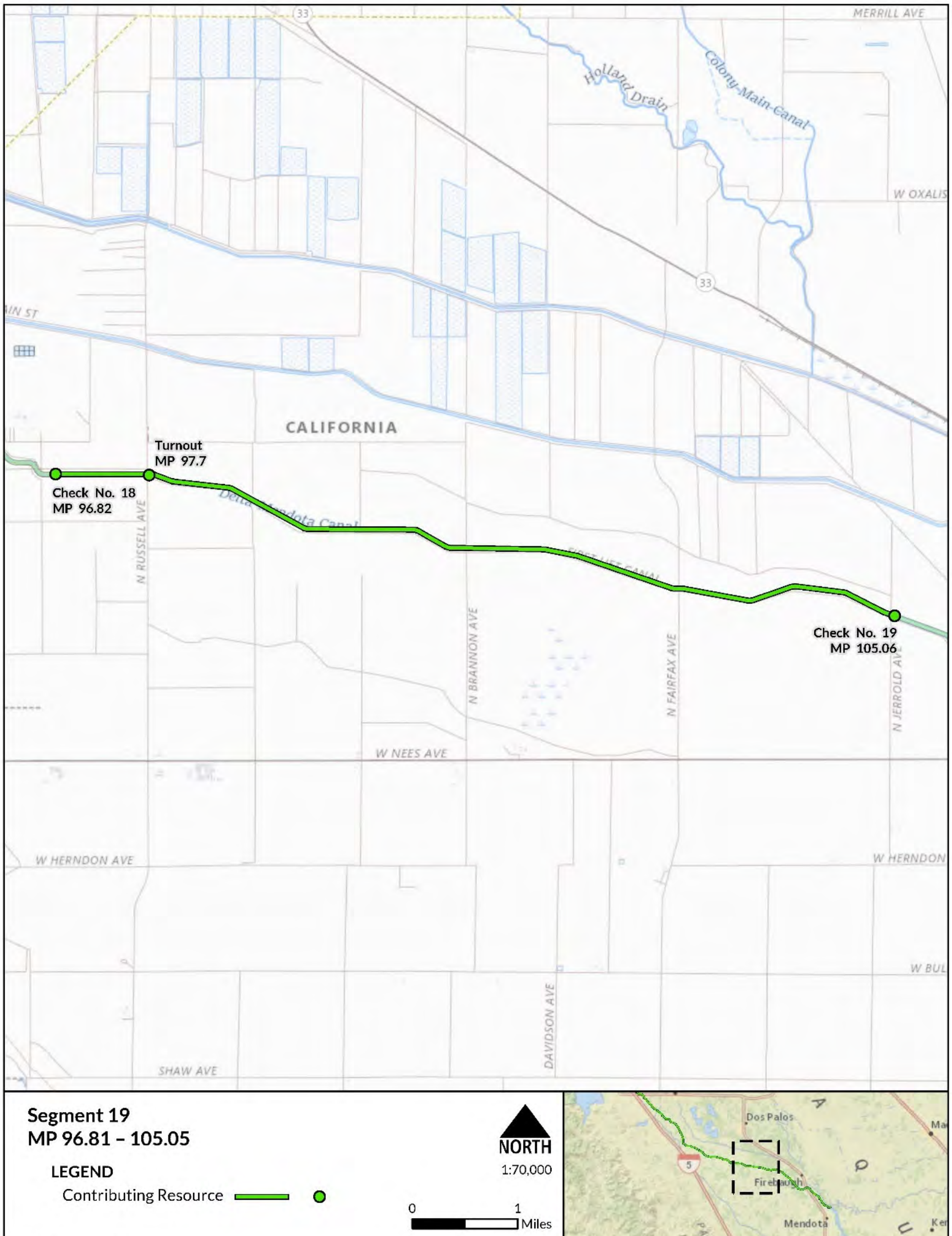
***Recorded by**: H. Norby & A. Young

***Date**: June 15, 2022 ☒ Continuation ☐ Update



source: JRP (2022); Esri et al. (2022).

source: JRP (2022); Esri et al. (2022).



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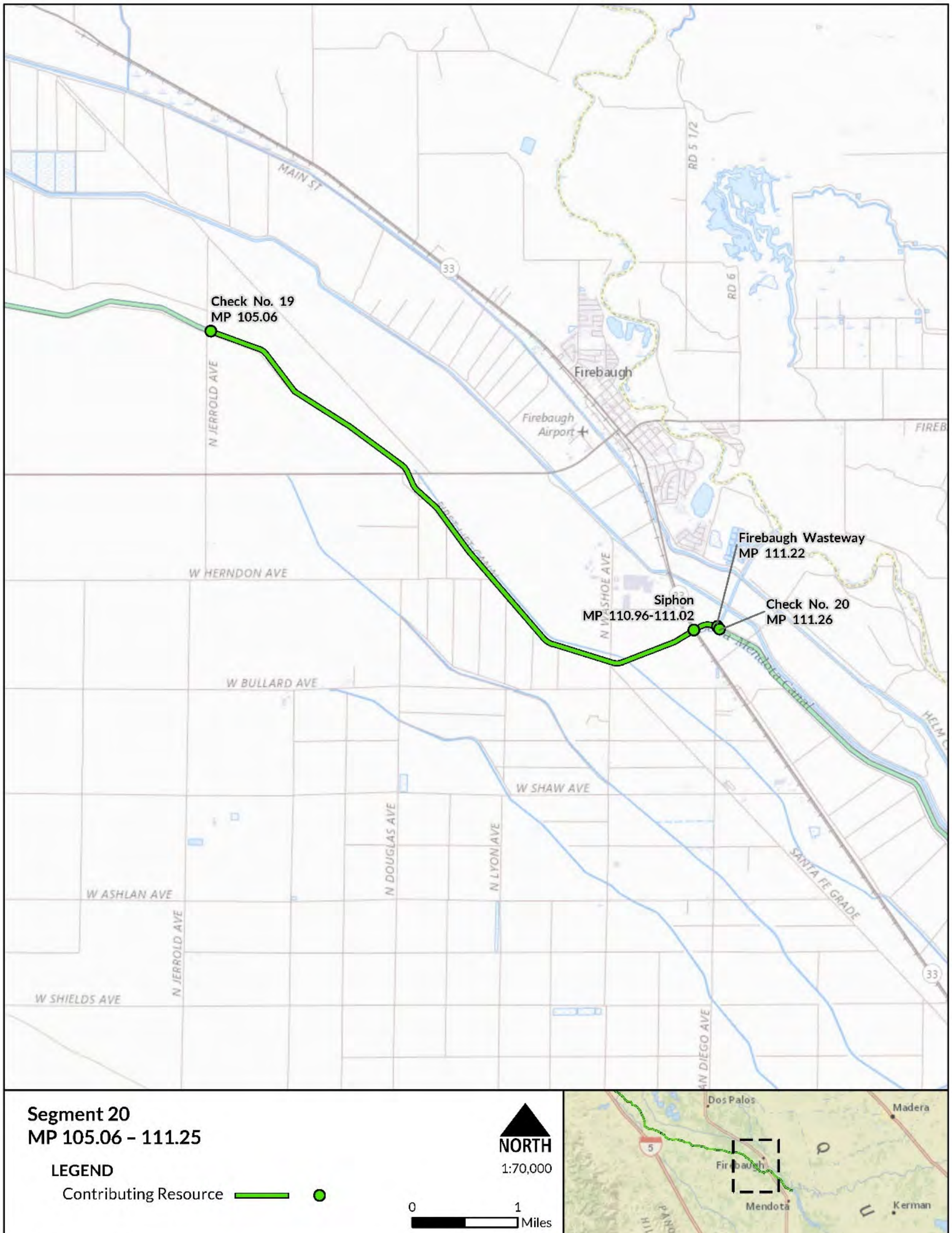
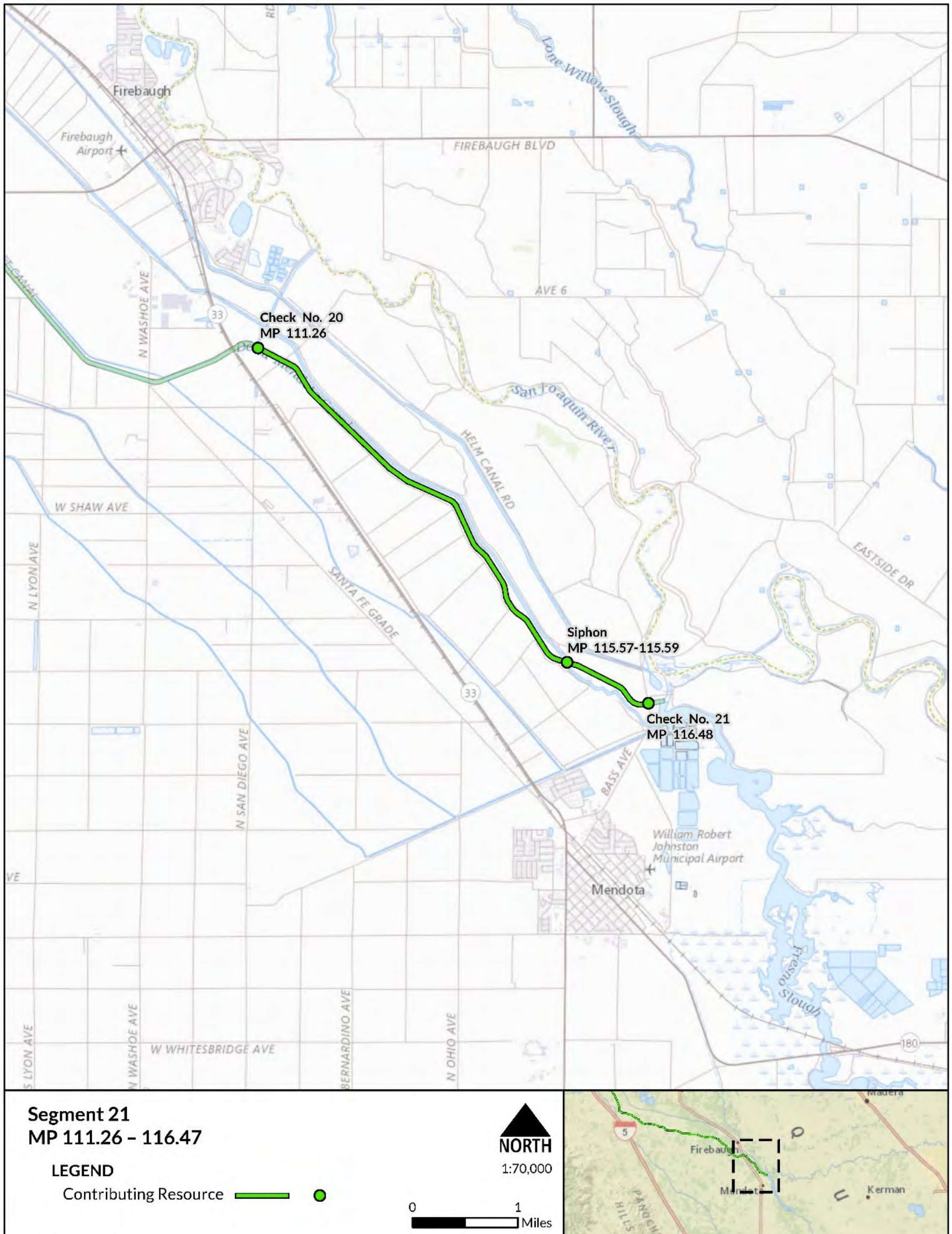


source: JRP (2022); Esri, et al. (2022).



source: JRP (2022); Esri et al. (2022).

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # ______
HRI # ______
Trinomial ______
NRHP Status Code 3S
Other Listings ______
Review Code ______ Reviewer ______ Date ______

 ***Resource Name or #** (Assigned by recorder) San Luis Drain

P1. Other Identifier: San Luis Drain

***P2. Location:** ☐ **Not for Publication** ☒ **Unrestricted** ***a. County** Fresno
and (P2b and P2c or P2d. Attach a Location Map as necessary.)

***b. USGS 7.5' Quad** See Continuation Sheet **Date** ____ **T** __; **R** __; ____ ¼ **of Sec** ; __ **B.M.**

c. Address NA City ______ Zip ______

d. UTM: (give more than one for large and/or linear resources) Zone ____; ______mE/ ______mN
Segment recorded from UTM Zone 10S, 725735.70mE / 4081383.62mN at the north, to Zone 10S, 734830.29mE / 4070262.12mN at the south.

e. Other Locational Data: (e.g., parcel #, directions to resource, elevation, etc., as appropriate)
Assessor Parcel Numbers: 008-02-031ST; 012-03-018ST; 012-03-023; 012-03-030ST; 012-06-034ST;012-07-024ST; 012-07-026ST; 012-13-022ST; 012-13-024ST; 013-03-051ST; 013-28-008ST; 013-28-010ST; 013-28-023ST; 019-26-002ST.

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries)
This form records one linear segment and two point-observations along the San Luis Drain (SLD), a component of the San Luis Unit of the Central Valley Project (CVP) (**Photograph 1**). The San Luis Drain spans roughly 87 miles between a point in the vicinity of the unincorporated community of Five Points in western Fresno County at the south end to the Kesterson Reservoir near the city of Gustine in western Merced County at the north end. San Luis Drain is a concrete-lined, trapezoidal drainage canal flanked by two compacted earth embankment levees, with numerous major and minor appurtenant structures distributed throughout its span—including check structures, pipe crossings, siphons, and a trapezoidal crossing in the drain recorded herein. SLD mile posts (M.P.) run north to south, and the structure is recorded herein at three locations (i.e., the study area for this form) between Firebaugh and Mendota in Fresno County, in the vicinity of and where the drainage canal crosses the area of potential effects (APE) for the project cited in *P11. See attached Linear Feature Records for descriptions of points, appurtenant structures, and the canal segment recorded on this form.

***P3b. Resource Attributes:** (List attributes and codes) HP20 – Canal / Aqueduct

***P4. Resources Present:** ☐ Building ☒ Structure ☐ Object ☐ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)

P5a. Photo or Drawing (Photo required for buildings, structures, and objects.)

P5b. Description of Photo: (View, date, accession #) **Photograph 1:** San Luis Drain with Delta-Mendota Canal (background left); camera facing east, July 20, 2022.

***P6. Date Constructed/Age and Sources:** ☒ Historic ☐ Prehistoric ☐ Both
1973 (U.S. Bureau of Reclamation)

***P7. Owner and Address:**
U.S. Department of the Interior
Bureau of Reclamation
Mid Pacific Regional Office
2800 Cottage Way
Sacramento, CA 95825

***P8. Recorded by:** (Name, affiliation, address)
Samuel Skow & Danielle Baza
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

***P9. Date Recorded:** July 20, 2022

***P10. Survey Type:** (Describe) Intensive

***P11. Report Citation:** (Cite survey report and other sources, or enter "none.") JRP Historical Consulting, LLC, "Finding of Eligibility Delta-Mendota Canal Subsidence Correction Project," 2022, prepared for US Bureau of Reclamation and San Luis & Delta-Mendota Water Authority.

***Attachments:** ☐ None ☒Location Map ☒ Sketch Map ☒ Continuation Sheet ☒ Building, Structure, and Object Record ☐ Archaeological Record ☐ District Record ☒ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record ☐ Artifact Record ☐ Photograph Record ☐Other (list) ______

BUILDING, STRUCTURE, AND OBJECT RECORD

***NRHP Status Code** 3S

***Resource Name or #** (Assigned by recorder) San Luis Drain

B1. Historic Name: San Luis Interceptor Drain

B2. Common Name: San Luis Drain

B3. Original Use: Drainage B4. Present Use: Drainage

***B5. Architectural Style:** Utilitarian

***B6. Construction History:** (Construction date, alteration, and date of alterations) San Luis Drain segments constructed 1969-1973; service discontinued in 1986; various appurtenant inlet drains added at unknown dates.

***B7. Moved?** ☒ **No** ☐ **Yes** ☐ **Unknown** **Date:** ______ **Original Location:** ______

***B8. Related Features:** Kesterson Reservoir; other San Luis Unit features of the Central Valley Project.

B9. Architect: U.S. Department of the Interior (USDI), Reclamation, Central Valley Project, West San Joaquin Division – San Luis Unit – California b. Builder: Multiple (see Continuation Sheet)

***B10. Significance: Theme** Environmental History **Area** United States

Period of Significance 1982-1988 **Property Type** Drainage canal **Applicable Criteria** A/1

(Discuss importance in terms of historical or architectural context as defined by theme, period, and geographic scope. Also address integrity.)

This evaluation concludes that the recorded segment and point observations of the San Luis Drain are significant under National Register of Historic Places (NRHP) Criterion A / California Register of Historical Resources (CRHR) Criterion 1, as well as meet the standards under Criteria Consideration G, and retain sufficient historic integrity to their period of significance, 1982-1988. The resource is significant for its important associations with the Kesterson Reservoir ecological disaster, an environmental crisis that drew national attention to the issue of toxic selenium contamination and contributed to a dramatic policy shift toward agricultural drainage disposal practices in the United States. The recorded segment and point observations have been evaluated in accordance with Section 106 of the National Historic Preservation Act of 1966 (as amended) (54 U.S.C. 306108) and its implementing regulations (36 CFR Part 800), and Section 15064.5(a)(2)-(3) of the CEQA Guidelines, using the criteria outlined in Section 5024.1 of the California Public Resources Code (see Continuation Sheet).

B11. Additional Resource Attributes: (List attributes and codes) ______

***B12. References:** Robert Autobee, "San Luis Unit, West San Joaquin Division, Central Valley Project" (Denver, Colorado: Bureau of Reclamation History Program, unpublished manuscript, 1995); Philip Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley* (Berkeley: University of California Press, 2011); See footnotes.

B13. Remarks:

***B14. Evaluator:** Samuel Skow, JRP Historical Consulting, LLC

***Date of Evaluation:** August 2022

(This space reserved for official comments.)

Sketch map with north arrow required

See Continuation Sheet.

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # ______________________
HRI # ______________________

***Resource Name or #** (Assigned by recorder): San Luis Drain

***Recorded by**: S. Skow and D. Baza

***Date**: July 20, 2022

L1. Historic and/or Common Name: San Luis Drain

L2a. Portion Described: ☐ Entire Resource ☐ Segment ☒ Point Observation **Designation**: SLD-1 (M.P. 119.31)

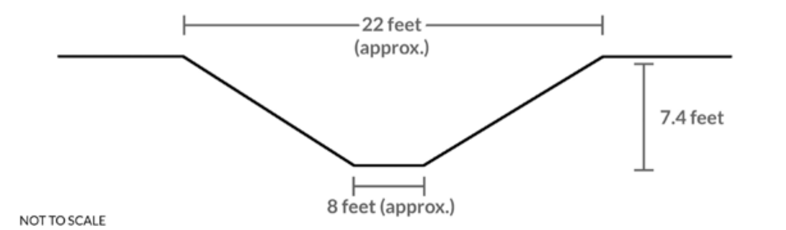
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) This point of San Luis Drain is located at the intersection of West Nees Avenue and the Outside Canal on the western outskirts of the community of Firebaugh. UTM: Zone 10S, 725721.12mE / 4081354.59mN

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
At this recorded point, San Luis Drain contains a concrete check structure where the canal crosses beneath West Nees Avenue in a concrete siphon with concrete wingwalls (**Photograph 2** and **Photograph 3**).The check structure (at SLD M.P. 119.31) is comprised of a concrete deck with metal handrails and it is separated from the public thoroughfare by chain-link fencing. The concrete-lined, trapezoidal drainage canal has an elevated right bank and a lower left bank, both with 1 ½: 1 slope. Some vegetative overgrowth is present along the earth embankment and in the canal bed. Parallel dirt and gravel operating and maintenance (O&M) roads extend along the levee crests on both sides of the drain.

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

a. **Top Width**: 22 feet (approx.)
b. **Bottom Width**: 8 feet
c. **Height or Depth**: 7.4 feet
d. **Length of Segment**: n/a

L4e. Sketch of Cross-Section (not to scale) **Facing**: South



L5. Associated Resources: San Luis Unit canals and water control features

L8a. Photograph, Map, or Drawing.

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
This resource is located in a rural agricultural area of Fresno County on the outskirts of the city of Firebaugh. The terrain is generally flat.

L7. Integrity Considerations: None.

L8b. Description of Photo, Map, or Drawing:
Photograph 2: Upstream view of San Luis Drain at Checkpoint 37 (M.P. 119.31) from south side of W. Nees Ave.; camera facing southeast, July 20, 2022.

L9. Remarks:

L10. Form prepared by:
Samuel Skow
JRP Historical Consulting, LLC
2850 Spafford St., Davis, CA 95618

L11. Date: July 20, 2022

Photograph 3: Downstream view of San Luis Drain from north side of W. Nees Ave.; camera facing northwest, July 20, 2022.

***Resource Name or #** (Assigned by recorder): San Luis Drain

***Recorded by**: S. Skow and D. Baza

***Date**: July 20, 2022

L1. Historic and/or Common Name: San Luis Drain

L2a. Portion Described: ☐ Entire Resource ☒ Segment ☐ Point Observation **Designation**: SLD-2 (M.P. 121.36-125.92)

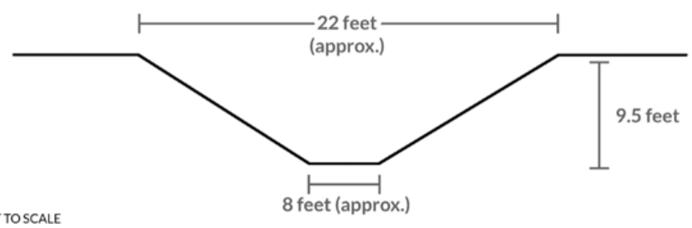
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) This segment of San Luis Drain is located where the drainage canal intersects and extends parallel to the Delta-Mendota Canal between Firebaugh and Mendota. UTM: Zone 10S, 727802.66mE / 4079226.53mN (north endpoint); 733108.67mE / 4074269.88mN (south endpoint)

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
This approximately five-mile recorded segment of the San Luis Drain is within the APE for the project cited in *P11. From the north, the canal extends southeast parallel to the Union Pacific Railroad (UPRR) / State Route (SR) 33 transportation corridor, which it traverses at a 90-degree angle underground via concrete siphon turning at Check Structure 38 (M.P. 121.38) before turning southeast 90 degrees and passing below the Delta-Mendota Canal (DMC) via similar precast concrete pressure pipe (**Photograph 4 – Photograph 6**). From here, the San Luis Drain extends southeasterly and parallel to the DMC for roughly 4.5 miles before veering south and exiting the APE just east of the intersection of the DMC and Outside Canal (**Photograph 1, Photograph 7,** and **Photograph 8**) (see Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

a. **Top Width**: 22 feet (approx.)
b. **Bottom Width**: 8 feet
c. **Height or Depth**: 9.5 feet
d. **Length of Segment**: 5 miles (approx.)

L4e. Sketch of Cross-Section (not to scale) **Facing**: North



L5. Associated Resources: San Luis Unit canals and water control features

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
This resource is located in a rural agricultural area of Fresno County between the cities of Firebaugh and Mendota. The terrain is generally flat.

L7. Integrity Considerations: Inlet pipes added sometime after initial construction period (1969-1974).

L8a. Photograph, Map, or Drawing.

L8b. Description of Photo, Map, or Drawing:
Photograph 4: Downstream view of San Luis Drain from O&M road, with UPRR / SR 33 corridor (background right); camera facing northwest, July 20, 2022.

L9. Remarks:

L10. Form prepared by:
Samuel Skow
JRP Historical Consulting, LLC
2850 Spafford St., Davis, CA 95618

L11. Date: July 20, 2022

L3. Description (Continued):

The concrete-lined, trapezoidal drainage canal has an elevated right bank and a lower left bank, both with 1 ½: 1 slope. Vegetative overgrowth is prominent throughout several sections of the canal bed. Parallel dirt and gravel O&M roads extend along the levee crests on both sides of the drain. In this segment, the San Luis Drain features three check structures, including Check 38 and Check 39, which are connected to siphons that traverse SR 33 and Sierra Avenue, respectively, and Check 40, a standalone structure (**Photograph 5, Photograph 7,** and **Photograph 9**). As described above, the concrete check structures comprise decks with metal handrails that span the width of the drain, with wingwalls channeling flows through two 4.5-foot-wide openings with wood flashboards to control access. This segment likewise features a trapezoidal crossing—an approximately 15-foot-wide and roughly 12-foot-tall, reinforced concrete vehicular bridge—a stainless steel safety ladder affixed with galvanized metal chain link, and various inlet pipes added after the original period of construction (1972-1973) (**Photograph 6**, **Photograph 8,** and **Photograph 10 - Photograph 12**).

Photographs:

Photograph 5: Downstream view of San Luis Drain from right-bank O&M road, with Check Structure 38 (center) and SR 33 (background); camera facing southwest, July 20, 2022.

Photograph 6: Upstream view of San Luis Drain from right bank O&M road, with non-original inlet drain (center right) and Delta-Mendota Canal left-bank levee (background); camera facing east, July 20, 2022.

Photograph 7: Upstream view of San Luis Drain at Check Structure 39 (M.P. 121.91), with DMC (left); camera facing southeast, July 20, 2022.

Photograph 8: Upstream view of San Luis Drain, with non-original inlet drain (center) and DMC Outside Canal siphon (background center); camera facing northeast, July 20, 2022.

Photograph 9: Downstream view of San Luis Drain at Check Structure 40 (M.P. 124.42); camera facing northwest, July 20, 2022.

***Recorded by** S. Skow & D. Baza *Date July 20, 2022
☒ Continuation ☐ Update

Photograph 10: Downstream view of San Luis Drain trapezoidal crossing at M.P. 125.59; camera facing north, July 20, 2022.

Photograph 11: Downstream view of San Luis Drain stainless steel safety ladder (partially obscured by erosion from the embankment); camera facing northwest, July 20, 2022.

Photograph 12: Upstream view of San Luis Drain, with non-original inlet pipe; camera facing southeast, July 20, 2022.

***Resource Name or #** (Assigned by recorder): San Luis Drain

***Recorded by**: S. Skow and D. Baza

***Date**: July 20, 2022

L1. Historic and/or Common Name: San Luis Drain

L2a. Portion Described: ☐ Entire Resource ☐ Segment ☒ Point Observation **Designation**: SLD-3 (M.P. 129.07)

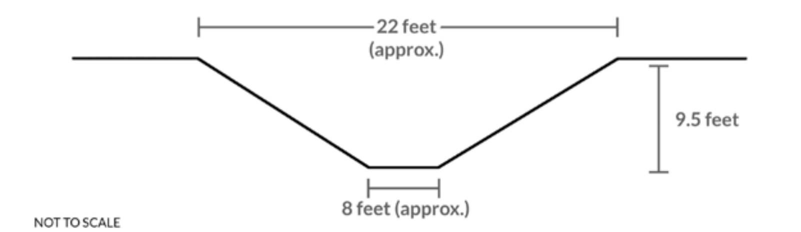
***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) This point of San Luis Drain is located at the intersection of Marie Street and West Belmont Avenue in the city of Mendota. UTM: Zone 10S, 734852.23mE / 4070263.39mN

L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)
At this recorded point, San Luis Drain contains a concrete check structure where the canal crosses beneath Marie Street, West Belmont Avenue, and the UPRR tracks in a concrete siphon with concrete wingwalls (**Photograph 13** and **Photograph 14**). Comprising a concrete deck with metal handrails, the check structure is separated from the public thoroughfare by chain-link fencing. The concrete-lined, trapezoidal drainage canal has an elevated right bank and a lower left bank, both with 1 ½: 1 slope. Vegetative overgrowth is prominent throughout several sections of the canal bed. Parallel dirt and gravel O&M roads extend along the levee crests on both sides of the drain.

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 22 feet (approx.)
- **b. Bottom Width**: 8 feet
- **c. Height or Depth**: 9.5 feet
- **d. Length of Segment**: n/a

L4e. Sketch of Cross-Section (not to scale) **Facing**: South



L5. Associated Resources: San Luis Unit canals and water control features

L8a. Photograph, Map, or Drawing.

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
This resource is located in an industrial section of the small city of Mendota in rural Fresno County. The terrain is generally flat.

L7. Integrity Considerations: None.

L8b. Description of Photo, Map, or Drawing:
Photograph 13: Downstream view of San Luis Drain from north side of Marie Street; camera facing north, July 20, 2022.

L9. Remarks:

L10. Form prepared by:
Samuel Skow
JRP Historical Consulting, LLC
2850 Spafford St., Davis, CA 95618

L11. Date: July 20, 2022

Photograph:

Photograph 14: Upstream view of San Luis Drain from south side of West Belmont Avenue, with Check Structure 42 (M.P. 129.07); camera facing south, July 20, 2022.

P2b. Location (continued):

USGS 7.5' QUAD	DATE	TOWNSHIP / RANGE	SECTION(S)	BASE MERIDIAN
Firebaugh	2021	T12S / R13E	29 and 32	Mount Diablo
		T13S / R13E	3, 4, 10, 11, 13, 14, and 24	
Mendota	2021	T13S / R15E	31	
Tranquility	2021	T14S / R15E	6	

B9b. Builders (continued):

Builder	Canal Segment(s)	Completion Date	Description of Work
Oscar C. Holmes, Inc., and Holmes-Clair, Inc.	Various	1970	Construction of pipe portions of canal crossings (DC-6681)
Gordon H. Ball, Inc.	M.P. 78.64 – 104.05 and Kesterson Reservoir	Pre-1973	Earthwork, concrete lining, and structures and Kesterson Reservoir first stage (DC-6823)
Carl W. Olson & Sons Co.	M.P. 104.05 – 119.33	1970	Earthwork, concrete lining and structures (DC-6703)
Ball, Ball & Brosamer Co.	M.P. 119.33 – 137.77	1973	Earthwork, concrete lining and structures (DC-6948)

Builder	Canal Segment(s)	Completion Date	Description of Work
Darkenwald Construction Co., Inc.	(about) M.P. 131.00 – 137.5	Pre-1973	Earthwork and structures (DC-6611)
Ball, Ball & Brosamer Co.	M.P. 137.77 – 163.47	1973	Earthwork, concrete lining and structures (DC-6958)

B10. Significance (continued):

Historic Context

The San Luis Drain recorded on this form was constructed in sections between 1969 and 1973 as part of the San Luis Unit addition to the Central Valley Project, which expanded the federal water-distribution network to irrigators in the western San Joaquin Valley. The following provides a broad historical overview of the San Luis Unit, chronicles the development of the San Luis Drain, and discusses the significance and lasting impact of the Kesterson Reservoir ecological disaster in the early to mid-1980s. For a discussion of the original Central Valley Project, see the DPR 523 form set prepared for the Delta-Mendota Canal appended to the report cited in *P11.

