

Physical Benefits Tab

Attachment 1: Flood Control Benefits

Attach any relevant flood damage reduction supporting documentation, such as hydraulic and hydrologic modeling studies, and property flood damage analysis (TR section 4.9.4). If information to support this question is located in another attachment, provide the location.

WSIP Application Instructions, March 2017

Response

This attachment describes the flood control benefits associated with the implementation of Sites Reservoir and all associated facilities, and provides modeling, historical flood and hydrology data, and climate change modeling data to explain localized and overall flood control benefits.

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NOTES:	FLOOD CONTROL BENEFITS			PAGE:	1	OF	11

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Acronyms and Abbreviations

CVFED	Central Valley Floodplain Evaluation and Delineation
FEMA	Federal Emergency Management Agency
NED	National Elevation Dataset
T-C	Tehama-Colusa
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

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Introduction

The proposed project is located in the Colusa Basin watershed in Colusa and Glenn. Due to the relatively low elevation, flooding in the watershed typically takes place between October and April due to rainfall-runoff. Flood flows from the foothill streams are prone to sudden surges that flow swiftly into the Colusa Basin Drain. The Colusa Basin Drain is a designated floodway according to the Central Valley Flood Protection Board. The primary cause of flooding is inadequate conveyance capacities in the many ephemeral streams throughout the watershed. In addition, high intensity rainfall will cause localized flooding due to poor drainage facilities.

Funks Creek flows into the existing Funks Reservoir at the Tehama-Colusa (T-C) Canal, with flow contributed from a drainage area of 43 square miles. Stone Corral Creek flows from a drainage area of approximately 38 square miles. The headwaters of Grapevine Creek are on the west side of the proposed Sites Reservoir inundation area and flow into the reservoir inundation area north of Sites-Lodoga Road. Grapevine Creek flows into Funks Creek approximately seven miles upstream of the existing Funks Reservoir. The headwaters of Antelope Creek are also on the west side of the proposed Sites Reservoir inundation area, just south of the headwaters of Grapevine Creek. Antelope Creek flows through the southern portion of the proposed Sites Reservoir inundation area and joins Stone Corral Creek near the town of Sites. To the north of the proposed reservoir inundation area, Hunters Creek flows to the east. Southeast of the proposed inundation area is Lurline Creek, which flows to the east. Both Hunters and Lurline Creeks flow into the Colusa Basin Drain. Figure 1 depicts the proximity of the proposed project features to these ephemeral streams.

