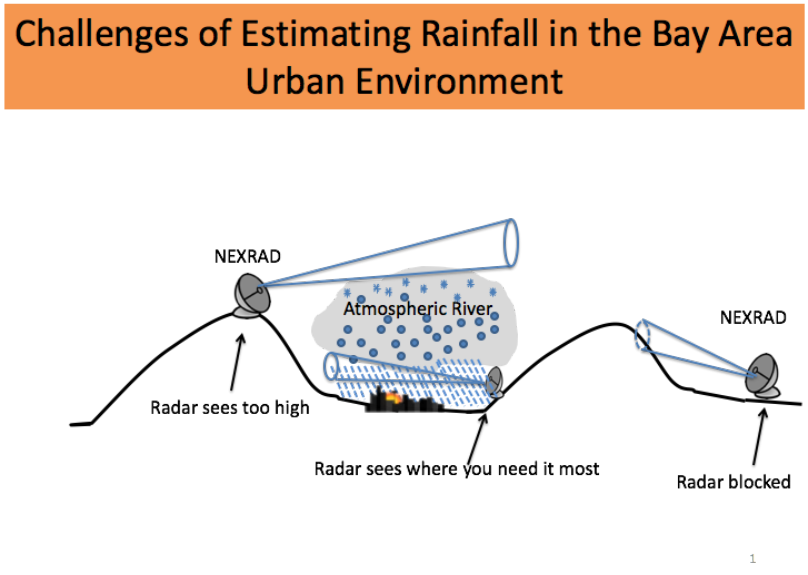
Q&A Highlights /
Notes from February 2018 Meetings

1. **How can I learn more about potential benefits of the AQPI system to the Bay Area?** NOAA's Lynn Johnson wrote a paper on the subject. You can download the study at: https://repository.library.noaa.gov/view/noaa/11186/noaa_11186_DS1.pdf? For the overview, here's a link to the Powerpoint Presentation: http://www.awra.org/meetings/Denver2015/doc/PP/powerpoint/Session%2080%20210%20Johnson.pdf
2. **What types of radar are currently in use in the Bay Area for weather prediction?** The NEXRAD or S-Band System is currently in use in the Bay Area. These radar systems were deployed throughout the US in the 1990s when they were "next generation." They are large radars that cannot easily be reconfigured or moved once installed.The only unit in the 9 county Bay Area is on Mount Umunhum, at 3,488 feet elevation, in Santa Clara. The next closest unit is in Davis, CA. The picture below shows the challenges of the current radars for predicting Bay Area weather.



3. **What kinds of radars will the AQPI Project install?** Radars are distinguished by the frequency or wavelength at which they transmit:

S-Band (NEXRAD)	~ 3GHz	~ 10 cm

C-Band	~ 5 GHz	~ 5 cm
X-Band	~9 GHz	~ 3cm

The size of the radar antenna scales with the radar frequency: S-Band (NEXRAD) are big radar systems with large antennas and X-Band radars are small systems with smaller antennas. C-Bands are in-between. AQPI will deploy one C-Band and four X-band radars to augment the existing NEXRAD coverage in the Bay Area. The C-Band will be placed near the ocean in Sonoma County and will be used to observe storms approaching from out over the ocean. This radar should be able to observe precipitation out to at least 100 km. The smaller X-bands have a range of about 40 km. The four AQPI X-Bands will be placed in the North, South, West and East Bay to form a network of overlapping coverage. As of January 2018, one temporary X-band radar is in place in Santa Clara County. Another temporary X-Band is anticipated to be deployed in Sonoma County by the end of February/beginning of March 2018. These will be replaced by permanent radars later in 2018. The other 2 X-bands and the C-band will be deployed in the following years.

