3.8: HYDROLOGY

Introduction

This section describes the hydrologic character of the project area and the applicable regulations pertaining to hydrology in the project area. This section also discusses potential impacts to hydrologic resources associated with the proposed project. The proposed new Line 400/401 Connection Pipeline will cross several waterways. Pipeline construction would involve boring beneath four major watercourses. Measures to mitigate any potentially significant impacts are proposed.

Environmental Setting

REGIONAL SETTING

Climate and Precipitation

The Wild Goose Expansion Project would be located within Butte and Colusa Counties. Both counties are located within the Sacramento Valley (Valley) and have similar climate. Hot dry summers and cold wet winters characterize the Valley. Average temperatures in the Valley range from lows below 40ºF in January to highs in the mid to upper 90ºF in July. Ground fog is common during wet winter months.

Rainfall varies across the Valley and adjacent areas. Maps prepared by the National Oceanic and Atmospheric Administration (NOAA 1973) illustrate these differences. Average rainfall on the western side of the Valley is measurably higher than on the eastern side.

Most rainfall occurs during winter months, from December through March. Rainfall can be intense at times. Record one-day accumulations were recorded in March 1995 and February 1998. On 9 March 1995, 2.80 and 3.61 inches of rain were recorded in Colusa and Chico, respectively. In 1998, 3.56 and 4.35 inches of rain fell in Colusa (February 2) and

Chico (February 3), respectively (Western Regional Climate Center website 2002). General and historical climate for each county is discussed below under Local Setting.

Surface Water and Flooding

The Sacramento River Basin covers 27,210 square miles and includes the entire area drained by the Sacramento River and its tributaries. For planning purposes, this includes all watersheds tributary to the Sacramento River north of the Cosumnes River watershed. It also includes the closed basin of Goose Lake and drainage sub-basins of Cache and Putah Creeks.

Principal watercourses in the Sacramento Valley are the Sacramento River and its larger tributaries are the Pit, Feather, Yuba, Bear, and American Rivers to the east and Cottonwood, Stony, Cache, and Putah Creeks to the west. Major reservoirs and lakes include Shasta, Oroville, Folsom, and Clear Lakes, as well as Lake Berryessa.

Flooding is a major concern in the Sacramento Valley. Low lying areas are prone to inundation during periods of heavy rainfall and high flows in rivers, streams, and creeks. Winter flooding is a recurring hazard due to flat terrain and high flow volumes. The Sacramento River is a principal flood threat during high flow periods.

In 1983, 1986, 1995 1997 and 1998, floods caused a combined $1.8 billion damage in the Central Valley (Oroville Mercury Register, December 16, 2001). Near catastrophic loss of life and damage were narrowly avoided in both the 1986 and 1997 floods. Storms greater than those of January 1997 are possible and the resulting flooding in the Central Valley could be catastrophic (California Reclamation Board 2001).

Efforts to control flooding were initiated in the early 1900s. Initial attempts to construct levees along the Sacramento River failed. After these failures, the State adopted a Sacramento River flood control project and created the State Reclamation Board to administer the project. This project was initiated in 1917 (Colusa County 1989).

Groundwater

The Sacramento Valley (Valley) represents the largest groundwater basin in northern California. The basin underlies a 5,000-square-mile area including parts of Butte, Colusa, Glenn, Placer, Sacramento, Solano, Sutter, Tehama, Yolo, and Yuba Counties. The Valley is drained by the Sacramento River and its tributaries. Average well yield is 800 gallons per minute (gpm), while maximum yield is 4,000 gpm. Storage capacity of the Valley is 113,650,000 acre-feet.

Proposed project facilities (including the Line 400/401 Connection Pipeline) would be located in the Sacramento Valley, spanning both sides of the Sacramento River from east to west. The Sacramento Valley is underlain by sediments that have been transported from the surrounding mountains by the Sacramento River and its tributaries. The project area is located at the junction of three groundwater storage subunits within the Sacramento Basin:

- Colusa Basin,
- Stony Creek Alluvial Fan, and
- An alluvial fan that extends from Delevan to Zamora (URS 2001).

The main groundwater bearing geologic formations are the Plio-Pleistocene Tehama Formation and Quaternary alluvium. These geologic units are described in Section 3.6, Geology and Appendix I.

Groundwater generally flows from the north in southeasterly (Butte County) and southwesterly (Colusa County) directions toward the Sacramento River. In the winter, groundwater is recharged mainly from deep percolation of rain and streams. During summer months, groundwater levels usually drop. Summer irrigation water also infiltrates to the groundwater basin. Shallow (perched) groundwater may be present in many areas within several feet of the ground surface due to the clay-rich alluvial deposits.

The Sacramento River groundwater basin is the water source for community water delivery systems in the local communities, such as Arbuckle, Colusa, Grimes, Maxwell, Princeton, and Williams. Main groundwater supply wells in these areas generally are 100 to 500 feet deep. The nearest water supply system to the site, the Maxwell Public Utility District (MPUD), provides water service. The MPUD operates a 100,000-gallon water storage tank and three wells. Water is supplied without treatment (Colusa County 1989).

The California Department of Water Resources (DWR) Northern District (District) routinely measures groundwater levels in wells located throughout the Valley. Since the 1940s, DWR has measured groundwater levels in more than 70 Butte County wells. Currently, 51 wells are monitored semi-annually. In addition, DWR measures six wells on a monthly basis. Since the late 1920s, DWR and US Bureau of Reclamation (USBR) have measured groundwater levels for 114 wells in Colusa County. Currently, seven wells are measured monthly in Colusa County to provide a record of how levels change throughout the year.

Most wells are measured semi-annually: once in spring, usually during March, and once in fall, during October. Measurement dates are timed to obtain the approximate highest static water level in the spring and approximate lowest static water level in the fall. Over time, the measurement frequency of many wells in the monitoring program has alternated between semi-annually and monthly. Nine wells in the DWR monitoring network are near project components. These wells provide an indication of groundwater conditions near specific locations relevant to project components.

Groundwater levels fluctuate annually in response to groundwater extractions (pumping), subsurface inflow and outflow, recharge from precipitation, stream percolation and infiltration of applied irrigation water. Levels are usually highest in the spring and lowest in the fall. Longer-term fluctuations occur when discharge exceeds or is less than recharge over several seasons. Changes in groundwater levels are determined from well measurements. Water level measurements are recorded on hydrographs (graphical plots of the measurements), illustrating annual spring to fall changes, long-term changes linked to increased or decreased groundwater extraction, or variations associated with wet or dry climatic conditions. Data from wells in the DWR monitoring network show historic water level fluctuations, during the past six decades, near specific project components (DWR 1993 and 1994). Therefore, these data may be important when planning pipeline construction activities.

Water Quality

DWR Northern District (District) currently monitors groundwater quality in 315 wells in northern California to identify areas of poor quality and to track changes in overall groundwater quality. Groundwater quality analyses typically include field measurements (temperature, pH, conductivity), minerals (calcium, magnesium, chloride, etc.) nutrients (phosphorus, nitrate, etc.), minor elements (arsenic, cadmium, iron, etc.), organic compounds (pesticides, petroleum derivatives, etc.), and pathogens (bacteria). The District's groundwater quality data extends back to the early 1950's (DWR Northern District website 2002).

In a few places within the Sacramento Valley, shallow salt water makes the groundwater unusable. In other areas, elevated levels of naturally occurring boron restrict the type of crops that can be irrigated with groundwater. In some areas, nitrates and other introduced chemicals make the groundwater unfit for domestic use (DWR Northern District website 2002).