Central Valley Project – San Luis Unit

The San Luis Drain was constructed as a critical element of the San Luis Unit, a joint state-federal expansion of the Central Valley Project (CVP) to distribute irrigation water to farmers on the west side of the San Joaquin Valley in the 1960s.

As compared to the east side of the valley, agricultural development arrived comparably late to the arid west side of Merced, Fresno, and Kings counties. Through the turn of the twentieth century, the regional economy revolved around ranching—primarily sheepherding—with an economic boom period of oil and coal strikes, which attracted railroads and light municipal development to the area. Irrigation efforts were modest during this period, with farmers digging small canals from the San Joaquin River and repurposing abandoned mining ditches. But, beginning in the 1910s, an influx of local farmers, aided by advances in turbine pump technology, began to extract increasing quantities of high-quality groundwater, converting acres of former pasturage to irrigable lands and progressively pushing ranchers west into the Coast Range foothills. By 1922, 33,000 acres had been irrigated, and by 1948, following the introduction of cotton, hay, grain, alfalfa, and sugar beet crops to the region and boosted by wartime demand, that total had exponentially increased to 484,000 acres. At this time, regional irrigation farmers primarily discharged drainage wastewater into the San Joaquin River and/or its tributaries. However, this growing dependence on underground water resources severely depleted the groundwater table, leading to a 10-foot-per-year drop in the 1930s, with farmers drilling wells as deep as 2,000 feet below the surface. By the early 1950s, the aquifer overdraft reached 500,000 acre-feet per year, an increase from 100,000 annual acre-feet in 1929. In 1942, in response to the growing threat of water scarcity, landowners in western Fresno and Kings counties—among whom several owned over 1,000 acres each in the San Joaquin Valley—established the Westside Landowners Association and began petitioning the US Bureau of Reclamation (Reclamation) to divert surface water from the CVP to the west side of the valley. In response, Reclamation determined that water resources at existing facilities at Shasta Dam on the Sacramento River and Friant Dam on the San Joaquin River would be insufficient to meet the permanent needs of westside farmers and that the CVP would require expansion to meet this growing demand.[1]

To raise political support for transferring water resources to the western San Joaquin Valley, the Westside Landowners Association was reorganized in 1952 as the Westlands Water District (WWD). The new irrigation district was comprised of various incorporated interests—including the Southern Pacific Railroad Company, Standard Oil, and the J. G. Boswell Company, one of the largest agricultural entities in the world—with a service area stretching almost 70 miles between Mendota in Fresno County to Kettleman City in Kings County encompassing 399,000 acres, which was ultimately expanded to 600,000

[1] Robert Autobee, "San Luis Unit, West San Joaquin Division, Central Valley Project" (Denver, Colorado: Bureau of Reclamation History Program, unpublished manuscript, 1995), 5-7, available at https://www.usbr.gov/projects/pdf.php?id=109 (accessed July 2022); Philip Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley* (Berkeley: University of California Press, 2011), 200-202.

acres in 1965 following a merger with the Westplains Water Storage District. In 1955, Reclamation released a feasibility study for delivering water to the westside, which it named the "San Luis Unit," and detailed an elaborate expansion of the existing CVP, whereby surplus water from the Sacramento-San Joaquin Delta would be delivered south via the Delta-Mendota Canal and pumped into a new storage reservoir: the San Luis Reservoir, with a one-million-acre-foot storage capacity, to be located in the inner Coast Range foothills roughly due west from Los Banos in Merced County. The study likewise identified the need for drainage facilities, as the west side experienced poor drainage conditions resulting from the impermeable Corcoran clay layer. To meet increased drainage needs attendant with the expansion of the water-delivery system, Reclamation envisioned an intricate system of underground drains for roughly 96,000 acres of the San Luis service area that would drain saline subsurface groundwater away from low-lying croplands into an open surface interceptor drain (that became the San Luis Drain, recorded on this form), which would convey the water north for release into the Sacramento-San Joaquin Delta. During this same period, the California Department of Water Resources (DWR) produced the California Water Plan as part of the State Water Project (SWP). The water plan included the Feather River Project, which proposed erecting the Oroville Dam on the Feather River; developing a statewide aqueduct system to convey water to the San Francisco Bay Area, the west side of the San Joaquin Valley, and south to Southern California; and constructing a storage reservoir at the San Luis site. In addition to conflict between state and federal authorities concerning their overlapping systems, opposition to the westside expansion of the CVP arose from other contingents as well, namely: groups that argued that the project would serve an area dominated by large landowners in defiance of the 1902 Reclamation Act, which stipulated a 160-acre limit on all lands served by federal irrigation; and water agencies located downstream from the San Luis Unit's service areathat would receive the west side's drainage flows. Following years of negotiations, which included an explicit 160-acre limitation for all lands served by the San Luis Unit along with the inclusion of a drainage provision for affected water agencies, the U.S. Congress passed and U.S. President Dwight Eisenhower signed into law the San Luis Act in 1960, which authorized the annual export of about 1.25 million acre-feet of water to the western San Joaquin Valley to irrigate approximately 500,000 acres in Merced, Fresno, and Kings counties. The act likewise provided for the return of said irrigation water to the Sacramento-San Joaquin Delta as drainage wastewater via proposed interceptor drain (ultimately constructed as the drain recorded on this form).[2]

In 1961, Reclamation and the State of California, which had authorized the SWP with the passage of the Burns-Porter Act of 1959 and narrowly passed bond measures to fund its construction in November 1960, officially resolved the overlapping areas of the CVP and SWP by entering into an agreement to jointly operate the San Luis Unit (**Figure 1**). Reclamation would construct and DWR would operate and maintain the San Luis Dam and Reservoir, now to be enlarged to over two million acre-feet—the largest off-stream reservoir in the United States—to accommodate both projects. In 1963, Morrison-Knudsen Company, Inc., Utah Construction and Mining Company, and Brown and Root, Inc. won the joint contract to build the dam and reservoir, which they completed in August 1967. Transporting SWP water from the Sacramento-San Joaquin Delta to the reservoir, the California Aqueduct would be known as the San Luis Canal where it delivered federal water to the San Luis Unit service area between the reservoir and Kettleman City, south of which it would resume its SWP designation and function: to supply irrigation water to farmers in Kings and Kern counties and in Southern California. Under Reclamation in the San Luis Unit, the San Luis Canal was constructed in five reaches between 1963 and 1968, when water released near Los Banos was finally received in Kettleman City. The San Luis facilities continue to serve the SWP and CVP, and presently comprise of the Governor Edmund G. Brown California Aqueduct / San Luis Canal; B. F. Sisk San Luis Dam; San Luis Reservoir; O'Neill Forebay and Dam, where CVP water from the Delta-Mendota Canal is impounded for distribution; the William R. Gianelli Pumping-Generating Plant, which pumps water from O'Neill Forebay into San Luis Reservoir for distribution via the San Luis Canal; the Dos Amigos Pumping Plant, a secondary pumping facility on the San Luis Canal; and the Los Banos and Little Panoche detention dams and reservoirs, which provide flood protection for the San Luis Canal, Delta-Mendota Canal, and various populated areas. Federal-only facilities include the O'Neill Pumping Plant and Intake Canal; Coalinga Canal, a distribution structure erected to sustain the local mining industry, encourage local agriculture, and provide clean drinking water to the city of Coalinga; Pleasant Valley Pumping Plant, which pumps CVP water into the Coalinga Canal; and the San Luis

[2] Autobee, "San Luis Unit," 7; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 202-205; U.S. Bureau of Reclamation (Reclamation), "San Luis Unit, Central Valley Project, California: A Report on the Feasibility of Water Supply Development" (Sacramento, California: Reclamation Region 2, 1955); Philip Garone, "The Tragedy at Kesterson Reservoir: A Case Study in Environmental History and a Lesson in Ecological Complexity," *Environs* 22, no. 2 (Spring 1999): 114-15.

Drain, discussed below.[3]

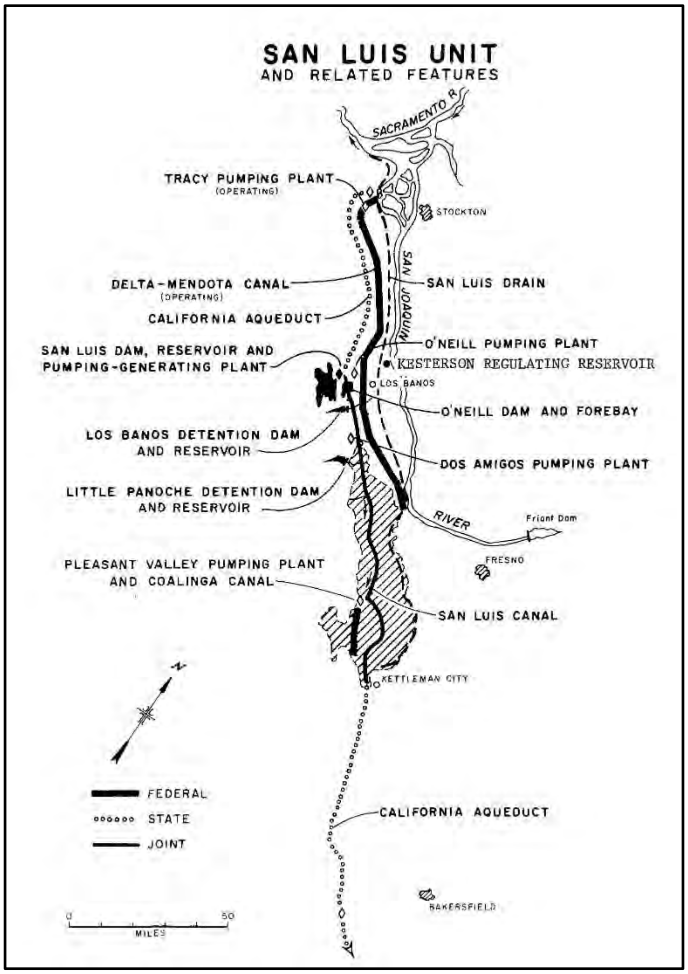


Figure 1: Map of "San Luis Unit and Related Features," ca. 1972.[4]

San Luis Drain

While construction forged ahead on the water storage and distribution elements of the joint state-federal San Luis Unit, the development of drainage facilities lagged. According to the San Luis Act of 1960, drainage infrastructure would either be built by DWR as a "master drain" for the entire San Joaquin Valley or by Reclamation as a smaller interceptor drain for those lands in the San Luis service area. Initially opting out of constructing the master drain, DWR reversed its position in 1964, proposing an approximately 280-mile, concrete-lined structure to extend north from Bakersfield in Kern County to a discharge point near the city of Antioch in Contra Costa County in the Sacramento-San Joaquin Delta, thereby serving the entire western San Joaquin Valley. Construction was stalled, however, when the Contra Costa County Water Agency objected to the plan because it would discharge nitrogen-rich saline drainage that may also contain pesticide residues into its freshwater resources. State and federal officials drafted several alternatives to the Antioch outfall, which included diluting discharge flows in natural streams like the San Joaquin River and Salt Slough or storing drainage in evaporation ponds. Reclamation and other supporters

[3] Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 208-209; Autobee, "San Luis Unit," 9, 14-17; California Department of Water Resources, "San Luis," 2022, https://water.ca.gov/Programs/State-Water-Project/SWP-Facilities/San-Luis (accessed August 2022).

[4] U.S. Bureau of Reclamation, "San Luis Unit and Related Features" (March 1972), dwg. no. 805-208-1947, reprinted in W. Turrentine Jackson and Alan M. Paterson, "The Sacramento-San Joaquin Delta: The Evolution and Implementation of Water Policy, an Historical Perspective" (Davis: California Water Resources Center, University of California, Davis, Contribution No. 163, June 1977), 137.

of the drain in the San Joaquin Valley did not accept these alternatives, however, because they failed to remove salt from the region, or they continued to utilize the San Joaquin River as a drain. Meanwhile, opposition to the Antioch outfall spread throughout the San Francisco Bay / Sacramento-San Joaquin Delta region, where congressional representatives called for investigations into the drain's pollution potential. In response, in early 1965 U.S. President Lyndon Johnson removed the San Luis Drain from the federal budget while requesting a $300,000 appropriation to fund an environmental investigation into a joint state-federal master drain by the U.S. Public Health Service. Two years later, the Federal Water Pollution Control Administration, subsequently tasked with the investigation, issued a comprehensive report that conditionally endorsed the drain, identifying fertilizer-derived nitrogen as the most dangerous pollutant and discounting subsurface drainage as a source of toxic pesticide residue. While nitrogen treatment and removal studies continued, the report advised partial construction of the San Luis Drain to enable drainage storage, which continued to threaten groundwater resources and agricultural output. In 1967, following the election of Ronald Reagan as California governor, DWR again reversed its position on the drain, finding no political support among San Joaquin Valley farmers for repayment rates at $18 per acre-foot and lacking even 25 percent of the upfront capital drainage construction costs. Responsibility for maintaining compliance with the San Luis Act of 1960 was retained by Reclamation alone, which was then being sued by the Central California Irrigation District for failing to provide drainage in accordance with the act; meanwhile, water deliveries were slated to begin as early as 1968.[5]

Following DWR's abandonment of the regionwide master drain, Reclamation set about designing and constructing an interceptor drain, initially conceived as a 188-mile structure to serve the area between Kettleman City in Kings County to the south and an undetermined discharge point in the Sacramento-San Joaquin Delta to the north. Until a final outfall location was made available, the drain was to empty into Kesterson Reservoir— a proposed complex of 12 interim storage ponds outside of Gustine in Merced County used to store and partially evaporate drainage flows (discussed below). This drainage network was to be developed alongside a drainage collection system constructed by Reclamation for the WWD, which would be comprised of underground concrete pipelines that gathered irrigation drainage from buried drainage pipes installed on private farms. In 1968, Reclamation began SLD's first phase of construction between Tranquility in Fresno County and Kesterson Reservoir. That March, the Sacramento-based Darkenwald Construction Company, Inc. won the first contract for a seven-mile stretch of drain excavation along with 11 irrigation crossings, five road crossings, and two encasement pipes between Highway 180 and Adams Avenue in Fresno County (south of the study area). That October, Menlo Park-based firms, Oscar C. Holmes, Inc. and Holmes-Clair, Inc., won the joint contract to construct precast concrete pipe portions of siphons below the Laguna, Main, Outside, and Bass Avenue / Intake canals, and—in the study area described above—the Delta-Mendota Canal (M.P. 121.50). In January 1969, San Mateo-based contracting company, Carl W. Olson & Sons, Inc., was awarded the contract to construct roughly 15 miles of earthwork, concrete lining, and structures between Dos Palos in Merced County and Firebaugh—including Check 37 recorded herein (M.P. 119.31). Work was slated to begin that April and involved a unique construction method to accommodate for the groundwater level located above the drain floor.[6] As explained by journalist Joe Thome, "Although several excavation techniques were tried and varying ones are being used, the best method has proven to be a sled system developed and built right on the job. It is called a 'pre-trimmer [(**Figure 2**)].'" Thome continues:

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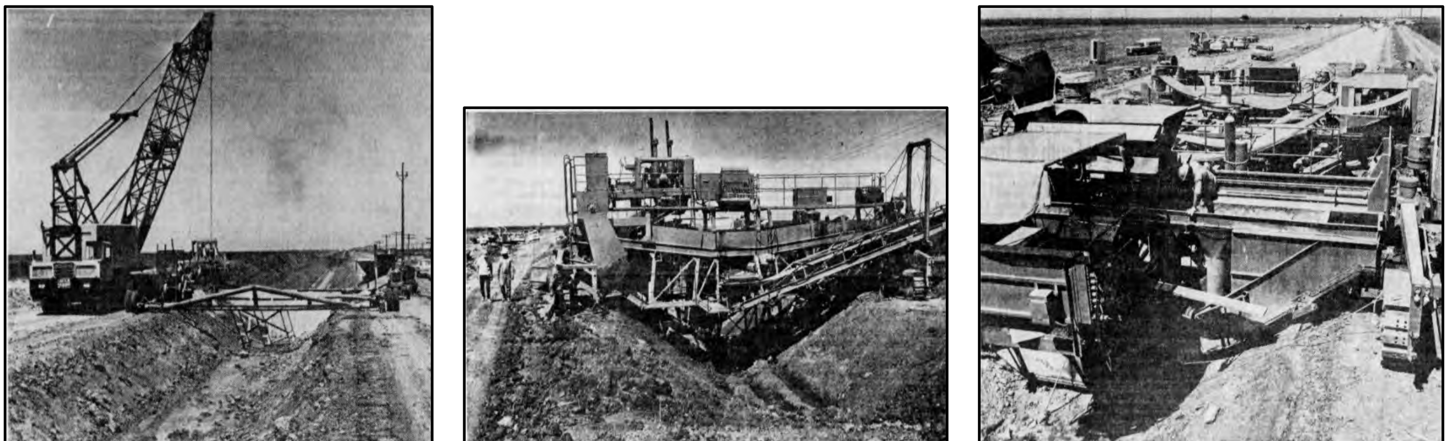
[5] Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 209-212; Jackson and Paterson, "The Sacramento-San Joaquin Delta," 139-143.

[6] Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 210; Jackson and Paterson, "The Sacramento-San Joaquin Delta," 144; "Major Recent Contract Awards," *Reclamation Era* 54, no. 2 (May 1968): 54; U.S. Bureau of Reclamation, "San Luis Unit, Central Valley Project: Plan for Disposal of Subsurface Agricultural Drainage" (Sacramento, California: USBR Region 2, June 1969), 17-21, on file at USBR Library, Sacramento, California; U.S. Bureau of Reclamation, Office of Design and Construction, "Designers' Operating Criteria: San Luis Drain, San Luis Unit, West San Joaquin Division, Central Valley Project, California" (Denver, Colorado: USBR, January 1975), 4; Memo Re: Field Inspection for Transfer from Construction to O&M Status for: Stage 1 Kesterson Reservoir and the Three Completed Reaches of the San Luis Drain—Specification Nos. DC-6611, DC-6681, DC-6703, DC-6823—San Luis Unit, CVP, California (December 17, 1973), ff. San Luis Drain (Spec. No. DC-6611), on file at USBR Library, Sacramento, California; "Major Recent Contract Awards," *Reclamation Era* 55, no. 1 (February 1969): n.p.; "Bureau Awards Contract for San Luis Drain," *The Fresno Bee* (January 17, 1969): 12A; "Reservoir Job Contract Due Danville Firm," *Salinas Californian* (March 7, 1969): 13; "Work on First Section of San Luis Drain Begins," *The Modesto Bee* (April 6, 1969): C4.

> The 'pre-trimmer' is pulled along the drain alignment as it excavates the drain to within six inches of the final cut. It also simultaneously excavates three trenches, each 14 inches wide, extending below the rough cut [sic] drain bottom. The center trench, extending about 30 inches below the drain bottom, is used by the contractor to 'de-water' the immediate drain route to allow further excavation and placing of the lining. The two trenches, which run along each edge of the eight-foot wide [sic] bottom, will function to collect and hold water and keep it from lifting the lining out of the ground. In the center trench the contractor lays a 4-inch perforated plastic pipe, which is covered with gravel, and ground water is pumped out at points 1,000 feet apart. The outer trenches, similarly built but only 15 inches deep, will be connected to the canal portion by weep valves, spaced 10 feet apart. This will allow water to seep into the canal through these valves, when it builds up in the trench, and will thus relieve uplift pressure which could 'float' the concrete lining. The action of the valve will, however, prevent drain water from going from the drain canal back into the trench.[7]



SHAPING THE ROUGH cut of the drain, the pretrimmer utilizes a sled system to excavate it to within six inches of the final cut.

A BUCKET TRIMMER excavates the drain within one inch of the grade prior to paving work on 15 miles of the ditch which runs from South Dos Palos to Firebaugh, the first construction on the project.

THE FINAL STEP—A huge paving train moves along a stretch of the San Luis Drain south of South Dos Palos, laying a concrete V which will carry off brackish irrigation water.

Bee Photos

Figure 2: Published photographs of San Luis Drain construction between Dos Palos and Firebaugh, 1969.[8]

Progress on the construction of San Luis Drain, however, was stalled by budget cuts. In April 1969, U.S. President Richard Nixon slashed $2 million from the San Luis Drain budget (among other cuts to the CVP), pushing the timeline back one year, with Carl Olson & Sons (discussed above) completing construction of their section in January 1970. That July, Gordon H. Ball, Inc., based in Danville, Contra Costa County, won the contract for the northernmost 26-mile stretch of earthwork, concrete lining, and structures between Gustine and Dos Palos, along with the 1,283-acre, 12-pond, Kesterson Reservoir, all outside the study area. As mentioned, while the drain's discharge point in the Delta was debated, Kesterson continued to function as a drainage detention and evaporation facility.[9] Aided by advanced technology, Ball reportedly streamlined the canal excavation method employed by Carl Olson & Sons, Inc. (described above), as reported in *Construction Methods & Equipment*, "By mounting a specially-designed digging unit on a canal trimmer, [Gordon H. Ball, Inc.] gained a one-pass machine that simultaneously excavates canal finger drains, trims slopes and bottom, lays continuous plastic pipe, backfills, and screeds drains level with the slopes. Any area passed over by the machine is immediately ready for concreting."[10] In June 1972, Ball, Ball & Brosamer of Danville won construction contracts for an approximately 18-mile stretch of earthwork, concrete lining, and structures comprising the bulk of the study area (M.P. 119.33 – 137.77), along with the southernmost segment terminating at Five Points, outside the study area. For much of the segment in the study area, Reclamation adapted a preexisting earth-lined drainage canal originally dug by the Firebaugh Canal Company around the same time that the Delta-

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[7] Joe Thome, "San Luis Drain Paving Begins Near South Dos Palos," *The Modesto Bee* (August 18, 1969): B2.
[8] Bee Photos, published in Thome, "San Luis Drain Paving Begins Near South Dos Palos."
[9] Memo Re: Field Inspection for Transfer from Construction to O&M Status for: Stage 1 Kesterson Reservoir and the Three Completed Reaches of the San Luis Drain—Specification Nos. DC-6611, DC-6681, DC-6703, DC-6823—San Luis Unit, CVP, California (December 17, 1973), ff. San Luis Drain (Spec. No. DC-6611), on file at USBR Library, Sacramento, California; Michael Green, "Budget Cut Costs CVP $11.7 Million," *The Modesto Bee* (April 16, 1969): A2; "San Luis Drain May be Finished in 6 or 7 Years," *The Fresno Bee* (April 4, 1970): 6B; "San Luis Drain is Year Ahead," *The Modesto Bee* (October 1, 1970): C1.
[10] David C. Etheridge, "Hybrid Rig is Versatile Canal Builder," *Construction Methods & Equipment* (October 1972): 61.

Mendota Canal was built, rerouting the earth-lined drain (Drain U-121.2, recorded and evaluated on a separate DPR 523 form attached to the report cited in *P11) immediately adjacent to the San Luis Drain segment (**Figure 3**). Ball, Ball & Brosamer completed all work the following year, when construction on the San Luis Drain was halted altogether (**Figure 4**).[11]

Figure 3: Excerpt of 1957 aerial photograph, with Firebaugh Canal Company drain (indicated by arrows) in same alignment as San Luis Drain, adjacent to Delta Mendota Canal.[12]

[11] Memo Re: Field Inspection for Transfer from Construction to O&M Status for: Stage 1 Kesterson Reservoir and the Three Completed Reaches of the San Luis Drain—Specification Nos. DC-6611, DC-6681, DC-6703, DC-6823—San Luis Unit, CVP, California (December 17, 1973), ff. San Luis Drain (Spec. No. DC-6611), on file at USBR Library, Sacramento, California; Michael Green, "Budget Cut Costs CVP $11.7 Million," *The Modesto Bee* (April 16, 1969): A2; "San Luis Drain May be Finished in 6 or 7 Years," *The Fresno Bee* (April 4, 1970): 6B; Declaration of Taking, United States of America vs. Redfern Ranches, No. F-232, October 4, 1968, 5629 O.R. 444, Fresno County Recorder, Fresno, California; Aero Exploration Co., Flight ABI, Frame ABI-18G-51, February 13, 1950, 1:20,000, flown for U.S. Department of Agriculture (USDA) – Production and Marketing, available at http://malt.lib.csufresno.edu/MALT/ (accessed July 2022); Cartwright and Company, Flight ABI-1957, Frame ABI-29T-138, June 22, 1957, 1:20,000, flown for USDA – Commodity Stabilization Service, available at https://mil.library.ucsb.edu/ap_indexes/FrameFinder/ (UCSB; accessed July 2022); "San Luis Drain Takes Shape in Fresno County," *The Fresno Bee* (September 16, 1973): C1.

[12] Cartwright and Company, Frame ABI-29T-138, 1957, UCSB.

Figure 4: Archival photograph of Ball, Ball & Brosamer constructing outlet transition at UPRR / SR 33 siphon undercrossing, September 20, 1973. San Luis Drain indicated by arrows. Note Delta-Mendota Canal next to the SLD in the middle ground.[13]

Collectively, Gordon H. Ball, Inc., and Ball, Ball & Brosamer constructed 69.51 miles of the extant San Luis Drain, nearly 80 percent of the completed structure, along with the Kesterson Reservoir evaporation ponds. Hailing from a contracting family, Gordon H. Ball began his career working for his father, N. M. Ball, an early proponent of underground concrete irrigation construction who branched out into highway building in the 1920s. Following his father's death in 1935, Gordon Ball partnered with his two brothers forming N. M. Ball Sons, which took on numerous military projects during World War II, including 200 miles of roads for the Hanford Atomic Energy Plant in Hanford, Washington. In the early 1950s, Gordon split off from his brothers, ultimately incorporating as Gordon H. Ball, Inc., in 1957, and was active throughout California, Oregon, Washington, and Hawaii, specializing in concrete paving, as well as highway and bridge construction. In addition to the company's work on the San Luis Drain and Kesterson Reservoir, other CVP work included the Tehama-Colusa Canal and preliminary work for the proposed but never built Auburn Dam (the contract for which issued to Auburn Constructors, a joint venture between Gordon H. Ball, Inc., Guy F. Atkinson Company, and the Arundel Corporation). By 1975, the company had been purchased and operated as a subsidiary of Dillingham Corporation. Some later projects included: the Woodburn-Hayesville Interchange on Interstate 5 between Salem and Portland, Oregon; the Stapleton International Airport runway in Denver, Colorado; runways at Mather and McLellan air force bases in Sacramento; a cofferdam and forebay for a powerhouse at Grand Coulee Dam in Washington; a subway tunnel for the Washington Metropolitan Area Transit Authority (jointly built with the J. F. Shea Company, Inc., and Norair Engineering); and numerous sections of highway throughout California and Oregon, including

[13] F. A. Shrader, Photograph No. CN805-243-9106NA: San Luis Drain, San Luis Unit, Bureau of Reclamation, Central Valley Project, California (August 20, 1973), available at U.S. Bureau of Reclamation, California-Great Basin Digital Library, https://usbr.contentdm.oclc.org/digital/collection/p15911coll7/id/3074/rec/7 (accessed August 2022).

