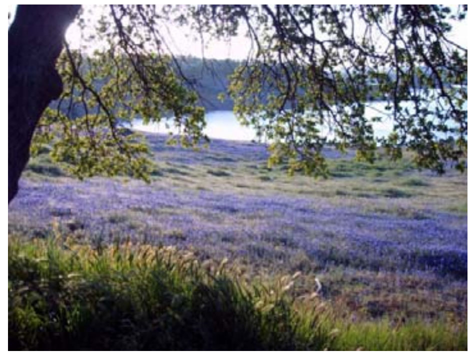
DON PEDRO
RESERVOIR FISH POPULATION SURVEY
STUDY REPORT
DON PEDRO PROJECT
FERC NO. 2299





Prepared for:
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Don Pedro Reservoir Fish Population Survey
Study Report

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List of Acronyms

ac ....acres

ACEC ....Area of Critical Environmental Concern

AF ....acre-feet

ACOE.........................U.S. Army Corps of Engineers

ADA ....Americans with Disabilities Act

ALJ.............................Administrative Law Judge

APE ....Area of Potential Effect

ARMR........................Archaeological Resource Management Report

BA ....Biological Assessment

BDCP ....Bay-Delta Conservation Plan

BLM ...........................U.S. Department of the Interior, Bureau of Land Management

BLM-S ....Bureau of Land Management – Sensitive Species

BMI ....Benthic macroinvertebrates

BMP ....Best Management Practices

BO ....Biological Opinion

CalEPPC ....California Exotic Pest Plant Council

CalSPA.......................California Sports Fisherman Association

CAS ....California Academy of Sciences

CCC............................Criterion Continuous Concentrations

CCIC ....Central California Information Center

CCSF..........................City and County of San Francisco

CCVHJV ....California Central Valley Habitat Joint Venture

CD ....Compact Disc

CDBW........................California Department of Boating and Waterways

CDEC ....California Data Exchange Center

CDFA ....California Department of Food and Agriculture

CDFG ....California Department of Fish and Game (as of January 2013, Department of Fish and Wildlife)

CDMG........................California Division of Mines and Geology

CDOF ....California Department of Finance

CDPH ....California Department of Public Health

CDPR.........................California Department of Parks and Recreation
CDSOD......................California Division of Safety of Dams
CDWR........................California Department of Water Resources
CE ....California Endangered Species
CEII............................Critical Energy Infrastructure Information
CEQA.........................California Environmental Quality Act
CESA ....California Endangered Species Act
CFR............................Code of Federal Regulations
cfs...............................cubic feet per second
CGS............................California Geological Survey
CMAP ....California Monitoring and Assessment Program
CMC...........................Criterion Maximum Concentrations
CNDDB......................California Natural Diversity Database
CNPS..........................California Native Plant Society
CORP ....California Outdoor Recreation Plan
CPUE ....Catch Per Unit Effort
CRAM........................California Rapid Assessment Method
CRLF..........................California Red-Legged Frog
CRRF ....California Rivers Restoration Fund
CSAS..........................Central Sierra Audubon Society
CSBP..........................California Stream Bioassessment Procedure
CT ....California Threatened Species
CTR............................California Toxics Rule
CTS ....California Tiger Salamander
CVRWQCB ....Central Valley Regional Water Quality Control Board
CWA ....Clean Water Act
CWHR........................California Wildlife Habitat Relationship
Districts......................Turlock Irrigation District and Modesto Irrigation District
DLA ....Draft License Application
DPRA.........................Don Pedro Recreation Agency
DPS ....Distinct Population Segment
EA ....Environmental Assessment
EC ....Electrical Conductivity

EFH ....Essential Fish Habitat
EIR ....Environmental Impact Report
EIS..............................Environmental Impact Statement
EPA ............................U.S. Environmental Protection Agency
ESA ....Federal Endangered Species Act
ESRCD.......................East Stanislaus Resource Conservation District
ESU ....Evolutionary Significant Unit
EWUA........................Effective Weighted Useable Area
FERC..........................Federal Energy Regulatory Commission
FFS ....Foothills Fault System
FL...............................Fork length
FMU ....Fire Management Unit
FOT ....Friends of the Tuolumne
FPC ....Federal Power Commission
ft/mi............................feet per mile
FWCA ....Fish and Wildlife Coordination Act
FYLF..........................Foothill Yellow-Legged Frog
g..................................grams
GIS ....Geographic Information System
GLO ....General Land Office
GPS ....Global Positioning System
HCP............................Habitat Conservation Plan
HHWP........................Hetch Hetchy Water and Power
HORB ....Head of Old River Barrier
HPMP.........................Historic Properties Management Plan
ILP..............................Integrated Licensing Process
ISR ....Initial Study Report
ITA ....Indian Trust Assets
kV...............................kilovolt
m ....meters
M&I............................Municipal and Industrial
MCL ....Maximum Contaminant Level
mg/kg ....milligrams/kilogram

mg/L..........................milligrams per liter
mgd ....million gallons per day
mi ....miles
mi^2 ....square miles
MID...........................Modesto Irrigation District
MOU ....Memorandum of Understanding
MSCS.........................Multi-Species Conservation Strategy
msl.............................mean sea level
MVA ....Megavolt Ampere
MW ....megawatt
MWh ....megawatt hour
mya............................million years ago
NAE ....National Academy of Engineering
NAHC ....Native American Heritage Commission
NAS............................National Academy of Sciences
NAVD 88 ....North American Vertical Datum of 1988
NAWQA ....National Water Quality Assessment
NCCP ....Natural Community Conservation Plan
NEPA ....National Environmental Policy Act
ng/g ....nanograms per gram
NGOs ....Non-Governmental Organizations
NHI ....Natural Heritage Institute
NHPA.........................National Historic Preservation Act
NISC ....National Invasive Species Council
NMFS.........................National Marine Fisheries Service
NOAA ....National Oceanic and Atmospheric Administration
NOI ....Notice of Intent
NPS ............................U.S. Department of the Interior, National Park Service
NRCS ....National Resource Conservation Service
NRHP ....National Register of Historic Places
NRI............................Nationwide Rivers Inventory
NTU ....Nephelometric Turbidity Unit
NWI............................National Wetland Inventory

NWIS ....National Water Information System
NWR ....National Wildlife Refuge
NGVD 29...................National Geodetic Vertical Datum of 1929
O&M ....operation and maintenance
OEHHA......................Office of Environmental Health Hazard Assessment
ORV ....Outstanding Remarkable Value
PAD............................Pre-Application Document
PDO............................Pacific Decadal Oscillation
PEIR...........................Program Environmental Impact Report
PGA............................Peak Ground Acceleration
PHG............................Public Health Goal
PM&E ....Protection, Mitigation and Enhancement
PMF............................Probable Maximum Flood
POAOR ....Public Opinions and Attitudes in Outdoor Recreation
ppb.............................parts per billion
ppm ....parts per million
PSP ....Proposed Study Plan
QA..............................Quality Assurance
QC..............................Quality Control
RA ....Recreation Area
RBP ....Rapid Bioassessment Protocol
Reclamation ...............U.S. Department of the Interior, Bureau of Reclamation
RM ....River Mile
RMP ....Resource Management Plan
RP...............................Relicensing Participant
RSP ....Revised Study Plan
RST ....Rotary Screw Trap
RWF ....Resource-Specific Work Groups
RWG ....Resource Work Group
RWQCB ....Regional Water Quality Control Board
SC...............................State candidate for listing under CESA
SCD............................State candidate for delisting under CESA
SCE ....State candidate for listing as endangered under CESA

SCT ....State candidate for listing as threatened under CESA
SD1 ....Scoping Document 1
SD2 ....Scoping Document 2
SE...............................State Endangered Species under the CESA
SFP.............................State Fully Protected Species under CESA
SFPUC ....San Francisco Public Utilities Commission
SHPO ....State Historic Preservation Office
SJRA ....San Joaquin River Agreement
SJRGA ....San Joaquin River Group Authority
SJTA ....San Joaquin River Tributaries Authority
SPD ....Study Plan Determination
SRA............................State Recreation Area
SRMA ....Special Recreation Management Area or Sierra Resource Management Area (as per use)
SRMP.........................Sierra Resource Management Plan
SRP ....Special Run Pools
SSC ....State species of special concern
ST...............................California Threatened Species under the CESA
STORET ....Storage and Retrieval
SWAMP.....................Surface Water Ambient Monitoring Program
SWE ....Snow-Water Equivalent
SWRCB......................State Water Resources Control Board
TAC............................Technical Advisory Committee
TAF ....thousand acre-feet
TCP ....Traditional Cultural Properties
TDS ....Total Dissolved Solids
TID.............................Turlock Irrigation District
TMDL ....Total Maximum Daily Load
TOC............................Total Organic Carbon
TRT ....Tuolumne River Trust
TRTAC ....Tuolumne River Technical Advisory Committee
UC..............................University of California
USDA.........................U.S. Department of Agriculture

USDOC......................U.S. Department of Commerce
USDOI .......................U.S. Department of the Interior
USFS..........................U.S. Department of Agriculture, Forest Service
USFWS ......................U.S. Department of the Interior, Fish and Wildlife Service
USGS .........................U.S. Department of the Interior, Geological Survey
USR............................Updated Study Report
UTM...........................Universal Transverse Mercator
VAMP........................Vernalis Adaptive Management Plan
VELB ....Valley Elderberry Longhorn Beetle
VRM ....Visual Resource Management
WPT ....Western Pond Turtle
WSA...........................Wilderness Study Area
WSIP..........................Water System Improvement Program
WWTP ....Wastewater Treatment Plant
WY.............................water year
µS/cm ....microSeimens per centimeter

1.0 INTRODUCTION

1.1 General Description of the Don Pedro Project

Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, the Districts) are the co-licensees of the 168-megawatt (MW) Don Pedro Project (Project) located on the Tuolumne River in western Tuolumne County in the Central Valley region of California. The Don Pedro Dam is located at river mile (RM) 54.8 and the Don Pedro Reservoir formed by the dam extends 24-miles upstream at the normal maximum water surface elevation of 830 ft above mean sea level (msl; NGVD 29). At elevation 830 ft, the reservoir stores over 2,000,000 acre-feet (AF) of water and has a surface area slightly less than 13,000 acres (ac). The watershed above Don Pedro Dam is approximately 1,533 square miles (mi^2).

Both TID and MID are local public agencies authorized under the laws of the State of California to provide water supply for irrigation and municipal and industrial (M&I) uses and to provide retail electric service. The Project serves many purposes including providing water storage for the beneficial use of irrigation of over 200,000 ac of prime Central Valley farmland and for the use of M&I customers in the City of Modesto (population 210,000). Consistent with the requirements of the Raker Act passed by Congress in 1913 and agreements between the Districts and City and County of San Francisco (CCSF), the Project reservoir also includes a “water bank” of up to 570,000 AF of storage. CCSF may use the water bank to more efficiently manage the water supply from its Hetch Hetchy water system while meeting the senior water rights of the Districts. CCSF’s “water bank” within Don Pedro Reservoir provides significant benefits for its 2.6 million customers in the San Francisco Bay Area.

The Project also provides storage for flood management purposes in the Tuolumne and San Joaquin rivers in coordination with the U.S. Army Corps of Engineers (ACOE). Other important uses supported by the Project are recreation, protection of the anadromous fisheries in the lower Tuolumne River, and hydropower generation.

The Project Boundary extends from approximately one mile downstream of the dam to approximately RM 79 upstream of the dam. Upstream of the dam, the Project Boundary runs generally along the 855 ft contour interval which corresponds to the top of the Don Pedro Dam. The Project Boundary encompasses approximately 18,370 ac with 78 percent of the lands owned jointly by the Districts and the remaining 22 percent (approximately 4,000 ac) is owned by the United States and managed as a part of the U.S. Bureau of Land Management (BLM) Sierra Resource Management Area.

The primary Project facilities include the 580-foot-high Don Pedro Dam and Reservoir completed in 1971; a four-unit powerhouse situated at the base of the dam; related facilities including the Project spillway, outlet works, and switchyard; four dikes (Gasburg Creek Dike and Dikes A, B, and C); and three developed recreational facilities (Fleming Meadows, Blue Oaks, and Moccasin Point Recreation Areas). The location of the Project and its primary facilities is shown in Figure 1.1-1.

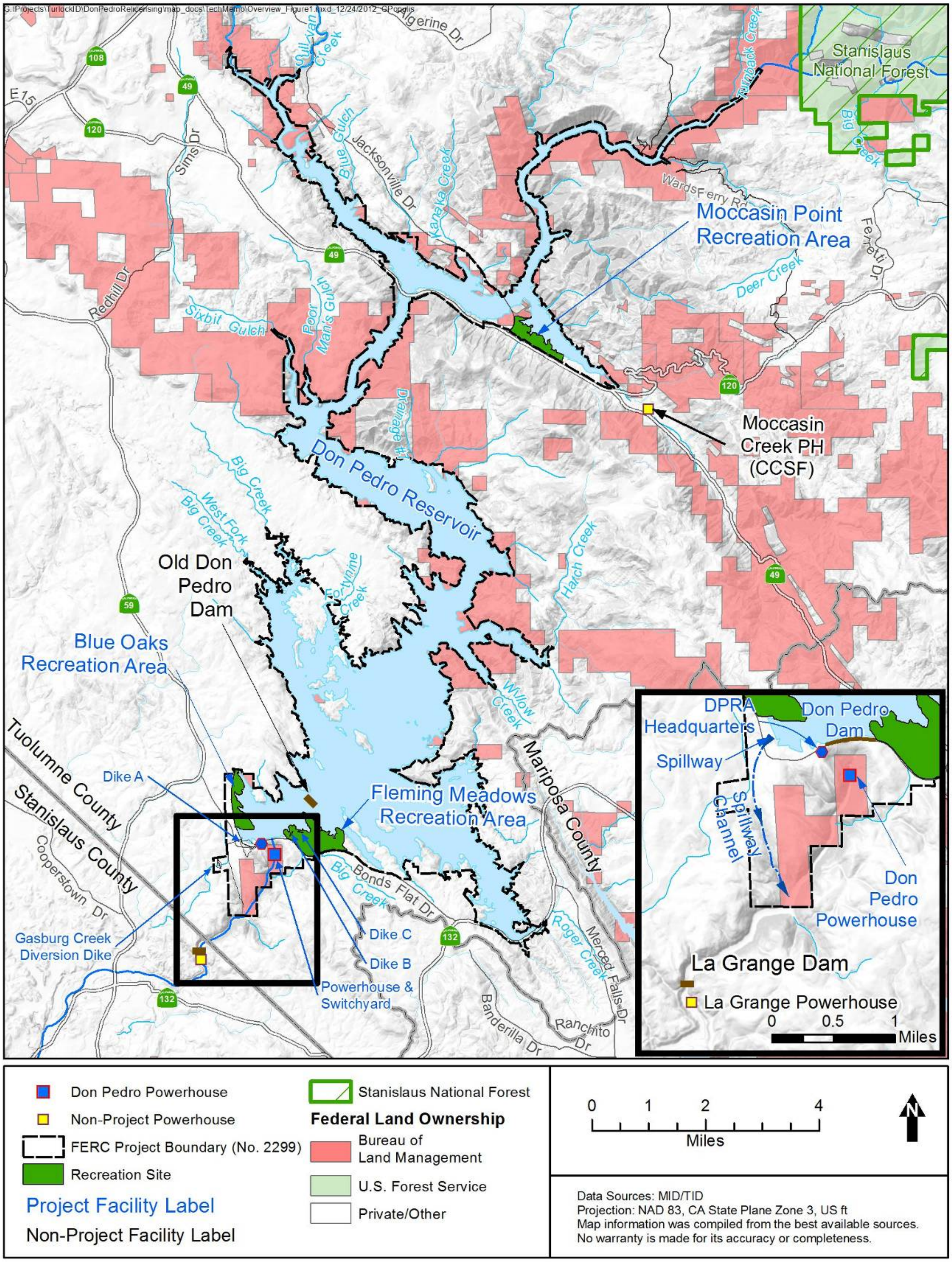


Figure 1.1-1. Don Pedro Project location.

1.2 Relicensing Process

The current FERC license for the Project expires on April 30, 2016, and the Districts will apply for a new license no later than April 30, 2014. The Districts began the relicensing process by filing a Notice of Intent and Pre-Application Document (PAD) with FERC on February 10, 2011, following the regulations governing the Integrated Licensing Process (ILP). The Districts' PAD included descriptions of the Project facilities, operations, license requirements, and Project lands as well as a summary of the extensive existing information available on Project area resources. The PAD also included ten draft study plans describing a subset of the Districts' proposed relicensing studies. The Districts then convened a series of Resource Work Group meetings, engaging agencies and other relicensing participants in a collaborative study plan development process culminating in the Districts' Proposed Study Plan (PSP) and Revised Study Plan (RSP) filings to FERC on July 25, 2011 and November 22, 2011, respectively.

On December 22, 2011, FERC issued its Study Plan Determination (SPD) for the Project, approving, or approving with modifications, 34 studies proposed in the RSP that addressed Cultural and Historical Resources, Recreational Resources, Terrestrial Resources, and Water and Aquatic Resources. In addition, as required by the SPD, the Districts filed three new study plans (W&AR-18, W&AR-19, and W&AR-20) on February 28, 2012 and one modified study plan (W&AR-12) on April 6, 2012. Prior to filing these plans with FERC, the Districts consulted with relicensing participants on drafts of the plans. FERC approved or approved with modifications these four studies on July 25, 2012.

Following the SPD, a total of seven studies (and associated study elements) that were either not adopted in the SPD, or were adopted with modifications, formed the basis of Study Dispute proceedings. In accordance with the ILP, FERC convened a Dispute Resolution Panel on April 17, 2012 and the Panel issued its findings on May 4, 2012. On May 24, 2012, the Director of FERC issued his Formal Study Dispute Determination, with additional clarifications related to the Formal Study Dispute Determination issued on August 17, 2012.

This study report describes the objectives, methods, and results of the Don Pedro Reservoir Fish Population Survey Study (W&AR-17) as implemented by the Districts in accordance with FERC's SPD and subsequent study modifications and clarifications. Documents relating to the Project relicensing are publicly available on the Districts' relicensing website at www.donpedro-relicensing.com.

1.3 Study Plan

FERC's *Scoping Document 2* identified potential effects of the Project on reservoir fish populations. The continued operation and maintenance (O&M) of the Project may contribute to effects on fish populations in Don Pedro Reservoir. Project operations influence Don Pedro Reservoir hydrology and water quality, including seasonal storage volume, water surface elevation, water surface area, dissolved oxygen and water temperature. Therefore, Project operations may affect fish populations and supported fisheries through changes in coldwater pool volume, water surface elevation fluctuations, littoral habitat, and water quality.

2.0 STUDY GOALS AND OBJECTIVES

The goal of this study was to collect baseline information concerning the distribution and occurrence of fish resources in Don Pedro Reservoir. The objectives of the study are to:

- Confirm the coldwater and warmwater fish assemblages and population composition, including relative abundance (e.g., catch per unit effort (CPUE)), age and size composition, occurrence in Don Pedro Reservoir relative to extant reservoir operations and habitat conditions;
- Characterize the influence of current operations on deterministic habitat conditions influencing the coldwater and warmwater fisheries in Don Pedro Reservoir; and
- Survey Don Pedro Reservoir's fish populations using standard, reservoir sampling procedures to identify species composition and relative abundance, age, length and condition of predominant game fishes using two general sampling methods.

3.0 STUDY AREA

Study efforts were conducted within Don Pedro Reservoir, and the surrounding recreational facilities. Given the large size of the Project Area and the broad extent that all of the studies encompassed, individual maps were prepared for each survey (e.g., gillnetting, electrofishing) and are presented in Section 4.0 Methodology of this report.

4.0 METHODOLOGY

To address the identified objectives, a series of integrated study efforts were conducted, including: 1) reservoir boat electrofishing; 2) reservoir gillnet sampling; 3) creel surveys; 4) bass nesting assessments, and 5) an age-scale assessment. Individual methods for each study effort are described below.

4.1 Fish Population Surveys

Gill net and electrofishing surveys were conducted in October 2012 to acquire fish assemblage and population composition information required to meet the study objectives listed above. Sixteen sampling sites for gillnet and boat electrofishing were distributed throughout Don Pedro Reservoir to represent available habitat and potential variations in fish assemblages. The study team sampled eight gillnet sites and eight boat electrofishing sites (Figures 4.1-1 and 4.1-2).

4.1.1 Gillnet Sampling

Gillnet sampling occurred at Don Pedro Reservoir from October 15 to October 18, 2012. Adult and juvenile variable mesh gillnets were deployed at eight sites. The adult variable mesh gillnets were 125 feet (ft) long and 8 ft deep and consisted of five, 25-ft long panels. Panel mesh sizes were 0.75-, 1.5-, 2-, 2.5-, and 3-inch (in.) The panels were successively arranged by mesh size with the smallest mesh size placed nearest the shore. The juvenile gillnets were 25 ft long and 8 ft deep and were comprised of two panels 12.5 ft long that had mesh sizes of 0.5 and 0.75 in. respectively. The gillnet panels with the smaller mesh were placed nearest to the shoreline.

Gillnet sample sites were selected based on depth contours and results of field visits to identify areas of interest or where fish may reside. These areas included sites near the dam intake structures where sampling could be safely performed, sites near tributaries, and sites that would cover a broad spatial extent of the reservoir. Once selected, the sampling sites were defined using a Global Positioning System (GPS) to collect Universal Transverse Mercator (UTM) coordinates.

Four adult gillnets and four juvenile gillnets were deployed at each site to sample shoreline (juvenile shore), shallow (adult shore), mid-water, and deepwater habitat. The near-shore end of the gillnets for the shoreline were placed at the water's edge and the gillnet was extended outward along the water's surface. The shallow sampling gillnets were placed offshore, to float on the reservoir surface. The gillnets for the mid-water sampling were placed at 50 percent of the total depth. The gillnets for the deepwater sampling were placed at 85 percent of the total depth, but no deeper than 100 ft.

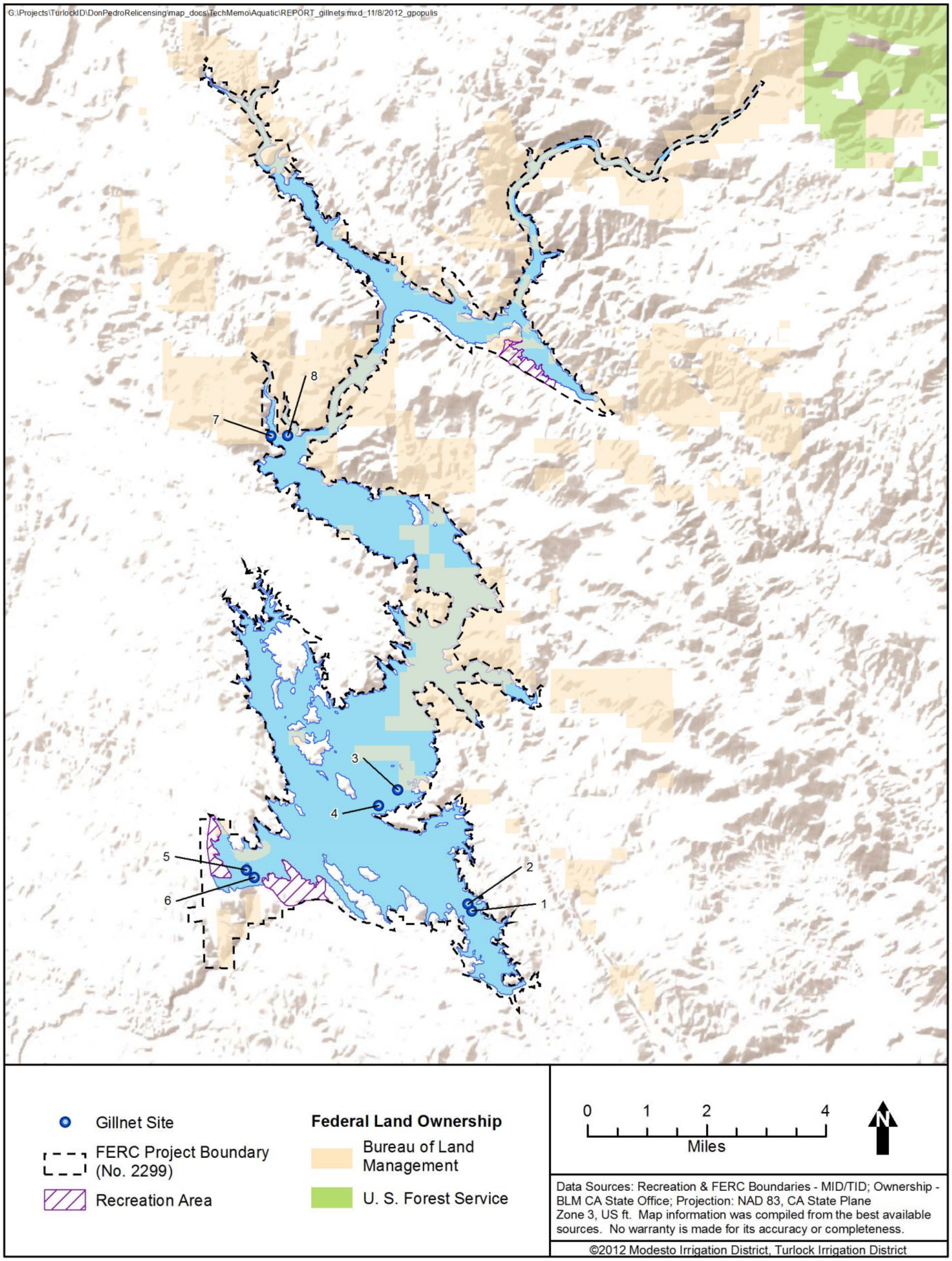


Figure 4.1-1. Location of fish population survey sites sampled using gill nets during the Don Pedro Reservoir Fish Population Survey, October 2012.

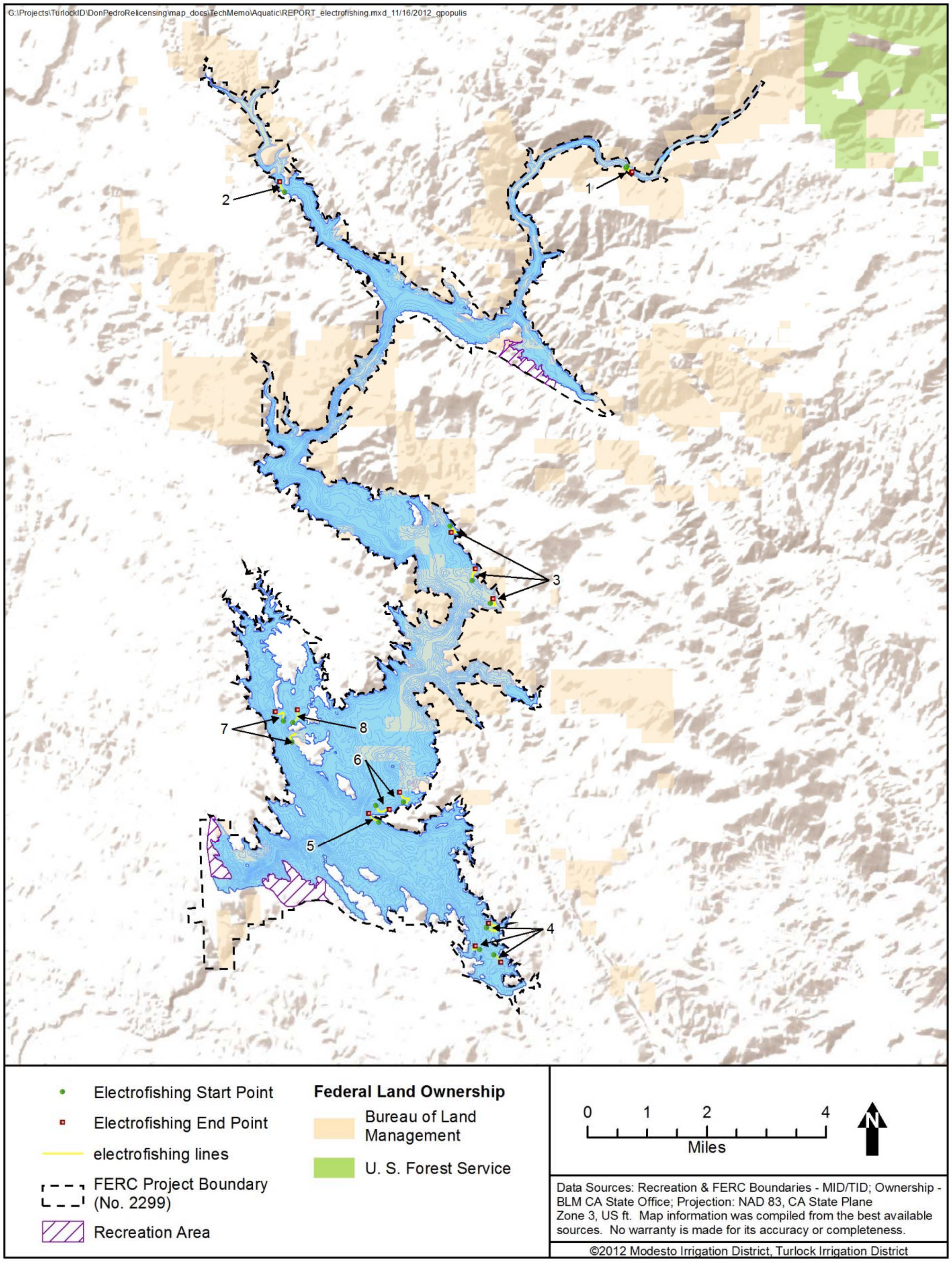


Figure 4.1-2. Location of fish population survey sites sampled using boat electrofishing during the Don Pedro Reservoir Fish Population Survey, October 2012.

The gillnets were oriented perpendicular to the shore with the finest mesh panel closest to the shore. Each deployed gillnet was marked by buoys for ease of relocation and easy visibility by recreational boaters.

The gillnets were fished five to six hours once during the day (dawn set) and once at night (dusk set), providing one day and one night sample for each site. The time of deployment and location of each gillnet set were recorded. Fish collected were processed and then released away from the gillnets to avoid recapture. Information collected during processing included species, fork length (FL) or total length (TL) in (mm) (as appropriate), and weight (grams [g]). Condition was noted if a fish was showing any visible issues, such as disease or parasites. Scale samples were collected from a subset of fish greater than 150 mm.

Other information collected at each sample site included, UTM coordinates of the sample site, minimum and maximum depth of site, distance of set from shore, water temperature, dissolved oxygen (DO), pH, turbidity, and electrical conductivity (EC). The thermocline, epilimnion, hypolimnion, and water temperature present during the sampling period were obtained from surveys being conducted as part of W&AR 3, Reservoir Temperature Modeling.

Data collected from all gillnet sampling sites were pooled and used to characterize reservoir populations. Summaries of the relative proportions, lengths, and weights of each fish species were developed for diel period, sampling site, and net depth. In addition, the amount of time the net soaked relative to the catch was used to determine a catch per unit effort, resulting in a measurement of the number of fish collected per hour. Length and weight data were pooled with electrofishing data to calculate a relative condition factor, described below.

4.1.2 Boat Electrofishing

Boat electrofishing was used to sample fish populations in near-shore habitats at Don Pedro Reservoir. Boat electrofishing was conducted using standard methods described by Reynolds (1996). Two electrode booms were employed; the booms and boat were outfitted with non-conductive material for safety. Boat electrofishing crews included three individuals, one operating the boat and two netting fish.

Eight electrofishing sites were selected to represent the array of habitats available within the near-shore areas of the reservoirs and were in areas with a relatively mild gradient or level lake bottom. The sites were selected using information from aerial photos, reservoir bathymetry maps, and field reconnaissance. Sites were replaced if safety became a concern (i.e., excessive nearby recreation). Once selected, the sampling sites were divided into one to three survey sites to encompass variation within the sample area and provide a comprehensive survey. The specific survey start and end points were identified using a GPS to collect UTM coordinates.

Boat electrofishing sampling began one hour after the sun completely set. Electrofishing effort or “time on,” was recorded for each sampling site. Effort and pace were consistent for all sites.

All captured fish were placed into an aerated holding tank for processing. Information collected during processing included species, FL or TL in mm, weight in g, and, if applicable, the general condition of the fish and a scale sample. Condition was noted if a fish was showing any visible issues, such as disease or parasites. Scale samples were collected from a subset of fish longer than 100 mm. After processing, fish were returned to the reservoir into the general area where they were collected. Basic water quality data, including water temperature, DO, and EC were also collected for each sampling site during each event.

Data collected from boat electrofishing were pooled and used to characterize reservoir fish populations. Relative proportion (e.g., abundance by species), lengths, and weights were summarized for each sampling site. The electrofishing effort (i.e., the time the unit was "on") was used to calculate a relative catch per unit effort, or CPUE (i.e., number of fish collected per hour).

4.1.3 Fish Condition

Weight and length data from gillnet and electrofishing surveys were pooled to calculate condition factors for individual species. These data were used to compute Kn, a relative condition factor, where:

$$Kn = W/W'$$

Where W equaled individual fish weight and W' equaled length-specific weight from the weight-length relationship. The individual fish weight can also be determined as a function of length, specifically:

$$W = a(FL)b$$

Where a and b are population specific coefficients (Anderson and Gutreuter 1983).

Relative condition factor provides a general indication of the fish condition and health, where a value of Kn greater than or equal to 1.0 indicates fish of average or better condition. The condition factor was calculated by pooling length-weight data for all collected fish of a species.

4.2 Angler Survey

The Districts conducted an angler survey as part of a broader recreational visitors survey that was implemented as described in Study RR-01 Recreation Facility Condition, Public Accessibility and Recreation Use Assessment Study (TID/MID 2013). During the conduct of the visitor survey, information on angling effort and success was gathered from visitors that had been fishing in the reservoir during the day of the encounter. Questions addressed effort or time spent fishing, angling method, number of fish caught/released by species/size groups, creel survey including identification and measurement of kept fish.

The Districts conducted the angler survey at all the recreation facilities identified in Table 4.2-1 and in Figure 4.2-1. The survey sample was stratified by recreation area, type of day (weekdays, non-holiday weekends, and holiday weekends), and time of day. The surveyors varied the times each survey site was visited to ensure a range of visitation times and potential user groups over the course of the survey period. To ensure the surveyors visited the facilities/sites at different times, the surveyors visited each facility following the same circuit or route, but started at the next facility on the circuit for each successive survey day.

Table 4.2-1. Summary of recreation facilities and other on-site amenities at Don Pedro Project-developed recreation areas.

Amenities	Moccasin Point RA	Blue Oaks RA	Fleming Meadows RA
Project Recreation Facilities			
Camping Units - Total	96	195	267
With water and electric hookups	18	34	90
Picnic Areas -Total	2	1	2
Group Picnic Sites	1	1	1
Boat Launch Ramp	1	1	1
Fish Cleaning Stations	1	1	1
Comfort Stations - Total	8	11	14
With hot showers	2	5	5
Additional On-Site Recreation Amenities			
Marina	Yes	No	Yes
Houseboat Mooring	Yes	No	Yes
Boat Rentals	Yes	No	Yes
Houseboat Rentals	Yes	No	Yes
Boat Repair Yard	No	Yes	No
Gas and Oil	Yes	No	Yes

The sampling frequency was divided into two categories – peak season and off-peak season. The peak season for all recreation use and activities on the Project is April 1 through September 30. The off-peak season is October 1 through March 31.

The monthly sampling frequency for the peak season was:

- Two randomly selected weekday days per month (Tuesday-Thursday)
- Two randomly selected weekend days (Saturday and Sunday) per month
- One pre-selected holiday day for each three-day holiday weekend (3 holiday days total) (Memorial Day, Independence Day, and Labor Day holiday weekends)

The monthly sampling frequency for the off-peak season was:

- Two randomly selected weekday days per month (Tuesday-Thursday)
- Two randomly selected weekend days (Saturday and Sunday) per month

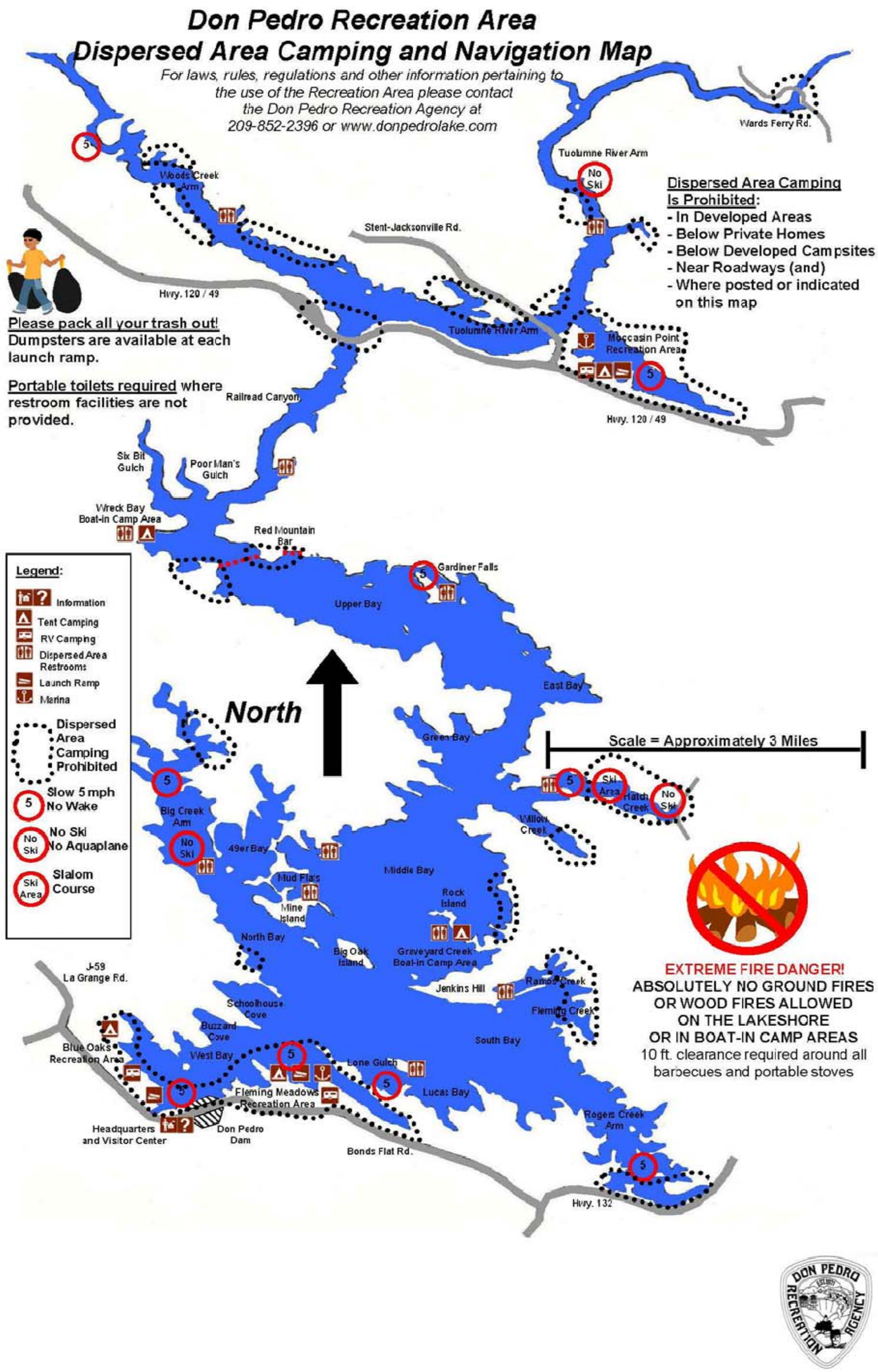


Figure 4.2-1. Developed facilities inventoried and evaluated for the Don Pedro Project recreation facility condition, public accessibility, and recreation use assessment.

4.3 Black Bass Nesting Habitat Assessment

The black bass[1] nesting habitat assessment included both a desktop evaluation and field surveys. A model was developed to estimate bass nesting habitat availability relative to reservoir elevation and bathymetry. Bass nesting habitat suitability was defined in terms of depth, slope and solar radiation[2], based on previous Don Pedro Reservoir bass nest surveys (Lee 1999) and on information reported by Hunt and Annette (2002), and Saunders et al. (2002). The reservoir bathymetry was used to estimate the area of the reservoir that met the depth and slope criteria (Figures 4.3-1 through 4.3-3) as a function of reservoir surface elevation. Area suitability was based on a logic function which used the value from the contributing factor that had the lowest suitability score for each pixel location. So if at location XY depth suitability was 0.45, slope suitability was 0.66 and solar radiance was 0.54 then for that location the overall score would be based on the depth suitability of 0.45. Sites were then stratified into four categories based on suitability: high value (HV) suitability (> 0.75), medium high value (MHV) suitability (>0.5-0.75), medium low value (MLV) suitability (>0.25-0.5), and low value (≤ 0.25).The intended use of the model is to evaluate potential effects of Project operations on bass nesting habitat due to the changes in reservoir water surface elevation.