LOCAL SETTING

Butte County Surface Water

Precipitation. Butte County has a typical Mediterranean climate with hot dry summers and cool wet winters**.** Annual Precipitation, generally in the form of rain, ranges from 18 inches along the Sacramento River to 80 inches in areas of high elevation (Butte County1979) [General Plan, Land Use Element]**.** A representative city within Butte County is the City of Chico**.** Chico is approximately 22 miles north of the project area**.** Annual average rainfall at Chico is 26 inches**.** The highest annual rainfall from 1906 to 2000 was 45.54 inches in 1941**.** The lowest annual rainfall from 1906 to 2000 was 10.4 inches in 1976 (Western Regional Climate Center website 2002)**.**

Butte Creek. Butte Creek is located approximately one-half mile west of the Well Pad Site, flowing southward toward the Sacramento River. The creek’s headwaters begin at elevations of 5,000 to 6,000 feet in the Jonesville Basin portion of the Sierra Nevada Mountains in the northeast corner of Butte County. Historic flows in Butte Creek, as measured at the “Butte Slough at Outfall Gates” station (Department of Water Resources Gauge), indicate the highest flows were during 1997 (35,600 cubic ft/sec) and the lowest flows were during the drought of 1977 (522 cubic ft/sec). While snowmelt contributes to some of the peak flows, the primary contributor is winter rain. Numerous diversion dams on Butte Creek north of the project study area regulate these flows. These dams do not impound water for storage, but merely divert channel flows into irrigation canals. A horizontal directionally drilled bore (1,400 feet long), to convey the pipeline, is proposed under Butte Creek.

Cherokee Canal. Cherokee Canal is the primary agricultural field drainage conveyance in this part of Butte County. It borders the east side of the proposed Well Pad Site. Within the project study area, the canal is contained on both sides by levees. South of Gridley Road, it provides protection from the 100-year flood to the lands east of the canal. The canal eventually drains into Butte Creek several miles south of the project study area.

Approximately 1,500 feet south of Gridley Road, there is a weir and turnout in the canal. The California Department of Water Resources maintains the weir, levees, and the canal to the north of this facility. Canal and levees maintenance to the south is the responsibility of the adjacent property owners. A horizontal directionally drilled bore (1,400 feet long), to convey the pipeline, is proposed under Cherokee Canal.

833 Canal. The 833 Canal, also referred to as the Main Drain, is a perennial waterway that runs in a southwesterly direction through the project study area. It connects with Cherokee Canal at a point approximately 1,200 feet north of the Well Pad Site. It provides both agricultural drainage and irrigation functions for most of its length during the summer, and storm water drainage during the winter months. A levee forms the north side of this canal from its junction with the Cherokee up to about the vicinity of the Remote Facility Site. This levee protects land to the north from the 100-year floodwaters and is maintained by Reclamation District 833, headquartered in Gridley.

Wetlands. Levees have been constructed along Butte Creek to prevent or reduce the seasonal flooding that once sustained extensive wetlands and marshes. The Gray Lodge and Upper Butte Basin Wildlife Management Areas and the waterfowl hunting clubs now manage and maintain their wetland areas by conducting seasonal flooding programs that allow seed-producing plants to grow and flower during spring. In the fall, the areas are flooded to provide resting and feeding grounds for migratory waterfowl, primarily various species of geese and ducks. The Well Pad Site, Remote Facility Site and connecting Storage Loop Pipeline are near or border the Gray Lodge Wildlife Management Area. The proposed Line 400/401 Connection Pipeline would traverse the southern boundary of the Upper Butte Basin Wildlife Management Area (see Figure 3.8-1).

Butte Sink. Butte Sink is an exceptionally low and flat depression, approximately 12 miles long. It generally stretches from the confluence of Butte Creek with the Sacramento River to just north of Gridley Road. Floodwaters in the Butte Sink area arise from stream flows originating in the Butte Creek watershed, as well as backwater from the Sacramento River via Moulton Weir and Sutter Bypass. Because of the flat stream gradient in Butte Sink, flood flows are typically low velocity. Waters rise gradually over several days of heavy rain, and retreat as the Sacramento River and bypass flood elevations recede.

Flood Zones. Under flood stage conditions, two bypasses on the south edge of the project study area – Moulton Weir and Sutter Bypass – allow water to flow overland southeast toward the Butte Sink and into Sutter County. Two areas in the county have been identified by the Federal Emergency Management Agency (FEMA) as located in the 100-year and 500-year flood zones. Figure 3.8-1 shows the flood zones in the project study area. The most severe hazards within the project study area are located along the Colusa Trough and the west side of the Butte Sink in the area of the Well Pad Site.

Colusa County Surface Water

Precipitation. Colusa County has mild winter temperatures and hot, dry summers. The climate is conducive to all outdoor activities as well as making Colusa County a leader in agriculture. Average annual rainfall in Colusa County is 21 inches (Colusa County website, 2002). A representative city within Colusa County is the City of Colusa. Colusa is approximately 7 miles south of the project area. Annual average rainfall at the City of Colusa is 16.11 inches. The highest annual rainfall from 1948 to 2000 was 35.68 inches in 1983. The lowest annual rainfall from 1948 to 2000 was 4.20 inches in 1970 (Western Regional Climate Center website 2002).

Sacramento River. The Sacramento River is the most prominent natural water feature in Colusa County, ultimately draining the entire Sacramento Valley. It flows in a generally southerly direction, toward San Francisco Bay. Shasta and Keswick dams, north of Redding, are used to control river flows. Water releases vary depending on flood control needs, power generation and minimum flow requirements to maintain water quality in the Sacramento/San Joaquin River Delta. Within river levees, agricultural activities include row crops and orchards, and remnant riparian areas provide habitat for a multitude of wildlife species. The River is a source of irrigation water for some agricultural fields and orchards along the levees. Other beneficial uses for the Sacramento River (designated in the Sacramento River Basin and San Joaquin River Basin Plan) include: domestic and municipal supply, recreation and fish habitat (RWQCB 1998). Multiple long (1,400 to 5,200 feet) horizontal directionally drilled bores, to convey the pipeline, are proposed under the Sacramento River near Stegeman.

Colusa Trough. Colusa Trough is a south-draining linear depression situated between the Sacramento River and Interstate 5. It collects runoff from storms and field drainage several miles to the north. Levees and canals in Colusa Trough are maintained by Reclamation District 2047, located in Colusa. This naturally occurring low-lying area includes Willow Creek and the Colusa Drain. Where these two drainages are not channelized to accommodate agricultural production, managed wetlands are present to provide wildlife habitat and waterfowl hunting opportunities.

Hunters Creek. Located in the western portion of the project study area, Hunters Creek drains the lower foothills of the Coastal Range into the wetlands and rice fields of the Colusa Trough. As an intermittent stream, its natural flow is only during the winter and/or following a storm event. It generally follows its natural course from its headwaters down along the south side of the Sacramento National Wildlife Refuge, becoming channelized where it enters the Colusa Trough. Hunters Creek also serves as a drain for the agricultural fields through which it passes. A horizontal directionally drilled bore (1,200 to 1,400 feet long), to convey the pipeline, is proposed under Hunters Creek.