California State Route 99 in Bakersfield, and Interstate 5 north of Los Angeles.[14] Ball, Ball & Brosamer was formed as joint venture between Gordon H. Ball's two sons, Gordon N. Ball and Dennis W. Ball, and Robert G. Brosamer. In addition to its work on the San Luis Drain, other CVP work includes rehabilitation of a portion of the Friant-Kern Canal, with other works for Reclamation including installation of the Gallegos Canyon Siphons as part of the Navajo Indian Irrigation Project in New Mexico and the Sonoqui Dike in Arizona. As with Gordon H. Ball, Inc., Ball, Ball & Brosamer was most actively involved in heavy highway construction. Gordon N. Ball went on to form Gordon N. Ball, Inc., and Robert Brosamer formed R & L Brosamer, Inc, both active firms based in the San Francisco Bay Area.[15]

The San Luis Drain was ultimately built out to about half of its proposed alignment, extending from a point near Five Points in Fresno County north to Kesterson Reservoir, when construction was halted in 1973 (**Figure 5**). Construction of the southernmost 29 miles of canal between Five Points and Kettleman City was impeded by a federal spending freeze that year and funding was never reinstated for its completion. The northernmost 75 miles between Kesterson Reservoir and the proposed Delta discharge outfall faced mounting opposition, not only from environmentalists in the San Francisco Bay Area, who claimed that nitrate-rich drainage water would cause algal blooms and compromise regional ecology, but also over half of all landowners along the proposed canal route between Kesterson and Antioch, most of whom saw the open canal as a loss to their property for the benefit of farmers further south. As a result, the San Luis Drain remained unfinished, and the 12 evaporation ponds at Kesterson Reservoir functioned as the ultimate discharge terminus through 1986, when use of the reservoir and drain was ultimately discontinued following the ecological disaster at Kesterson, discussed below.[16]

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14 "Small Staff Takes on Big Highway Program," *Contractors and Engineers* (January 1965): 35; "Major Recent Contract Awards," *Reclamation Era* 58, no. 2 (May 1972): 33; "Scrapers are Modified to Haul 26-yd Payloads," *Construction Methods & Equipment* 43, no. 9 (September 1961): 86; "Slip-form Machine Paves Three Lanes in One Pass," *Contractors and Engineers* 60, no. 7 (July 1963): 64; "80-ton Bottom-dump Trains Clock Million Yards Monthly," *Roads and Streets* 112, no. 8 (August 1969): 40; "How Ball Handles Maintenance on Oregon's Biggest Highway Job," *Western Construction* 50, no. 10 (October 1975): 24; "Slipform Lanes 50 Feet Wide and 18 Inches Deep," *Western Construction* 50, no. 12 (December 1975): 26; "Aggregate Base and CTB Mixed in Pugmill Plant," *Contractors and Engineers Magazine* 69, no. 5 (May 1972): 16; "Auburn Dam," *Compressed Air Magazine* 80, no. 11 (November 1975): 18; "Blaw-Knox Road and Airport Duo-forms Speed Air Base Paving," *Construction Methods & Equipment* 41, no. 5 (May 1959): 241; "Loaders, Trucks, and Scrapers Move Million Yards a Month," *Contractors & Engineers Magazine* 67, no. 11 (November 1970): 11; "Subway Contractors Overcome Poor Soil Conditions," *Contractors & Engineers Magazine* 68, no. 1 (January 1971): 18;

15 "Irrigation Trickles," *Irrigation Journal* 27, no. 3 (May-June 1977): 34; "Contractors," *Western Construction* 50, no. 7 (July 1975): 127; U.S. Department of Interior, *Decisions of the United States Department of the Interior Vol. 93, January-December 1986* (Washington, D.C.: U.S. Government Printing Office, 1987), 144; "County Repays FAA $480,000 for False Billing," Los Angeles Times (June 29, 2000): B1; "Gordon N. Ball, Inc.," NewBayBridge.org, n.d. https://www.newbaybridge.org/the_builders/gordon_ball/ (accessed August 2022); "Featured Projects," Gordon N. Ball Inc., 2017, http://ballconco.com/featured-projects/ (accessed August 2022); Robert L. "Bob" Brosamer, "Message from Bob Brosamer," R & L. Brosamer, Inc. [newsletter] (Spring 2001): 2, available at https://www.thenewsletterguy.com/samples/CustomerNewsletters/RLBrosamer.pdf (accessed August 2022).

16 Jackson and Paterson, "The Sacramento-San Joaquin Delta," 144; William Schiffman, "San Luis Project is Dwindling," Merced *Sun-Star* (October 29, 1973): 2; "Landowners Oppose San Luis Interceptor Drain as Proposed," Newman *Index* (December 14, 1972): 8.

***Resource Name or #** (Assigned by recorder) San Luis Drain

***Recorded by** S. Skow & D. Baza *Date July 20, 2022 ☒ Continuation ☐ Update

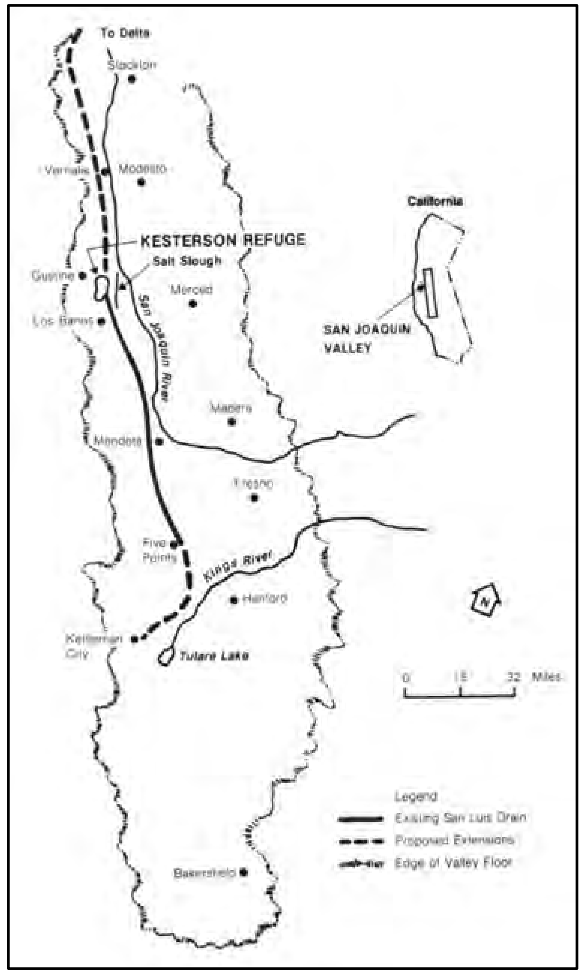

Figure 5: Location of the completed San Luis Drain, from Five Points to Kesterson Reservoir, with proposed segments at north and south ends, no date.[17]

Ecological Disaster at Kesterson Reservoir[18]

As discussed above, the ultimate build-out of the San Luis drainage system terminated at Kesterson Reservoir, a roughly 1,283-acre complex of 12, roughly 100-acre evaporation and seepage ponds separated by earthen berms with a combined storage capacity of 4,330 acre-feet (**Figure 6**). Completed in 1971, Kesterson Reservoir was contained within the larger Kesterson National Wildlife Management Area, created via joint agreement in 1970 between Reclamation and the U.S. Fish

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[17] U.S. Bureau of Reclamation, untitled map of San Luis Drain, no date, reprinted in Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 211.

[18] The following provides an overview of the ecological disaster at Kesterson Reservoir in the mid-1980s. For a detailed scholarly account, see: Philip Garone, "The Tragedy at Kesterson Reservoir: A Case Study in Environmental History and a Lesson in Ecological Complexity," *Environs* 22, no. 2 (Spring 1999): 107-144; and the expanded chapter, "Tragedy at Kesterson Reservoir" in Philip Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley* (Berkeley: University of California Press, 2011). For a journalistic account, see: Russell Clemings, *Mirage: The False Promise of Desert Agriculture* (San Francisco: Sierra Club Books, 1996); and Tom Harris, *Death in the Marsh* (Washington, D.C.: Island Press, 1991). Since the closure of the Kesterson Reservoir, Reclamation and recipients of CVP irrigation water in the western San Joaquin Valley have struggled with the issue of drainage up to the present. However, this study does not discuss this ongoing aspect of the history of the San Luis Drain. For more information on the evolution of Reclamation's drainage policies in the twenty-first century, see: Kathleen Nitta, "A Tale of Two Water Districts: The Future of Agriculture in California's San Joaquin Valley Lies in Compromise Over Drainage," *Golden Gate University Environmental Law Journal* 5, no. 2 (May 2012): 439-480; and Nigel W. T. Quinn, "Policy Innovation and Governance for Irrigation Sustainability in the Arid, Saline San Joaquin River Basin," *Sustainability* (2020), available at https://escholarship.org/uc/item/7dn0w5g2 (accessed July 2022).

and Wildlife Service (USFWS), which would manage the area as a wildlife refuge. Historically, the area contained within Kesterson had been used for cattle ranching and waterfowl hunting, a popular area among local duck clubs. With about half of the fall and winter marsh acreage comprised of seasonally flooded grasslands and other copious food sources, Kesterson was a key stopping point on the Pacific Flyway for migratory birds and other grazing animals. As a partial remediation for summer water scarcity, the Grasslands Water District, under contract with Reclamation, was to furnish several thousand acre-feet of water per year. At the same time, surface agricultural drainage water began flowing into the Kesterson Reservoir via the San Luis Drain in 1972—one year prior to the completion of construction of the reaches further south. Diluted with irrigation-quality water supplied by the Grasslands Water District, the discharge initially produced high-quality wetland habitat between 1972 and 1978, fostering breeding activities among various duck species that nested there in the spring. In 1975, Reclamation officially changed the status of Kesterson from a regulating reservoir to a terminal holding reservoir for storing and concentrating drainage water for release into the San Joaquin River during sufficiently high flows. Meanwhile, in compliance with the San Luis Act of 1960, Reclamation developed the WWD Drainage Collector System, comprised of a network of plastic drains lain six-to-eight feet below the ground surface, between 1976 and 1980. In 1978, for the first time, Reclamation began conveying subsurface irrigation drainage water to Kesterson Reservoir, and by 1981, virtually all the inflow that the SLD conveyed to Kesterson consisted of subsurface water, which contained higher concentrations of trace elements, saline, and other contaminants leached into the soil than surface drainage.[19]

For about a decade prior to the development of the San Luis drainage facilities, state and federal agencies had warned against reusing drainage water. As early as 1960, DWR had identified irrigated agricultural drainage as a key source of water quality degradation in the lower San Joaquin Valley, specifically regarding drainage waters in the Panoche Fan area of the WWD (located in the vicinity west of Firebaugh and Mendota) as "unusable for beneficial purposes" (**Figure 7**).[20] Four years later, DWR discovered selenium in water sampled from this area. As discussed below, selenium is the natural mineral trace element that later caused the ecological disaster at Kesterson Reservoir. In 1961, scientists with the U.S. Department of Agriculture reported on the high probability of selenium in alkali soils, such as those prevalent in the arid San Joaquin Valley. The USFWS warned Reclamation the following year about the risks of toxins bioaccumulating in various organisms exposed to agricultural drainage, as well as the potential harms posed to humans that consumed them. In 1963, the USFWS likewise warned that agricultural contaminants rendered irrigation drainage water unsuitable for wetlands habitat restoration. That same year, the agency further warned that impounded agricultural irrigation drainage water would likely contaminate groundwater, a warning reissued in 1977 by the California State Water Resources Control Board (SWRCB), which determined that the groundwater below Kesterson would ultimately be contaminated should the area continue to serve as the terminus of the San Luis Drain.[21]

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[19] Reclamation, "Designers' Operating Criteria: San Luis Drain," 7; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 212-213; S. M. Benson, M. Delamore, and S. Hoffman, "Kesterson Crisis: Sorting Out the Facts" (prepared for the U.S. Department of Energy under Contract Number DE-AC03-76SF00098, July 1990), 2; U.S. Department of the Interior, "Kesterson Reservoir Closure and Cleanup Plan: State Water Resources Control Board Order No. WQ 85-1 for Cleanup and Abatement of Kesterson Reservoir" (July 5, 1985), 2-3; Arnold Schultz, "Background and Recent History," in *Selenium and Agricultural Drainage: Implications for San Francisco Bay and the California Environment, Proceedings of the Second Selenium Symposium, March 23, 1985, Berkeley, California* (Berkeley, California: Bay Institute of San Francisco, 1986), 6.

[20] DWR, "Lower San Joaquin Valley Water Quality Investigation: Bulletin No. 89" (Sacramento: California Department of Water Resources, 1960), 95, qtd. in Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 215.

[21] H. W. Lakin, "Geochemistry of Selenium in Relation to Agriculture," in Selenium in Agriculture" (Washington, D.C.: U.S. Department of Agriculture, Agricultural Research Service, Agriculture Handbook No. 200, 1961), 12; S. B. Moore, "Fish and Wildlife Resources and Agricultural Drainage in the San Joaquin Valley, California: Vol. 1" (Sacramento: San Joaquin Valley Drainage Program, 1990), 3-6; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 215.

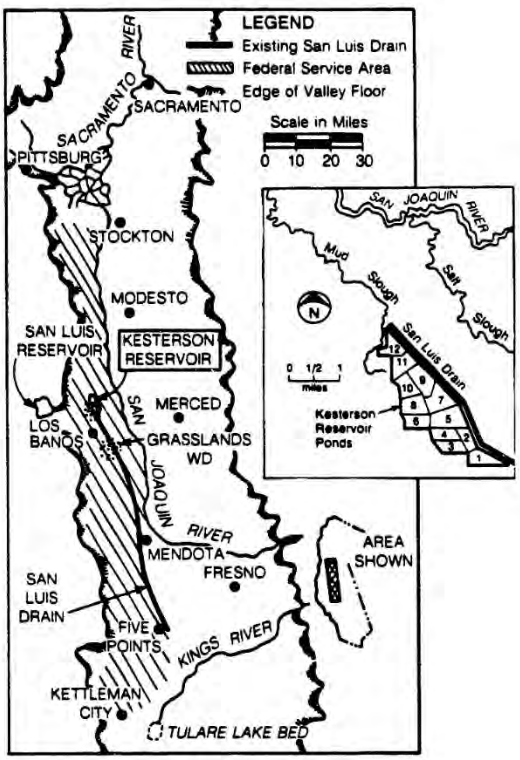

Figure 6: Location map of Kesterson Reservoir, Merced County, showing 12 evaporation ponds in inset, ca. 1990.[22]

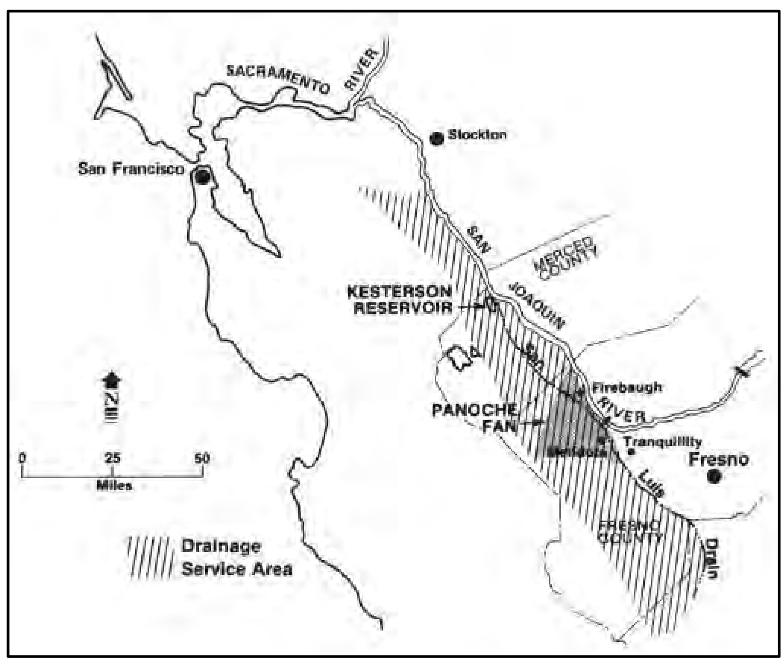

Figure 7: Map of San Luis drainage service area, showing Panoche Fan area—source of high quantities of selenium that contaminated Kesterson Reservoir.[23]

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[22] Benson, Delamore, and Hoffman, "Kesterson Crisis," 2.

[23] U.S. Bureau of Reclamation, untitled map of San Luis drainage service area, no date, reprinted in Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 207.

As various agencies had warned, discharging subsurface irrigation drainage via the SLD for indefinite storage in the wetland habitat at Kesterson had disastrous consequences. In 1982 following four years of receiving WWD wastewater in the SLD that was sent to Kesterson Reservoir, perennial cattails were dying off, algal blooms were present throughout the pond complex, the migratory bird population had decreased substantially, and all but one fish species—the mosquitofish—had completely died off. Scientists found the highest recorded selenium concentrations of any living fish among Kesterson mosquitofish. The following summer, USFWS biologists reported that roughly 10 percent of all nests among Kesterson's resident waterfowl breeding populations contained one or more chicks with various developmental deformities. Noting multiple similarities between these deformities and those reported among chicken populations in South Dakota raised on seleniferous soils in the 1930s, the USFWS issued a series of memoranda calling attention to the growing crisis at Kesterson and expressing concern over using agricultural wastewater for habitat management. Around this time, the USFWS closed the Kesterson wildlife refuge to the public and began a hazing program to ward off migrating waterfowl. The following year, scientists also found adult birds dead from selenium poisoning, with one final estimate of at least 1,000 migratory birds, including adults, chicks, and embryos having died of selenium toxicosis from bioaccumulation between 1983 and 1985; scientists have since come to refer to these symptoms of selenium poisoning as the "Kesterson Syndrome." In August 1983, U.S. Geological Survey (USGS) scientists conducted tests in the Kesterson collection ponds, the San Luis Drain, drainage effluents, and shallow groundwater, finding dangerous levels of selenium—140-1,400 micrograms per liter (µ/L), as opposed to that found in typical freshwater, 0.2-0.4 µ/L. Additional testing by the USGS found elevated levels of selenium throughout the WWD service area, from Los Banos to Kettleman City. In September, regional media picked up the Kesterson story and followed the unfolding saga for the next few years—the story even featured on CBS' *60 Minutes*, which fueled public outrage with graphic images of deformed birds and reports of bureaucratic negligence. In March 1984, adjoining landowners, discovering sick and deformed birds on their property, petitioned the Central Valley Regional Water Quality Control Board and ultimately, the SWRCB to take enforcement action against Reclamation.[24]

Compelled by state authorities, Reclamation finally addressed the crisis at Kesterson. Following two hearings in December 1984 and February 1985, and under the authority of the state Porter-Cologne Water Quality Control Act and the Toxic Pits Cleanup Act of 1984, the SWRCB issued Cleanup and Abatement Order No. WQ 85-1, which required the U.S. Department of Interior to resolve the problems at Kesterson and ordered Reclamation to submit a cleanup and abatement plan within five months. The following month, at a House Subcommittee on Water and Power Resources congressional hearing in Los Banos, the Department of Interior dramatically announced its decision to close Kesterson Reservoir and the San Luis Drain and to immediately cease all irrigation water deliveries to the WWD service area that drained into Kesterson for fear of violating the Migratory Bird Treaty Act. Shortly thereafter, Department of Interior amended this arrangement with WWD, which pledged to reduce the export of drainage wastewater by 20 percent every two months beginning in September 1985, plugging all subsurface drains by July 1986. In October 1986, Reclamation, in cooperation with the USFWS and the U.S. Army Corps of Engineers, submitted its environmental impact statement for the Kesterson cleanup project, which offered four solutions, ordered least to most expensive: a flexible response plan; an immobilization plan; a wetland restoration / onsite disposal plan; and an offsite disposal plan.[25] Reclamation proposed a phased approach, graduating from the flexible response plan to the onsite disposal plan as necessary. The SWRCB rejected the phased approach and ordered Reclamation to implement the onsite disposal plan, which called for the excavation, disposal, and replacement of the uppermost six-inch soil layer, including vegetation. However, subsequent studies showed that selenium had concentrated in shallow groundwater at comparable levels to the drainage ponds, indicating that their release into the wetland would render the ponds as toxic as before. Therefore, in July 1988 the SWRCB ordered Reclamation to fill all low-lying areas where ephemeral pools formed six inches above the

[24] Michael K. Saiki, "Concentrations of Selenium in Aquatic Food Chain Organisms and Fish Exposed to Agricultural Tile Drainage Water," in *Selenium and Agricultural Drainage: Implications for San Francisco Bay and the California Environment, Proceedings of the Second Selenium Symposium, March 23, 1985, Berkeley, California* (Berkeley, California: Bay Institute of San Francisco, 1986), 6; Theresa S. Presser and Ivan Barnes, "Selenium Content in Waters Tributary to and in the Vicinity of Kesterson NWR" (Menlo Park, California: U.S. Geological Survey, 1984), 16; Deborah Blum, "Mineral is Linked to Bird Deformities," *The Fresno Bee* (September 21, 1983): 1; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 217-231.
[25] U.S. Bureau of Reclamation, "Final Environmental Impact Statement, Kesterson Program, Merced and Fresno Counties, California" (Sacramento: U.S. Department of the Interior, Bureau of Reclamation, 1986).

expected seasonal groundwater level by January 1, 1989. By November 1988, Reclamation contractors had filled about 710 low-lying acres of the former reservoir with 1,050,437 cubic yards of imported earth, converting the former wetland to an upland habitat and attracting a variety of terrestrial bird species. By the early 1990s, selenium concentrations among plants and animals at Kesterson had stabilized.[26]

The Kesterson disaster fundamentally transformed scientific understanding of selenium-contaminated irrigation drainage, spurring advances in environmental research, wetlands preservation, and governmental policy. Prior to Kesterson, selenium contamination research was largely confined to problems at the individual farm scale, such as how the trace element contaminates crops and impairs livestock. However, following the demonstrated dangers of high selenium concentrations in irrigation drainage at Kesterson, environmental scientists better understood the problem to be an environmental protection issue at the watershed scale with major consequences for irrigation management throughout the western United States. California emerged (and remains) as a global center for selenium contamination research and environmental management. As early as 1985, government scientists began proactively testing for selenium concentrations throughout the Central Valley, with USFWS biologists detecting high rates of selenium poisoning among plants, insects, birds, and fish in the Tulare Basin. Around that same time, as part of the Department of Interior's National Irrigation Water Quality Program, scientists investigated all federal irrigation and drainage facilities for concentrated toxins, finding Kesterson-level rates of selenium toxicosis at five sites in the western United States. By the early 1990s, scientists had established firm links between human activity and high selenium concentrations, identifying sites of irrigated agriculture, mining, and fossil fuel refinement as areas of particular concern. Researchers likewise noted intensified rates of bioaccumulation and biomagnification in aquatic ecosystems, particularly wetland habitats like Kesterson, where selenite—one of the element's primary dissolved forms—was observed to readily concentrate in stagnant areas among various invertebrates and fish species before spreading up the food chain and throughout the ecosystem.[27]

In response to heightened awareness and a more refined understanding of aquatic selenium contamination, environmental managers in California and elsewhere developed new water quality regulations and environmental management strategies. In 1987, the U.S. Environmental Protection Agency (EPA) established new criteria for imposing maximum limits for selenium concentrations in freshwater and saltwater environments, based partly on observed laboratory results and partly on field studies—including those conducted at Kesterson Reservoir. These standards were made legally binding for 14 states, including California, with the promulgation of the 1992 Water Quality Standards. Noting excessive selenium concentrations in the area surrounding Kesterson, between 1988 and 1990 the California Legislature added 8,224 acres of grasslands watershed marshes, a section of the lower San Joaquin River downstream from subsurface drainage, Salt Slough, and Mud Slough to California's Clean Water Act section 303(d) list of impaired waters. In 1996, Reclamation and the San Luis & Delta-Mendota Water Authority developed the Grasslands Bypass Project to rectify this problem in accordance with total maximum daily load limits for selenium and best management practices introduced that same year by the Central Valley Regional Water Quality Control Board. The Grasslands Bypass Project incorporates the northernmost 28 miles of the San Luis Drain in Merced County to discharge drainage water into Mud Slough for release into the San Joaquin River. Discharges are closely and regularly monitored for selenium, salinity, boron, molybdenum and various nutrients by the USFWS, California EPA, the Central Valley Regional Water Quality Control Board, and California Department of Fish and Wildlife.[28] According to Reclamation, "Since

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[26] Garone, "The Tragedy at Kesterson Reservoir," 122-123; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 229.
[27] Matteo Francesco Kausch, "From Soil Aggregate to Watershed, from California's Central Valley to the Salton Sea – Agricultural Selenium Contamination Across Ecosystems, Scales, and Disciplines" (PhD. diss., University of California, Berkeley, Spring 2013), 9-13; Arnold Schultz, "Highlights Since Selenium II," in *Selenium and Agricultural Drainage: Implications for San Francisco Bay and the California Environment, Proceedings of the Third Selenium Symposium, March 15, 1986, Berkeley, California*, ed. Alice Q. Howard (Berkeley, California: Bay Institute of San Francisco, 1989), 5, 7; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 231-235.
[28] Kausch, "From Soil Aggregate to Watershed, from California's Central Valley to the Salton Sea," 9-13; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 231-235; U.S. Environmental Protection Agency, "Ambient Water Quality Criteria for Selenium – 1987" (EPA-440/5-87-006, September 1987), 25, available at https://www.epa.gov/sites/default/files/2019-03/documents/ambient-wqc-selenium-1987.pdf (accessed August 2022); U.S. EPA, "Section 319: Nonpoint Source Program Success Story

the implementation of the [Grasslands Bypass Project], all discharges of drainage water from the Grassland Drainage Area into wetlands and refuges have been eliminated. The Project has reduced the load of selenium discharged from the Grassland Drainage Area by 61 percent (from 9,600 lbs. to 3,000 lbs.).”[29] Perhaps most importantly, the disaster at Kesterson illustrated an urgent ecological need to reform the CVP—which had historically served the interests of agribusinesses—to incorporate environmental stewardship among its mandates. In 1992, the U.S. Congress passed the Central Valley Project Improvement Act (CVPIA) into law, which mandated reform of the CVP to better protect, restore, and enhance fish and wildlife habitat by placing environmental goals on par with irrigation and domestic water usage. Some environmental policy changes implemented under the Act include: the dedication of 800,000 acre-feet of water per year to fish and wildlife along with firm water commitments to Central Valley wildlife refuges; the restoration of anadromous fish populations; the establishment of a habitat restoration fund financed by water and power users; and the installation of mitigative technology at various sites, including temperature control devices and fish passage infrastructure. The Act also stipulates that the CVP would establish no new contracts until it had achieved its environmental goals. Since the passage of the CVPIA, Reclamation, in partnership with various federal, state, and local agencies, has implemented aquatic habitat improvement projects on the American, Stanislaus, Yuba, and Upper Sacramento rivers and Clear, Mill, and Deer creeks; provided annual water allotments and upgraded or built conveyance facilities to 19 federal, state, and private managed wetlands; and funded independent restoration programs on the San Joaquin and Trinity rivers through the habitat restoration fund.[30]

NRHP / CRHR Evaluation

Criteria for Evaluation

The eligibility criteria for designating historic properties under federal and state criteria are essentially the same. The criteria for listing properties in the National Register of Historic Places (NRHP) are codified in 36 CFR 60 and expanded upon in numerous guidelines published by the National Park Service. Buildings, structures, objects, sites, and districts listed in, eligible for listing in, or that appear eligible for listing in the NRHP are considered historic properties under the regulations for Section 106 of the National Historic Preservation Act (NHPA). Eligibility for listing buildings, structures, objects, sites, and districts (i.e., historic properties) in the NRHP rests on twin factors of *historic significance* and *integrity*. A resource must have both significance and integrity to be considered eligible. Loss of integrity, if sufficiently great, will overwhelm the historic significance a property may possess and render it ineligible. Likewise, a property can have complete integrity, but if it lacks significance, it must also be considered ineligible. Historic significance is judged by applying the NRHP criteria, identified as Criteria A through D. The NRHP guidelines state that a historic property’s “quality of significance in American history, architecture, archeology, engineering, and culture” must be determined by meeting at least one of the four main criteria. Properties may be significant at the local, state, or national level. The NRHP criteria are:

Criterion A: association with “events that have made a significant contribution to the broad patterns of our history;”

Criterion B: association with “the lives of persons significant in our past;”

– California Grasslands Bypass Project Reduces Selenium in the San Joaquin Basin” (September 2011), https://www.epa.gov/sites/default/files/2015-10/documents/ca_sanjoaquin.pdf (accessed August 2022).

[29] U.S. Bureau of Reclamation, “Grassland Bypass Project,” July 29, 2020, https://www.usbr.gov/mp/grassland/ (accessed August 2022).

[30] U.S. Bureau of Reclamation, “ Central Valley Project Improvement Act (CVPIA),” April 27, 2022, https://www.usbr.gov/mp/cvpia/ (accessed August 2022); U.S. Bureau of Reclamation, “Central Valley Project Improvement Act: Fact Sheet,” October 2021, https://www.usbr.gov/mp/mpr-news/docs/factsheets/cvpia.pdf (accessed August 2022); U.S. Bureau of Reclamation, “CVP Habitat Restoration,” February 2022, https://www.usbr.gov/mp/mpr-news/docs/factsheets/habitat-restoration.pdf (accessed August 2022); California Department of Fish and Wildlife, “Refuge Water Supply Program,” n.d., https://wildlife.ca.gov/Conservation/Watersheds/Refuge-Water (accessed August 2022).

Criterion C: resources "that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values;"

Criterion D: resources "that have yielded, or may be likely to yield, information important to history or prehistory."[31]

Integrity is determined through applying seven factors to the historic resource: location, setting, design, workmanship, materials, feeling, and association. These seven can be roughly grouped into three types of integrity considerations. Location and setting relate to the relationship between the property and its environment. Design, materials, and workmanship, as they apply to historic buildings, relate to construction methods and architectural details. Feeling and association are the least objective of the seven criteria and pertain to the overall ability of the property to convey a sense of the historical time and place in which it was constructed.

Central Valley Project Draft Multiple Property Listing

In 2009, Reclamation prepared a *Draft National Register of Historic Places Multiple Property Documentation Form: Central Valley Project* (CVP MPL).[32] The CVP MPL identifies the period of significance for the CVP as 1935 when the project received its first authorizations to 1956 when the last of the major project components was completed. However, as stated, "This MPL is also designed to be easily amended as more project engineering features become historic," as with the multiple elements that comprise the San Luis Unit, the bulk of which were constructed by the late 1960s, and the San Luis Drain, which was constructed between 1969 and 1973—all of which were identified in the section "CVP Engineering Features 1957-2000: An Overview."[33] The document provides registration criteria regarding NRHP significance and integrity. The subsections of the registration requirements relied upon for this evaluation of San Luis Drain for individual eligibility for listing in the NRHP are the subsections for "Canals" and "Drains" as quoted below.[34] The NRHP and CRHR evaluation of San Luis Drain contained in this report utilizes in part the framework provided in the CVP MPL.

The following is excerpted from the CVP MPL:

Main Canals

Main canals form the CVP's primary arteries. These canals consist of Contra Costa (the first built and operational), Madera, Delta-Mendota (both intake and distribution sections), Delta Cross Channel, and the Friant-Kern, all built and operational before 1952. The longest main canal is the Friant-Kern Canal at 151.8 miles, while the shortest is the Delta Cross Channel at 1.2 miles. All main canals are located on Reclamation fee title or easement land.

