4.9 HYDROLOGY AND WATER QUALITY

4.9.1 INTRODUCTION

The Hydrology and Water Quality section of the EIR describes existing drainage patterns for the proposed project site (including the MRIC site and the Mace Triangle site), regional flooding, and utilization of groundwater at the project site. The section evaluates potential impacts of the proposed project with respect to increases in stormwater runoff, on- and off-site flooding, and degradation of water quality. The analysis in this section relies primarily upon the *Drainage Study for Mace Ranch Innovation Center* prepared by Watermark Engineering, Inc. (see Appendix F),[1] the Innovation Center *Water Supply Assessment* (see Appendix K),[2] the *Innovation Center Flood Elevation and Inundation Area Increase Study*,[3] and the *Davis General Plan*[4] and associated EIR.[5] It should be noted that impacts associated with water supply and conveyance are addressed in Section 4.15, Utilities, of this EIR.

4.9.2 EXISTING ENVIRONMENTAL SETTING

The section below describes the existing hydrological features of the project site and the surrounding region, as well as the water quality of the existing resources in and around the project site.

Regional Hydrology

The proposed 229-acre project site is located immediately east of the City of Davis, within Yolo County, at the southwestern end of the Sacramento Valley, approximately 30 miles north of the confluence of the San Joaquin and Sacramento Rivers. The Sacramento Valley is bordered by the Coast Ranges and Delta on the west and the foothills of the Sierra Nevada to the east. Water resources in this region include rivers, streams, sloughs, marshes, wetlands, channels, harbors, and underground aquifers.

1 Watermark Engineering, Inc. *Drainage Study for Mace Ranch Innovation Center*. June 15, 2015.
2 Brown and Caldwell. *Water Supply Assessment.* June 2015.
3 West Yost Associates. *Innovation Center Flood Elevation and Inundation Area Increase Study*. May 15, 2015.
4 City of Davis. *Davis General Plan.* Adopted May 2001. Amended through January 2007.
5 City of Davis. *Program EIR for the City of Davis General Plan Update and Project EIR for Establishment of a New Junior High School*. January 2000.

Climate and Rainfall

Summers in the City of Davis are warm and dry, and winters are cool and mild. The region is subject to wide variations in annual precipitation, and also experiences dry periods and wild fires in the regional watershed and surrounding areas. The temperature range is approximately 30 to 100 degrees Fahrenheit (ºF), with an annual average of 61ºF.[6]

Watersheds

The City of Davis is located in the Sacramento River Hydrologic Region, which covers approximately 17.4 million acres (27,200 square miles) and all or large portions of Modoc, Siskiyou, Lassen, Shasta, Tehama, Glenn, Plumas, Butte, Colusa, Sutter, Yuba, Sierra, Nevada, Placer, Sacramento, El Dorado, Yolo, Solano, Lake, and Napa counties. Small areas of Alpine and Amador counties are also within the region.

Geographically, the region extends south from the Modoc Plateau and Cascade Range at the Oregon border, to the Sacramento---San Joaquin Delta. The Sacramento Valley, which forms the core of the region, is bounded to the east by the crest of the Sierra Nevada and southern Cascades and to the west by the crest of the Coast Range and Klamath Mountains. Other significant features include Mount Shasta and Lassen Peak in the southern Cascades, Sutter Buttes in the south central portion of the valley, and the Sacramento River, which is the longest river system in the State of California, with major tributaries: the Pit, Feather, Yuba, Bear, and American Rivers.

Valley Putah-Cache Hydrologic Unit

The City of Davis is located within the Valley Putah-Cache Hydrology Unit. For purposes of regional planning, hydrologic units are generally considered to be the appropriate watershed planning level. However, the hydrologic unit level is generally too large in terms of a planning scale for individual projects; and a hydrologic area or hydrologic subarea may be considered more appropriate.

Lower Putah Creek Hydrologic Area

The City of Davis is located within the Lower Putah Creek Hydrologic Area. This watershed is approximately 225,301 acres and is bound by Putah Creek to the south and Cache Creek to the north. The headwaters of the watershed begin just west of Winters, near Lake Berryessa, and extend to the east, approximately 25 miles, to the Sacramento River. There are 17 water bodies on the 303(d) list (list of impaired and threatened waters), six of which have a TMDL for various pollutants. A Total Maximum Daily Load, or TMDL, is a calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards. None of the listed 303(d) water bodies are located in the vicinity of the project site.

[6] City of Davis. *Program EIR for the City of Davis General Plan Update and Project EIR for Establishment of a New Junior High School [pg. 5G-1]*. January 2000.

Local Hydrology

According to the Davis General Plan, the planning area is drained by Putah Creek, Dry Slough, and the Willow Slough Bypass. The old North Fork of Putah Creek, east of Interstate 80, no longer contains flowing water because the water has been diverted into the South Fork for flood control. The South Fork of Putah Creek runs through the University of California, Davis (UC Davis) campus eastward and terminates in the Putah Creek Sinks, located in the Yolo Bypass at the eastern edge of the planning area.

The California Department of Water Resources (DWR) maintains the Willow Slough Bypass, which directs water away from Willow Slough and Dry Slough, in the eastern section of the Davis planning area, and carries water eastward to the Yolo Bypass at the eastern boundary of the planning area. Willow Slough drains the valley floor between Putah and Cache Creeks. Agricultural runoff contributes water to the slough during irrigation season. The Yolo Bypass, which runs north-south, is flooded when the Sacramento River carries high stormwater runoff levels. Water is released into the Yolo Bypass from the Fremont Weir located downstream from Knight's Landing.