Agricultural Irrigation and Drainage Canals. Various irrigation and drainage canals and ditches are crossed by project components in Colusa County. Agricultural irrigation water in the area is almost all surface water from Lake Oroville. There are numerous canals and ditches in the project study area, some serving both irrigation and drainage functions. Drumheller Slough is a naturally occurring waterway that now serves to drain rice fields in the project study area. Colusa Drain described above serves as the primary agricultural drainage system for the area between the Sacramento River and Interstate 5. At the west end of the project study area is the Glenn-Colusa Canal, which provides irrigation water to farms in the west end of the project study area. In addition, a major local ditch called the Belding Lateral Drain crosses West Liberty Road approximately one-half mile east of the Remote Facility Site.

Wetlands. Freshwater wetlands and marshes are primarily found along the Sacramento River and within the two National Wildlife Refuges (Section 3.4). A large private wetland complex was developed in the Colusa Trough between the Sacramento National Wildlife Refuge and the Colusa Drain, north of the Line 400/401 Connection Pipeline route. Flooded rice fields also provide wetland and wildlife habitat values during parts of the year.

Flooding

Four local levee and reclamation districts maintain levees along the Sacramento River in Colusa County. The California Department of Water Resources (DWR) maintains levees in areas outside these districts.

Flood Zones. Seasonal overflow of creeks and the Sacramento River, along with poor drainage in the natural basin, contribute to the flood hazards in Colusa County. The Sacramento River is contained by an established levee and bypass system that affords protection to most towns along the river. DWR maintains Sacramento River levees in the project study area. Flood zones within the project study area are shown on Figure 3.8-1.

Groundwater

Both Butte and Colusa Counties are divided into two general groundwater resource areas: the Sacramento Valley, which is the major groundwater basin, and the foothills and mountains west and east of the valley, respectively. The latter has limited groundwater resources. DWR's monitoring program focuses only on wells located in the Sacramento Valley groundwater basin (DWR 1993 and 1994).

Groundwater in Butte County receives recharge from precipitation, applied water, local creeks, and the Thermalito Afterbay. The major creeks are Big Chico, Little Chico, and Butte Creeks. Groundwater generally flows from northeast to southwest and discharges at the Sacramento and Feather Rivers (DWR 1993).

Groundwater in Colusa County receives recharge from local creeks, the Glenn-Colusa Canal, and the Sacramento River when the surface water level is higher than the adjacent groundwater level. Recharge is also by precipitation, applied water, and subsurface inflow from the north and east. Groundwater discharges from the County are at the Sacramento River and Colusa Basin Drain, as well as subsurface outflows toward the south (DWR 1994).

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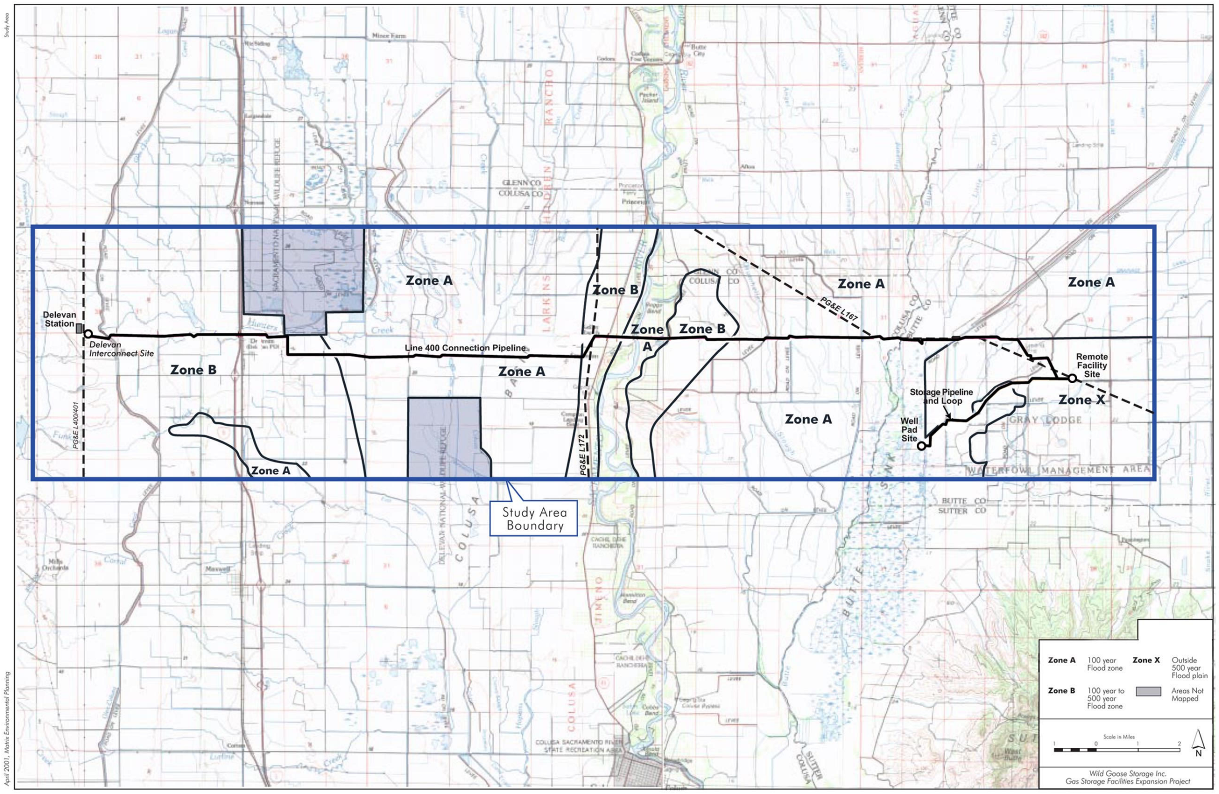
Figure 3.8-1: Flood Zones



SOURCE: MHA 2002 and WGSI 2001

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In general, historical groundwater data for Butte and Colusa County wells show trends and changes in area groundwater levels (DWR 1993 and 1994). The conclusions presented below are evident following a review of data from monitoring wells located in the vicinity of project components.

- Groundwater levels in Butte County have not changed significantly since the 1950s.
- In Butte County, the seasonal fluctuation (spring to fall change) is about 10 to 20 feet in the north and east portion of the county, while less than 5 feet in the southwest portion of the county near the proposed project.
- Groundwater level declines in most of the Butte County wells, and in some of the Colusa County wells, are associated with the 1976-77 and 1987-92 drought periods.
- All groundwater levels recovered from the 1976-77 to pre-drought levels during the wet period in the early 1980s. Most of the groundwater levels recovered from the 1987-92 drought period during the wet 1992-93 winter and spring.
- Wells producing from the unconfined aquifer east of Glenn Colusa Canal (i.e. 17N/03W-10C01M near the proposed pipeline route) show almost no seasonal fluctuation. Groundwater is near the surface because it is not used much in the area. Deep percolation from surface water irrigation keeps the groundwater basin full.

Three wells in DWR's monitoring network are located in the Delavan area, south of the proposed pipeline route. Four DWR monitored wells are located in the general pipeline route vicinity between Delavan and Wild Goose Field. General characteristics of these wells, including well number (DWR designation), elevation, groundwater depths, aquifer type, and well use, are summarized in Table 3.8-1 below.