Appurtenant Features: Conveyance; Regulating; Water Management; Protective; and Miscellaneous Structures and Objects

1. *Conveyance Structures*

Conveyance structures are features such [as] inverted siphons, drops, chutes, flumes, tunnels, and pipelines that are used to safely transport water from one location to another traversing various existing natural and manmade topographic features along the way.

2. *Regulating Structures*

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[31] USDI, National Park Service, *Guidelines for Applying the National Register Criteria for Evaluation, National Register Bulletin 15* (Washington, D.C.: USDI, National Park Service, 1990, rev. 1997).
[32] Jim Bailey, "National Register of Historic Places Multiple Property Documentation Form, Central Valley Project: Planning and Construction of the First Four Divisions, 1935-1956," draft prepared for Reclamation, 2009, updated 2018.
[33] Bailey, draft CVP MPL (2009, updated 2018), 100-105, 107.
[34] For San Luis Drain, this evaluation uses the CVP MPL evaluative framework for "canals" and "drains," the latter classification largely grouped with minor lateral and sub-lateral canals, because the drain recorded on this form is an explicitly identified engineering feature—the only drain identified as such in the document—and possesses numerous appurtenant structures; Bailey, draft CVP MPL (2009, updated 2018), 105.

Regulating structures are used to raise, lower, or control the release and volume of the water flow. Regulating structures that are located at the source of the water supply include headworks and turnouts. Headworks control the release of water into the canal and are often located downstream from a major diversion or storage facility. Regulating structures located along the course of a canal include turnouts, checks, check-drops, and diversion structures. The smaller regulating structures like checks and turnouts are basic components of an irrigation system.

3. Protective Structures

Protective structures protect the canal system and adjacent property from damage which would result from uncontrolled storm runoff or drainage water, or an uncontrolled excess of flow within the canal. Several different types of structures perform this function, including overchutes, drainage inlets, siphon spillways, and wasteways.

4. Water Measurement Structures and Objects

Water measurement structures are used to gauge water flow and ensure its equitable distribution. Many different types of water measurement structures are used in irrigation systems. The type most commonly used in Reclamation systems are Parshall flumes, weirs, open-flow meters, and constant head orifices.

Drains

Drains are water conveyance structures (either open channels or buried pipes) that carry excess water away from irrigated agricultural fields to prevent rising water tables. A drain classification was instituted by Reclamation in 1920 that categorized drains into three classes according to their size and relative importance. Class I or "deep drains" are the largest and most significant, with Class III being the smallest and least significant.[35]

Significance

In conjunction with the storage and diversion dams, canals form the CVP's backbone. They provide the means to transfer, transport, and deliver water through the system and ultimately to the water users. Traversing across hundreds of miles, the canals form a significant feature of the physical landscape and define the geographical limits of the project. In keeping with the original CVP plan of large-scale water transfers, canals are the primary means behind the geographical redistribution of fresh water from the valley's wetter northern reaches to the drier southern stretches.[36]

The need for continual maintenance and repairs to canals requires special consideration of integrity. Irrigation systems are constantly evolving as features are upgraded, repaired, or replaced. Alterations made to canals during the period of significance and even subsequent to that may not nullify eligibility if a canal retains certain basics. Most important are integrity of location, association, and overall design configuration of the prism (i.e. depth and width). A canal which has retained its original form and associated appurtenant features has a high degree of integrity. It is not uncommon for a canal lining to be replaced, or for previously unlined segments to be lined. Such changes may not preclude a canal's eligibility if they do not significantly damage the canal's historic association or its overall design. If in addition to integrity of association, location, and overall design, the historical setting and feeling of a canal are maintained, then the likelihood is even higher that an altered canal would be eligible. On the other hand, if an entire canal is piped, it would no longer convey any of its original design, workmanship, materials, or historical association and would not be contributing. Conversely, partial piping of a significant canal may not preclude eligibility if a majority of a canal is still open and intact.[37]

Secondary to the canals in distributing water are the thousands of laterals and their appurtenant features. As with canals, many appurtenant features are upgraded, altered, or even replaced over time due to the constant ongoing maintenance needs. For laterals to be considered contributing, they must exhibit a high level of integrity, and serve as principal laterals or incorporate a larger number of contributing appurtenant features. Because of the vast number of appurtenant features and the many miles of laterals, it may only be appropriate to identify representative samples of contributing elements. In unusual cases, laterals

[35] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 124.
[36] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 125.
[37] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 126-127.

and appurtenant features may have individual significance if they are: surviving examples of a rare type of design or construction; of innovative engineering design that impacted subsequent designs; or were specifically designed to meet an unusual engineering challenge.[38]

Sub-lateral canals and their branches are not considered as contributing resources to the CVP. The small size of sub-laterals does not make a significant contribution to the function or design of the CVP and are not individually eligible. Sub-laterals could, however, be eligible if they are associated with a historic farm or district where the impact the lateral has in combination with the other resources is substantial.[39]

The evaluation of the significance of drains is similar to that of laterals. The principal, or Class I drains, are contributing features if they retain a high level of integrity and fall within the period of significance. Class II and III drains are not considered contributing resources. In unusual cases, drains may have individual significance if they fall within the period of significance and are: rare, surviving examples of a type of design or construction, of innovative engineering design that impacted subsequent designs, or were specifically designed to meet an unusual engineering challenge. Like laterals and sub-laterals, drains are considered as ineligible components of the CVP.[40]

Registration Requirements

The period of significance for historic CVP water conveyance structures begins in 1937 with the initial construction of the first CVP canal, the Contra Costa Canal, and ends in 1952 with the completion of the Friant-Kern, Delta-Mendota, and Delta Cross Channel canals. Like the dams, these canals are part of the initial CVP authorizations.[41]

Water conveyance structures with adequate integrity are considered eligible as part of the multiple property listing for the National Register for the following reasons:

Criterion A: They have had a significant impact on the settlement, agricultural economy, or development patterns of the project area; they have been defining elements in the evolution of the cultural landscape; they are directly associated with important events.

Criterion B: They are the result of the direct efforts of a prominent individual associated with the CVP and are the most prominent feature associated with that individual.

Criterion C: They represent the distinctive characteristics of Reclamation canal design and/or methods of construction used on the CVP; they involved challenging engineering design problems due to topography, grade, length, natural obstacles, and resulted in complex or innovative solutions; they are among the best or a rare surviving example of a distinctive type of water conveyance structure; they represent the evolving technology in design of water conveyance structures; they were identified during the construction period as an individually significant feature; or they embody the work of a significant engineer or builder.

Criterion D: They have the ability to yield information important to understanding the history of the CVP. None of the CVP water conveyance structures are eligible under this criterion.[42]

Evaluation

The following evaluates two point-observations and one linear segment of the San Luis Drain together for individual eligibility for listing in the NRHP and CRHR under the themes and within the framework presented above. This evaluation concludes that the San Luis Drain is historically significant under NRHP / CRHR Criterion A / 1 at the national level for its important association with the ecological disaster at Kesterson Reservoir, an historically significant event that profoundly impacted subsequent governmental policies toward drainage and wildlife habitat management. While this evaluation concludes that the

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[38] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 127.
[39] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 127.
[40] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 128.
[41] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 129.
[42] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 129.

San Luis Drain meets NRHP and CRHR criteria, it does not conclude that the entire multi-component resource is eligible for listing in the NRHP and CRHR because assessing the integrity of any part of the San Luis Drain beyond the APE for the project cited in *P11 is outside the scope of this project. This evaluation assesses the historic integrity of one linear segment and two point-observations of the San Luis Drain in and adjacent to the APE and concludes that they retain historic integrity to their period of significance, 1982-1988, and would be contributing elements of the overall San Luis drainage system if the entire linear resource is found to possess sufficient integrity to be listed.

Criteria A and 1

The San Luis Drain does not possess significance under these criteria for its involvement with the CVP. The San Luis Drain, an integral but short-lived component of the San Luis Unit of the CVP, returned subsurface irrigation drainage water from irrigation districts within the San Luis service area between 1972 and 1986. Following decades of lobbying by agricultural interests in the region, Reclamation was authorized in 1960 to deliver irrigation water to the western San Joaquin Valley with the formation of the San Luis Unit, a first in federal-state joint-use facilities. In addition to rallying support for supplementing their depleted groundwater sources with CVP surface water, local irrigators also lobbied for the addition of critical drainage facilities, as the rising groundwater table of highly saline subsurface irrigation wastewater threatened to drown crops and sterilize thousands of acres of valuable agricultural lands. During planning, the San Luis Drain sparked controversy among residents in the San Francisco Bay Area and Sacramento-San Joaquin Delta, where the drain was originally planned to discharge near Antioch in Contra Costa County. Following years of negotiations and federal budgetary constraints, the San Luis Drain was ultimately built out to about half of its intended length, roughly 88 miles, and rather than discharging into the Delta, irrigation wastewater containing high levels of toxic selenium was instead pooled in a complex of evaporation ponds at Kesterson Reservoir near Gustine in Merced County. Following high rates of deformity and death among migratory and nesting waterfowl and other wetland species at Kesterson (discussed below), Reclamation discontinued use of the San Luis Drain and reservoir. The San Luis Drain failed to meet the drainage needs of the San Luis service area, was effectively retired, and is thus not eligible for listing in the NRHP or CRHR under these criteria for its involvement with the CVP.

However, under these same criteria, the San Luis Drain possesses significance for its important association with the ecological disaster at Kesterson Reservoir in the early to mid-1980s and the associated subsequent advances in environmental research / wetlands preservation, along with shifts in governmental reclamation policies and the broadening of CVP's attention to encompass ecological issues that went well beyond its previous focus centered on the interests of agribusiness in the western San Joaquin Valley. According to *National Park Service National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*, properties like San Luis Drain, the significant associations of which have occurred within a period of less than 50 years ago, must also meet Criteria Consideration G. To meet Criteria Consideration G, the property needs to show that its associations within the last 50 years are of "exceptional importance."[43] The San Luis Drain appears to meet this high threshold, and sufficient historical perspective exists to demonstrate this significance. In the early 1980s, USFWS scientists began to discover high rates of embryonic and infant deformity and adult mortality among various plant, fish, and waterfowl species at Kesterson Reservoir, which they soon traced to toxic exposure to selenium, and as the tragedy unfolded, ultimately culminating in the retirement of the San Luis drainage system in 1986, the ecological crisis at Kesterson Reservoir garnered national attention. The disaster was dubbed an "avian holocaust," and it illustrated the extreme environmental risks posed by selenium-contaminated irrigation drainage, reframing the problem from an individual farm-scale issue to a watershed-level environmental protection crisis.[44] California emerged as a global center for selenium-contamination research and environmental management during this period, with scientists establishing firm links between human activity and sites of selenium concentration. In response, environmental managers at the federal, state, and regional levels instituted a growing body of water quality regulations that established maximum daily load limits for selenium among discharges of agricultural drainage, as illustrated by the Grasslands Bypass Project—a joint-state federal drainage program that monitors drainage for trace elements in the Central Valley Grasslands. Perhaps most importantly, the disaster at Kesterson dramatically illustrated

[43] National Park Service, *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*, 1990, rev. 1995, 41, 43.
[44] Harold E. Thomas, "Ode to the San Luis Drain," *Groundwater* 24, no. 1 (January 1986): 79.

the ecological burden that decades of unrestrained and federally subsidized agriculture had placed on the region, leading reformers to fundamentally transform the CVP—which had historically served the interests of agribusinesses—to incorporate environmental stewardship among its mandates. In 1992, the Central Valley Project Improvement Act (CVPIA) was passed into law, which, for the first time, placed wildlife habitat management on equal footing with the agricultural and industrial goals of the CVP. Since the passage of the CVPIA, Reclamation and its federal, state, and local partner agencies have implemented habitat improvement projects on the American, Stanislaus, Yuba, and Sacramento rivers and delivered CVP water to federal, state, and private managed wetlands throughout the state. Most importantly, it has ceased all drainage discharges into wildlife refuges.

As the structural vehicle for delivering selenium-contaminated subsurface irrigation drainage water to Kesterson Reservoir, the San Luis Drain possesses strong and meaningful associations with the Kesterson disaster, an environmental calamity of exceptional historical significance for the critical role it played in transforming governmental policy. Thus, the two point-observations and one linear segment of the San Luis Drain recorded on this form contribute to its significance under these criteria. The period of significance under these criteria dates from 1982, when USFWS scientists first detected selenium toxicosis among various plant and animal species at Kesterson, and 1988, when the U.S. Department of Interior—having discontinued use of the San Luis drainage facilities—remediated the selenium contamination problem at Kesterson by dewatering and infilling the evaporation ponds.

Criteria B and 2

The CVP was the result of the efforts of many individuals and agencies over many years and no one person or group of people rises in the historical record as playing a direct role in its implementation in a way that would be best demonstrated by San Luis Drain; therefore, San Luis Drain is not individually eligible for listing in the NRHP under Criterion B or in the CRHR under Criterion 2.

Criteria C and 3

San Luis Drain does not possess individual eligibility for listing in the NRHP and CRHR under Criterion C or Criterion 3. While the San Luis Drain is a rare structural type (interceptor drain) within the CVP, construction of the structure was ultimately not completed to its full schematics, and it failed to adequately remedy the regional drainage problem (which persists to the present). Originally planned to span 188 miles between Kettleman City in Kings County to a discharge point near Antioch in Contra Costa County, construction on the San Luis Drain was impeded by political opposition and budgetary constraints, and it was ultimately built out to 88 miles—less than half the intended span—from a point near Five Points in Fresno County to the Kesterson Reservoir outside of Gustine in Merced County. The structure is a largely non-operational concrete-lined trapezoidal channel with numerous appurtenant structures—such as checks, siphons, and crossings. The San Luis Drain was designed and built to receive and convey subsurface drainage water from regionally distributed drainage collector systems that were operated by irrigation districts, which in turn collected drainage from underground pipe networks lain on private farms. The San Luis drainage system has largely been retired as designed. It not only was not built out to its full extent, but it also did not meet its the drainage objectives, and thus does not possess significance for its engineering.

Under these same criteria, the San Luis Drain is likewise not significant for its construction methodology. Reclamation had employed large industrial trimmers for canal excavation for decades prior to the construction of the drain recorded on this form. During construction of the Delta-Mendota Canal in particular, contractors navigated the same issues relating to the regional groundwater table elevated above the canal trench. While construction on the San Luis Drain innovated upon and in many ways streamlined earlier methods, this effort did not introduce fundamentally new technologies or methodologies. Therefore, the drain recorded on this form does not possess individual significance in this regard.

Also considered under these criteria, San Luis Drain does not represent the important work of a master engineer or builder. Lead project engineer for San Luis Drain, Edward J. Brannan joined Reclamation in 1937 as a transitman on the Columbia Basin Project before he was promoted to construction engineer on the Spokane Valley Project in Washington in 1965 and ultimately the San Luis Drain in the late 1960s and early 1970s. Brannan does not appear to have developed new designs but rather follow the standardized designs drafted earlier by Reclamation engineer Harry Raymond McBirney.[45] Additionally, Gordon H. Ball, Inc., and Ball, Ball & Brosamer, who collectively won three construction contracts for San Luis Drain comprising nearly 80 percent of the extant structure (69.51 miles) in addition to Kesterson Reservoir, were the companies responsible for the largest share of the drain's construction. While they were prolific contractors, there is insufficient evidence to support Gordon H. Ball and Ball, and Ball & Brosamer, as master builders. Moreover, both firms appear to have specialized in heavy highway construction, not canal building. While construction of San Luis Drain was a large undertaking for the companies, it does not best represent their body of work. They were most known during the 1960s and 1970s for construction of highways, runways, and general concrete work. San Luis Drain would not best represent the work of any of the other contractors who won contracts for San Luis Drain because their contributions to the project were only to a small fraction of the overall project. For these reasons, the drain recorded on this form is not individually eligible for listing in the NRHP or CRHR under these criteria.

Criteria D and 4

San Luis Drain is not eligible under NRHP Criterion D or CRHR Criterion 4 for information potential because it was designed and built according to well-documented practices, and the project is well documented through drawings, textual records, and photographs.

Character-defining Features, Integrity, and Boundary of San Luis Drain

In general, the character-defining features of the recorded segment of the San Luis Drain are its alignment, the size, shape, and dimensions of the canal prism, and its concrete lining material. Individual elements within the study area that contribute to the significance of San Luis Drain along the approximately five-mile recorded segment are those structures that are directly related to its significance under NRHP Criterion A / CRHR Criterion 1, i.e. structures that directly relate to the conveyance of subsurface irrigation drainage water from the southern terminus in Fresno County north to Kesterson in Merced County. Structures like check structures and siphons that convey and control the water's northerly flow all related directly to the drain's significance and purpose and therefore contribute to the significance of the historic property. Structures in the study area that accommodate pre-existing uses like the Drain U-121.2 undercrossing and trapezoidal road crossing do not contribute to the historical significance of this linear historic property because they are not directly related to the conveyance of subsurface irrigation wastewater, and instead serve ancillary purposes.

The recorded segment of the San Luis Drain along with its contributing structures all retain historic integrity to their period of significance, 1982-1988, and would contribute to the overall resource if the San Luis Drain possesses sufficient integrity throughout its span. In terms of design and setting, the recorded segment of the San Luis Drain remains in its original location, the setting of which remains defined by flat rural farmland. In terms of design, materials, and workmanship, research did not reveal that any substantial modifications have been made to any of the character-defining features that would reduce the integrity of this segment of the study property. While it is unclear when some inlets were added to the structure, these additions are comparably minor and do not detract from the overall feeling of the resource. The recorded drain segment suffers diminished integrity of association because it is no longer operational.

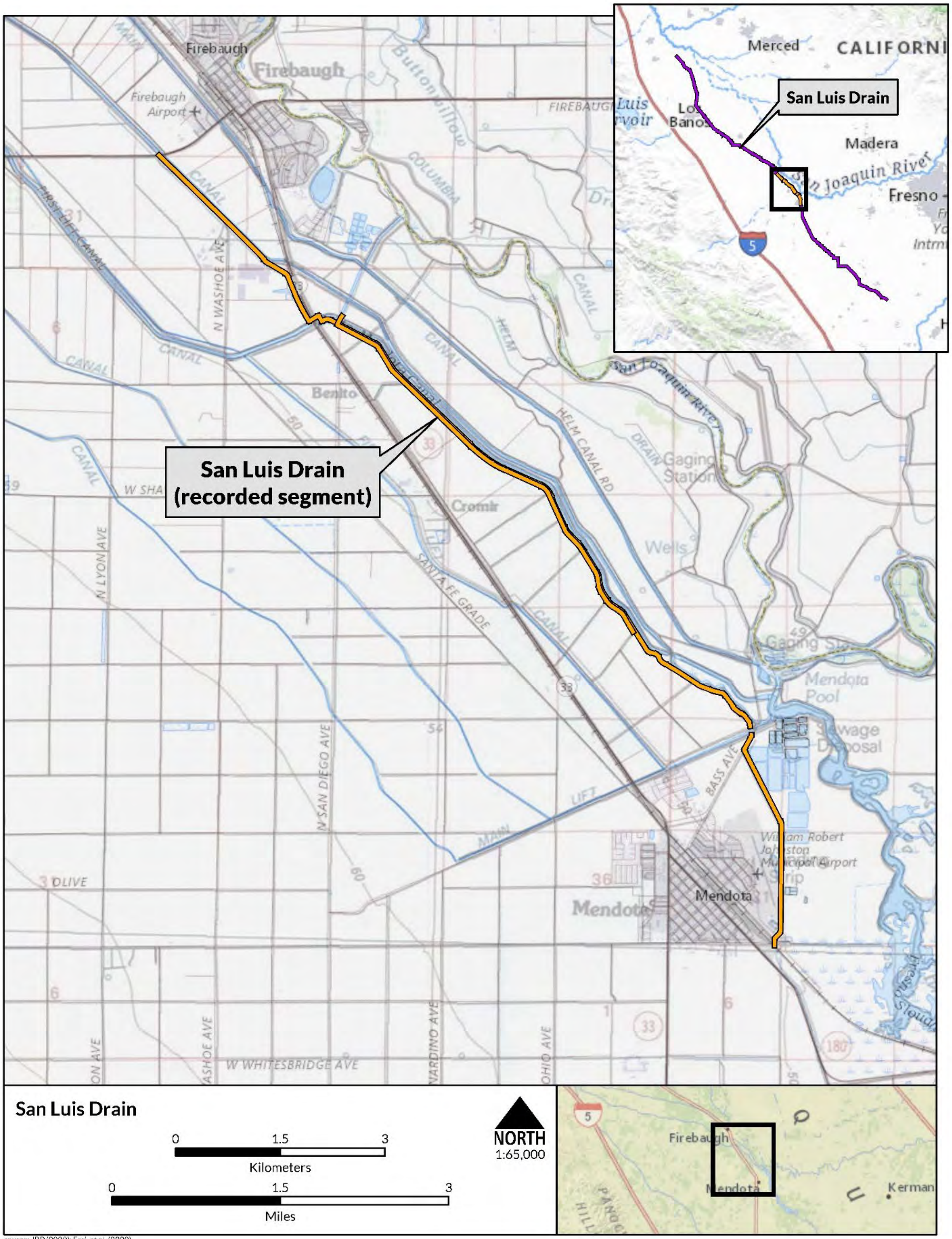
The boundaries of the San Luis Drain are the channel's right-of-way, encompassing the canal prism and two flanking embankments, between the southern terminus—a point near Five Points in Fresno County—and the northern terminus at the former Kesterson Reservoir.

[45] "Water Project Post is Filled," *Spokane Daily Chronicle* (February 16, 1965): 3.

State of California – The Resources Agency **DEPARTMENT OF PARKS AND RECREATION**	**Primary #** ______________________________ **HRI #** ______________________________
LOCATION MAP	**Trinomial** ______________________________

 ***Resource Name or #** (Assigned by recorder) San Luis Drain

***Map Name:** San Luis Drain – Recorded Segment ***Scale:** 1:24,000 ***Date of map:** 2022



source: JRP (2022); Esri, et al. (2022).

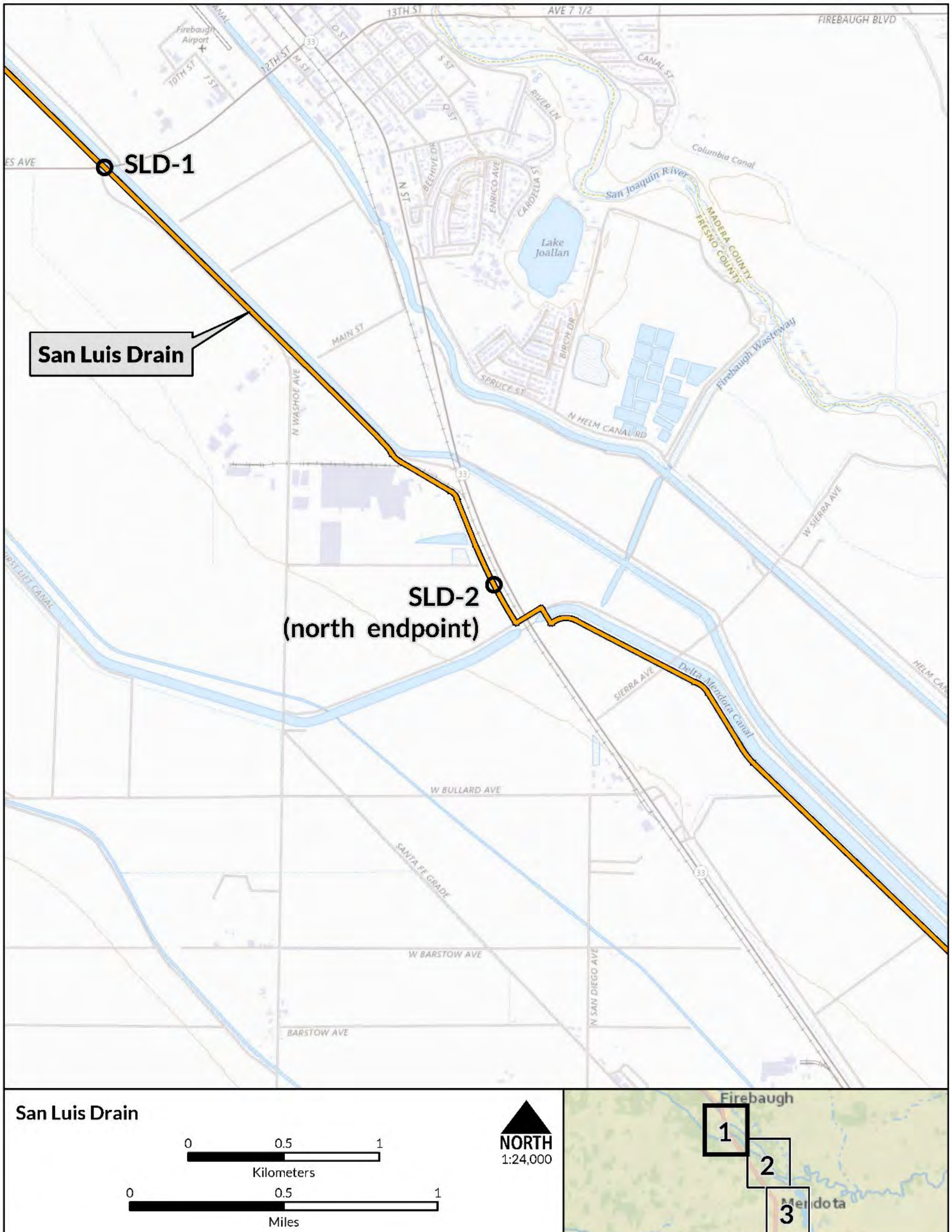
State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
SKETCH MAP

Primary # ______________________________
HRI # ______________________________
Trinomial ______________________________

***Resource Name or #** (Assigned by recorder) San Luis Drain

***Drawn by:** JRP Historical Consulting, LLC

***Date of map:** ___2022_____



source: JRP (2022); Esri, et al. (2022).

