

What's Happening at MMWD

Krishna Kumar, General Manager

Northbay Watershed Association

March 2, 2018



**MARIN MUNICIPAL
WATER DISTRICT**



- **Water Supply** – Krishna Kumar, General Manager
- **Dam Safety** – Michael Ban, Environmental & Engineering Services Division Manager



- Established **1912**
- **245** employees
- **62,000** connections
- Serve **187,000** people
- **147** square mile service area
 - San Rafael, Mill Valley, Fairfax, San Anselmo, Ross, Larkspur, Corte Madera, Tiburon, Belvedere, Sausalito, County



Alpine Lake



- **7** reservoirs
- **2** surface water treatment plants
 - San Geronimo
 - Bon Tempe
- **900** miles pipe
- **1** recycled water plant
- **21,000** acres watershed
- Recreation
 - **130** miles hiking
 - **73** miles biking

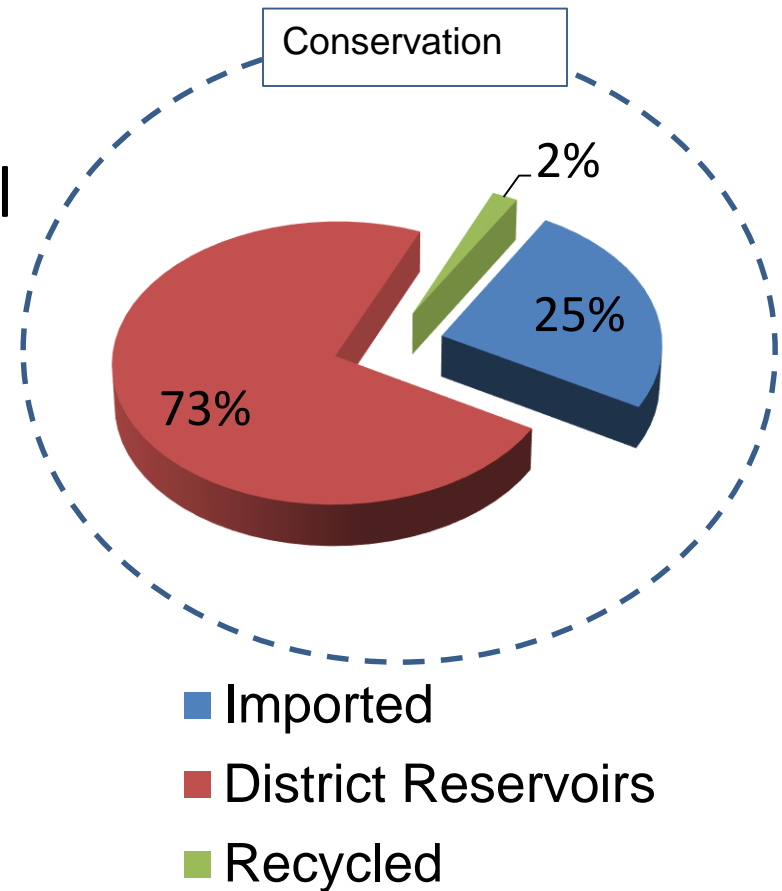


Bon Tempe Treatment Plant



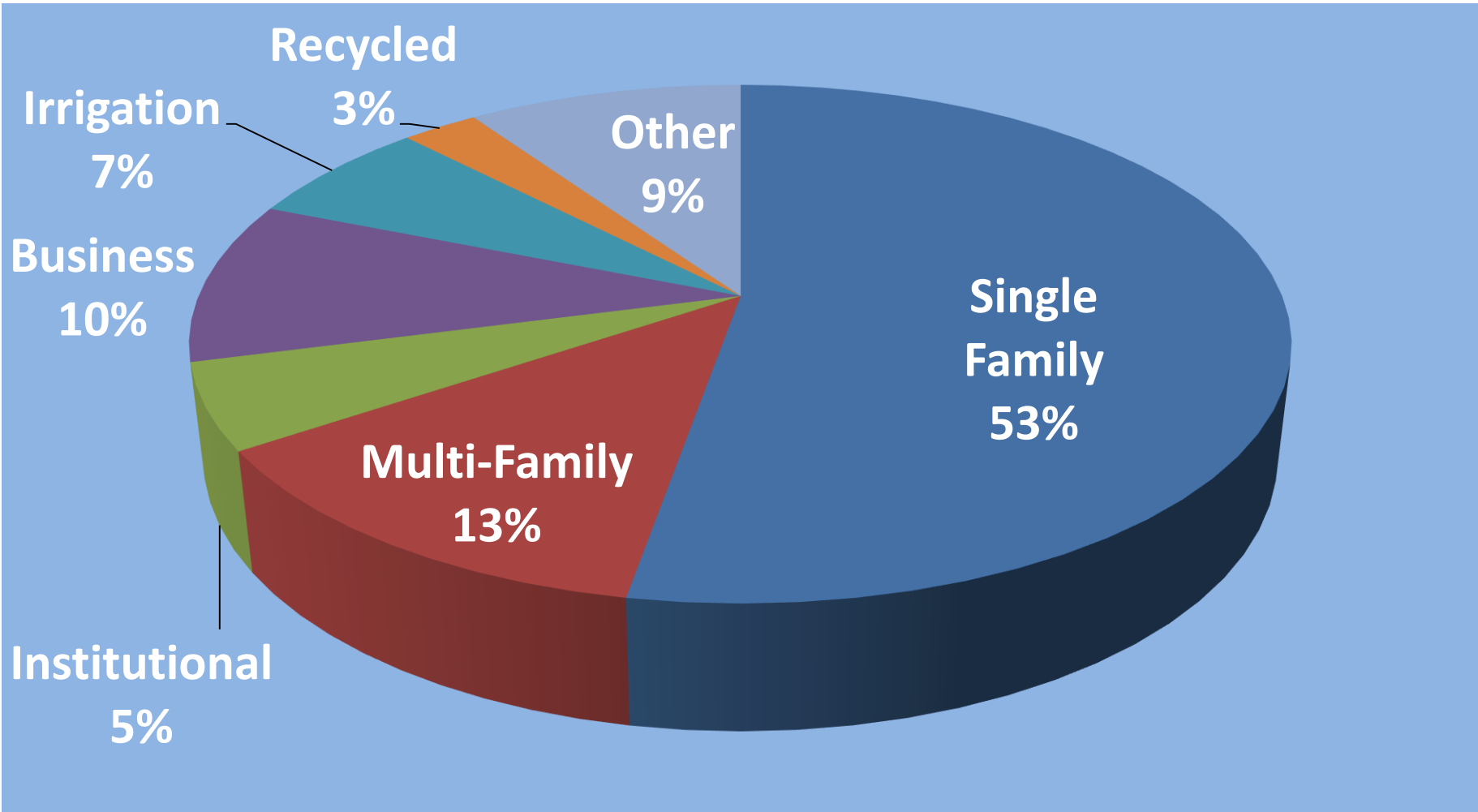
Water Supply

- Multiple sources provide better reliability & operational flexibility
- FY 2016-2017
 - Provided **23,000 AF** for domestic use
 - Provided **7,400 AF** for fish habitat (**24%** of total water provided)