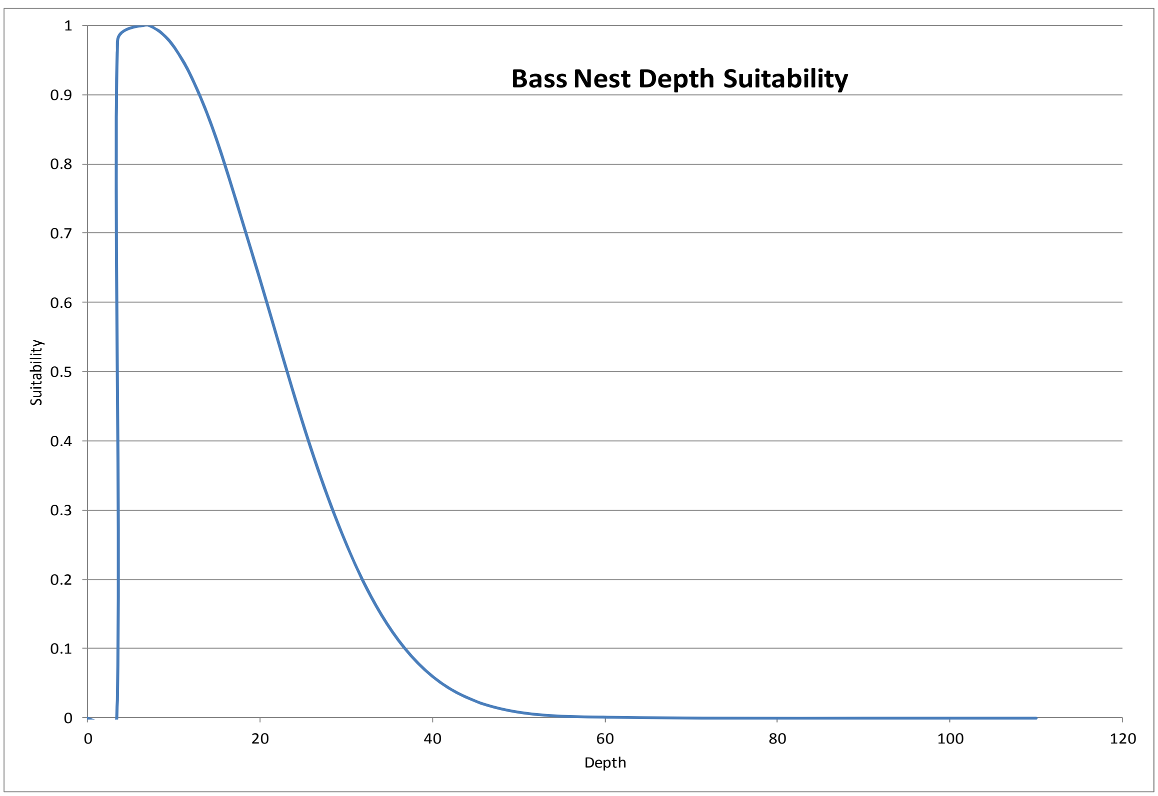


Figure 4.3-1. Depth suitability curve used for bass nesting habitat model assessment during the Don Pedro Reservoir fish population survey, 2012

[1] Don Pedro Reservoir black bass includes largemouth (*Micropterus salmoides*), smallmouth (*Micropterus dolomieu*), and spotted bass (*Micropterus punctulatus*).
[2] The solar radiance is the amount of solar radiation measured in watt-hours per square meter WH/m2 and increased radiance is associated with increased warming which is considered to increase nesting habitat suitability.

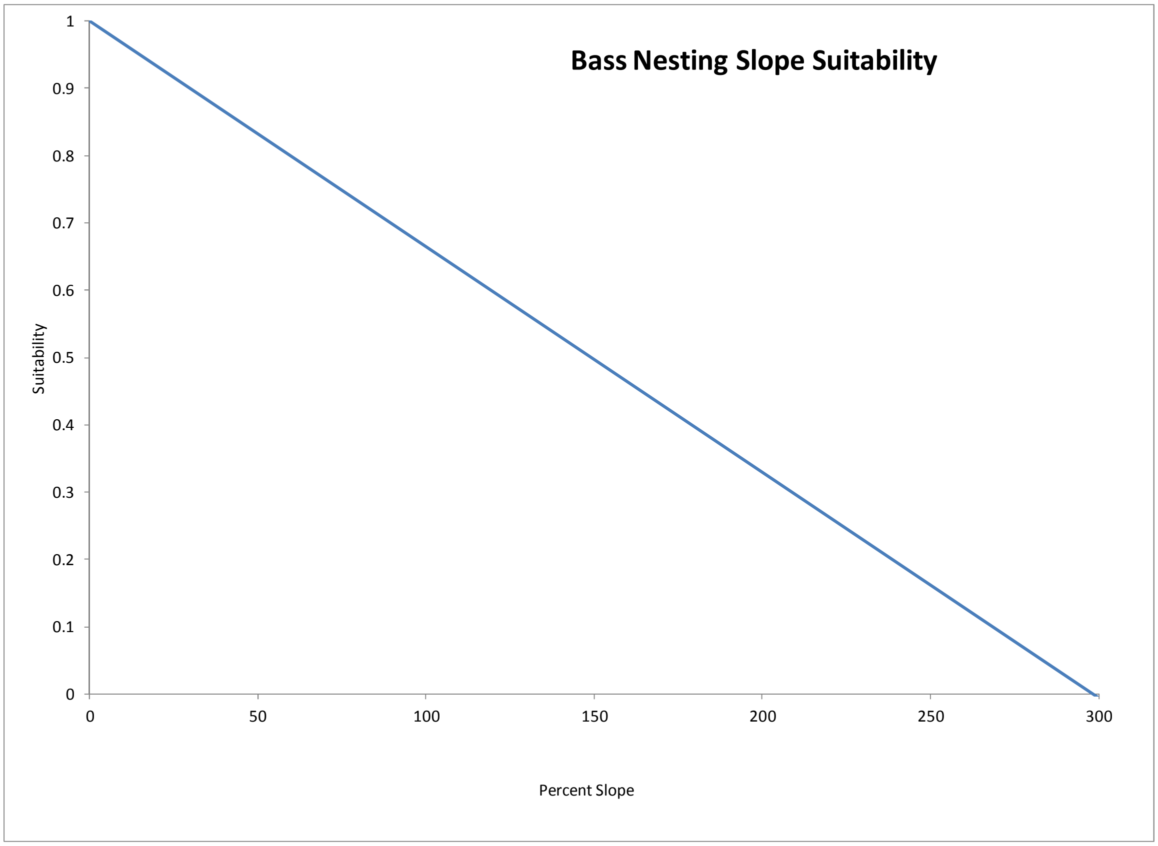


Figure 4.3-2. Slope suitability curve used for bass nesting habitat model assessment during the Don Pedro Reservoir fish population survey, 2012.

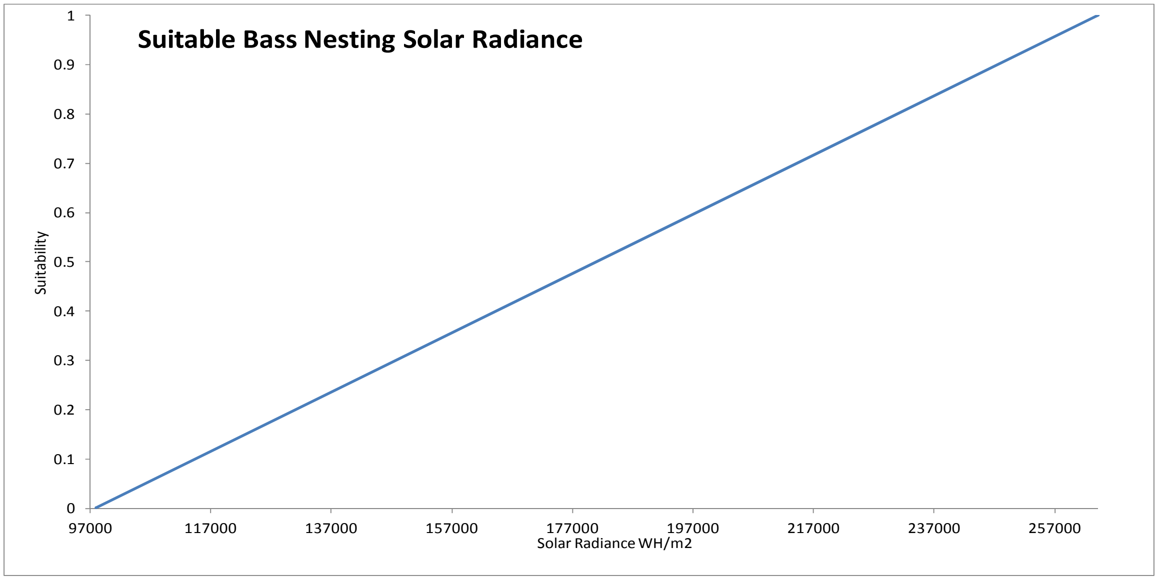


Figure 4.3-3. Solar radiation suitability curve used for bass nesting habitat model assessment during the Don Pedro Reservoir fish population survey, 2012.

In order to assess the utility of the model, field surveys were conducted to corroborate that habitat conditions in the field were consistent with conditions predicted by the model. Prior to the field assessments, a Geographic Information System (GIS) technician assessed habitat suitability based on existing Don Pedro Reservoir bathymetry data and water surface elevations corresponding to the period of field assessments. Areas showing relatively low gradient and shallow depths (3-15 ft) were identified for the entire reservoir. A total of 100 sites were selected within the suitable areas of the reservoir and surveyed during May 2012.

The evaluation areas were prioritized for field surveys in order to minimize searching in the field. Each site represented an area 100 m (of shoreline) long by the perpendicular distance from the shore to a depth of about 6.5 ft. Field crews navigated by boat to pre-selected low gradient habitat or other likely habitat such as bulrush beds to visually seek out nests. Searching included snorkeling along the bank in depths over 1.5 ft and searching from the bow of the boat. The area surveyed extended from shore to where depth was about 15 ft. When a nest was found, the surveyor looked to identify attending bass. Species of the tending bass was recorded as well as depth of nest, diameter of the nest, GPS location, water temperature, surrounding substrate, nest distance from cover, size of cover and type of cover. General information such as water turbidity and weather were noted to characterize the ability of the field team to find nests.

The potential operation effects on bass nest survival were evaluated. A desktop assessment using reservoir water surface elevation data from 1984—2012 was conducted to examine the historic frequency and magnitude of reservoir stage reductions during the spawning period (March—June). This assessment was based on methods reported by CDFG (Lee 1999) and used in similar evaluations of reservoir operations on bass nesting success (DWR 2001). Lee (1999) established a spawning survival curve based on the cumulative number of nests as a percentage of total nests observed. The percentage of successful nests was determined by dividing the nest depth by the estimated average number of days from nest construction to the free-swimming fry stage. If the drawdown did not exceed the nest depth, the nest was considered successful. The data used to derive the curves are described in Lee (1999). The curves establish reservoir reduction rates for the 20 percent spawning nest survival criterion used in this analysis. Based on the data reported by Lee (1999), the following equations were used to evaluate the effect of flow changes in Don Pedro Reservoir during the bass nesting period during the previous 27 years:

$$\text{Largemouth Bass } Y = -56.378*\ln(X)-102.59$$
$$\text{Smallmouth Bass } Y = -46.466*\ln(X)-83.34$$
$$\text{Spotted Bass } Y = -79.095*\ln(X)-94.162$$

Where: X is the fluctuation rate, m/day
Y is the percentage of successful nests

Using the equations, the 20 percent nest survival criteria were estimated to be 0.11 m/d, 0.11 m/d, and 0.23 m/d for largemouth (*Micropterus salmoides*), smallmouth (*Micropterus dolomieu*), and spotted bass (*Micropterus punctulatus*), respectively.

Don Pedro Reservoir monthly water surface elevation records were obtained from the TID. TID reports monthly reservoir storage data from 10/1/1983 to 7/31/2012. To correspond with months bass are potentially nesting monthly reservoir storage from 3/1/1984 to 7/31/2012 were used in the study. Daily water surface elevation levels calculated by TID were used in this evaluation.

Historic Don Pedro Reservoir water surface elevation reductions and reduction rates were compared with criteria which specify reduction rates that would sustain a minimum of a 20 percent spawning nest survival rate for black bass. Lee (1999) reports fluctuation rates in meters per day (m/d); therefore, reservoir water surface elevation fluctuation rates were converted to m/d. Bass spawning nest success (percent) was calculated for each month of the spring spawning period (March through June) for each year included in the analysis (1984-2010). The numbers of occasions for each month included in the analysis over the period of record in which black bass nest survival equaled or exceeded the 20 percent nest survival criterion were enumerated. Long-term (1984-2010) average mean monthly black bass spawning nest survival estimates were calculated overall, and for each month of the March through June spawning period. The literature review indicates that the majority of black bass spawning in California reservoirs occurs from March through June (Lee 1999, Moyle 2002). Therefore, overall long-term average mean monthly nest survival estimates also were calculated for the period extending from March through June. Identical analyses were performed separately for largemouth bass, smallmouth bass, and spotted bass.

4.4 Age-Scale Assessment

Scale samples were taken from salmonids and black bass) exceeding 100 mm FL collected during boat electrofishing and gillnet sampling. Scales were removed from the area anterior to the posterior insertion of the dorsal fin and above the lateral line, placed in an envelope, and marked with a number that identified the record of the species, length, and weight. The scales were collected to validate length-age relationships.

Length-frequency distributions were prepared to analyze the age-class structure of game fish. Age-classes were determined by identifying the minimum and maximum fork lengths in a given age-class for each species as defined by scale analysis (n>15). Length at age estimates were compared to aged scale samples for identification of outliers. Scales used to identify age classes were cleaned, mounted between glass microscope slides, and examined by two independent viewers for the presence of annuli. All scales were viewed and aged on a dissecting microscope.

4.5 Tributary Spawning Access

The potential influence of the Project on access to spawning tributaries for coldwater fish species was evaluated using a desktop analysis. The study team identified stream reaches within tributaries that could become inaccessible to migrating adult salmonids as the reservoir pool level decreased, then determined the stream gradient within those reaches to identify potential fish passage impediments. The evaluated stream reach extended from the lowest reservoir pool elevation to the highest reservoir pool elevation potentially occurring during the spring (March—June) and fall (October—November) spawning periods. Stream reaches with a gradient greater than 10%, within a minimum 1,000 ft stream reach, were considered fish passage impediments.

Exceedance curves were developed based on reservoir pool elevations during spring and fall spawning migration periods measured in Don Pedro Reservoir between 1984 and 2012. Reservoir bathymetry was used to identify the slope within tributary streams reaches that would be exposed when reservoir pool elevations were at the 90 percent exceedance level during the two spawning periods.

The evaluation addressed streams considered to typically contain surface flows during the spring and fall spawning periods Streams evaluated for spring spawning included “named” streams on USGS Topographic maps (7.5 minute) (Table 4.5-1). Only perennial tributary streams within the Project area were identified as potentially supporting fall spawning. (Table 4.5-1).

Table 4.5-1. Streams tributary to Don Pedro Reservoir that were evaluated for potential fish passage impediments during the fall and spring salmonid spawning periods.

Stream	Spring Spawning	Fall Spawning
Tuolumne River	Yes	Yes
Deer Creek	Yes	No
Moccasin Creek	Yes	Yes
Hatch and First Creeks	Yes	No
Willow Creek	Yes	No
Fleming Creek	Yes	No
Rogers Creek	Yes	Yes
Lucas Gulch	Yes	No
Ranchero Creek	Yes	No
West Fork Creek	Yes	No
Big Creek	Yes	Yes
Fortynine Creek	Yes	No
Sixbit Gulch	Yes	No
Poormans Gulch	Yes	No
Woods Creek	Yes	Yes
Sullivan Creek	Yes	No
Kanaka Creek	Yes	No
Rough and Ready Creek	Yes	No

5.0 RESULTS

The following section summarizes the results of fish population sampling for each survey. Boat electrofishing and gillnet sampling are reported in Section 5.1. Section 5.2 describes the results of the creel surveys. Section 5.3 summarizes the bass nesting results.

5.1 Reservoir Fish Population Survey

The results of gillnet and boat electrofishing sampling efforts are presented in this section. The combined results of these efforts are presented in Section 5.1.1 to characterize species composition, relative abundance, and size composition of the Don Pedro Reservoir fish population. Results of each sampling method are also presented in independent sections.

5.1.1 Species Composition, Relative Abundance and Size

All together, 650 fish were collected, with 14 species caught during the combined fish population sampling efforts conducted at Don Pedro Reservoir. Boat electrofishing collected the most fish (n=483, 74.3 percent of the total combined catch) as compared to gillnet sampling (n=167, 25.7 percent). Table 5.1-1 presents a summary of species composition, size, and condition. Figure 5.1-1 presents a summary of the proportion of species by both catch and measured biomass. Threadfin shad (*Dorosoma petenense*) was numerically dominant (n=135, 20.8 percent of the catch). The majority of game fish were composed of sunfishes (Family Centrarchidae), which were represented primarily by largemouth bass (n=116). Other frequently collected Centrarchids included green sunfish (*Lepomis cyanellus*) (n=95), bluegill (*Lepomis macrochirus*) (n=78) spotted bass (n=57), and smallmouth bass (n=20). Trout and salmon (Family Salmonidae) species were represented by kokanee (*Oncorhynchus nerka*) (n=18), and rainbow trout (*O. mykiss*) (n=1). Other commonly collected species included channel catfish (*Ictalurus punctatus*) (n=30) and common carp (*Cyprinus carpio*) (n=8).

Species that were well represented generally were present in multiple size classes. The range of lengths for all fish collected was 52 to 686 mm. Largemouth bass ranged in length from 45 to 465 mm (mean 252.3mm) and 1.1 to 1723.7 g (mean 361.2 g), while spotted bass ranged from 100 to 403 mm (mean 276.8 mm) and11.9 to 992.2 g (mean 377.1 g). Mean length for kokanee was 332.3 mm. Juvenile lifestage fish were not collected for kokanee over all sample events. Other common species included threadfin shad (mean 76.3 mm), bluegill (mean 80.7 mm), green sunfish (mean 67.1 mm) and smallmouth bass (mean 201.7mm). The largest collected fish was a common carp that was 686 mm and weighed 4,677.6 g.

While largemouth bass was not the most common species in number, it comprised 31.6 percent of all measured fish biomass (weight): the greatest biomass of any species. Common carp (17.7 percent), channel catfish (16.8 percent), and spotted bass (16.4 percent) also represented a significant proportion of measured biomass.

Fish condition (Kn) suggested that fish were healthy based upon their relative weight. The average relative condition factor for all fish ranged from 0.92 for kokanee to 1.06 for largemouth bass.

Table 5.1-1. Summary of relative abundance, length, and weight of all fish species collected at Don Pedro Reservoir in 2012.

Species	Composition		Length (mm)			Weight (g)			Mean relative condition factor (Kn)[1]
	N	%	Min	Max	Mean	Min	Max	Mean	
Black bass (unidentified[2])	76	11.7	52	98	68.8	1.2	11.2	4.1	--
Bluegill sunfish (*Lepomis macrochirus*)	78	12.0	37	138	80.7	1.0	60.0	12.8	1.00
Channel catfish (*Ictalurus. punctatus*)	30	4.6	60	575	326.1	3.3	2,350	760.8	0.99
Common carp (*Cyprinus carpio*)	8	1.2	450	686	578.0	1,420	4,678	2,910	--
Crappie (spps)	1	0.2	57	57	57.0	2.2	2.2	2.2	--
Golden Shiner (*Notemigonus crysoleucas*)	5	0.8	53	90	70.6	2.6	11.5	6.0	--
Green sunfish (*L. cyanellus*)	95	14.6	32	102	67.1	0.5	19.0	5.2	1.04
Kokanee (*Oncorhynchus nerka*)	18	2.8	308	412	332.3	172.0	965.0	380.6	0.92
Largemouth bass (*Micropterus salmoides*)	116	17.8	45	465	252.3	1.1	1,723	361.2	1.06
Rainbow trout (*O. mykiss*)	1	0.2	422	422	422.0	683.0	683.0	683.0	--
Sacramento sucker (*Catostomus occidentalis*)	9	1.4	322	495	406.9	322.0	1310	785.0	--
Smallmouth bass (*M. dolomieu*)	20	3.1	54	410	201.7	2.1	1,107	285.3	1.04
Spotted bass (*M. punctulatus*)	57	8.8	100	403	276.8	11.9	992.2	377.1	0.95
Threadfin shad *(Dorosoma petenense)*	135	20.8	58	111	76.3	1.0	18.7	6.0	0.99
White catfish (*Ameiurus catus*)	1	0.2	295	295	295	368.5	368.5	368.5	--
Total	650	100.0							

1 Species with 10 or less individuals or poor fit regressions did not have a reportable condition factor.
2 Small-sized black bass were not identified to species

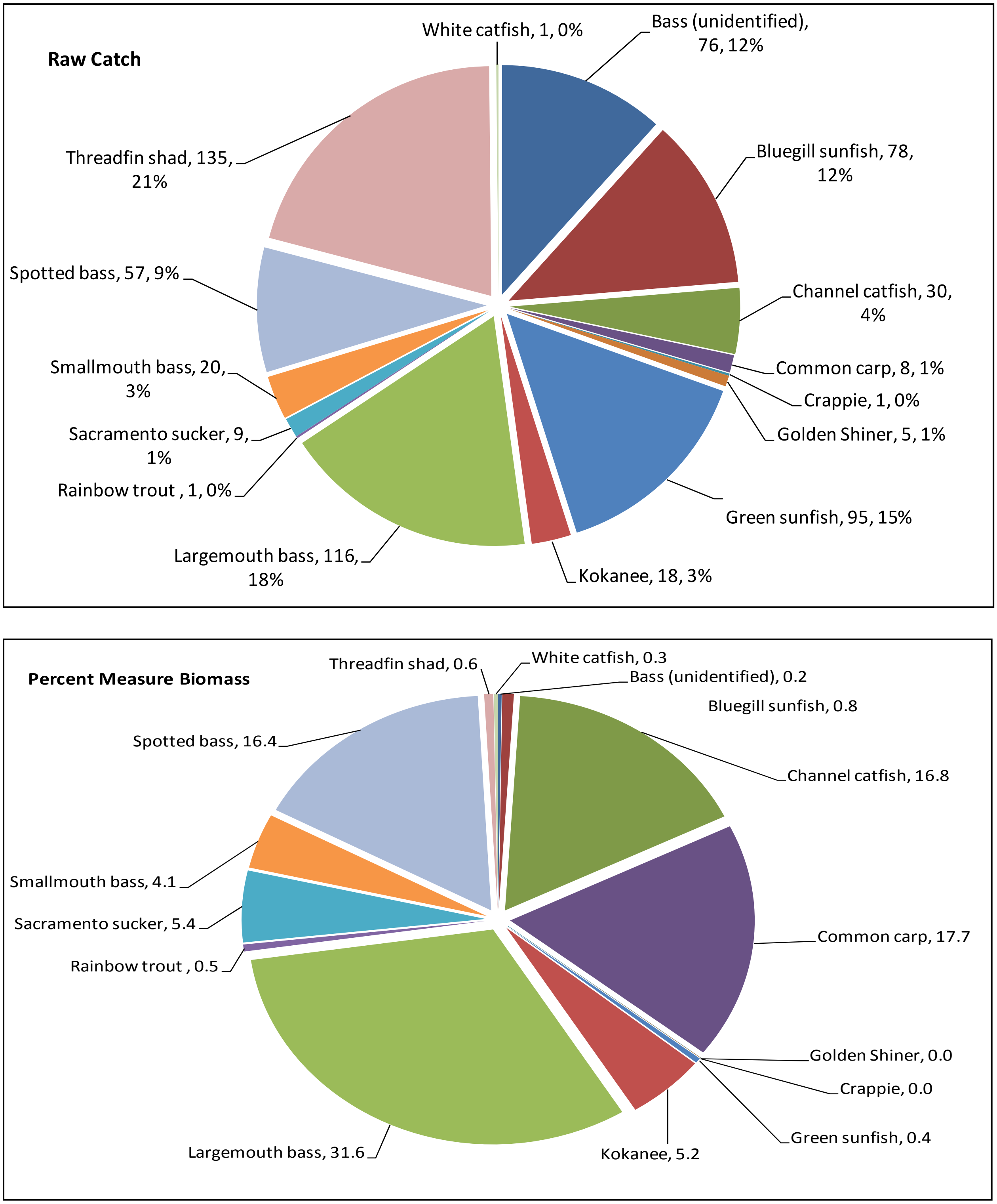


Figure 5.1-1. Relative numbers of fish (top) and percent measured biomass (bottom) by species, combined from gillnet and boat electrofishing activities during the Don Pedro Reservoir fish population survey conducted in October 2012.

5.2 Gill Net Survey Results

Gillnet surveys were conducted at eight sites (Figure 4.1-1; Table 5.2-1) between October 15 and October 19, 2012. All sites were sampled during the dawn and dusk. The maximum depth of the sampled sites ranged from 140 to 200 ft (Table 5.2-2). Surface water temperatures ranged from 22.7 to 23.5 °C. Dissolved oxygen concentrations ranged from 6.97 to 7.54 mg/l (Table 5.2-2). The reservoir elevation during the gill netting survey ranged from 752.9 ft to 752.2 ft. Storage was about 1,150,000 AF.

Due to equipment malfunction, temperature and DO were only measured at the surface during the gill netting surveys. However, the reservoir water temperature profile was measured on October 9, 2012 in Middle Bay, during the gill netting survey period in conjunction with W&AR 3. The temperatures ranged from 22.9 °C at the surface to 9.8 °C at 360 ft deep (Figure 5.2-1). The epilimnion extended to a depth of about 45 ft, the metalimnion extended from about 45 ft to about 150 ft deep. The depth of the thermocline extended from about 60 ft to 180 ft deep. Additionally, a reservoir water temperature profile and concurrent dissolved oxygen level profile was measured on August 22, 2012, also in conjunction with W&AR 3 (Figure 5.2-2). DO measured between 8.1mg/l at the surface and 6.1 mg/l near the 250 ft depth. DO concentrations were less than 5 mg/l at depths greater than 275 ft.

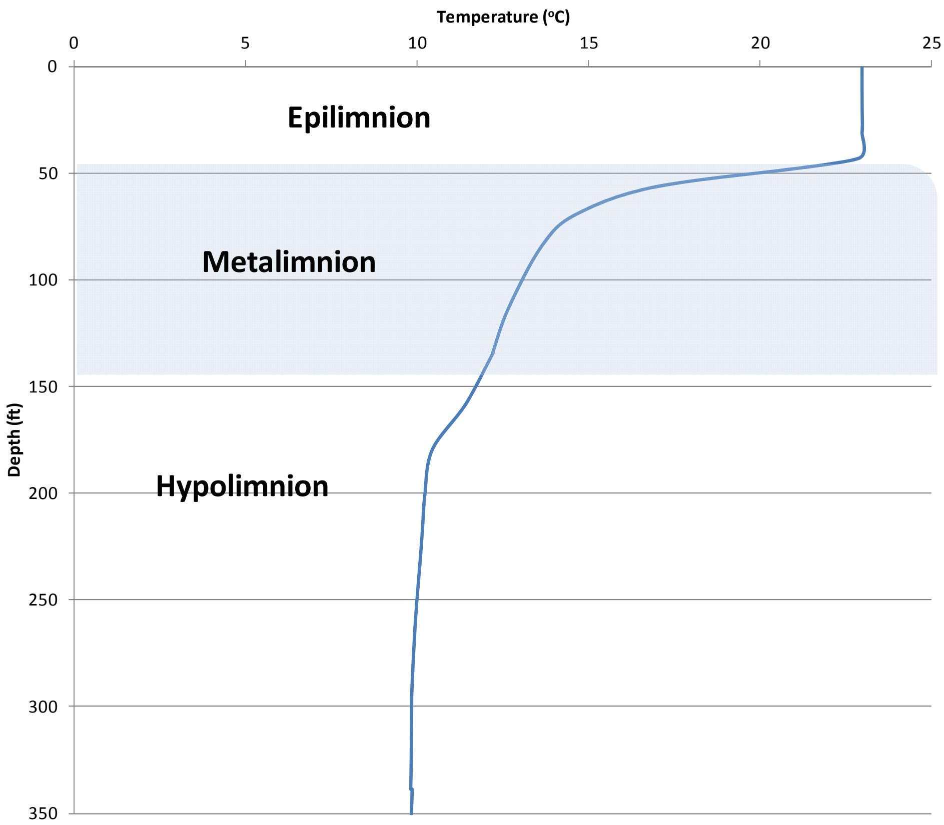


Figure 5.2-1. Temperature profile of Don Pedro Reservoir measured on October 9, 2012.

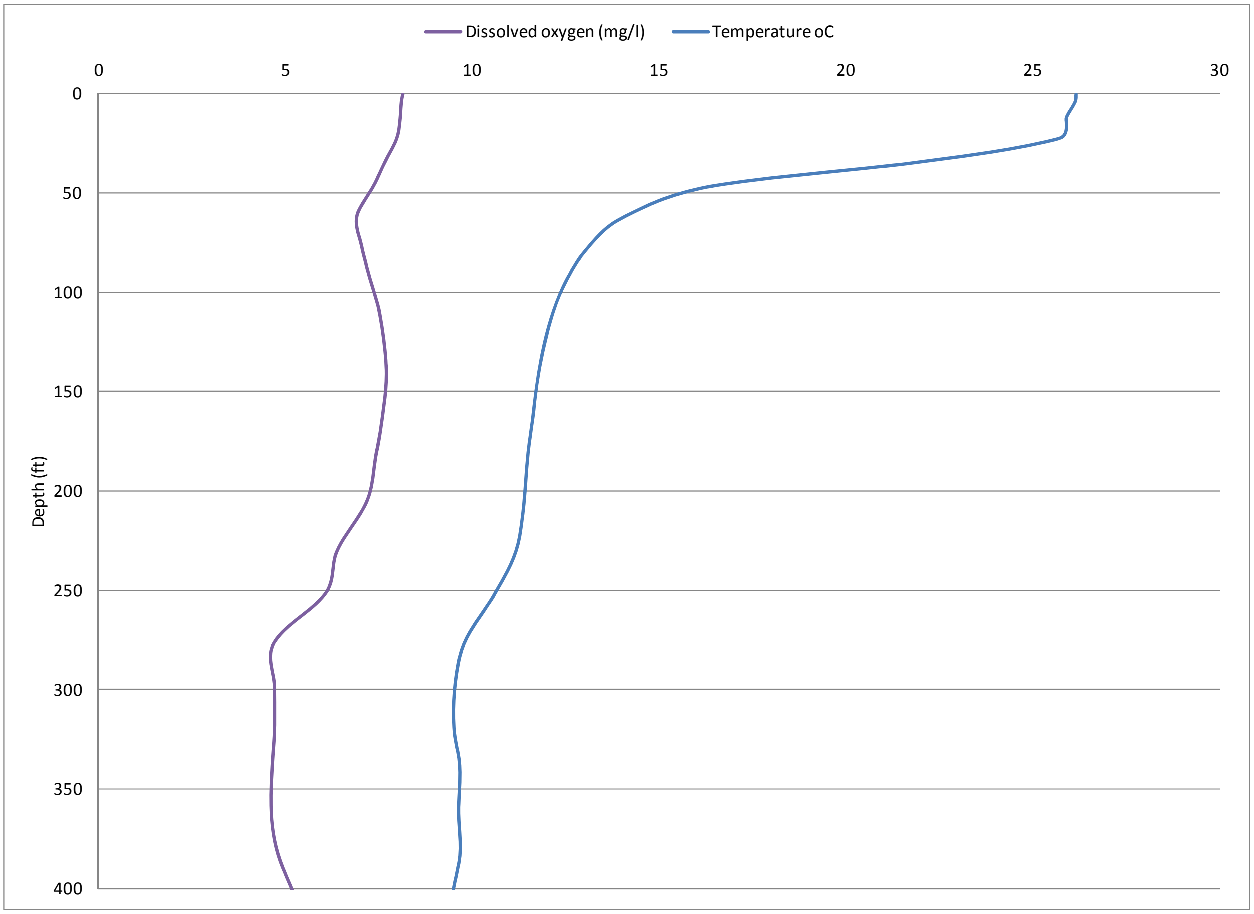


Figure 5.2-2. Temperature and dissolved oxygen profile of Don Pedro Reservoir measured on August 22, 2012

The shore and shallow areas were only sampled at four of the eight sample sites as morality rates observed during the first four surveys were high and the study team determined that the data collected up to that time was sufficient to characterize the fish populations within the littoral reaches of Don Pedro Reservoir. Data collected by boat electrofishing also addressed littoral areas. As such, the remaining gill net survey period focused on sampling pelagic, deeper areas of the reservoir using only mid-water and deepwater sets.

Gillnet sampling yielded a total catch of 167 fish comprising 11 species during the Don Pedro Reservoir fish population survey. Table 5.2-3 presents a summary of species composition, and size statistics. Figure 5.2-3 presents a summary of the proportion of species by both catch and measured biomass. Black bass, including largemouth, smallmouth and spotted bass were numerically dominant (n=126, 75 percent of the catch). The majority of game fish caught were sunfishes (Family Centrarchidae), which were represented primarily by largemouth bass (n=60). Other captured Centrarchids included spotted bass (n=57), and smallmouth bass (n=9), and bluegill (n=1). Trout and salmon (Family Salmonidae) species were represented by kokanee (n=18), and rainbow trout (n=1). Other collected species included channel catfish (n=6), common carp (n=8), white catfish (n=1), and Sacramento sucker (n=8).

Table 5.2-1. Summary of gillnet survey sampling effort by site, time period, and set (depth) during the Don Pedro Reservoir fish population survey, October 2012.

Site	Site ID	Dawn Effort				Dusk Effort			
		Shore	Shallow	Mid-water	Deep water	Shore	Shallow	Mid-water	Deep water
1	Rogers Creek #1	6.75	7.25	8.08	8.25	5.25	4.50	4.00	4.00
2	Rogers Creek #2	6	6.00	7.00	7.00	4.17	4.00	4.00	2.00
3	Graveyard #1	4.5	4.66	4.83	4.75	6	5.00	6.00	5.75
4	Graveyard #2	4.75	4.58	4.75	4.83	6	6.00	5.75	5.75
5	Dam 2	None	None	4.00	4.17	None	None	5.17	5.25
6	Dam 1	None	None	4.00	4.00	None	None	5.17	5.25
7	Sixbit Gulch	None	None	4.00	4.25	None	None	4.50	4.25
8	Poormans Gulch	None	None	4.25	4.25	None	None	5.25	5.00
All		22.00	22.49	40.91	41.50	21.42	19.50	39.84	37.25

Species that were well represented generally were present in multiple size classes (Table 5.2-3; Figure 5.2-4). The range of lengths for all fish collected was 82 mm (threadfin shad) to 545 mm (channel catfish). Largemouth bass ranged in length from 99 to 436 mm (mean 300.1mm) and in weight from 12.8 to 1,474.2 g (mean 521.5 g), spotted bass ranged from 100 to 403 mm (mean 276.8 mm) and 11.9 to 992.2 g (mean 377.1 g), and smallmouth bass ranged from 220 to 440 mm in length (mean 332.2), and from 142 to 1,107 g in weight (mean =578.7 g). Kokanee salmon adults were the most abundant salmonid captured during the gillnet survey (n=18). Mean length for kokanee was 332.3 mm. Juvenile kokanee were not collected during the gillnet surveys. Other species included threadfin shad (n=5, mean 76.3 mm), channel catfish (n=6, mean length = 417.2 mm), and Sacramento sucker (*Catostomus occidentalis*) (n=8, mean length =401 mm).

Table 5.2-2. Summary of the survey conditions measured at gill net survey sites during the Don Pedro Reservoir fish population survey, October 2012.

Date	Site	Distance from Shore (ft)	Water Temp (C)	Dissolved Oxygen (mg/l)	pH	EC	Turbidity (JTU)	Site Max Depth (ft)	Site Min Depth (ft)
10/15/2012	1	30	22.7	8.36	7.44	46.4	7 FT	120	0
10/15/2012	2	30	22.7	8.36	7.44	46.4	7 FT	130	0
10/16/2012	3	30	23.6	8.76	7.18	56.3	1.57	140	0
10/16/2012	4	30	23.6	8.76	7.18	56.3	1.57	130	0
10/18/2012	5	375	22.6	8.38	7.54	63.3	1.06	160	70
10/18/2012	6	75	23.5	8.38	7.54	63.3	1.06	200	80
10/17/2012	7	150	22.6	8.37	6.97	40.5	1.49	157	50
10/17/2012	8	360	22.6	8.37	6.97	40.5	1.49	140	50

Table 5.2-3. Summary of the number, composition and sizes of fish collected by gill netting during the Don Pedro Reservoir fish population survey, October 2012.

Species	Number	% of catch	Length (mm)				Weight (g)			
			Min	Max	Mean	Std	Min	Max	Mean	Std
Bluegill sunfish	1	0.60	136	136	136.0	N/A	40.0	40.0	40.0	N/A
Channel catfish	6	3.59	315	545	417.2	76.8	488.5	2,350.0	976.5	780.3
Common carp	1	0.60	450	450	450.0	N/A	1419.7	1,419.7	1419.7	N/A

Species	Number	% of catch	Length (mm)				Weight (g)			
			Min	Max	Mean	Std	Min	Max	Mean	Std
Kokanee	18	10.78	308	412	332.3	23.4	172.0	965.0	380.6	156.5
Largemouth bass	60	35.93	99	436	300.1	73.4	12.8	1,474.2	521.5	369.7
Rainbow trout	1	0.60	422	422	422.0	N/A	683.0	683.0	683.0	N/A
Sacramento sucker	8	4.79	322	495	401.1	61.1	322.0	1310.0	809.5	361.0
Smallmouth bass	9	5.39	220	410	332.2	56.0	142.0	1107.0	578.7	281.7
Spotted bass	57	34.13	100	403	276.8	80.0	11.9	992.2	377.1	279.7
Threadfin shad	5	2.99	82	92	88.0	3.7	8.3	11.3	9.7	1.5
White catfish	1	0.60	295	295	295.0	N/A	368.5	368.5	368.5	N/A
Total	167	100								

5.2.1 Summary of Collected Fish by Method, Diel Period Location

The rate of catch by gillnet position was notably higher in shore nets. As noted above, due to the higher catches and high mortality observed in the shallow adult and juvenile gillnet sets, only adult mid-water and deepwater gillnet sets were fished in four of the eight gillnet sample sites. Figure 5.2-5 shows the total number of fish collected in gillnets by net type (i.e., adult or juvenile size mesh) and position in the water column. The majority of fish collected were by adult gillnets in the shallow sets (n=122, 73.1 percent), while 17 fish (10.1 percent) were collected in the shallow juvenile gillnet sets, 16 fish (9.6 percent) were collected in the mid-water adult gillnet sets and 12 fish (7.2 percent) were collected in the deepwater adult gillnet sets. Rate of catch for adult nets ranged from a minimum of 0.17 fish/hr in the deepwater net, 0.20 fish/h in the mid-water net to a maximum of 2.91 fish/hr in the shore net. Juvenile gillnet catch rate was 0.39 fish/hr in the shore gillnets.

Diel period did not appear to strongly influence total captures (Table 5.2-4). Figure 5.2-6 summarizes the totals of all fish collected by diel period and gillnet depth. However, gillnets set in near-shore habitats collected substantially more fish than other habitats for both day and night survey efforts. The majority of fish were collected during the night (dusk) sampling (n=87) with catch ranging from 0.20 fish/hr in the mid-water gillnets to 2.98 fish/hr in the adult shore gillnets. Day time (dawn) gillnets collected fish at slightly lower rates (n=80) with a minimum of 0.06 fish/hr in the deepwater gillnets and a maximum of 2.98 fish/hr in the adult shore nets.