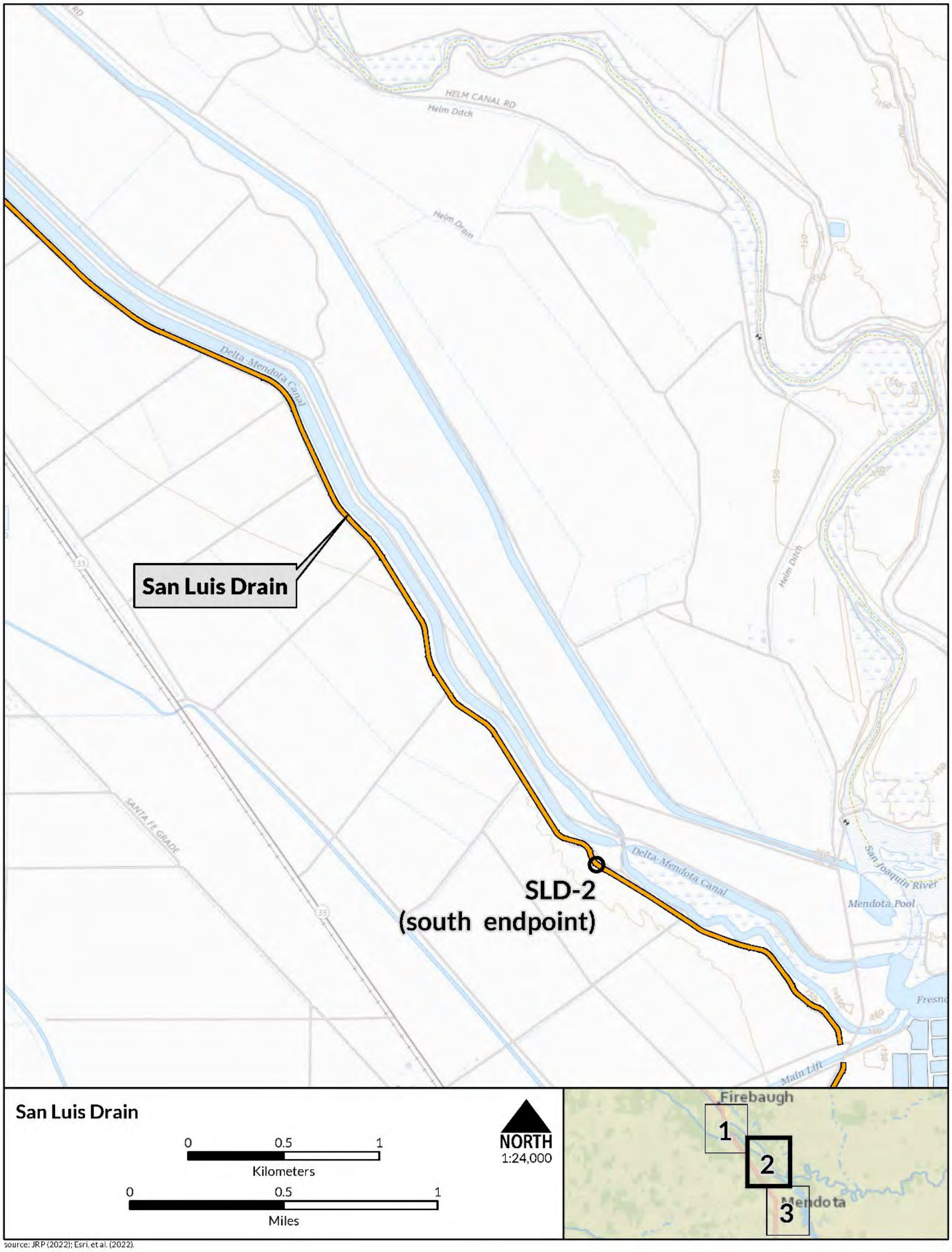
State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
SKETCH MAP

Primary # ________________________
HRI # ________________________
Trinomial ________________________

***Resource Name or #** (Assigned by recorder) San Luis Drain

***Drawn by:** JRP Historical Consulting, LLC

***Date of map:** 2022



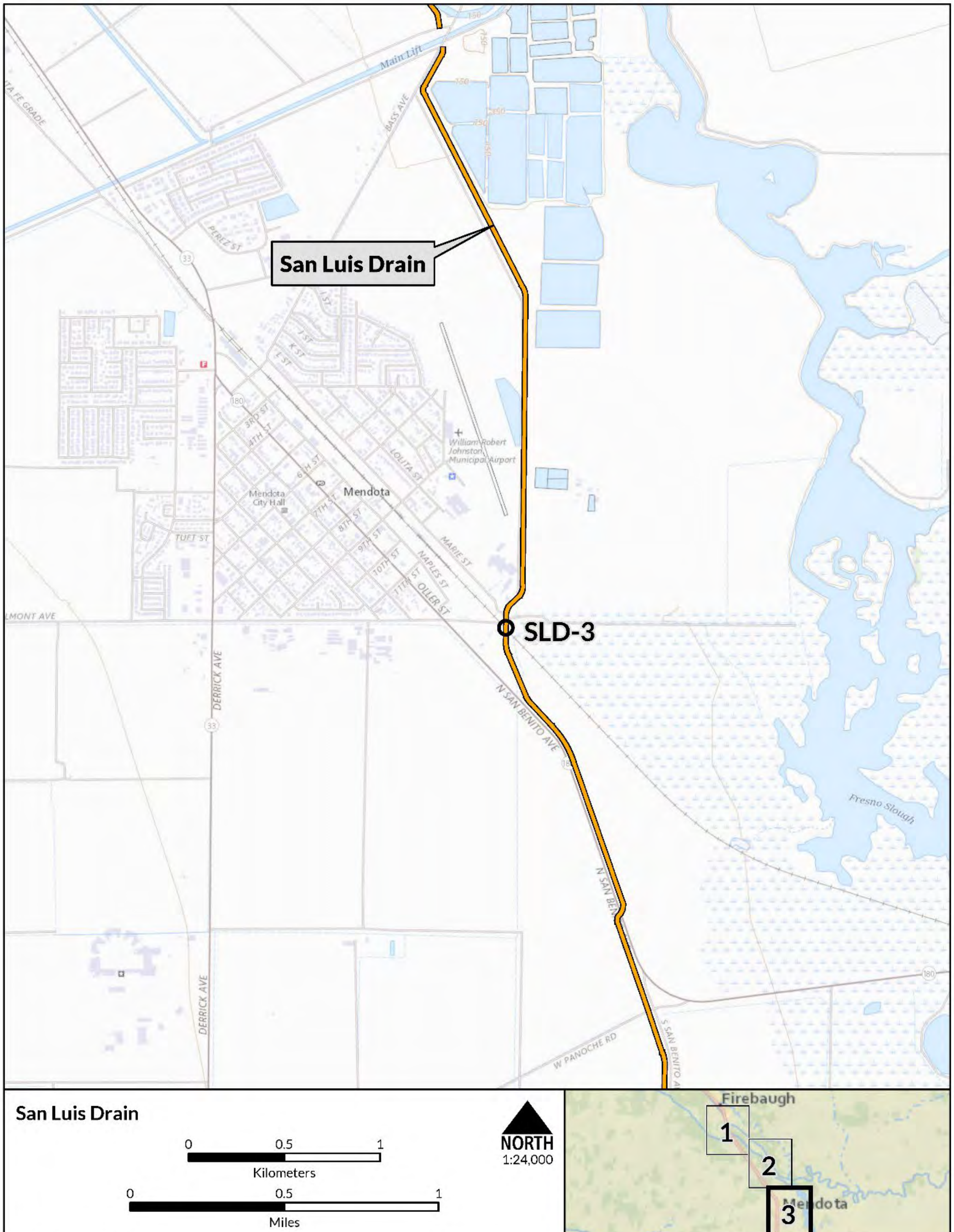
State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
SKETCH MAP

Primary # ______________________
HRI # ______________________
Trinomial ______________________

***Resource Name or #** (Assigned by recorder) San Luis Drain

***Drawn by:** JRP Historical Consulting, LLC

***Date of map:** 2022



source: JRP (2022); Esri, et al. (2022).

NOTE: Include bar scale and north arrow.

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # ______
HRI # ______
Trinomial ______
NRHP Status Code 6Z

Other Listings ______
Review Code ______ Reviewer ______ Date ______

***Resource Name or #** (Assigned by recorder) Drain U-121.2

P1. Other Identifier: Drain U-121.2

***P2. Location:** ☐ Not for Publication ☒ Unrestricted ***a. County** Fresno

and (P2b and P2c or P2d. Attach a Location Map as necessary.)

***b. USGS 7.5' Quad** Firebaugh **Date** 2021 **T** 13S; **R** 14E; __ ¼ of Sec ; Mount Diablo **B.M.**

c. Address NA City Firebaugh (vic.) Zip ______

d. UTM: (give more than one for large and/or linear resources) Zone ______; ______mE/ ______mN

Segment recorded from Zone 10S, 728390.36mE / 4079117.19mN at the north, to Zone 10S, 732684.75mE / 4074696.30mN at the south.

e. Other Locational Data: (e.g., parcel #, directions to resource, elevation, etc., as appropriate)

Assessor Parcel Numbers: 012-031-21ST; 012-030-33S; 012-060-59S; 012-070-25S

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries)

This form records Drain U-121.2, a component of the Firebaugh Canal Water District in western Fresno County, between Firebaugh and Mendota (**Photograph 1**). The entire drainage canal is located in and adjacent to the area of potential effects (APE) for the project cited in *P11. See the attached Linear Feature Record for a description of the resource.

***P3b. Resource Attributes:** (List attributes and codes) HP20 – Canal / Aqueduct

***P4. Resources Present:** ☐ Building ☒ Structure ☐ Object ☐ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)

P5a. Photo or Drawing (Photo required for buildings, structures, and objects.)

P5b. Description of Photo: (View, date, accession #) **Photograph 1.** Upstream view of Drain U-121.2; camera facing southeast, July 20, 2022.

***P6. Date Constructed/Age and Sources:** ☒ Historic ☐ Prehistoric ☐ Both
ca. 1951; 1973 (Aero Exploration Co.; HistoricAerials.com; U.S. Bureau of Reclamation)

***P7. Owner and Address:**
Firebaugh Canal Water District
2412 Dos Palos Road / Highway 33
Mendota, CA 93640

***P8. Recorded by:** (Name, affiliation, address)
Samuel Skow & Danielle Baza
JRP Historical Consulting, LLC
2850 Spafford Street
Davis, CA 95618

***P9. Date Recorded:** July 20, 2022

***P10. Survey Type:** (Describe) Intensive

***P11. Report Citation:** (Cite survey report and other sources, or enter "none.") JRP Historical Consulting, LLC, "Finding of Eligibility Delta-Mendota Canal Subsidence Correction Project," 2022, prepared for US Bureau of Reclamation and San Luis & Delta-Mendota Water Authority.

***Attachments:** ☐ None ☐ Location Map ☒ Sketch Map ☒ Continuation Sheet ☒ Building, Structure, and Object Record ☐ Archaeological Record ☐ District Record ☒ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record ☐ Artifact Record ☐ Photograph Record ☐ Other (list) ______

***NRHP Status Code** 6Z

***Resource Name or #** (Assigned by recorder) Drain U-121.2

B1. Historic Name: Firebaugh Canal Company Drain

B2. Common Name: Drain U-121.2

B3. Original Use: Drainage B4. Present Use: Drainage

***B5. Architectural Style:** Utilitarian

***B6. Construction History:** (Construction date, alteration, and date of alterations) Drain built ca. 1951; replacement drain constructed in parallel alignment 1973; drainage pipes, pumps, replacement trash screens added at unknown dates.

***B7. Moved?** ☒ **No** ☐ **Yes** ☐ **Unknown** **Date:** ______ **Original Location:** ______

***B8. Related Features:** None

B9. Architect / Engineer: U.S. Department of Interior (USDI), Reclamation, Central Valley Project, Delta-Mendota Canal / West San Joaquin Division – San Luis Unit

b. Builder: United Concrete Pipe Corp. and Vinnell Co., Inc.; Ball, Ball & Brosamer Co.

***B10. Significance: Theme** n/a **Area** n/a

Period of Significance n/a **Property Type** n/a **Applicable Criteria** n/a

(Discuss importance in terms of historical or architectural context as defined by theme, period, and geographic scope. Also address integrity.)

Drain U-121.2 does not meet the criteria for listing in the National Register of Historic Places (NRHP) or the California Register of Historical Resources (CRHR) because it is not historically significant within the context of the Central Valley Project (CVP) or the development of regional agriculture. It is not an historic property under Section 106 of the National Historic Preservation Act nor is it an historical resource for the purposes of the California Environmental Quality Act (CEQA). This resource has been evaluated in accordance with Section 106 of the National Historic Preservation Act of 1966 (as amended) (54 U.S.C. 306108) and its implementing regulations (36 CFR Part 800), and Section 15064.5(a)(2)-(3) of the CEQA Guidelines, using the criteria outlined in Section 5024.1 of the California Public Resources Code (see Continuation Sheet).

B11. Additional Resource Attributes: (List attributes and codes) ______

***B12. References:** U.S. Department of Interior, Reclamation, Central Valley Project, "Delta-Mendota Canal – Sta. 5200+00: Drain Siphon Crossing – Plan, Profile, and Sections," dwg. no. 214-D-16411, August 22, 1949, Specifications No. DC-2857, Reclamation Design & Construction Library, Sacramento, California; Declaration of Taking, United States of America vs. Redfern Ranches, No. F-232, October 4, 1968, 5629 O.R. 444, Fresno County Recorder, Fresno, California; see footnotes.

B13. Remarks:

***B14. Evaluator:** Samuel Skow, JRP Historical Consulting, LLC

***Date of Evaluation:** August 2022

(This space reserved for official comments.)

Sketch map with north arrow required

See Continuation Sheet.

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
LINEAR FEATURE RECORD

Primary # ______________________
HRI # ______________________

 ***Resource Name or #** (Assigned by recorder): Drain U-121.2

***Recorded by**: S. Skow and D. Baza ***Date**: July 20, 2022

L1. Historic and/or Common Name: Drain U-121.2

L2a. Portion Described: ☒ Entire Resource ☐ Segment ☐ Point Observation **Designation**: Drain U-121.2

***b. Location of point or segment:** (Provide UTM coordinates, legal description, and any other useful locational data. Show the area that has been field inspected on a Location Map.) Segment recorded from Zone 10S, 728390.36mE / 4079117.19mN at the north, to Zone 10S, 732684.75mE / 4074696.30mN at the south.

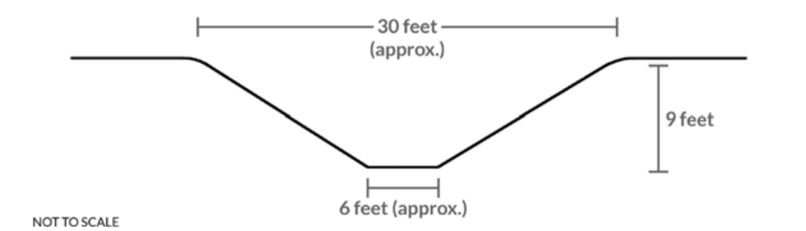
L3. Description: (Describe construction details, materials, and artifacts found at this segment/point. Provide plans/sections as appropriate.)

Drain U-121.2 is an earth-lined drainage canal that extends roughly five miles from a point in the Northeast ¼, Section 24, Township 13 South, Range 14 East, Mount Diablo Base Meridian (NE ¼ Sec. 24, T13S / R14E, MDBM), northwesterly downstream in a parallel alignment to the adjacent San Luis Drain and Delta Mendota Canal (recorded and evaluated on separate DPR 523 forms appended to the report cited in *P11) to its northern terminus in the NW ¼, Sec. 3, T13S / R14E (**Photograph 2** and **Photograph 3**). Here, the drain is siphoned below the two canals named above into a discharge outlet on the northeast side of the Delta Mendota Canal adjacent to the Firebaugh Wasteway, into which Drain U-121.2 empties via corrugated metal pipe (**Photograph 3** – **Photograph 6**) (see Continuation Sheet). The Firebaugh Wasteway sends water into the San Joaquin River (see Continuation Sheet).

L4. Dimensions: (in feet for historic features and meters for prehistoric features)

- **a. Top Width**: 30 feet (approx.)
- **b. Bottom Width**: 6 feet
- **c. Height or Depth**: 9 feet (approx.)
- **d. Length of Segment**: 5 miles (approx.)

L4e. Sketch of Cross-Section (not to scale) **Facing**: South



L8a. Photograph, Map, or Drawing.

L5. Associated Resources: Firebaugh Canal Water District canals, drains, and water control features

L6. Setting: (Describe natural features, landscape characteristics, slope, etc., as appropriate.)
This resource is located in a rural agricultural area in Fresno County. The terrain is generally flat.

L7. Integrity Considerations: Canal rerouted in 1973

L8b. Description of Photo, Map, or Drawing:
Photograph 2: Upstream view of Drain U-121-2 San Luis Drain operating and maintenance road (left bank); camera facing southeast, July 20, 2022.

L9. Remarks:

L10. Form prepared by:
Samuel Skow
JRP Historical Consulting, LLC
2850 Spafford St., Davis, CA 95618

L11. Date: July 20, 2022

L3. Description (continued):

The earth-lined, trapezoidal drainage canal has a slightly elevated right bank and a lower left bank, both with 1 ½: 1 slope. Vegetative overgrowth is prominent in various sections of the canal bed and walls. Parallel dirt and gravel roads extend along the levee crests, with a 14-foot-wide O&M road on the right bank and private farm roads extending the left bank (**Photograph 2**). The drain is conveyed beneath the San Luis Drain and Delta-Mendota Canal via concrete pipe, with a metal trash screen and pump at the inlet, a round concrete manhole tube extending from the siphon through the right bank of the San Luis Drain, and a concrete outlet with wingwalls (**Photograph 3, Photograph 4,** and **Photograph 7**). Other appurtenant structures include a concrete pipe culvert at Sierra Avenue, an assortment of different metal and plastic subsurface inlet drains from the adjoining agricultural lands, and modern pumping equipment (**Photograph 8** – **Photograph 12**).

B10. Significance (continued):

Historic Context

The oldest components of Drain U-121.2 recorded on this form were constructed circa 1951, around the same time that construction was completed on the adjacent Delta-Mendota Canal (DMC) for the Central Valley Project (CVP), with the remainder of the linear resource rerouted to accommodate the 1973 construction of the San Luis Drain, a key component of the San Luis Unit expansion of the CVP. For a discussion of the original CVP, the Delta-Mendota Canal, the San Luis Unit, and the San Luis Drain, see the DPR 523 form sets prepared for the Delta-Mendota Canal and the San Luis Drain appended to the report cited in *P11.

Drain U-121.2

The discharge outlet of the drainage canal recorded on this form was originally constructed sometime between 1950 and 1955, likely around the same time that construction of the DMC was completed in 1951. As originally constructed, the drain occupied the same general alignment as the present-day San Luis Drain, the construction of which enlarged and concreted the formerly earth-lined structure in this section (**Figure 1**). Reclamation drafted plans as early as 1949 for a drain siphon crossing at the location of the underground structure recorded on this form, indicating that the Firebaugh Canal Company—the drain's original owner—may have planned the structure at the location sometime even earlier, but likely after 1939. That year, four subsidiaries of the Miller & Lux Corporation—the Firebaugh Canal Company, the San Joaquin & Kings River Canal & Irrigation Company, Inc., the Columbia Canal Company, and the San Luis Canal Company—all entered into a contract with the federal government to receive CVP water in exchange for relinquishing access to San Joaquin River water, which Reclamation ultimately stored in Friant Reservoir for diversion south to Kern County. These four entities were collectively referred to as the "Exchange Contractors," and they remain active in the region at present as the San Joaquin River Exchange Contractors Water Authority.[1]

The Firebaugh Canal Water District appears to retain ownership of Drain U-121.2. This district was originally formed in 1914 as the Panoche Canal Company, a subsidiary of Miller & Lux, Inc., the single largest cattle, land, and irrigation operation in the western United States, at one time owning or holding leases to over one million acres throughout California, Oregon, and

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[1] Aero Exploration Co., Flight ABI, Frame ABI-18G-51, February 13, 1950 (1:20,000), flown for U.S. Department of Agriculture, Production and Marketing, , available at http://malt.lib.csufresno.edu/MALT/ (Fresno State; accessed July 2022); HistoricAerials.com, "Firebaugh, California," 1955, https://historicaerials.com/viewer (accessed July 2022); U.S. Department of Interior, Reclamation, Central Valley Project, "Delta-Mendota Canal – Sta. 5200+00: Drain Siphon Crossing – Plan, Profile, and Sections," dwg. no. 214-D-16411, August 22, 1949, Specifications No. DC-2857, Reclamation Design & Construction Library, Sacramento, California; Declaration of Taking, United States of America vs. Redfern Ranches, No. F-232, October 4, 1968, 5629 O.R. 444, Fresno County Recorder, Fresno, California; Decision No. 31861: Before the Railroad Commission of the State of California – Application No. 22391, March 20, 1939, University of California (UC) at Merced, UC Cooperative Extension Archive, available at https://calisphere.org/item/ark:/86071/d2mh9f/ (August 2022); San Joaquin River Exchange Contractors Water Authority (SJRECWA), "Exchange Contractors: History of SJRECWA," http://www.sjrecwa.net/about/history/ (accessed August 2022); Ebasco Services, Inc., "Agricultural Drainwater Management Organizations in the Drainage Problem Area of the Grasslands Area of the San Joaquin Valley," prepared for the San Joaquin Valley Drainage Program, March 1989, 3-3.

Nevada. In 1920, the Panoche company changed its name to the Firebaugh Canal Company and developed an irrigation system of one, 3.5-mile main canal and three approximately 10-mile lateral canals for distributing diversions from the San Joaquin River, the company's primary water source. By 1930, the company had irrigated some 18,354 acres, where farmers mainly grew cotton but also grain, alfalfa, grapes, and beans (**Figure 2**). By the early 1950s, the service area had grown to encompass 22,640 acres in Fresno County near the towns of Firebaugh and Mendota, where farmers produced cotton, rice, alfalfa, sugar beets, vegetables, and grain. By the late 1980s, the Firebaugh Canal Company distributed water through 47 miles of main and lateral canals and disposed of irrigation drainage water in 58 miles of surface drains—nine miles of which drained into the Firebaugh Wasteway (including the drain recorded on this form), with most emptying into the Firebaugh Main Drain, which transported wastewater beyond the service area into the Agatha Drain in Merced County. The company was reincorporated in 1988 as the Firebaugh Canal Water District, and it now distributes water to over 30 farms and provides financial assistance for agricultural water conservation projects.[2]

Figure 1: Excerpt of 1957 aerial photograph, with Firebaugh Canal Company drain (identified with arrows) in same alignment as San Luis Drain, adjacent to Delta Mendota Canal.[3]

[2] California Department of Public Works, *Bulletin No. 36: Cost of Irrigation Water in California, Reports on State Water Plan Prepared Pursuant to Chapter 832, Statutes of 1929* (Sacramento: California State Printing Office, 1930), 82; "Order to Show Cause on Application for Change of Name of Corporation," San Francisco *Recorder* (September 23, 1920): 5; "Third of Lift Canals Completed on West Side," *The Fresno Bee* (March 8, 1929): 2B; Thomas G. Mapel and Thomas H. Means, "Appraisal: Market Value Mutual Water Company Stock Appurtenant to Bureau Lands Fresno County," prepared for United States Department of the Interior, Bureau of Reclamation, April 26, 1951, 4-6, University of California, Riverside, Library, Water Resources Collections and Archives, available at https://calisphere.org/item/ark:/86086/n2zc81q9/ (accessed August 2022); Ebasco, "Agricultural Drainwater Management Organizations in the Drainage Problem Area of the Grasslands Area of the San Joaquin Valley," 4-5 – 4-6; U.S. Department of Agriculture, Soil Conservation Service, *Mendota-Gustine Study: Fresno and Merced Counties, California* (September 1972), 8; SJRECWA, "Member Districts: Firebaugh Canal Water District," 2022, http://www.sjrecwa.net/member-districts/firebaugh-canal-water-district/ (accessed August 2022).

[3] Cartwright and Company, Frame ABI-29T-138, 1957, UCSB.

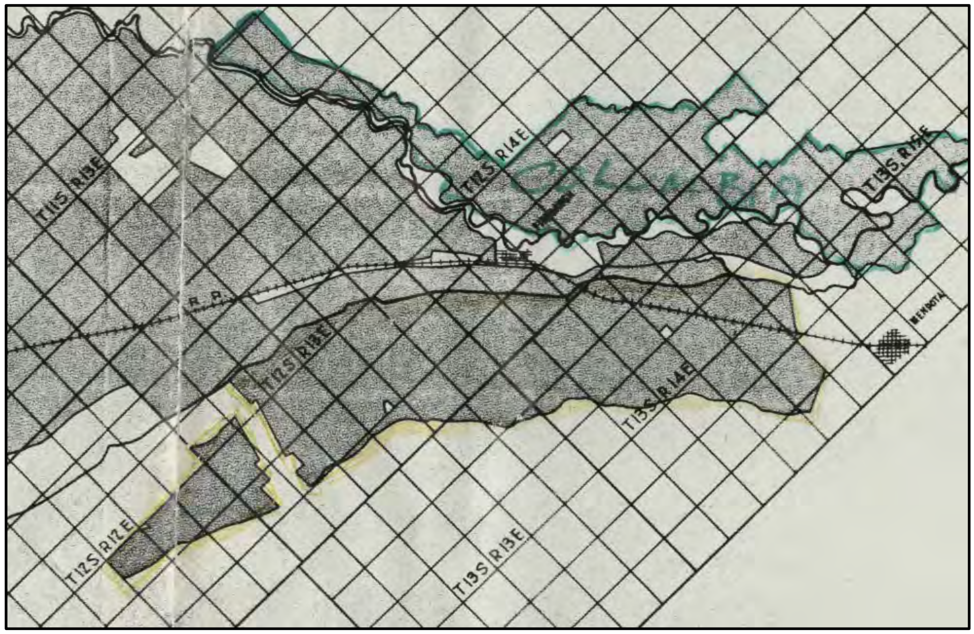

Figure 2: Excerpt of 1939 map showing service areas of San Joaquin River Exchange Contractors; Firebaugh Canal Company (outlined in yellow).[4]

One such farming enterprise serviced by what is now the Firebaugh Canal Water District is Redfern Ranches, Inc., the present and historic owner of 116.18 acres (APN 012-030-33S) containing part of Drain U-121.2 recorded on this form. Redfern Ranches was founded by prominent local farmer, Floyd E. Redfern sometime prior to 1947, the same year that he conveyed that acreage outside of Firebaugh containing a portion of the drain recorded on this form to his business. Born in Nebraska and raised on his family's farm in Dos Palos (about 16 miles north of Drain U-121.2), Floyd Redfern struck out on his own in 1926, initially leasing croplands before purchasing his home ranch south of Dos Palos, where he remained for the duration of his life. By 1942, Redfern was one of the largest rice cultivators in the San Joaquin Valley, expanding up to 1,500 acres by the end of the decade, and reportedly introducing several new practices, like aerial planting and mechanized thresher-and-Caterpillar harvesting. Redfern grew other crops, including alfalfa—which, then as now, was grown at the Firebaugh property near the DMC. Redfern also grew cotton, sugar beets, wheat, and various species of grass, in addition to raising Hereford beef cattle on 13,000 acres outside of Gilroy in Santa Clara County and sheep for wool on 4,000 acres in the western San Joaquin Valley. Redfern was likewise active among various agriculture-related groups. In the 1930s, he was a founding member and vice president of the Merced Production Credit Association, which lent short-term agricultural loans to small farmers in Merced, Mariposa, and western Fresno counties on behalf of the U.S. Farm Credit Administration. The following decade, he also helped found and serve as president of the West Side Alfalfa Pest Control Association. In the 1950s, Redfern was an active participant and booster of the U.S. Department of Agriculture's soil bank reserve program, whereby the federal government subsidized underplanting to discourage overproduction; he was active with the Poso, Panoche, Loma Prieta, and Firebaugh soil conservation districts. Redfern was also an advocate for water efficiency, installing an extensive tailwater return system at his home ranch near Dos Palos that comprised of two holding reservoirs with 15- and 30-horsepower pumps that redistributed the water via concrete pipes. Floyd Redfern had amassed some 26,000 acres throughout the region by the time he died in 1993. His daughter, Suzanne Compte nee Redfern currently owns and operates Redfern Ranches.[5] Research did not

[4] "Exhibit 'A': Map Showing The Service Areas of The San Joaquin & Kings River Canal & Irrigation Company, Incorporated, Columbia Canal Company, San Luis Canal Company, Firebaugh Canal Company," ca. 1939, appended to Decision No. 31861, March 20, 1939.

[5] Fresno County Assessor, property information for APN 012-031-33S, accessed via ParcelQuest.com; Deed, Floyd E. and Gladys W. Redfern to Redfern Ranches, Inc., May 21, 1947 (recorded August 13, 1947), 2543 O.R. 368, Fresno County Recorder, Fresno, California; A. W. Emerson, "Floyd E. Redfern of California—A Profile," *Soil Conservation* 24, no. 12 (July 1959): 281; U.S. Census Bureau, Manuscript Population Schedule: 1900, California, Fresno County, First Township, Enumeration District No. 1, sheet 13A, accessed via Ancestry.com; U.S. Census Bureau, Manuscript Population Schedule: 1910, California, Fresno County, Township 1, Dos Palos Colony (unincorporated), Enumeration District No. 26, sheet 2A (Ancestry.com); "Dos Palos Farmer was a Visionary: Floyd Redfern Dies After

identify other historic-period landowners adjacent to Drain U-121.2; however, aerial satellite imaging and Google Street View appear to indicate that the majority acreage was not planted in orchards until circa 2014.

As it had while building the DMC 18 years earlier, the federal government filed a Declaration of Taking against Redfern Ranches in 1968 for the construction of the San Luis Drain. As part of the project, the original earth-lined drainage canal was enlarged and lined with concrete, and another earth-lined drain was planned along with the "non-exclusive right to discharge drainage water through culverts to be installed by the United States into and to convey drainage water through Drain U-121.2, to be constructed by the United States as a replacement for the Firebaugh Canal Company drain, and in a 24-inch concrete pipe crossing of the San Luis Drain … as a part of said replacement drain."[6] In June 1972, Ball, Ball & Brosamer of Danville won construction contracts for an approximately 18-mile stretch of earthwork, concrete lining, and structures on San Luis Drain comprising that section that traverses the APE for the project cited in *P11, along with the southernmost drain segment where it terminates near Five Points in Fresno County. Included in the design specifications were also plans for Drain U-121.2. Ball, Ball and Brosamer completed all work the following year, when construction on the San Luis Drain was halted altogether (**Figure 3**).[7]

Ball, Ball & Brosamer was formed as joint venture between Gordon H. Ball's two sons, Gordon N. Ball and Dennis W. Ball, and Robert G. Brosamer. In addition to its work on the San Luis Drain, other CVP work included rehabilitation of a portion of the Friant-Kern Canal, with other works for Reclamation including installation of the Gallegos Canyon Siphons as part of the Navajo Indian Irrigation Project in New Mexico and the Sonoqui Dike in Arizona. As with Gordon H. Ball, Inc., Ball, Ball & Brosamer was most actively involved in heavy highway construction. Gordon N. Ball went on to form Gordon N. Ball, Inc., and Robert Brosamer formed R & L Brosamer, Inc, both active firms based in the San Francisco Bay Area.[8]

Helping Set Course for Agriculture," *Merced Sun-Star* (August 21, 1993): A3; "Dos Palos Starts Harvesting of Rice," *Oakland Tribune* (October 11, 1929): 35D; "Rice Being Harvested South of Dos Palos," *The Fresno Bee* (October 7, 1934): 8D; "Largest West Side Rice Crop Being Harvested," *The Fresno Bee* (November 15, 1942): 4D; "Lemoore Now San Joaquin Wool Capital," *Hanford Sentinel* (May 26, 1944): 4; "KMJ Will Broadcast Rice Grower's Talk," *The Fresno Bee* (July 24, 1949): n.p.; "Fresno County Hay Growers Call Lahontan Good Stopgap to Aphid," *The Fresno Bee* (October 27, 1957): 19D; "Loan Group at Merced Named," *The Modesto Bee* (November 30, 1933): 2; "Butterfly War will be Waged on West Side," *The Fresno Bee* (August 4, 1946): n.p.; "67 Producers Paid $5,261,000 in Soil Bank Reserve Program," The San Bernadino County *Daily Sun* (December 24, 1957): B9; Larry D. Adams, "West Side Farms Use Unclaimed Tailwaters," *The Fresno Bee* (April 19, 1970): 3F;

[6] Declaration of Taking, United States of America vs. Redfern Ranches, No. F-232, October 4, 1968, 5629 O.R. 444, Fresno County Recorder, Fresno, California;

[7] Memo Re: Field Inspection for Transfer from Construction to O&M Status for: Stage 1 Kesterson Reservoir and the Three Completed Reaches of the San Luis Drain—Specification Nos. DC-6611, DC-6681, DC-6703, DC-6823—San Luis Unit, CVP, California (December 17, 1973), ff. San Luis Drain (Spec. No. DC-6611), on file at USBR Library, Sacramento, California; ff. San Luis Drain (Spec. No. DC-6948), on file at USBR Library, Sacramento, California; "San Luis Drain Takes Shape in Fresno County," *The Fresno Bee* (September 16, 1973): C1.