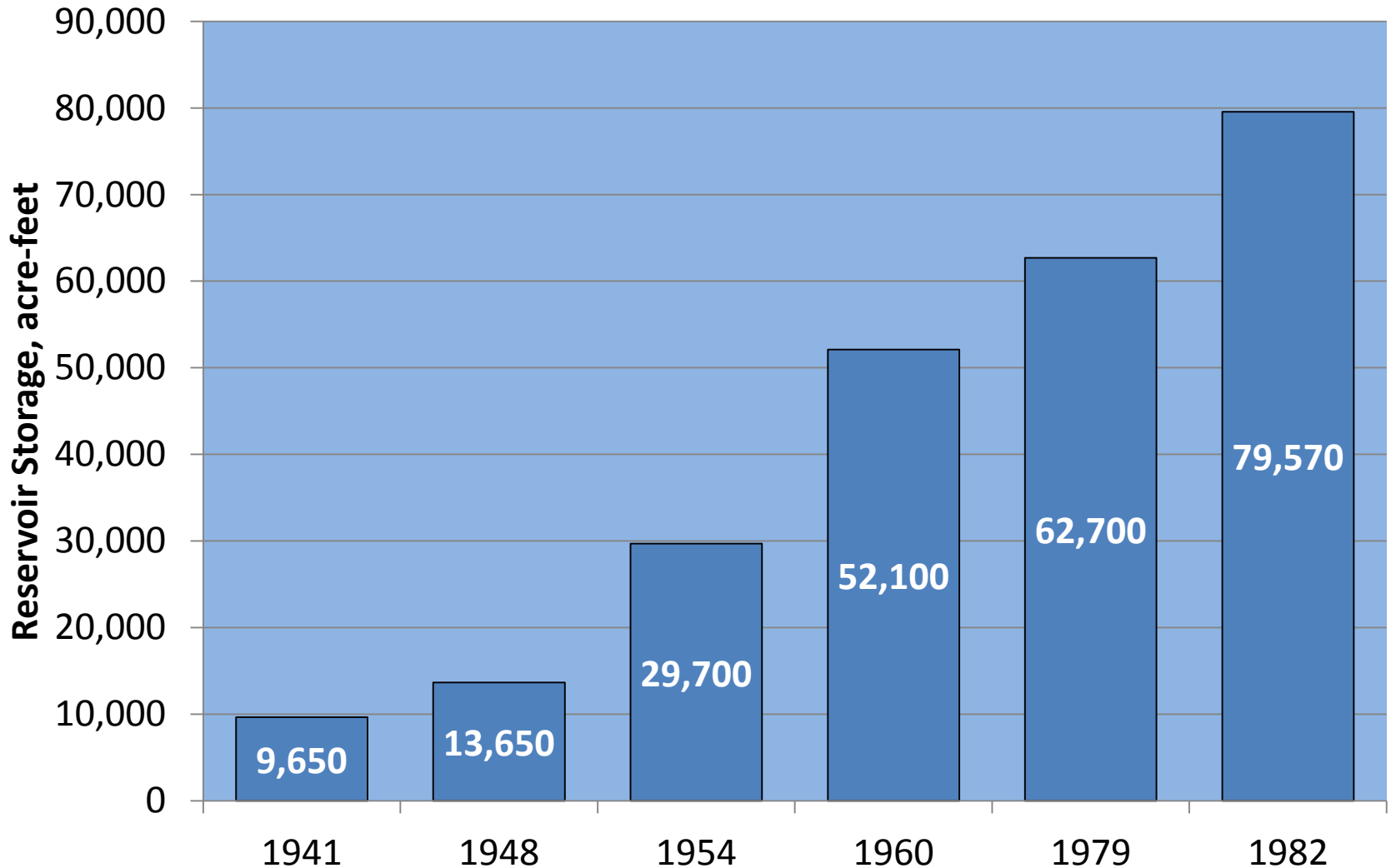


How Is Our Water Used?