Within the Lower Putah Creek Hydrologic Area, there are four principal watersheds, which total 198 square miles. The project site is located within the East Davis watershed (see Figure 4.9-1). The East Davis watershed includes the areas located to the east of the Covell Drain and the City of Davis. The watershed consists of slightly sloping alluvial plains with elevations ranging from 30 feet to 15 feet. The area drains directly into the Yolo Bypass by means of culverts that have flap gates to prevent backflow when high stages exist in the Yolo Bypass.[7]

The City's stormwater system conveys rainwater out of the City using a series of 1,802 storm sewer maintenance holes, 3,093 catch basins, 126 miles of drainage lines, six (6) stormwater ponds, 15 miles of drainage channel, and nine (9) stormwater pump stations.[8] The City's storm drain system is divided into 11 basins (see Figure 4.9-2). Rainfall runoff flows by gravity into the City's four (4) detention ponds, one (1) detention basin, and one (1) drainage pond. Pump stations lift water from these facilities into main drainage channels: the Covell Drainage Channel, Channel A, Mace Ranch Park Drainage Channel, and the El Macero Drainage Channel. These channels ultimately drain to Willow Slough Bypass or the Yolo Basin wetlands, Davis Site, east of the City. The Willow Slough Bypass consists predominately of runoff from agricultural lands to the north of the City. The Mace Drainage Channel, which runs through the center of the site, connects to the existing Railroad Channel east of Road 105, which flows to the Yolo Bypass levee. Figure 4.9-2 presents the basins and the flow paths of the stormwater system.

Flood control services outside of the City are provided by the Yolo County Flood Control and Water Conservation District (YCFCWCD) and the California DWR. DWR has primary responsibility of maintaining the levees in the Davis planning area.

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7 Yolo County Flood Control & Water Conservation District. *Covell Drainage System Comprehensive Drainage Plan [pg. 7]*. September 1993.