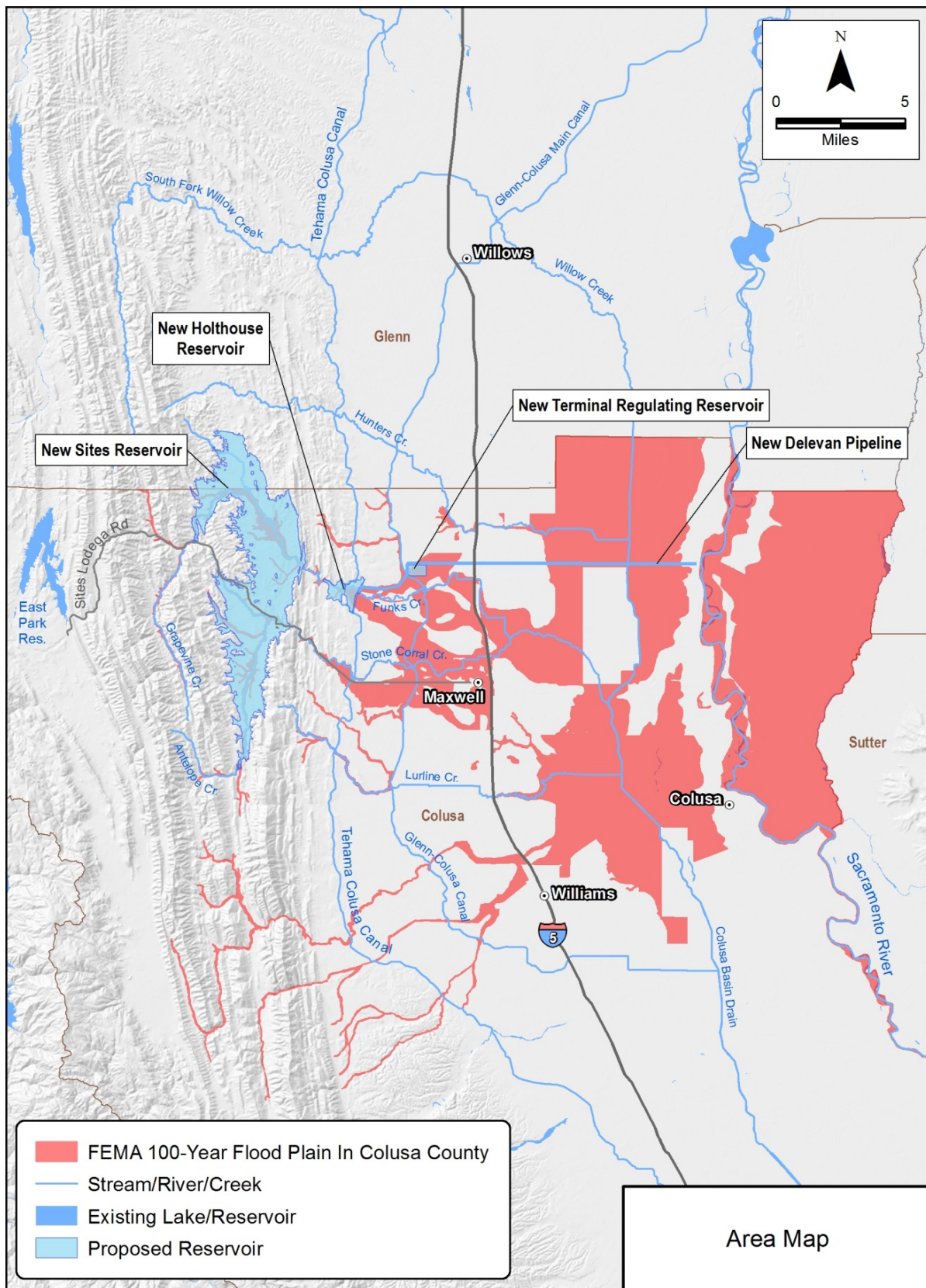


Figure 1. Area Map

Without-Project Future Conditions

The without-project future conditions and existing conditions are assumed to be similar given the rural nature of the area and limited potential for growth and development in Glenn and Colusa counties. Commercial and residential land use is generally limited to the town of Maxwell and areas adjacent to Interstate Highway 5, State Highway 20, and the local roads which traverse this part of Colusa County.

Figure 2 depicts the existing Federal Emergency Management Agency (FEMA 100-year floodplain in western Colusa County. A portion of the area along Funks Creek, downstream of the existing Funks Reservoir, and Stone Corral Creek are in the existing 100-year floodplain. Funks Reservoir is not a flood control reservoir and therefore can be overwhelmed with runoff allowing peak flows to continue downstream in Funks Creek. Of the 76,269 acres located within the existing 100-year floodplain, 75,716 acres are currently agricultural, 64 acres residential, and 489 acres non-residential.

A large portion of the town of Maxwell is located within the existing 100-year floodplain. Maxwell is a farm community with a population of about 1,100 people located west of Interstate Highway 5. The most recent census information (2015 American Community Survey) reports that the town of Maxwell has 370 housing units. No census information is provided on the number of businesses in town, although the Colusa County Assessor's parcel records indicate 14 commercial properties with structures present in Maxwell. In addition, the town of Maxwell has one governmental parcel as well as six institutional parcels with an even split of churches and schools.

In February 2017, the Sacramento Valley experienced heavy rainfall. In Colusa County, the rainfall runoff caused flooding along Stone Corral Creek inundating the town of Maxwell and the surrounding areas including a portion of Interstate Highway 5 and the Sites Project Authority office. Photos of the flooding are included as Figure 3.