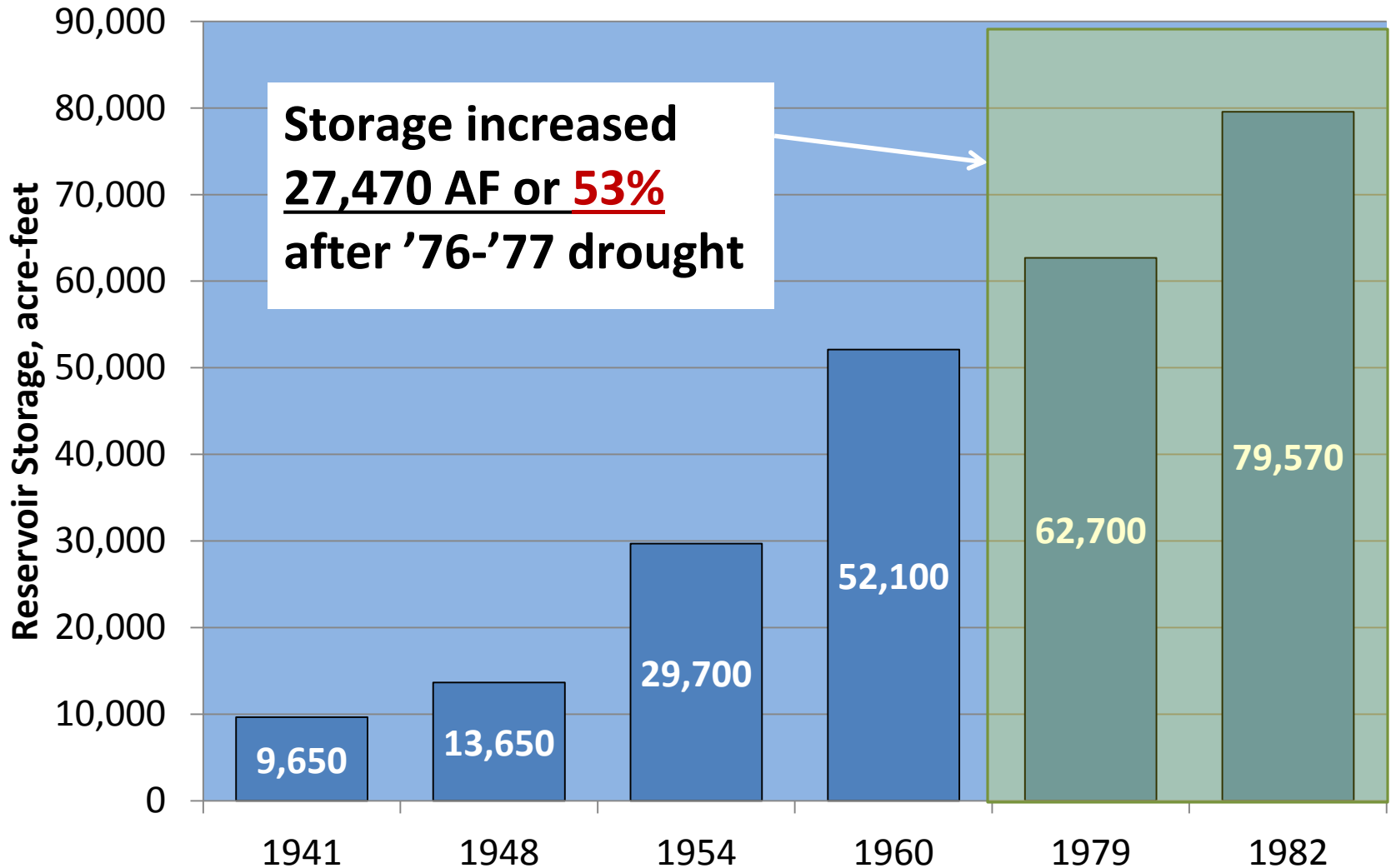


Reservoir Storage Development





Reservoir Storage Development





Actions Taken Since 76-77

Drought

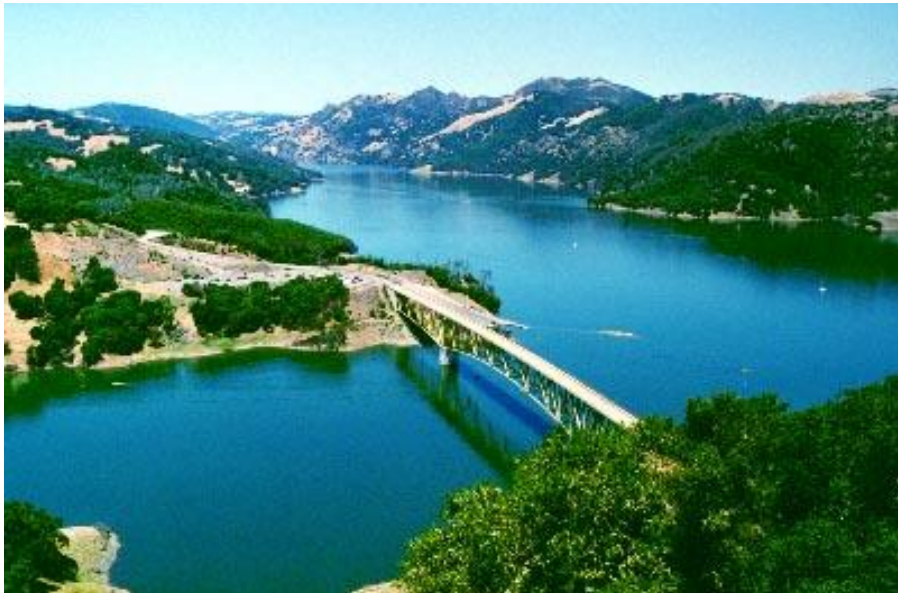
- Built Soulajule ('79), added **10,600 AF** of storage
- Expanded Kent ('82), added **16,900 AF** of storage
- Recycled water program ('81), save **600 AF/yr**
- Aggressive conservation program & conservation-oriented rate structure ('93)
- Increased SCWA supply available to MMWD by **10,000 AF**