Table 3.8-1: Summary of DWR Monitoring Groundwater Well Data

		Depth to Groundwater				
Well No.	**Elevation** feet msl	**Depth Range** feet bgs	**Normal Range** feet bgs	**Aquifer**	**Use**	**General Location**
Delavan Area						
17N/03W-03Q01M	90	3 to 9	4 to 6	unconfined	stock	Southeast of Delavan, less than 1/2 mile south of pipeline route
17N/03W-08R01M	105	9 to 20	11 to 16	semi-confined	domestic	Southwest of Delavan, about 2 miles southeast of interconnect
17N/03W-10C01M	94.2	4 to 12	5 to 7	unconfined	domestic	Southeast of Delavan, over 1/2 south of pipeline route
Pipeline Route						
17N/01W-06R01M	70	4 to 31	10 to 20	Qfl + Qob	irrigation	East of Sacramento River, about 3/4 mile south of pipeline crossing

Well No.	Elevation feet msl	Depth to Groundwater: Depth Range feet bgs	Depth to Groundwater: Normal Range feet bgs	Aquifer	Use	General Location
						pipeline crossing
18N/01W-32L02M	75	1 to 25	10 to 15	unconfined	irrigation	East of Sacramento River, about 1/4 mile north of pipeline crossing
18N/01W-35K01M	60	1 to 5	2 to 3	unconfined	domestic	Between Drumheller Slough and Butte Creek, about 1/4 mile north of pipeline route
18N/02W-36B01M	73	1 to 15	5 to 11	semi-confined	unknown	West of Sacramento River, about 1 mile north of pipeline crossing
Field Area						
17N/01E-10A01M	63	5 to 18	8 to 12	composite	domestic	Over 1 mile west of Remote Facility Site, about 2-1/2 miles northeast of Well Pad Site
17N/01E-17F01M	55	0 to 8	2 to 6	unavailable	unavailable	Approx 1/4 mile north of Well Pad Site

SOURCE: Summarized by MHA from data included in DWR reports (DWR 1993, 1994) and from data available from the DWR Northern District Website (2002)

One well is located near the center of Wild Goose Field, immediately north of the Well Pad Site. Another well in is located near storage field facilities. DWR well number 17N/1E 10A01 is near the Storage Loop Pipeline route, about 2.5-miles northeast of the Well Pad Site, and a little over one mile west of the Remote Facility Site. A summary of DWR monitoring network groundwater supply wells located near project components is provided in Table 3.8-1 above.

Shallow groundwater information from borings drilled for this study and the previous storage field application is presented in Table 3.8-2. Water is generally shallow throughout the project area, but particularly in the areas between the Sacramento River, and the low hills and alluvial fans. This condition is due to the surface infiltration of precipitation and irrigation water, subsurface lateral flow of water in shallow porous layers, and the presence of clay-rich or hard layers restricting downward flow of water to deeper aquifers.

Table 3.8-2: Water Depths at Boring Locations

Location	Depth		
	Detected	**Stabilized**	**Other**
Near Interconnect Facility (URS 2001)	Bedrock NM	NM	NA
Hunters Creek (Kleinfelder 2001a)	NM	NM	2 miles SE = 4 to 10 ft bgs; 4 miles SW = 10 to 20 ft bgs
Sacramento River (Kleinfelder 2001b)	7 to 20 ft bgs	NM	20 to 30 ft bgs landward of east levee
Butte Creek (Kleinfelder 2001c)	NM	NM	NA
Well Pad Site (Anderson Consulting 1997)	7 to 13.5 bgs	5 feet bgs	NA
Storage Pipeline (Anderson Consulting 1997)	5 to 10.5 ft bgs	4.5 to 6.6 ft bgs	NA
Cherokee Canal (Kleinfelder 2001d)	NM	NM	Caltrans, 9 ft below levee
Remote Facility Site (Anderson Consulting 1997)	9.5 to 10.5 ft bgs	2.5 to 5 feet bgs	NA

NM = Not Measured at this location

SOURCE: URS 2001, Kleinfelder 2001abcd, Anderson Consulting 1997

Groundwater in the Butte County project study area is quite shallow – as close as 3 feet below the surface in the Butte Sink area. Well water in this area is normally obtained between 100 and 200 feet below the surface. In the eastern portion of Colusa County, groundwater is typically obtained from 100 to 500 feet below the surface.

Water Quality

DWR is responsible for monitoring both surface water and groundwater. The Northern District of DWR oversees the project area. These agencies and their responsibilities are discussed further under Regulatory Setting.

Surface Water. DWR monitors the quality of surface at many locations. A summary of water quality data collected by DWR from stations along the Sacramento River, Butte Creek and Butte Slough, near the project vicinity, is presented below in Table 3.8-3. Samples were collected from various monitoring locations between 1988 and 1997. Data in Table 3.8-3 represents 146 sampling events: 49 for the Sacramento River, 18 for Butte Creek and 89 for Butte Slough. Additional surface water data are available from the DWR Northern District office.

Table 3.8-3: Summary of DWR Surface Water Quality Measurements

Constituent	Units	Location		
		Sacramento River	Butte Creek	Butte Slough
NO3	mg/l	0.3 to 0.4	0.1 to 0.7	0.6 to 1.4
NH3	mg/l	0.3 to 0.4	0.1 to 0.7	0.6 to 1.4
Phosphorus	mg/l	0.02 to 0.19	0.01	0.06 to 0.35
Calcium	mg/l	9 to 13	6 to 12	11 to 36
Magnesium	mg/l	4 to 7	3 to 5	5 to 27
Sodium	mg/l	4 to 10	1 to 4	5 to 42
Potassium	mg/l	0.9 to 3.0	0.9 to 2.0	1.0 to 3.1
SO4	mg/l	4 to 7	1.0 to 3.0	5.0 to 13.0
Chloride	mg/l	2 to 13	<1.0 to 2.0	2 to 59
Hardness	mg/l	42 to 62	39 to 50	81 to 196
Dissolved Oxygen	ppm	7.8 to 11.5	8.8 to 12.7	4.4 to 11.2
pH		7.2 to 8.4	7.2 to 8.1	7.1 to 8.2
Alkalinity	mg/l	37 to 63	33 to 73	38 to 223
Turbidity	NTU	2.1 to 76.0	0.4 to 8.0	1.6 to 120.0

SOURCE: Summarized by MHA from data provided by DWR Northern District office, 2002

Surface water quality objectives included in the Sacramento River Basin and San Joaquin River Basin Plan (RWQCB 1998) are summarized below.

Bacteria. In waters designated for contact recreation, the fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed a geometric mean of 200/100 ml, nor shall more than ten percent of the total number of samples taken during any 30-day period exceed 400/100 ml.

Biostimulatory Substances. Water shall not contain biostimulatory substances which promote aquatic growths in concentrations that cause nuisance or adversely affect beneficial uses.

Chemical Constituents. Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. Chemical constituent objectives for specific water bodies are presented in Table III-1 of the Sacramento River Basin and San Joaquin River Basin Plan (RWQCB 1998). Water quality objectives are also contained in the Water Quality Control Plan for Salinity, adopted by the State Water Board in May 1991.

At a minimum, water designated for use as domestic or municipal supply shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs) specified in the following provisions of Title 22 of the California Code of Regulations: Tables 64431-A (Inorganic Chemicals) and 64431-B (Fluoride) of Section 64431, Table 64444-A (Organic Chemicals) of Section 64444, and Tables 64449-A

(Secondary Maximum Contaminant Levels-Consumer Acceptance Limits) and 64449-B (Secondary Maximum Contaminant Levels-Ranges) of Section 64449.