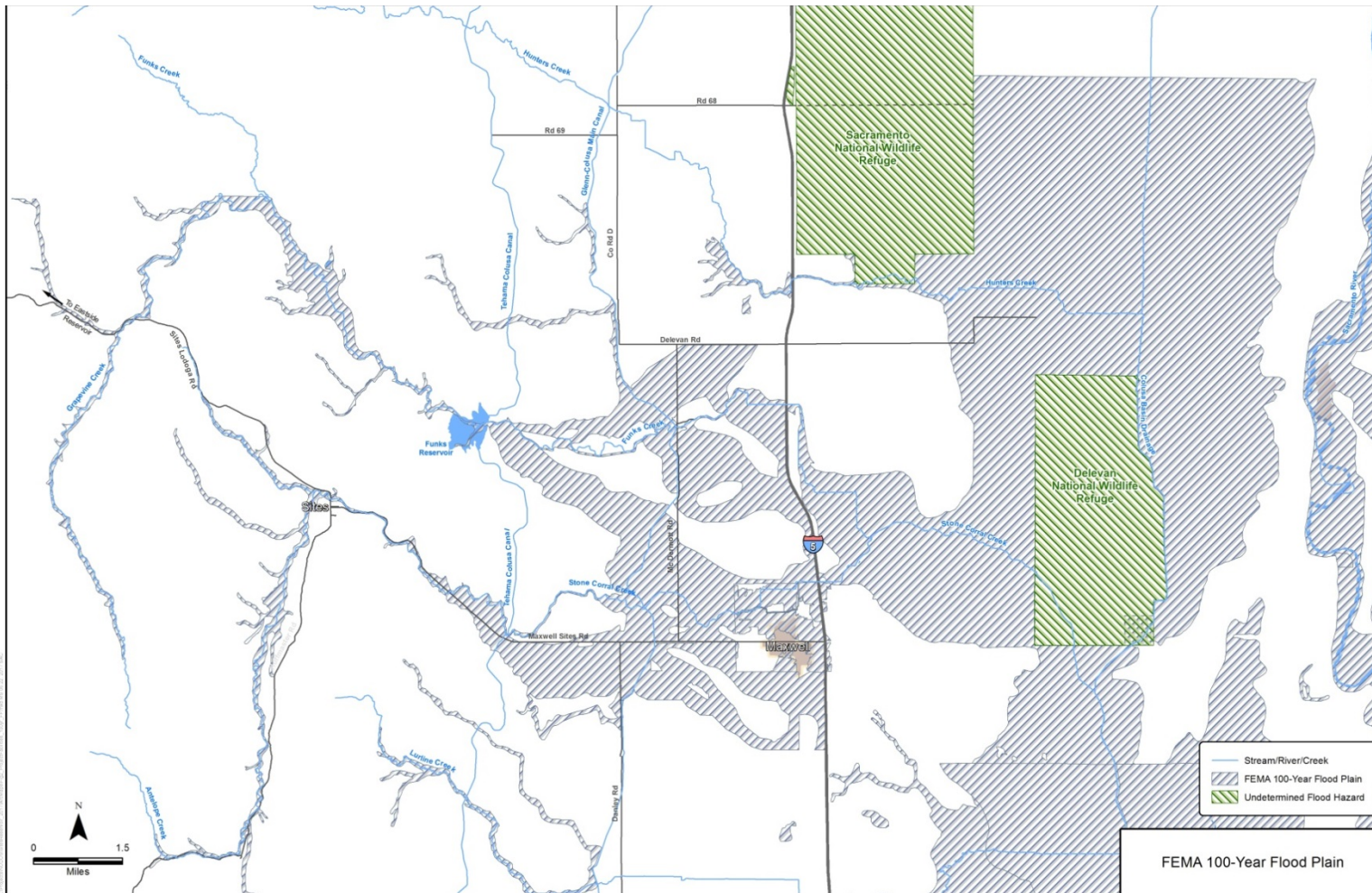


Figure 2. Existing FEMA 100-year Floodplain (Without-Project Future Conditions)

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Figure 3. February 2017 Flooding: Town of Maxwell and Vicinity

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With-Project Future Conditions - Potential Flood Control Physical Benefits

Direct flood control benefits would be provided by the proposed project within the Stone Corral Creek and Funks Creek watersheds including the town of Maxwell by reducing the size of the floodplain within the region. It is estimated that the proposed project would reduce the 100-year floodplain by about 10,000 acres, a 9% reduction. In addition to increasing the level of protection in the Funks Creek and Stone Corral Creek watersheds, 100-year level of protection would also be achieved for approximately 4,025 acres in the Colusa Basin located east of Interstate Highway 5. Table 1 provides a summary of the change in 100-year floodplain area by land use type. Figure 3 depicts the With-Project Future Conditions 100-year floodplain.

Table 1. Sites Reservoir Changes in Flooding Footprint and Damages for the 100-Year Event

	100-Year Existing (Acres)	100-Year With Project (Acres)	Net Change (Acres)
Agriculture	75,716	65,874	9,842
Residential	64	44	20
Non-Residential	489	349	140
Total	76,269	66,267	10,002