Actions Taken Since 76-77

Drought cont'd

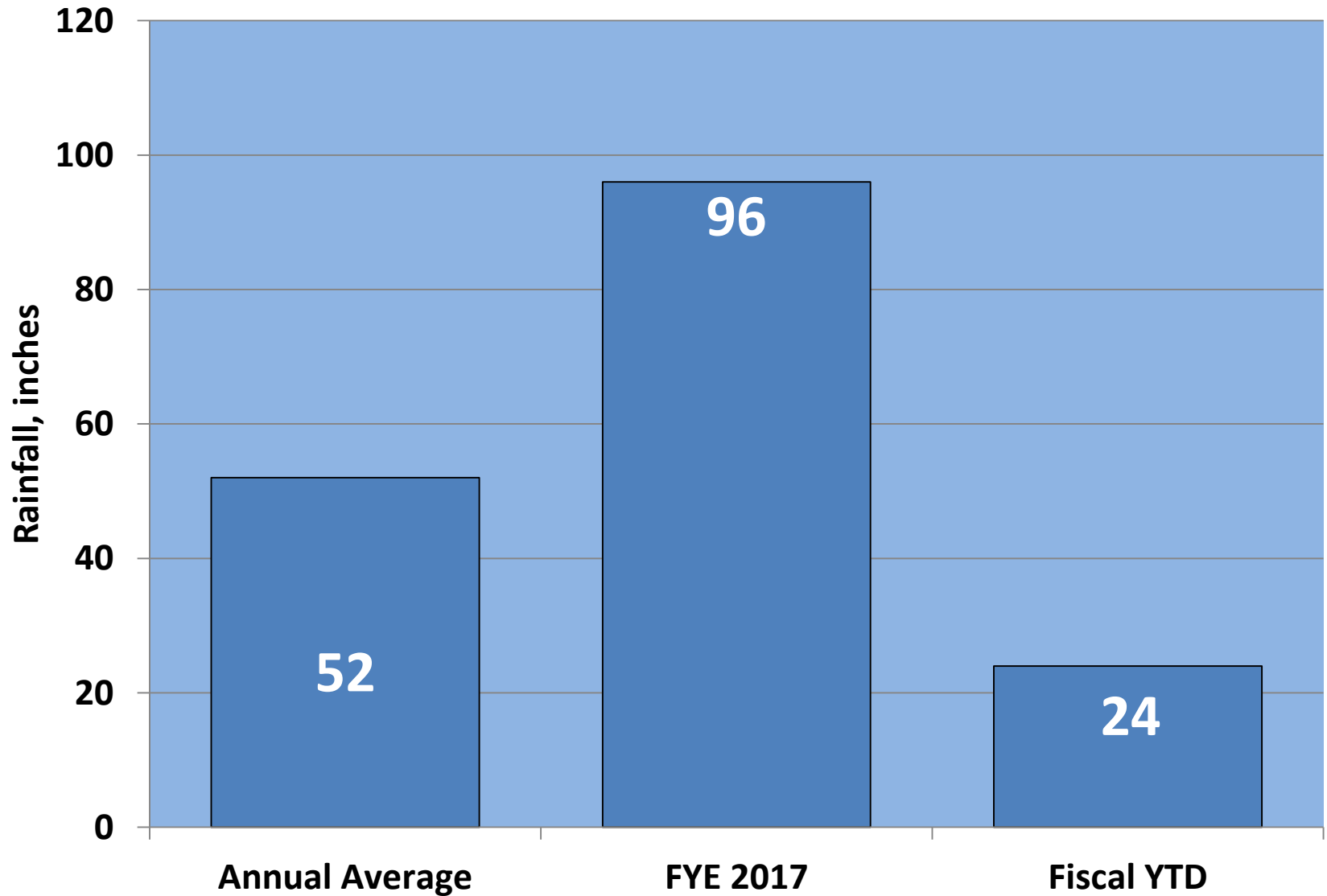
- SCWA built Lake Sonoma ('84)
- Water supply pool = **245,000 AF**
- Current annual consumption = **41,000 AF/yr**
- Peak annual consumption = **67,000 AF/yr**
(2004)