[8] "Irrigation Trickles," *Irrigation Journal* 27, no. 3 (May-June 1977): 34; "Contractors," *Western Construction* 50, no. 7 (July 1975): 127; U.S. Department of Interior, *Decisions of the United States Department of the Interior Vol. 93, January-December 1986* (Washington, D.C.: U.S. Government Printing Office, 1987), 144; "County Repays FAA $480,000 for False Billing," Los Angeles Times (June 29, 2000): B1; "Gordon N. Ball, Inc.," NewBayBridge.org, n.d. https://www.newbaybridge.org/the_builders/gordon_ball/ (accessed August 2022); "Featured Projects," Gordon N. Ball Inc., 2017, http://ballconco.com/featured-projects/ (accessed August 2022); Robert L. "Bob" Brosamer, "Message from Bob Brosamer," R & L. Brosamer, Inc. [newsletter] (Spring 2001): 2, available at https://www.thenewsletterguy.com/samples/CustomerNewsletters/RLBrosamer.pdf (accessed August 2022).

Figure 3: Excerpt of 1977 aerial photograph, with Drain U-121.2 (identified with arrows) adjacent to segments of San Luis Drain and Delta-Mendota Canal.[9]

NRHP / CRHR Evaluation

Criteria for Evaluation

The eligibility criteria for designating historic properties under federal and state criteria are essentially the same. The criteria for listing properties in the National Register of Historic Places (NRHP) are codified in 36 CFR 60 and expanded upon in numerous guidelines published by the National Park Service. Buildings, structures, objects, sites, and districts listed in, eligible for listing in, or that appear eligible for listing in the NRHP are considered historic properties under the regulations for Section 106 of the National Historic Preservation Act (NHPA). Eligibility for listing buildings, structures, objects, sites, and districts (i.e., historic properties) in the NRHP rests on twin factors of *historic significance* and *integrity*. A resource must have both significance and integrity to be considered eligible. Loss of integrity, if sufficiently great, will overwhelm the historic significance a property may possess and render it ineligible. Likewise, a property can have complete integrity, but if it lacks significance, it must also be considered ineligible. Historic significance is judged by applying the NRHP criteria, identified as Criteria A through D. The NRHP guidelines state that a historic property's "quality of significance in American history, architecture, archeology, engineering, and culture" must be determined by meeting at least one of the four main criteria. Properties may be significant at the local, state, or national level. The NRHP criteria are:

Criterion A: association with "events that have made a significant contribution to the broad patterns of our history;"

Criterion B: association with "the lives of persons significant in our past;"

Criterion C: resources "that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values;"

[9] Flight 1977 FRE, Frame 1977 FRE CO 6-26R, June 26, 1977, flown for U.S. Department of Agriculture – Agricultural Adjustment Administration, Western Division Laboratory, Fresno State.

Criterion D: resources "that have yielded, or may be likely to yield, information important to history or prehistory."[10]

Integrity is determined through applying seven factors to the historic resource: location, setting, design, workmanship, materials, feeling, and association. These seven can be roughly grouped into three types of integrity considerations. Location and setting relate to the relationship between the property and its environment. Design, materials, and workmanship, as they apply to historic buildings, relate to construction methods and architectural details. Feeling and association are the least objective of the seven criteria and pertain to the overall ability of the property to convey a sense of the historical time and place in which it was constructed.

Central Valley Project Draft Multiple Property Listing

In 2009, Reclamation prepared a *Draft National Register of Historic Places Multiple Property Documentation Form: Central Valley Project* (CVP MPL).[11] The CVP MPL identifies the period of significance for the CVP as 1935 when the project received its first authorizations to 1956 when the last of the major project components was completed. However, as stated, "This MPL is also designed to be easily amended as more project engineering features become historic."[12] The document provides registration criteria regarding NRHP significance and integrity. The subsections of the registration requirements relied upon for this evaluation of Drain U-121.2 for individual eligibility for listing in the NRHP are the subsections for "Drains" as quoted below. The NRHP and CRHR evaluation of Drain U-121.2 contained in this report utilizes in part the framework provided in the CVP MPL.

The following is excerpted from the CVP MPL:

Drains

Drains are water conveyance structures (either open channels or buried pipes) that carry excess water away from irrigated agricultural fields to prevent rising water tables. A drain classification was instituted by Reclamation in 1920 that categorized drains into three classes according to their size and relative importance. Class I or "deep drains" are the largest and most significant, with Class III being the smallest and least significant.[13]

Significance

In conjunction with the storage and diversion dams, canals form the CVP's backbone. They provide the means to transfer, transport, and deliver water through the system and ultimately to the water users. Traversing across hundreds of miles, the canals form a significant feature of the physical landscape and define the geographical limits of the project. In keeping with the original CVP plan of large-scale water transfers, canals are the primary means behind the geographical redistribution of fresh water from the valley's wetter northern reaches to the drier southern stretches.[14]

The need for continual maintenance and repairs to canals requires special consideration of integrity. Irrigation systems are constantly evolving as features are upgraded, repaired, or replaced. Alterations made to canals during the period of significance and even subsequent to that may not nullify eligibility if a canal retains certain basics. Most important are integrity of location, association, and overall design configuration of the prism (i.e. depth and width). A canal which has retained its original form and associated appurtenant features has a high degree of integrity. It is not uncommon for a canal lining to be replaced, or for previously unlined segments to be lined. Such changes may not preclude a canal's eligibility if they do not significantly damage the canal's historic association or its overall design. If in addition to integrity of association, location, and overall design, the historical setting and feeling of a canal are maintained, then the likelihood is even higher that an altered canal would be eligible.

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[10] USDI, National Park Service, *Guidelines for Applying the National Register Criteria for Evaluation, National Register Bulletin 15* (Washington, D.C.: USDI, National Park Service, 1990, rev. 1997).
[11] Jim Bailey, "National Register of Historic Places Multiple Property Documentation Form, Central Valley Project: Planning and Construction of the First Four Divisions, 1935-1956," draft prepared for Reclamation, 2009, updated 2018.
[12] Bailey, draft CVP MPL (2009, updated 2018), 100-105, 107.
[13] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 124.
[14] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 125.

On the other hand, if an entire canal is piped, it would no longer convey any of its original design, workmanship, materials, or historical association and would not be contributing. Conversely, partial piping of a significant canal may not preclude eligibility if a majority of a canal is still open and intact.[15]

Secondary to the canals in distributing water are the thousands of laterals and their appurtenant features. As with canals, many appurtenant features are upgraded, altered, or even replaced over time due to the constant ongoing maintenance needs. For laterals to be considered contributing, they must exhibit a high level of integrity, and serve as principal laterals or incorporate a larger number of contributing appurtenant features. Because of the vast number of appurtenant features and the many miles of laterals, it may only be appropriate to identify representative samples of contributing elements. In unusual cases, laterals and appurtenant features may have individual significance if they are: surviving examples of a rare type of design or construction; of innovative engineering design that impacted subsequent designs; or were specifically designed to meet an unusual engineering challenge.[16]

Sub-lateral canals and their branches are not considered as contributing resources to the CVP. The small size of sub-laterals does not make a significant contribution to the function or design of the CVP and are not individually eligible. Sub-laterals could, however, be eligible if they are associated with a historic farm or district where the impact the lateral has in combination with the other resources is substantial.[17]

The evaluation of the significance of drains is similar to that of laterals. The principal, or Class I drains, are contributing features if they retain a high level of integrity and fall within the period of significance. Class II and III drains are not considered contributing resources. In unusual cases, drains may have individual significance if they fall within the period of significance and are rare, surviving examples of a type of design or construction, of innovative engineering design that impacted subsequent designs, or were specifically designed to meet an unusual engineering challenge. Like laterals and sub-laterals, drains are considered as ineligible components of the CVP.[18]

Registration Requirements

The period of significance for historic water conveyance structures begins in 1937 with the initial construction of the first CVP canal, the Contra Costa Canal, and ends in 1952 with the completion of the Friant-Kern, Delta-Mendota, and Delta Cross Channel canals. Like the dams, these canals are part of the initial CVP authorizations.[19]

Water conveyance structures with adequate integrity are considered eligible as part of the multiple property listing for the National Register for the following reasons:

Criterion A: They have had a significant impact on the settlement, agricultural economy, or development patterns of the project area; they have been defining elements in the evolution of the cultural landscape; they are directly associated with important events.

Criterion B: They are the result of the direct efforts of a prominent individual associated with the CVP and are the most prominent feature associated with that individual.

Criterion C: They represent the distinctive characteristics of Reclamation canal design and/or methods of construction used on the CVP; they involved challenging engineering design problems due to topography, grade, length, natural obstacles, and resulted in complex or innovative solutions; they are among the best or a rare surviving example of a distinctive type of water conveyance structure; they represent the evolving technology in design of water conveyance structures; they were identified during the construction period as an individually significant feature; or they embody the work of a significant engineer or builder.

[15] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 126-127.
[16] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 127.
[17] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 127.
[18] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 128.
[19] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 129.

Criterion D: They have the ability to yield information important to understanding the history of the CVP. None of the CVP water conveyance structures are eligible under this criterion.[20]

Evaluation

The following evaluates Drain U-121.2 in its entirety for individual eligibility for listing in the NRHP and CRHR under the themes and within the framework presented above.

Criteria A and 1

Drain U-121.2, which encompasses the entire length of the drainage canal, does not have direct associations with significant historic events, trends, or patterns of development at the local, state, or national level, and thus is not eligible for listing under NRHP Criterion A or CRHR Criterion 1. The drainage canal recorded on this form was built around the same time as the Delta-Mendota Canal as a minor irrigation drainage discharge structure. As a minor component of the CVP, this basic earth-lined wastewater conveyance lacks meaningful associations to the larger themes and points of significance discussed above. The drain is likewise not significant for its associations with the Firebaugh Canal Company, a subsidiary of Miller & Lux. The drain recorded on this form was constructed circa 1951, well after Miller & Lux and their agent entities began construction of the earliest irrigation works to provide water to the western San Joaquin Valley and therefore it is not associated with the pioneering period of irrigated agriculture in the region. The drain is a common mid-twentieth-century wastewater conveyance structure, a common addition to the region as it began to receive increasing quantities of imported CVP surface water, and as such is not eligible for listing in the NRHP or the CRHR under these criteria.

Criteria B and 2

The canal is not eligible for listing under NRHP Criterion B or CRHR Criterion 2 for meaningful associations with the lives of individuals important to history. Floyd E. Redfern may have played a prominent role in the regional agricultural economy, both as a productive farmer and as a financial organizer and governmental program booster, but he does not appear to have fundamentally changed the industry. On the whole, while his regional contributions to rice cultivation, farm finance, and efficient water use are notable, they do not elevate him to the status of historically significant under these criteria.

Criteria C and 3

Drain U-121.2 is not eligible for listing under NRHP Criterion C or CRHR Criterion 3 for design, method of construction, or representation of the work of a master engineer or builder. There is no indication that the canal applied anything other than standard methods in widespread use in the San Joaquin Valley in the twentieth century. Indeed, basic earthen canals date back thousands of years across a broad swath of global civilizations, and their construction has continued to follow the same general principles as demonstrated by the canal recorded on this form. Drain U-121.2 is a typical earthen canal, principally comprised of an excavated ditch flanked by compacted earthen banks, with culverts, a siphon, and a network of subsurface metal and plastic drainage pipes.

Drain U-121.2 does not represent the important work of a master engineer or builder. Lead project engineer for the larger San Luis Drain project—of which the Drain U-121.2 reroute was a small part—Edward J. Brannan joined Reclamation in 1937 as a transitman on the Columbia Basin Project before he was promoted to construction engineer on the Spokane Valley Project in Washington in 1965 and ultimately the San Luis Drain in the late 1960s and early 1970s. Brannan does not appear to have developed new designs but rather followed the standardized designs drafted earlier by Reclamation engineer Harry Raymond McBirney.[21] Additionally, Ball, Ball & Brosamer won two construction contracts for San Luis Drain, including the Drain U-121.2 reroute project. A prolific joint venture, Ball, Ball & Brosamer's status as master builders is somewhat debatable. Moreover, both firms appear to have specialized in heavy highway construction. While construction of Drain U-121. was a large undertaking for the companies, it does not best represent their body of work.

Criteria D and 4

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[20] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 129.
[21] "Water Project Post is Filled," *Spokane Daily Chronicle* (February 16, 1965): 3.

Drain U-121.2 is not eligible under NRHP Criterion D or CRHR Criterion 4 for information potential because it was designed and built according to well-documented practices, and the project is well documented through drawings, textual records, and photographs.

Integrity

Drain U-121.2 along with its contributing structures retains integrity to its period of reconstruction, 1973. In terms of design and setting, the drain recorded on this form remains in its original location, the setting of which remains defined by flat rural farmland. In terms of design, materials, and workmanship, research did not reveal that any substantial modifications have been made to outside of the 1973 reroute. While some inlet drains appear to have been added at some unknown date, these additions are comparably minor and do not detract from the overall feeling of the drain. Drain U-121.2 continues to function as a drain and thus retains integrity of association. However, the drain recorded on this form lacks significance under all NRHP / CRHR Criteria and is therefore not eligible for listing in either register.

Photographs:

Photograph 3: Downstream view of Drain 121.2 inlet to drain undercrossing; camera facing west, July 20, 2022.

Photograph 4: Upstream view of Drain U-121.2 outlet to drain undercrossing, with Delta-Mendota Canal recorder house (background left); camera facing south, July 20, 2022.

Photograph 5: Upstream view of Drain U-121.2 discharge inlet (bottom left) and view of Delta-Mendota Canal recorder house (background center); camera facing south, July 20, 2022.

Photograph 6: Downstream view of Drain U-121.2 discharge point at Firebaugh Wasteway; camera facing southwest, July 20, 2022.

Photograph 7: Upstream view of Drain U-121.2 (right), San Luis Drain (left), and manhole tube (far left); camera facing southeast, July 20, 2022.

Photograph 8: Upstream view of Drain U-121.2 culvert undercrossing at Sierra Avenue; camera facing southeast, July 20, 2022.

Photograph 9: Downstream view of Drain U-121.2 subsurface inlet drainpipe with valve; camera facing northwest, July 20, 2022.

Photograph 10: Upstream view of Drain U-121.2 with extended subsurface inlet drain pipe; camera facing southeast, July 20, 2022.

Photograph 11: Downstream view of Drain U-121.2 corrugated metal and plastic subsurface inlet drainpipes; camera facing southwest, July 20, 2022.

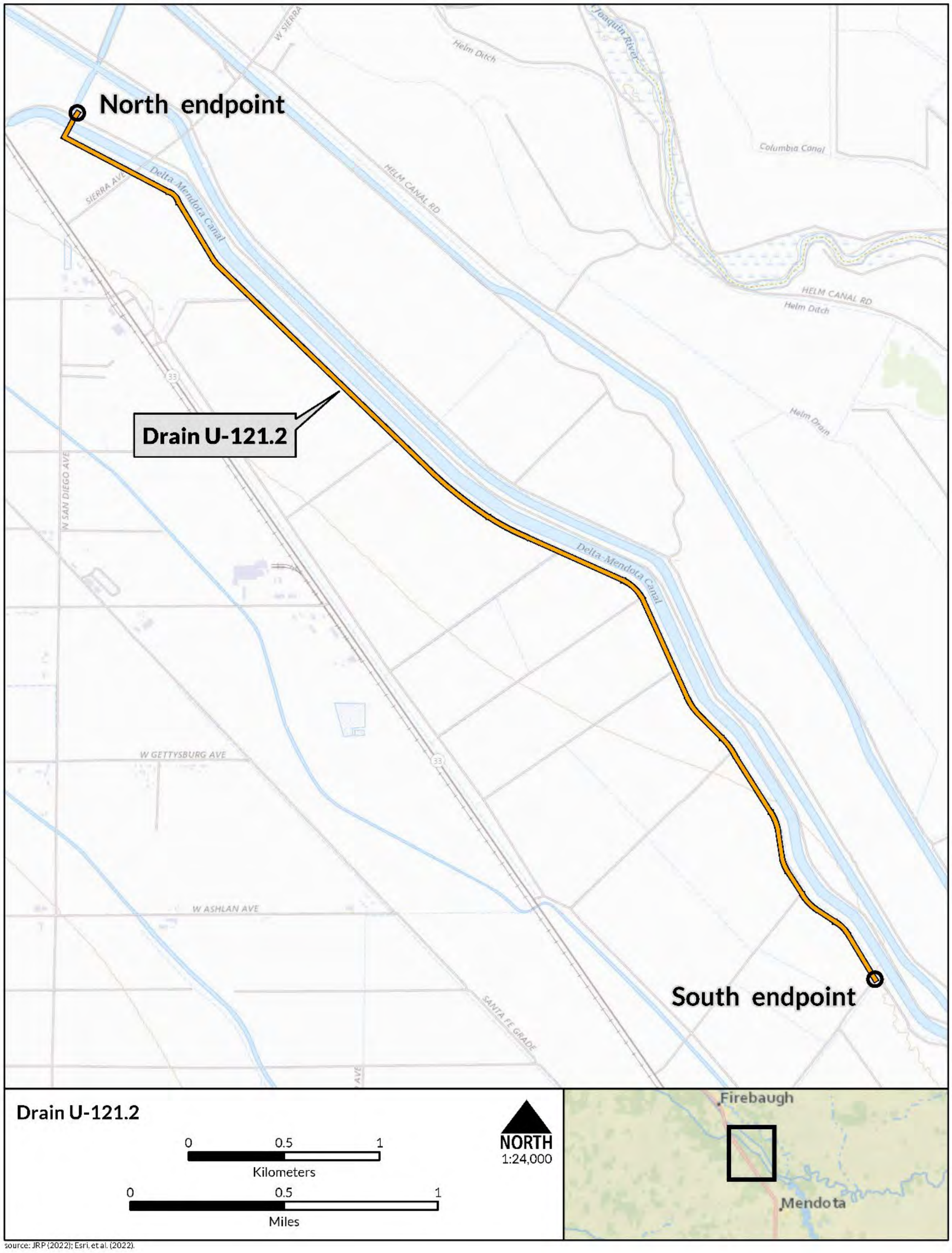
Photograph 12: Downstream view of Drain U-121.2 modern pumping equipment; camera facing northwest, July 20, 2022.

Primary # ________________________
HRI # ________________________
Trinomial ________________________

*Resource Name or # (Assigned by recorder) Drain U-121.2

*Drawn by: JRP Historical Consulting, LLC

*Date of map: 2022



State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # ____________
HRI # ____________
Trinomial ____________
NRHP Status Code 6Z

Other Listings ____________
Review Code ________ Reviewer ____________ Date ________

 ***Resource Name or #** (Assigned by recorder) APN: 251-050-120

P1. Other Identifier: ________

***P2. Location:** ☐ **Not for Publication** ☒ **Unrestricted** ***a. County** San Joaquin
and (P2b and P2c or P2d. Attach a Location Map as necessary.)
***b. USGS 7.5' Quad** Tracy, California **Date** 1980 **T** T3S; **R** 4E; NE ¼ **of Sec** 1; M.D. **B.M.**
c. Address 27655 South Lammers Road City Tracy Zip 95377
d. UTM: (give more than one for large and/or linear resources) Zone ______; ____________mE/ ____________mN
e. Other Locational Data: (e.g., parcel #, directions to resource, elevation, etc., as appropriate)
Assessor Parcel Number (APN) 251-050-120

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries)

The property at 27655 South Lammers Road lies on a 5.01-acre lot in Tracy, to the north of the Delta-Mendota Canal right of way. It comprises a main house, animal shelter, and prefabricated secondary home (**See Site Map**). The main house is a wood-framed 1,629 square-foot Ranch style single family residence (**Photograph 1**). Constructed in 1972 on a raised foundation with vents, this single-story house features a slightly irregular rectangle footprint. The wood shingle roof is side-gabled, with a wide eave overhang. The façade and north end of the house is of grooved plywood material, and the rest of the house is clad in stucco. There is a shallow recessed porch with brick veneer and supported by two unadorned square columns. The main entrance is an off-set wooden door with a centered glass panel. There is a wooden deck with lattice protruding on the east side of the residence. Fenestration includes a large metal-framed sliding window in the recessed porch, and smaller sliding windows in both directions. There is a two-car garage facing north, with a narrower prow roof line. Vertical board siding extends from the top of the garage doors to the roof line. (See Continuation Sheet.)

***P3b. Resource Attributes:** (List attributes and codes) HP2- Single Family Property

***P4. Resources Present:** ☒ Building ☐ Structure ☐ Object ☐ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)

P5a. Photo or Drawing (Photo required for buildings, structures, and objects.)

P5b. Description of Photo: (View, date, accession #) **Photograph 1**: residence (right) and prefabricated building (left background), camera facing southwest, July 18, 2022.

***P6. Date Constructed/Age and Sources:** ☒ Historic ☐ Prehistoric ☐ Both
1972, San Joaquin County Assessor

***P7. Owner and Address:**
Peter A. and Beth M. Swanson
27655 South Lammers Road
Tracy, CA 95377

***P8. Recorded by:** (Name, affiliation, address)
Cheryl Brookshear and D. Baza
JRP Historical Consulting, LLC
2850 Spafford St.
Davis, CA 95618

***P9. Date Recorded:** July 18, 2022

***P10. Survey Type:** (Describe) Intensive

***P11. Report Citation:** (Cite survey report and other sources, or enter "none.") JRP Historical Consulting, LLC, "Finding of Eligibility Delta-Mendota Canal Subsidence Correction Project," 2022, prepared for US Bureau of Reclamation and San Luis & Delta-Mendota Water Authority.

***Attachments:** ☐ None ☐ Location Map ☐ Sketch Map ☒ Continuation Sheet ☒ Building, Structure, and Object Record ☐ Archaeological Record ☐ District Record ☐ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record ☐ Artifact Record ☐ Photograph Record ☐ Other (list) ____________

***NRHP Status Code** 6Z

***Resource Name or #** (Assigned by recorder) APN: 251-050-120

B1. Historic Name: ______________
B2. Common Name: ______________
B3. Original Use: Residence B4. Present Use: Residence
***B5. Architectural Style:** Ranch
***B6. Construction History:** (Construction date, alteration, and date of alterations) Residence constructed 1972, animal shelter added 1972-1987; secondary residence added 1987-1993 and replaced 1993-2004

***B7. Moved?** ☒ **No** ☐ **Yes** ☐ **Unknown** **Date:** ______________ **Original Location:** ______________
***B8. Related Features:** ______________

B9. Architect: Unknown b. Builder: Unknown
***B10. Significance: Theme** n/a **Area** n/a
Period of Significance n/a **Property Type** n/a **Applicable Criteria** n/a
(Discuss importance in terms of historical or architectural context as defined by theme, period, and geographic scope. Also address integrity.)

The residence and outbuildings at 27655 South Lammers Road do not meet the criteria for listing in the National Register of Historic Places (NRHP) or the California Register of Historical Resources (CRHR), nor do they appear to be a historical resource for the purposes of California Environmental Quality Act (CEQA). These buildings have been evaluated in accordance with Section 106 of the National Historic Preservation Act of 1966 as amended and Section 15064.5(a)(2)-(3) of the CEQA Guidelines, using the criteria outlined in Section 5024.1 of the California Public Resources Code.

Historic Context
This property is located southwest of Tracy, on the dryer west side of the San Joaquin Valley, south of the fertile Sacramento-San Joaquin Delta lands. This area developed small scale agriculture later than other portions of the county and this property was not constructed until the second half of the twentieth century. (See Continuation Sheet.)

B11. Additional Resource Attributes: (List attributes and codes) ______

***B12. References:** Thompson and West, *History of San Joaquin County California with Illustrations*, Berkeley, California: Howell-North Books. 1968 reprint; Tinkham, George H. *History of San Joaquin County*. Los Angeles: Historic Record Company, 1923. Jelinek, Lawrence. *Harvest Empire: A History of California Agriculture.* San Francisco, CA: Boyd & Fraser, 1979. *Tracy Press* (See also footnotes.)

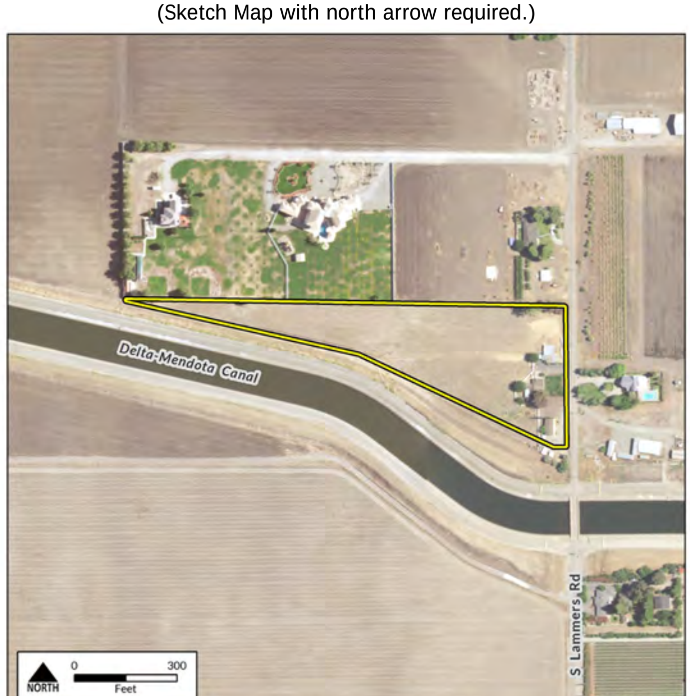
B13. Remarks:

***B14. Evaluator:** Cheryl Brookshear

***Date of Evaluation:** July 2022

(This space reserved for official comments.)

(Sketch Map with north arrow required.)



P3a. Description (continued):

The animal shelter on the property is an enclosed structure of one central square, and two roofs extending from the north and east sides (**Photograph 2).** All roofs are of corrugated metal with exposed eaves and projecting rafter tails. The main portion is wood framed with vertical wood siding. There are two doors on the west side. Off to the north, the structure features a long shed roof on two-by-two wood supports. Here there are open rafters and diagonal bracing between the posts and roof. The western side has a shorter roof and two bays, situated on two-by-one supports. There is a four-by-four enclosure composed of salvage such as a left-over utility pole and miscellaneous posts. Salvage is also used for fencing to create corrals.

South of the main house is a double-wide one-story side-gabled prefabricated home on a raised foundation with vents. The roof is composition shingle, and the walls are covered in grooved plywood. A prominent metal chimney extends from the northeastern side of the roof. There are deep overhangs on the gabled ends, but no overhang on the sides. The door is centered, with its own wooden stoop. It appears that there was previously an overhang above the door, for the gutters stop on either side. Fenestration is asymmetrical; the sliding windows are irregularly placed anodized aluminum. They include a flat trim and decorative panels below each window **(Photograph 3).**

In the southwestern corner of the property, there is a prefabricated end-gabled shed.

B10. Significance (continued):

The land southwest of Tracy was considered of little value through the 1850s as miners traveled through the area to and from the mines to cities around the San Francisco Bay. As the area is in the rain shadow of the Coast Range, dry farming of grain began in the area slightly later than other areas of the valley with grain cultivation starting around 1867. Wheat production through the county grew through the 1850s and 1860s and became a major economic force in the 1870s with most processing occurring in Stockton. While other areas of the county diversified with alfalfa, fruits, vines and orchards, the western portion of the valley remained dominated by grains and cattle grazing.[1]

Arrival of the Central Pacific Railroad in the area in 1869 stabilized settlement in the western part of the San Joaquin County. The railroad initially established Ellis as a coaling station on the route across the Altamont Pass, and in 1878 the Central Pacific Railroad created a second route connecting the San Joaquin line with West Oakland and Martinez. The two routes crossed east of Ellis, and the new location was named Tracy. The community became a railroad hub with additional lines meeting at the junction.[2]

Increased diversification of crops developed in the early twentieth century with irrigation. For the last half of the nineteenth century, hopes for irrigating the western side of the San Joaquin valley rested upon construction of canals from Tulare Lake. While companies were formed, no one succeeded in developing such a project. Instead, in 1910 the Patterson Ranch Company, attempting to profit from extensive land holdings, created the Patterson Water Company to operate an irrigation system on the west side of the San Joaquin Valley. Unlike the east side irrigation districts which were gravitationally fed districts, Patterson developed a pumped system that became a model for the west side of the valley. The area surrounding Tracy formed into the West Side Irrigation District in 1915. Irrigation led to diversified crops with additional fruits and

[1] Thompson and West, *History of San Joaquin County California with Illustrations* (Berkeley, California: Howell-North Books. 1968 reprint) 128-131; George H. Tinkham, *History of San Joaquin County* (Los Angeles: Historic Record Company, 1923) 105-106, 117-118, 120.