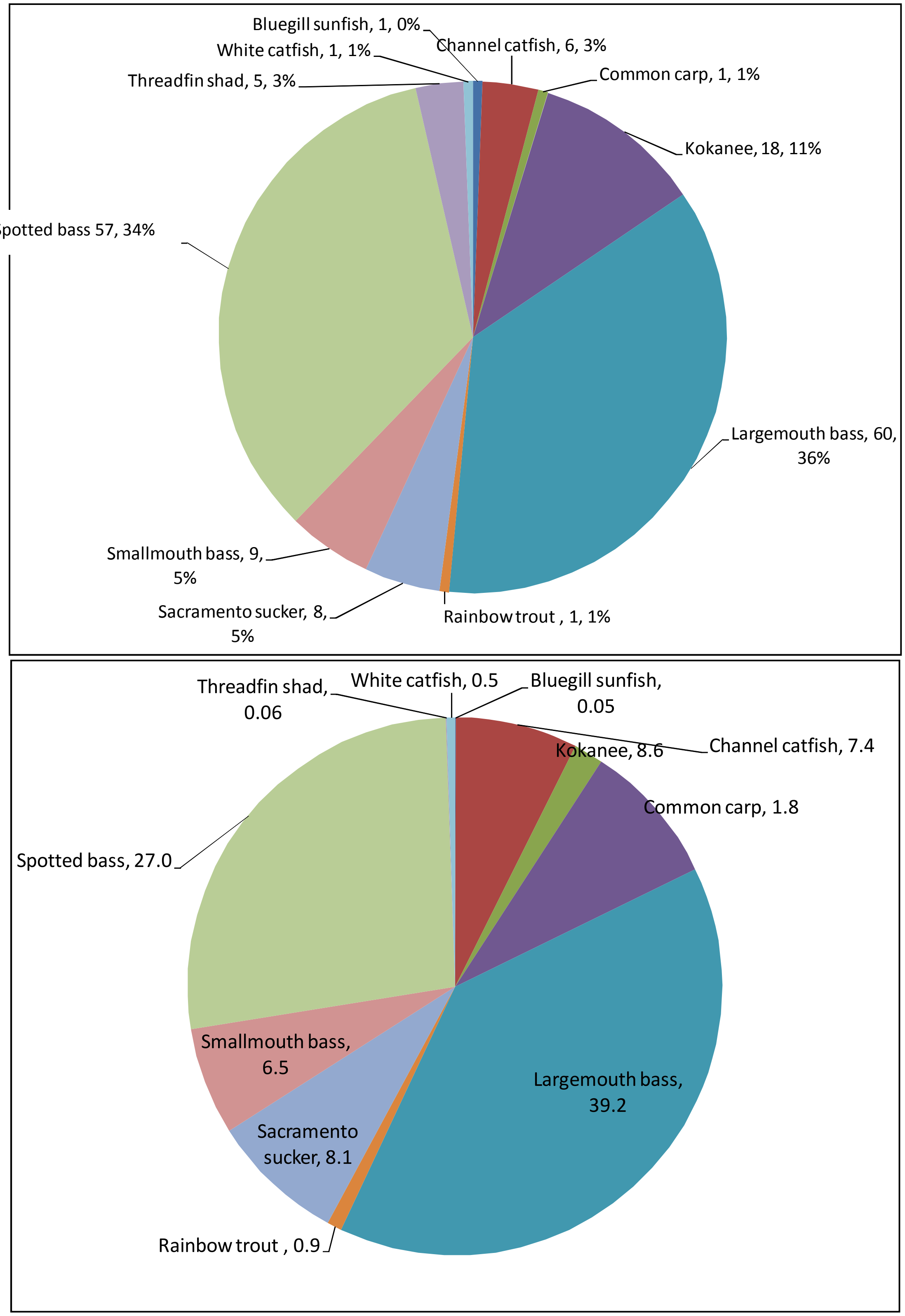


Figure 5.2-3. Relative numbers of fish (top) and percent measured biomass (bottom) by species, from gill netting activities during the Don Pedro Reservoir fish population survey conducted in October 2012.

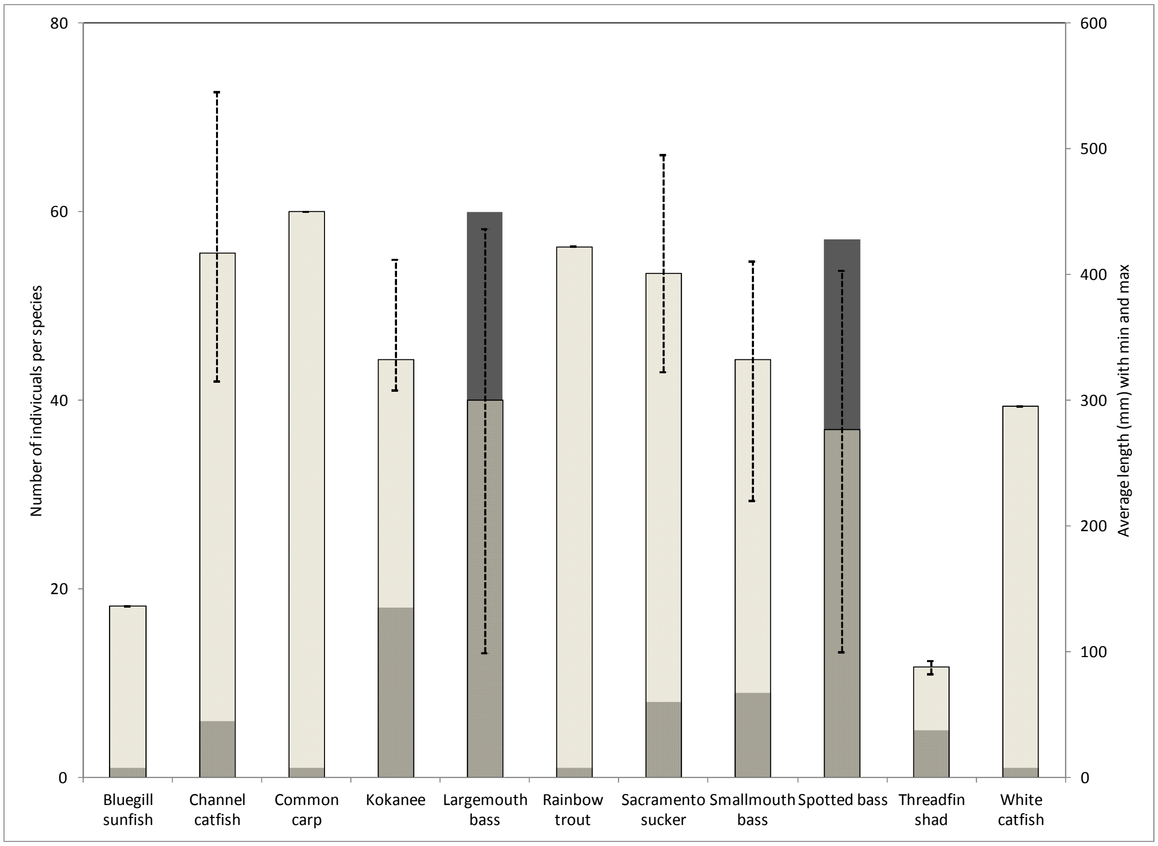
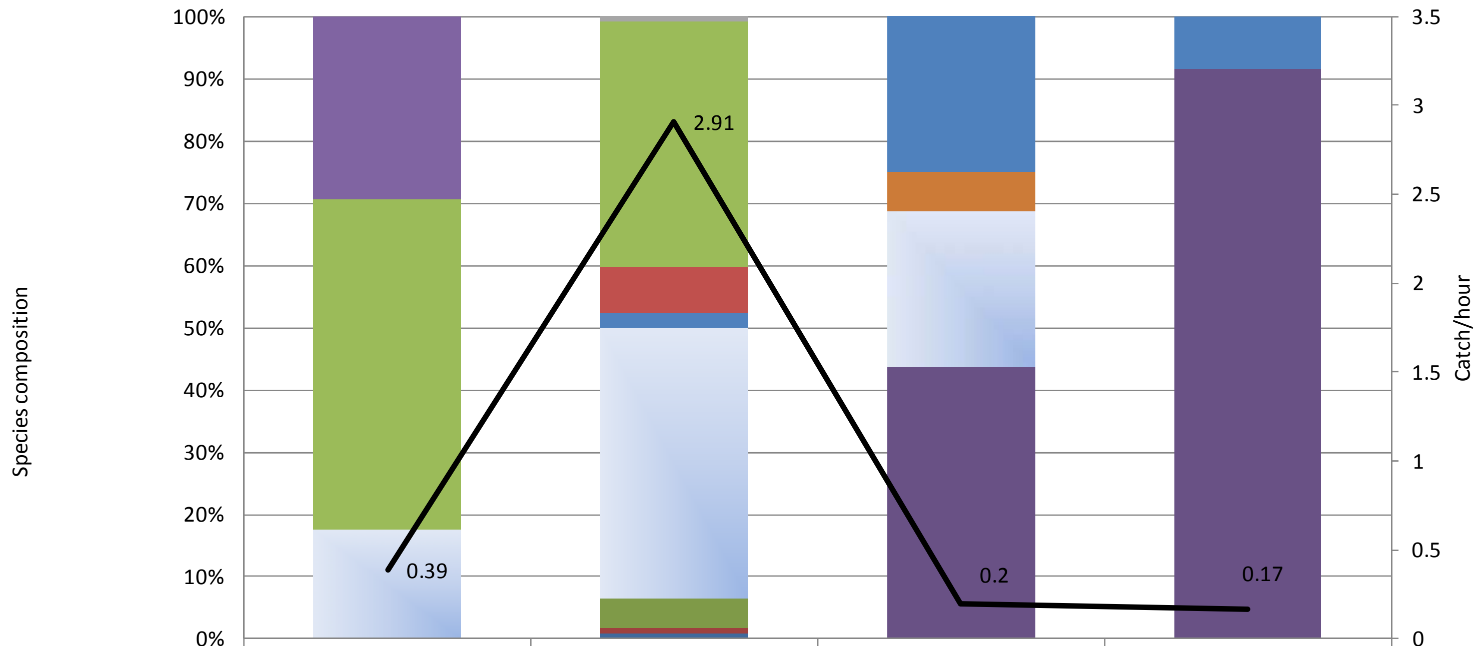


Figure 5.2-4. Summary of abundance and size ranges of fish collected by gill netting during the Don Pedro Reservoir fish population survey, October 2012.



	Juvenile shore	Adult shore	Midwater	Deepwater
White catfish	0	1	0	0
Threadfin shad	5	0	0	0
Spotted bass	9	48	0	0
Smallmouth bass	0	9	0	0
Sacramento sucker	0	3	4	1
Rainbow trout	0	0	1	0
Largemouth bass	3	53	4	0
Kokanee	0	0	7	11
Channel catfish	0	6	0	0
Carp	0	1	0	0
Bluegill	0	1	0	0
Total catch/h	0.39	2.91	0.2	0.17

Figure 5.2-5. Species composition and catch per hour of fish captured by gill net placement during the Don Pedro Reservoir fish population survey, October 2012.

Table 5.2-4. Summary of the total catch, relative abundance, length, and weight of fish species collected by survey period using gillnets during the Don Pedro Reservoir fish population survey, October 2012.

Sample Period	Species	N	%	Length (mm)			Weight (g)		
				Min	Max	Mean	Min	Max	Mean
Dawn (n=80)	Bluegill	1	1.25%	136	136	136.0	40.0	40.0	40.0
	Carp	0	0.00%	--	--	--	--	--	--
	Channel catfish	1	1.25%	385	385	385.0	572.0	572.0	572.0
	Kokanee	7	8.75%	310	355	330.0	285.0	351.0	330.1
	Largemouth bass	22	27.50%	215	436	330.4	95.1	1474.2	660.0
	Rainbow trout	0	0.00%	--	--	--	--	--	--
	Sacramento sucker	2	2.50%	340	445	392.5	452.0	1105.0	778.5
	Smallmouth bass	4	5.00%	325	385	346.3	435.0	817.0	594.0
	Spotted bass	42	52.50%	100	403	303.1	14.0	992.2	464.0
	Threadfin shad	0	0.00%	--	--	--	--	--	--
	White catfish	1	1.25%	295	295	295.0	368.5	368.5	368.5
Dusk (n=87)	Bluegill	0	0.00%	--	--	--	--	--	--
	Carp	1	1.15%	450	450	450.0	1420.0	1419.7	1420.0
	Channel catfish	5	5.75%	315	545	423.6	488.5	2350.0	1077.6
	Kokanee	11	12.64%	308	412	333.7	172.0	965.0	412.7
	Largemouth bass	38	43.68%	99	403	282.5	12.8	1160.0	441.3
	Rainbow trout	1	1.15%	422	422	422.0	683.0	683.0	683.0
	Sacramento sucker	6	6.90%	322	495	404.0	322.0	1310.0	819.9
	Smallmouth bass	5	5.75%	220	410	321.0	142.0	1107.0	566.5
	Spotted bass	15	17.24%	100	310	203.1	11.9	434.0	113.8
	Threadfin shad	5	5.75%	82	92	88.0	8.3	11.3	9.7
	White catfish	0	0.00%	--	--	--	--	--	--

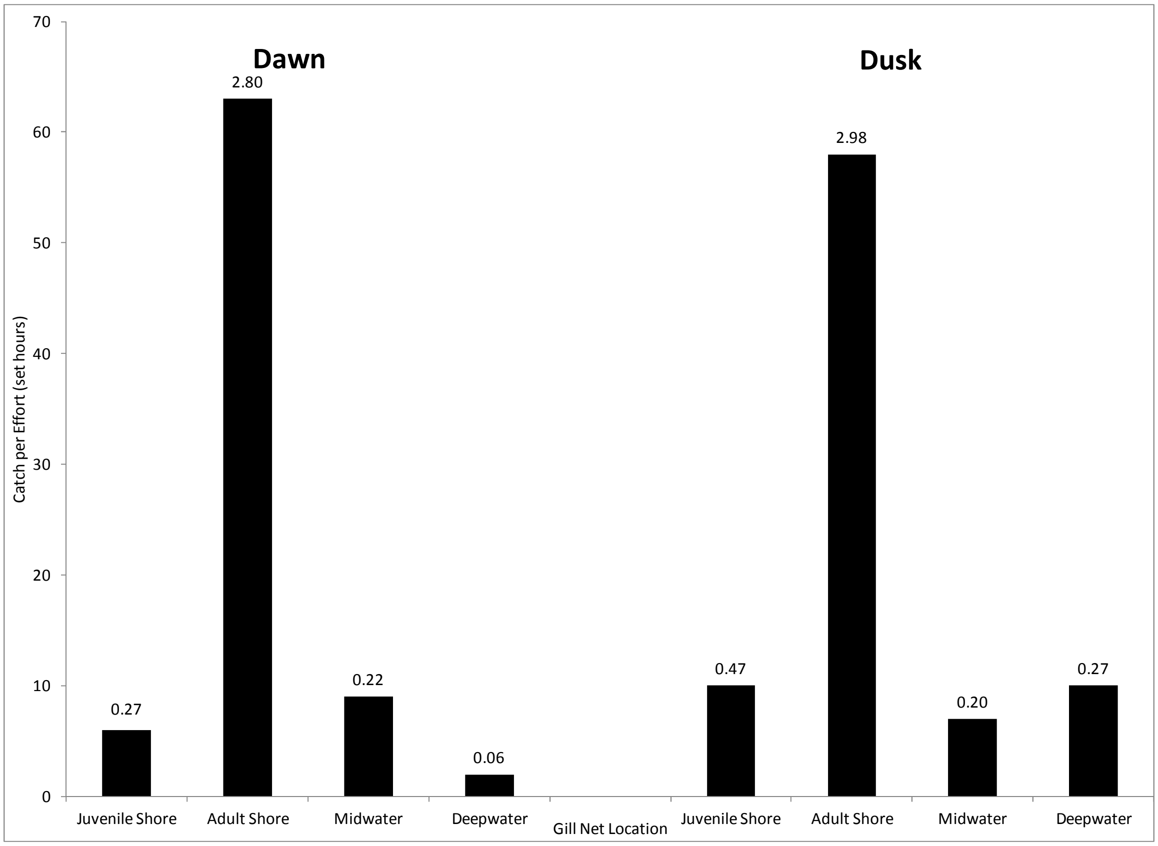


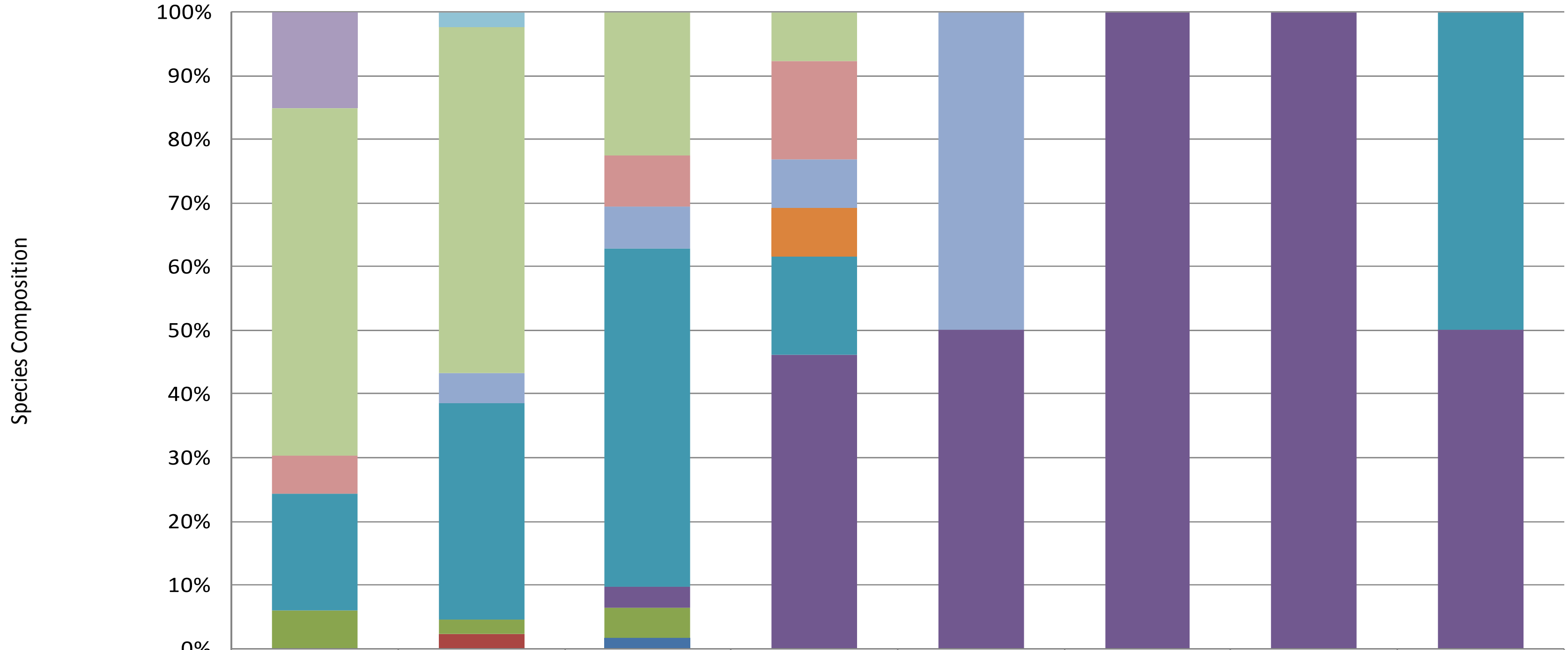
Figure 5.2-6. Comparison of catch per unit effort observed during dawn and dusk gill net sets during the Don Pedro Reservoir fish population survey, October 2012.

Catch by site was variable (Table 5.2-5; Figure 5.2-7), although the greatest variation among catch by site was associated with surface oriented surveys. Catches at sites one to four ranged from 13 at site four to 62 at site three with most fish being captured in the adult surface gillnets. At sites five to eight, where only deeper net sets were fished, catch ranged from one to eight fish (Table 5.2-4). Black bass, the most abundant fish captured, were the dominant fish caught at all four sites fished with surface oriented sets. Only kokanee, Sacramento sucker, and rainbow trout were captured in the deeper sets.

At sites five and six, gillnets were sampled near Don Pedro Dam. Table 5.2-5 and Figure 5.2-7 summarize fish collected by gillnet sampling at these sites. The deepwater intake at Don Pedro Reservoir is generally at a depth greater than 350 ft throughout the year. Gillnets were able to sample up to 100 ft in depth. Only three fish were captured at these sites (two kokanee and one sucker) in 18.6 hours of fishing mid-water and deepwater gillnets combined. Rainbow trout, kokanee, and spotted bass were the only species collected in deepwater gillnets at this site.

Table 5.2-5. Summary of abundance and composition of fish caught by site using gillnets during the Don Pedro Reservoir fish population survey, October, 2012

Species	Gill Net Sites								Total
	1	2	3	4	5	6	7	8	
Bluegill	--	--	1	--	--	--	--	--	1
Carp	--	1	--	--	--	--	--	--	1
Channel catfish	2	1	3	--	--	--	--	--	6
Kokanee			2	6	1	1	4	4	18
Largemouth bass	6	15	33	2	--	--	--	4	60
Rainbow trout	--	--	--	1	--	--	--	--	1
Sacramento sucker	--	2	4	1	1	--	--	--	8
Smallmouth bass	2		5	2	--	--	--	--	9
Spotted bass	18	24	14	1	--	--	--	--	57
Threadfin shad	5	--	--	--	--	--	--	--	5
White catfish	--	1	--	--	--	--	--	--	1
Totals	33	44	62	13	2	1	4	8	167



	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
White catfish	0	1	0	0	0	0	0	0
Threadfin shad	5	0	0	0	0	0	0	0
Spotted bass	18	24	14	1	0	0	0	0
Smallmouth bass	2	0	5	2	0	0	0	0
Sacramento sucker	0	2	4	1	1	0	0	0
Rainbow trout	0	0	0	1	0	0	0	0
Largemouth bass	6	15	33	2	0	0	0	4
Kokanee	0	0	2	6	1	1	4	4
Channel catfish	2	1	3	0	0	0	0	0
Carp	0	1	0	0	0	0	0	0
Bluegill	0	0	1	0	0	0	0	0

Figure 5.2-7. Species composition by sample site of fish collected by gillnet during the Don Pedro Reservoir fish population survey, October 2012.

5.3 Boat Electrofishing Survey Results

A total of 15 boat electrofishing surveys were conducted at within 8 sites (Figure 4.1-2; Table 5.3-1) between October 8 and October 10, 2012. All sites were sampled starting after dusk. Boat electrofishing is most efficient in shallow water (< 10 ft) and as such was only used to sample near-shore habitats. Survey site depths ranged from 1.5 ft to 8 ft (Table 5.3-1). Effort was measured as time the shocking unit was on (in seconds) ranged from 311 to 1,165 seconds.

Table 5.3-1. Summary of boat electrofishing sites surveyed during the Don Pedro Reservoir fish population survey, October 2012, location, effort and depth

Date	Site Number	Site_ID	Depth (ft)	Effort (sec)	Water Temp (F	Dissolved Oxygen (mg/l)	EC
10/8/2012	1.1	Inlet south	5.5	342	64.2	8.46	76.6
10/8/2012	1.2	Inlet north	1.5	311	64.2	8.49	76.6
10/8/2012	3	Woods Creek	2	675	72.6	7.78	89.6
10/9/2012	3.1	Upper Bay#2	5	645	73.5	7.32	31.5
10/9/2012	3.2	Upper Bay #1	4	509	74.3	7.8	79.6
10/8/2012	3.3	Upper Bay	5	576	73.5	7.95	40
10/9/2012	4.1	Rogers Creek	5	469	74.2	8.34	44.6
10/9/2012	4.2	Rogers Creek	4	556	74	8.36	37
10/9/2012	4.3	Rogers Creek	4	1165	72.8	8.32	36.3
10/9/2012	5	Jenkins Hill	6	666	73.7	8.27	33.8
10/10/2012	6.1	Graveyard Bay #1	6	888	73.1	8.12	32.9
10/9/2012	6.2	Graveyard Bay #2	3	846	74	8.11	36.9
10/10/2012	7.1	Big Creek #1	8	443	73.5	8.18	32.9
10/10/2012	7.2	Big Creek	8	775	73.3	8.13	31.9
10/10/2012	8	49er Bay	5	632	72.8	8.16	32.2

Electrofishing yielded a total catch of 483 fish comprising 10 species during the Don Pedro Reservoir fish population survey. Table 5.3-2 presents a summary of species composition, abundance and size statistics. Figure 5.3-1 presents a summary of the proportion of species by both catch and measured biomass. Threadfin shad was numerically dominant (n=130, 26.9 percent of the catch). The majority of game fish were composed of sunfishes (Family Centrarchidae), which were represented by largemouth bass (n=56), green sunfish (n=94), bluegill (n=77), crappie (n=1) and smallmouth bass (n=11). Other collected species included channel catfish (n=24) and common carp (n=7), golden shiner (n=6) and Sacramento sucker (n=1). No trout or salmon were collected by electrofishing.

Table 5.3-2. Summary of the number, composition and sizes of fish collected by boat electrofishing during the Don Pedro Reservoir fish population survey, October 2012.

Species	No.	% of catch	Length (mm)				Weight (mm)			
			Min	Max	Mean	STD	Min	Max	Mean	STD
Bass (unidentified)	76	15.7	52	98	68.8	12.1	1.2	11.2	4.1	1.8
Bluegill sunfish	77	15.9	37	138	79.9	23.6	1.0	60.0	12.5	12.6
Channel catfish	24	5.0	60	575	303.4	209.8	3.3	2,000.0	715.9	780.5

Species	No.	% of catch	Length (mm)				Weight (mm)			
			Min	Max	Mean	STD	Min	Max	Mean	STD
Common carp	7	1.4	500	686	596.3	69.6	2,000.0	4,678.0	3,123.0	1,021.8
Crappie	1	0.2	57	57	57.0	N/A	2.2	2.2	2.2	N/A
Golden shiner	6	1.2	52	90	67.8	13.3	2.3	11.5	5.4	3.4
Green sunfish	94	19.5	32	102	67.2	11.9	0.5	19.0	5.3	2.9
Largemouth bass	56	11.6	45	465	201.2	92.2	1.1	1,723.7	186.3	298.3
Sacramento sucker	1	0.2	453	453	453.0	N/A	589.0	589.0	589.0	N/A
Smallmouth bass	11	2.3	54	226	94.8	53.7	2.1	154.0	21.3	47.4
Threadfin shad	130	26.9	58	111	75.9	14.1	1.0	18.7	5.9	3.6
Total	483	100								

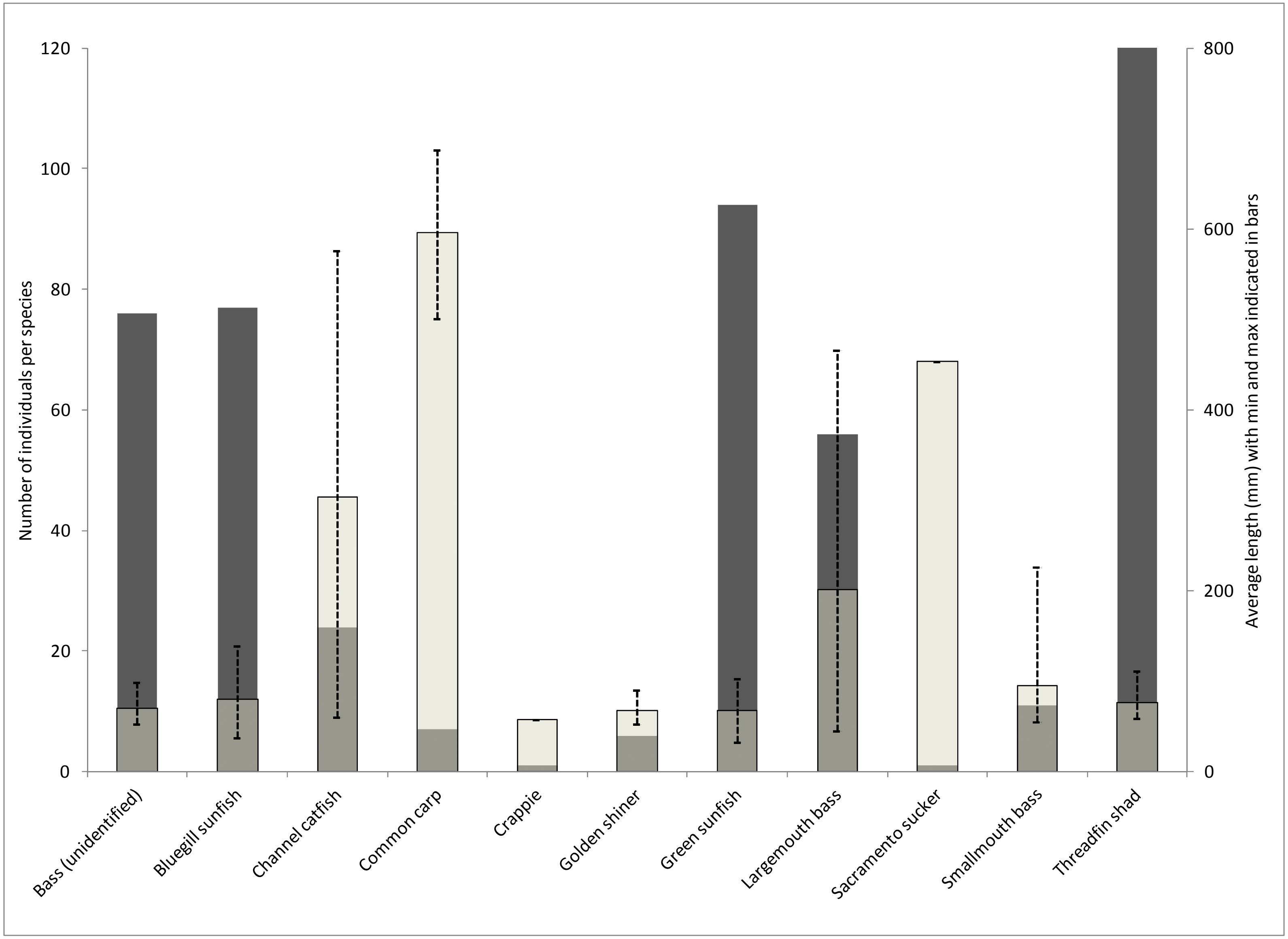


Figure 5.3-1. Summary of numbers and size ranges of fish collected by boat electrofishing during the Don Pedro Reservoir fish population survey, October 2012.

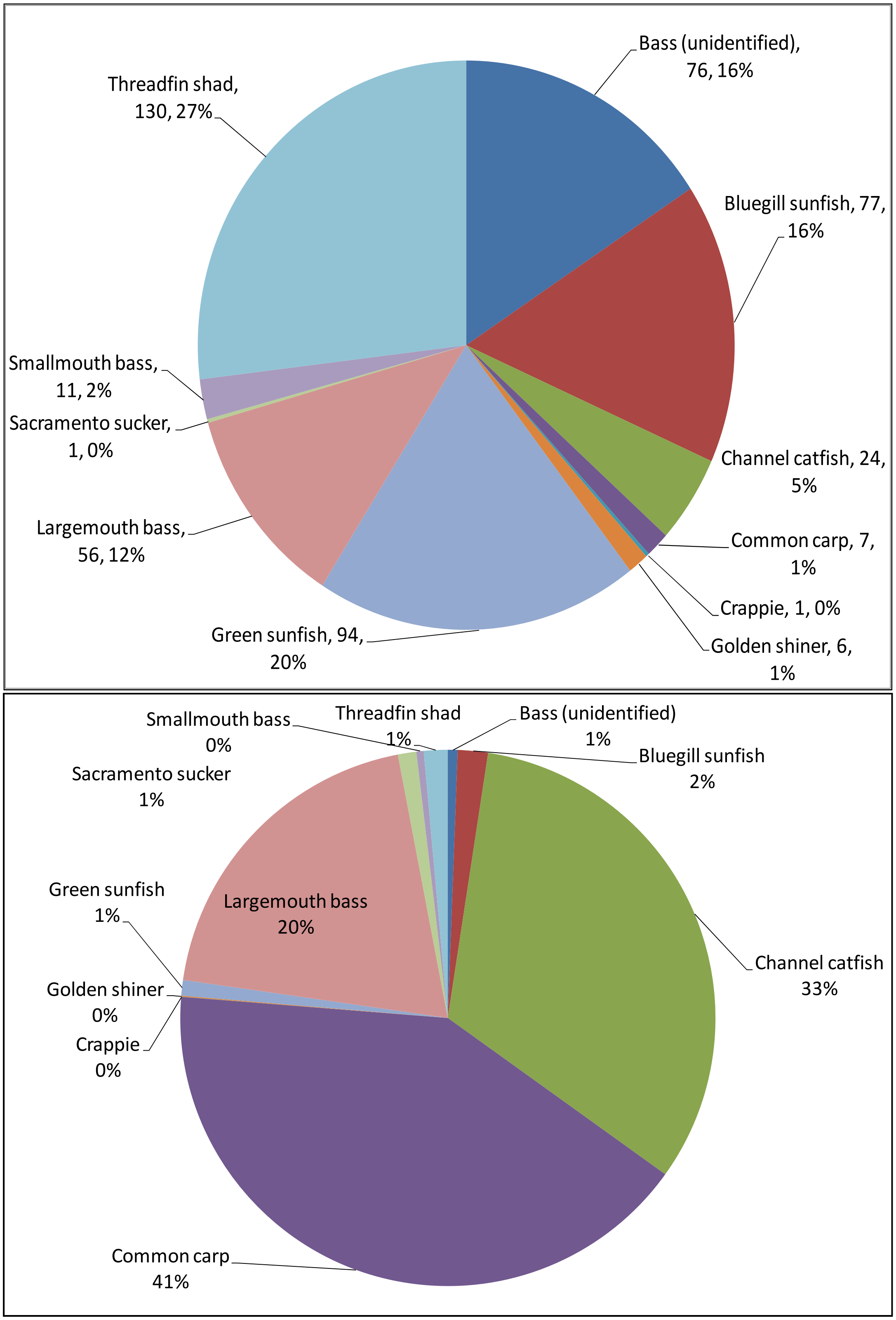


Figure 5.3-2. Relative numbers of fish (top) and percent measured biomass (bottom) by species from boat electrofishing activities during the Don Pedro Reservoir fish population survey conducted in October 2012.

Table 5.3-3. Summary of abundance, catch rate and size composition of fish species collected by boat electrofishing during the Don Pedro Reservoir fish population survey, October 2012.

Site	Species	Count	% Catch	Effort (sec)	Fish /h	Length (mm)			Weight (g)		
						Min	Max	Mean	Min	Max	Mean
1.1	Bass (unidentified)	1	5.0	342	4.0	66	66	66.0	3.3	3.3	3.3
	Channel catfish	3	15.0		12.0	505	540	523.3	1,420	2,000	1,715
	Common carp	1	5.0		4.0	650	650	650.0	2,000	2,000	2000.0
	Green sunfish	6	30.0		24.0	50	73	60.8	2.3	6.3	4.1
	Largemouth bass	8	40.0		32.0	45	325	261.3	1.1	559	293
	Sacramento sucker	1	5.0		4.0	453	453	453.0	589.0	589	589
1.2	Bass (unidentified)	2	20.0	311	6.0	52	85	68.5	1.5	6.1	3.8
	Bluegill sunfish	3	30.0		9.0	42	61	50.0	1.0	2.4	1.6
	Golden shiner	5	50.0		15.0	52	73	63.4	2.3	6.7	4.2
2	Bass (unidentified)	17	17.2	675	23.7	56	98	66.2	1.2	11.2	3.7
	Bluegill sunfish	46	46.5		64.2	37	130	82.1	1.2	60.0	14.8
	Channel catfish	2	2.0		2.8	90	575	332.5	7.2	2,000	1,004
	Common carp	1	1.0		1.4	538	538	538.0	2,000	2,000	2,000
	Crappie	1	1.0		1.4	57	57	57.0	2.2	2.2	2.2
	Largemouth bass	31	31.3		43.3	95	350	181.6	11.0	648.5	112
	Threadfin shad	1	1.0		1.4	70	70	70.0	3.4	3.4	3.4
3.1	Bluegill sunfish	1	5.9	576	2.0	82	82	82.0	8.6	8.6	8.6
	Channel catfish	2	11.8		4.0	117	155	136.0	16.5	33.8	25.2
	Golden shiner	1	5.9		2.0	61	61	61.0	3.6	3.6	3.6
	Green sunfish	7	41.2		14.0	47	75	61.4	2.5	6.8	4.1
	Largemouth bass	3	17.6		6.0	114	125	121.0	15.3	25.9	22.2
	Threadfin shad	3	17.6		6.0	70	110	84.0	1.5	14.6	6.6
3.2	Bass (unidentified)	1	11.1	645	2.0	55	55	55.0	1.5	1.5	1.5
	Bluegill sunfish	1	11.1		2.0	65	65	65.0	4.5	4.5	4.5
	Channel catfish	2	22.2		4.0	67	470	268.5	3.9	1,226	615
	Green sunfish	4	44.4		8.0	56	72	67.0	2.4	5.3	4.5
	Threadfin shad	1	11.1		2.0	75	75	75.0	5.1	5.1	5.1
3.3	Bass (unidentified)	1	5.0	509	3.0	82	82	82.0	6.1	6.1	6.1
	Bluegill sunfish	1	5.0		3.0	57	57	57.0	2.8	2.8	2.8
	Green sunfish	1	5.0		3.0	86	86	86.0	10.6	10.6	10.6
	Largemouth bass	2	10.0		6.0	155	265	210.0	43.4	267.0	155.2
	Threadfin shad	15	75.0		45.0	60	95	74.6	1.9	9.4	4.9
4.1	Bass (unidentified)	3	5.9	469	6.0	1	73	53.5	3.8	4.1	4.0
	Common carp	3	5.9		6.0	500	686	615.3	2,608	4,677	3808.3
	Largemouth bass	3	5.9		6.0	90	410	290.0	8.5	1,106	588.7
	Threadfin shad	42	82.4		84.0	59	101	73.0	1.0	13.0	5.0

Site	Species	Count	% Catch	Effort (sec)	Fish /h	Length (mm)			Weight (g)		
						Min	Max	Mean	Min	Max	Mean
4.2	Bass (unidentified)	14	28.6	556	28.0	60	81	71.6	2.0	6.1	4.0
	Channel catfish	5	10.2		10.0	75	566	182.8	4.9	454.6	97.4
	Green sunfish	3	6.1		6.0	54	78	63.7	1.6	8.0	4.4
	Smallmouth bass	4	8.2		8.0	61	75	68.3	2.4	4.8	3.8
	Threadfin shad	23	46.9		46.0	1	105	76.1	2.6	18.7	7.0
4.3	Bass (unidentified)	2	33.3	666	4.0	69	90	79.5	3.7	8.5	6.1
	Golden shiner	1	16.7		2.0	90	90	90.0	11.5	11.5	11.5
	Largemouth bass	2	33.3		4.0	128	465	296.5	28.0	1,724	875.9
	Smallmouth bass	1	16.7		2.0	81	81	81.0	6.2	6.2	6.2
5	Bass (unidentified)	8	21.6	1165	8.0	57	80	67.0	2.0	5.8	3.7
	Channel catfish	4	10.8		4.0	113	495	385.8	15.5	1,474	911.1
	Green sunfish	3	8.1		3.0	54	80	71.3	2.8	8.3	6.4
	Smallmouth bass	1	2.7		1.0	60	60	60.0	2.6	2.6	2.6
	Threadfin shad	21	56.8		21.0	60	105	76.6	2.5	16.0	6.0
6.1	Bass (unidentified)	3	10.3	846	7.2	60	85	71.3	3.0	7.5	4.7
	Green sunfish	22	75.9		52.8	53	84	66.6	2.3	9.6	4.6
	Largemouth bass	2	6.9		4.8	172	175	173.5	46.5	67.8	57.2
	Smallmouth bass	2	6.9		4.8	54	64	59.0	2.1	3.2	2.7
6.2	Bass (unidentified)	10	19.2	888	12.0	60	77	69.2	2.6	5.6	3.9
	Bluegill sunfish	20	38.5		24.0	65	108	82.0	4.6	19.2	9.5
	Channel catfish	1	1.9		1.2	173	173	173.0	15.2	15.2	15.2
	Common carp	2	3.8		2.4	565	575	570.0	3,147	3,289 8	3217.7
	Golden shiner	1	1.9		1.2	84	84	84.0	8.3	8.3	8.3
	Green sunfish	13	25.0		15.6	56	98	77.1	1.1	15.5	7.6
	Largemouth bass	2	3.8		2.4	155	245	200.0	42.4	213.5	128.0
	Threadfin shad	3	5.8		3.6	67	73	70.0	3.1	4.5	3.9
7.1	Bass (unidentified)	5	35.7	443	10.0	60	95	74.4	2.5	9.8	5.1
	Channel catfish	1	7.1		2.0	60	60	60.0	3.3	3.3	3.3
	Green sunfish	8	57.1		16.0	56	87	67.5	2.8	10.3	5.0
7.2	Bass (unidentified)	7	16.7	775	8.4	60	90	71.9	2.7	8.9	4.5
	Bluegill sunfish	3	7.1		3.6	47	63	55.0	1.6	12.0	5.4
	Channel catfish	1	2.4		1.2	87	87	87.0	7.1	7.1	7.1
	Golden shiner	1	2.4		1.2	65	65	65.0	4.2	4.2	4.2
	Green sunfish	20	47.6		24.0	32	102	63.9	0.5	19.0	5.1
	Largemouth bass	1	2.4		1.2	183	183	183.0	81.5	81.5	81.5
	Smallmouth bass	1	2.4		1.2	150	150	150.0	-	-	-
	Threadfin shad	9	21.4		10.8	60	111	83.2	2.1	16.8	7.5

Site	Species	Count	% Catch	Effort (sec)	Fish /h	Length (mm)			Weight (g)		
						Min	Max	Mean	Min	Max	Mean
8	Bass (unidentified)	1	4.2	632	2.0	73	73	73.0	4.7	4.7	4.7
	Bluegill sunfish	2	8.3		4.0	81	138	109.5	8.8	47.7	28.3
	Channel catfish	3	12.5		6.0	480	495	486.7	1,304	1,644	1,531
	Golden shiner	1	4.2		2.0	53	53	53.0	2.6	2.6	2.6
	Green sunfish	3	12.5		6.0	57	83	73.0	3.2	9.2	6.8
	Largemouth bass	1	4.2		2.0	188	188	188.0	86.9	86.9	86.9
	Smallmouth bass	2	8.3		4.0	135	226	180.5	30.0	154.0	92.0
	Threadfin shad	11	45.8		22.0	60	105	80.6	2.2	14.1	7.3

Table 5.3-4. Total catch of fish by species and site for boat electrofishing at Don Pedro Reservoir, 2012.