8 City of Davis. *Integrated Water Resources Study*. August 2013.

Figure 4.9-1
Principal Watersheds in Davis Area

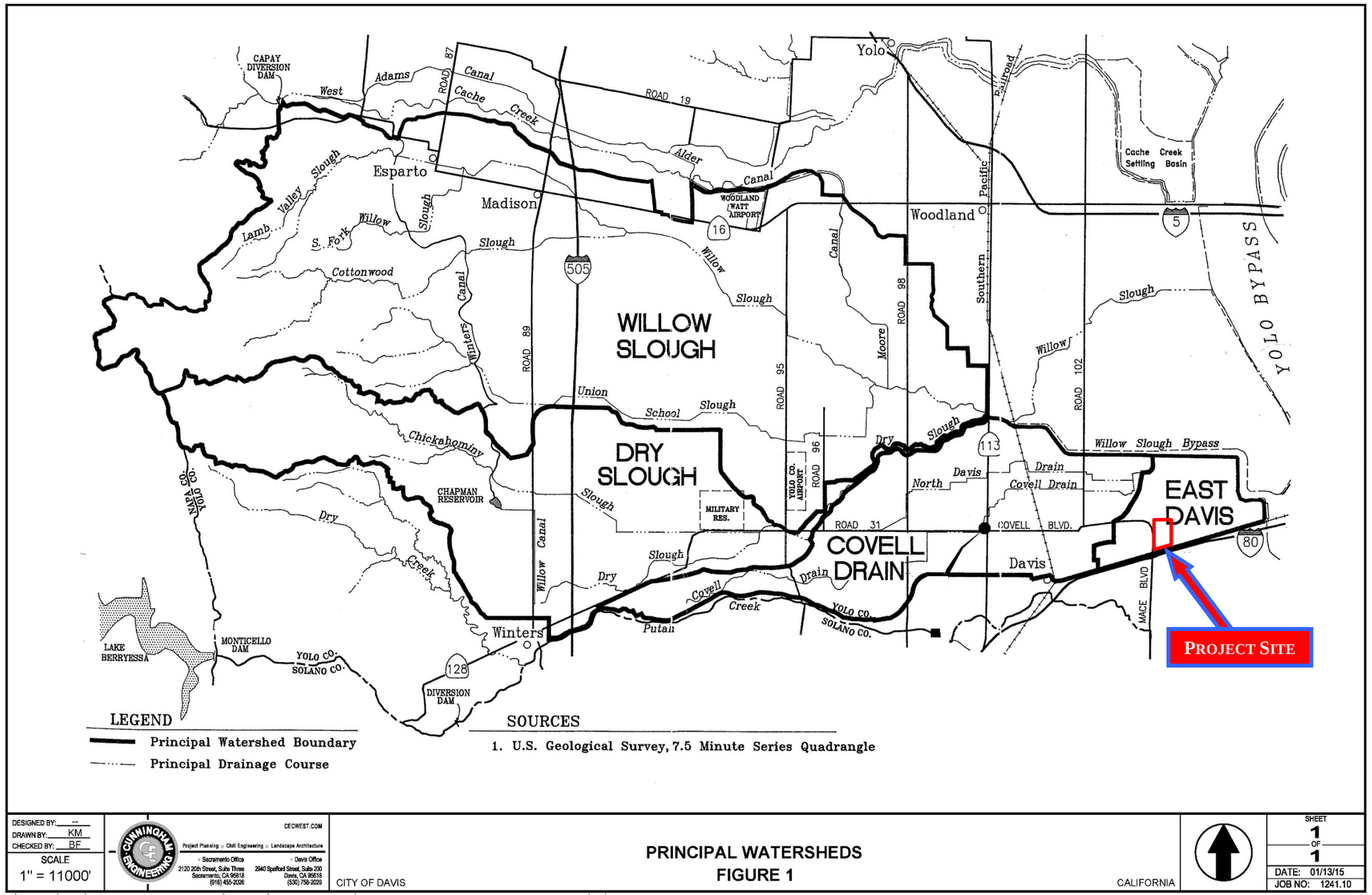
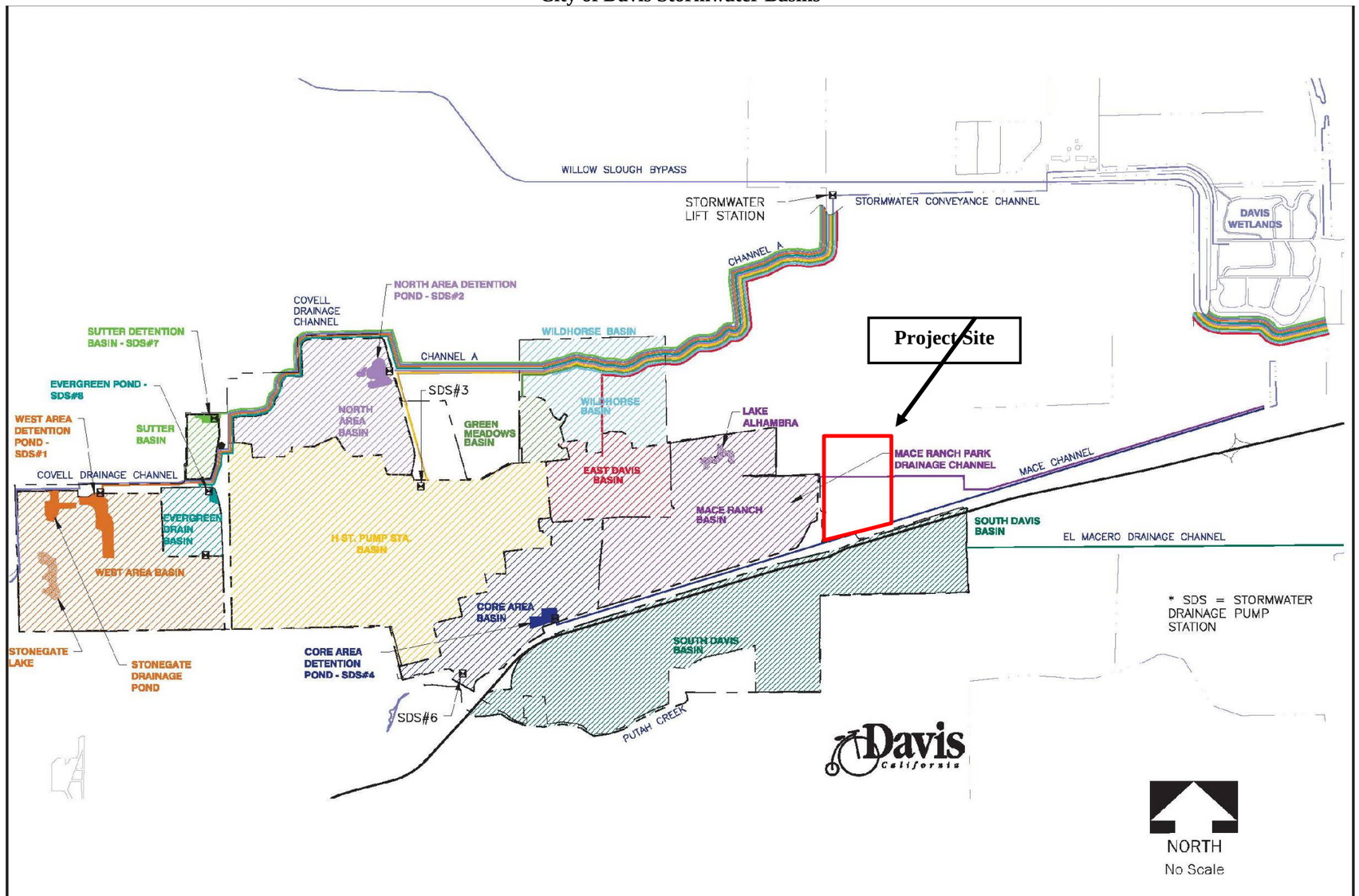


Figure 4.9-2
City of Davis Stormwater Basins



Project Site Drainage

The project site includes both the 212-acre MRIC site and the 17-acre Mace Triangle site. An existing City drainage channel, known as the Mace Drainage Channel (MDC), traverses the center of the MRIC site. Aquatic features do not exist on the Mace Triangle site. Runoff from the Triangle flows south or southeast to the existing drainage channel located between County Road 32A and the railroad embankment. The collected runoff then flows east along the existing channel that discharges into the Mace Ranch channel east of County Road 105 via a storm drain culvert. The existing railroad channel also conveys runoff from an undetermined relatively small drainage area(s) west of Mace Boulevard via a culvert under the Mace Boulevard overcrossing embankment.

Mace Drainage Channel

The MDC was constructed in the early 1900's in two phases. The MDC improvements were completed in 1992 and extend east from Mace Boulevard to about one-half mile downstream or east of County Road 105. At that point, the MDC joins with a relatively large channel along the north side of the railroad (railroad channel) that extends to the Yolo Bypass levee.

Phase 1 was a relatively large trapezoidal channel about seven feet deep from the storm drain outfall at Mace Boulevard east to the eastern property boundary of the MRIC site. Another component of the Phase 1 improvements was on offline detention basin located just south of the MDC near the eastern boundary of the MRIC site. The detention basin was needed to significantly attenuate flows from the nearby Mace Ranch residential development. At that time, the MDC stopped at the MRIC site property boundary. From the MRIC site to the east, only a small agricultural ditch a few feet wide and less than two feet deep exists. Thus, the detention basin was needed to significantly attenuate flows from the Mace Ranch residential development and to prevent ponding on nearby fields.

The Mace Ranch residential development, which includes approximately 535 acres of mostly residential use, drains the northern portion of the shed through a typical storm drain system. The shed area draining to the MDC at Mace Boulevard is about 730 acres.