4. **Where can I get information on upcoming improvements in satellites for weather forecasting?** Please see this link for details on the GOES-S Weather Satellite. A few highlights:

> "When it launches March 1 and becomes operational later this year, GOES-S will see the west in true high-definition, and along with the remaining satellites in our GOES-R series, will extend the life of NOAA's geostationary satellite constellation through 2036," said Tim Walsh, acting director of NOAA's GOES-R program…. The upgraded GOES satellites provide higher-resolution imagery with an advanced imaging camera that can help forecasters distinguish between clouds, snow cover, fog, smoke and volcanic ash in the atmosphere. The new GOES satellites will return imagery up to five times more often than NOAA's previous meteorological observers in geostationary orbit. "These satellites are giving us the ability to look at storms as often as every 30 seconds, allowing forecasters to see storms as they're developing instead of as they've already happened," Walsh said.

Forecasters will use the new satellites to help track hurricanes, severe storms, lightning strikes, wildfires, volcanic eruptions and ground fog. Data from the GOES-S satellite will be used to provide initial weather conditions for the rapid-refresh weather prediction models, which should greatly improve the 12-48 hour forecasts from these models.

5. **What is the National Water Model?** The National Water Model (NWM) is a hydrologic model that simulates observed and forecast streamflow over the entire continental United States. The NWM simulates the water cycle with mathematical representations of the different processes and how they fit together. This complex representation of physical processes such as snowmelt and infiltration and movement of water through the soil layers varies significantly with changing elevations, soils, vegetation types and a host of other variables. Additionally, extreme variability in precipitation over short distances and times can cause the response on rivers and streams to change very quickly. Overall, the process is so

complex that to simulate it with a mathematical model means that it needs a very high powered computer or super computer in order to run in the time frame needed to support decision makers when flooding is threatened. See http://www.water.noaa.gov/map

FAQ from October 2017

Project Goals:

1. **How might better storm prediction help with releases for endangered species? Help with flow management?** Improved forecasting will be useful for agencies that release water for endangered species and/or manage flows. The AQPI team is working with several agencies for which this information is central. Lessons learned will be shared and will benefit water managers throughout the region.
2. **How small/large a drainage area can be modeled and at what interval can we get data?** The NOAA Office of Weather Prediction's National Water Model shows local creeks and rivers of various size. The model routes water at 250m resolution and it represents land surface processes at 1km resolution. Urban drainages having very short response times (< 1 hr) may not be well represented. This model as well as Hydro-CoSMoS will be used and improved as part of the AQPI project. AQPI project team members will model creeks throughout the region using the high resolution precipitation information to improve runoff forecasting.
3. **Local stream and rain gauges are not currently telemetered? Can this project help integrate the gauges?** Yes, the AQPI Team seeks to learn about current observational assets throughout the region and add as many as possible to assets currently in use at NOAA. The project has some funding to telemeter rain and stream gauges that currently do not have this capability. It is not yet known whether all gauges in the region can be telemetered.
4. **How does the project help Storm Water agencies/meeting Storm Water permits?** The AQPI team seeks to provide water management agencies with improved storm observation and forecasting information beginning in the spring of 2018 (with updates approximately every six months until 2021). With better information on incoming storms and affected watersheds, participating agencies can prepare to collect samples from critical locations (under permit) and improve stormwater management plans throughout the region.

Process/Project Partners:

5. **Who are you meeting with?** The project's primary audience is the Bay Area's water resource management agencies (the project is funded largely by the Department of Water Resources). However, water management systems are dependent and/or interact with Emergency Services, Transportation, Planning, Fisheries and other infrastructure

agencies. The project seeks to interact with such agencies so that flooding information can be widely disseminated and storm impacts to areas of concern minimized.

6. **How does the project address Sea Level Rise? Are you linked to Resilient by Design? Adapting to Rising Tides?** A critical component of APQI is the combined watershed and coastal storm model system: Hydro-CoSMoS, which will model water level in the Bay and near shore areas. Hydro-CoSMoS will provide water managers with enhanced information on storm surge levels, allowing managers to prepare and respond better.
7. **What is the life of the project & what will happen when grant ends?** The project is funded by DWR until 2021. By the time the grant sunsets, DWR, Sonoma County Water Agency (the grant recipient), participating local agencies, and the AQPI Team will have a Continued Operations Plan in place.