Species	Site															
	1.1	1.2	2	3.1	3.2	3.3	4.1	4.2	4.3	5	6.1	6.2	7.1	7.2	8	Total
Bass (unidentified)	1	2	17	0	1	1	4	14	2	8	3	10	5	7	1	76
Bluegill sunfish	0	3	46	1	1	1	0	0	0	0	0	20	0	3	2	77
Channel catfish	3	0	2	2	2	0	0	5	0	4	0	1	1	1	3	24
Common carp	1	0	1	0	0	0	3	0	0	0	0	2	0	0	0	7
Crappie	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Golden shiner	0	5	0	1	0	0	0	0	1	0	0	1	0	1	1	10
Green sunfish	6	0	0	7	4	1	0	3	0	3	22	13	8	20	3	90
Largemouth bass	8	0	32	3	0	2	3	0	2	0	2	2	0	1	1	56
Smallmouth bass	0	0	0	0	0	0	0	4	1	1	2	0	0	1	2	11
Sacramento sucker	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Threadfin shad	0	0	1	3	1	15	42	24	0	21	0	3	0	9	11	130
Total	**20**	**10**	**100**	**17**	**9**	**20**	**52**	**50**	**6**	**37**	**29**	**52**	**14**	**43**	**24**	**483**

5.4 Bass Nesting Evaluation

The potential effect of Project operations on black bass is associated with the operations effect on reservoir water surface elevations during spawning and early juvenile rearing (March—June). As discussed above, decreased water surface elevations during the nesting season can expose nests and decrease egg survival and bass recruitment. CDFG (Lee 1999) identifies acceptable levels of egg survival in terms of rate and extent of reservoir elevation reduction criteria during this period (see Section 4.3). Application of CDFG's criteria to water surface elevation fluctuations observed during the nesting period over a 27-year period showed that conditions in Don Pedro Reservoir met or exceeded targeted nest survival targets over 95 percent of the time for all three black bass species that occur in the reservoir.

5.4.1 Bass Nesting Habitat Use and Availability

5.4.1.1 Bass Nest Survey

Bass nesting surveys identified 14 bass nests (see Attachment A). Nest depths ranged from 2.2 ft deep to 8.0 ft deep (mean depth – 5.1 ft; Table 5.4-1). Nest sizes ranged from 0.6 ft diameter to 6.5 ft diameter (mean diameter = 3.0 ft; Table 5.4-1). Most nests were close to cover and within 30 ft of shore.

Table 5.4-1. Summary of bass nest survey conducted during the Don Pedro Reservoir fish population survey, May 9-11, 2012.

Site ID	Date	Depth (ft)	Diameter (ft)	Dist to shore (ft)	Dist to cover (ft)	Cover type
HV11	5/11/2012	8	1.0	33	0	Boulder3
HV13	5/9/2012	5.3	4.0	20	3	Boulder
HV13	5/9/2012	7.5	3.5	16	7	Rooted Vegetation
HV13	5/9/2012	6.6	4.0	20	7	Boulder
HV18	5/9/2012	5.3	3.5	26	7	Rooted Vegetation
LV10	5/11/2012	6	0.6	33		None
LV14	5/11/2012	4	1.0	13	0	Rooted Vegetation
LV14	5/11/2012	3.5	1.0	13	0	Rooted Vegetation
LV20	5/9/2012	4.8	3.5	26	16	Rooted Vegetation
LV20	5/9/2012	6.7	4.0	56	33	Rooted Vegetation
LV7	5/9/2012	4.3	3.0	20	1	Rooted Vegetation
LV9	5/11/2012	2.2	2.0	23	1	Rooted Vegetation
MLV1	5/9/2012	4.0	6.5	16	16	Boulder
MLV16	5/9/2012	4.2	4.0	66	3	Boulder
Mean		5.17	3.0	27	7	
Minimum		2.2	0.6	16	0	
Maximum		8	6.5	66	33	

5.4.1.2 Bass Nesting Habitat Assessment

The bass nesting habitat assessment was conducted concurrently with the bass nest survey described above. Survey sites identified by the model were intended to represent areas of habitat that were about 330 ft long and extending from the shore to a depth of 6.5 ft. Measurements of slope and depth within the areas were made to assess habitat conditions as well as to provide for comparison with the modeled conditions. The sites were selected based on their relative suitability predicted for the reservoir pool elevation at the time of the survey.

Results of the habitat assessment revealed that depths measured in the field were within a range of values that were expected given the bathymetry identified by the GIS model.

Conditions describing bass nesting suitability, primarily areas of suitable depth, can be estimated for varying reservoir pool elevations using the GIS model to allow comparison of relative amounts of bass nesting habitat availability.

The elevation at the time of the survey (801 ft) was three ft higher than the elevation used to predict habitat suitability and identify representative survey sites (798 ft). As a result, measurements made to characterize the survey sites were made for an area that was different from that considered in the model. The measurements were made perpendicular from shore and extended to a predetermined depth (6.5 ft), and as such were relatively tied to the survey point.

In order to evaluate bass nesting suitability model, the results of the bass nesting surveys were plotted on a map. For example, in Figure 5.4-1, the red and yellow dots are the bounding limits along the shoreline where transects took place for a given site. The black line represents the shoreline as calculated from the bathymetry model for the time the survey was conducted (elevation 801 Feet NAVD88). The survey methods called for the surveyors to measure depth and distance from shore along transects perpendicular to the shoreline out to a depth of 6.5 ft. The orange line represents the 6.5 ft depth as derived from the bathymetry model. The blue area a representation of the area that encompasses the surveyed transects. The black square represents the random sample location where the suitability had been modeled. The green shading shows the combined depth and slope suitability with darker green areas representing higher suitability.

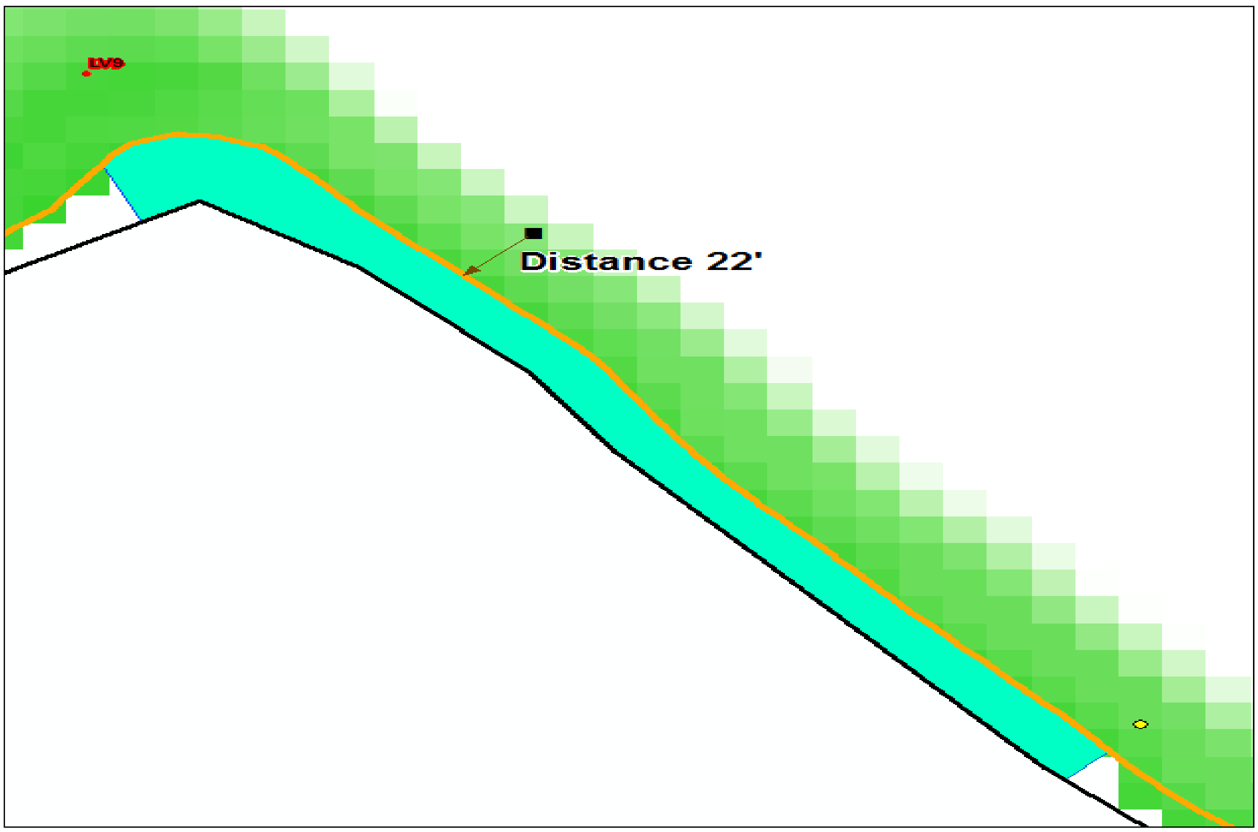


Figure 5.4-1. Example of bass nest suitability survey site including evaluation parameters, as discussed in the preceding paragraphs.

The survey results were compared with the modeled conditions, including relative location of survey to site identified by the model and variation in predicted versus measured slope of the survey area. These results are provided in Attachment B and include the distance from the point that was to have been surveyed and the actual area surveyed and the average percent slope [3] of each survey area based on the bathymetry model and the slope measured along the survey transect at each site.

[3] Percent slope is how many vertical feet there are for every 100 horizontal feet. 100% slope is a slope of 1:1 or 45°.

A comparison of slope within the survey area as calculated by the bathymetry model and the slope as determined in the field is displayed in Figure 5.4-2. The slopes calculated within GIS and in the field appear to correlate quite well and exhibit an expected range of variability.

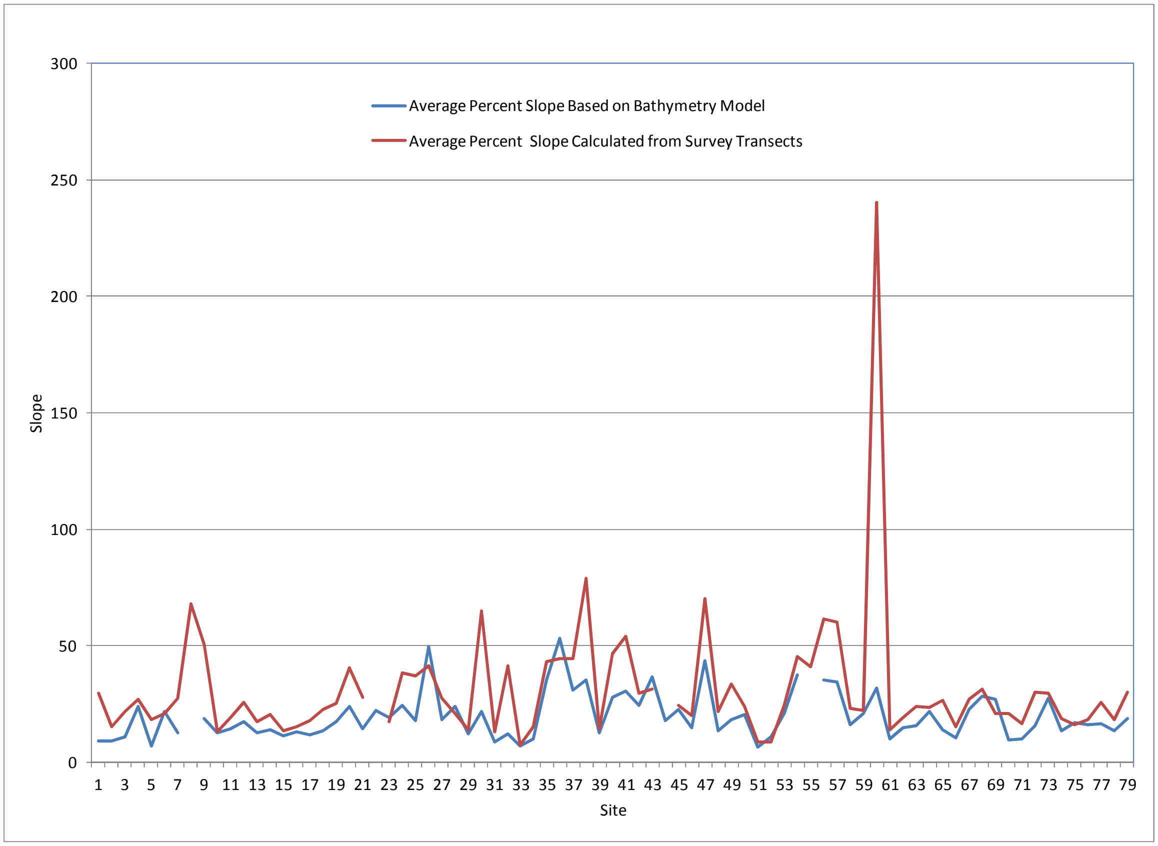


Figure 5.4-2. Summary of difference in slope measured versus slope predicted by the bathymetry model for bass nesting survey sites evaluated during the Don Pedro Reservoir fish population survey, 2012.

5.4.2 Bass Nest Survival Evaluation

The bass nest survival evaluation showed that reservoir elevation changes occurring during the past 27 years maintained bass nest survival at or above that identified by CDFG (Lee 1999). The frequency that monthly reservoir elevations decreased during March through June by comparing first-of-the-month and end-of-the-month water surface elevations 1984-2010 are summarized in Table 5.4-2). These results show that for the months extending from March through June, water surface elevation reductions occurred 33.3 percent of the time in March, 44.4 percent in April, 22.2 percent in May, and 33.3 percent in June (Table 5.4-2).

Table 5.4-2. Don Pedro Reservoir water surface elevation monthly reduction from 1984-2010.

Month	Number of Months Evaluated	Frequency of Monthly Elevation Reduction	Percent of Months with elevation reduction
March	27	9	33.3
April	27	12	44.4

Month	Number of Months Evaluated	Frequency of Monthly Elevation Reduction	Percent of Months with elevation reduction
May	27	6	22.2
June	27	4	33.3

Table 5.4-3. Number of months that largemouth bass nest survival equaled or exceeded 20 percent based on water surface elevation reductions in Don Pedro Reservoir, (1984-2010).

Month	Number of Months Analyzed	No. Months ≥20% Survival	% Total Months
March	27	27	100
April	27	26	96.2
May	27	27	100
June	27	26	96.2

Table 5.4-4. Number of months that smallmouth bass nest survival equaled or exceeded 20 percent based on water surface elevation reductions in Don Pedro Reservoir, (1984-2010).

Month	Number of Months Analyzed	No. Months ≥20% Survival	% Total Months
March	27	27	100
April	27	26	96.2
May	27	27	100
June	27	26	96.2

Table 5.4-5. Number of months that spotted bass nest survival equaled or exceeded 20 percent based on water surface elevation reductions in Don Pedro Reservoir, (1984-2010).

Month	Number of Months Analyzed	No. Months ≥20% Survival	% Total Months
March	27	27	100%
April	27	27	100%
May	27	27	100%
June	27	27	100%

Table 5.4-6. Black bass estimated spawning nest survival (percent) in Don Pedro Reservoir for March through June, over the 1984-2010 period of record.

Month	Largemouth	Smallmouth	Spotted
March	100%	100%	100%
April	96.2%	96.2%	100%
May	100%	100%	100%
June	96.2%	96.2%	100%
March-June Average	98.1%	98.1%	100%
March-May Average	98.7%	98.7%	100%

5.5 Angler Survey

Surveyors interviewed 448 angler parties during the 2012 Don Pedro Reservoir fish population survey (Table 5.5-1). An angler party averaged three individuals, but ranged from one to 27 anglers. Out of 196 parties that identified their fishing location, 109 angler parties preferred fishing from boats, with 69 parties fishing from shore and 18 parties utilizing both. Results from angler interviews found that angling by boat was more common than fishing from shore.

On average, anglers spent 6.7 hours fishing per trip. Casting was the most popular fishing method, followed by trolling. Still fishing was the least popular method. Numerous anglers reported using a combination of the different methods throughout the day. The majority of anglers reported using artificial lures with bait being used less often.

Creel surveys were conducted for a total of nine months. The completed creel surveys resulted in interviewing 448 angler parties, representing 840 anglers, fishing for 3,009 angler hours. Table 5.5-1 provides the number of anglers interviewed, angler effort, and numbers of fish caught during creel surveys at Don Pedro Reservoir. The greatest number of angler parties interviewed and subsequently the highest number of fish reported caught was during May. In contrast, the fewest angler parties and lowest number of fish reported caught was during September. The highest rates of catch (0.52 fish/hr) occurred during June. The mean rate of catch over all months was 0.22 fish/hr. February had the lowest rates (0.12 fish/hr). During all months, except February and March, anglers released the majority of their catch.

Table 5.5-1. Number of anglers interviewed, angler effort, and numbers of fish caught during each of the eight live creel survey events conducted on Don Pedro Reservoir between January and September 2012.

Month	Number of parties	Number of anglers	Total angler hours	Total fish caught	Number fish released	Fish/hr	Fish released (%)
January	27	49	173	62	36	0.36	58.1
February	41	111	626	74	36	0.12	48.6
March	18	39	192	42	13	0.22	31.0
April	59	128	694	123	71	0.18	57.7
May	83	179	637	134	86	0.21	64.2
June	67	102	247	128	84	0.52	65.6
July	73	136	329	86	50	0.26	58.1
August	53	67	100	23	14	0.23	60.9
September	27	29	11	2	1	0.18	50.0
Total	**448**	**840**	**3,009**	**674**	**391**	**0.22**	**58.0**

Anglers reported catching a total of 672 fish, representing eight species (Table 5.5-2). Black bass were the most common fishes (n=338, 50.1 percent) reported caught, of which 78.4 percent were released. Kept black bass size averaged 364 mm (range: 178 to 559 mm) and weighed an average of 789.8 g (range: 385.6 to 3,692.2 g). Rainbow trout (n=177, 26.3 percent) was the second most abundant species. Under half (38.9 percent) of the rainbow trout collected were released. Kept rainbow trout average FL was 396 mm (range: 356 to 483 mm) and the average weight was 550.1 g (range: 340.2 to 907.2 g). Chinook salmon (n=117, 17.4 percent) was the third most abundant species. Under half (29.7 percent) of the Chinook salmon collected were released. Kept Chinook salmon average FL was 398 mm (range: 324 to 559 mm) and the average weight was 622.9 g (range: 326.6 to 1,360.8 g). Catch of bluegill sunfish, catfish, crappie, kokanee salmon, and Sacramento sucker was relatively low.

Table 5.5-2. Species composition and size statistics of fish caught by anglers interviewed during creel surveys conducted on Don Pedro between January and September 2012.

Species	Catch (released)	Catch Composition	Length[1] (cm)			Weight[1] (g)		
			Min	Max	Mean	Min	Max	Mean
Black bass	338 (265)	50.1%	178	559	364	385.6	3692.2	789.8
Bluegill	3 (3)	0.4%	203	203	203	158.8	158.8	158.8
Catfish spp.	20 (15)	3.0%	305	559	440	190.5	2449.4	880.0
Chinook salmon	117 (38)	17.4%	324	559	398	326.6	1360.8	622.9
Kokanee	11(0)	1.6%	274	373	313	226.8	567.0	381.8
Rainbow trout	177 (69)	26.3%	305	559	396	340.2	907.2	550.1
Sucker spp.	6 (4)	0.9%	356	483	415	331.1	1691.9	901.1
Total	672 (394)							

[1] Length and weight measurements were collected opportunistically and do not represent the total number of fish caught.

The highest number of rainbow trout reported was during January (Table 5.5-3). Rainbow trout were caught in eight of nine months, not being represented in September. Chinook salmon were caught in every surveyed month but January and September. Black bass were caught during all events except September. Black bass and rainbow trout were the highest reported species caught during all events, except September where only catfish were recorded. Crappie was only present in January and bluegill only in July.

Table 5.5-3. Number of fish species captured and released during each of the nine month creel survey events conducted on Don Pedro Reservoir between January and September 2012[1].

Month	Black bass	Bluegill	Catfish spp.	Crappie	Rainbow Trout	Chinook Salmon and kokanee[2]
January	13 (1)	0 (0)	0 (0)	2 (2)	47 (34)	0
February	38 (24)	0 (0)	0 (0)	0 (0)	26 (9)	7 (3)
March	11 (3)	0 (0)	0 (0)	0 (0)	22 (6)	7 (4)
April	69 (57)	0 (0)	0 (0)	0 (0)	28 (3)	26 (10)
May	67 (67)	0 (0)	2 (2)	0 (0)	28 (9)	37 (8)
June	79 (70)	0 (0)	4 (0)	0 (0)	12 (8)	33 (6)
July	47 (35)	3 (3)	8 (8)	0 (0)	13 (0)	14 (4)
August	14 (8)	0 (0)	4 (4)	0 (0)	1 (0)	4 (3)
September	0 (0)	0 (0)	2 (1)	0 (0)	0 (0)	0 (0)
Total	338 (265)	3 (3)	20 (15)	2 (2)	177 (69)	128 (38)

[1] Total number caught (total number released). Sucker spp. n=6, with 4 being released is not documented in this table.
[2] Chinook and kokanee salmon were combined as 'Salmon' in the survey questionnaire. Weights and lengths were differentiated by species.

5.6 Age-Scale Analysis

Field crews targeted collection of black bass and salmonids for age analysis. They collected and analyzed scales from 102 black bass collected during the electrofishing survey (Table 5.6-1). Insufficient numbers of rainbow trout and kokanee were collected for meaningful scale aging, so only black bass scales were read. Four age groups were identified for all three species of black bass. Sufficient numbers of scales were collected to identify minimum and maximum sizes for eight of the 15 species-age groups encountered in the survey (Table 5.6-1)

Table 5.6-1. Black bass scale samples collected for age-scale analysis.

Species	Age	Count	Length (mm)		
			Mean	Minimum	Maximum
Largemouth Bass (n=19)	0	19	121	105	168
Largemouth Bass (n=26)	1	26	203	155	250
Largemouth Bass (n=19)	2	19	280	243	320
Largemouth Bass (n=22)	3	22	350	315	390
Largemouth Bass (n=10)	4	10	407	375	465
Smallmouth Bass (n=2)	0[1]	2	143	135	150
Smallmouth Bass (n=2)	1[1]	2	220	220	220
Smallmouth Bass (n=2)	2[1]	2	303	300	305
Smallmouth Bass (n=3)	3[1]	3	348	325	370
Smallmouth Bass (n=3)	4[1]	3	398	385	410
Spotted Bass (n=4)	0[1]	4	103	100	108
Spotted Bass (n=20)	1	20	217	170	242
Spotted Bass (n=16)	2	16	317	280	329
Spotted Bass (n=12)	3	12	350	335	388
Spotted Bass (n=4)	4[1]	4	396	385	402

[1] sample size was too small to define a range of fish sizes for this age group.

Length-frequency distributions prepared for game fish where the number collected was greater than 15 fish included largemouth, smallmouth, and spotted bass, green sunfish, bluegill and kokanee. Age-classes were determined by identifying the minimum and maximum fork lengths in a given age-class for each species as defined by scale analysis where at least 15 fish were identified in an age class (Figures 5.6-1 - 5.6-6). Even though the field team was able to collect some age zero to age four black bass, the number of fish in several age groups was insufficient to provide meaningful detail about the range of fish sizes per age group (Table 5.6-1).

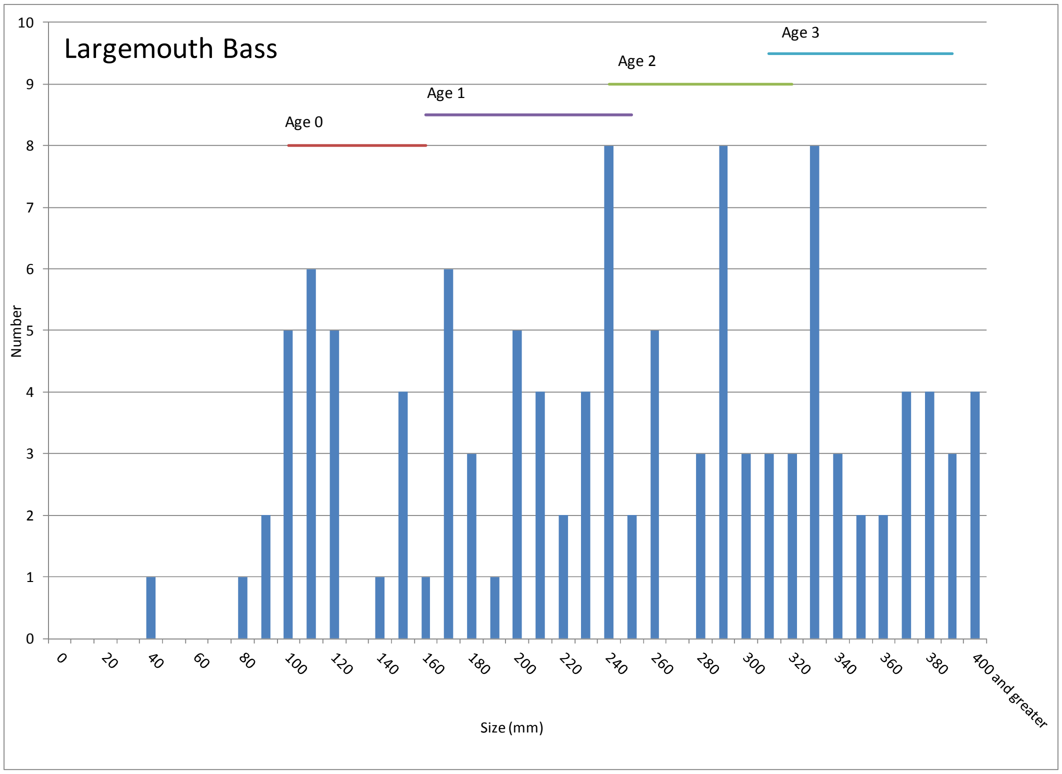


Figure 5.6-1. Length frequency distribution of largemouth bass sampled during the Don Pedro Reservoir fish population survey, October 2012.

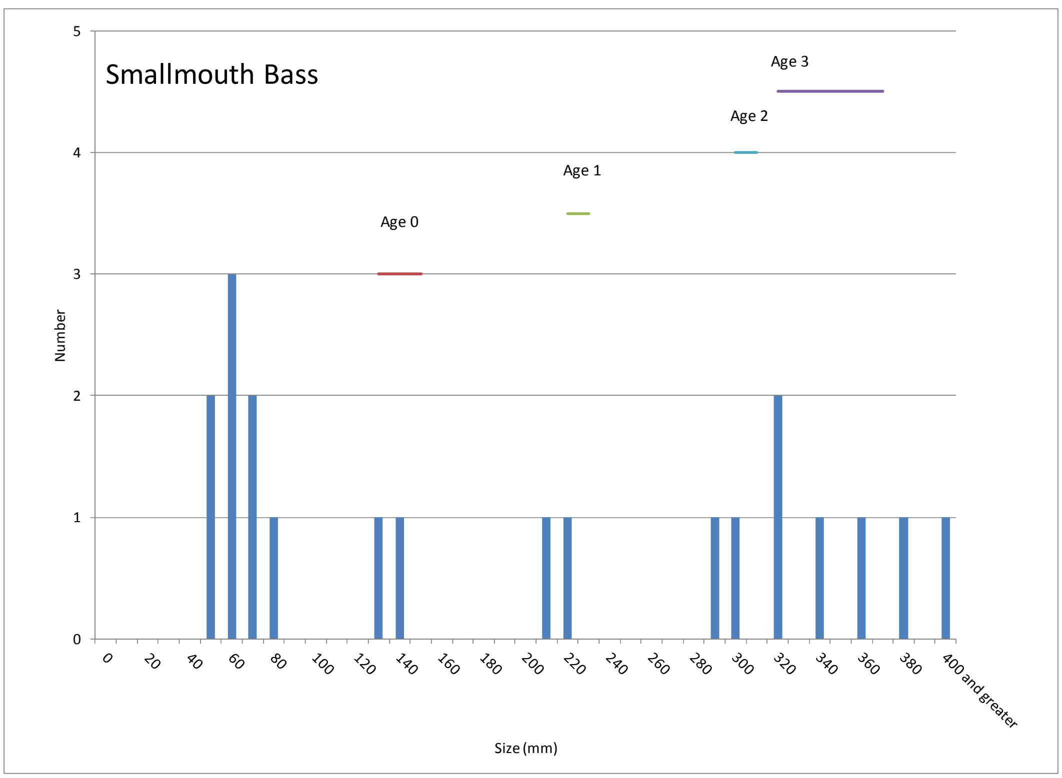


Figure 5.6-2. Length frequency distribution of smallmouth bass sampled during the Don Pedro Reservoir fish population survey, October 2012.

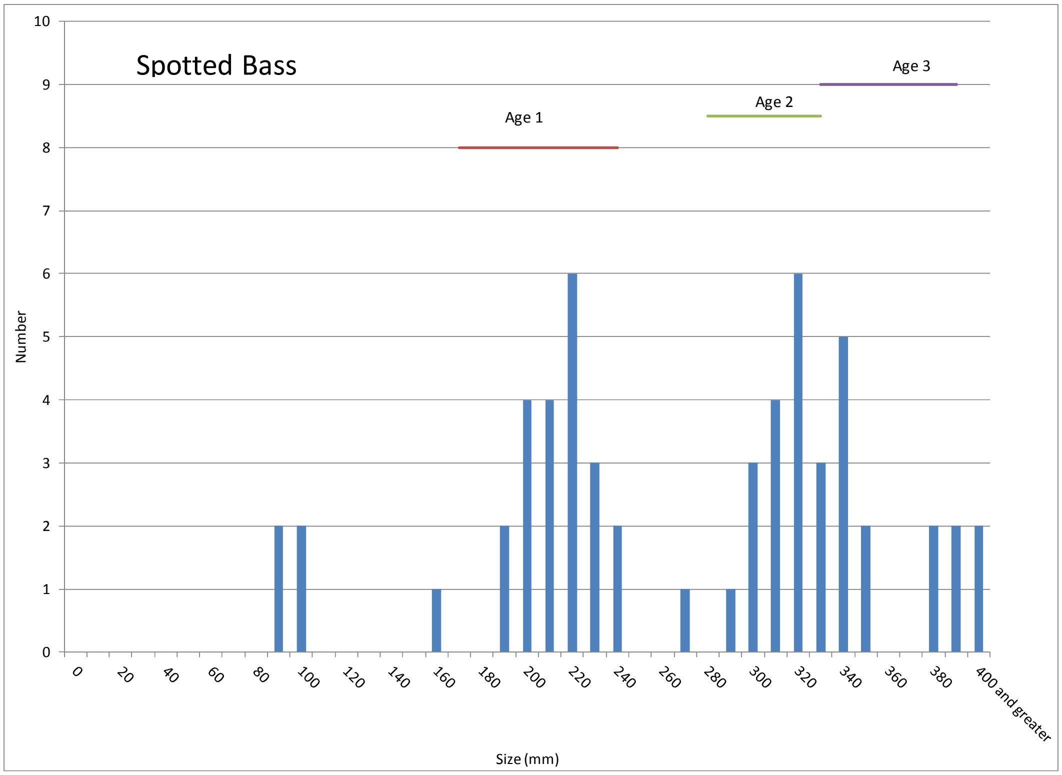


Figure 5.6-3. Length frequency distribution of spotted bass sampled during the Don Pedro Reservoir fish population survey, October 2012.

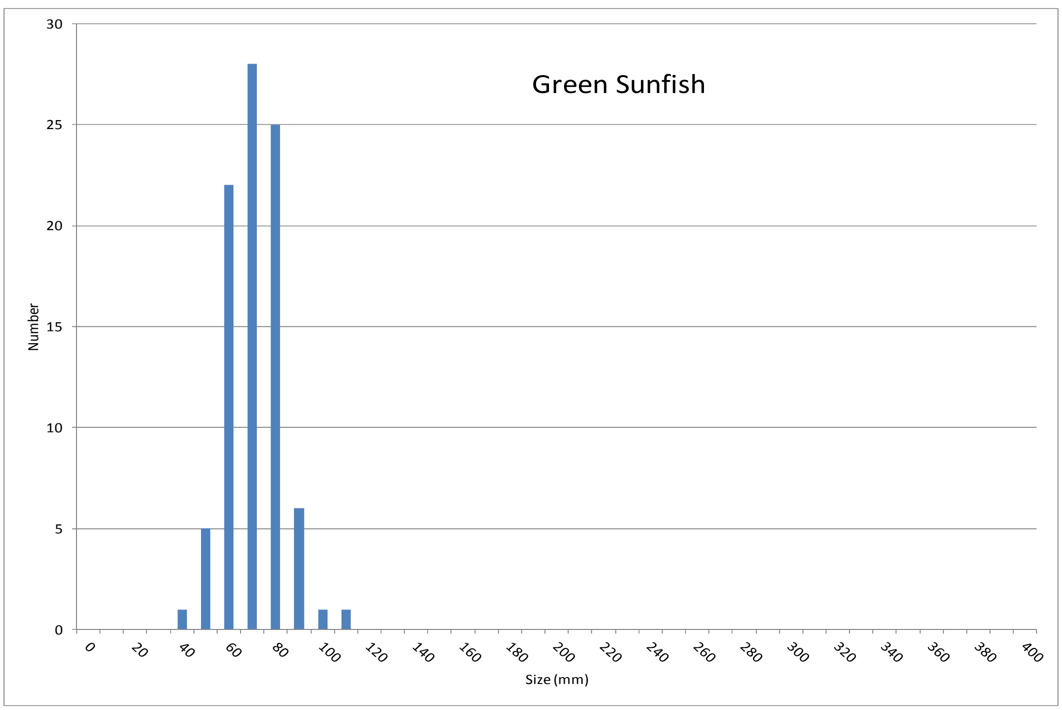


Figure 5.6-4. Length frequency distribution of green sunfish sampled during the Don Pedro Reservoir fish population survey, October 2012.

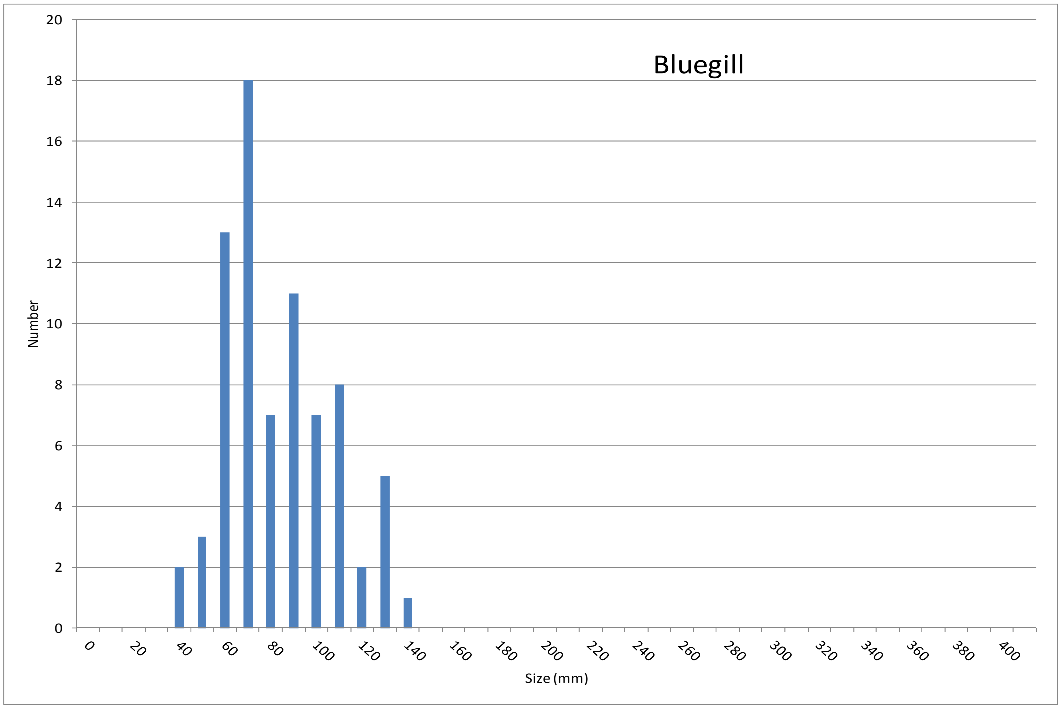


Figure 5.6-5. Length frequency distribution of bluegill sampled during the Don Pedro Reservoir fish population survey, October 2012.

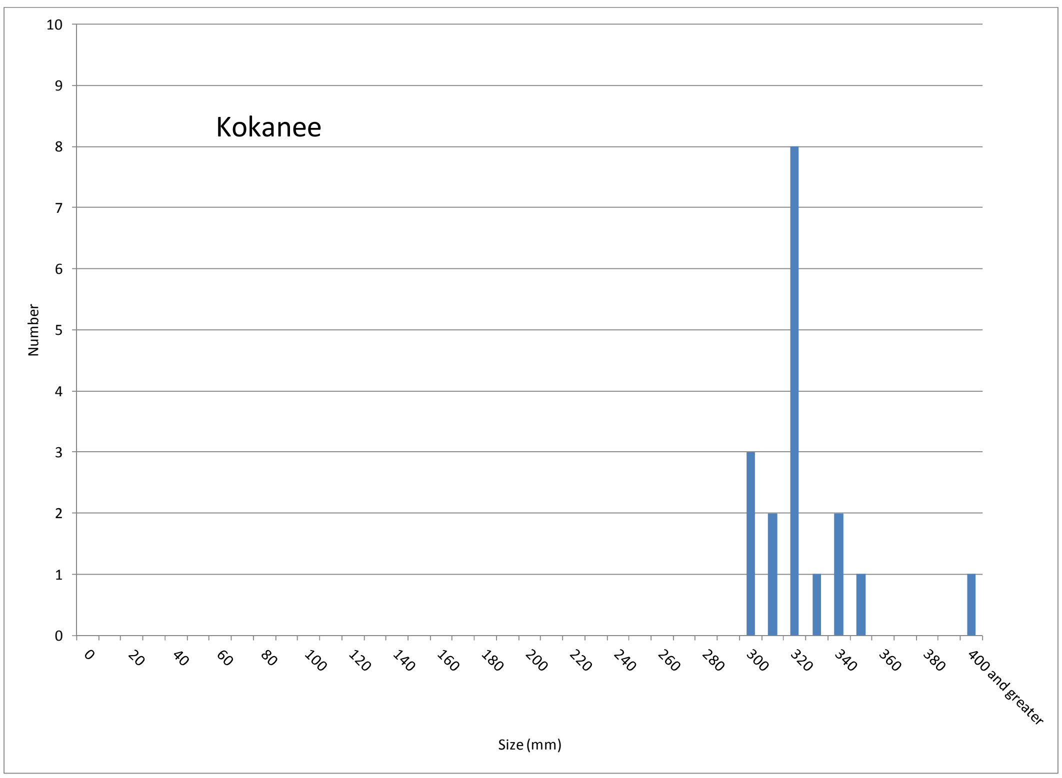


Figure 5.6-6. Length frequency distribution of kokanee sampled during the Don Pedro Reservoir fish population survey, October 2012.