*Conveyance
challenges remain*

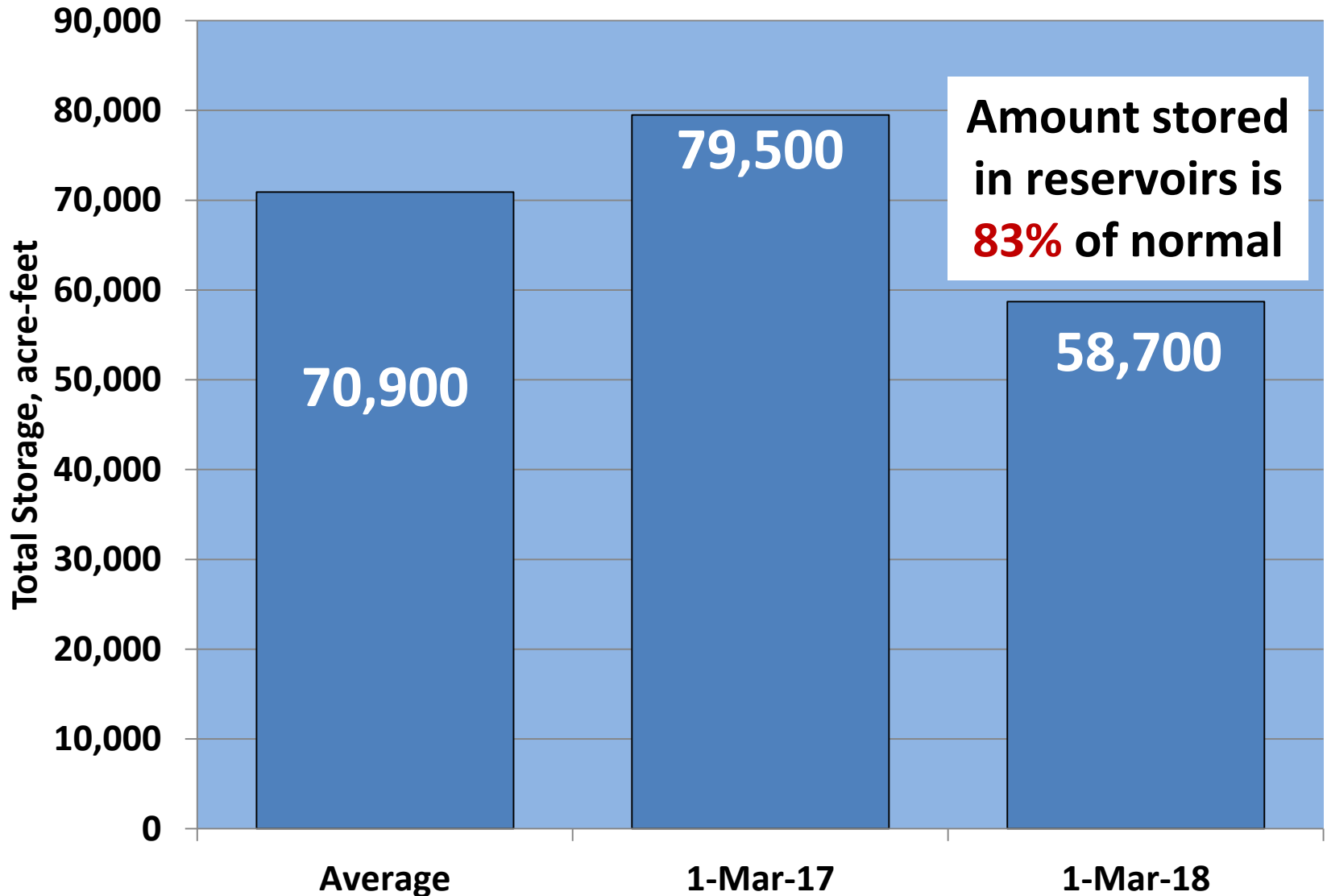


MMWD Rainfall Data





Amount Stored in MMWD Reservoirs on March 1





- Optimizing use of imported water supply
 - MMWD has unique ability to import water during shoulder months
- Inter-agency agreement with North Marin to backfeed Stafford Lake (March 6)
 - Utilized in 1988, 1989, 1991, 2009, 2014
- Early start of recycled water system
 - Subject to demand

Dam Safety at MMWD

**Michael Ban, Environmental & Engineering
Services Division Manager**





Dam Safety in California

- Division of Safety of Dams (DSOD) regulates 1,250 dams in CA





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- St. Francis Dam
 - Primary water source for growing LA area