The Phase 2 improvements extended the MDC farther east, connecting to an existing channel located north of the railroad embankment (known as Railroad Channel). The detention basin at the eastern side of the MRIC site was still an integral part of the attenuation, but the size was reduced because less attenuation was needed with the larger downstream channel. At the time, the Railroad Channel emptied into the Yolo Bypass through a 30-inch culvert. The culvert included a flap gate to prevent high flows in the bypass from back flowing onto the agricultural lands located north of the Railroad Channel and west of the bypass levee.

Currently, a vehicle crossing exists at the curved section of the MDC just east of the MRIC site and the two channels are connected by two 24-inch CMPs. One pipe is located at the channel slow lines, and the other is several feet higher. The connection represents a significant bottleneck along the MDC.

As part of the Phase 2 improvements, a larger outfall from the Railroad Channel into the Yolo Bypass was installed. The 30-inch corrugated metal pipe (CMP) was replaced with a five-foot by five-foot reinforced concrete box culvert fitted with a flap gate and a slide gate for extra protection against bypass waters entering the adjacent fields.

Even before the Mace Ranch residential development began, the 30-inch culvert was a severe bottleneck, causing agricultural runoff to pond "behind" the bypass levee as runoff was slowly metered into the bypass. The new box culvert has nearly 13 times the conveyance capacity compared to the 30-inch culvert that was replaced. As a result, both the frequency and duration of ponding behind the levee has been greatly reduced. As an example, prior to the new culvert, a large storm event could generate runoff that would pond and remain in the fields for several days to weeks. With the installation of the large box culvert, ponding is less and of shorter duration. The exception is when the water level in the bypass is higher than the water level in the Railroad Channel. During these infrequent periods, flow will not occur, and the box culvert will drain the Railroad Channel and adjacent fields at a much faster rate.

The southern 195 acres north of 2nd Street is zoned for Planned Development and includes commercial, business, several open parcels, some residential, and a park. Rainfall runoff is collected in typical storm drains and discharged into a long flood channel that provides conveyance and attenuation storage to reduce peak outflow.

Both the north and south systems join at Alhambra Boulevard, about 1,000 feet west of Mace Boulevard. The twin outfall pipes continue east along Alhambra, then turn north about 600 feet along Mace Boulevard and outfall into the MDC.

Local Flood Hazards

The soils in the eastern portion of Yolo County contain appreciable amounts of clay that limit infiltration rates and consequently cause high runoff rates. Flooding has frequently occurred in the Willow and Dry Sloughs and watersheds north of Putah Creek. Yolo County has been mapped by the Federal Emergency Management Agency (FEMA) as part of the National Flood Insurance Program, which identifies areas of potential flooding and their associated risks.

The potential for flooding in the planning area exists when floodwaters from the Sacramento River back up into the Yolo and Willow Slough Bypasses, eliminating gravity flow from these systems. Ponding also occurs in some areas from combinations of rainfall intensity, impermeable soils, shallow groundwater conditions, and presence of depressions.

There are approximately 7.5 square miles of land that drain to the eastern terminus of the Railroad Channel at the Yolo Bypass, into which the MDC flows. This includes approximately 730 acres of Mace Ranch and 4,100 acres of agricultural land west of the Covell Drain and bounded by the Willow Slough Bypass levee to the north, the UPRR to the south, and the Yolo Bypass levee to the east. During typical rainstorms, runoff from this area discharges into the Yolo Bypass.

When there is heavy and prolonged rainfall in Northern California, flow in the bypass rises. High flow in the bypass creates backwater and can completely stop MDC flows from entering the bypass. When this occurs, runoff from the 7.5-square mile tributary area ponds "behind" the bypass levee and remains there until the ponded water level is higher than the bypass water level.

During extreme storm events and when the bypass is high, both the Covell Drain and then North Davis Drain overflow to the east, adding runoff volume to the ponding area, east of the bypass levee.

Project Site Flood Hazards

According to the Drainage Study prepared for the proposed project, the entire MRIC site is located in Zone X (Panels 604, 610, 612, and 620 of 785).[9] The entire MRIC site is located outside of the regulatory floodplain. In addition, the Mace Triangle site is located in Zone X (Panel 612 of 785). Zone X includes areas determined to be outside the 0.2 percent annual chance floodplain. The area east of County Road 105, directly east of the MRIC site, is within the 100-year floodplain. In addition, the area north of County Road 30B, north of the MRIC site, is within the 100-year floodplain.

A review of the California Department of Water Resources Best Available Maps shows that the 200-year USACE Comprehensive Study floodplain extends onto the northeast quarter of the project site. Achieving 200-year flood protection for the MRIC is not required by the California Urban Level of Flood Protection criteria because:[10]

- The FEMA special flood hazard mapping does not cover any of the MRIC site
- FEMA has not delineated a Moderate Flood Hazard in the vicinity of the site

The levees along the Yolo Bypass and Willow Slough Bypass were thought to provide 100-year flood protection to the Wastewater Treatment Plant (WWTP) and the surrounding area until June 2010.[11] At that time, FEMA published new floodplain maps that placed the WWTP in a Zone A floodplain, while the project site's Zone X designation was retained.

The newly defined floodplain is not the result of a new study or new data that predicts increased flows and stages in the surrounding waterways, but is the result of a new approach used by FEMA for determining the flood protection offered by levees. For this approach, FEMA now requires that levee owners provide technical documentation that demonstrates that a levee meets federal design, construction, maintenance, and operation standards to provide protection from the 100-year flood. Without such documentation, FEMA assumes that a levee does not provide flood protection during a 100-year storm and the areas that are protected from flooding by the levee are mapped into the floodplain. Because the technical data for the levees protecting the WWTP is

[9] Watermark Engineering, Inc. *Drainage Study for Mace Ranch Innovation Center* [Attachment 7]. June 15, 2015.
[10] West Yost Associates. *Review of the Drainage Study for Mace Ranch Innovation Center*. August 10, 2015.
[11] West Yost Associates. *Special Design Study TM #8 – Flood Mitigation Evaluation*. June 3, 2013.

not available, the levees were de-accredited by FEMA and the area was mapped into the floodplain.

