# APPENDIX M-1

# WATER UTILITIES
# TECHNICAL MEMORANDUM

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# Water Utility Technical Memorandum

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| To | Ray Hrenko, Domenic Lupo, PE | Page | 1 |
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| Subject | Stadium Reconstruction Project – Water Utility Technical Memorandum | | |
| From | Jason Caprio, PE | | |
| Date | August 6, 2015 | | |

## Introduction

This Technical Memorandum for Water Infrastructure Utilities evaluates and analyzes the existing Water Infrastructure Utilities that serve Qualcomm Stadium and provides recommendations for improvements (if any) required to support the Stadium Reconstruction Project (Project).

## Existing Water Infrastructure Utilities

The existing Qualcomm Stadium and surrounding area is currently served by a 48-inch-diameter transmission main composed of a steel cylinder rod-wrapped pipe (SCRW), which is an acceptable selection for potable water mains 24 inches in diameter or larger. The subject water transmission supply, known as the Alvarado 2nd Pipeline, is in the 536 pressure zone. This 48-inch SCRW water transmission main runs along the southside of Friars Road, then turns and runs along and within the north side of the Project boundary, just west of Mission Village Drive. Near the northeast corner of the Project boundary, the alignment turns south, parallel to and slightly west of Interstate 15 (I-15) until the southeast corner of the Qualcomm Stadium property, where the 48-inch SCRW water transmission main exits the Qualcomm Stadium property and crosses beneath I-15.

Within the northeastern quadrant of the Project site are ancillary facilities, including a pressure reducing valve (PRV) station and a connection with a 16-inch-diameter ductile iron pipe, which ultimately serves Qualcomm Stadium and the surrounding area. The PRV station steps down the pressure from the 536 pressure zone to a 390 pressure zone. From the noted 16-inch-diameter ductile iron water distribution main, a single looped system consisting of a 12-inch-diameter asbestos cement (AC) water pipeline feeds a 10-inch-diameter AC water pipeline that circles Qualcomm Stadium.

For an illustration of the existing water infrastructure as described above, please see the Water Utilities figure at the end of this Technical Memorandum. Recycled water facilities are not currently available to the Project site.

Based on the description above, the existing capacity would be governed by the 12-inch-diameter AC water pipeline. Based on the City's Capital Improvement Plan (CIP) Guidelines and Standards, a maximum allowable velocity of 15 feet per second (fps) would limit acceptable flow rate to approximately 5,300 gallons/minute.

**Water Demands and Service Criteria**

Existing Water Demands

The City of San Diego provided actual water consumption data from existing water meters servicing Qualcomm Stadium covering the time frame of July 2011 through June 2015. The actual annual water demand for years 2012, 2013, and 2014 (2011 and 2015 are not full calendar years) averages approximately 18,500,000 gallons per year. This is further refined to just less than 51,000 gallons per day. Although these amounts are actual metered water volumes for Qualcomm Stadium, for purposes of estimating the Project, these volumes and demands will only be used for comparison purposes.

Proposed No Event Water Demand (days without National Football League (NFL) or other non-NFL Large Event)

Another method for estimating demand for the Project is based on the City's CIP Guidelines and Standards' Land Use Categories. Assuming the existing Qualcomm Stadium and surrounding area can be categorized as *Commercial and Industrial* land use, and considering that 17 acres would be developed for the new stadium out of the 166-acre property, then average water demand can be calculated. In accordance with the City's CIP Guidelines and Standards, the Unit Water Demand for *Commercial and Industrial* land use is 5,000 gallons/net acre-day. Based on a 17-acre development, the water demand is calculated as:

- 17 net-acres x 5,000 gallons/net acre-day = 85,000 gallons/day

The Land Use Category method will be used for estimating the Non-Event (or baseline) Water Demand for the Project for all days without an event (NFL Game Day or Non-NFL Large Event). Compared to the actual water consumption data from 2012–2014, the Land Use Category method appears to be a conservative and reasonable estimation of typical non-event water demands.

**Annual Scenarios and Estimations for Water Demands**

Given the nature of the new stadium, it is expected that there would be three (3) scenarios of when the Project would consume different amounts of water, resulting in three (3) demand scenarios, as described below.

Scenario 1 – NFL Game Day Event

NFL Game Day Events would include pre-season (2 days), regular season (8 days), post-season (2 days), and the Super Bowl (1 day). Although it is understood that most calendar years would likely include only the pre-season and regular season, for purposes of this Technical Memorandum, the post-season and Super Bowl events are included (for maximum possible demand). Therefore, in a calendar year, NFL Game Day Events would occur thirteen (13) days between August and February. For these days, it is estimated that capacity would be full, which equates to 75,000 attendees. For clarification, the attendees are conservatively defined by event attendees, stadium staff, vendors, press, players, and other persons who would be present and served by the water supply.

Based on the *49ers Stadium, LLC Development Application* (2009), which utilized several sources of data, including multiple years of actual water demand data from other NFL stadiums, a conservative unit water demand of 3 gallons per capita (person/attendee) per day will be used for purposes of this Technical Memorandum for NFL Game Day Events. The unit water demand will be multiplied by the estimated number of attendees anticipated.