 - Built 1926 near Saugus
 - 175 feet high, 38,000 AF of storage



St Francis Dam

- March 12, 1928
 - AM: Mulholland inspects leak in west abutment
 - 11:30 PM water level begins to drop
 - Midnight: dam fails catastrophically, releasing 140-foot flood wave
- 1929 State creates Dam Safety Program



Dam failed due to defective foundation



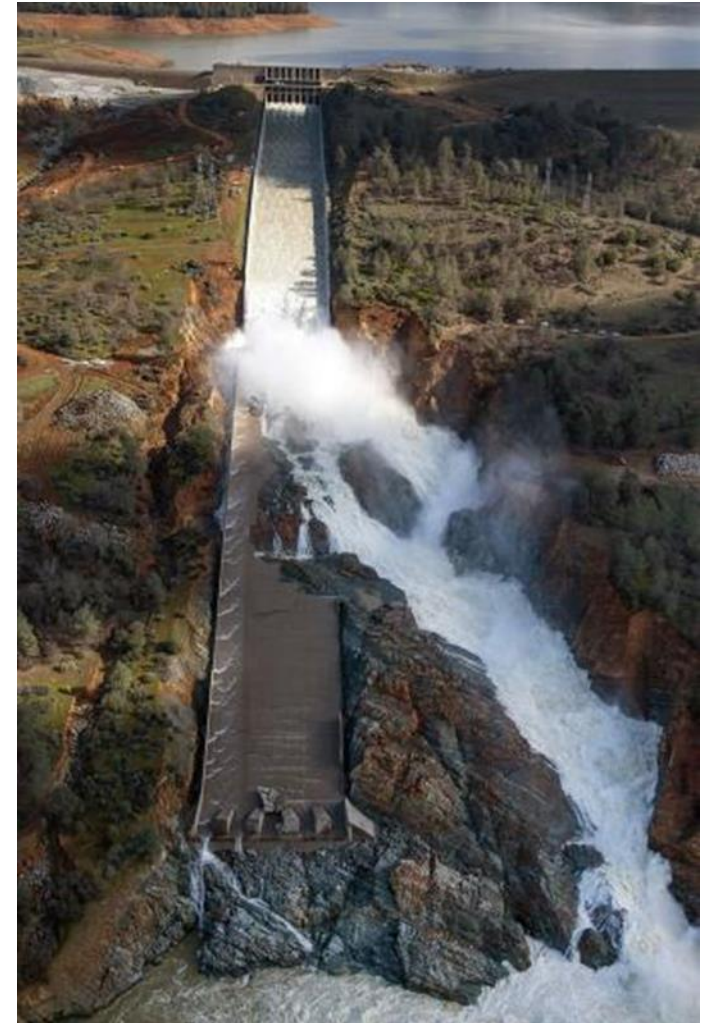
MARIN MUNICIPAL
WATER DISTRICT

Oroville Dam Spillway Incident





- Feb 7, 2017: spillway chute fails while releasing 52,000 cfs, gates closed
- Feb 8-10: chute inspected, intermittent flow released
- Feb 10-11: flow at 55,000 cfs
- Feb 11: water flows over emergency spillway
- Feb 12: severe erosion, flow raised to 100,000 cfs