Dam Failure

The Monticello Dam, located approximately 23 miles from Davis at Lake Berryessa, has the potential to inundate the City of Davis if the dam were to fail. The failure of the Monticello Dam is estimated by the California Emergency Management Agency to cause flooding up to three meters in Davis. Dam failure is generally a result of structural instability caused by improper design or construction, instability resulting from seismic shaking, or overtopping and erosion of the dam.

Larger dams that are higher than 25 feet, or with storage capacities over 50 acre-feet (ac-ft) of water, are regulated by the California Dam Safety Act, which is implemented by the California DWR, Division of Safety of Dams (DSD). The DSD is responsible for inspecting and monitoring larger dams. The Act requires that dam owners submit to the California Office of Emergency Services inundation maps for dams that would cause significant loss of life or personal injury as a result of dam failure. The County Office of Emergency Services is responsible for developing and implementing a Dam Failure Plan that designates evacuation plans, the direction of flood waters, and provides emergency information.

An inundation map prepared by the Bureau of Reclamation to analyze the effects of dam failure shows that the flooding in Davis would not be significantly greater than in a 100-year flood because of the 23-mile distance between the Monticello Dam and Davis.[12]

Groundwater

The City currently uses groundwater as the sole potable water supply source. The City pumps groundwater from the Yolo Basin, which is a portion of the larger Sacramento Valley groundwater basin. The Yolo Basin is subject to the 2014 Sustainable Groundwater Management Act (SGMA), which became effective January 31, 2015. The SGMA applies to the 127 High and Medium Priority groundwater basins, which account for approximately 96 percent of groundwater use in California. The Yolo subbasin is designated as High Priority under the Sustainable Groundwater Management Act. The SGMA requires High and Medium Priority basins under the California Statewide Groundwater Elevation Monitoring (CASGEM) program subject to critical conditions of overdraft to be managed under a groundwater sustainability plan by January 31, 2020 (Water Code § 10720.7(a) (1)), and requires all other groundwater basins designated as High or Medium Priority basins to be managed under a groundwater sustainability plan by January 31, 2022 (Water Code § 10720.7 (a) (2)). According to Bulleting 118, the Yolo subbasin is not subject to Critical conditions of overdraft.[13]

[12] City of Davis. *Davis General Plan [pg. 317].* Adopted May 2001. Amended through January 2007.
[13] Department of Water Resources. *Bulletin 118 [pg. 98]*. Update 2003.

The SGMA requires the formation of local groundwater sustainability agencies (GSAs) that must assess conditions in their local water basins and adopt locally-based management plans. The SGMA provides substantial time (20 years) for GSAs to implement plans and achieve long-term groundwater sustainability. It protects existing surface water and groundwater rights and does not impact current drought response measures. The City is in the planning stages to partner with other local agencies to comply with the SGMA.

On April 1, 2015, the Governor proclaimed a continued state of emergency directing the SWRCB to enhance emergency regulations adopted in 2014 and reaffirmed on March 17, 2015. The Governor's Executive Order B-29-15 sets 2013 as a base year and directed the SWRCB to impose restrictions to achieve a statewide 25 percent water reduction through February 28, 2016.

On May 5, 2015 the State Water Resources Control Board adopted emergency regulations, which included a number of new prohibitions for end users of water and also required the City to reduce its' water production by 28% between June 2015 and February 2016 as compared to the same calendar months in 2013 (June 2013 through December 2013, January 2013, and February 2013). The regulations were approved by the California Office of Administrative Law on May 18, 2015. The regulations are effective as of May 18, 2015. Therefore, the City has an obligation to implement the new regulations immediately. On June 2, 2015, the City of Davis adopted an Urgency Ordinance designed to move this forward by adopting City regulations to implement the State mandates and to provide for penalties and enforcement of the regulations.

The regulations correspond to Davis' 2010 Urban Water Management Plan's Stage 2/Stage 3 Water Shortage Contingency Plan and is consistent with the SWRCB's regulations previously adopted on July 15, 2014 and reaffirmed March 17, 2015. The requirements include:

- Prohibiting using water for street and sidewalk cleaning and gutter flooding
- All plumbing leaks must be corrected
- Car wash facilities must use recycled water
- No watering outdoors between 9 a.m. and 6 p.m., except with a hand-held container or hose with a shut-off nozzle, or for very short periods when adjusting a sprinkler system;
- Outdoor watering is restricted to three days a week: Tuesday, Thursday and Saturday for premises with odd numbered addresses and Wednesday, Friday and Sunday for premises with even numbered addresses. No outdoor watering on Monday;
- No watering during periods of rain.
- Unlawful for any person to apply potable water to outdoor landscapes in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private walkways, roadways, parking lots, or structures.
- Unlawful for any person to use a hose that dispenses potable water to wash a motor vehicle, except where the hose is fitted with a shot-off nozzle or device attached to it that causes it to cease dispensing water immediately when not in use.
- Unlawful for any person to apply potable water to driveways and sidewalks.
- Unlawful for any person to use potable water in a fountain or other decorative water feature, except where the water is part of a recirculating system.
- Unlawful for any restaurant to serve drinking water unless a patron requests drinking water.

