

# Best Practices for Road Weather Management

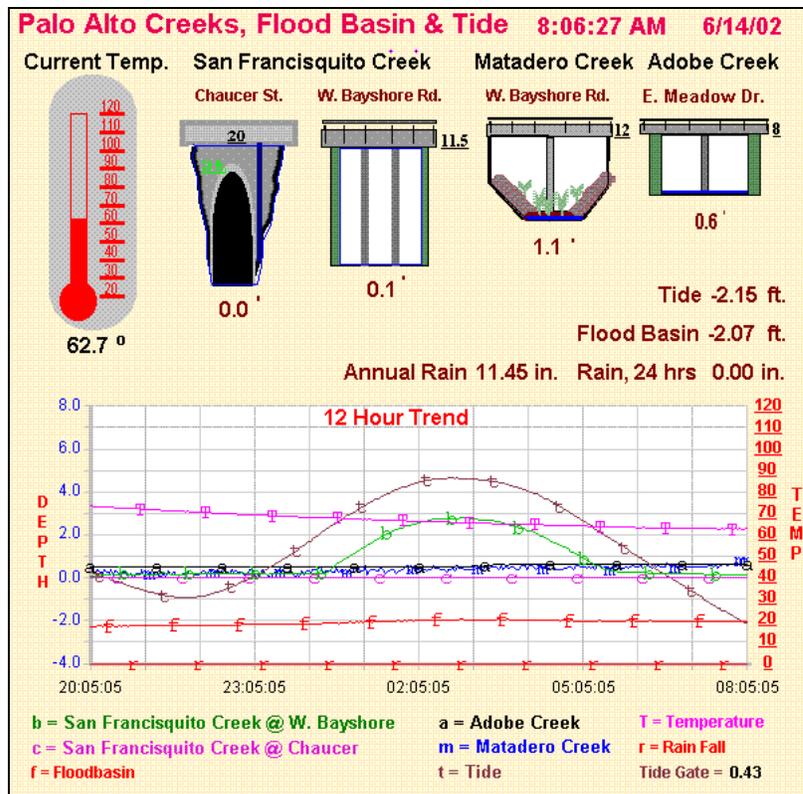
## City of Palo Alto, California Flood Warning System

In February 1998 several days of heavy rainfall caused the San Francisquito creek to overflow its banks flooding the City of Palo Alto, California. City residents and emergency managers had no advanced warning of the flood. This event prompted the City to develop a flood warning system. This web-based system has become an integral part of the City's emergency management operations. When flood conditions exist, emergency managers utilize automated surveillance techniques to supply information to the public.

**System Components:** Water level sensors, a rain gauge, flood basin detectors, tide monitors, and a Closed Circuit Television camera are used to assess field conditions. Ultrasonic sensors were installed at five bridge locations to detect high water or flood conditions. The ultrasonic water level sensors use acoustics or sound waves to measure the distance from a transducer to the water surface. Water level readings are transmitted to the water, gas, and storm drain Supervisory Control and Data Acquisition (SCADA) system via the City's telephone and radio communication networks. A Digital Subscriber Line transmits still video images from one bridge site to the Emergency Operations Center (EOC).

**System Operations:** Real-time and historical water level data and video images are posted on the City's "Creek Level Monitor" web site for viewing at the EOC and by Palo Alto residents. Current water level, 12-hour water level trend, 24-hour rainfall, annual rainfall, current temperature, and tidal data are updated every minute on the SCADA system computer and posted on the server for website updates every three minutes.

Emergency managers access this information to plan response actions and to alert residents. In the event of a flood threat, an automatic telephone warning system at the EOC dials all City residents and businesses in threatened areas to advise of potential flood conditions.



**"Creek Level Monitor" Web Site**  
([www.city.palo-alto.ca.us/earlywarning](http://www.city.palo-alto.ca.us/earlywarning))

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*Transportation Outcome:* Prior to installation of the flood warning system, emergency management personnel traveled to bridge locations to visually monitor the storm drain system and physically check water levels. Drain system status and water level readings were radioed to the EOC every 20 minutes. By eliminating the need for field measurements, the monitoring system has enhanced the productivity of City staff and provided timely access to traveler information to improve public safety. City residents may utilize information to make travel and safety decisions.

*Implementation Issues:* The warning system project was initiated due to resident complaints following the 1998 flood. The Public Works Operations department conducted a study of the City's bridge locations and wireline communication systems, assessed sensor technologies, and deduced that water level sensors could be deployed and integrated with the existing SCADA system. Non-intrusive sensors were selected over other technologies (e.g., pressure transmitters, bubblers, floats) due to concerns about floating or submerged debris that could damage equipment placed in the creeks.

The original intent of the system was to furnish emergency managers with precipitation and hydrologic data, which would serve as decision support for providing information to the public. After determining hardware, software, and interface requirements system designers decided to add the web-based information dissemination feature to better serve city residents.

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*References:*

- Kulisch, E., "System Monitors Flood-prone Creeks", [www.civic.com/civic/articles/2001/0122/web-flood-01-26-01.asp](http://www.civic.com/civic/articles/2001/0122/web-flood-01-26-01.asp)
- City of Palo Alto, "Creek Level Monitor Website: How Do We Do It?" <http://www.city.palo-alto.ca.us/earlywarning/how.html>.

*Keywords:* rain, flooding, flood warning system, emergency management, traveler information, advisory strategy, bridge, remote sensing, closed circuit television (CCTV), internet/website, safety, productivity