Water designated for use as domestic or municipal supply shall not contain lead in excess of 0.015 mg/l. The Regional Water Board acknowledges that specific treatment requirements are imposed by state and federal drinking water regulations on the consumption of surface waters under specific circumstances. To protect all beneficial uses the Regional Water Board may apply limits more stringent than MCLs.

Color. Water shall be free of discoloration that causes nuisance or adversely affects beneficial uses.

Dissolved Oxygen. For surface water bodies outside the legal boundaries of the Delta, the monthly median of the mean daily dissolved oxygen *(DO)* concentration shall not fall below 85 percent of saturation in the main water mass, and the 95 percentile concentration shall not fall below 75 percent of saturation. The dissolved oxygen concentrations shall not be reduced below the following minimum levels at any time.

- Waters designated WARM 5.0 mg/l
- Waters designated COLD 7.0 mg/l
- Waters designated SPWN 7.0 mg/l

More stringent objectives presented in Table III-2 of the Sacramento River Basin and San Joaquin River Basin Plan (RWQCB 1998) apply to specific water bodies in these Basins.

Floating Material. Water shall not contain floating material in amounts that cause nuisance or adversely affect beneficial uses.

Oil and Grease. Waters shall not contain oils, greases, waxes, or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.

pH. The pH shall not be depressed below 6.5 nor raised above 8.5. Changes in normal ambient pH levels shall not exceed 0.5 in fresh waters with designated COLD or WARM beneficial uses. In determining compliance with the water quality objective for pH, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.

Pesticides. No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses.

- Discharges shall not result in pesticide concentrations in bottom sediments or aquatic life that adversely affect beneficial uses.
- Total identifiable persistent chlorinated hydrocarbon pesticides shall not be present in the water column at concentrations detectable within the accuracy of analytical methods approved by the Environmental Protection Agency or the Executive Officer.
- Pesticide concentrations shall not exceed those allowable by applicable anti-degradation policies (see State Water Resources Control Board Resolution No. 68-16 and 40 C.F.R. Section 131.12.).
- Pesticide concentrations shall not exceed the lowest levels technically and economically achievable.

- Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of pesticides in excess of the Maximum Contaminant Levels set forth in California Code of Regulations, Title 22, Division 4, Chapter 15.
- Waters designated for use as domestic or municipal supply shall not contain concentrations of thiobencarb in excess of 1.0 μg/l.

Where more than one objective may be applicable, the most stringent objective applies. For the purposes of this objective, the term pesticide shall include: (1) any substance, or mixture of substances which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest, which may infest or be detrimental to vegetation, man, animals, or households, or be present in any agricultural or nonagricultural environment whatsoever, or (2) any spray adjuvant, or (3) any breakdown products of these materials that threaten beneficial uses. Note that discharges of "inert" ingredients included in pesticide formulations must comply with all applicable water quality objectives.

Radioactivity. Radionuclides shall not be present in concentrations that are harmful to human, plant, animal or aquatic life nor that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal or aquatic life.

At a minimum, waters designated for use as domestic or municipal supply shall not contain concentrations of radionuclides in excess of the maximum contaminant levels (MCLs) specified in Table 4 (MCL Radioactivity) of Section 64443 of Title 22 of the California Code of Regulations, which are incorporated by reference into this plan. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect.

Salinity, Electrical Conductivity and Total Dissolved Solids--Special Cases in the Sacramento River Basin Other Than the Delta. Objectives for salinity (electrical conductivity, total dissolved solids, and chloride), which apply to the Sacramento River and other water bodies, are presented in Table III-5 of the Sacramento River Basin and San Joaquin River Basin Plan (RWQCB, 1998). To the extent of any conflict with the general Chemical Constituents water quality objectives, the more stringent shall apply. For specific locations along the Sacramento River, electrical conductivity shall not exceed (at 25°C) 230 micromhos/cm (50 percentile) or 235 micromhos/cm (90 percentile) at Knights Landing above Colusa Basin Drain; or 240 micromhos/cm (50 percentile) or 340 micromhos/cm (90 percentile) at I Street Bridge, based upon previous 10 years of record.

Groundwater. Groundwater quality in the Sacramento Valley, as a whole, is considered good for irrigation and domestic uses; however, there is a high concentration of boron in some irrigation water and high concentrations of nitrates and chloride in some domestic water. All domestic and municipal systems in Colusa County are supplied by groundwater.

Groundwater in Butte County is generally of very good quality with a low total dissolved solids range of 250 to 300 mg/L. The chemistry of groundwater in the valley is greatly influenced by the chemistry of recharge water. Approximately one-third of the variation in groundwater chemistry can be attributed to this effect. As groundwater flows through the basins, mineral content increases due to dissolution of minerals. Physical parameter concentrations show increases across the county. Therefore, groundwater mineral content in the project area is higher than in western parts of the county.

Water quality in Butte County typically has elevated concentrations of iron, manganese, and total dissolved solids. Sulfur is also sometimes present in low, yet detectable concentrations. Filter systems are usually effective in removing these constituents. With the abundance of surface water available in the project study area, ground water is rarely used for agricultural irrigation.

The Sacramento River Basin and San Joaquin River Basin Plan (RWQCB 1998) describes beneficial uses and objectives for groundwater quality. Groundwater quality objectives for the Sacramento River Basin, although not required by the federal CWA, are relevant to the protection of designated beneficial uses (RWQCB 1998). These objectives do not require improvement over naturally occurring background concentrations.

Bacteria. In groundwater used for domestic or municipal supply, the most probable number of coliform organisms over any seven-day period shall be less than 2.2/100 ml.

Chemical Constituents. Groundwater shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At a minimum, ground waters designated for use as domestic or municipal supply shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs) specified in the following provisions of Title 22 of the California Code of Regulations: Tables 64431-A (Inorganic Chemicals) and 64431-B (Fluoride) of Section 64431, Table 64444-A (Organic Chemicals) of Section 64444, and Tables 64449-A (Secondary Maximum Contaminant Levels-Consumer Acceptance Limits) and 64449-B (Secondary Maximum Contaminant Levels-Ranges) of Section 64449. At a minimum, water designated for use as domestic or municipal supply shall not contain lead in excess of 0.015 mg/l. To protect all beneficial uses, the Regional Water Board may apply limits more stringent than MCLs.

Radioactivity. At a minimum, groundwater designated for use as domestic or municipal supply shall not contain concentrations of radionuclides in excess of the maximum contaminant levels (MCLs) specified in Table 4 (MCL Radioactivity) of Section 64443 of Title 22 of the California Code of Regulations.

Tastes and Odors. Groundwater shall not contain taste or odor producing substances in concentrations that cause nuisance or adversely affect beneficial uses.

Toxicity. Groundwater shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life associated with designated beneficial use(s). This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances.

Regulatory Setting

FEDERAL SETTING

Clean Water Act of 1977

The Clean Water Act (CWA) establishes the framework that permits discharge of waste to surface waters. This National Pollutant Discharge Elimination System (NPDES) permit typically has conditions specific to the permitted operation. It may set limits on acidity (pH), chemical concentrations, oil and grease, dissolved and suspended solids, and temperature. In lieu of an NPDES permit, a project may use Notices of Intent (NOIs) to comply with the general NPDES requirements that regulate storm water and other discharges to water by establishing effluent limitations, monitoring, and reporting requirements. The CWA also prohibits the discharge of pollutants to storm water. The CWA is administered by the United States Environmental Protection Agency (US EPA). The US EPA has delegated most authority on water pollution issues to the state.