- Unlawful for any restaurant to wash dishes unless the dish washing system is fitted with a water saving dish wash spray valve.
- Unlawful to install non-recirculating water systems at new commercial car washes and laundry systems.
- Unlawful for hotels and motels to fail to provide guests with notice and the option to decline daily bed linen and towel changes.

Local Groundwater Aquifer Characteristics

The City obtains groundwater from both the deep and intermediate depth aquifers. The City's deep aquifer zone exists throughout the service area, and is more predominant to the north and west. The deep aquifer zone slopes downward from the west of the service area, with gradual flattening towards the east. Both the City and UC Davis primarily rely on the deep aquifer due to its generally better quality in terms of hardness and total dissolved solids compared to water produced from the intermediate depth aquifer.

Aquifers in the Davis area are recharged by percolation of rainfall and to a lesser extent irrigation water. Other significant sources include infiltration in streambeds, channels, and the Yolo Bypass. Relatively course-grained deposits line both Putah and Cache Creeks, allowing substantial infiltration. The deep aquifer has a much longer recharge period as compared to the intermediate depth aquifer, on the order of thousands of years versus hundreds of years, respectively.

The City's water supply quantity available from groundwater is not impacted by dry, average, or wet years.[14] In dry years, the groundwater levels may decline, but this does not reduce the pumping capacity of the City's wells until the groundwater levels drop significantly. The City has an understanding with UC Davis to limit the maximum daily groundwater pumping capacity of the deep aquifer wells. Treatment facilities may be needed on some of the existing deep wells in the future depending on changes in groundwater quality and drinking water standards. As of August 2014, all of the City's wells meet the drinking water standards with the exception of Well 14. Well 14 exceeds the Secondary standard for Iron and is currently used as a standby well. Additional groundwater aquifer information is provided in Section 4.15, Utilities, of this EIR. Please refer to Section 4.15 for more discussion.

Groundwater Quality

Groundwater quality in the planning area is generally high in total dissolved solids and hardness that causes scaling in plumbing systems and affects taste and odor. Over one-half of the residential homes use water softeners to lower hardness levels. Overall, groundwater quality in the planning area is of fair quality when compared to current drinking water regulations.

[14] Brown and Caldwell. *Water Supply Assessment.* June 2015, p. 4-3.

Water Quality

Water is essential to recreation, the viability of agriculture, and the development of housing, commerce, and industry, as well as the maintenance of high-quality fish and wildlife habitats. Potential hazards to surface water quality include the following nonpoint pollution problems: high turbidity from sediment resulting from erosion of improperly graded construction projects; concentration of nitrates and dissolved solids from agriculture or surfacing septic tank failures; contaminated street and lawn runoff from urban areas; and warm water drainage discharges into cool water streams.

A critical period of surface water quality is following a rainstorm which produces significant amounts of drainage runoff into streams at low flow, resulting in poor dilution of contaminants in the low flowing stream. Such conditions are most frequent during the fall at the beginning of the rainy season when stream flows are near their lowest annual levels and contaminants have accumulated on impervious surfaces over the drier summer months. Besides greases, oils, pesticides, litter, and organic matter associated with such runoff, heavy metals such as copper, zinc, and cadmium can cause considerable harm to aquatic organisms when introduced to streams in low flow conditions.

Surface water pollution is also caused by erosion. Excessive and improperly managed grading, vegetation removal, quarrying, logging, and agricultural practices can lead to increased erosion of exposed earth and sedimentation of watercourses during rainy periods. In slower moving water bodies, these same factors often cause a buildup of sediment, which ultimately reduces the capacity of the water system to percolate and recharge groundwater basins, as well as adversely affects both aquatic resources and flood control efforts.

Land uses and activities that the City must consider in protecting the quality of the City's water include construction activities, agricultural land uses, and urban runoff.

Construction Activities

Construction grading can impact water quality because it exposes bare soil. Rainfall on bare soil can cause erosion and sedimentation into nearby water bodies. Unstabilized soil can be washed or wind-blown into nearby surface water. Construction activities can also result in petroleum products and other pollutants from construction equipment entering nearby drainages.

Agricultural Land Uses

Water running off irrigated agricultural fields may contain fertilizers and pesticides. Improper use and disposal of farm chemicals can contaminate surface and groundwater resources. Agricultural procedures can also result in erosion of unstabilized soil, especially during conversion of vegetation. Aerial spraying could also drift into nearby water bodies.

Urban Runoff

Urban runoff includes household chemicals (including pesticides, herbicides, and paints), as well as petroleum products from automobiles and landscaping equipment. Municipal sources of pollution include government yards where transportation, fueling, and maintenance activities take place.

4.9.3 REGULATORY CONTEXT

The following is a description of federal, State, and local environmental laws and policies that are relevant to the review of hydrology and water quality under the California Environmental Quality Act (CEQA) process.

Federal Regulations

The following are the federal environmental laws and policies relevant to hydrology and water quality.

Federal Emergency Management Agency (FEMA)

The Federal Emergency Management Agency (FEMA) is responsible for determining flood elevations and floodplain boundaries and utilizing U.S. Army Corps of Engineers (USACE) levee information and other studies. FEMA is also responsible for distributing the Flood Insurance Rate Maps (FIRMS), which are used in the National Flood Insurance Program (NFIP). These maps identify the locations of special flood hazard areas, including the 100-year floodplains.

FEMA allows non-residential development in the floodplain; however, construction activities are restricted within the flood hazard areas, depending upon the potential for flooding within each area. Federal regulations governing development in a floodplain are set forth in Title 44, Part 60 of the Code of Federal Regulations (CFR). These standards are implemented at the State level through construction codes and local ordinances; however, these regulations only apply to residential and non-residential structure improvements. Although roadway construction or modification is not explicitly addressed in the FEMA regulations, the California Department of Transportation (Caltrans) has also adopted criteria and standards for roadway drainage systems and projects situated within designated floodplains. Standards that apply to floodplain issues are based on federal regulations (Title 23, Part 650 of the CFR). At the State level, roadway design must comply with drainage standards included in Chapters 800-890 of the Caltrans Highway Design Manual. CFR Section 60.3(c)(10) restricts cumulative development from increasing the water surface elevation of the base flood by more than one foot within the floodplain.