[2] Thompson and West, *History of San Joaquin County California,* 130; Raymond W. Hillman and Leonard A. Covello, *Cities & Towns of San Joaquin County Since 1847* (Fresno, CA: Panorama West Books, 1985); "The Important Cities of San Joaquin County," *The Lodi Sentinel*, Sept. 25, 1913; Ralph Lee and Christi Kennedy, "Tracy traces its roots back to railroad company," *Lodi News-Sentinel*, May 20, 2005; *Tracy Diamond Jubilee: 1878 to 1953* (Tracy, CA: Tracy Diamond Jubilee, Inc., 1953); Tracy Historical Society, *Images of America: Tracy* (San Francisco: Arcadia Publishing, 2004); *Tracy Press Centennial Edition*, Sept. 6, 1978.

vegetables. Three crops became dominant: alfalfa cultivation and ensuing dairy operations, sugar beet production, and beans.[3]

The area southwest of Tracy started changing after World War II. Until that time, the area was dominated by field-crops. The war expanded the agricultural economy throughout the state, and during the latter half of the twentieth century various shifts occurred that placed development pressures on farmland near urban areas across California. Agricultural pressures were both internal to the industry and external. Relocation of agricultural production from southern California and the coastal valleys increased farmland values in the San Joaquin Valley. Farming also became more industrialized in the latter half of the twentieth century. In general, this resulted in increasing farm sizes not only in land ownership, but in operational units, which for some farms included leased land from multiple owners to reach efficiencies in size.[4]

Under these pressures two trends developed. The state legislature passed the California Land Conservation Act of 1965 (Williamson Act), which allowed landowners to reduce their property tax by committing to retain their land as open space. The increased size of agricultural operational units caused some owners to lease the farmland and separate it from existing farmsteads and other structures. These trends continued through the late twentieth century and continue today. Combined with the many legal permutations for transferring farm ownership and operation to the next generation, agricultural land was and continues to be, increasingly separated from the historically associated farmsteads.[5]

Land in the vicinity of the Delta-Mendota Canal southwest of Tracy did not begin to divide into smaller parcels until the mid-twentieth century. At that time, the area that includes the subject parcel was owned by Roy F. Tuso and his wife Margaret. The family had purchased a ranch along Lammers Road around 1954 and constructed a home at 27545 South Lammers Road north of the subject property. Roy and his brothers Charles and Sal owned multiple properties around Tracy that they operated together.[6] Margaret Tuso, the administrix of Roy Tuso's estate, split a portion of the former Tuso ranch forming the subject parcel in 1972, four years after his death. Mary Foster, a teacher in the Tracy public schools purchased it and had the house built. The Ranch style house had a construction cost of $22,675. Foster continued teaching, possibly leasing the agricultural land. She sold the house in 1986 and within the next two years it was sold three times in rapid succession until it was purchased by current owners Carolyn and Peter Swanson, and Herbert Swanson. While the animal pen had been constructed prior to their purchase they added a secondary residence to the south between 1987 and 1993. It was replaced by the current prefabricated home between 1993 and 2004.[7]

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[3] History (pattersonid.org) accessed July 2022; Harmon S. Bonte, *Division of Water Resources Bulletin 37 Financial and General Data Irrigation, Reclamation and Other Public Districts in California* (Sacramento: California Division of Water Resources, 1930) 104; Tinkham, *History of San Joaquin County*, 115-116; Works Progress Administration, "History of Stockton and San Joaquin County," Works Progress Administration, 1938, Tracy 3.

[4] Lawrence Jelinek, *Harvest Empire: A History of California Agriculture* (San Francisco, CA: Boyd & Fraser, 1979),89,94; Philip M. Raup, "Disaggregating Farmland Markets," *Government Policy and Farmland Markets: The Maintenance of Farmer Wealth* (Ames, Iowa: Iowa State Press, 2003) 19; John E. Reynolds and Warren Johnston, "Micro-markets for Farmland: The Case of Florida and California," *Government Policy and Farmland Markets: The Maintenance of Farmer Wealth* (Ames, Iowa: Iowa State Press, 2003) 367-390;

[5] Lawrence Jelinek, *Harvest Empire: A History of California Agriculture* (San Francisco, CA: Boyd & Fraser, 1979),89,94; California Department of Conservation, The Land Conservation Act, www.conservation.ca.gov/dlrp/lca/Pages/Index.aspx, accessed June, 2017; Philip M. Raup, "Disaggregating Farmland Markets," *Government Policy and Farmland Markets: The Maintenance of Farmer Wealth* (Ames, Iowa: Iowa State Press, 2003) 19; John E. Reynolds and Warren Johnston, "Micro-markets for Farmland: The Case of Florida and California," *Government Policy and Farmland Markets: The Maintenance of Farmer Wealth* (Ames, Iowa: Iowa State Press, 2003) 367-390;

[6] "John Tuso First Tracy Baby of '59." *Tracy Press*, January 5, 1959, 1; "Roy Tuso," *Stockton Evening and Sunday Record*, March 26, 1968; "Funeral Service for Roy F. Tuso Set for Friday," *Tracy Press*, March 27, 1968; San Joaquin County Recorder, Deed Margaret Tuso and Estate of Roy Francis Tuso to Mary L. Foster, Book 3618, 215, February 9, 1972; San Joaquin County Assessor, Parcel Record for 251-050-240, accessed via parcelquest.com July 2022.

[7] R.L. Polk & Co., *Polk's Tracy City Directory* (Monterey Park, California: R.L. Polk & Co., 1972) 52; San Joaquin County Recorder, Deed Margaret Tuso and Roy Tuso estate to Mary Foster, Book 3618, 215, February 9, 1972; "Permits Issued for Two Homes in Rural Area," *Tracy Press*, March 8, 1972, 15; San Joaquin County Recorder, Deed Mary Foster to James D and Clare Atkins, Document

Evaluation

This property was developed during the post war reorganization of agriculture into a more industrial and corporate model and large lot residential construction began to meld urban and rural development (NRHP Criterion A / CRHR Criterion 1). The residence and associated acreage do not fit well within either trend. Mary Foster's use of the land is not documented. This parcel is larger than most used for rural residential development, but it is not large enough to represent industrial and corporate agriculture. Nor does her development of the property represent any other noted trend of the period.

This property does not have an association with the life of an individual important to history (NRHP Criterion B / CRHR Criterion 2). It does not appear that any specific person associated with this property made demonstrably important contributions to history at the local, state, or national level. This residence and associated buildings were constructed after the Tuso family began to pool their lands to create a more corporate farming system, and the buildings are not associated with the family. Mary Foster was a schoolteacher, and the residence and agricultural land does not represent her productive life. Later occupants have used the property for small scale agriculture and research did not reveal any significant activities.

Under NRHP Criterion C / CRHR Criterion 3 this property is not significant as an important example of a type, period, or method of construction. The main residence has a low long plan typical of the Ranch style developed in the 1930s and 1940s which tried to adopt the affect of early western residences. The houses typically had a long low profile including long porches and mixed materials. The Ranch style became popular in the 1950s and 1960s. By the 1970s new influences were introduced. This example shows the increasing influence of Contemporary style with a more minimalistic façade and the pointed ship-like prow projection of the roof ridge. The residence does not appear to include new materials such as glue laminated beams that came to define the Contemporary style. While a transitional example, this residence does not embody significant innovations to either style. The animal shelter is utilitarian and is a common example of the type of building. The prefabricated secondary residence is a newer addition but shows wear. This example is a double-wide mobile home type developed during the 1970s and has become common place in rural and isolated areas. Easily relocated based upon need, and inexpensive they are frequently largely utilitarian with little stylistic elements. The inclusion of faux panels below the windows does not represent any specific architectural style and does not elevate this building to a level of aesthetic interest. As such, these buildings are not important architectural examples and do not meet these significance criteria.

Under NRHP Criterion D / CRHR Criterion 4, this property is not a significant or likely source of important historical information. The ranch residence, animal shelter, and prefabricated residence on this parcel do not appear to have any likelihood of yielding important information about historic construction materials or technologies. Also, the property's land use and the layout of the extant built environment resources, and the relationship the building with the surrounding parcels is typical of the period and does not provide important information within the broader economic, social, and cultural setting of the area since its construction in 1972. This evaluation does not address non-built environment resources or pre-historic resources.

Visual inspection of the residences does not indicate any significant modifications to the buildings. The animal shelter appears to have been partially accretive, but lacks any indications of particular building campaigns. The property retains integrity of location, materials, design, workmanship, setting, feeling, and association. The expansion of Tracy and the construction, currently in progress, of a new housing development to the east will result in a decline to the integrity of the setting. Despite general integrity, the property does not meet any of the criteria necessary for eligibility for listing in either the NRHP or CRHR.

86037339, May 27, 1986; San Joaquin County Recorder, Deed James D and Clare Atkins to Elizabeth C Fee, Document 87115448, December 23, 1987; San Joaquin County Recorder, Deed Elizabeth C Fee to Carolyn S, Herbert T and Peter A Swanson, Document 87115449, December 23, 1987; USGS, Aerial Photographs San Joaquin County Flight NAPP 515-59, June 29, 1987, Earth Explorer Accessed July 2022; Google, Google Earth Historic imagery 1993 and 2004, accessed July 2022.

Photographs (continued):

Photograph 2. Animal shelter north of residence, camera facing northwest, July 18, 2022.

Photograph 3. Prefabricated secondary residence (center) and prefabricated shed (left) camera facing northwest, July 18, 2022.

*Resource Name or # (Assigned by recorder) APN:251-050-120

*Recorded by C. Brookshear and D. Baza *Date July 18, 2022 ☒ Continuation ☐ Update

Site Map:

data: JRP (2022); San Joaquin County GIS (2022). base map: Service Layer Credits: © 2022 Microsoft Corporation © 2022 Maxar ©CNES (2022) Distribution Airbus DS

State of California – The Resources Agency
DEPARTMENT OF PARKS AND RECREATION
PRIMARY RECORD

Primary # ________
HRI # ________
Trinomial ________
NRHP Status Code 6Z

Other Listings ________
Review Code ________ Reviewer ________ Date ________

***Resource Name or #** (Assigned by recorder) APN: 240-140-260

P1. Other Identifier: ________

***P2. Location:** ☐ Not for Publication ☒ Unrestricted ***a. County** San Joaquin

and (P2b and P2c or P2d. Attach a Location Map as necessary.)

***b. USGS 7.5' Quad** Tracy, California **Date** 1980 **T** 3S; **R** 5E; SW ¼ **of Sec** 6; M.D. **B.M.**

c. Address 4500 South Lammers Road City Tracy Zip 95377

d. UTM: (give more than one for large and/or linear resources) Zone ______; ________mE/ ________mN

e. Other Locational Data: (e.g., parcel #, directions to resource, elevation, etc., as appropriate)

Assessor Parcel Number (APN) 240-140-260

***P3a. Description:** (Describe resource and its major elements. Include design, materials, condition, alterations, size, setting, and boundaries)

The property at 4500 South Lammers Road sits on a one-acre lot just outside Tracy on the south side of the Delta-Mendota Canal right of way. The property contains a 2,335 square-foot residence, and a 1,500 square-foot out building. The main house is a wood-framed single-family residence that has a generally rectangular footprint with a square addition off the northeast corner (**Photograph 1**). Constructed in 1956 on a concrete slab, this single-story house has a composition shingle complex hip roof that sits atop the stucco and brick veneer walls. The residence has an off-center entry projection north of the attached two bay garage. The projection is clad in brick veneer. Large, anodized metal or vinyl sliding windows are on the façade. A large textured window is on the north side of the entrance projection. The square rear addition has smaller sliding windows with little or no trim. The roof has deep eaves with a narrow fascia trim. Solar panels are a recent addition on the roof. A large brick chimney projects from the east slope of the roof. (See Continuation Sheet.)

***P3b. Resource Attributes:** (List attributes and codes) HP2- Single Family Property

***P4. Resources Present:** ☒ Building ☐ Structure ☐ Object ☐ Site ☐ District ☐ Element of District ☐ Other (Isolates, etc.)

P5a. Photo or Drawing (Photo required for buildings, structures, and objects.)

P5b. Description of Photo: (View, date, accession #) **Photograph 1.** Residence camera facing southeast, July 18, 2022

***P6. Date Constructed/Age and Sources:** ☒ Historic ☐ Prehistoric ☐ Both
1956, San Joaquin County Assessor

***P7. Owner and Address:**
Joseph Cardenas et al
4500 South Lammers Road
Tracy, CA 95377

***P8. Recorded by:** (Name, affiliation, address)
Cheryl Brookshear and D. Baza
JRP Historical Consulting, LLC
2850 Spafford St.
Davis, CA 95618

***P9. Date Recorded:** July 18, 2022

***P10. Survey Type:** (Describe) Intensive

***P11. Report Citation:** (Cite survey report and other sources, or enter "none.") JRP Historical Consulting, LLC, "Finding of Eligibility Delta-Mendota Canal Subsidence Correction Project," 2022, prepared for US Bureau of Reclamation and San Luis & Delta-Mendota Water Authority.

***Attachments:** ☐ None ☐ Location Map ☐ Sketch Map ☒ Continuation Sheet ☒ Building, Structure, and Object Record ☐ Archaeological Record ☐ District Record ☐ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record ☐ Artifact Record ☐ Photograph Record ☐ Other (list) ________

***NRHP Status Code** 6Z
***Resource Name or #** (Assigned by recorder) APN: 240-140-260

B1. Historic Name: ______
B2. Common Name: ______
B3. Original Use: Residence B4. Present Use: Residence
***B5. Architectural Style:** Minimal Traditional/ Ranch
***B6. Construction History:** (Construction date, alteration, and date of alterations) Residence constructed 1956; updated 1967, divided from surrounding agricultural land 1997; solar panels added 2020; secondary rear building added 1993-2003

***B7. Moved?** ☒ **No** ☐ **Yes** ☐ **Unknown Date:** ______ **Original Location:** ______
***B8. Related Features:** ______

B9. Architect: Unknown b. Builder: Perry Associates, Builders of Homes, Inc.
***B10. Significance: Theme** n/a **Area** n/a
Period of Significance n/a **Property Type** n/a **Applicable Criteria** n/a
(Discuss importance in terms of historical or architectural context as defined by theme, period, and geographic scope. Also address integrity.)

The residence and outbuilding at 4500 South Lammers Road do not meet the criteria for listing in the National Register of Historic Places (NRHP) or the California Register of Historical Resources (CRHR), nor do they appear to be historical resources for the purposes of California Environmental Quality Act (CEQA). These buildings have been evaluated in accordance with Section 106 of the National Historic Preservation Act of 1966 as amended and Section 15064.5(a)(2)-(3) of the CEQA Guidelines, using the criteria outlined in Section 5024.1 of the California Public Resources Code.

Historic Context

This property is located southwest of Tracy, on the dryer west side of the San Joaquin Valley, south of the fertile Sacramento-San Joaquin Delta lands. This area developed small scale agriculture later than other portions of the county and this property was not constructed until the second half of the twentieth century. (See Continuation Sheet.)

B11. Additional Resource Attributes: (List attributes and codes) ______

***B12. References:** Thompson and West, *History of San Joaquin County California with Illustrations*, Berkeley, California: Howell-North Books. 1968 reprint; Tinkham, George H. *History of San Joaquin County*. Los Angeles: Historic Record Company, 1923. Jelinek, Lawrence. *Harvest Empire: A History of California Agriculture*. San Francisco, CA: Boyd & Fraser, 1979. *Tracy Press* (See also footnotes.)

B13. Remarks:

***B14. Evaluator:** Cheryl Brookshear

***Date of Evaluation:** July 2022

(This space reserved for official comments.)

(Sketch Map with north arrow required.)

P3a. Description (continued):

A large secondary building sits behind the residence mostly obscured by vegetation and the main house (**Photograph 2).** The nearly square building has a side gable roof and is clad in stucco. The western façade is recessed under the roof creating a full-length porch supported on simple, square, wood posts. A pair of French doors on the west façade were the only other discernable features.

B10. Significance (continued):

The land southwest of Tracy was considered of little value through the 1850s as miners traveled through the area to and from the mines to cities around the San Francisco Bay. As the area is in the rain shadow of the Coast Range, dry farming of grain began in the area slightly later than other areas of the valley with grain cultivation starting around 1867. Wheat production through the county grew through the 1850s and 1860s and became a major economic force in the 1870s with most processing occurring in Stockton. While other areas of the county diversified with alfalfa, fruits, vines and orchards, the western portion of the valley remained dominated by grains and cattle grazing.[1]

Arrival of the Central Pacific Railroad (CPRR) in the area in 1869 stabilized settlement in the western part of the San Joaquin County. The railroad initially established Ellis as a coaling station on the route across the Altamont Pass, and in 1878 the CPRR created a second route connecting the San Joaquin line with West Oakland and Martinez. The two routes crossed east of Ellis, and the new location was named Tracy. The community became a railroad hub with additional lines meeting at the junction. When the Western Pacific Railroad (WPRR) sought to challenge CPRR in the early twentieth century it ran tracks largely parallel to the earlier Central Pacific route through the pass. But since Tracy was formed and controlled by CPRR and its successor Southern Pacific Railroad, the WPRR tracks passed south of the city with its own junction at Carbona by 1909.[2]

Increased diversification of crops developed in the early twentieth century with irrigation. For the last half of the nineteenth century, hopes for irrigating the western side of the San Joaquin valley rested upon construction of canals from Tulare Lake. While companies were formed, no one succeeded in developing such a project. Instead, in 1910 the Patterson Ranch Company, attempting to profit from extensive land holdings, created the Patterson Water Company to operate an irrigation system on the west side of the San Joaquin Valley. Unlike the east side irrigation districts which were gravitationally fed districts, Patterson developed a pumped system that became a model for the west side of the valley. The area surrounding Tracy formed into the West Side Irrigation District in 1915. Irrigation led to diversified crops with additional fruits and vegetables. Three crops became dominant: alfalfa cultivation and ensuing dairy operations, sugar beet production, and beans.[3]

The area southwest of Tracy started changing after World War II. Until that time, the area was dominated by field-crops. The war expanded the agricultural economy throughout the state, and during the latter half of the twentieth century various shifts occurred that placed development pressures on farmland near urban areas across California. Agricultural pressures

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[1] Thompson and West, *History of San Joaquin County California with Illustrations* (Berkeley, California: Howell-North Books. 1968 reprint) 128-131; George H. Tinkham, *History of San Joaquin County* (Los Angeles: Historic Record Company, 1923) 105-106, 117-118, 120.

[2] Thompson and West, *History of San Joaquin County California*, 130; Raymond W. Hillman and Leonard A. Covello, *Cities & Towns of San Joaquin County Since 1847* (Fresno, CA: Panorama West Books, 1985); "The Important Cities of San Joaquin County," *The Lodi Sentinel*, Sept. 25, 1913; Ralph Lee and Christi Kennedy, "Tracy traces its roots back to railroad company," *Lodi News-Sentinel*, May 20, 2005; *Tracy Diamond Jubilee: 1878 to 1953* (Tracy, CA: Tracy Diamond Jubilee, Inc., 1953); Tracy Historical Society, *Images of America: Tracy* (San Francisco: Arcadia Publishing, 2004); *Tracy Press Centennial Edition*, Sept. 6, 1978; Arthur L. Lloyd, "Western Pacific Railroad: A Railroader's History," *Classic Trains*, August 2021, Western Pacific Railroad: A railroader's history - Trains; USGS, *Tracy, California Topographic Map* (Washington, D.C.: USGS, 1916).

[3] History (pattersonid.org) accessed July 2022; Harmon S. Bonte, *Division of Water Resources Bulletin 37 Financial and General Data Irrigation, Reclamation and Other Public Districts in California* (Sacramento: California Division of Water Resources, 1930) 104; Tinkham, *History of San Joaquin County*, 115-116; Works Progress Administration, "History of Stockton and San Joaquin County," Works Progress Administration, 1938, Tracy 3.

were both internal to the industry and external. Relocation of agricultural production from southern California and the coastal valleys increased farmland values in the San Joaquin Valley. In the latter half of the twentieth century farming also became more industrialized. In general, this resulted in increasing farm sizes not only in land ownership, but in operational units, which for some farms included leased land from multiple owners to reach efficiencies in size.[4]

Under these pressures two trends developed. The state legislature passed the California Land Conservation Act of 1965 (Williamson Act), which allowed landowners to reduce their property tax by committing to retain their land as open space. The increased size of agricultural operational units caused some owners to lease the farmland and separate it from existing farmsteads and other structures. These trends continued through the late twentieth century and continue today. Combined with the many legal permutations for transferring farm ownership and operation to the next generation, agricultural land was and continues to be increasingly separated from the historically associated farmsteads.[5]

The property in the vicinity of the Delta-Mendota Canal southwest of Tracy did not begin to divide into smaller parcels until the mid-twentieth century. Charles and Josephine Spatafore purchased 22 acres (from which the subject parcel would later be separated) between the WPRR tracks, the Delta-Mendota Canal, and Lammers Road in 1956. The property was for their son Charles Jr. who had just married Margaret McDaniel. The elder Spatafores were apricot farmers on the east side of Tracy along Chrisman Road. Charles Jr. and his wife took up apricot farming on the new land. The elder Spatafores had the home built at 4500 South Lammers Road for the couple by Perry Associates Builders that same year. The house was a simple rectangular building with the slight projecting entryway near the south end. While Charles developed the farm, Margaret was active promoting apricots, literacy, and community social events. In 1960, the younger Spatafores were able to purchase their land from the elder couple. By 1967 the ranch was productive and participated in a field test for mechanical apricot harvesting equipment developed by the University of California, Davis. The financial success resulted in a renovation of the home including the construction of the two garage bays on the south end and the square addition off the northeast corner. As farming continued to industrialize in the San Joaquin Valley, Spatafore joined with his parents and other farmers to create Bella Vista Farms as a joint business venture. The couple also created a pick your own farm, farmstand, bakery, and fishing pond along Patterson Pass Road. As they matured Charles Jr. went on to serve on several water and irrigation district boards. In their later years the couple changed their agricultural pursuits. In 1997, they sold the residence recorded on this form and a single acre to Ronald and Margaret Wiley who are the likely builders of the second building. The residence at 4500 South Lammers Road has sold two additional times and serves as a large parcel rural residence and is no longer associated with the Spatafore family, nor is it associated with agriculture.[6]

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[4] Lawrence Jelinek, *Harvest Empire: A History of California Agriculture* (San Francisco, CA: Boyd & Fraser, 1979),89,94; Philip M. Raup, "Disaggregating Farmland Markets," *Government Policy and Farmland Markets: The Maintenance of Farmer Wealth* (Ames, Iowa: Iowa State Press, 2003) 19; John E. Reynolds and Warren Johnston, "Micro-markets for Farmland: The Case of Florida and California," *Government Policy and Farmland Markets: The Maintenance of Farmer Wealth* (Ames, Iowa: Iowa State Press, 2003) 367-390;

[5] Lawrence Jelinek, *Harvest Empire: A History of California Agriculture* (San Francisco, CA: Boyd & Fraser, 1979),89,94; California Department of Conservation, The Land Conservation Act, www.conservation.ca.gov/dlrp/lca/Pages/Index.aspx, accessed June, 2017; Philip M. Raup, "Disaggregating Farmland Markets," *Government Policy and Farmland Markets: The Maintenance of Farmer Wealth* (Ames, Iowa: Iowa State Press, 2003) 19; John E. Reynolds and Warren Johnston, "Micro-markets for Farmland: The Case of Florida and California," *Government Policy and Farmland Markets: The Maintenance of Farmer Wealth* (Ames, Iowa: Iowa State Press, 2003) 367-390;

[6] San Joaquin County Recorder, Deed Salvatore and Anna Magnasco to Charles and Josephine Spatafore, Book 1841, 391, February 26, 1956; "Margaret McDaniel Becomes Bride of Charles Spatafore," *Stockton Evening Record*, June 20, 1956, 25; San Joaquin County Recorder, Notice of Completion, Book 1906, 247, September 24, 1956; "Mrs. Charles Spatafore Offers Recipes for Elegant 'Do-Ahead' Buffet Dinner," *Tracy Press*, May 27, 1964, 10; "Jo and Marge Spatafore Share Apricot Recipes," *Tracy Press*, July 6, 1966, 12; San Joaquin County Recorder, Deed Charles and Josephine Spatafore to Charles Jr. and Margaret Spatafore, Book 2266, 491, January 21, 1960; "Machine Harvest of Apricots Tested in Central California," *Stockton Evening Record*, July 22, 1967, 21; "Legal Notice," *Tracy Press*, October 18, 1967, 16; "Apricot Growers' Wives Form Auxiliary," *Tracy Press*, June 7, 1972, 13; "Public Notice," *Tracy Press*, June 4, 1976, 21; San Joaquin County Recorder, Deed Charles Jr. and Margaret Spatafore to Ronald and Margaret Wiley, Document 9705747, May 23, 1997; San Joaquin County Assessor, Assessor Parcel Data Parcel 240-140-270, obtained via ParcelQuest, July 2022; "Obituary Charles Spatafore Jr." *The Record*, November 27, 2008; Cartwright and Company, San Joaquin County Aerial Photography,

Evaluation

Under NRHP Criterion A or CRHR Criterion 1, this property does not have significant associations with important historic events or trends. The residence was constructed as part of a family farm. Although the house's residents appear to have shared some aspects of farm management, the property does not appear to contribute to the trend of industrialization and corporation of agriculture. This property does not illustrate the growing industrialization and corporation of California agriculture in the latter half of the twentieth century. The residence was separated from the associated agricultural land in 1997, which is late in the development of large parcel residential properties in the state. The property did not form a model for this type of growth or initiate growth in the rural area around Tracy.

This property does not have an association with the life of an individual important to history (NRHP Criterion B / CRHR Criterion 2). It does not appear that any specific person associated with this property made demonstrably important contributions to history at the local, state, or national level. Charles Spatafore Jr. and his wife were successful agriculturists and businesspeople active in their community. While active their varied pursuits, those accomplishments did not result in or affect significant trends or developments within the community. Later occupants have used the property as a residence and research did not reveal any significant activities.

Under NRHP Criterion C / CRHR Criterion 3 this property is not significant as an important example of a type, period, or method of construction. Based upon floor plan and the general simplicity of the north end (oldest portion) of the house it was likely constructed as a Minimal Traditional residence. The Minimal Traditional style was an attempt to modernize architecture, leaving behind all the stylistic embellishments of the past beginning in the 1930s. Simple clean lines were used with minimal trim and no ornament. The style reached the height of popularity immediately after World War II, by the later 1950s and 1960s the style was replaced with the Ranch style which had developed around the same time as Minimal Traditional. The style attempted to evoke the ranches of mid-nineteenth century western settlement. The long low profile expressed the expanse of the outdoors, and a mix of materials the accretive nature of early development. They often had long porches and deep roofs. Elements of this transition are commonly found in homes of this period. The Minimal Traditional them offered compact, economical floor plans, and the Ranch a bit of stylistic flair. This residence with very plain northern and southern ends and a more elaborate entry is typical. The entry with the brick veneer attempts to evoke a more Ranch like theme. Extending the garage to the south also enhanced the Ranch like appearance. The Minimal Traditional lines are still visible, and the projecting entry rather than a recessed or porch covered entry prevent a full transition to the later style. This example is common and typical to both urban and rural areas throughout California. Perry Associates was not a significant builder of the period, and the residence is not the work of a master or has high artistic merit.

Under NRHP Criterion D / CRHR Criterion 4, this property is not a significant or likely source of important historical information. The residence and secondary building on this parcel do not appear to have any likelihood of yielding important information about historic construction materials or technologies. Also, the property's land use and the layout of the extant built environment resources, and the relationship the buildings have with the surrounding parcels is typical of the period and does not provide important information within the broader economic, social, and cultural setting of the area since its construction in 1956. This evaluation does not address non-built environment resources or pre-historic resources.

The main residence was significantly altered in 1967 adding the two-bay garage and northeastern addition. The façade windows appear to be double glazed replacements likely during the construction of the secondary residence between 1997-2003. The property's integrity of design, materials, workmanship, setting, feeling, and association to the date of original construction, 1956, is thus diminished. The property has more integrity to the 1967 renovation retaining design and most materials and workmanship. The separation of the property from the associated agricultural land however affects the feeling and association of the property. Rapid development of Tracy resulting in construction of a housing development directly north of the residence is beginning to affect the property's integrity of the setting.

Flight ABD-1957, frame 39T-42, July 15, 1957, for USDA, accessed UC Santa Barbara Frame Finder, July 2022; San Joaquin County Recorder, Deed Ronald and Margaret Wiley to Samantha and Alexander O'Connor, Document 2020069346, June 12, 2020; San Joaquin County Recorder, Deed Alexander O'Connor to Joseph Cardenas et al, Document 2021208477, December 14, 2021; Google Earth Historic Imagery, accessed July 2022.

Photographs (continued):

Photograph 2. Second building behind the main residence, camera facing southeast, July 18, 2022.