STATE/REGIONAL SETTING

The primary agency for regulating surface water and groundwater pollution in California is the Regional Water Quality Control Board (RWQCB). The State Water Resources Control Board (SWRCB) delegates authority for implementation of regulations to the RWQCB, but creates general policies and plans. Once approved, these water quality control plans are implemented and enforced by the nine RWQCBs. The SWRCB and RWQCB are agencies within the California Environmental Protection Agency (CalEPA). The RWQCB determines allowable concentration limits for effluents, issues permits, and enforces the regulations.

Various regional boards have developed water quality control plans to protect the beneficial uses of surface water and groundwater within their respective regions. The regional board that regulates the WGSI project is the Central Valley Regional Water Quality Control Board (CVRWQCB).

The Sacramento River Basin and San Joaquin River Basin Plan (RWQCB 1998) describes beneficial uses and objectives for groundwater. Unless otherwise designated by the Regional Water Board, all groundwater in the Region are considered as suitable or potentially suitable, at a minimum, for municipal and domestic water supply, agricultural supply, industrial service supply, and industrial process supply. In making any exceptions to the beneficial use designation of municipal and domestic supply, the Regional Water Board applies criteria in State Water Board Resolution No. 88-63, 'Sources of Drinking Water Policy'. Criteria for exceptions are summarized below.

- Total dissolved solids (TDS) exceed 3,000 mg/l (5,000 &mhos/cm, electrical conductivity) and it is not reasonably expected by the Regional Water Board to supply a public water system
- There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices
- The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day

The Sacramento River Basin and San Joaquin River Basin Plan (RWQCB 1998) describes beneficial uses and objectives for surface water and groundwater quality. The Porter-Cologne Water Quality Control Act defines water quality objectives as "...the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area" [Water Code Section 13050(h)]. It also requires the Regional Water Board to establish water quality objectives, while acknowledging that it is possible for water quality changes, to some degree, without unreasonably affecting beneficial uses. The Sacramento

River is the only surface water body within the project area with designated beneficial uses as defined in the Plan.

Local water districts, water suppliers, and health departments may also act when a pollutant has the potential to threaten their drinking water supply. Effluent limitations and toxic and effluent standards are established pursuant to Sections 301, 301, 303(d), 304, 307, and 316 of the CWA. The RWQCB for the Central Valley Region produced the most recent *Central Valley Water Quality Control Plan* in 1998. This document outlines general water quality goals for the Sacramento and San Joaquin valleys. Industrial service supply water (e.g. process water supply) is identified as a beneficial use and as such has "essentially no water quality limitations except for gross constraints…" (RWQCB 1998b). The proposed project would operate in accordance with all applicable laws, ordinances, regulations, and standards (LORS). The LORS that are potentially applicable to water resources components of this project are identified below. Several LORS involve conformance only by reporting to the applicable agency if a spill or release occurs or require notification/approval for structural work within a surface body.

Porter-Cologne Water Quality Control Act of 1998

The Porter-Cologne Act established the jurisdiction of the nine California RWQCBs, granting them the authority to issue Waste Discharge Requirements (WDRs) that impose annual discharge fees and establish discharge limits, operation, and maintenance requirements for treatment equipment, and monitoring, record keeping, and reporting requirements. Discharge of waste to land, such as septic leach fields, must comply with the WDRs.

California Water Code § 13550 et seq.

The California Water Code (CWC) requires use of reclaimed water where available and appropriate. The SWRCB also adopted Resolution 75-58, which encourages the use of wastewater for power plant cooling and established the following order of preference for cooling purposes:

1. Wastewater discharged to the ocean
2. Ocean water
3. Brackish water or irrigation return flow
4. Inland wastewater with low total dissolved solids
5. Other inland water

California Water Code § 13260

Any discharge waste that could affect the "quality of the waters of the State, other than into a community sewer system" requires a Report of Waste Discharge (ROWD), which includes discharge of waste into a septic leach field.

California Water Code § 13271-13272; CCR § 2250-2260

The California Office of Emergency Services requires filing a report of release of specified reportable quantities of hazardous substances including oil and petroleum products when the release is into or will likely discharge into waters of the State.

California Safe Drinking Water and Toxics Enforcement Act (Prop. 65)

Through the RWQCB administration, actions are prohibited that contaminate drinking water with chemicals known to cause cancer or possessing reproductive toxicity.

LOCAL SETTING

Butte County

The Butte County General Plan includes the following recommendations and policies that are relevant to the proposed project and project alternatives to preserve or protect hydrologic resources:

Land Use Element

- Require adequate drainage improvements for new development.
- Encourage improvement of flood control facilities along the Sacramento River, while at the same time preserving the riparian habitat of the river.
- Direct future urban growth away from flood-plain areas.

Safety Element

Geologic hazard

- Protect against subsidence from ground-water withdrawal and oil and gas withdrawal. Support the conservation of ground water from deep wells for use within the county.
- Support protection of river banks with appropriate methods. Support dam projects in Northern California, which are beneficial to erosion control.

Fire hazard

- Carefully evaluate the effect of development on water supplies.

Open Space Element

- No urban development should be permitted on highly erodible land.
- Logging, mining, recreational vehicles, and other open space uses should be regulated to prevent erosion and protect water resources
- The County should control land use and water pollution in accordance with state water quality control guidelines.

Colusa County

The Colusa County General Plan contains the following policies relevant to the proposed project and project alternatives to preserve or protect hydrologic resources:

CO-1. The conservation of the county's natural resources shall be promoted and projects, which would waste resources or unnecessarily degrade them shall be discouraged.

CO-13. Waste disposal sites and other sources of hazardous or polluting materials should be discouraged in close proximity to streams, creeks, reservoirs, or the Sacramento River groundwater basin.

CO-14. Sedimentation and erosion shall be minimized through control of grading, quarrying, logging, vegetation removal, placement of roads and bridges, use of off-road-vehicles, and agricultural practices.

CO-17. Water-conserving agricultural practices and reuse of water should be promoted.

CO-18. Native or non-water demanding landscaping should be encouraged in new subdivisions.

CO-26. The California Environmental Quality Act (CEQA) shall be strictly enforced.

FL-3 . Wherever possible, flood control projects should avoid extensive alteration of natural creeks and destruction of riparian vegetation.

FL-4 . New development should be required to mitigate its drainage impact through any of a series of measures that should be explored in a countywide drainage and flood control plan.

FL-6. Future development in the county should be located in a way that precludes the need for costly flood control structures and drainage improvements. Development in the 100-year flood plain should be discouraged; no critical or high occupancy structures such as schools and hospitals shall be permitted in the flood plain.

FL-7. Comprehensive drainage solutions to community flooding should be supported. Environmental evaluation of development should always consider cumulative drainage impact.

FL-8. The County should support efforts to acquire state and federal funds for the reconstruction of levees and other flood control structures.

SAFE-1. Flood plains should generally be maintained as open space. In these areas, their use for agriculture, recreation, preservation of vegetation and wildlife habitat, and scenery should be encouraged.

SAFE-2. There will be no development in the 100-year flood plain.

SAFE-5. Flood control policies in the Community Services Element should be supported to reduce the hazards associated with flooding.

WA-4. New industries, which consume significant amounts of water, should be encouraged to recycle the water and ensure its percolation back into the groundwater strata.

WA-6. Where no surface water source is available, the availability of groundwater sufficient to meet project needs should be one of the primary considerations used to determine the suitability of a site for development.