Based on the 75,000-person capacity for the Project with maximum attendance, the water demand is calculated as:

- 75,000 attendees x 3 gallons per attendee per day = 225,000 gallons/day

Also, an additional source of water demand and consumption would be the cooling towers for discharging heat in the air conditioning process. These cooling towers require water supply as evaporation is the most significant part of the process with these types of equipment. For the Project, two cooling towers are anticipated with three 750-ton cells per cooling tower. Based on discussions with manufacturers of this industry's equipment, 3 gallons per minute of water is lost through the evaporation process during operation for every ton (nominal size rating). For this case, a water demand of 270 gallons per minute is expected. During NFL Game Day Events, it is assumed that the cooling towers would be operational for 8 hours during the subject event. Based on the above-noted information, the water demand is calculated as:

- 270 gallons/minute * 60 minutes/hour * 8 hours = 129,600 gallons/day

Scenario 2 – Non-NFL Large Event

Non-NFL Large Events are expected to be events resulting in significant attendance and subsequent water demand but smaller attendance than an NFL event. For purposes of estimating the Project, 20 Non-NFL Large Events are estimated per calendar year. For these days, it is estimated that capacity would be at 50%, which equates to 37,500 attendees.

Based on the 37,500-person capacity for the Project and the conservative unit water demand as described above, the water demand is calculated as:

- 37,500 attendees x 3 gallons per attendee per day = 112,500 gallons/day

Similar to the NFL Game Day Events, the cooling towers are expected to be fully operational for all Non-NFL Large Events as well, resulting in the same water demand as follows:

- 270 gallons/minute * 60 minutes/hour * 8 hours = 129,600 gallons/day

Scenario 3 – No Event Day (Proposed Baseline Water Demand)

The No Event Day, as expected, is classified as the total of any day in the calendar year in which no events are held at the new stadium. Based on deduction, three hundred thirty two (332) calendar days are included where only the proposed baseline water demand is considered. As previously mentioned, the water demand is calculated as:

- 17 net-acres x 5,000 gallons/net acre-day = 85,000 gallons/day

Total Water Demand for Project

The collective annual total water demand for NFL Game Day Events, Non-NFL Large Events, and No Event Days is shown in Table 1.

**Table 1: Project Annual Water Demands**

| Total Water Demand | Water Demand [Gallons/Day] | Number of Days/Events Per Calendar Year | Water Demand [Gallons/Year] | Water Demand [Hundred Cubic Feet/Year] | Water Demand [Acre-Feet/Year] |
|---|---|---|---|---|---|
| Water Demand for NFL Game Day Event [Scenario 1, Includes Baseline] | 439,600 | 13 | 5,714,800 | 7,640 | 17.5 |
| Water Demand for Non-NFL Large Event [Scenario 2, Includes Baseline] | 327,100 | 20 | 6,542,000 | 8,745 | 20.1 |
| Water Demand For All Other Days [Scenario 3, Baseline] | 85,000 | 332 | 28,220,000 | 37,725 | 86.6 |
| **Totals** | **NA** | **365** | **40,476,800** | **54,110** | **124.2** |

Peak Water Demands

Peak Water Demands are categorized into two considerations: (1) Peak Hour Demand and (2) Maximum Day Demand. These demands are estimated using the City's CIP Guidelines and Standards' Peaking Factors. In this case, the property boundary location lies within *Inland Central* (see the City's CIP Guidelines and Standards Figure 2-1 and 2-2 for clarification). Based on the Average Annual Water Demand and the Inland Coastal zone, the demand factors are:

- Peak Hour Demand Factor = 6.5
- Maximum Day Demand Factor = 2.7

Given that peak water demands will occur during a NFL game Day Event, the Peak Hour Demand and Maximum Day Demand are as follows:

- Peak Hour Demand = (225,000 gallons/day + 85,000 gallons/day) * 6.5 + 129,600 gallons/day (consistent) = 2,144,600 gallons/day or 2.14 million-gallons/day or nearly 1,500 gallons/minute.
- Maximum Day Demand = (225,000 gallons/day + 85,000 gallons/day) * 2.7 + 129,600 gallons/day (consistent) = 966,600 gallons/day or 0.97 million-gallons/day or nearly 675 gallons/minute.

Peak Hour Demand was also assessed from a practical standpoint given the nature of the new stadium. In this case, it was assumed the 225,000 gallons/day (75,000 attendees x 3 gallons per

attendee per day) were consumed in a four (4) hour time frame, the 129,600 gallons/day (cooling towers usage) were consumed in an eight (8) hour time frame, and the 85,000 gallons/day (baseline) were consumed in a twelve (12) hour time frame.

- 225,000 gallons/day in 4 hours = 56,250 gallons/hour = 938 gallons/minute
- 129,600 gallons/day in 8 hours = 16,200 gallons/hour = 270 gallons/minute
- 85,000 gallons/day in 12 hours = 7,083 gallons/hour = 118 gallons/minute
- Peak Hourly Demand = 1,326 gallons/minute

This rationally derived method yields a slightly lower Peak Hour Demand and therefore, for purpose of being conservative, the Peak Hour Demand will remain estimated at 1,500 gallons/minute.