Appendix C: Tables

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Misc	0.09	4+69.4	Non-Contributing	No Adverse Effect	No Adverse Effect
O&M Road, Left Bank	0.19-116.61		Contributing	No Adverse Effect	No Adverse Effect
Canal Lining Section	0.19-0.85		Contributing	No Adverse Effect	No Adverse Effect
O&M Road, Right Bank	0.19-116.61		Contributing	No Adverse Effect	No Adverse Effect
Bridge	0.33	17+32	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	0.38	19+95	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	0.38	19+95	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	0.74	19+95	Non-Contributing	No Adverse Effect	No Adverse Effect
Canal Lining Section	0.87-2.52		Contributing	No Adverse Effect	No Adverse Effect
Drainlet	0.95	50+25	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	1.05		Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	1.33	70.20	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	1.36	72+35	Non-Contributing	No Adverse Effect	No Adverse Effect
Siphon	1.36-3.50	72+37	Contributing	No Adverse Effect	No Adverse Effect
Sign	1.41	74+32	Contributing	No Adverse Effect	No Adverse Effect
Drainlet	1.44	75+67	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	1.63	86+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	1.89	100+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	1.94	102+81	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	1.95	103+37	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	1.96	103+93	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	1.97	104.49	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	1.99	105+61	Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Shoulder Drain	2.07	110+09	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	2.08	110+65	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	2.37	125+20	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	2.47	130+14	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	2.53	133+75	Contributing	No Adverse Effect	No Adverse Effect
Culvert	2.68		Non-Contributing	No Adverse Effect	No Adverse Effect
Misc	3.12	164+64	Contributing	No Adverse Effect	No Adverse Effect
Culvert	3.33		Non-Contributing	No Adverse Effect	No Adverse Effect
Building	3.49	184+01	Contributing	No Adverse Effect	No Adverse Effect
Inlet	3.50		Non-Contributing	No Adverse Effect	No Adverse Effect
Canal Lining Section	3.50-13.66		Contributing	Adverse Effect	Adverse Effect
Pipe	3.53		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	3.53		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	3.53		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	3.54-4		Non-Contributing	No Adverse Effect	No Adverse Effect
Building	3.65	193+34	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	3.78	199+60	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	3.96	209+15	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	3.96	209+11	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	4.16	218+02	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	4.17	218+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	4.22		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	4.29	225+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Siphon	4.41-4.63	231+80	Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Shoulder Drain	4.76	250+20	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	4.77	250+30	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	4.97	260+60	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	4.98	261+25	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	4.99	261+75	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	5.15	270+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	5.30	278+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	5.45		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	5.67	297+90	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	5.77		Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	6.01	316+10	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	6.01	315+85	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	6.27		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	6.36	334+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	6.59	346+72	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	6.60	347+42	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	6.60	347+07	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	6.74	354.90	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	6.75	355+40	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	6.95	366+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	7.00		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	7.10		Non-Contributing	No Adverse Effect	No Adverse Effect
Building	7.23		Non-Contributing	No Adverse Effect	No Adverse Effect
Overchute	7.25	381+50	Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Shoulder Drain	7.29	383+61	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	7.50	395+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	7.66	403+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	7.67	403+92	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	7.67	404+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	7.67		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	7.69	404+98	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	7.81		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	8.01	422+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	8.21	433+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	8.37	441+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	8.49		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	8.51		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	8.52		Contributing	Adverse Effect	Adverse Effect
Turnout	8.71		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	8.80		Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	8.91	469+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	8.92	470+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	9.04	476+34	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	9.07	477+95	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	9.26	487+42	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	9.27-9.29	487+94	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	9.27	487+94	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	9.29	489+30	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	9.29	489+40	Non-	No Adverse	No Adverse

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
			Contributing	Effect	Effect
Turnout	9.29		Contributing	No Adverse Effect	No Adverse Effect
Turnout	9.40		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	9.43	497+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	9.82		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	9.85		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	9.87	574+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	10.09		Contributing	Adverse Effect	Adverse Effect
Bridge	10.28	585+41	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	10.53		Contributing	Adverse Effect	Adverse Effect
Drainlet	10.55	610+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	10.61		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	10.62	613+29	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	10.78	622+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Overchute	10.86	626+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	10.87	626+75	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	11.04	635+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	11.28		Contributing	Adverse Effect	Adverse Effect
Stillwell	11.32	650+85	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	11.35	652+65	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 1	11.35	652+65	Contributing	Adverse Effect	Adverse Effect
Drainlet	11.38	635+95	Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	11.41	655+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	11.45		Contributing	Adverse Effect	Adverse Effect
Shoulder Drain	11.49	659+40	Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Siphon	11.49-11.51	659+72	Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	11.51	660+60	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	11.53	661+47	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	11.74	673+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	11.77	674+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Overchute	11.88	680+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	12.07		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	12.09	691+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	12.31	702+95	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	12.33	704+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	12.37		Contributing	Adverse Effect	Adverse Effect
Inlet	12.37	706+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	12.71		Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	12.75	723+80	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	13.00		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	13.25		Contributing	No Adverse Effect	No Adverse Effect
Bridge	13.25	752+60	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	13.25	752+85	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	13.25	752+35	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	13.26		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	13.27		Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	13.31		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	13.45	763+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	13.57		Contributing	Adverse Effect	Adverse Effect
Siphon	13.66-13.69	774+66	Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Shoulder Drain	13.69	775+90	Non-Contributing	No Adverse Effect	No Adverse Effect
Canal Lining Section	13.70-20.62		Contributing	Adverse Effect	Adverse Effect
Shoulder Drain	13.96	789+75	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	13.96	790+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	13.97		Contributing	No Adverse Effect	No Adverse Effect
Turnout	14.12		Contributing	Adverse Effect	Adverse Effect
Drainlet	14.19	802+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	14.26		Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	14.26		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	14.49		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	14.49		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	14.49		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	14.79	833+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	14.79		Contributing	Adverse Effect	Adverse Effect
Bridge	14.80	833+87	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	14.80		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	14.81		Contributing	Adverse Effect	Adverse Effect
Culvert	14.82		Non-Contributing	No Adverse Effect	No Adverse Effect
Misc	15.08		Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	15.09	850+25	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	15.10	850+74	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	15.10		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	15.10		Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	15.85	872+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	15.95		Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Turnout	16.14		Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	16.15	899+25	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	16.16	899+90	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 2	16.19	901+05	Contributing	Adverse Effect	Adverse Effect
Building	16.19	901+05	Non-Contributing	No Adverse Effect	No Adverse Effect
Siphon	16.20-16.25	901+65	Contributing	No Adverse Effect	No Adverse Effect
Siphon	16.31-16.34	907+15	Contributing	No Adverse Effect	No Adverse Effect
Stillwell	16.39	911+05	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	16.64		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	16.65	925+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	16.78		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	16.78		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	16.80		Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	17.10	949+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	17.22		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	17.23	954+14	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	17.59		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	17.77		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	18.05	996+94	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	18.05		Contributing	Adverse Effect	Adverse Effect
Turnout	18.06		Contributing	Adverse Effect	Adverse Effect
Pipe	18.47		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	18.47		Non-Contributing	No Adverse Effect	No Adverse Effect
Overchute	18.59	1025+68	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	18.60		Contributing	Adverse Effect	Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Turnout	18.90		Contributing	Adverse Effect	Adverse Effect
Turnout	19.15		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	19.17	1052+30	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	19.18		Contributing	Adverse Effect	Adverse Effect
Turnout	19.39		Contributing	Adverse Effect	Adverse Effect
Turnout	19.40		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	19.59		Contributing	No Adverse Effect	No Adverse Effect
Drainlet	19.59	10.74+25	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	19.85	1088+20	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	20.00		Contributing	Adverse Effect	Adverse Effect
Drainlet	20.20	1096+40	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	20.37	1115.50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	20.42		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	20.43		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	20.59		Contributing	Adverse Effect	Adverse Effect
Stillwell	20.60	1127+55	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	20.63	1128+70	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 3	20.63	1129+35	Contributing	Adverse Effect	Adverse Effect
Canal Lining Section	20.66-34.41		Contributing	Adverse Effect	Adverse Effect
Stillwell	20.69	1132+35	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	20.70	1133+25	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	20.71	1133+75	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	20.85	1141+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	20.96	1146+85	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	20.97		Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Turnout	20.97		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	21.00	1154+99	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	21.12		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	21.13		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	21.22	1160+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	21.25		Contributing	Adverse Effect	Adverse Effect
Bridge	21.49	1174+52	Non-Contributing	No Adverse Effect	No Adverse Effect
Sign	21.49	1174+52	Contributing	No Adverse Effect	No Adverse Effect
Turnout	21.65		Contributing	Adverse Effect	Adverse Effect
Inlet	21.86		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	21.87	1195+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Overchute	21.91	1197+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	21.95	1199+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	22.20		Contributing	Adverse Effect	Adverse Effect
Drainlet	22.26	1215+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	22.37	1220+90	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	22.39	1220+90	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	22.45	1225+12	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	22.48	1226+80	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	22.50		Contributing	No Adverse Effect	No Adverse Effect
Drainlet	22.51	1227+80	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	22.54	1229+90	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	22.57	1231+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	22.60	1233+15	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	22.67	1237+00	Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Shoulder Drain	22.67	1237+85	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	22.70	1239+37	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	22.72	1240+57	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	22.73	1240+80	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	22.73	1240+57	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	22.75		Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	22.77	1242+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	22.78		Contributing	Adverse Effect	Adverse Effect
Shoulder Drain	22.80	1252+80	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	23.09	1259+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	23.26	489+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	23.36	494+35	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	23.41	497+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	23.41		Contributing	Adverse Effect	Adverse Effect
Drainlet	23.72	513+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	23.76		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	23.81		Contributing	Adverse Effect	Adverse Effect
Turnout	23.94		Contributing	No Adverse Effect	No Adverse Effect
Siphon	23.95-24.01	525+70	Contributing	No Adverse Effect	No Adverse Effect
Inlet	24.38		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	24.38		Contributing	Adverse Effect	Adverse Effect
Drainlet	24.39	548+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	24.40	549+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	24.40	548+85	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 4	24.42	550+00	Contributing	Adverse Effect	Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Building	24.43	550+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	24.48	553+60	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	24.48	553+35	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	24.67	563+60	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	24.89	575+45	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	25.02		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	25.02		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	25.03		Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	25.07	584+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	25.10	585+90	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	25.18		Non-Contributing	No Adverse Effect	No Adverse Effect
Overchute	25.20	591+20	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	25.27	594+90	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	25.37	600+20	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	25.59	611+80	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	25.61		Non-Contributing	No Adverse Effect	No Adverse Effect
Overchute	25.62	613+36	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	25.63		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	25.63		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	25.65		Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	25.67	615+70	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	25.75	619+70	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	26.13	640+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	26.18	643+00	Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Turnout	26.21		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	26.21	644+57	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	26.69	670+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	26.89		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	26.93	682+58	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	26.95		Contributing	Adverse Effect	Adverse Effect
Drainlet	27.21	698+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	27.42		Contributing	Adverse Effect	Adverse Effect
Drainlet	27.59	718+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	27.80		Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	27.80	729+75	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	27.84		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	28.04	742+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	28.19		Contributing	Adverse Effect	Adverse Effect
Shoulder Drain	28.27	754+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	28.27	754+19	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	28.53	768+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	28.78	781+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	28.89		Contributing	Adverse Effect	Adverse Effect
Drainlet	28.96	790+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	29.19	802+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	29.19		Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	29.19	802+85	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	29.19	802+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	29.19	802+55	Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Turnout	29.19		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	29.56		Contributing	Adverse Effect	Adverse Effect
Drainlet	29.69	828+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	29.79	833+85	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 5	29.81	835+65	Contributing	Adverse Effect	Adverse Effect
Building	29.82	835+65	Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	29.88	838+65	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	29.91	840+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	29.93	841+23	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	29.95		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	30.33		Contributing	Adverse Effect	Adverse Effect
Drainlet	30.34	862+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	30.43		Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	30.43	867+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	30.43	867+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	30.63		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	30.96		Contributing	Adverse Effect	Adverse Effect
Bridge	31.12	903+91	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	31.31	913+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	31.31		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	31.32	914+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	31.59	928+38	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	31.60	929+20	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	31.60		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	31.60		Contributing	Adverse Effect	Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Drainlet	31.61	929+70	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	31.81	940+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	32.10	955+51	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	32.29	965+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	32.36		Contributing	Adverse Effect	Adverse Effect
Turnout	32.38		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	32.61	982+32	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	32.61		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	32.62		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	32.83	994+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	32.94		Contributing	Adverse Effect	Adverse Effect
Turnout	33.07		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	33.29	1018+27	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	33.53	1031+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	33.71	1040+30	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	33.71		Contributing	Adverse Effect	Adverse Effect
Drainlet	33.89	1050+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	33.90		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	33.98	1054+75	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	34.08		Contributing	Adverse Effect	Adverse Effect
Drainlet	34.30	1071+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Westley Wasteway	34.32	1072+55	Contributing	No Adverse Effect	No Adverse Effect
Drainlet	34.35	1074+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	34.39	1076+58	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	34.39	1076+33	Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Building	34.42	1078+15	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 6	34.42	1078+15	Contributing	Adverse Effect	Adverse Effect
Canal Lining Section	34.45-54.40		Contributing	Adverse Effect	Adverse Effect
Stillwell	34.47	1081+15	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	34.50	1082+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	34.55		Contributing	Adverse Effect	Adverse Effect
Inlet	34.63	1089+42	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	34.63		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	34.76	1096+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	34.89	1102+78	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	35.04		Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	35.05	1111+46	Non-Contributing	No Adverse Effect	No Adverse Effect
Siphon	35.05	1111+46	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	35.10	1114+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	35.18		Contributing	Adverse Effect	Adverse Effect
Drainlet	35.38	1128+40	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	35.39	1129+24	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	35.71	1146+49	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	35.72	1146+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	35.72	1146+65	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	35.73	1146+90	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	35.73	1146+90	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	35.73		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	35.74	1146+96	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	36.01		Contributing	Adverse Effect	Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Inlet	36.01	1162+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	36.09	1166+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	36.39		Contributing	Adverse Effect	Adverse Effect
Turnout	36.45		Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	36.52	1189+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	36.55	1190+20	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	36.68		Contributing	Adverse Effect	Adverse Effect
Inlet	36.80	1200+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	36.81	1204+35	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	37.10	1204+35	Non-Contributing	No Adverse Effect	No Adverse Effect
Siphon	37.24-37.31	1227+85	Contributing	No Adverse Effect	No Adverse Effect
Bridge	37.28	1229+28	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	37.32	1231+40	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	37.32		Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	37.33		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	37.34	1231+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	37.58	1245+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	37.58		Contributing	Adverse Effect	Adverse Effect
Drainlet	37.70	1251+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	38.11	1273+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Misc	38.11	1273+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Misc	38.11	1273+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	38.14	1274+30	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	38.14		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	38.15		Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Turnout	38.15		Contributing	Adverse Effect	Adverse Effect
Drainlet	38.39	1287+40	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	38.59	1298+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	38.64	1300+85	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	38.68	1302+65	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 7	38.68	1302+65	Contributing	Adverse Effect	Adverse Effect
Stillwell	38.74	1305+65	Non-Contributing	No Adverse Effect	No Adverse Effect
Misc	38.76		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	38.80		Contributing	Adverse Effect	Adverse Effect
Drainlet	38.99	1319+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	39.20		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	39.21	1330+56	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	39.22		Contributing	Adverse Effect	Adverse Effect
Wasteway	39.32-39.42	1331-01	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	39.46		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	39.78		Contributing	Adverse Effect	Adverse Effect
Bridge	39.81	1362+42	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	39.86	1365+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	40.00	1365+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	40.37	1391+74	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	40.39		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	40.45		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	40.62	1405+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	40.77	1413+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	41.01	1425+70	Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Turnout	41.03		Contributing	Adverse Effect	Adverse Effect
Drainlet	41.35	1433+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	41.49	1451+03	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	41.53		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	41.53		Contributing	Adverse Effect	Adverse Effect
Overchute	41.93	1474+40	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	41.94		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	41.99	1477+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	42.08		Contributing	Adverse Effect	Adverse Effect
Turnout	42.10		Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	42.50	1504+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	42.50		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	42.51		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	42.52	1505+40	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	42.53	1505+86	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	42.53	1505+40	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	42.68		Contributing	Adverse Effect	Adverse Effect
Misc	42.90	1525+75	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	43.08	1535+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	43.22		Contributing	Adverse Effect	Adverse Effect
Inlet	43.22	1540+40	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	43.24	1542+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	43.24	1541+41	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	43.26	1542+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	43.73		Contributing	Adverse Effect	Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Inlet	43.73	1569+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	44.19	1593+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	44.20	1593+90	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	44.22		Contributing	Adverse Effect	Adverse Effect
Turnout	44.24		Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	44.24	1596+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	44.26	1597+65	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 8	44.26	1597+65	Contributing	Adverse Effect	Adverse Effect
Stillwell	44.32	1600+65	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	44.53	1610+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	44.56	1613+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	44.73	1622+01	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	45.20		Contributing	Adverse Effect	Adverse Effect
Drainlet	45.25	1647+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	45.26	1648+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	45.35		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	45.38		Contributing	Adverse Effect	Adverse Effect
Drainlet	45.43	1657+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	45.75		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	45.77	1675+17	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	45.78		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	45.79		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	45.92	1683+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	46.02		Contributing	Adverse Effect	Adverse Effect
Pipe	46.17		Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Turnout	46.19		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	46.35	1705+80	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	46.36		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	46.36	1706+06	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	46.62	1720+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	46.83		Contributing	Adverse Effect	Adverse Effect
Bridge	46.84	1731+79	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	47.09	1745+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	47.37		Contributing	No Adverse Effect	No Adverse Effect
Turnout	47.37		Contributing	Adverse Effect	Adverse Effect
Bridge	47.38	1759+88	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	47.53	1768+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	47.87		Contributing	Adverse Effect	Adverse Effect
Bridge	47.88	1786+38	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	47.88	1786+15	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	47.88	1786+60	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	47.89		Non-Contributing	No Adverse Effect	No Adverse Effect
Overchute	48.13	1799+62	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	48.14		Contributing	Adverse Effect	Adverse Effect
Drainlet	48.37	1812+25	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	48.38	1812+75	Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	48.59	1824+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	48.60		Contributing	Adverse Effect	Adverse Effect
Building	48.62	1825+65	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 9	48.62	1825+65	Contributing	Adverse Effect	Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Stillwell	48.69	1829+30	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	48.70	1829+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	48.80		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	48.96		Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	48.97	1843+48	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	48.97	1843+48	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	49.20	1856+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	49.43	1868+60	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	49.43		Contributing	Adverse Effect	Adverse Effect
Inlet	49.54	1874+20	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	49.55	1874+64	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	49.56		Contributing	No Adverse Effect	No Adverse Effect
Drainlet	49.58	1876+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	49.71	1883+32	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	49.82	1889+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	49.84		Contributing	Adverse Effect	Adverse Effect
Shoulder Drain	50.00		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	50.20	1911+75	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	50.46		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	50.49	1927+40	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	50.49		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	50.53	1929+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	50.53	1929+25	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	50.66		Contributing	Adverse Effect	Adverse Effect
Turnout	50.70		Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Siphon	51.18-51.27	1964+55	Contributing	No Adverse Effect	No Adverse Effect
Culvert	51.31		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	51.40	1975+64	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	51.41		Contributing	Adverse Effect	Adverse Effect
Turnout	51.65		Contributing	Adverse Effect	Adverse Effect
Inlet	51.66	1988+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	52.01	2007+68	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	52.02		Non-Contributing	No Adverse Effect	No Adverse Effect
Shoulder Drain	52.18	2016+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Inlet	52.40	2028+25	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	52.40		Contributing	Adverse Effect	Adverse Effect
Drainlet	52.72	2057+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	52.85	2073+35	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	53.15	2083+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	53.39	2094+75	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	53.41		Contributing	Adverse Effect	Adverse Effect
Bridge	53.43	2096+86	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	53.63	2107+75	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	53.63	2107+75	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	53.64		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	53.98	2126+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	53.98	2126+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	54.01	2127+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	54.01		Contributing	Adverse Effect	Adverse Effect
Drainlet	54.36	2146+00	Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Newman Wasteway	54.38	2147+00	Contributing	No Adverse Effect	No Adverse Effect
Stillwell	54.39	2147+35	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	54.41	2148+65	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 10	54.41	2148+65	Contributing	Adverse Effect	Adverse Effect
Canal Lining Section	54.44-69.00		Contributing	No Adverse Effect	No Adverse Effect
Stillwell	54.49	2152+30	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	54.67	2162+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	54.70		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	55.07	2183+85	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	55.19		Contributing	Adverse Effect	Adverse Effect
Culvert	55.23		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	55.34		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	55.85		Contributing	Adverse Effect	Adverse Effect
Drainlet	55.92	2247+65	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	55.95		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	56.02	2253+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	56.18		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	56.18	2261+55	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	56.60	2283+62	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	56.78		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	56.80		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	56.82		Contributing	Adverse Effect	Adverse Effect
Turnout	56.83		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	56.85		Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	57.46	2340+00	Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Turnout	57.46		Contributing	Adverse Effect	Adverse Effect
Drainlet	57.73	2354+18	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	57.95		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	57.95	2366+10	Non-Contributing	No Adverse Effect	No Adverse Effect
Drainlet	57.95	2366+10	Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	58.25	2381+32	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	58.26		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	58.27		Contributing	Adverse Effect	Adverse Effect
Check No. 11	58.28	2382+00	Contributing	Adverse Effect	Adverse Effect
Building	58.28	2382+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Siphon	58.29-58.35	2384+25	Contributing	No Adverse Effect	No Adverse Effect
Stillwell	58.40	2389+70	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	58.46	2392+79	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	58.73	2392+79	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	58.90		Contributing	Adverse Effect	Adverse Effect
Turnout	59.50		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	59.50		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	59.53		Contributing	Adverse Effect	Adverse Effect
Bridge	60.06	2477+17	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	60.54		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	60.65		Contributing	Adverse Effect	Adverse Effect
Turnout	61.05		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	61.06	2530+22	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	61.37		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	61.84		Contributing	Adverse Effect	Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Turnout	62.08		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	62.09	2588+40	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	62.67		Contributing	Adverse Effect	Adverse Effect
Stillwell	63.95	2691+60	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	63.96		Contributing	Adverse Effect	Adverse Effect
Check No. 12	63.99	2693+00	Contributing	No Adverse Effect	No Adverse Effect
Building	63.99	2693+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	64.06	2697+30	Non-Contributing	No Adverse Effect	No Adverse Effect
Overchute	64.28	2709+35	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	64.30	2710+33	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	64.32		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	64.32		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	64.85		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	65.35		Contributing	Adverse Effect	Adverse Effect
Turnout	65.37		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	65.38		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	65.52		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	65.89	2802+98	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	65.91	2802+98	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	66.06		Contributing	Adverse Effect	Adverse Effect
Turnout	66.20		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	66.68		Non-Contributing	No Adverse Effect	No Adverse Effect
Overchute	66.70	2844+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	66.73		Contributing	Adverse Effect	Adverse Effect
Turnout	67.16		Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Turnout	67.16		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	67.16	2869+53	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	67.55		Contributing	No Adverse Effect	No Adverse Effect
Bridge	68.03	2922+13	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	68.03		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	68.03		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	68.58		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	68.58		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	68.59		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	68.83		Non-Contributing	No Adverse Effect	No Adverse Effect
Canal Lining Section	69.00-69.25		Contributing	No Adverse Effect	No Adverse Effect
Turnout	69.21		Contributing	No Adverse Effect	No Adverse Effect
Canal Lining Section	69.25-69.99		Contributing	No Adverse Effect	No Adverse Effect
O'Neill Forebay Inlet Canal	69.30	2985+99	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	69.62		Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	69.85		Non-Contributing	No Adverse Effect	No Adverse Effect
Volta Wasteway	69.98	3022+00	Contributing	No Adverse Effect	No Adverse Effect
Stillwell	69.99	3022+60	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 13	70.01	3023+65	Contributing	No Adverse Effect	No Adverse Effect
Building	70.01	3023+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	70.01	3023+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Canal Lining Section	70.04-85.08		Contributing	No Adverse Effect	No Adverse Effect
Stillwell	70.09	3027+30	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	70.13		Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Turnout	70.62		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	71.31		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	71.31	3091+44	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	71.32		Contributing	Adverse Effect	Adverse Effect
Turnout	71.34		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	71.59		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	71.66		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	71.69		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	72.25		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	72.33	3145+53	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	72.33		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	72.34		Contributing	Adverse Effect	Adverse Effect
Bridge	72.80	3167+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	72.80		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	72.82	3167+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	73.06		Contributing	No Adverse Effect	No Adverse Effect
Turnout	73.38		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	73.43		Contributing	Adverse Effect	Adverse Effect
Culvert	73.81		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	73.87		Contributing	Adverse Effect	Adverse Effect
Turnout	74.35		Contributing	Adverse Effect	Adverse Effect
Stillwell	74.36	3253+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 14	74.40	3256+50	Contributing	Adverse Effect	Adverse Effect
Building	74.40	3256+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	74.45	3257+37	Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Bridge	74.77	3275+58	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	74.84		Non-Contributing	No Adverse Effect	No Adverse Effect
Overchute	75.38	3307+80	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	75.43		Contributing	Adverse Effect	Adverse Effect
Bridge	75.84	3332+41	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	75.86	3256+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	76.03		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	76.03		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	76.05		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	76.77		Contributing	Adverse Effect	Adverse Effect
Turnout	77.19		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	77.20	3403+89	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	77.20		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	77.24		Contributing	Adverse Effect	Adverse Effect
Bridge	77.63	3426+93	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	77.98		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	78.56		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	78.57		Contributing	Adverse Effect	Adverse Effect
Overchute	78.59	3477+40	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	79.12	3506+26	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	79.12		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	79.13		Contributing	Adverse Effect	Adverse Effect
Stillwell	79.63	3533+90	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 15	79.64	3533+90	Contributing	Adverse Effect	Adverse Effect
Siphon	79.64-79.72	3534+50	Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Building	79.64	3534+58	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	80.00	3537+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	80.01	3537+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	80.03		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	80.34		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	80.34	3570+19	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	80.93		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	80.99		Contributing	No Adverse Effect	No Adverse Effect
Turnout	81.08		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	81.69	3641+23	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	81.79	3646+89	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	81.80		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	82.31		Contributing	No Adverse Effect	No Adverse Effect
Pipe	82.52		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	82.52	3685+64	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	82.79		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	82.79		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	83.07	3714+64	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	83.08		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	83.08		Contributing	No Adverse Effect	No Adverse Effect
Pipe	83.36		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	83.57		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	83.62		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	83.63		Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Pipe	83.88		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	83.88	3757+30	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	84.38	3783+58	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	84.39		Contributing	Adverse Effect	Adverse Effect
Pipe	84.65		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	84.65		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	84.82	3806+72	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	84.82		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	85.04		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	85.05		Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	85.07	3819+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	85.08		Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 16	85.09	3821+50	Contributing	Adverse Effect	Adverse Effect
Building	85.09	3821+50	Non-Contributing	No Adverse Effect	No Adverse Effect
Canal Lining Section	85.10-98.62		Contributing	No Adverse Effect	No Adverse Effect
Stillwell	85.14	3825+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	85.47		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	85.47	3841+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	85.68		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	86.17		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	86.17		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	86.19		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	86.19	3879+11	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	86.70		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	86.71		Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Turnout	86.72		Contributing	Adverse Effect	Adverse Effect
Turnout	87.35		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	87.48		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	87.97		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	88.13	3981+67	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	88.24		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	88.62	4007+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	88.65		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	88.91		Contributing	No Adverse Effect	No Adverse Effect
Pipe	89.23		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	89.56		Contributing	No Adverse Effect	No Adverse Effect
Turnout	90.27		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	90.53		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	90.53		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	90.53		Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	90.53	4108+18	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	90.54	4108+70	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 17	90.54	4108+70	Contributing	Adverse Effect	Adverse Effect
Bridge	90.56	4110+17	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	90.56		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	90.57		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	90.57		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	90.57		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	90.57		Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	90.61	4110+64	Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Bridge	90.91	4128+25	Non-Contributing	No Adverse Effect	No Adverse Effect
Pip	90.91		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	91.71		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	92.23		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	92.73	4224+36	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	92.73		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	93.23		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	93.24	4251+55	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	93.25		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	93.27		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	94.26		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	94.27	4305+93	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	94.57		Contributing	Adverse Effect	Adverse Effect
Pipe	95.45		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	95.45	4368+05	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	95.45		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	95.50		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	95.50		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	95.95		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	96.61		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	96.61	4429+57	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	96.62		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	96.70		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	96.70		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	96.70		Non-	No Adverse	No Adverse

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
			Contributing	Effect	Effect
Turnout	96.70		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	96.70		Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	96.79	4432+60	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	96.81	4440+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 18	96.82	4440+00	Contributing	No Adverse Effect	No Adverse Effect
Stillwell	96.88	4441+37	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	97.68	4482+25	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	97.69		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	97.70		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	97.70		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	97.70		Contributing	No Adverse Effect	No Adverse Effect
Canal Lining Section	98.64-111.55		Contributing	Adverse Effect	Adverse Effect
Bridge	98.74	4540+12	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	98.74		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	98.74		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	99.82	4597+05	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	99.82		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	100.23		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	100.80		Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	100.85		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	100.85	4652+15	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	100.85		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	101.27		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	102.03	4713+89	Non-	No Adverse	No Adverse

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
			Contributing	Effect	Effect
Turnout	102.04		Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	102.38		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	102.54		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	102.93		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	102.93		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	102.93	4761+81	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	102.95		Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	103.56		Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	104.74		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	105.03		Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	105.03		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	105.03	4873+29	Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	105.04		Non-Contributing	No Adverse Effect	No Adverse Effect
Stillwell	105.05	4875+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	105.05		Non-Contributing	No Adverse Effect	No Adverse Effect
Building	105.06	4875+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 19	105.06	4875+00	Contributing	Adverse Effect	Adverse Effect
Stillwell	105.09	4876+17	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	105.55	4901+06	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	105.55		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	105.56		Non-Contributing	No Adverse Effect	No Adverse Effect
Pipe	106.48		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	106.58	4955+00	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	106.59		Non-Contributing	No Adverse Effect	No Adverse Effect

Structure	Mile Post	Station	Contributing?	Alt1	Alt2
Bridge	107.42	5000+14	Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	107.85		Non-Contributing	No Adverse Effect	No Adverse Effect
Turnout	109.45		Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	110.12	5142+79	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	110.27		Non-Contributing	No Adverse Effect	No Adverse Effect
Siphon	110.96-111.02	5186+97	Contributing	No Adverse Effect	No Adverse Effect
Culvert	111.07		Non-Contributing	No Adverse Effect	No Adverse Effect
Firebaugh Wasteway	111.22	5190+03	Contributing	No Adverse Effect	No Adverse Effect
Stillwell	111.24	5201+70	Non-Contributing	No Adverse Effect	No Adverse Effect
Culvert	111.24		Non-Contributing	No Adverse Effect	No Adverse Effect
Building	111.26	5201+90	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 20	111.26	5202+30	Contributing	Adverse Effect	Adverse Effect
Stillwell	111.28	5203+07	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	111.51	5216+16	Non-Contributing	No Adverse Effect	No Adverse Effect
Canal Lining Section	111.55-114.05		Contributing	Adverse Effect	Adverse Effect
Canal Lining Section	114.05-116.61		Contributing	Adverse Effect	Adverse Effect
Siphon	115.57-115.59	5430+15	Contributing	No Adverse Effect	No Adverse Effect
Stillwell	116.45	5476+35	Non-Contributing	No Adverse Effect	No Adverse Effect
Building	116.48	5477+10	Non-Contributing	No Adverse Effect	No Adverse Effect
Bridge	116.48	5477+22	Non-Contributing	No Adverse Effect	No Adverse Effect
Check No. 21	116.48	5477+37	Contributing	No Adverse Effect	No Adverse Effect
Building	116.50	5478+54	Non-Contributing	No Adverse Effect	No Adverse Effect