Federal Clean Water Act

The National Pollutant Discharge Elimination System (NPDES) permit system was established in the federal Clean Water Act (CWA) to regulate municipal and industrial discharges to surface waters of the U.S. Each NPDES permit contains limits on allowable concentrations and mass

emissions of pollutants contained in the discharge. Sections 401 and 402 of the CWA contain general requirements regarding NPDES permits. Section 307 of the CWA describes the factors that EPA must consider in setting effluent limits for priority pollutants.

Nonpoint sources are diffuse and originate over a wide area rather than from a definable point. Nonpoint pollution often enters receiving water in the form of surface runoff, but is not conveyed by way of pipelines or discrete conveyances. As defined in the federal regulations, such nonpoint sources are generally exempt from federal NPDES permit program requirements. However, two types of nonpoint source discharges are controlled by the NPDES program – nonpoint source discharge caused by general construction activities, and the general quality of stormwater in municipal stormwater systems.

Section 402 of the CWA mandates that certain types of construction activities comply with the requirements of the National Pollutant Discharge Elimination System (NPDES) stormwater program. The Phase II Rule, issued in 1999, requires that construction activities that disturb land equal to or greater than one acre require permitting under the NPDES program. In California, permitting occurs under the General Permit for Stormwater Discharges Associated with Construction Activity, issued to the SWRCB, implemented and enforced by the nine Regional Water Quality Control Boards (RWQCBs).

All dischargers with projects that include clearing, grading or stockpiling activities expected to disturb one or more acres of soil are required to obtain compliance under the NPDES Construction General Permit Order 2009-0009-DWQ. This General Permit requires all dischargers, where construction activity disturbs one or more acres, to take the following measures:

1. Develop and implement a Storm Water Pollution Prevention Plan (SWPPP) to include a site map(s) of existing and proposed building and roadway footprints, drainage patterns and storm water collection and discharge points, and pre- and post- project topography;
2. Describe types and placement of Best Management Practices (BMPs) in the SWPPP that will be used to protect storm water quality;
3. Provide a visual and chemical (if non-visible pollutants are expected) monitoring program for implementation upon BMP failure; and
4. Provide a sediment monitoring plan if the area discharges directly to a water body listed on the 303(d) list for sediment.

To obtain coverage, a SWPPP must be submitted to the RWQCB electronically and a copy of the SWPPP must be submitted to the City of Davis When project construction is completed, the landowner must file a Notice of Termination (NOT).

Construction Site Runoff Management

In accordance with NPDES regulations, in order to minimize the potential effects of construction runoff on receiving water quality, the State requires that any construction activity affecting one (1) acre or more must obtain a General Construction Activity Stormwater Permit. Permit applicants are required to prepare a Stormwater Pollution Prevention Plan (SWPPP) and

implement Best Management Practices (BMPs) to reduce construction effects on receiving water quality by implementing erosion and sediment control measures.

State Regulations

The following are the State environmental laws and policies relevant to hydrology and water quality.

California Department of Water Resources

The California Department of Water Resources defines the "Urban Level of Flood Protection" as follows:

> "Urban level of flood protection" means the level of protection that is necessary to withstand flooding that has a 1-in-200 chance of occurring in any given year using criteria consistent with, or developed by, the Department of Water Resources (California Government Code Section 65007(l) and California Water Code Section 9602(i)).

For an area under consideration to be found able to withstand flooding, the following must apply:

> All structures must be capable of withstanding direct and prolonged contact with floodwaters without sustaining significant damage. The term "prolonged contact" means at least 72 hours, and the term "significant damage" means any damage requiring more than cosmetic repair. "Cosmetic repair" includes cleaning, sanitizing, and resurfacing (e.g., sanding, repair of joints, repainting) of the material. The cost of cosmetic repair should also be less than the cost of replacement of affected materials and systems. In addition to these requirements, individual materials that are considered flood damage-resistant must not cause degradation of adjacent materials or the systems of which the material is a part (FEMA, 2008).

As noted previously, achieving 200-year flood protection for the MRIC is not required by the California Urban Level of Flood Protection criteria because:[15]

- The FEMA special flood hazard mapping does not cover any of the MRIC Site; and
- FEMA has not delineated a Moderate Flood Hazard in the vicinity of the Site

State Water Resources Control Board

The SWRCB and the RWQCBs are responsible for ensuring implementation and compliance with the provisions of the federal CWA and California's Porter-Cologne Water Quality Control Act. The project site is situated within the jurisdictional boundary of the Central Valley RWQCB (Region 5). The Central Valley RWQCB has the authority to implement water quality protection standards through the issuance of permits for discharges to waters at locations within their jurisdiction.

[15] West Yost Associates. *Review of the Drainage Study for Mace Ranch Innovation Center*. August 10, 2015.

Executive Order B-29-15

On April 1, 2015, the Governor of California proclaimed a continued state of emergency directing the SWRCB to enhance emergency regulations adopted in 2014 and reaffirmed on March 17, 2015. The Governor's Executive Order B-29-15 sets 2013 as a base year and directed the SWRCB to impose restrictions to achieve a statewide 25 percent water reduction through February 28, 2016.

On May 5, 2015, the State Water Resources Control Board adopted an emergency regulation requiring an immediate 25 percent reduction in overall potable urban water use statewide in accordance with the Governor's April 1, 2015 Executive Order. Based upon the City of Davis' average residential gallons per capita per day usage between July-September 2014, the City's total potable water production must be reduced by 28 percent for each month as compared to the amount used in the same month in 2013. Beginning June 1, 2015, the City of Davis shall comply with this conservation standard.