Impact Analysis

AREAS OF POTENTIAL ENVIRONMENTAL CONCERN

The following topics are areas of potential environmental concern that may be associated with implementation of the proposed project. This analysis will consider whether the project would:

- Violate any water quality standards or waste discharge requirements.
- Otherwise substantially degrade water quality.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner, which would result in flooding on- or off-site.
- Create or contribute runoff water, which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner, which would result in substantial erosion or siltation on- or off-site.
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).
- Place housing within a 100-year flood hazard area as mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.
- Place within a 100-year flood hazard area, structures that would impede or redirect flood flows.

THRESHOLD OF SIGNIFICANCE

The project may have a significant effect on water resources if it:

- Adversely affects surface or groundwater quality or quantity
- Adversely affects drainage in the project area
- Adversely affects any significant water body, such as a stream, lake, or bay
- Adversely depletes groundwater quality or quantity
- Causes substantial flooding or erosion or exposes people to reasonably foreseeable hydrologic hazards, such as flooding or tsunamis

IMPACT DISCUSSION

Areas of potential environmental concern include flooding of project facilities and possible attendant damage to equipment. In addition, accidental releases from project facilities or during construction could degrade local water quality. De-water activities during pipeline construction could also affect local groundwater supply, groundwater quality or surface water quality. Storage gas leaking from abandoned gas wells could affect local water quality.

Impact 3.8-1. Potential to Substantially Degrade Surface and Groundwater Water Quality

Surface Water. Due to shallow groundwater conditions at the Remote Facility Site and along much of the route for the Line 400/401 Connection Pipeline and the Storage Loop Pipeline, activities would require de-watering (WGSI 2001). In such cases, water would be discharged to local drainage canals. This process creates the potential to degrade surface water quality in these canals by increasing turbidity. Water extracted during construction de-watering would be analyzed prior to discharge to ensure it meets NPDES permit requirements. If water exceeds NPDES permit requirements, treatment would be necessary to reduce potential contaminants below regulatory levels; therefore, no impacts are anticipated from discharging water extracted from trenches during construction de-watering. Water used for hydrostatic testing of pipeline segments would be obtained from local irrigation canals, and discharged back to these irrigation canals after testing is complete. Following hydrostatic pipeline testing, this water may contain minute amounts of residue and materials (metals, oil and grease) remaining from the manufacturing process or construction activities. Water used for hydrostatic testing would be analyzed prior to discharge to ensure it meets NPDES permit requirements. If water exceeds NPDES permit requirements, treatment would be necessary to reduce potential contaminants below regulatory levels. No impacts are anticipated from discharging hydrostatic test water.

Pipeline construction would require boring (drilling) beneath the Sacramento River and other waterways. Drilling fluid may enter surface waters if a "frac-out" occurs. "Frac-out" is a term used to describe drilling fluids reaching the surface (or overlying water course) during boring. Migration through existing natural fractures, induced fractures, or porous and permeable zones (gravels and cobbles) could allow drilling fluids to reach the surface. If drilling fluids reach a surface water body, they would degrade water quality.

Drilling mud is used during the subsurface river boring process to maintain an open bore, remove rock "cuttings," and facilitate drilling operations. Drilling mud is typically a bentonite (clay)-based material containing various chemical additives. Some chemical additives for specific types of drilling mud may not be compatible with shallow borings near domestic water supplies. A list of possible drilling fluid additives is provided in the geotechnical reports prepared by Kleinfelder, Inc. (2001a, b, c, and d) for each proposed crossing.

Groundwater. Several private water supply wells are present in the project area. Some of these wells are monitored regularly by the DWR. Those wells included in the DWR monitoring network, within the project vicinity, are listed above in this document. Other wells not monitored by DWR are not specifically listed in this document, but general well locations were obtained from DWR (see Appendix M). Some of these wells may be in close proximity to the proposed pipeline route. Most residences and hunting clubs have domestic supply wells (see discussion of sensitive receptors in Section 3.7, Hazards and Hazardous Materials). Domestic supply wells in the project vicinity range in depth from less than 50 feet to as much as 500 feet.

There are over 200 wells near proposed pipeline components and alternative pipeline routes. The approximate number of wells that may be located near project components are: 1 in Well Pad Site vicinity, 6 near Remote Facility Site, 4 along Storage Loop Pipeline, and 78 along Line 400/401 Connection Pipeline. In addition, there are over 100 wells along the north pipeline alternative and about 41 wells along the southern pipeline alternative. Construction activities could affect water quality in these wells. Appendix M includes a table summarizing general information for water wells in the project vicinity.

Well Pad Site. If any hazardous or potentially hazardous materials are stored on-site, they could be released into surface waters during a flood or accident, resulting in an adverse impact.

One water well included in the DWR monitoring network, well number 17N01E-17F01M, is located near the Well Pad Site and several old abandoned gas wells (T17N-R01E, SE/4 NW/4 Section 17). This well is at the Tule Goose Gun Club, and is situated near the center of Wild Goose Field. Approximately three water wells may be in the field vicinity. If abandoned gas wells leak in the vicinity of a water well, gas could enter the aquifer and affect local water quality. Leaking abandoned gas wells are discussed in Section 3.7, Hazards and Hazardous Materials.

If abandoned gas wells near the Tule Goose Gun Club leak, gas could reach the aquifer providing water supply to the local water well. If gas is present in the aquifer, a potential groundwater quality impact would result. With implementation of mitigation measures, potential impacts are reduced to a less than significant level.

Line 400/401 Connection and Storage Loop Pipelines. Drilling fluid could impact the Sacramento River or other waterway (Hunters Creek, Butte Creek, and Cherokee Canal) if a “frac-out” occurred during boring. Increased turbidity would degrade water quality, resulting in a potential adverse impact. Mitigation measures would greatly reduce the possibility of a “frac-out” occurring; therefore, surface water quality impacts associated with river crossings are not anticipated.

Chemical compounds in drilling mud used during river borings (underground crossing) could degrade groundwater quality. If potentially hazards chemicals were used in drilling mud, a possible adverse impact could occur. This would be a temporary, construction related impact. With mitigation, no significant groundwater quality impact is anticipated from boring operations.

Local “perched” groundwater is found through most of the project area at depths often as shallow as 4 to 11 feet. This is the depth interval for burial of the Line 400/401 Connection Pipeline; therefore, project construction could have an effect on these shallow water conditions.

The water rests on layers of low permeability and these conditions vary from location to location throughout the project area. Future water seepage that may collect within, around or on foundations, slabs, cut/fill slopes, utility trenches, or other project facilities, could be mitigated by raising grades sufficiently above the highest water levels as a part of normal design practices. Water that may be intercepted in a deep trench excavation could be controlled by dewatering if the water would pose a safety or slope stability problem. Water that floods the trench following placement of the pipeline may create a buoyant effect that could uplift and damage the pipeline.

WGSI states that since the two pipeline routes cross wetlands and rice fields with historically high groundwater, the trench would partially fill with water during construction (WGSI 2001, pg. 3.5-10). The pipeline contractor may choose to place the pipe in the trench and backfill without dewatering. Based on pipeline and Remote Facility Site construction experience during initial project development, the pipeline trench and foundation excavations would need to be dewatered (WGSI 2001, pg. 3.5-7).

WGSI proposed two measures to reduce effects to surface water or groundwater quality.