Fire Demands

In accordance with the City's CIP Guidelines and Standards, the *Industrial Development Type* fire demand is as follows:

- Fire Demand = 6,000 gallons/minute

Although this flow rate is significant, it will not factor into the Water Demands from a consumption stand-point. Fire Demand will, however, be a consideration when recommending the sizes of distribution water mains and design and operating pressure requirements.

**Design Pressures and Operating Pressures**

In accordance with the City's CIP Guidelines and Standards, water systems must be designed to provide the minimum residual pressures given:

(1) maximum day demands plus fire demand conditions, or;
(2) peak hour demand conditions.

As described previously, please see the following, where maximum day demands plus fire demand conditions will govern these considerations.

(1) maximum day demands plus fire demand conditions = 675 + 6,000 = 6,675 gallons/minute, or
(2) peak hour demand conditions = 1,500 gallons/minute

As noted in the Existing Water Infrastructure Utilities section, there are two existing pressure zones of water supply. The 16-inch-diameter ductile iron, 12-inch-diameter AC, and 10-inch-diameter AC water distribution main that circles Qualcomm Stadium is a part of the 390 pressure zone. The 48-inch-diameter SCRW water transmission main is in the 536 pressure zone. In accordance with the City's CIP Guidelines and Standards, minimum operational pressure shall be no less than 40 pounds per square inch (psi) during maximum day demand flows. Once further into and during the design process, if it is determined that there are pressure deficiencies within the system based on maximum day or peak hour water demands of any kind or magnitude, a physical connection with the higher pressure zone (536) can be evaluated and planned.

**Existing Water Distribution System**

Typical velocity for design purposes is 6 fps. Based on the City's CIP Guidelines and Standards, a maximum velocity of 15 fps is allowed under certain conditions (e.g., fires, emergencies, etc.). As mentioned previously, water mains are designed with velocities and specific flow rates considered. For this reason, Table 2 identifies water main capacities.

**Table 2: Existing Water Main Design Capacities**

| Nominal Pipeline Diameter [Inches] | Nominal Pipeline Flow Area [Feet$^2$] | Design Water Velocity [Feet / Second] | Pipeline Flow Capacity [Feet$^3$ / Second] | Pipeline Flow Capacity [Gallons / Minute] |
|---|---|---|---|---|
| 10 | 0.55 | 6 | 3.3 | 1,469 |
| 12 | 0.79 | 6 | 4.7 | 2,115 |
| 16 | 1.40 | 6 | 8.4 | 3,760 |

When evaluating the data above, it is noted that the existing water distribution system is sized appropriately for typical demands and peak hour demands. With this, it is also clear that the current water distribution system is not well suited to handle fire flow demands of 6,000 gallons per minute. In conjunction with maximum velocities of 15 fps during fires, fire flow demands can be viewed based Table 3.

**Table 3: Existing Water Main Capacities**

| Nominal Pipeline Diameter [Inches] | Nominal Pipeline Flow Area [Feet$^2$] | Maximum Water Velocity [Feet / Second] | Pipeline Flow Capacity [Feet$^3$ / Second] | Pipeline Flow Capacity [Gallons / Minute] |
|---|---|---|---|---|
| 10 | 0.55 | 15 | 8.2 | 3,672 |
| 12 | 0.79 | 15 | 11.8 | 5,288 |
| 16 | 1.40 | 15 | 20.9 | 9,400 |

Similarly, it is noted that only a 16-inch-diameter water pipeline (or larger) can accommodate fire flow demands of 6,000 gallons/minute.

Even with these criteria considered, the materials and age of the existing water distribution system are not recommended for the Project.

**Availability of Recycled Water Supply**

Recycled water infrastructure is currently not available within the Project boundary. The nearest location of recycled water infrastructure utilities is over 2 miles from the Project site. For this reason and within the context of this Project, it is not reasonable to consider recycled water as a viable option for supporting any of the water demands.

**Recommendations for Improvements**

In reviewing and evaluating the available data and certain assumptions made, the following are recommendations for the Project related to a water distribution system:

1) Utilize the 48-inch SCRW water transmission main and 16-inch-diameter ”stub-outs” along said pipeline as available connection points, replace the existing 12-inch-diameter AC water pipeline and 10-inch-diameter AC water “looped” pipelines with a new 12-inch C900 PVC water pipeline. This would abandon the existing connection to the 16-inch-diameter ductile iron water distribution main. These improvements would serve the potable water demands for the Project and would be separately and individually “master” metered.

2) Also, utilize the 48-inch SCRW water transmission main and 16-inch-diameter “stub-outs” as available connection points, install new 16-inch C905 PVC water pipeline in a “looped” system that would circle the new stadium. These improvements would be installed outside of the perimeter of the new potable water distribution mains but would serve fire flow demands only during such an event. The fire flow water pipeline would also be on a “master” meter.

Additionally, it is not recommended to provide potable water or fire suppression storage facilities if the improvements noted above are implemented.