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Oroville Dam Spillway Incident



Emergency Overflow Spillway Weir

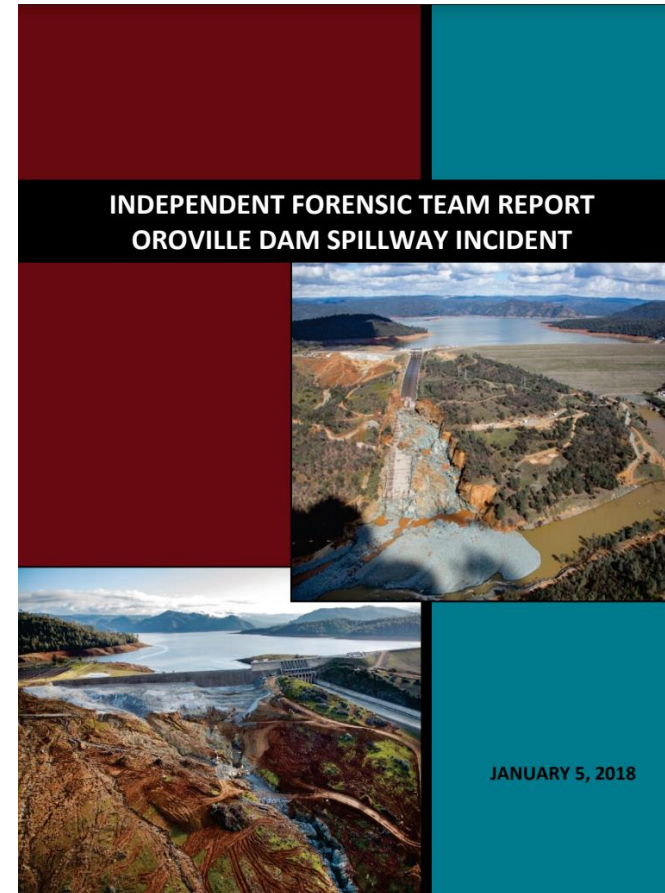
Lake Oroville

Photo of erosion taken on
February 13, 2017



- Feb 12: evacuation orders issued for 188,000
- Feb 12-16: flow through spillway raised to 100,000 cfs
- Feb 14: evacuation order changed to warning
- March 19: evacuation order lifted
- May 19: gates closed on spillway for reconstruction

- No single root cause
- Design did not fit site conditions
 - Site issues raised in geology reports not addressed
- Chute cracking and high underdrain flows declared “normal”
- Progressive deterioration of concrete and corrosion of steel over 50 years





- June 2017: Governor orders review of 93 spillways statewide (reservoirs > 10,000 AF of storage)
- 3 MMWD spillways impacted
 - Kent, Alpine and Soulajule
 - State accepted MMWD workplan in August 2017
 - Evaluation to be completed early summer



- Approved by Governor on 2/26/18
- Inspect “high” hazard dams yearly, “low” hazard dams every two years
- Annually operate critical outlet features
- Inspection reports to be public records



- DSOD revise dam safety protocol by **1/1/2019** in consultation with experts:
 - Review original design, construction, geotech, hydraulic data and overall dam performance
 - Review protocol every 10 years
 - Incorporate recommendations of Oroville Independent Team Report