> **WGSI Measure 3.8.1.** Provide continuous visual observation of waterway during boring operations. If visual observations indicate possible problems, cease boring operations immediately until conditions are stabilized.
>
> **WGSI Measure 3.8-2.** WGSI will submit a list of proposed drilling mud components and additives to DTSC, RWQCB, and DWR for review and receive approval of specific products prior to commencing subsurface boring operations.

Level of Significance Without Mitigation. WGSI has committed to dewater the trenches where necessary, so it is assumed for purposes of the impact analysis that dewatering would be done if there are any trench stability or safety concerns indicated by the soil and water conditions. With regard to construction, if required regulations are adhered to, and if the measures described above are employed during project development, potential shallow groundwater soil impacts would be less than significant. Buoyant uplift effects, if not properly accounted for in the design, could lead to damage of the pipeline. If such uplift and damage (failure or incipient wrinkling) occurred, this would be considered a significant impact.

Mitigation Measures. The following describes the mitigation measures proposed for this impact.

> **Mitigation Measure 3.8-1.** In addition to visual observation of waterways, provide continuous monitoring of drilling fluid pressures while advancing each pipeline bore**.** If fluid pressure changes indicate possible problems, cease boring operations immediately until conditions are stabilized.
>
> **Mitigation Measure 3.8-2.** No hazardous or potentially hazardous materials shall be stored on-site at the Well Pad Site.
>
> **Mitigation Measure 3.8-3.** Prior to project implementation, water samples would be collected from water well number 17N01E-17F01M, located at the Tule Goose Gun Club. Dissolved gases would be analyzed to ascertain if methane is present. If detected, methane would be further analyzed to determine its origin (biogenic, thermogenic or storage gas) to establish baseline conditions. If storage gas were detected, appropriate investigations would be conducted to find the gas leak source and initiate remedial actions as necessary. Water samples would be collected and analyzed for methane annually, as part of the WGSI field monitoring program. Results would be reported to DOGGR, CPUC, RWQCB and DWR. Remedial actions would be implemented as deemed necessary by these State agencies.
>
> **Mitigation Measure 3.8-4.** With regard to buoyant uplift effects, both beam and cable effects shall be included in buoyant uplift calculations. Also, buoyant span lengths other than 100 feet shall be considered. The critical span length is the length that generates the largest strain for a given amplitude of a selected buoyant uplift profile.

Impact 3.8-2: Potential to Substantially Deplete Groundwater Supply

There are over 200 wells near project components and alternative pipeline routes. The approximate number of wells that may be located near pipeline components are: 1 in Well Pad Site vicinity, 6 near Remote Facility Site, 4 along Storage Loop Pipeline, and 78 along Line 400/401 Connection Pipeline. In addition, there are over 100 wells along the north pipeline alternative and about 41 wells along the southern pipeline alternative. Domestic supply wells in the project vicinity range in depth from less than 50 feet to as much as 500 feet. Construction activities could affect water levels in these wells.

Line 400/401 Connection and Storage Loop Pipelines. Perched groundwater is typically unconfined groundwater that is separated from the main (deeper) groundwater aquifer by an unsaturated zone. The water rests upon a sufficiently low permeability layer that prevents rapidly downward water movement. Such conditions can vary from location to location throughout the project area, with some perched zones being semi-confined between two low permeability layers. This is seen where water contacted in a boring at depth rises into the boring within a relatively short period as it equalizes to the driving forces caused by higher surrounding elevations (head or potentiometric pressure). Construction related de-watering activities could lower groundwater levels locally. If water supply wells are affected, an adverse impact would result. This would be a temporary construction impact. Implementation of mitigation measures would reduce potential impact below a significant level.

Level of Significance Without Mitigation. This impact could be significant without mitigation.

> **Mitigation Measure 3.8-5.** Locate all water supply wells in the project vicinity. After identifying the approved pipeline route and developing initial pipeline construction design plans, and prior to initiating construction, delineate wells in the immediate vicinity of the selected route. Conduct a hydrogeological investigation to determine de-water effects on the nearby area wells. Based on results of the hydrogeological investigation, modify construction plans or de-watering methods, if necessary, to protect local groundwater supplies. The hydrogeological investigation shall be conducted by a California Certified Hydrogeolgist or Certified Engineering Geologist with an appropriate background in evaluating impacts to water wells associated with surface de-watering activities. The revised plans or de-watering methods must be reviewed and approved by the CPUC prior to implementing those operations.

Impact 3.8-3: Potential for Flooding or to Place Structures within a 100-year Flood Hazard Area

Most project components are located within designated 100-year or 500-year flood hazard zones. Inundation of the Well Pad Site could damage equipment and above ground pipelines. New wells are located inside underground steel vaults. If the Well Pad Site is inundated, these underground vaults could fill with water. Equipment at the Well Pad Site is designed to withstand periodic inundation.

Erosion caused by rapidly flowing floodwaters could uncover and damage buried pipelines. The proposed Line 400/401 Connection Pipeline crosses beneath the Sacramento River and other waterways. It would be constructed below anticipated scour depth, so flood damage is not anticipated. The Remote Facility Site is located outside the

100-year and 500-year flood hazard zones, and therefore, should not be subject to flooding.

The proposed project increases the size of the existing Well Pad Site by placement of new fill material. Currently, the Well Pad Site occupies 1.5 acres. By expanding the Well Pad Site by 195 feet to the west, approximately 1.4 additional acres of wetland would be displaced. A perimeter berm would surround the Well Pad Site. The volume of material placed in the wetland is minimal in comparison to the overall size of the wetland area. This additional fill material would not substantially affect flood control in the area.

Well Pad Site. The Well Pad Site could be exposed to flood waters, which could inundate or damage facilities. The site could be rendered inaccessible by a severe flood event. Flood damage to the Well Pad Site or facilities would be considered an adverse impact if damaged wells or associated equipment could not be accessed for repairs.

The Well Pad Site is within the area designated by the FEMA as the 100-year flood hazard zone. Historic flood elevation at the Well Pad Site is approximately 65 feet (USGS Datum). In normal rainfall years, it is expected that this area would be submerged for at least part of the winter by up to 5 feet of water. Figure 3.8-1 shows the outlines of FEMA-designated flood zones in the project study area.

Line 400/401 Connection Pipeline. The majority of the Line 400/401 Connection Pipeline alignment crosses 100-year flood zone areas (Zone A). Approximate three-quarters of the pipeline, or 19 miles, would be located within Zone A (100-year flood zone). Most of the western quarter of the pipeline route, along with some small sections in the middle (adjacent to the Sacramento River), would be within 500-year flood zone areas (Zone B). Since the pipeline would be buried approximately 5 feet below ground level (deeper beneath the Sacramento River and other water ways), this impact would be considered less than significant.

Remote Facility Site. The Remote Facility Site is located within Zone X, outside the 500-year flood zone. The Remote Facility Site should not be exposed to flooding and this impact would be considered less than significant.

> **WGSI Measure 3.8.3.** WGSI would construct a berm around the Well Pad Site. It will be 3 to 4 feet high. This berm would be designed for visual screening and garter snake habitat, but not specifically for flood control.

Level of Significance Without Mitigation. The impact at the Well Pad Site would be significant without mitigation.

Mitigation Measures. The following describes the mitigation measure proposed for this impact.

> **Mitigation Measure 3.8-6.** The berm around the Well Pad Site shall be designed to withstand exposure to flood waters anticipated during a 100-year and 500-year event. Berm height shall be sufficiently high to exceed high water surges. Berm design shall include measures to protect exposed surfaces from erosion and to minimize water seepage through the berm (internal erosion called piping).