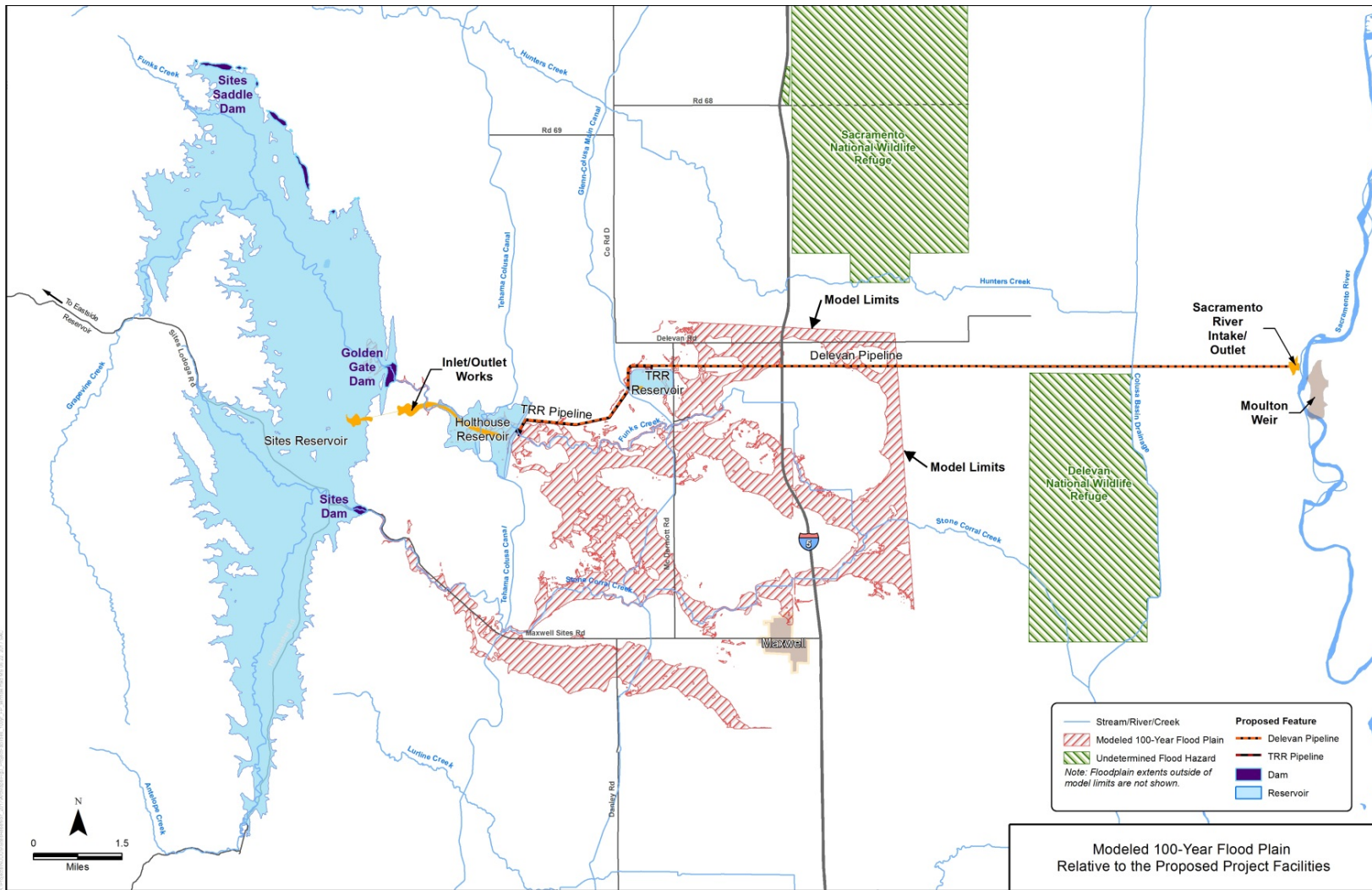


Figure 4. Modeled 100-year Floodplain with Proposed Project (With-Project Future Conditions)

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Flood Inundation Study

A flood inundation study was conducted to better understand the extent of existing flooding along Funks Creek and Stone Corral Creek downstream of the proposed project area and to analyze changes in the floodplain with the proposed Sites Reservoir project in place.

Existing information from FEMA’s Flood Insurance Study for Colusa County (May 2003) and Letter of Map Revision for town of Maxwell (effective July 2015) were reviewed. FEMA’s model was not readily available; therefore, a new numerical model was developed to analyze the future with-project conditions for the 5-, 10-, 25-, 50-, 100-, and 500-year flood events. Table 2 summarizes the elements of the new hydraulic model developed for this analysis. The modeling results compared to FEMA’s results are similar especially near the town of Maxwell.

Table 2. Hydraulic Model Data Sources

Item	FEMA Studies	Sites Reservoir Flood Inundation Study
Hydraulic model software	U.S. Army Corps of Engineers (USACE) Model HEC-2 and HEC-RAS version 4.1 (1-D) and FLO-2D (2-D) (https://www.flo-2d.com/)	USACE Model HEC-RAS version 5.0.3 (1-D/2-D) (http://www.hec.usace.army.mil/software/hecras/)
Topography / Digital Terrain Model	USGS quadrangles and LiDAR from Central Valley Floodplain Evaluation and Delineation (CVFED) program	USGS National Elevation Dataset (NED) (https://nationalmap.gov/elevation.html)
Hydrology	HEC-1 and HEC-HMS (from Preliminary Hydrologic Analysis for Colusa County; Maxwell, Williams, and Arbuckle Study areas (supported Colusa County Letter of Map revision); May 2013)	Preliminary Hydrologic Analysis for Colusa County; Maxwell, Williams, and Arbuckle Study areas (May 2013) and USGS Regression Equations