Radars:

8. **What types of sites are ideal? Are all sites selected?** Some sites are selected (an X-band radar is already installed in Santa Clara County). Other locations are proposed but not fully confirmed. Ideal sites provide excellent views of large swaths of the Bay Area and are easy to permit (maybe the land is owned by a water agency or other local government entity), have the necessary infrastructure (a cement pad or building, power and internet connectivity), can be accessed for installation, maintenance and repair, security, and may operate at low cost indefinitely.
9. **The project proposes 4 X-band radars and 1 C-band radar: Will this provide enough coverage for the SF Bay Area? What are the ranges of the radar bands?** The proposed radars will provide estimates of rainfall intensity and distribution throughout the Bay Area. They will provide a significant improvement in resolution of rainfall mapping over the current network. The X band radar has a range of ~40 km. The C-band's coverage range is ~100 km for rainfall estimation. Data provided by the new radars is not intended to be stand alone. It will be input into existing and soon-to-be-improved NOAA weather models which include a large variety of existing assets.

Improving Precipitation Forecasts:

10. **How will these new observations (radars and precipitation gauges) improve precipitation forecasts?** These new observations, together with the large set of observations already used by the operational weather prediction models at the National Weather Service, will be used to get the best initial conditions into our high-resolution (3 km) rapidly updating weather prediction model (this model is called HRRR). Improved initial conditions improve the accuracy of the forecast, and can also be used to evaluate the accuracy of the forecasts from this model.
11. **How will the likelihood of the precipitation forecasts be communicated?** Research is underway to create an ensemble of precipitation forecasts from models like the HRRR, especially when the model is initialized with slightly different initial conditions. The

output from this ensemble can be used to specify the probability that a specified amount of precipitation would fall over an area in a certain window of time. This probabilistic information can then be incorporated into other products that use these forecasted precipitation information, such as the National Water Model. AQPI will also provide experimental guidance into week two to improve risk-based decision making for flood and drought water resource management.

AQPI System Questions:

12. **What data/information will be produced by AQPI and when will we get it?** The AQPI system is being designed to meet Bay Area needs and will be able to provide any and all observations that are captured by the system: current conditions and forecast precipitation, river stage, and storm surge information. The AQPI system will provide the first data to participating Water Resource Agencies within six months (Spring 2018). The first products will be observations, current conditions and forecasts of precipitation. After that, updates will be provided roughly every six months until 2021 which will include observations and now cast from radars, watershed, and CoSMoS data. Over the course of the various meetings of the week of October 23, different water resource agencies had different needs for timing of information on storms, types of data (spreadsheets, links to maps, bulletins). The AQPI Team intends to provide the information type needed to each agency in usable formats and timely manner.
13. **Which watersheds will be selected for special study?** The Team plans to select a variety of watersheds throughout the region - some will be larger (Alameda Creek and tributaries - sized); others quite small. The range will be determined based upon the stated interests of Water Resource Agencies (i.e. specific areas of flooding) as well as the need for a distribution.
14. **Can Hydro-CoSMoS predict levee overtopping?** Hydro-CoSMoS will predict creek/bay water levels under storm conditions, taking tides, and tributary flows into consideration. Structures located within tidal zones will be in studied areas.
15. **We know the radars are specifically to benefit the Bay Area? But how will the AQPI system benefit water supply watershed management in the Sierras?** As California storms generally pass from the Bay Area to the Central Valley, data uploaded to NOAA from local assets will be input into current and next generation national weather models. This information will thus inform modeling throughout the larger region. AQPI will also provide experimental guidance to better inform risk of extreme events at lead times beyond 48 hours. The AQPI Team has met with Bay Area Water Supply Agencies that draw water from outside the region. We anticipate that both questions and types of ways that information is provided will evolve as the project progresses.
16. **Do we have enough data on soils and soil moisture to characterize and predict runoff?** The number of soil moisture probes throughout the Bay Area that are currently tied into NOAA systems is small. The AQPI project will entail installing some additional probes. The National Water Model forecasts soil moisture levels at 250 m but

may require calibration to improve accuracy. So, soil moisture measurements will probably be a continuing concern that the AQPI project cannot entirely solve.