5.7 Tributary Spawning Access Assessment

Stream gradient was determined in 20 tributary stream reaches that occur within the inundation zone defined by the 10 and 90 percent spring and fall exceedance reservoir pool elevations in Don Pedro Reservoir (Figures 5.7-1 and 5.7-2; Table 5.7-1). Reservoir pool elevations bracketing the spring spawning access evaluation ranged from 745 ft to 825 ft (Figure 5.7-1). Fall spawning access was evaluated in five streams (Table 5.7-1). Reservoir pool elevations bracketing the fall spawning access evaluation ranged from 720 to 799 ft (Figure 5.7-2). The slopes were determined based on the contours identified in the bathymetry survey presented as an attachment to W&AR-03 – Reservoir Temperature Model Report. Overall, slopes were well below the 10 percent criteria defining fish impediment in this evaluation (Table 5.7-1).

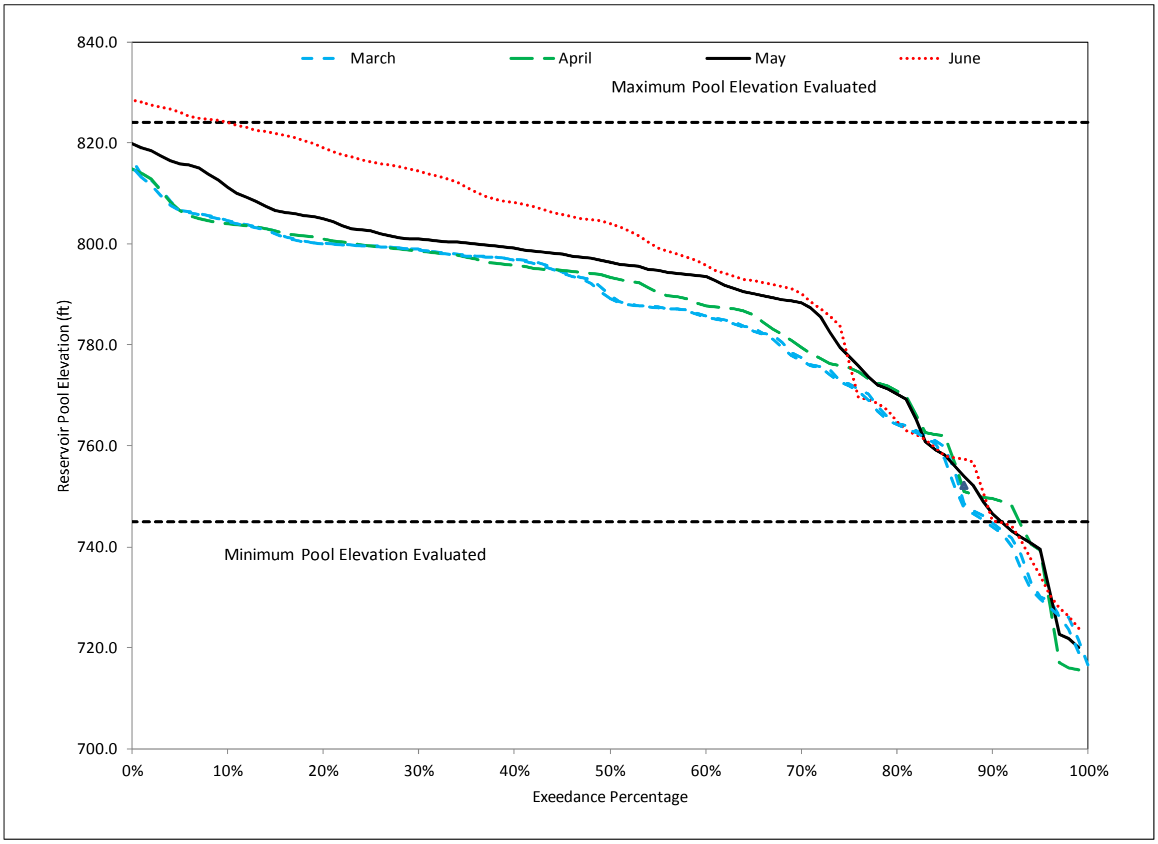


Figure 5.7-1. Probability of exceedance for pool reservoir elevation during the spring spawning period, March—June in tributaries evaluated during the Don Pedro Reservoir fish population study, 2012.

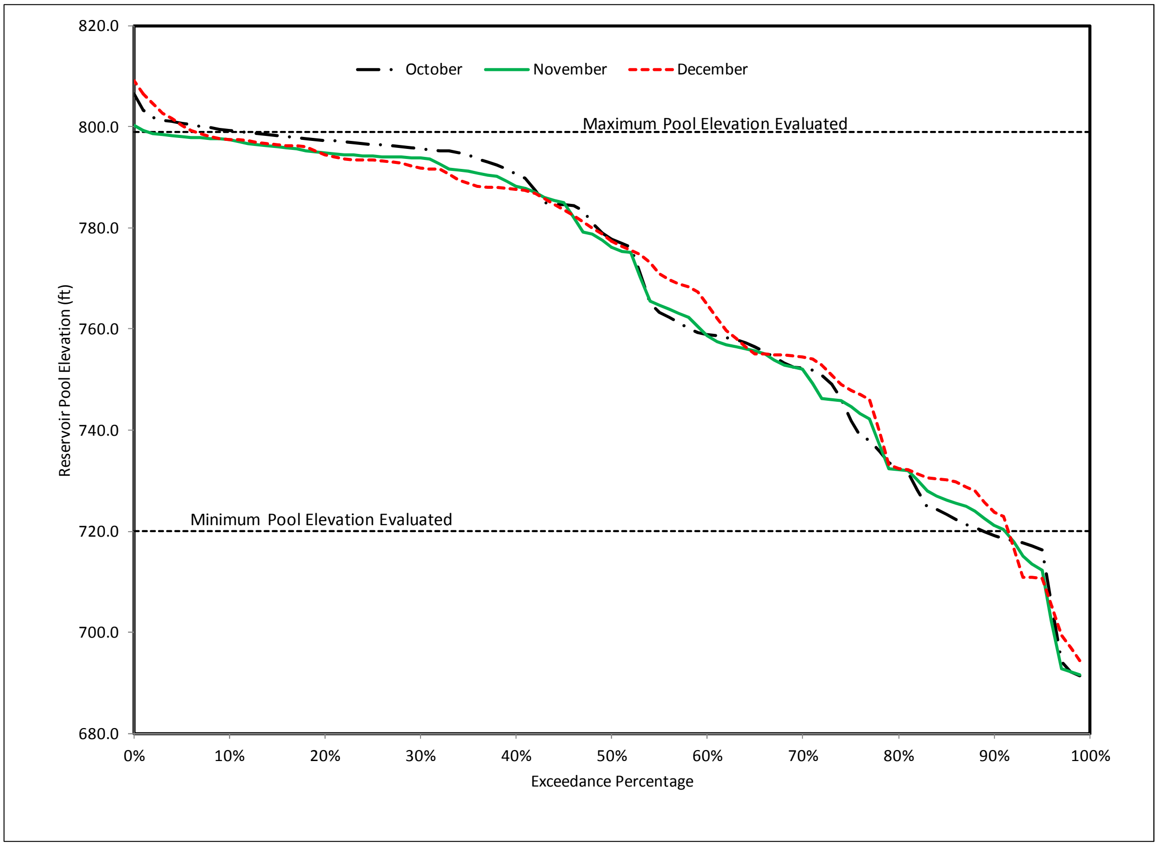


Figure 5.7-2. Probability of exceedance for pool reservoir elevation during the fall spawning period, October—December in tributaries evaluated during the Don Pedro Reservoir fish population study, 2012.

Table 5.7-1. Slope of named[1] tributaries to Don Pedro Reservoir within the reach inundated between the 750 ft and 800 ft water surface elevations.

Stream	Mouth at 800 ft elevation	Spring Slope (~ % between listed reservoir water surface elevations)		
		Spring		Fall
		745 to 825 ft	745 to 1,000 ft[2]	720 to 799 ft
Tuolumne River[3]	N 37.88122 W 120.29047	0.1	--	0.1
Deer Creek	N 37.87350 W 120.29566	14.4[4]	20.8[4]	--
Moccasin Creek[3]	N 37.82046 W 120.31789	1.4	--	1.4
Hatch and First Creek	N 37.74842 W 120.33304	1.4	--	--
Willow Creek	N 37.74011 W 120.35072	2.5	--	--
Fleming Creek	N 37.70701 W 120.35364	2.5	--	--
Rogers Creek	N 37.67530 W 120.34196	1.2	--	1.2
Lucas Gulch	N 37.69343 W 120.37960	4.6	--	--
Ranchero Creek	N 37.75026 W 120.42423	4.6	--	--
West Fork Creek	N 37.76607 W 120.42209	1.9	--	--
Big Creek	N 37.76878 W 120.41548	1.4	--	1.5
Fortynine Creek	N 37.75606 W 120.40277	2.8	--	--
Sixbit Gulch	N 37.82450 W 120.41483	2.5	--	--
Poormans Gulch	N 37.81758 W 120.40938	4.9	--	--
Woods Creek[3]	N 37.89460 W 120.42887	0.1	--	0.1

Stream	Mouth at 800 ft elevation	Spring Slope (~ % between listed reservoir water surface elevations)		
		Spring		Fall
		745 to 825 ft	745 to 1,000 ft[2]	720 to 799 ft
Sullivan Creek[3]	N 37.89430 W 120.41728	0.1	--	--
Blue Gulch[3]	N 37.86306 W 120.39466	--	--	--
Smarts Gulch[3]	N 37.86340 W 120.39389	--	--	--
Kanaka Creek[3]	N 37.84717 W 120.36080	5.5	--	5.4
Rough and Ready Creek[3]	N 37.87993 W 120.33514	4.2	--	4.1

1 Tributaries that are named on USGS topographic maps.
2 Calculated if slope between 750 and 800 ft elevations was greater than 10 percent.
3 Streams closed to fishing during spring and fall spawning period managed by CDFG for coldwater fish spawning.
4 Bold indicates fish passage impediment indicated by high gradient reach within the potential inundated portion of this stream

Fish passage impediments were only identified in Deer Creek. Based on gradient assessment made between 750 and, 1,000 ft, Deer Creek is steep beyond the reservoir pool elevation potentially occurring throughout spring spawning season and is not considered a salmonid spawning stream. All other streams that the Districts evaluated slope within the tributary reaches that could be exposed during spring or fall spawning periods were determined to be accessible between the potential pool elevation and the reach beyond the maximum pool elevation. Operations accommodate access to possible coldwater spawning tributaries during the spring and fall migration periods.

6.0 DISCUSSION AND FINDINGS

6.1 Don Pedro Reservoir Fish Habitat

The results of the 2012 Don Pedro Reservoir fish population survey substantiate existing information that current operations and resultant habitat conditions along with ongoing fishery management programs support quality warmwater and coldwater fisheries. The study results are consistent with the reported high quality warmwater fisheries, indicated by three species of black bass. All three black bass species were prominent in the gill net and electrofishing surveys and in the angler surveys. Bass nesting habitat conditions were found to be of suitable quality and abundance to support population recruitment that along with the current bass stocking program has provided a popular, quality bass fishery. The surveys also confirmed the presence of quality salmon and trout fisheries. Reservoir conditions in spring and fall are sufficient to provide potential spawning trout and salmon access to tributary streams; the coldwater fisheries appear dependent upon stocked hatchery fish.

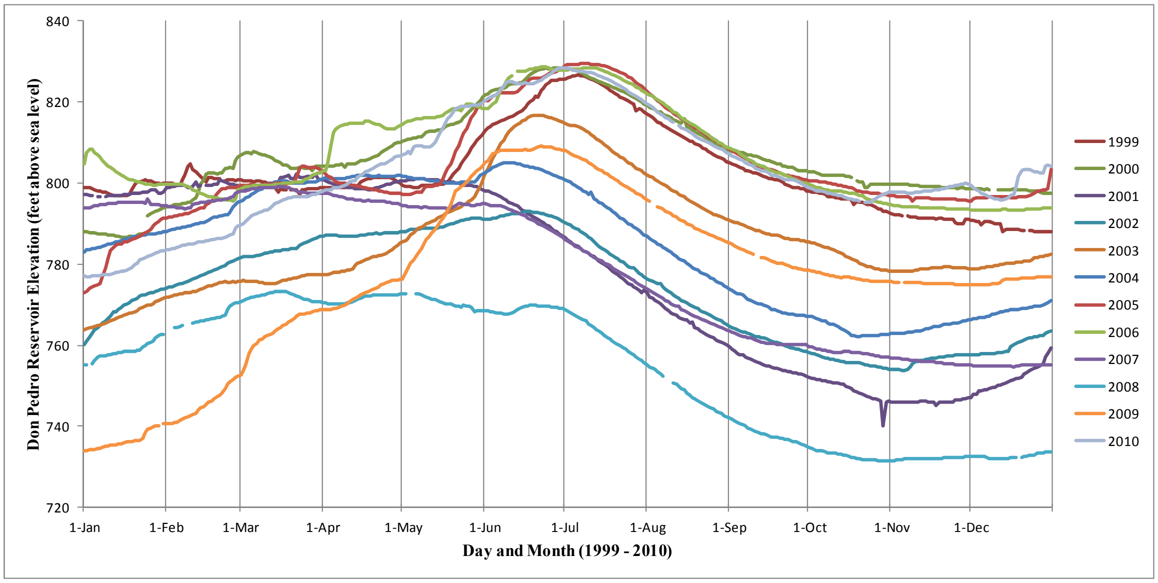
There are two primary reservoir conditions that influence habitat and fish populations in Don Pedro Reservoir. The cold water pool volume can affect the magnitude and quality of cold-water fishery conditions by influencing the volume of cold, oxygenated water during lake stratification. The greater the volume of cold, oxygenated waters during the warmer seasons, the greater the amount of coldwater habitat to support the stocking-dependent coldwater fisheries in Don Pedro Reservoir. Warm water fisheries are primarily dependent on sustained spawning and juvenile rearing habitats during the spring. These, typically littoral, shallow areas can be impacted during the spawning season if reservoir levels drop significantly. The findings of this study are consistent with all available evidence that suggests that the current habitat conditions within Don Pedro Reservoir support quality coldwater and warmwater fisheries, as discussed below.

6.1.1 Water Resources

6.1.1.1 Hydrology

The evaluation of bass nesting survival and tributary stream access support previous findings (Figure 6.1-1) that hydrology of Don Pedro Reservoir is capable of supporting both warmwater and coldwater fish reproduction and survival to recruitment. Don Pedro Reservoir's daily water surface elevations typically change gradually throughout the year, generally increasing during December through June, and decreasing during July through October (Figure 6.1-1). Water elevation changes would be most critical during the warm water fish spring spawning period (typically March through June).

Results of this study show that decreases in reservoir elevations during this period do not excessively dewater spawning nests and strand juvenile fish and are conducive with conditions necessary to support a sustained black bass fishery, even though the Don Pedro Reservoir black bass population is supported by fingerling stocking.



Data source: California Data Exchange Center 2011

Figure 6.1-1. Daily Don Pedro Reservoir water surface elevations (1999 – 2010).

6.1.1.2 Water Quality

As part of a fish mercury study in Don Pedro Reservoir, Stillwater Sciences (2009) conducted water quality sampling at one site upstream and at four sites within Don Pedro Reservoir (Moccasin Creek arm, Woods Creek arm, Middle Bay of reservoir, and Don Pedro Dam – east of Blue Oaks Recreation Area) from September 21 through October 1, 2008 to coincide with thermal stratification of the reservoir (see Table 6.1-1, below). Results are summarized below.

Table 6.1-1. Don Pedro Reservoir water quality data.

Sampling Date	Sample Depth (ft)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)	pH
Moccasin Creek Arm					
9/30/2008	0.5	23.3	9.1	107	7.7
	3	23.3	9.1	107	7.8
	45	20.3	7.1	79	6.7
	48	19.2	5.8	62	6.6
	81	15.0	3.1	30	6.8
Woods Creek Arm					
9/30/2008	0.5	22.8	8.8	102	7.3
	3	22.8	8.8	102	7.3
	42	20.5	5.0	56	6.3
	45	19.5	1.9	21	6.1
	120	12.2	1.6	15	6.4
Middle Bay of Don Pedro Reservoir					
10/1/2008	0.5	24.9	8.7	105	7.7
	3	24.5	8.7	104	7.7
	42	19.8	5.5	60	6.6
	45	18.7	6.0	65	6.6
	275	9.8	7.2	63	6.8

Sampling Date	Sample Depth (ft)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)	pH
Don Pedro Dam – East of Blue Oaks Recreation Center					
10/1/2008	0.5	23.6	8.7	102	7.8
	3	23.6	8.7	102	7.8
	45	19.5	5.6	60	6.6
	48	18.5	5.4	57	6.6
	165	11.72	1.68	16	6.8

Source: Adapted from Stillwater Sciences 2009

Surface waters within Don Pedro Reservoir are characterized by uniform temperatures of 22 to 25°C (71 to 77°F) in the epilimnion, with the thermocline located at a depth of over 10 meters (35 feet). Water temperatures reached a minimum of 15.2°C (59.3°F) at the reservoir bottom in the shallow Moccasin Creek Arm, whereas minimum hypolimnetic temperatures found at all other sites within Don Pedro Reservoir were about 10 to 12°C (~50 to 53°F). Although surface water dissolved oxygen levels were near 9 mg/L, the thermal stratification was accompanied by dissolved oxygen levels less than 7 mg/L at the thermocline, hypolimnetic DO levels of 6 to 7 mg/L in deeper water (less than 10 meters [35 feet]), and dissolved oxygen levels of two to three mg/L in data collected nearest the reservoir bottom in the shallower creek arms of the reservoir. Hypolimnetic pH levels ranged from 6.2 to 6.7 at these sites (Stillwater Sciences 2009).

6.1.1.3 Water Temperature

Within Don Pedro Reservoir there is cold water inflow at Ward's Ferry Bridge in the winter and early spring. Thermal stratification in the reservoir is typically well established by May and extends into November. The temperature drops off quickly below the surface, forming a stable epilimnion and then gradually cools at greater depths of the reservoir. The water in the epilimnion begins to cool and destratify through the fall, becoming almost fully mixed by early winter. The cold inflow at Ward's Ferry Bridge begins again in late winter. By the middle of spring, stratification is typically re-established.

The water temperature profile measured during the study period was consistent with that observed in previous years[4]. Reservoir profiles measured during winter, spring and summer have been measured during previous years and provide additional characterization of the seasonal distribution and conditions of the reservoirs cold and warmwater habitats.

6.2 Analysis of Don Pedro Fish Population

Results of the reservoir fish population survey shows that a diverse fish population resides within the Project reservoir. Table 6.2-1 presents an overview of all fish species historically or currently found within the Project reservoir and whether they were stocked or are typically produced in the wild. Native fish populations in Don Pedro Reservoir were likely present when the Projects inundated the Tuolumne River; introduced fish populations were likely established through stocking to support the game fisheries, as bait fish, or other external events. Section 6.1 provides a discussion of the current status of the reservoir fish populations, in light of existing

[4] Reservoir temperature profiles are available from 2004 through 2012 in the Reservoir Model Study, W&AR 03. and in Attachment 5.2.1-1 of the PAD.

information and the 2012 survey. For those species collected within the Project, a summary of available historical data, stocking practices, current abundance, and life history requirements is presented by species in Section 6.2.

Table 6.2-1. List of fishes reported to occur in the Project area. Source: PAD, Stocking Records, 2012 surveys.

Species	Scientific Name	Origin	In Don Pedro from PAD	Stocking Reference Available	2012 Fish Survey Source of Identification		
					Gillnet	Electrofishing	Creel
Black crappie	*Pomoxis nigromaculatus*	I	Y	-	-	Y	Y
Bluegill	*Lepomis macrochirus*	I	Y	-	Y	Y	Y
Brook trout	*Salvelinus fontinalis*	I	Y	Y	-	-	-
Brown trout	*Salmo trutta*	I	Y	Y	-	-	-
Channel catfish	*Ictalurus punctatus*	I	Y	-	Y	Y	Y
Chinook salmon	*O. tshawytscha*	N[1]	Y	Y	-	-	Y
Common Carp	*Cyprinus carpio*	I	-	-	Y	Y	-
Cutthroat trout	*O. clarkii*	N[1]	Y	Y	-	-	Y
Eagle Lake trout	*O. mykiss aquilarum*	N[1]	Y	Y	-	-	-
Golden shiner	*Notemigonus crysoleucas*	I	-	-	-	Y	-
Green sunfish	*Lepomis cyanellus*	I	-	-	-	Y	-
Kokanee salmon	*O. nerka*	I	Y	Y	Y	-	Y
Largemouth bass	*Micropterus salmoides*	I	Y	Y	Y	Y	Y
Rainbow trout	*O. mykiss*	N	Y	Y	Y	-	Y
Sacramento sucker	*Catostomus occidentalis*	N	-	-	Y	Y	Y
Smallmouth bass	*Micropterus dolomieu*	I	Y	Y	Y	Y	Y
Spotted bass	*Micropterus punctulatus*	I	-	Y	Y	-	Y
Threadfin shad	*Dorosoma petenense*	I	Y	-	Y	Y	-
White catfish	*Ameiurus catus*	I	-	-	Y	-	Y

[1] These fish are native to California but are stocked hatchery fish in Don Pedro reservoir.

6.2.1 Species Presence and Stocking Records

CDFG manages Don Pedro Reservoir for rainbow trout, Chinook salmon, kokanee, and black bass fisheries. Table 6.2-2 summarizes fish stocking records for species planted in Don Pedro reservoir by CDFG from 2000 to 2012. Coldwater species are managed as a Put-and-Take

Fishery. As part of CDFG's Inland Salmon Program, CDFG generally plants rainbow trout, kokanee, and Chinook salmon in Don Pedro Reservoir annually. Don Pedro is also managed by CDFG as a year-round fishery for black bass.

Table 6.2-2. Fish stocking record of species planted in Don Pedro by CDFG for the years 2000 to 2012.

Year	Kokanee[1]	Chinook Salmon[2]	Brook trout	Brown trout	Rainbow trout	Rainbow trout Eagle lake	Black Bass
2000	45,982	0	2,000	20,070	59,100	0	1,980
2001	50,103	0	3,520	19,800	65,600	0	2,758
2002	10,080	0	0	14,600	52,450	0	1,719
2003	10,043	0	0	0	71,675	0	1,825
2004	9,984	0	0	26,400	179,263	0	3,621
2005	10,143	100,440	118,400	73,687	262,585	3,600	2,000
2006	4,061	70,015	0	22,100	388,720	405	1,062
2007	6,517	91,000	0	15,860	41,720	72,680	1,667
2008	10,080	93,885	18,222	10,050	37,617	31,600	1,680
2009	10,050	100,006	5,610	31,320	329,495	93,790	1,367
2010	10,032	100,000	0	0	4,800	52,300	1,755
2011	10,260	129,980	0	16,000	44,300	55,300	0[3]
2012	10,000	99,997	0	15,400	52,300	37,900	2,000

Source: David Jigour, Don Pedro Recreation Agency (pers. comm.. January 11, 2013) and Greg Kollenborn, CDFG (pers. comm.. January 14, 2013)

1 Stocked kokanee are primarily reared at Friant Hatchery

2 Stocked Chinook salmon are from the Klamath River and are reared at Iron Gate Hatchery then quarantined at Silverado Fish Hatchery near Napa prior to stocking in Don Pedro Reservoir

3 No bass planted due to mortalities at hatchery

Historic information identified 13 species present in Don Pedro Reservoir (TID/MID 2011). No prior scientific sampling was identified, but angler reports suggested that largemouth bass, smallmouth bass, bluegill, crappie, catfish, rainbow trout, kokanee, and landlocked Chinook salmon were present, as well as threadfin shad and occasionally stocked brook and brown trout. Available stocking records confirmed that between 2000 and 2009 CDFG stocked rainbow trout, kokanee, and landlocked Chinook salmon. CDFG sometimes stocks brook and brown trout between fall and spring. The Don Pedro Recreation Agency has been stocking black bass in the lake on an annual basis since the early 1980s.

During this study, four additional species were identified in the reservoir, including carp, green sunfish, Sacramento sucker, and golden shiner.

The fish population surveyed in Don Pedro Reservoir was primarily represented by warmwater species including threadfin shad, the most abundant species sampled, and spotted, largemouth and smallmouth bass. Most warmwater fish were collected in the surface and shallow areas of the reservoir, and were the dominant species that was suffering high mortality early in the gillnetting survey. When sampling of the shallow areas was suspended due to the higher mortality, sampling focused on the deeper, coldwater habitat.

The deepwater surveys produced very few fish, primarily kokanee and Sacramento sucker, with one rainbow trout. Sampling the deepwater near the intake at Don Pedro Dam yielded only three fish; two kokanee and one Sacramento sucker. A total of 12 fish, representing seven percent of the overall catch were caught in the deeper areas of Don Pedro Reservoir. The collected species were kokanee (n=11) and Sacramento sucker (n=1).

6.2.2 Creel Survey

Creel data reported from Don Pedro Reservoir show that recreation is well distributed. Overall, anglers primarily caught black bass species followed by rainbow trout and salmon (Chinook salmon and kokanee). Catfish spp., crappie spp., green sunfish, common carp, and bluegill were less frequently caught. Anglers did generally practice catch and release fishing, with over half of the reported catch from live creel surveys being released.

6.2.3 Bass Nesting Survey

Successful black bass productivity was also highlighted during the bass nesting survey. The survey found that operations generally increased the reservoir stage during bass nesting based on historical records. Potential nest dewatering events appeared to be rare, with little potential overall effect. Lee (1999) stated that if nesting success is over 60 percent, then a population of bass would be able to independently subsist. Analysis of potential nest dewatering events over 27 years of historical data showed that nest survival was 95 percent every year for all three black bass species that occur in Don Pedro Reservoir. Given the criteria from Lee (1999), the bass nesting assessment suggests that black bass in Don Pedro Reservoir should be able to independently subsist.

Results of the bass nesting habitat survey indicate that the GIS bathymetry model of Don Pedro reservoir can be used to identify areas of nesting habitat based primarily on water depth at a given reservoir pool elevation.

6.3 Tributary Assessments

CDFG manages tributaries to Don Pedro Reservoir that are east of Highway 49 for protection of spawning salmonids. Angling is restricted during the fall—spring spawning period in these tributaries. Tributaries west of Highway 49 have no restrictions to protect potential salmonid spawners. All tributaries that potentially could attract salmonid spawners were evaluated by conducting an assessment of gradient within the inundation zone of all named streams appearing on USGS topographic maps that are tributary to Don Pedro Reservoir. The results of this analysis indicated that only one tributary, Deer Creek, contained potential impediments to fish passage. Deer Creek was determined to be quite steep (> 20%) immediately upstream of Don Pedro Reservoir's highest pool elevation.

Based on the results of this analysis, further field investigation of fish passage within Don Pedro Reservoir tributaries is unnecessary.

6.4 Species Accounts

A summary of available historical data, stocking practices, current abundance, and life history are presented below by species for those species captured, observed, or reported (i.e., during creel sampling) as required within the FERC-approved study plan.

6.4.1 Black Crappie

Black crappie were expected to occur in Don Pedro Reservoir based on historical records summarized in the PAD (TID/MID 2011).

During the 2012 fish population studies, a single black crappie was captured during electrofishing and several crappie (spps) were reported in the creel survey. Species abundance of black crappie based on electrofishing and gillnetting in Don Pedro Reservoir was low (<1.0 percent of catch).

Black crappie is game fish that is a non-native species to California. Black crappie is native to the Mississippi watershed and eastern North America, exclusive of the Atlantic Coast north of the Carolinas (Steiner 2010). Black crappies are schooling fish, traveling, feeding and spawning in a group. Black crappies prefer waters that are clearer and cooler than those inhabited by the white crappie (*Pomoxis annularis*). The black crappie lives among aquatic vegetation and prefers quiet ponds and small lakes, the shallower areas of large lakes and reservoirs, and the slow-flowing sections of rivers, where it is almost always associated with underwater weeds (Steiner 2010). During the day black crappies stay in schools around large, submerged objects and feed predominantly at night (Steiner 2010). Black crappies prefer water between 27–29°C but can range from 1–38°C (Steiner 2010; UC-Davis 2010). Black crappies can also tolerate salinities up to 10 ppt and in areas with DO levels as low as 1–2 ppt (UC-Davis 2010).

Black crappies mature in two to three years and spawn between March and July or when temperatures exceed 12–17°C peaking between 18–20°C (Steiner 2010; UC-Davis 2010). Males dig dish-shaped nests on the bottom, near or among underwater plants in 1–2 m of water. The nests, found in colonies, are spaced five to six ft apart. An adult black crappie female may produce between 20,000 to 50,000 eggs, and may spawn in the nest of more than one male. The males guard the nest and eggs, which hatch in three to five days. The males protect the hatched fry for a short time, until the young fish leave the nest (Steiner 2010).

Young black crappies eat tiny crustaceans and aquatic insects and grow fast. As they grow, black crappie food preferences change to eating other fish, but as adults they also feed on mayflies, midges, dragonflies, other aquatic insects and crustaceans. Black crappies reach 38–60 mm in their first year and 152–305 mm in their fourth year (UC-Davis 2010). Black crappie may grow to 406 mm long, making them one of the largest sunfish (Steiner 2010).

6.4.2 Bluegill

Bluegill were expected to occur in Don Pedro Reservoir based on historical records summarized in the PAD (TID/MID 2011).

During the 2012 fish population study, bluegill were captured during gillnet sampling and electrofishing on Don Pedro Reservoir. Creel surveys reported bluegill catches as well. Species abundance for bluegill based on electrofishing and gillnetting was moderate (12 percent of catch).

Bluegill is a game fish that is not native to California. Its native range included the eastern half of the United States, southeastern Canada, and northeastern Mexico, exclusive of the coastal plain north of Virginia (TPWD 2009).

Bluegill are a highly adaptive species and can successfully reproduce under a large range of environmental conditions making them one of the most numerous freshwater fishes in California (McGinnis 2006). They have a wide temperature range and populations can be found in various habitats ranging from warm shallow lakes, reservoirs, ponds, sloughs, to colder lakes and streams. Bluegill have adapted to live in winter temperatures as cold as 2–5°C and summer temperatures up to 40–41°C, however they prefer more moderate temperatures from 27–32°C (Moyle 2002). Bluegill can endure low DO levels, particularly in cool temperatures, and can survive with less than 1 mg/L, however maximum growth is achieved in waters with 4–8 mg/l. Salinity is the main habitat limitation as bluegill prefer freshwater (< 1–2 ppt), although they can occur in levels up to 5 ppt, with 12 ppt being fatal (UC-Davis 2010).

Bluegills begin spawning at water temperatures nearing 21°C. Spawning in California usually peaks in May or June but may continue into early fall (UC-Davis 2010). Because of their long spawning season, bluegills have very high reproductive potential, which often results in overpopulation in the face of low predation or low fishing pressure (TPWD 2009). Nesting sites are located in shallow waters 5–15 cm deep and are constructed with gravel or sand substrate or with mud containing vegetative debris. Nests are situated in protective colonies, where each male defends his nest and the surrounding area from other males and potential predators. Females release between 2,000–50,000 eggs (UC Davis 2010). The fertilized eggs stick to debris on the bottom of the nest and stay there until they hatch two to three days later in 20°C water. Males protect the embryos and fry for about one week before starting another breeding cycle (Moyle 2002). The fry slowly travel from nest to aquatic plant beds where they will stay until they are 10 to 25 mm long in which they enter the water column and feed on plankton. As they grow the diet shifts to include aquatic insect larvae, planktonic crustaceans, flying insects, snails, small fish, fish eggs, and crayfish when available (UC-Davis 2010). In their first year they will grow to 4–6 cm and will add 2–5 cm each following year. Few individuals live longer than six years (UC-Davis 2010).

6.4.3 Channel Catfish

Channel catfish were expected to occur in Don Pedro Reservoir based on historical records summarized in the PAD (TID/MID 2011).

During the 2012 fish population study, channel catfish were captured during gillnet sampling and electrofishing in Don Pedro Reservoir. Creel surveys reported catfish (spps) catches as well, which likely included channel catfish. Species abundance from electrofishing and gillnetting for channel catfish was moderate (4 percent of catch).

Channel catfish are a game fish and are a non-native species to California. Their native habitats include the central drainages of the United States (US) and the eastern US as far north as Canada and south into northern Mexico (Dill and Cordone 1997). They were introduced to central California around 1891 (Dill and Cordone 1997).

Channel catfish are found primarily in large, warm water streams with sand, gravel, or rubble bottoms but can also be found in farm ponds, reservoirs, and turbid, muddy bottomed rivers. They can tolerate a range of habitat conditions and have been known to survive in waters with salinities as high as 10 ppt, temperatures as high as 36–38°C, and DO levels as low as 1–2 mg/l (UC-Davis 2010). Adults tend to feed at night in midcurrent sections of streams or rivers and take shelter below undercut banks, root tangles, or logjams between feeding events (McGinnis 2006). Channel catfish are omnivores but tend to prey more on fish as they become larger. Juveniles feed on crustaceans and insect larvae and will begin hunting fish and other larger prey as adults (Page and Burr 1991).

Channel catfish grow quickly and prefer warm water conditions for optimal growth. Depending on habitat they can reach lengths of 7–10 cm in their first year and 35–45 cm in their fifth year with significant differences between each population (UC-Davis 2010). Reproductive timing is variable but most channel catfish must reach three years of age and be at least 30 cm in length for spawning to occur, however spawning age and size range from two to eight years old and between 18 and 56 cm (Moyle 2002). Depending on the region, spawning occurs between April and August when temperatures are between 21–29°C. Channel catfish are cavity spawners and need semi-dark sheltered areas to excavate their nests. The males will often build a nest in undercut banks, hollow logs, rock piles, man-made debris, logjams, riprap, and beaver or muskrat burrows (TPWD 2009). It is common for channel catfish to not spawn at all if adequate spawning habitat is not found. Most females spawn only once a year but when mating begins it occurs multiple times until the female lays all her eggs. Females produce between 2,000 and 70,000 eggs depending on her size. The males defend nest sites against any intruder until the eggs hatch five to 10 days later depending on the water temperature. About one to two days after hatching, the 10–12 mm fry begin actively swimming around and leave the nest approximately seven days later. When the juveniles do leave the nest they may school together as a group for some time before departing on their own when they reach approximately 25 mm in length (Moyle 2002).

6.4.4 Chinook Salmon (Landlocked)

Landlocked Chinook salmon were expected to occur in Don Pedro Reservoir based on historical records summarized in the PAD (TID/MID 2011). Anadromous forms of Chinook salmon do not occur in the Project area. CDFG has regularly stocked Don Pedro Reservoir with between 70,000 and 100,000 yearling landlocked Chinook since the 2005 (TID/MID 2011).

During the 2012 fish population studies, Chinook salmon were only observed in the creel survey.

Landlocked Chinook salmon are planted game fish with similar life histories to anadromous salmonids. However, landlocked Chinook live their entire lives in freshwater, effectively substituting deepwater lakes and/or reservoirs for ocean habitats. Chinook feed on insects, amphipods, and other crustaceans while young, and primarily on other fishes when older.

6.4.5 Common Carp

Common carp were not documented as occurring in Don Pedro Reservoir but were identified upstream of the Project in the Tuolumne River based on historical records summarized in the PAD (TID/MID 2011).

Common carp were found in low abundance (1 percent of catch) at Don Pedro Reservoir during gillnet sampling and electrofishing in support of the Districts' 2012 fish population survey. They were also reported by the Districts' 2012 creel survey.

Common carp are a non-native species to California and optimal habitats include warm, turbid waters of eutrophic lakes, reservoirs, and sloughs with silty bottoms and high vegetation growth or in turbid, alkaline streams with deep permanent pools, and soft bottoms. They are a resilient species and can tolerate less favorable habitats including waters as cold as 4°C and as warm as 31–36°C, salinities up to 16 ppt, and dramatically low levels of DO (between 0.5 and 3.0 ppm) (UC-Davis 2010; Moyle 2002). These tolerances have allowed them to settle into lakes and streams with harsh conditions and help them return to an area after a drought (UC-Davis 2010). Common carp prefer shallow areas where they forage for most of the year but spend winter in the deeper areas of their range. They leave these secure depths in spring to root through the soil by "grubbing," a feeding method where they fill their mouths with substrate and then spit it out to feed on the suspended invertebrates (McGinnis 2006). This feeing method is detrimental to aquatic vegetation which other species utilize and increases turbidity which further affects aquatic vegetation (Moyle 2002). Common carp feed on aquatic insect larvae, small mollusks, crustaceans, and annelid worms (UC-Davis 2010). Newly hatched larvae feed purely on algae and zooplankton but by the time they are a year old they switch to the adult feeding mode (McGinnis 2006). Adults will also feed on plants and algae but this appears to be less important to their diet (UC-Davis 2010).

Spawning begins when water temperatures begin to exceed 15°C in spring and early summer, reaching peak activity when the water is between 19–23°C (UC-Davis 2010; Moyle 2002). Spawning begins with a large school swimming around slowly before breaking off into smaller groups, usually one female and two or three males that swim to shallow, weedy areas to spawn. Females lay 500 eggs at a time and can lay between 50,000 and 2,000,000 in a single season. Adhesive eggs stick to the sides of aquatic plants and hatch three to six days later (McGinnis 2006; UC-Davis 2010; Moyle 2002). Larvae fall to the bottom and feed off their yolk sack before finding cover in aquatic vegetation about a week later. They will stay in the safety of aquatic cover until they are 7–10 cm in length (UC-Davis 2010).

Factors affecting growth include summer temperatures, water quality, and food abundance. By the first summer young common carp can be anywhere from 7–36 cm long but average between 10–15 cm. They will usually double in size by the second summer, and then increase by 10–12 cm annually until growth slows by year four or five. Common carp average a length of 80 cm and a weight of 4.5 kg and generally live from 12–15 years in the wild (UC-Davis 2010).

Captive individuals have been found to live up to 47 years and the largest carp from California recorded weighed 26.3 kg (Moyle 2002).

6.4.6 Golden Shiner

Golden shiner were not known to occur in Don Pedro Reservoir based on historical records summarized in the PAD (TID/MID 2011).

During the 2012 fish population studies, golden shiner were collected in low abundance with only five captured during electrofishing (1 percent of catch).

Golden shiner is a non-native species to California and was originally distributed throughout most of eastern North America (Moyle 2002). They have been established throughout many water bodies in California by anglers using them as baitfish (Moyle 2002). Golden shiner generally reside in warm water ponds and sloughs with abundant aquatic vegetation. They can be found in streams but exclusively in the low gradient reaches (Moyle 2002). In California, they are generally a part of fish communities dominated by introduced species (Moyle 2002). Golden shiner are tolerant of a high range of water qualities, and continue to grow in water up to 37°C and DO concentrations as low as 1 mg/l. Strong fins and a compressed body shape indicate golden shiners are active swimmers that pursue prey in open water. Daphnia and terrestrial insects at the surface are the primary source of food for golden shiner, although they will shift to filamentous algae when prey become limited (Moyle 2002). A shift to flying insects over shallower water has been observed when the risk of predation by larger fish is increased (Moyle 2002).