MMWD's Dam Safety Program

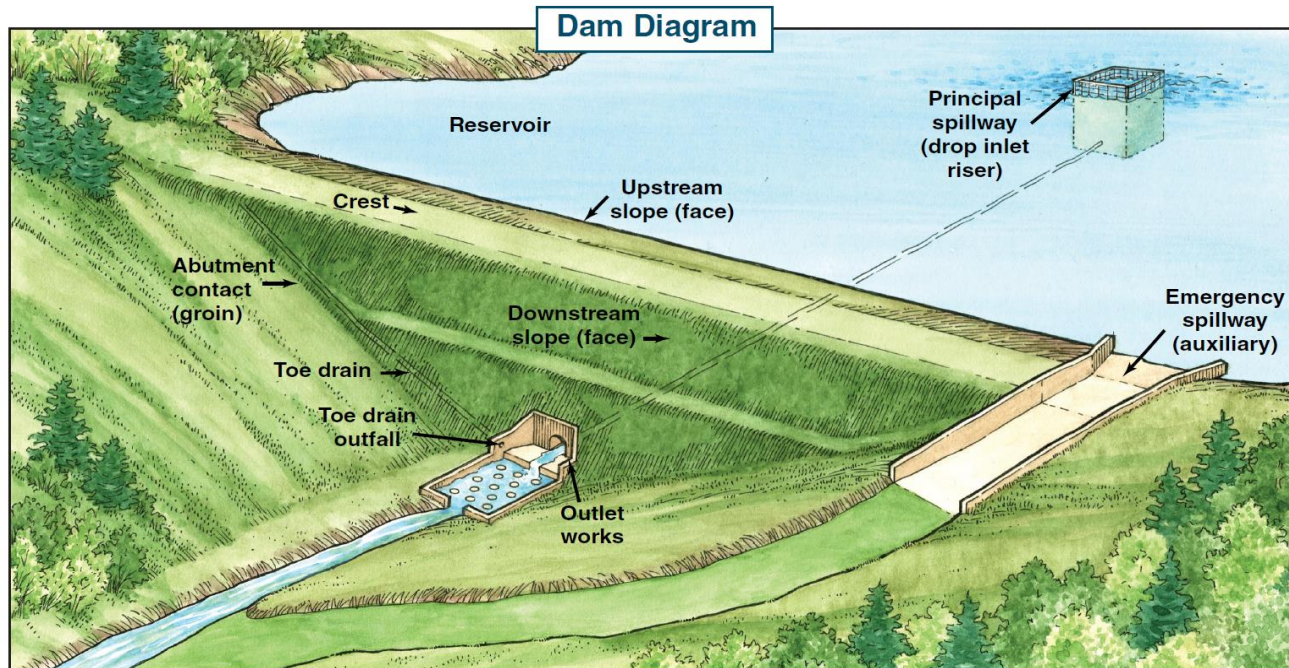




- Monitoring
 - Instruments track water seepage, dam movement, water pressure
 - Frequent inspections of each dam by technicians, rangers and water quality personnel
- Inspections and maintenance
 - On-going maintenance activities & capital improvements
 - Annual instrumentation report provided to DSOD
- Annual inspections by **DSOD**



DSOD Annual Inspections



- Spillways examined for vegetation, cracks
- Vegetation management
- Critical appurtenances operating and exercised every six months
- Emergency access is in good condition



DSOD Annual Inspections

- MMWD posts all DSOD inspection reports on website

STATE OF CALIFORNIA
CALIFORNIA NATURAL RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Alpine Dam No. 33 County Marin
 Type of Dam GRAV Type of Spillway Eight siphons
 Water is 1 feet above the spillway crest and 7.0 feet below the dam crest.
 Weather Conditions Moderate to heavy rain
 Contacts Made Lucy Croy, Trinity Leonard, and Ronnie Chasteen during the inspection
 Reason for Inspection Periodic evaluation

Important Observations, Recommendations or Actions Taken

Woody and tall non-woody vegetation has been cleared from along both downstream groins as requested.

The dam galleries were not entered during this inspection, and were last inspected in June of 2013. The owner should make arrangements to allow for inspection of the galleries during the next periodic inspection.

The plunge pool below the outlet conduit Tee outfall is susceptible to erosion and should be armored with concrete stabilized large-boulder riprap.

Conclusions

From the known information and visual inspection, the dam, reservoir, and the appurtenances are judged safe for continued use.

Observations and Comments

<u>Dam</u>	The visible portions of the upstream face, crest, downstream face, and abutments are in satisfactory condition, with no indication of surficial distress or instability. Minor cracks and offsets appear unchanged from that reported in previous inspection reports. Vegetation control is satisfactory, and woody and tall non-woody vegetation have been cleared from both downstream groins.
<u>Galleries</u>	The galleries are considered a confined space requiring qualified and trained personnel for access and inspection, and were not entered during this inspection; the galleries were inspected by David Borger on July 28, 2009, and by Jim Lowe on June 26, 2013. The galleries should be inspected during the next periodic inspection.
<u>Spillway</u>	The spillway approach was open and clear. A polyethylene log boom was in place several dozen yards upstream of the dam. Approximately 1.0' of water was flowing through the two spillway gates; the spillway siphon was not flowing. The current design storm, prepared in 1982, is for a 170,000 year return period producing 9475 cfs (~929 cfs / sq mi) from the 10.2 square mile drainage area. The spillway capacity is ~9770 cfs which is slightly greater than the peak inflow. Total freeboard is 8 feet and the residual freeboard for the design storm is 2.3 feet. Freeboard is satisfactory.
<u>Outlet</u>	The 125-foot tall dry outlet tower has inlets at five different elevations. The upper most inlet at elevation 626' is controlled with a 24-inch slide gate mounted outside of the tower; the remaining four inlets at elevations 595', 567.5', 540', and 530.75' are controlled with externally mounted 18-inch slide gates. Each of the five slide gate valves outside of the tower has an equivalent sized gate valve within the dry portion of the tower.

Photos taken? Yes No
 cc for Owner/Book

Inspected by J. Lowe
 Date of Inspection 8 February 2017
 Date of Report 21 February 2017

Sheet 1 of 3

Thank you!



**MARIN MUNICIPAL
WATER DISTRICT**