Golden shiners spawn between March and September, depending on when water temperatures reach 20°C. Spawning takes place in shoals and occurs over multiple days. Moyle (2002) states that females deposit eggs, which adhere to submerged vegetation and woody debris where they are quickly fertilized by males. Golden shiner will also utilize the nests of green sunfish and largemouth bass for laying their eggs, thus providing additional protection for their eggs. The fry will school in shallow habitats near shore. Fry prefer areas with submerged vegetation where they feed primarily on rotifers and diatoms until they are large enough to shift to small crustaceans (Moyle 2002).

6.4.7 Green Sunfish

Green sunfish were not known to occur in Don Pedro Reservoir, but were expected to occur upstream of the Project based on historical records summarized in the PAD (TID/MID 2011).

During the 2012 fish population studies, green sunfish were captured during electrofishing on Don Pedro Reservoir. Species abundance was moderately high (15 percent of catch).

Green sunfish are game fish that are a non-native species to California and have been introduced to the majority of low elevation streams and reservoirs in California (Dill and Cordone 1997). They are present in all of the continental United States (Moyle 2002). Green sunfish are often the sole inhabitants of disturbed and polluted streams and ponds. They prefer warm water (26–

30°C) streams and the shallow edges of lakes. They can tolerate temperatures up to 38°C and oxygen levels below 1 mg/l (Moyle 2002). In lakes and reservoirs, they tend to occupy warm shallow areas with emergent vegetation (Moyle 2002). Green sunfish are good dispersers and their ability to tolerate poor water quality allows them to dominate small seasonal foothill streams by persisting in remnant pools during the dry times of the year (Moyle 2002). The large mouth and aggressive behavior of the green sunfish indicate that it is an opportunistic predator. They feed on benthic macroinvertebrates and smaller fish in all life stages, with young of the year being the only life stage to feed on zooplankton (Moyle 2002).

Green sunfish spawning occurs during the spring and summer. When water temperatures reach 19°C in May or June, males begin moving to shallow areas with sandy bottoms to build nests (Moyle 2002). Green sunfish mate in pairs, but both sexes will select multiple partners (Moyle 2002). After mating, males will stay on the nest guarding the eggs for five to seven days until the young larvae are free swimming and leave the nest. Larval fish will drift and feed on zooplankton until becoming stronger swimmers. Green sunfish grow to 30–50 mm in the first year and up to 50 mm per year in successive years, although few reach more than 150 mm in their lifetimes (Moyle 2002).

6.4.8 Kokanee

Kokanee were expected to occur in Don Pedro Reservoir based on historical records summarized in the PAD (TID/MID 2011). Records indicate that kokanee have been stocked in Don Pedro Reservoir since at least 1953. CDFG fish stocking records indicated that from 2000 through 2012, Don Pedro Reservoir annually received approximately 4,000 to 50,000 planted kokanee.

During the 2012 fish population study, kokanee were the most abundant coldwater fish captured, all during the gillnetting surveys. Kokanee were also recorded in the Districts' creel survey. Based on gillnet sampling, species abundance for kokanee was low in Don Pedro Reservoir (3 percent of catch).

Kokanee have been introduced to many reservoirs in California and are a sub-species of the sockeye salmon which are native to coastal streams. The kokanee's landlocked behavior and development makes it enough of a unique organism to be treated independently from sockeye salmon. Kokanee favor well oxygenated, open waters with temperatures in the range of 10–15°C, normally large lakes and reservoirs. They typically stay near the water surface and migrate deeper as surface temperatures get warmer. Their diet consists mainly of zooplankton, including copepods and cladocerans, and occasionally small fish and insects. The kokanee diet changes little as the fish grow larger but is highly dependent on zooplankton availability which may change throughout the seasons (Moyle 2002)

Kokanee life cycles can range from 2 to 7 years, with the majority reaching a mature stage within 4 years. In California, mature kokanee typically measure around 20 cm in length, however environmental factors and genetic background can influence the size and age at maturity (UC-Davis 2010). Spawning begins in August and usually continues into early February, but is determined by water temperature and stock origins. In California, kokanee were found spawning as late as April. Kokanee locate spawning areas using the distinct scent to home back to their original lake or stream spawning site. It is a good indication that mature adults are ready to spawn when they begin to gather at these sites (Moyle 2002). Females fan redds out of the gravel and then lay eggs into the nest followed by at least one male who will then fertilize them, once fertilized the female buries the eggs under 5–15 cm of gravel. Females lay between 200 and 1,800 eggs, depending on her size and both males and females die shortly after they spawn. Depending on when the spawning occurred, fry emerge in April through June and move downstream to mature in lakes. They will reach 10–25 cm by their first year (UC-Davis 2010).

6.4.9 Largemouth Bass

Largemouth bass were expected to occur in Don Pedro Reservoir based on historical records summarized in the PAD (TID/MID 2011).

During the 2012 fish population study, largemouth bass were captured during gillnet sampling and electrofishing at Don Pedro Reservoir. Although not identified to species, black bass (i.e., general term for smallmouth, spotted, and largemouth bass) were also recorded during the Districts' 2012 creel survey. Black bass was one of the most abundant fish species collected during the population surveys and observed during the creel census. Species abundance based on electrofishing and gillnetting for largemouth bass was high in Don Pedro Reservoir (18 percent of catch).

CDFG compiles data for black bass fishing contests as annual *Summary Reports of Black Bass Fishing Contests Held in California* (Murphy 2009; 2010). These reports provide annual summaries by water body including total contest days, total fish counted and weighted, total number of fish reported dead, total number of contest competitors, total contest hours, total fishing hours or effort, annual catch per hour (i.e., total fish counted/total fishing hours) and mean weight per fish. Bass fishing results for 1985 through 2009 in Don Pedro Reservoir are displayed in Table 6.4-1, below. The reported mean weight per fish caught during fishing tournaments has generally gradually increased between 1985 and 2009 (Figure 6.4-1, below).

Table 6.4-1. Annual black bass fishing contest results for Don Pedro Reservoir.

Year	Contest Days (1)	Total Fish Count (2)	Total Fish Weight (2)	Total Reported Dead Fish	Number of Competitors	Total Contest Hours	Total Hours Effort	Total Catch per Hour (2)	Mean Weight per Fish (2)
2009	73	3,798	7,409.4	43	1,937	556.50	17,380.00	0.22	1.95
2008	82	6,006	12,180.1	35	2,447	584.50	21,571.50	0.28	2.03
2007	54	5,463	12,694.5	67	1,796	395.20	17,357.00	0.31	2.32
2006	74	6,153	14,264.0	135	2,400	543.80	21,335.00	0.29	2.32
2005	73	5,266	10,913.6	62	2,283	570.50	21,781.00	0.24	2.07
2004	77	5,676	12,016.0	90	2,482	584.50	24,007.00	0.24	2.12
2003	82	5,430	10,513.8	70	2,607	613.50	23,830.00	0.23	1.94
2002	77	5,694	10,482.8	67	2,535	582.50	24,620.00	0.22	1.91
2001	89	6,572	14,296.4	112	3,012	640.50	27,883.00	0.24	2.18
2000	70	7,312	13,674.0	121	3,112	542.50	31,080.50	0.24	1.87
1999	24	2,194	3,976.0	10	1,262	195.00	11,269.00	0.20	1.80
1998	55	5,777	10,745.0	71	2,377	432.50	22,753.00	0.25	1.86
1997	82	10,036	19,120.0	149	3,459	654.50	33,872.00	0.30	1.91

Year	Contest Days [1]	Total Fish Count [2]	Total Fish Weight [2]	Total Reported Dead Fish	Number of Competitors	Total Contest Hours	Total Hours Effort	Total Catch per Hour [2]	Mean Weight per Fish [2]
1996	63	6,461	12,582.0	86	2,260	512.00	23,299.50	0.28	1.95
1995	69	6,084	10,364.0	72	2,841	542.50	27,731.50	0.22	1.70
1994	64	5,777	10,364.0	97	1,978	479.00	17,911.50	0.32	1.79
1993	60	4,280	7,147.0	54	1,964	491.00	19,542.00	0.22	1.67
1992	76	4,996	8,096.0	105	2,460	602.00	23,354.50	0.21	1.62
1991	82	4,515	6,682.0	62	3,297	620.50	30,559.00	0.15	1.52
1990	71	5,944	9,421.0	152	3,261	569.00	28,811.00	0.21	1.58
1989	26	4,408	6,584.0	114	2,205	198.00	19,796.00	0.22	1.49
1988	28	3,614	5,230.0	78	1,993	234.00	19,452.50	0.19	1.45
1987	11	2,892	4,648.0	91	1,280	107.00	12,141.00	0.24	1.61
1986	11	1,305	1,704.0	35	1,027	105.00	11,895.00	0.11	1.31
1985	3	631	801.0	18	338	27.00	3,042.00	0.21	1.27

[1] Data represents results for permitted contests with complete contest reports only.
[2] Total Fish Count, Total Fish Weight, Total Catch per Hour and Mean Weight per Fish are for largemouth, smallmouth, and spotted bass combined (Tournament organizers seldom distinguished black bass species). Source: CDFG Summary Reports of Black Bass Fishing Contests Held in California.

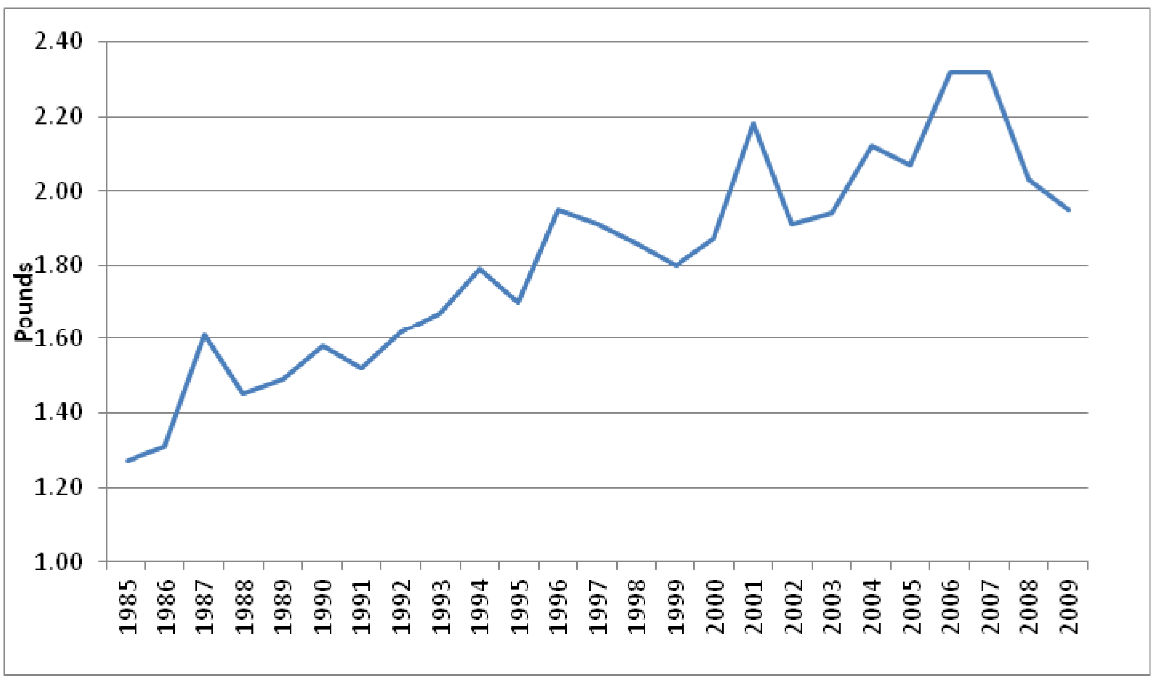


Figure 6.4-1. Mean Weight per Fish Caught during black bass fishing contests in Don Pedro Reservoir

Largemouth bass are a game species that are not native to California and were originally distributed throughout most of what is now the United States east of the Rockies (TPWD 2009). Largemouth bass were first introduced to central California between 1871 and 1891 from Vermont and Michigan strains (Dill and Cordone 1997). Later plants of the faster growing Florida strains were planted in various California lakes in 1959 (Dill and Cordone 1997).

Largemouth bass prefer waters with moderate clarity and beds of aquatic plants. Such water bodies include farm ponds, lakes, reservoirs, sloughs, and river backwaters (UC-Davis 2010). Largemouth bass seek protective cover such as logs, rock ledges, vegetation, and human-made structures. Lake populations stay close to shore in water 1–3 m deep, but travel to deeper water, if summer temperatures increase above 27°C. Largemouth bass can endure temperatures up to 37°C however the optimal temperature for growth is between 25–30°C (Moyle 2002). Largemouth bass have a tolerance for adverse water quality conditions and can survive in water with DO levels as low as 1 mg/l. In California, largemouth bass tend to avoid high alkaline waters and are rarely found in waters with more than 3 ppt (Moyle 2002).

Juvenile bass tend to congregate in schools close to shore, feeding on crustaceans and rotifers. Adults become solitary hunters and feed on crayfish, fish fry, and tadpoles (Moyle 2002). Largemouth bass hide among plants, roots, or limbs to stalk or ambush their prey. Foraging happens throughout the daylight hours, but is most intense at dusk before becoming almost nonexistent at night (UC-Davis 2010). They become piscivorous at a small size (50–60 mm) and it's common to find a bass feeding on another fish half its size (McGinnis 2006). The growth of largemouth bass is highly dependent on genetic background, food availability, competition, and temperature regimes among other factors. On average largemouth bass grow 10 to 15 cm during their first year, 20 to 30 cm in two years, 40 cm in three years. With adequate forage they can surpass two pounds their first year (TPWD 2009).

In California, spawning begins in the spring when water temperatures reach about 15–16°C. This could occur as early as February or as late as May, depending on location. Males build the nests in two to eight ft of water, with preferred nesting habitat located in quieter, more vegetated areas. Adults may use any substrate besides soft mud, including submerged logs (UC-Davis 2010). Once a female lays eggs in the nest (usually between 2,000 and 43,000), she is chased away by the male who then guards the eggs. The young fry hatch in five to eight days. Fry remain in a school near the nest and under the male's watch for several days after hatching (UC-Davis 2010).

6.4.10 Rainbow Trout

Rainbow trout were expected to occur in Don Pedro Reservoir based on historical records summarized in the PAD (TID/MID 2011). Rainbow trout have been regularly stocked in Don Pedro Reservoir. CDFG fish stocking records indicated that from 2000 to 2009, annual plants of rainbow trout ranged from 37,000 to 388,000. In addition, Eagle Lake rainbow trout have been occasionally planted in Don Pedro Reservoir. Since 2005, between 400 and 94,000 Eagle Lake rainbow trout were annually stocked in the reservoir.

During the 2012 fish population study, only one rainbow trout was collected (by gillnet). Rainbow trout were frequently identified in the creel survey. Based on the percentage of the total catch by electrofishing and gillnetting, species abundance for rainbow trout was low (<0.1 percent of catch).

Rainbow trout are a native game species to California and have adapted to a broad variety of habitats throughout their California range. Rainbow trout generally have one of two distinct life patterns: resident inland trout and sea-run or anadromous steelhead (UC-Davis 2010). Resident forms of rainbow trout are found in Project waters. No anadromous forms occur in Project waters. Resident populations spend their entire lives within the same general location of stream or within the same lake. In small streams and high mountain lakes, rainbow trout seldom live longer than six years of age or grow larger than 40 cm (Moyle 2002). In streams and lakes, rainbow trout feed on zooplankton, invertebrates, insects, drifting organisms, and sometimes other fish (Moyle 2002). Feeding usually peaks at dawn and dusk and feeding is more active in summer than in winter.

Rainbow trout are a cold water fish with optimal growth occurring at 15–18ºC and mortality typically results at 24–27ºC (UC-Davis 2010). Most wild rainbow trout reach sexual maturity by age two or three and usually spawn between February and June, depending on water temperature and strain (Behnke 1992). Rainbow trout dwelling in lakes need to migrate into tributaries for spawning. Rainbow trout spawn in gravel, usually in riffles. The eggs hatch in 15 weeks at 3.5ºC and 11 weeks at five degrees C (Shapovalov and Taft 1954). In warmer water greater than five degrees C, eggs can hatch in as little time as three to four weeks (UC-Davis 2010). Sac fry spend another two to three weeks under the cover of the gravel before emerging as fry. Juvenile and adult rainbow trout may migrate into a lake or other downstream areas, or remain in the stream defending a small home range (Moyle 1976).

6.4.11 Sacramento Sucker

Sacramento sucker were not documented to occur in Don Pedro Reservoir, but were identified upstream of the Project in the Tuolumne River based on historical records summarized in the PAD (TID/MID 2011).

During the 2012 fish population study, Sacramento sucker were captured during gillnet sampling and electrofishing and were observed in the creel survey. Species abundance of Sacramento sucker from gillnet and electrofishing was low (one percent of catch). Sacramento sucker was the only fish species besides kokanee to be captured in the deepwater gill nets.

Sacramento sucker are a native sucker and occupy a variety of water bodies in the Sierra foothills and Sacramento Valley. They are known to occur in diverse environmental conditions from cold, high-flow streams to warm sloughs and low-salinity estuarine habitats. Adults tend to occupy large streams and lakes while juveniles can be found in shallow pools within streams or towards the upstream area of a lake or reservoir (McGinnis 2006). They can tolerate a broad range of temperatures but show a preference for water conditions that do not exceed 25°C with optimum growth occurring at 20–25°C. Much higher temperatures can be tolerated with 36°C being lethal (Moyle 2002). Sacramento sucker appear to have a high tolerance for saline waters surviving in areas with 13 ppt. Adults tend to be found in small groups relaxing in deep pools and runs during the day, moving into riffles to forage at night. Sacramento sucker are bottom to mid-water feeders with a diet consisting mostly of algae, detritus and small invertebrates (Moyle 2002).

Sacramento sucker reach maturity when they measure around 200–320 mm and reach four to six years of age (Moyle 2002). Spawning migrations are initiated by the onset of warmer water temperatures, usually between February and June but can begin as early as late December and end as late August (UC Davis 2010). Spring spawning gives larvae access to warm, calm channel margins with emergent vegetation for rearing. Lake dwelling Sacramento sucker often commence migration by congregating at the mouth of a stream, whereas stream dwelling sucker relocate to a spawning stream, typically a tributary to a large river or reservoir. Adequate water temperatures for spawning are usually 12–18°C (Moyle 2002). Spawning will often take place in riffles or where spawning gravels are covered by 30 cm of water. If flows drop, spawning will cease until the flow is restored (Moyle 2002). Females disperse an average of 20,000 eggs over the spawning gravels where they are fertilized by one or several attending males (McGinnis 2006). The eggs attach to gravel or debris and will hatch two to four weeks later.

Post larval sucker have terminal mouths and feed primarily at the surface and in the water column on small invertebrates. When their mouths shift to the sub terminal position, juvenile Sacramento sucker begin to feed on algae and diatoms. Juvenile fish will grow between 47–145 mm by year one, and 40 mm per year thereafter (Moyle 2002).

6.4.12 Smallmouth Bass

Smallmouth bass were known to occur in Don Pedro Reservoir based on historical records summarized in the PAD (TID/MID 2011).

During the 2012 fish population study, smallmouth bass were caught by gillnet sampling and electrofishing on Don Pedro Reservoir. In addition although not identified to species, black bass (i.e., general term for smallmouth, spotted, and largemouth bass) were also recorded during the creel survey. Black bass accounted for more than 50 percent of the fish species identified during the creel survey. Smallmouth bass catch during the population survey was the lowest among the black bass (10 percent of black bass caught, three percent of the total catch).

Smallmouth bass are a game fish that are not native to California. They were originally distributed throughout the upper Mississippi River drainage, south roughly through Arkansas as well as the Great Lakes watershed including the edge of southeast Canada (Moyle 2002). Dill and Cordone (1997) indicated that smallmouth bass were potentially the first bass species introduced into California around 1874 but were then reported only as “black bass.”

Smallmouth bass tend to prefer water bodies with abundant cover, cooler temperatures, and rocky substrate. Potential water bodies include clear lakes, streams, and rivers. Optimum riverine habitat for smallmouth bass is composed of complex habitat with deep pools, riffles, rocky bottoms, overhanging vegetation and a moderate gradient. Lake populations tend to prefer narrow bays along shorelines, where rocky shelves project under water (Moyle 2002).

Juvenile smallmouth bass prefer shallow water habitats resulting in a warmer optimum temperature range than that of adults. The ideal temperatures for growth are 29–31°C for juveniles and 25–27°C for adults, respectively (Moyle 2002). Regardless of age, however, temperatures greater than 35°C are metabolically stressful and temperatures over 38°C are lethal (UC-Davis 2010). In addition to the need for a narrow range of cool temperatures, smallmouth bass also limit their niche habitat by the amount of DO in the water. While they can survive in areas with one to three mg of oxygen per liter, they require at least six mg/l for normal growth rates (Moyle 2002).

In California, smallmouth bass spawn from May to June, when water temperatures are between 13–16°C (Moyle 2002). The male smallmouth builds the nest usually at one m in depth near shore in lakes and downstream from boulders or some other obstruction that offers protection against strong current in streams. The male guards the nest from other bass males and predators until a female is identified and is led to the nest by the male. After circling the nest performing mating rituals, the pair will finally settle into the nest to spawn. The mature females release 10–50 eggs at a time and may lay 2000–21,000 eggs total (Moyle 2002). Once the spawning has concluded the male begins guarding the nest and continues to protect and aerate the embryos for one to two weeks. Once the fry become active and rise from the nest the male herds them into a dense shoal where he will continue to guard them for another one to four weeks. Fry begin to disperse into shallow water when they are two to three cm in length and likely have high mortality rates due to predation and strong stream flows (UC-Davis 2010).

As in other black bass, fry begin to feed on zooplankton, switching to insect larvae and finally fish and crayfish as they grow. They feed avidly on these until they are large enough to feed upon aquatic insects, large crustaceans, and fry. Adult smallmouth bass are opportunistic, and insects, fish, amphibians, and small mammals are common sources of food (UC-Davis 2010).

6.4.13 Spotted Bass

Spotted bass were expected to occur in Don Pedro Reservoir based on historical records summarized in the PAD (TID/MID 2011).

During the 2012 fish population survey, spotted bass were captured during gillnet sampling and electrofishing. Although not identified to species, black bass is the dominant fish species recorded during the Districts' creel survey. Species abundance for spotted bass based on electrofishing and gillnetting was moderately high (nine percent of catch). Spotted bass accounted for 30 percent of black bass caught during the population surveys.

Spotted bass are a game fish that is not native to California. They originally occupied the central and lower Mississippi basin and Gulf Coast drainages (Moyle 2002). This species was first confirmed planted into California waters in 1933 from populations in Ohio (Dill and Cordone 1997).

Spotted bass prefer small to medium streams with low gradients, clear water and gravel or rock bottoms. In streams and rivers they can be found in pools and are very elusive, avoiding riffles and backwaters with heavy vegetation. When they occupy reservoirs they favor steep, rocky banks mostly towards the mouth of the stream and to remain in one limited area and inhabit depths ranging from one to four m (Moyle 2002). Spotted bass have a comparatively low tolerance for brackish waters but have been known to survive in salinities up to 10 ppt. Favoring summer temperatures, spotted bass are typically found in temperatures ranging between 24–31°C and tend to seek out deeper water in the fall as temperatures become steadily warmer (UC-Davis 2010). Feeding behavior for the spotted bass are similar to that of other bass, focusing their diet on primarily zooplankton and invertebrates as fry and juveniles to mainly crayfish and fishes as they increase in size (McGinnis 2006).

Spotted bass have a shorter life-span than other bass and rarely live for more than five years. This generally limits the maximum size of adults to no more than 40 cm. Reproductive maturity is reached during the second or third year and spawning occurs when temperatures reach 15–18°C in late March to early April, and continues until temperatures reach 22–23°C in early June (Moyle 2002). Spawning is initiated when males move to shallow water and begin constructing nests in areas 0.5–4.5 m deep with large rocks and rubble or gravel (UC-Davis 2010). Spotted bass lay relatively few eggs, averaging 8,000 per female and ranging from 2,000–14,000 eggs (McGinnis 2006; Moyle 2002). Males guard the eggs during incubation and for up to four weeks after they have hatched. As young fish grow their diet shifts from zooplankton to insects, and finally to fish and crayfish (TPWD 2009). Growth varies with habitat, with warm-water reservoirs supporting the highest growth and cold streams the slowest. On average, however, individuals reach 65–170 mm by year one and 245–435 mm by year four. Few live longer than four to five years and the largest recorded individual for California was 450 mm (UC-Davis 2010).

6.4.14 Threadfin Shad

Threadfin shad were not documented to occur in Don Pedro Reservoir based on historical records summarized in the PAD (TID/MID 2011).

During the 2012 fish population study, threadfin shad were captured during gillnet sampling and electrofishing. Threadfin shad were captured in high abundance and made up a major portion of the catch (21 percent of catch).

Threadfin shad are a non-native species to California and were introduced by CDFG to reservoirs throughout California in the 1950's (Moyle 2002). They have the ability to colonize new environments quickly at the expense of other fish populations and are now one of the most widespread fish in the lower elevation waterways of California (McGinnis 2006). They prefer freshwater and tend to stay near the surface as they depend on light for feeding and rarely occupy areas deeper than 18 m (UC-Davis 2010). As a result, they are typically found in the open waters of sluggish backwaters, large ponds, and reservoirs where they stay close to the inlets of small streams or along the surfaces of dams.

Threadfin shad favor warm waters exhibiting better survival and growth rates in waters where summer temperatures do not exceed 22–24°C and winter temperatures do not drop below seven to nine degrees C. They cannot tolerate sudden drops in temperature, prolonged cold spells, or temperatures below four degrees C (Moyle 2002). They are most often found in schools organized by size with smaller groups tending to be deeper in the water column, especially at night. It is not uncommon to see these schools very close to the surface as they are chased by fish below and by birds from above (UC-Davis 2010).

Threadfin shad capture food using two separate techniques, filtering and picking, which allows for them to have a broad diet. The picking method is used to feed individually on larger organisms such as copepods whereas the filtering method consists of using their gill rakers to strain small zooplankton, phytoplankton, and organic debris from the surface (UC Davis 2010). During the day the two methods are mostly balanced but hunting becomes more difficult in low light when the shads ability to see their prey is diminished making filtration the more dominant feeding method at night (Moyle 2002).

Threadfin shad are not long-lived and rarely live past the second year. However they have the ability to grow fast increasing in length by one to three cm per month and measuring 10–13 cm by the end of the first summer of life (Moyle 2002). In California, spawning for the threadfin shad typically takes place from April through August and peaks when water temperatures exceeds 20°C, although spawning has occurred in temperatures ranging 14–18°C. Spawning rituals begin when groups of Threadfin shad gather near the surface and charge floating or submerged objects such as logs or brush. The tight groups will rush the object turning just before collision, and as they turn the eggs and sperm are released. Females produce 900 to 21,000 eggs (UC Davis 2010). The ability for the eggs to attach to floating objects rather than fixed objects is an advantage for fish in fluctuating waters and is likely the reason threadfin shad have been so successful in reservoirs (Moyle 2002). Embryos will hatch three to six days later into planktonic larvae that stay near the surface during the day and fall deeper into the water column at night. They will mature into juveniles in approximately two to three weeks when they are 2 cm in length, but later in lower temperatures (UC Davis 2010).

6.4.15 White Catfish

White catfish were not specifically identified as occurring in Don Pedro Reservoir based on historical records summarized in the PAD (TID/MID 2011).

During the 2012 fish population survey, white catfish were captured during electrofishing. Based on electrofishing catch, species abundance for white catfish was low in (< 1 percent of catch).

White catfish are a non-native game fish to California and were originally from the eastern Atlantic coastal areas. They were introduced to central California around 1874 and have been stocked by CDFG and its processors throughout various water bodies in the state since that time (Dill and Cordone 1997).

White catfish are adaptable to a broad range of water conditions and a variety of habitats throughout their California range. White catfish are considered a warm water species and can be found in deep lakes and reservoirs, warmer slow moving sections of river and streams, and in brackish bays. They prefer temperatures over 20°C, surviving in water up to 31°C (UC Davis 2010; Page and Burr 1991). White catfish tend be more active during the day then other catfish species but actively feed at night and move from deep daytime habitats to shallower vegetated habitats (Moyle 2002).

White catfish are opportunistic carnivorous bottom feeders. As juveniles they eat a variety of carrion and prey including amphipods, shrimp, and insect larvae. Their eating habits diversify as they increase in size, adding fish (specifically threadfin shad in reservoirs), large invertebrates, and in some cases small birds and mammals into their diet (Moyle 2002).

White catfish mature at very different growth rates depending on diet and habitat. Maturity is reached at approximately three to four years of age in California and adults can range from 27–60 cm and weigh 0.5–3 kg. Spawning generally occurs when water temperatures are greater than 21°C, usually in June and July in California, but can extend into September (UC-Davis 2010). Nests are excavated by males out of sand or gravel, near vegetative cover, or rocky cave-like areas. Females lay several thousand eggs that hatch in seven to 10 days, when temperatures are near 26°C (UC-Davis 2010; Page and Burr 1991). The young are protected by the male and will stay together for a short period after hatching.

7.0 STUDY VARIANCES AND MODIFICATIONS

There was one variance to the FERC-approved study. The study plan called for a summary of water quality information with respect to thermocline location, epilimnion and hypolimnion water temperatures and dissolved oxygen concentrations to the extent feasible. Dissolved oxygen concentrations were only recorded at the surface during the conduct of this study due to equipment failure that prevented measurements in deeper locations. This variance did not have a substantial effect on data availability, as dissolved oxygen profiles were measured along with temperature earlier during the targeted study period (i.e., summer-fall) during sampling for the Water Quality Study (W&AR-02) on August 22, 2012, and are reported in Section 5 of this report.

8.0 REFERENCES

Anderson, R.O. and S.J. Gutreuter. 1983. Length, weight, and associated structural indices. Pages 284-300 in L. Nielsen and D. Johnson (eds.) Fisheries Techniques. American Fisheries Society, Bethesda, Maryland

Behnke, R.J. 1992. Native Trout of Western North America. American Fisheries Society Monograph 6. American Fisheries Society. Bethesda, MD.

California Data Exchange Center (CDEC). 2011. California Reservoir Operations. Available online: <http://cdec.water.ca.gov/reservoir.html>. Accessed on September 28, 2011. State of California Department of Water Resources. Sacramento, CA.

California Department of Water Resources (DWR). 2001. Draft Memorandum Report on the Application of CALSIM II Model st 2020 Level-of-Development. California Department of Water Resources, Sacramento, California.

Dill, W.A. and A.J. Cordone. 1997. History and Status of Introduced Fishes to California, 1871 – 1996. Department of Fish and Game Fish Bulletin 178. Available online: http://content.cdlib.org/view?docId=kt8p30069f&query=Mission%20San%20Gabriel&brand=calisphere. Accessed on August 1, 2010.

FERC (Federal Energy Regulatory Commission). 2011. Study Plan Determination for the Don Pedro Hydroelectric Project; Project No. 2299-075—California. Washington, DC.

Hunt, J. and C. A. Annett. 2002. Effects of habitat manipulation on reproductive success of individual largemouth bass in an Ozark reservoir. North American Journal of Fisheries Management 22: 1201–1208.

Lee, D.P. 1999. Water Level Fluctuation Criteria for Black Bass in California Reservoirs. Reservoir Research Management Project: Informational Leaflet No. 12

McGinnis, S.M. 2006. Field Guide to Freshwater Fishes of California. University of California Press. Berkeley, CA. pp. 539.

Moyle, P.B. 1976. Inland Fishes of California. University of California Press. Berkeley, CA. pp. 405.

_____. 2002. Inland Fisheries of California, 2nd Ed. University of California Press. Davis, CA.

Murphy, K. 2009. Summary Report of Black Bass Fishing Contests held in California during 2008. CDFG, Flatwater Reservoir Research and Management Project, 21 pp. June 2009. [Online] URL: http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=15057. (Accessed July 29, 2010.)

——. 2010. Summary Report of Black Bass Fishing Contests held in California during 2009. California Department of Fish and Game, Flatwater Reservoir Research and Management Project, 23 pp. June 2010. [Online] URL: http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=22191. (Accessed July 29, 2010.)

Page, L.M., and B.M. Burr. 1991. A Field Guide to Freshwater Fishes: North America North of Mexico. Peterson Field Guides. Houghton Mifflin Co. New York. pp. 432.

Reynolds, J. B. 1996. Electrofishing. *Fisheries techniques*, 2nd edition. American Fisheries Society, Bethesda, Maryland. pp. 221-253.

Saunders, R., M. A. Bozek, C. J. Edwards, M. J. Jennings, and S. P. Newnan. 2002. Habitat features affecting smallmouth bass *Micropterus dolomieu* nesting success in four northern Wisconsin lakes. Pages 123–134 in: D. P. Philipp, and M. S.

Shapovalov, L., and A.C. Taft. 1954. The Life Histories of the Steelhead Rainbow Trout (*Salmo gairdneri gairdneri*) and Silver Salmon (*Oncorhynchus kisutch*). State of California Department of Fish and Game. Fish Bulletin No. 98. Sacramento, CA. pp. 375.

Steiner, L. 2010. Pennsylvania Fishes. Pennsylvania Fish & Boat Commission. Available online: http://www.fish.state.pa.us/pafish/fishhtms/chap22.htm. Accessed on July 6, 2010.

Stillwater Sciences. 2009. Don Pedro Reservoir Fish Mercury Study. Final Report for Turlock Irrigation District and Modesto Irrigation District.

Texas Parks and Wildlife Department (TPWD). 2009. Freshwater Fishes Found in Texas. State of Texas. Available online: http://www.tpwd.state.tx.us/landwater/water/aquaticspecies/inland.phtml. Accessed on July 1, 2010.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2013. Recreation Facility and Public Accessibility Assessment Progress Report (RR-01), Section 2.2.1 of the Don Pedro Hydroelectric Project Initial Study Report. January 2013.

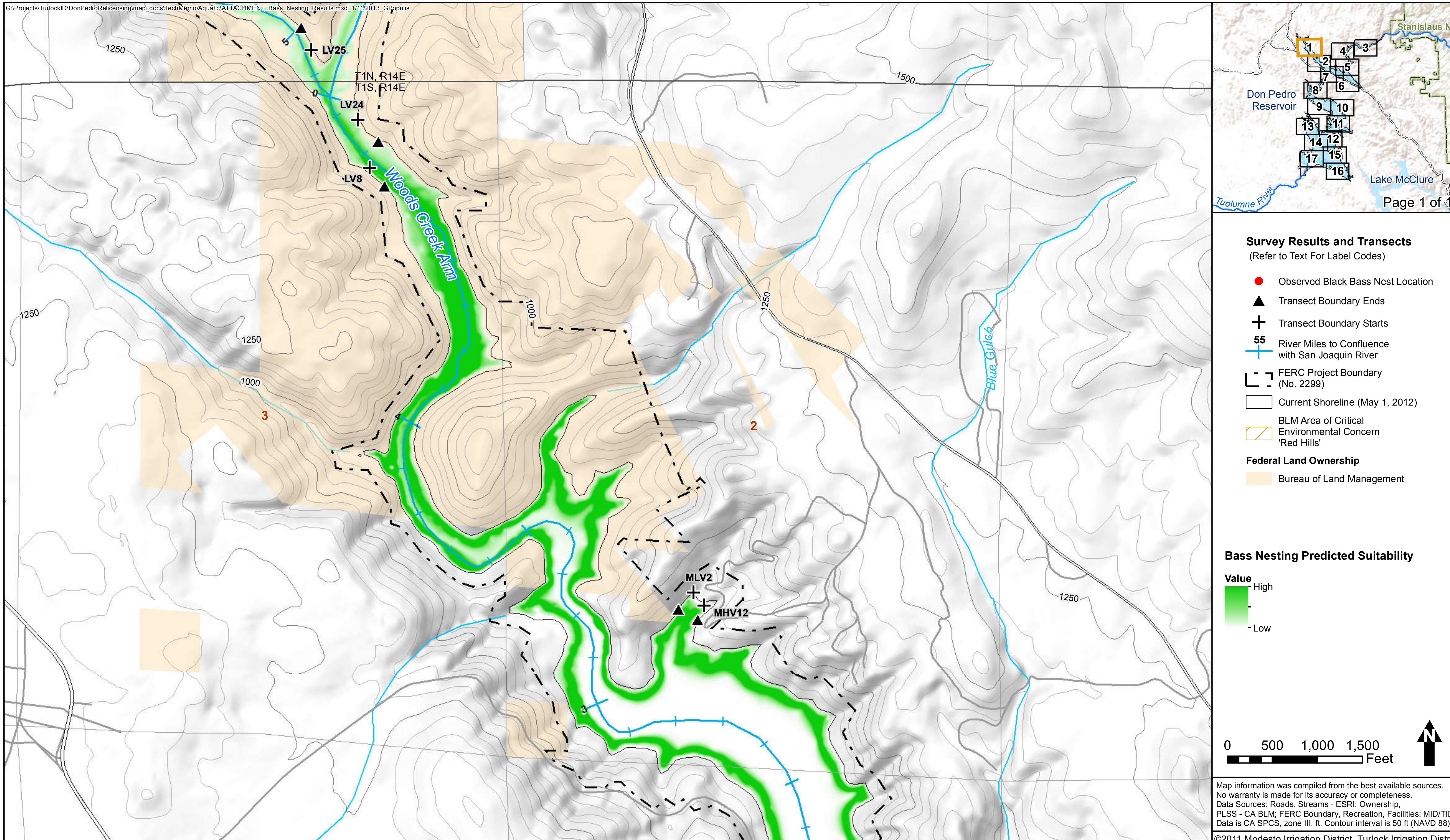
_____. 2011. Don Pedro Project. FERC No. 2299. Pre-Application Document. February 2011. Available online at: www.donpedro-relicensing.com

University of California Cooperative Extension at UC Davis (UC-Davis). 2010. California Fish. Available online: http://ucce.ucdavis.edu/datastore/datastoreview/showpage.cfm?reportnumber=746. Accessed on June 3, 2010.

STUDY REPORT WAR-17
RESERVOIR FISH POPULATION

ATTACHMENT A

BASS NESTING SUITABILITY AND SURVEY RESULTS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T1S, R14E
LV24
LV8
Woods Creek Arm
MLV2
MHV12
Blue Gulch
1250
1500
1000
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
Page 1 of 17
Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
River Miles to Confluence with San Joaquin River
FERC Project Boundary (No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical Environmental Concern 'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0 500 1,000 1,500 Feet
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Map information was compiled from the best available sources.
No warranty is made for its accuracy or completeness.
Data Sources: Roads, Streams - ESRI; Ownership,
PLSS - CA BLM; FERC Boundary, Recreation, Facilities: MID/TID.
Data is CA SPCS, zone III, ft. Contour interval is 50 ft (NAVD 88).
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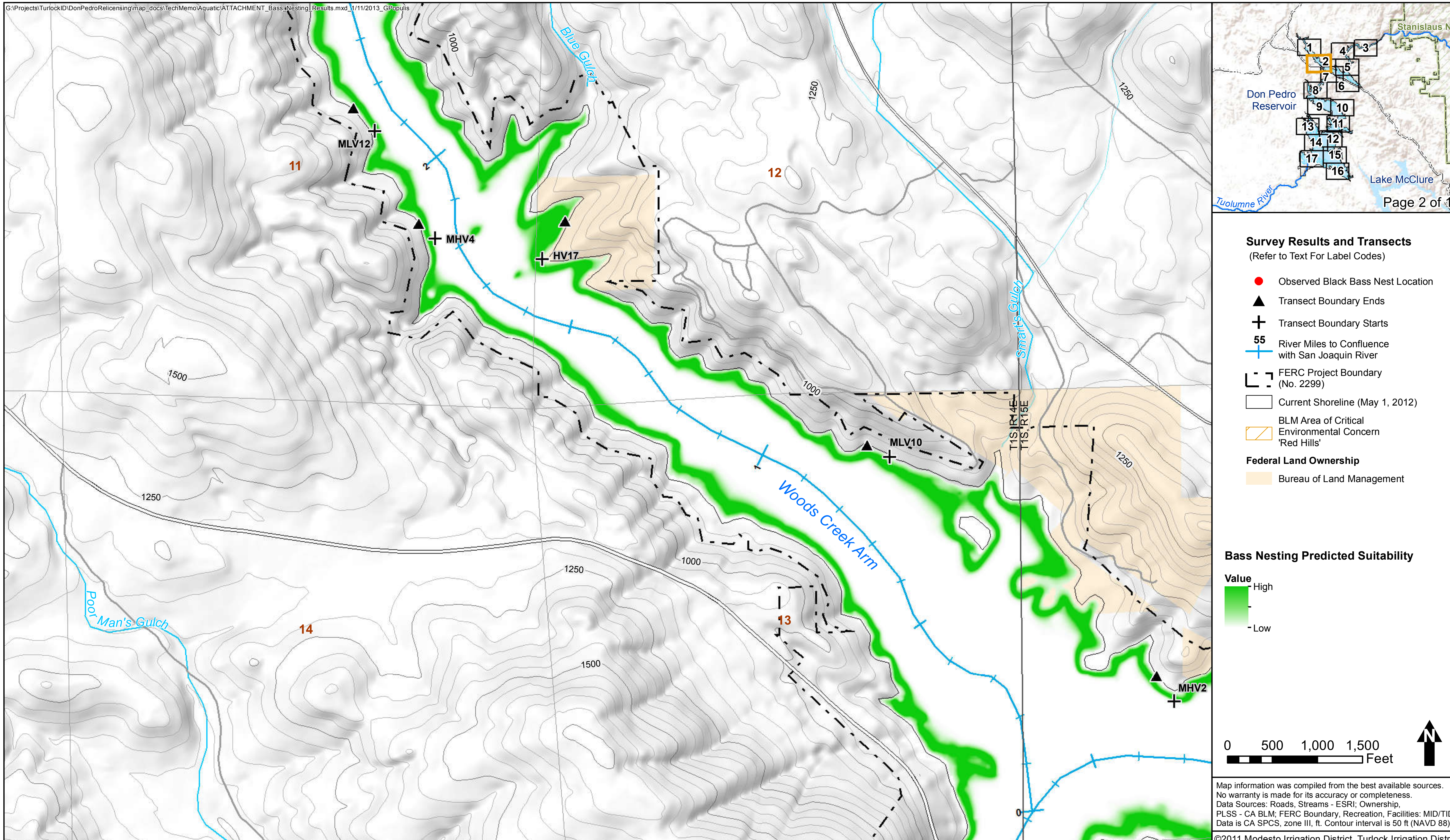

Blue Gulch
Smart's Gulch
Woods Creek Arm
Poor Man's Gulch
MLV12
MHV4
HV17
MLV10
MHV2
11
12
13
14
1000
1250
1500
T1S, R14E
T1S, R15E
Stanislaus NF
Don Pedro Reservoir
Lake McClure
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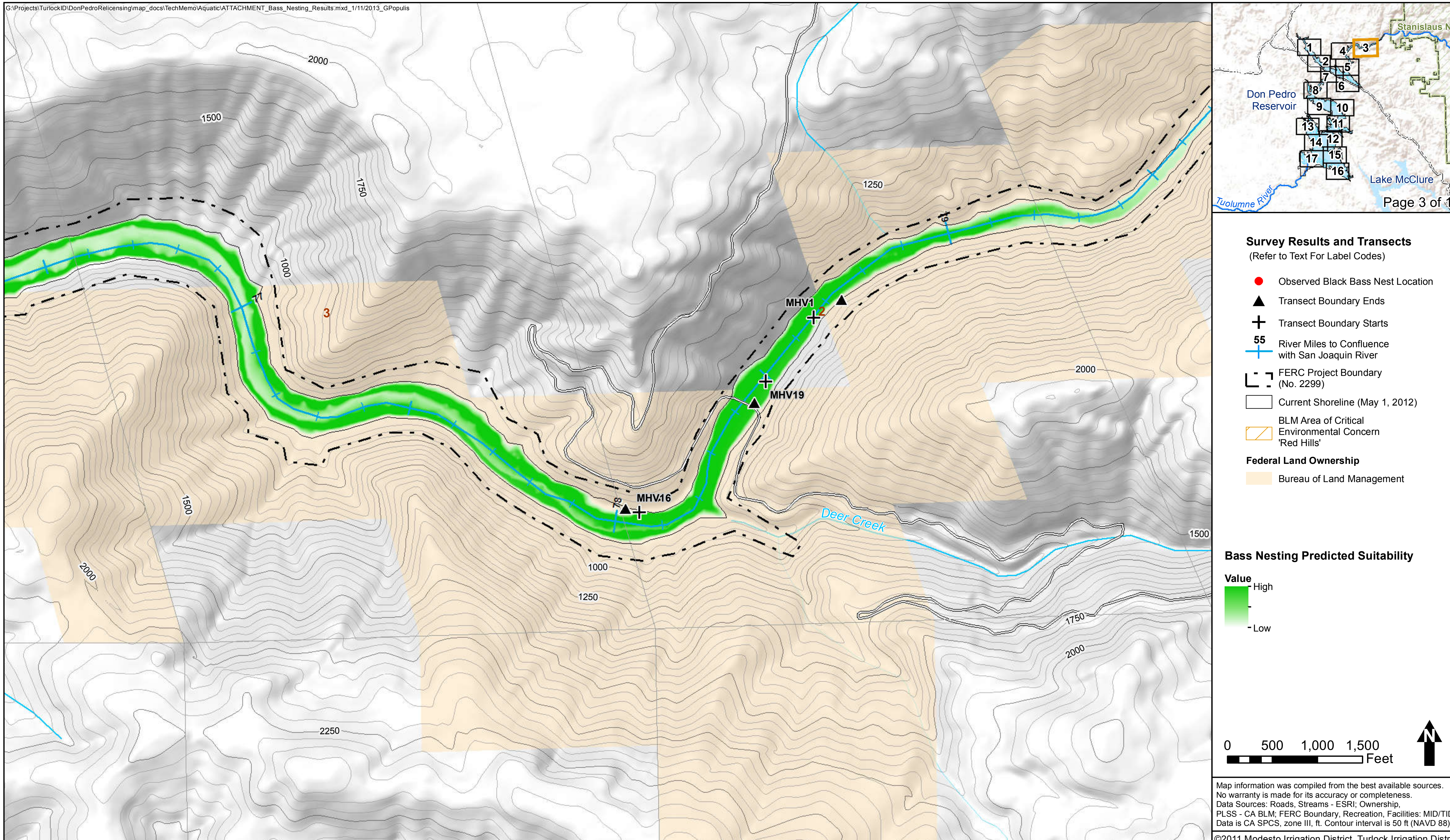
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Deer Creek
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
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(Refer to Text For Label Codes)
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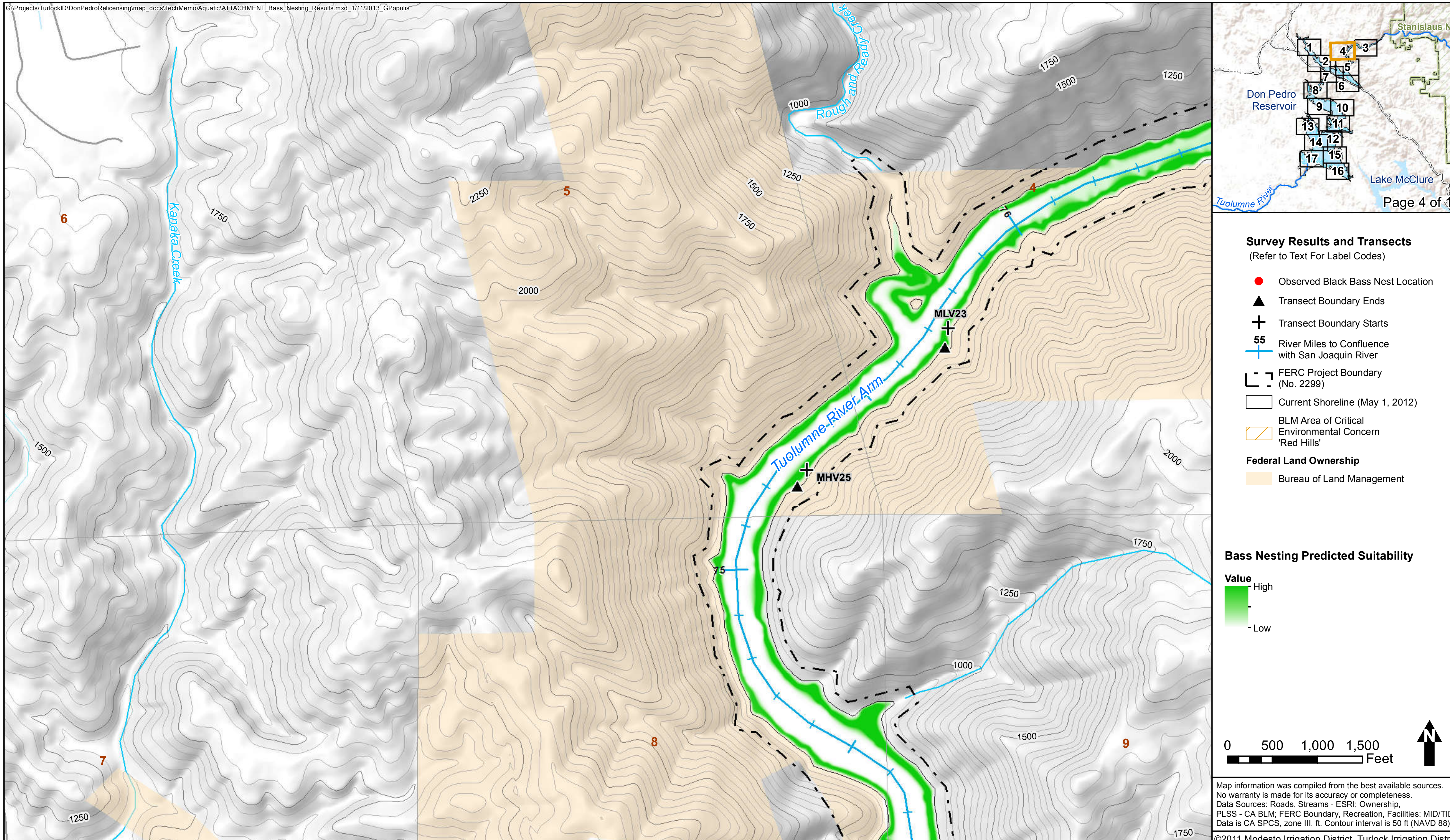

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Rough and Ready Creek
Kanaka Creek
Tuolumne River Arm
MLV23
MHV25
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9
Stanislaus NF
Don Pedro Reservoir
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Data Sources: Roads, Streams - ESRI; Ownership,
PLSS - CA BLM; FERC Boundary, Recreation, Facilities: MID/TID.
Data is CA SPCS, zone III, ft. Contour interval is 50 ft (NAVD 88).
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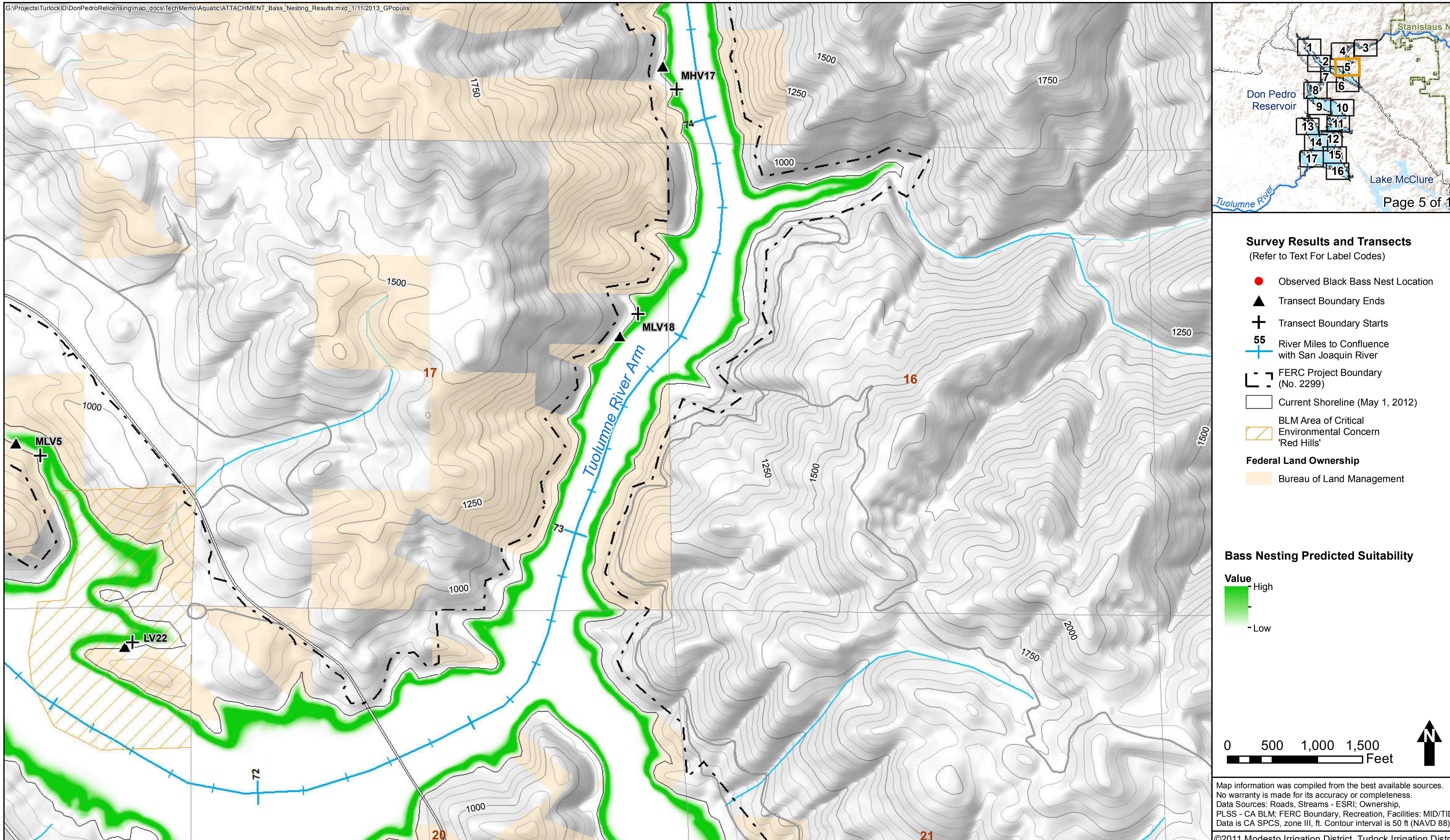
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MHV17
MLV18
MLV5
LV22
Tuolumne River Arm
74
73
72
17
16
20
21
1000
1250
1500
1750
2000
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Page 5 of 17
Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
55
River Miles to Confluence with San Joaquin River
FERC Project Boundary (No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical Environmental Concern 'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0
500
1,000
1,500
Feet
N
Map information was compiled from the best available sources.
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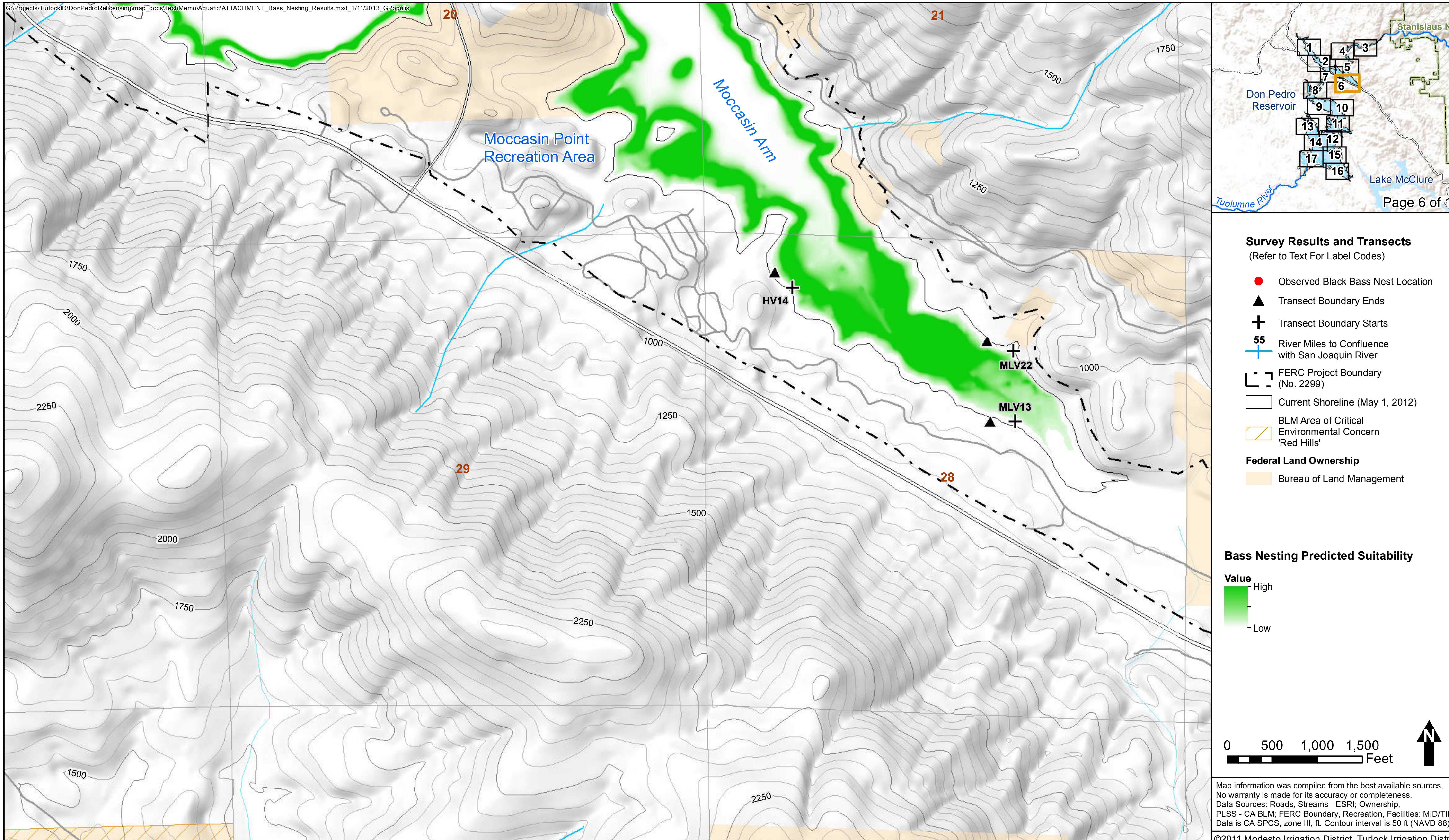
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20
21
29
28
Moccasin Point
Recreation Area
Moccasin Arm
HV14
MLV22
MLV13
1750
1500
1250
1000
2000
2250
Stanislaus NF
Don Pedro
Reservoir
Lake McClure
Tuolumne River
Page 6 of 17
Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
River Miles to Confluence
with San Joaquin River
FERC Project Boundary
(No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical
Environmental Concern
'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0 500 1,000 1,500
Feet
N
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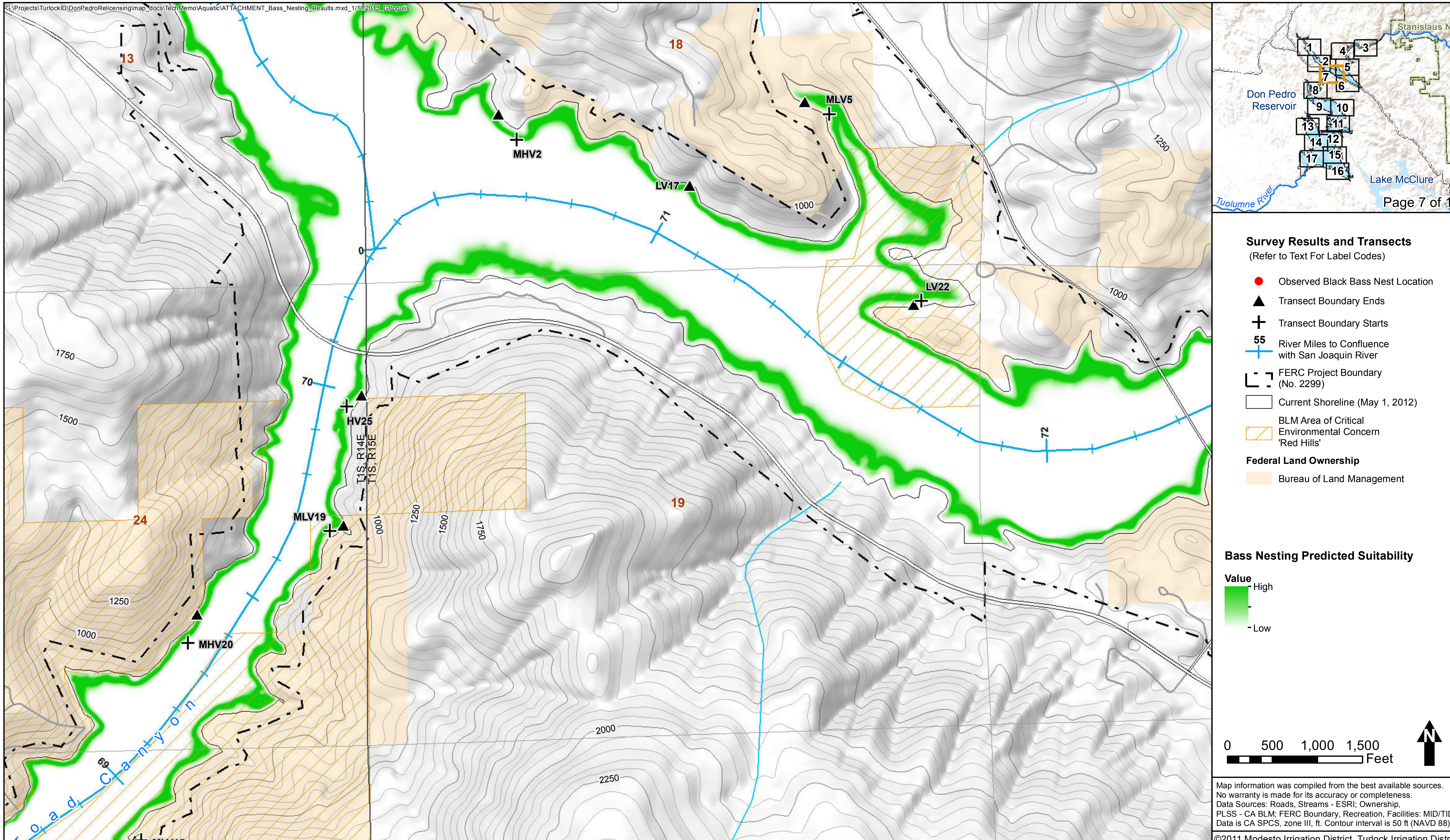

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13
18
19
24
MHV2
MLV5
LV17
LV22
HV25
MLV19
MHV20
MLV15
70
71
72
69
0
T1S, R14E
T1S, R15E
road Canyon
1000
1250
1500
1750
2000
2250
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Page 7 of 17
Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
55
River Miles to Confluence with San Joaquin River
FERC Project Boundary (No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical Environmental Concern 'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0 500 1,000 1,500
Feet
N
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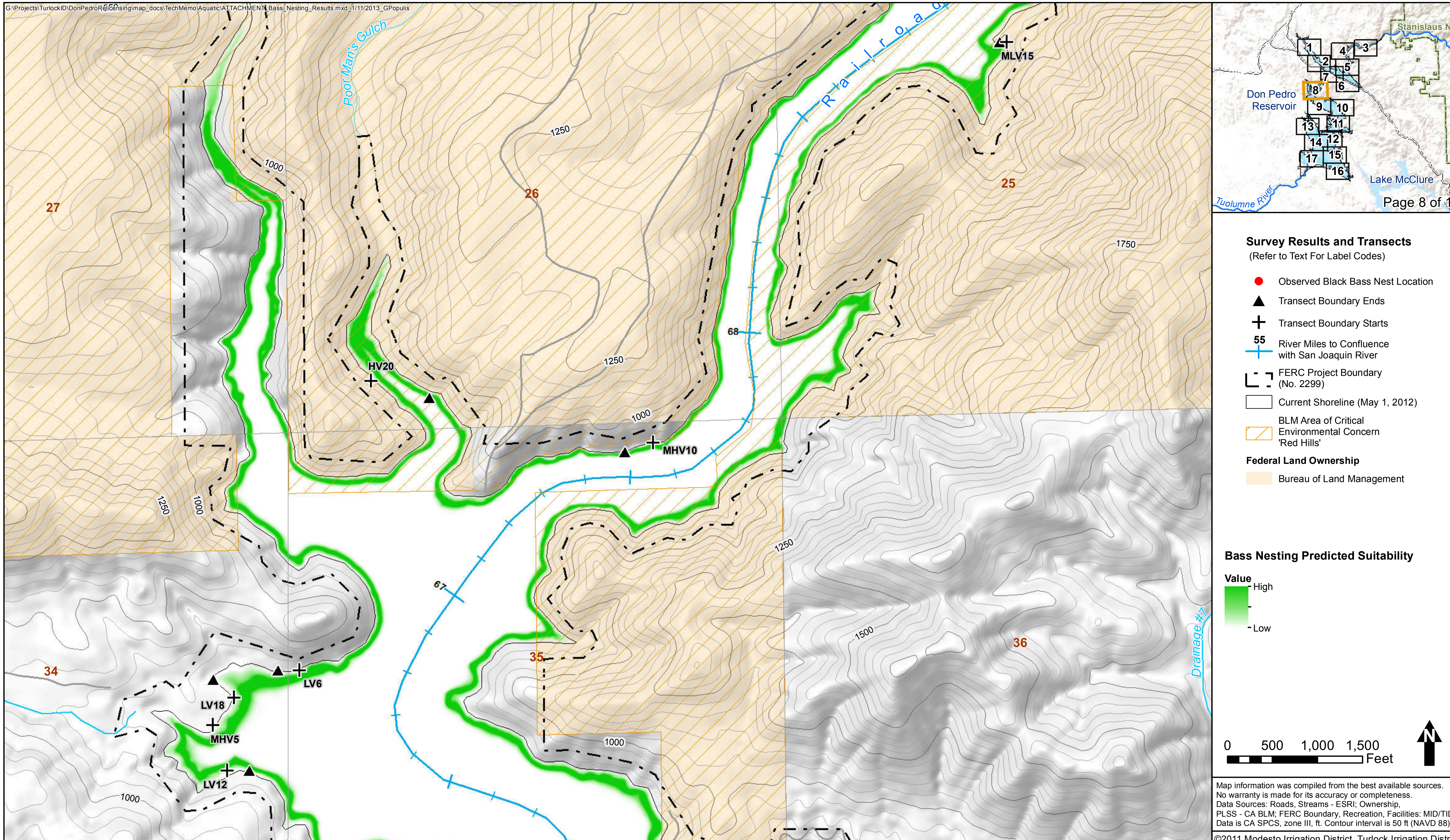

G:\Projects\TurlockID\DonPedroRelicensing\map_docs\TechMemo\Aquatic\ATTACHMENT\Bass_Nesting_Results.mxd 1/11/2013 GPopulis
Poor Man's Gulch
Railroad
27
26
25
34
35
36
1000
1250
1500
1750
67
68
HV20
MHV10
MLV15
LV6
LV18
MHV5
LV12
Drainage #7
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Page 8 of 17
Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
55
River Miles to Confluence with San Joaquin River
FERC Project Boundary (No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical Environmental Concern 'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0
500
1,000
1,500
Feet
N
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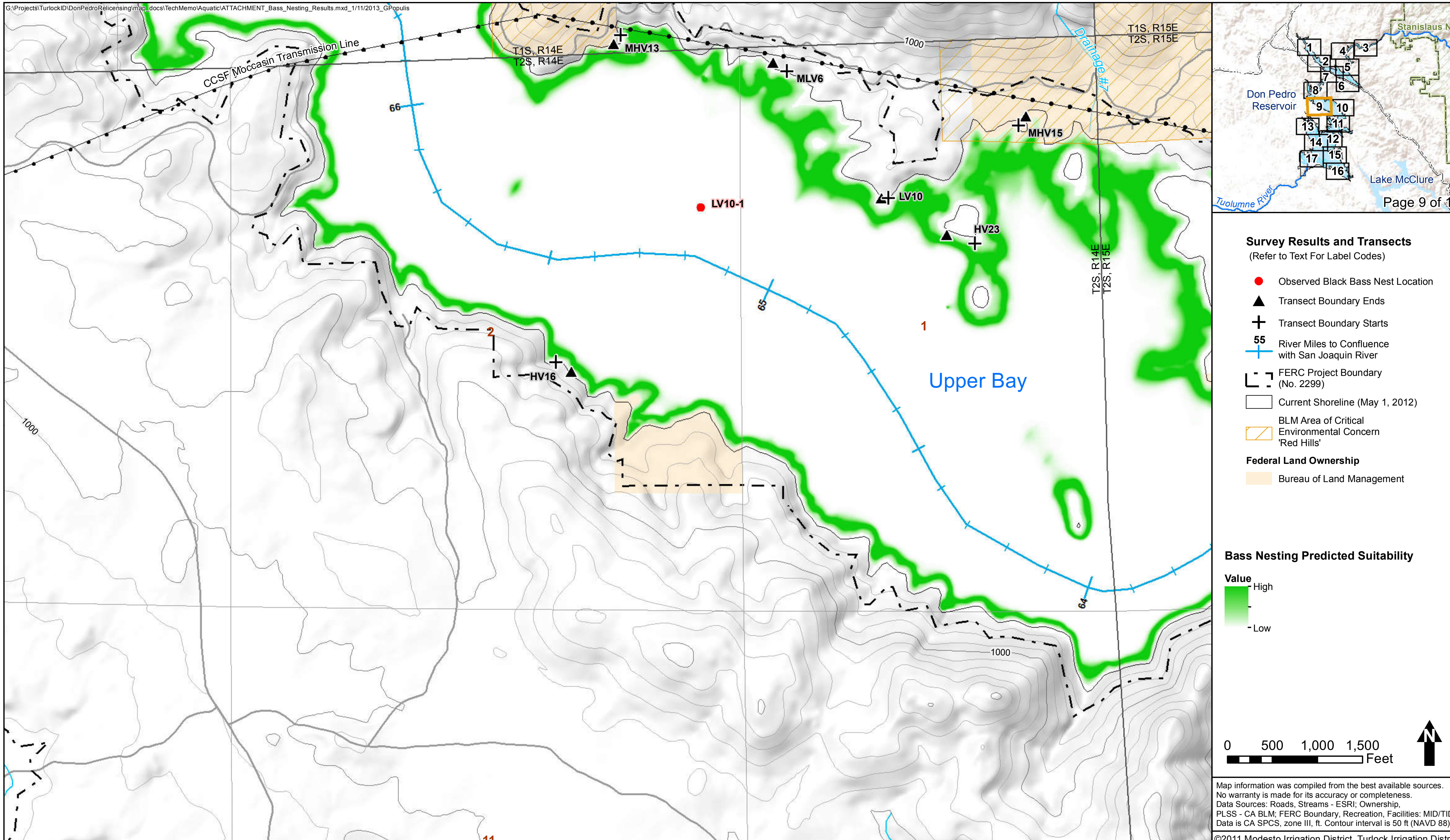
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CCSF Moccasin Transmission Line
T1S, R14E
T2S, R14E
T1S, R15E
T2S, R15E
T2S, R14E
T2S, R15E
Dramage #7
MHV13
MLV6
MHV15
LV10
LV10-1
HV23
HV16
Upper Bay
66
65
64
1000
1
2
11
12
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
Page 9 of 17
Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
55
River Miles to Confluence with San Joaquin River
FERC Project Boundary (No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical Environmental Concern 'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0
500
1,000
1,500
Feet
N
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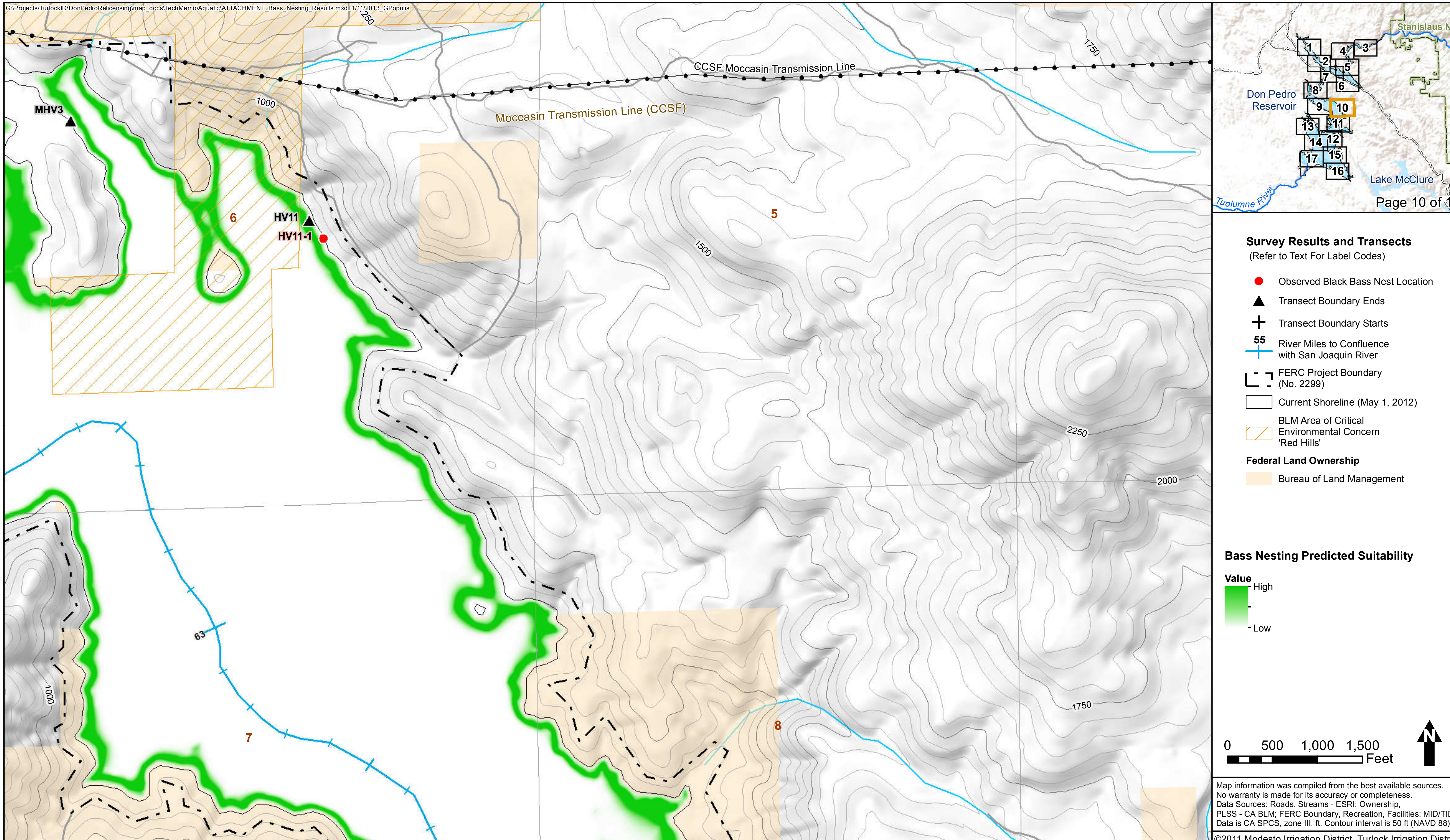

G:\Projects\TurlockID\DonPedroRelicensing\map_docs\TechMemo\Aquatic\ATTACHMENT_Bass_Nesting_Results.mxd 1/11/2013_GPopulis
CCSF Moccasin Transmission Line
Moccasin Transmission Line (CCSF)
MHV3
HV11
HV11-1
6
5
7
8
63
1000
1500
1750
2000
2250
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
Page 10 of 17
Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
55
River Miles to Confluence with San Joaquin River
FERC Project Boundary (No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical Environmental Concern 'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0 500 1,000 1,500 Feet
N
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Data Sources: Roads, Streams - ESRI; Ownership, PLSS - CA BLM; FERC Boundary, Recreation, Facilities: MID/TID.
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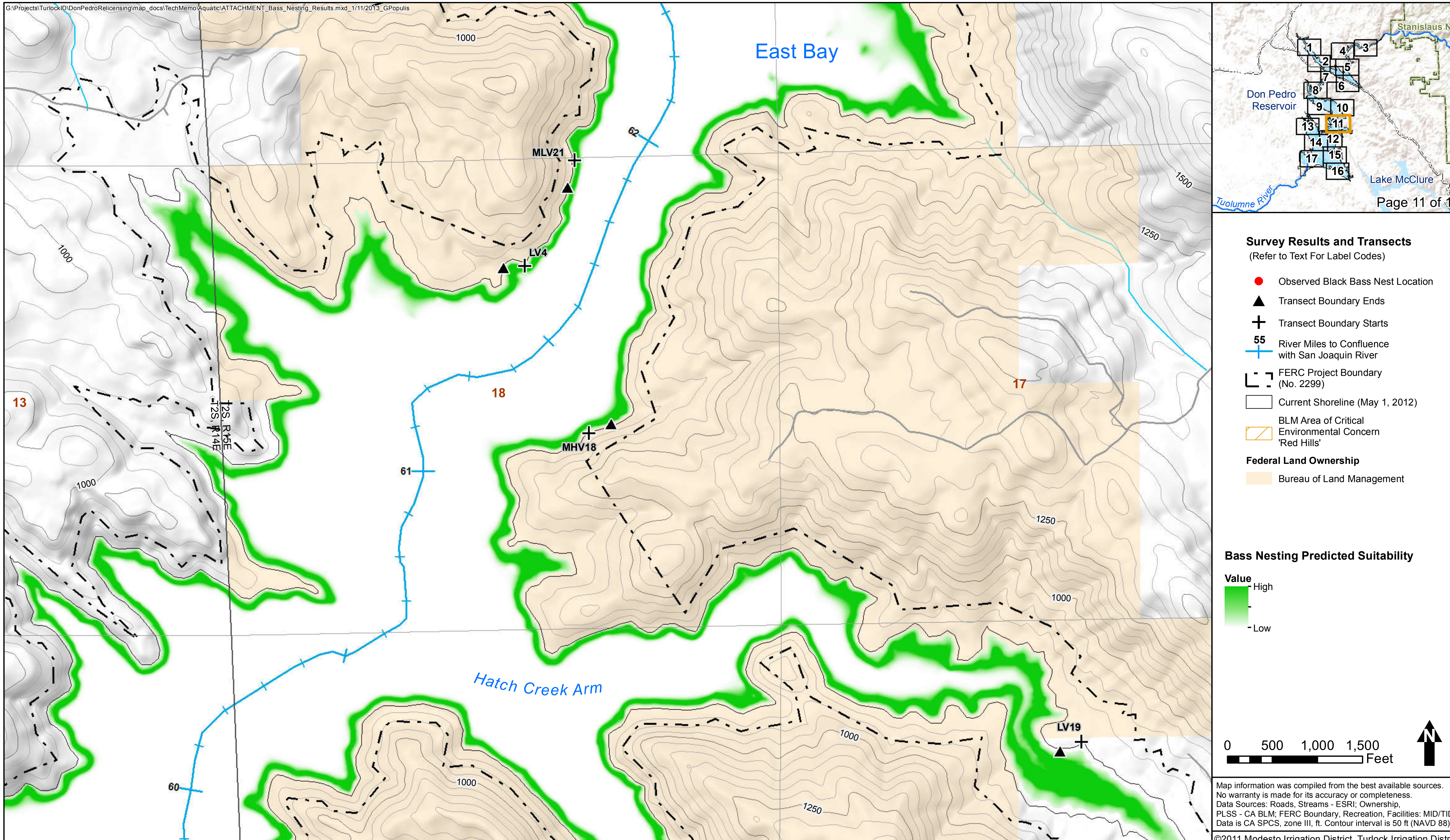
East Bay
Hatch Creek Arm
MLV21
LV4
MHV18
LV19
62
61
60
13
18
17
T2S, R15E
T2S, R14E
1000
1250
1500
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
Page 11 of 17
Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
River Miles to Confluence with San Joaquin River
FERC Project Boundary (No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical Environmental Concern 'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0 500 1,000 1,500 Feet
N
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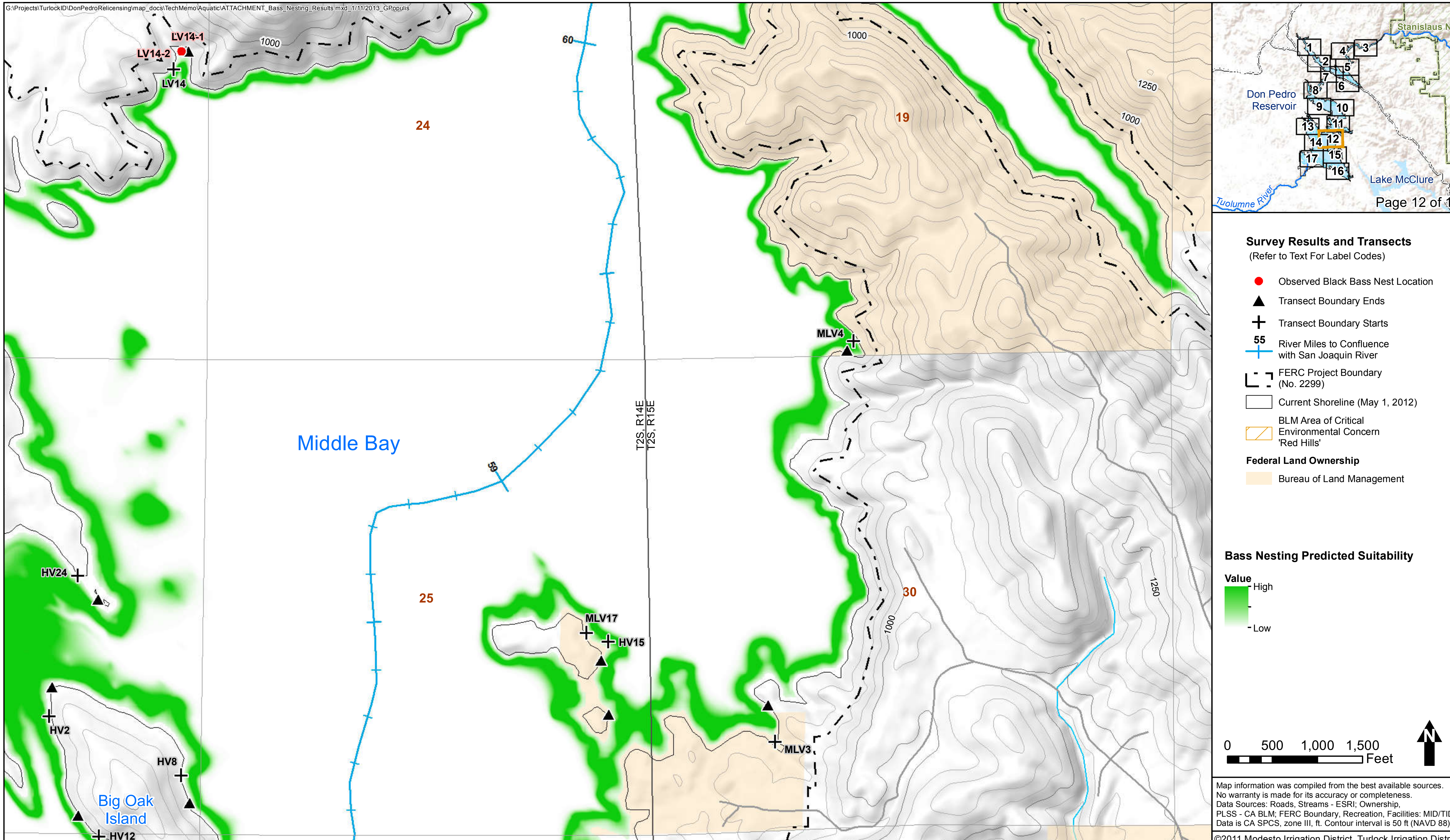
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LV14-1
LV14-2
LV14
1000
60
24
19
1000
1250
1000
Middle Bay
T2S, R14E
T2S, R15E
59
MLV4
HV24
25
30
MLV17
HV15
1000
1250
HV2
HV8
MLV3
Big Oak Island
HV12
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Page 12 of 17
Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
55
River Miles to Confluence with San Joaquin River
FERC Project Boundary (No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical Environmental Concern 'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0 500 1,000 1,500
Feet
N
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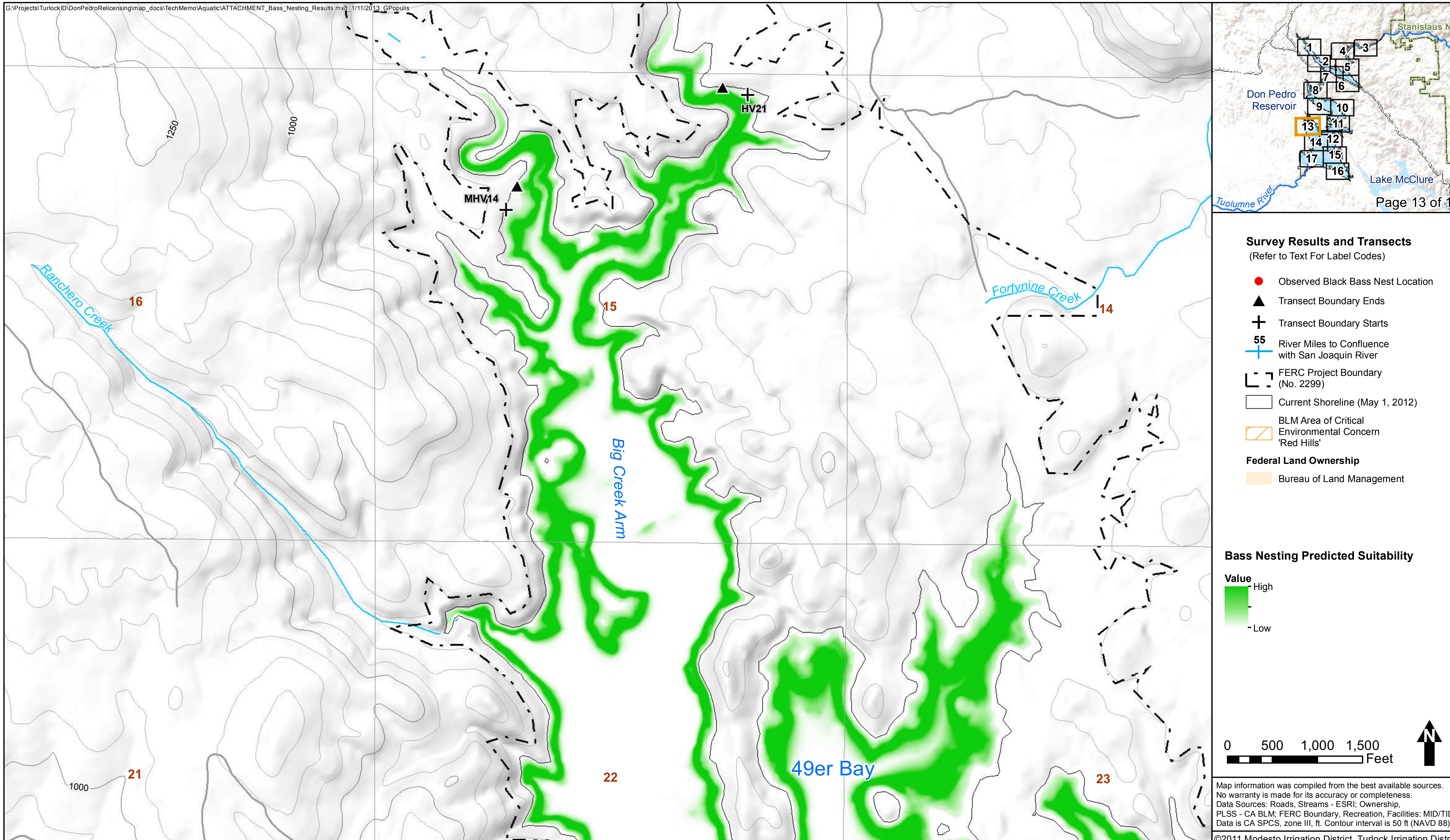
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MHV14
HV21
1250
1000
Ranchero Creek
16
15
14
Fortynine Creek
Big Creek Arm
21
22
23
49er Bay
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
Page 13 of 17
Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
55
River Miles to Confluence with San Joaquin River
FERC Project Boundary (No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical Environmental Concern 'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0 500 1,000 1,500
Feet
N
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PLSS - CA BLM; FERC Boundary, Recreation, Facilities: MID/TID.
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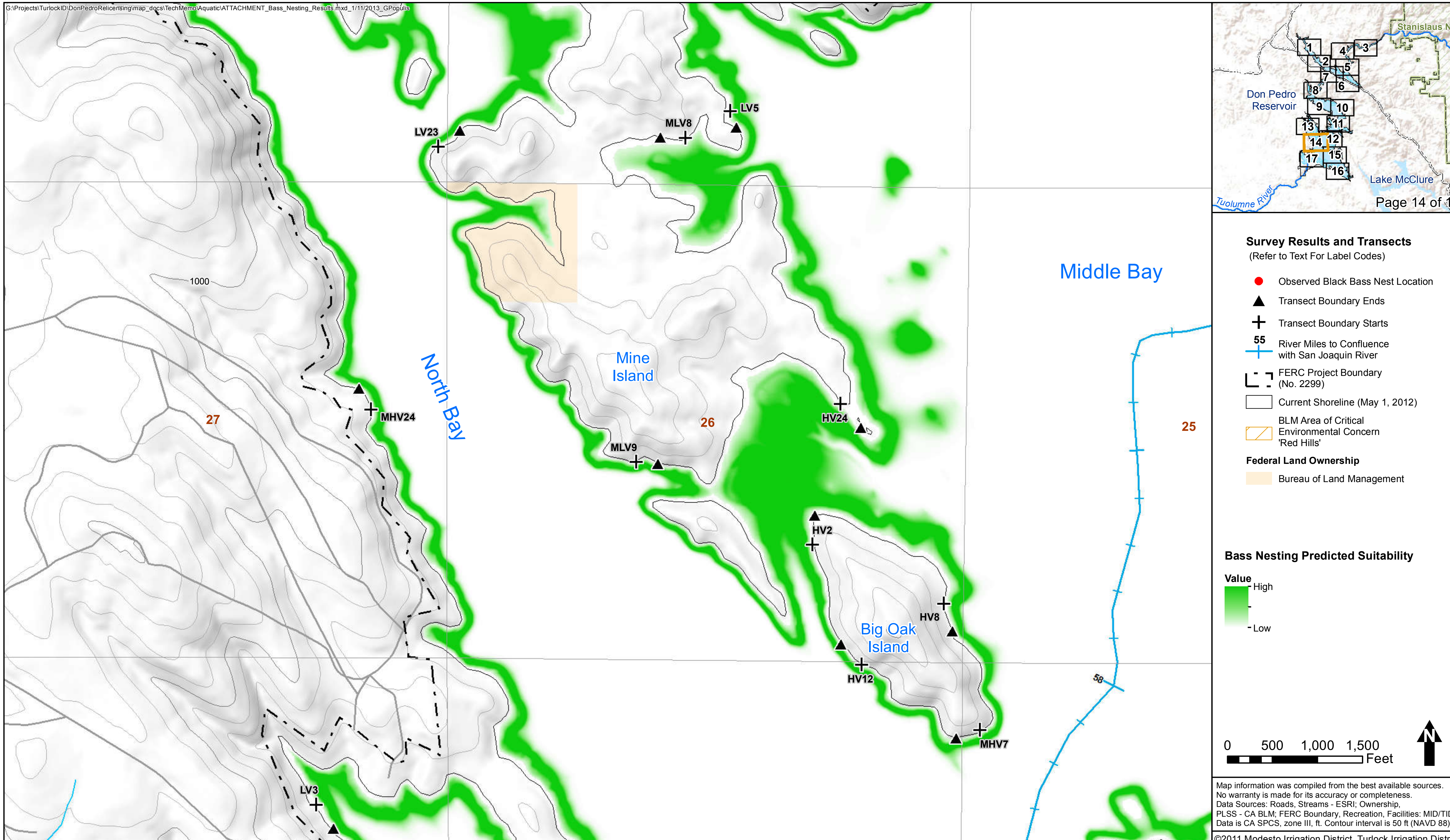

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LV23
MLV8
LV5
1000
Mine Island
North Bay
Middle Bay
MHV24
27
26
25
MLV9
HV24
HV2
HV8
Big Oak Island
HV12
MHV7
58
LV3
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Page 14 of 17
Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
55
River Miles to Confluence with San Joaquin River
FERC Project Boundary (No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical Environmental Concern 'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0
500
1,000
1,500
Feet
N
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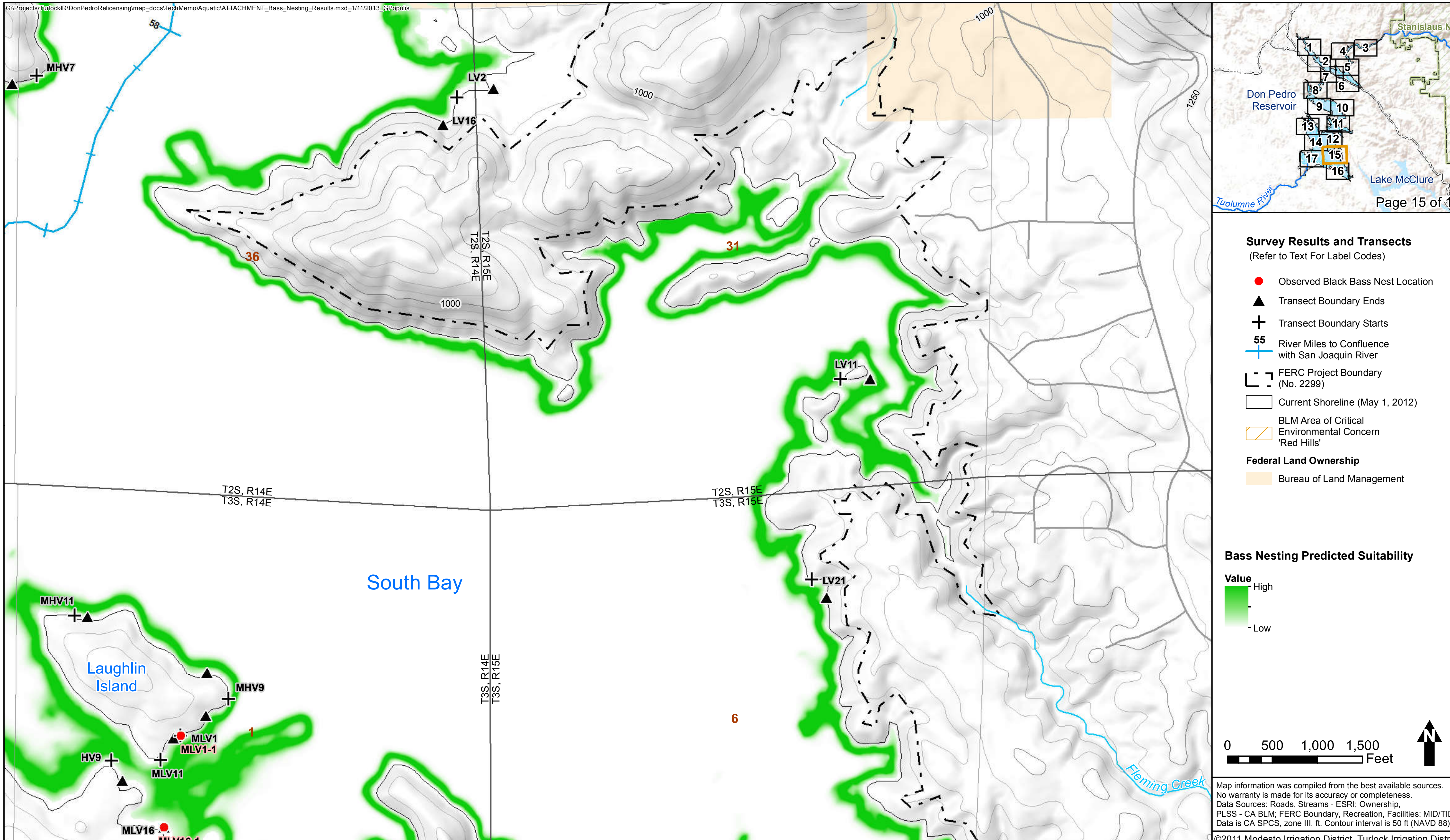
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58
MHV7
LV2
LV16
1000
1250
36
31
T2S, R15E
T2S, R14E
T2S, R14E
T3S, R14E
T2S, R15E
T3S, R15E
T3S, R14E
T3S, R15E
LV11
LV21
South Bay
MHV11
Laughlin Island
MHV9
MLV1
MLV1-1
HV9
MLV11
MLV16
MLV16-1
1
6
Fleming Creek
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Page 15 of 17
Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
55
River Miles to Confluence with San Joaquin River
FERC Project Boundary (No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical Environmental Concern 'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0 500 1,000 1,500 Feet
N
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PLSS - CA BLM; FERC Boundary, Recreation, Facilities: MID/TID.
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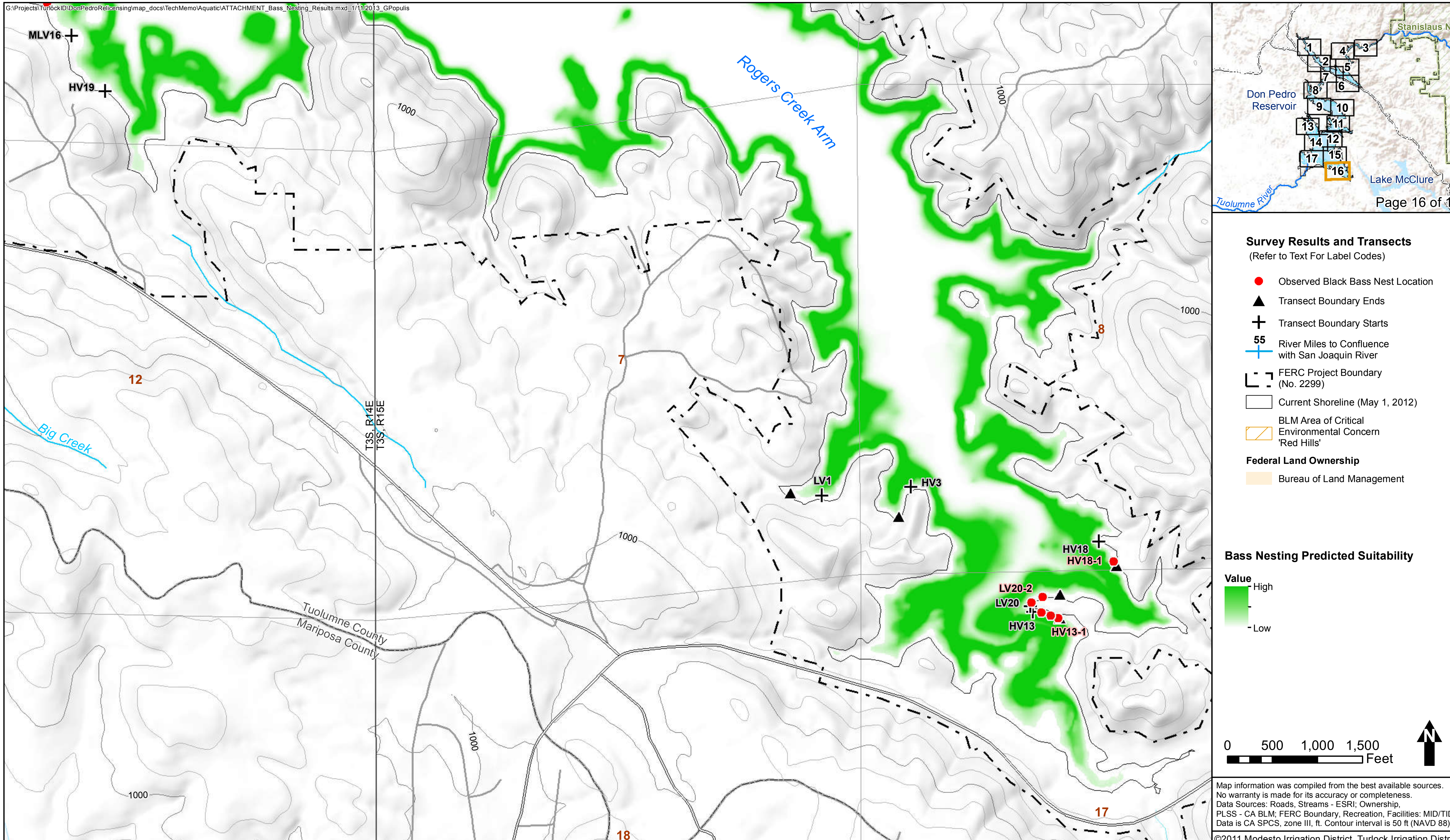

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MLV16
HV19
Rogers Creek Arm
Big Creek
T3S, R14E
T3S, R15E
Tuolumne County
Mariposa County
1000
12
7
8
17
18
LV1
HV3
HV18
HV18-1
LV20-2
LV20
HV13
HV13-1
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
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Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
55
River Miles to Confluence with San Joaquin River
FERC Project Boundary (No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical Environmental Concern 'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0 500 1,000 1,500
Feet
N
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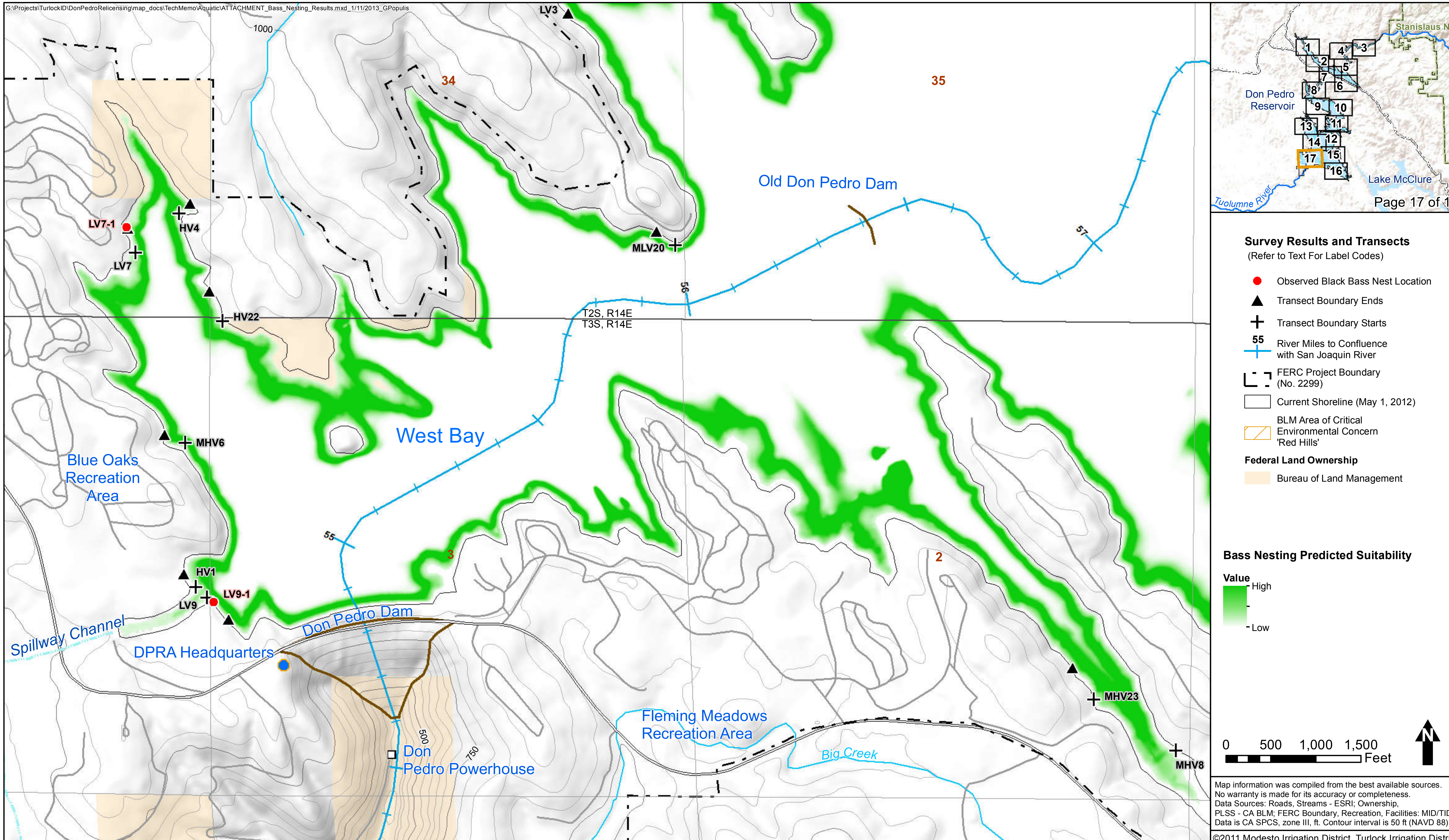

G:\Projects\TurlockID\DonPedroRelicensing\map_docs\TechMemo\Aquatic\ATTACHMENT_Bass_Nesting_Results.mxd_1/11/2013_GPopulis
Old Don Pedro Dam
West Bay
Blue Oaks Recreation Area
Spillway Channel
DPRA Headquarters
Don Pedro Dam
Don Pedro Powerhouse
Fleming Meadows Recreation Area
Big Creek
T2S, R14E
T3S, R14E
LV3
MLV20
HV4
LV7-1
LV7
HV22
MHV6
HV1
LV9
LV9-1
MHV23
MHV8
34
35
3
2
55
56
57
1000
500
750
Stanislaus NF
Don Pedro Reservoir
Lake McClure
Tuolumne River
Page 17 of 17
Survey Results and Transects
(Refer to Text For Label Codes)
Observed Black Bass Nest Location
Transect Boundary Ends
Transect Boundary Starts
River Miles to Confluence with San Joaquin River
FERC Project Boundary (No. 2299)
Current Shoreline (May 1, 2012)
BLM Area of Critical Environmental Concern 'Red Hills'
Federal Land Ownership
Bureau of Land Management
Bass Nesting Predicted Suitability
Value
High
Low
0 500 1,000 1,500 Feet
N
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STUDY REPORT W&AR-17
RESERVOIR FISH POPULATION

ATTACHMENT B

BASS NESTING HABITAT SURVEY DATA

Table B-1. Summary of comparison of measured and modeled statistics describing bass nesting habitat in Don Pedro Reservoir.

	Distance (ft) From Random Sample Point To Survey Area	Average Percent Slope Based on Bathymetry Model	Average Percent Slope Calculated from Survey Transects
LV1	92	9.261111259	29.64912281
LV2	122	9.389296532	15.31100478
LV3	55	10.86377048	21.9924812
LV4	202	23.88143349	27.04678363
LV5	25	6.940048695	18.2748538
LV6	15	22.00548553	21.19883041
LV7	13	12.8448801	27.57309942
LV8	510	--	68.07017544
LV9	22	18.9151783	50.7518797
LV10	54	12.72452927	13.15789474
LV11	36	14.34134197	19.36090226
LV12	30	17.53594398	25.58479532
LV14	58	12.73394871	17.54385965
LV16	37	14.18078899	20.57416268
LV18	173	11.37833214	13.74269006
LV19	17	13.04664516	15.12303486
LV20	35	11.71995449	17.9244066
LV21	46	13.77182198	22.95321637
LV22	423	17.71149826	25.48358075
LV23	26	24.18478584	40.66985646
LV24	92	14.67205238	28.07017544
LV25	210	22.3139801	--
MLV1	750	19.43855286	17.34755687
MLV2	170	24.51216507	38.41655421
MLV3	22	17.95923805	37.28070175
MLV4	14	49.9507637	41.66666667
MLV5	93	18.35230064	27.45723489
MLV10	88	24.23433495	20.84795322
MLV11	564	12.14775467	14.23655292
MLV12	24	21.85465622	65.05847953
MLV13	300	8.763425827	13.3566482
MLV15	70	12.45050049	41.66666667
MLV16	182	7.029069424	7.596675034
MLV17	72	10.28205299	15.52287582
MLV18	102	35.46584702	43.10776942
MLV19	95	53.21976089	44.72488038
MLV20	2320	30.94618607	44.75238984
MLV21	13	35.31928635	78.94736842
MLV22	112	12.77369022	14.62962963
MLV23	26	28.00794601	46.60331384
MHV1	120	30.55106163	54.16666667
MHV2	110	24.28796577	29.54340981
MHV4	176	36.63057709	31.5612263
MHV6	76	17.920084	--
MHV7	126	22.69138908	24.66680267
MHV9	958	14.98862362	20.28508772
MHV10	117	43.63079834	70.1754386
MHV11	168	13.76362896	21.66483402

	Distance (ft) From Random Sample Point To Survey Area	Average Percent Slope Based on Bathymetry Model	Average Percent Slope Calculated from Survey Transects
MHV12	62	18.57670212	33.84015595
MHV13	240	20.39792824	23.96616541
MHV14	100	6.558805466	8.798936998
MHV15	144	10.803339	8.760531787
MHV16	883	21.01062965	24.26948052
MHV17	186	37.55208588	45.60738969
MHV18	41	--	41.22807018
MHV19	200	35.48554993	61.35477583
MHV20	24	34.55274963	60.4288499
MHV23	190	16.28932762	23.0628655
MHV24	53	20.80405807	22.13868003
MHV25	92	31.80298424	240.3283851
HV1	208	10.27791214	13.99331662
HV2	454	14.72746849	19.36090226
HV3	185	15.67484474	24.24549135
HV4	140	21.70242119	23.60446571
HV8	214	13.98120499	26.81704261
HV9	183	10.65107536	15.12955643
HV11	88	22.7088089	27.2556391
HV12	65	28.49526596	31.53814769
HV13	506	26.92913437	21.21480171
HV14	314	9.649372101	21.14661654
HV15	210	10.12749863	16.83053788
HV16	107	15.86354065	30.26315789
HV17	170	27.65468025	29.70720111
HV18	244	13.66698837	18.84635832
HV21	351	16.865942	16.34099942
HV22	220	16.24079895	18.47265222
HV23	112	16.60954666	25.68922306
HV24	950	13.40922737	18.2748538
HV25	130	18.92339134	29.97873472

Table B-2. Comparison of bass nesting habitat survey measurements and bathymetry-based predictions of conditions at the transect sites evaluated during the Don Pedro Reservoir fish population survey, May 2012.

Site_ID	Date	Boundary1_Lat	Boundary1_Long	Boundary2_Lat	Boundary2_Long	StartDepthSuitability	EndDepthSuitability	DistShoreline	DistShorlineStart
HV1	5/11/2012	37.70158	-120.42781	37.70197	-120.42828	Low	Low	3	70
HV11	5/11/2012	37.9	-120.36028	37.79056	-120.36083	Low	Medium Low	52	
HV12	5/11/2012	37.72408	-120.39319	37.72472	-120.394	Low	Low	15	6
HV13	5/9/2012	37.68047	-120.34597	37.68029	-120.34496	Medium Low	Low	43	43
	5/9/2012	37.68047	-120.34597	37.68029	-120.34496	Medium Low	Low	41	42
	5/9/2012	37.68047	-120.34597	37.68029	-120.34496	Medium Low	Low	40	42
HV14	5/11/2012	37.82634	-120.33062	37.82681	-120.33131	Medium Low	Low	--	--
HV15	5/11/2012	37.73	-120.37361	37.72778	-120.37361	High	Low	30	140
HV16	5/11/2012	37.78917	-120.39639	37.788889	-120.39583	Low	Low	25	8
HV17	5/11/2012	37.85908	-120.39538	37.86024	-120.39452	Medium Low	High	33	59
HV18	5/9/2012	37.68261	-120.34345	37.68188	-120.34278	Low	Low	30	24
HV19	5/9/2012	37.69641	-120.38156	0	0	Low	Low	--	--
HV2	5/11/2012	37.72775	-120.39508	37.72864	-120.395	Low	Low	18	22
HV20	5/11/2012	37.81384	-120.41	37.81333	-120.40778	Low	High	--	--
HV21	5/23/2012	37.76691	-120.41265	37.76714	-120.41363	Low	Low	13	63
HV22	5/9/2012	37.70971	-120.42677	37.71061	-120.42731	Low	Low	30	33
HV23	5/11/2012	37.79278	-120.38028	37.79306	-120.38139	Low	Low	52	72
HV24	5/11/2012	37.73205	-120.3939833	37.73131667	-120.3932167	Low	Low	19	18
HV25	5/23/2012	37.8374	-120.37765	37.83775	-120.37708	High	Low	13	75
HV3	5/9/2012	37.68431	-120.35065	37.68338	-120.35113	Low	Low	34	44
HV4	5/9/2012	37.71298	-120.42845	37.7133	-120.42804	Low	Low	15	45
HV8	5/11/2012	37.72594	-120.39003	37.72511	-120.38972	Low	Low	10	6
HV9	5/9/2012	37.70116	-120.38579	37.70055	-120.38538	Low	Low	50	74
LV1	5/9/2012	37.68404	-120.35407	37.68411	-120.35529	Low	Low	50	48
LV10	5/11/2012	37.79417	-120.38361	37.79417	-120.38389	Low	Low	9	8
LV11	5/11/2012	37.71277778	-120.3577778	37.71277778	-120.3566667	Low	Low	52	54
LV12	5/11/2012	37.80194	-120.41556	37.80194	-120.41472	Medium Low	Medium High	27	49
LV14	5/11/2012	37.7475	-120.3902778	37.74805556	-120.3897222	Medium Low	Low	28	23
	5/11/2012	37.7475	-120.3902778	37.74805556	-120.3897222	Medium Low	Low	--	--
LV16	5/11/2012	37.72138889	-120.3725	37.72055556	-120.3730556	Low	Low	35	20
LV17	5/11/2012	37.84336	120.36414	37.84413	-120.36445	Low	Medium High	--	--
LV18	5/11/2012	37.80417	-120.41528	37.80472	-120.41611	Low	Low	0	38
LV19	5/11/2012	37.74972	-120.34028	37.74944	-120.34111	Low	Low	32	15
LV2	5/11/2012	37.72139	-120.3725	37.72167	-120.37111	Low	Low	39	23
LV20	5/9/2012	37.68064	-120.34608	37.681	-120.34496	Low	Low	30	23
	5/9/2012	37.68064	-120.34608	37.681	-120.34496	Low	Low	--	--
LV21	5/11/2012	37.70666667	-120.3588889	37.70611111	-120.3583333	Low	Low	3	21
LV22	5/11/2012	37.84062	-120.355525	37.84049	-120.35584	High	Low	25	63
LV23	5/11/2012	37.73992	-120.40942	37.74042	-120.40861	Low	Low	17	6
LV24	5/11/2012	37.88882	-120.42009	37.88815	-120.41932	Low	Low	27	20
LV25	5/11/2012	37.89093	-120.42187	37.89162	-120.42229	Low	Low	2	15
LV3	5/11/2012	37.71983333	-120.4141333	37.7191	-120.4135	Low	Low	20	30
LV4	5/23/2012	37.76427	-120.36163	37.76422	-120.36246	Medium High	Low	15	51
LV5	5/11/2012	37.741	-120.3982167	37.7405	-120.398	Low	Low	10	63
LV6	5/11/2012	37.805	-120.41278	37.805	-120.41361	Low	Low	3	17
LV7	5/9/2012	37.71179	-120.43011	37.71254	-120.43044	Medium Low	Low	54	88
LV8	5/11/2012	37.88735	-120.41963	37.88677	-120.41908	Medium High	Low	3	60
LV9	5/11/2012	37.70125	-120.42739	37.70058	-120.42656	Low	Low	27	54
MHV1	5/11/2012	37.87963	-120.29251	37.88018	-120.29146	High	Low	2	83
MHV10	5/11/2012	37.81194	-120.39917	37.81167	-120.40028	Medium Low	Low	2	12
MHV11	5/9/2012	37.70559	-120.38721	37.70555	-120.38673	Low	Low	35	23

Site_ID	Date	Boundary1_Lat	Boundary1_Long	Boundary2_Lat	Boundary2_Long	StartDepthSuitability	EndDepthSuitability	DistShoreline	DistShorlineStart
	5/9/2012	37.70559	-120.38721	37.70555	-120.38673	Low	Low	--	--
MHV12	5/11/2012	37.87397	-120.40678	37.87353	-120.40705	Low	Low	2	50
MHV13	5/11/2012	37.79917	-120.39389	37.79889	-120.39417	Low	Low	10	20
MHV14	5/23/2012	37.76339	-120.42194	37.76411	-120.42154	Low	Low	22	31
MHV15	5/11/2012	37.79639	-120.37861	37.79667	-120.37833	Low	Low	15	3
MHV16	5/11/2012	37.87368	-120.29923	37.87381	-120.29977	Medium High	Low	12	25
MHV17	5/11/2012	37.85747	-120.33456	37.85818	-120.33511	High	Medium Low	13	53
MHV18	5/11/2012	37.75917	-120.35917	37.75944	-120.35833	Low	Medium Low	17	5
MHV19	5/11/2012	37.87767	-120.29436	37.87703	-120.29482	High	High	130	120
MHV2	5/11/2012	37.84554	-120.3711	37.84633	-120.3718	Medium High	Low	10	125
MHV20	5/23/2012	37.8302	-120.38377	37.83107	-120.38343	Low	Medium Low	12	120
MHV23	5/23/2012	37.6981	-120.3933	37.69907	-120.39413	Low	Low	15	15
MHV24	5/11/2012	37.731889	-120.412028	37.73253	-120.4125	Low	Low	5	3
MHV25	5/11/2012	37.87112	-120.33813	37.87063	-120.33851	High	Low	22	53
MHV3	5/11/2012	0	0	37.79361	-120.37	Low	Low	--	--
MHV4	5/11/2012	37.8597	-120.3995	37.86017	-120.40015	Low	Low	0	130
MHV5	5/11/2012	37.80333	-120.41611	37.80472	-120.41611	Low	Low	--	--
MHV6	5/11/2012	37.70597	-120.42822	37.70622	-120.42903	High	Low	6	93
MHV7	5/11/2012	37.72208	-120.38864	37.72183	-120.38958	Low	Low	13	10
MHV8	5/23/2012	37.69654	-120.39015	37.64746	-120.39104	Low	Low	--	--
MHV9	5/9/2012	37.70303	-120.38131	37.70384	-120.38213	Low	Low	42	4
MLV1	5/9/2012	37.70192	-120.38314	37.70253	-120.38219	Low	Low	2	23
MLV10	5/11/2012	37.85303	-120.38203	37.85339	-120.38291	Low	Low	8	14
MLV11	5/9/2012	37.70118	-120.3839	37.70184	-120.38342	Low	Low	16	53
MLV12	5/11/2012	37.863	-120.40184	37.86369	-120.40266	High	Low	15	45
MLV13	5/11/2012	37.82223	-120.32206	37.822244	-120.32304	Low	Low	48	53
MLV15	5/11/2012	37.82417	-120.38556	37.82417	-120.38583	Low	Low	26	12
MLV16	5/9/2012	37.69811	-120.38285	37.69913	-120.38378	Low	Low	64	74
MLV17	5/11/2012	37.73028	-120.37444	37.72944	-120.37389	Low	Low	20	28
MLV18	5/11/2012	37.85062	-120.33607	37.84993	-120.3368	Medium Low	Low	3	32
MLV19	5/23/2012	37.83361	-120.3783	37.83377	-120.37779	High	Medium High	38	66
MLV2	5/11/2012	37.87437	-120.40719	37.87386	-120.40777	Low	Low	1	17
MLV20	5/11/2012	37.712	-120.40936	37.71242	-120.41011	Low	Low	4	20
MLV21	5/11/2012	37.7675	-120.35972	37.76667	-120.36	Medium High	Low	10	30
MLV22	5/11/2012	37.82438	-120.32212	37.82469	-120.32316	Low	Low	22	30
MLV23	5/11/2012	37.87544	-120.33269	37.87485	-120.33283	High	Medium High	34	50
MLV3	5/11/2012	37.72694	-120.36722	37.72806	-120.3675	Low	Low	3	42
MLV4	5/11/2012	37.73917	-120.36417	37.73889	-120.36444	High	Medium High	40	47
MLV5	5/11/2012	37.84631	-120.35906	37.8467	-120.36003	Low	Low	24	43
MLV6	5/11/2012	37.79806	-120.3875	37.79833	-120.38806	Low	Low	--	--
MLV8	5/11/2012	37.74018333	-120.3999333	37.7402	-120.4009167	Low	Low	--	--
MLV9	5/11/2012	37.73028	-120.40183	37.73022	-120.40103	Low	Low	--	--