Senate Bill 88 (2015)

On June 23, 2015, Governor Jerry Brown signed into law Senate Bill No. 88 ("SB 88"). SB 88 amends California Water Code section 377 to permit a court and public entities that provide wholesale or retail water to hold a person civilly liable for violations of water conservation programs adopted pursuant to Water Code section 375 *et seq*. and emergency regulations adopted by the California State Water Resources Control Board (the "Water Board") pursuant to Water Code section 1058.5. The civil penalties may not exceed $10,000. In addition to these remedies, the bill authorizes a public entity to enforce water use limitations by imposing volumetric penalties in an amount established by the public entity.

SB 88 amends provisions of the Water Code governing water conservation programs (Water Code section 375 et seq.); provides specific authority for imposing civil penalties for violations of a water conservation program; establishes specific procedures that must be followed for imposing penalties, including issuing a citation and a complaint; authorizes the imposition of volumetric penalties; and restricts the use of the revenues from those penalties for water conservation programs only.

These new provisions of the Water Code will supersede any contrary policies, rules, regulations, procedures, resolution, ordinance or Municipal Code provisions the City has in place that govern the procedures for imposing a penalty for violations of a water conservation program and any related appeals procedures. Local agencies, like Davis, that have previously adopted an ordinance or resolution that establish specific procedures for enforcement and appeals for violations of their policies, rules, regulations, procedures, or Municipal Code provisions governing their water conservation program are now required follow these procedures for enforcing their water conservation programs.

Local Regulations

The following are the local environmental laws and policies relevant to hydrology and water quality.

Davis General Plan

The General Plan policies and standards, which are applicable to hydrology and water quality, are included in Table 4.9-5 below, under Impact 4.9-6.

City of Davis Municipal Code

All construction within areas of special flood hazards shall be required to comply with the standards in Chapter 8, Buildings, of the Municipal Code:

8.07.010 Standards of construction.

(a) Anchoring.
  (1) All new construction and substantial improvements shall be anchored to prevent flotation, collapse or lateral movement of the structure resulting from hydro-dynamic and hydrostatic loads, including the effects of buoyancy.
  (2) All manufactured homes shall meet the anchoring standards of Section 8.07.040
(b) Construction materials and methods.
  (1) All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage.
  (2) All new construction and substantial improvements shall be constructed using methods and practices that minimize flood damage.
  (3) All new construction and substantial improvements shall be constructed with electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.
  (4) Require within Zone AH or AO, adequate paths around structures on slopes to guide floodwaters around and away from proposed structures.
(c) Elevation and floodproofing.
  (1) New construction and substantial improvements of any structure shall have the lowest floor, including basement, elevated to or above the base flood elevation. Nonresidential structures may meet the standards in subparagraph (c)(3) of this section. Upon the completion of the structure the elevation of the lowest floor including basement shall be certified by a registered professional engineer or surveyor to be properly elevated. Such certification or verification shall be provided to the floodplain administrator.
  (2) New construction and substantial improvement of any structure in Zone AH or AO shall have the lowest floor, including basement, elevated above the highest adjacent grade at least as high as the depth number specified in feet on the FIRM, or at least two feet if no depth number is specified. Nonresidential structures may meet the standards in subparagraph (c)(3) of this section. Upon the completion of the structure the elevation of the lowest floor including basement shall be

certified by a registered professional engineer or surveyor to be properly elevated. Such certification or verification shall be provided to the floodplain administrator.

(3) Nonresidential construction shall either be elevated in conformance with subparagraph (c)(1) or (c)(2) of this section or, together with attendant utility and sanitary facilities:
    (A) Be floodproofed so that below the base flood level the structure is watertight with walls substantially impermeable to the passage of water;
    (B) Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy; and
    (C) Be certified by a registered professional engineer or architect that the standards of this subsection are satisfied. Such certifications shall be provided to the floodplain administrator.

(4) Require, for all new construction and substantial improvements, that fully enclosed areas below the lowest floor that are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or meet or exceed the following minimum criteria:
    (A) Either a minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers, valves or other coverings or devices provided that they permit the automatic entry and exit of floodwaters;
    (B) Or be certified to comply with a local floodproofing standard approved by the Federal Insurance Administration.

(5) Manufactured homes shall also meet the standards in Section 8.07.040. (Ord. 1464 § 2)

In addition, Chapter 30, Stormwater Management and Discharge Control, contains the following relevant standards related to stormwater facilities:

30.03.010 Construction activities subject to State of California NPDES General Permit for Stormwater Discharges Assocaited with Consturction Activity.

Each discharger associated with construction activity, as described in the NPDES *General Permit for Stormwater Discharges Associated with Construction Activity* (NPDES General Permit No. CAS000002) shall submit a NOI and comply with the general permit. (Ord. 2391 § 1, 2012)

30.03.030 New development and significant redevelopment projects subject to State of California NPDES Phase II Small Municipal Separate Storm Sewer System General Permit.

All discretionary development and redevelopment projects that are classified as either categorical redevelopment and/or categorical development projects are subject to the standards as described in the NPDES *General Permit for Phase II Small Municipal Separate Storm Sewer System* (NPDES General Permit No. CAS000004). (Ord. 2391 § 1, 2012)

30.03.050 City approval of stormwater control measures.

> No building permit shall be issued by the city unless the design of the required stormwater control measures has been reviewed and approved by the city. No final certificate of occupancy shall be issued by the city until the installation of such stormwater control measures has been completed in substantial conformance with the approved design as determined by the director or designee. Stormwater control measures shall be designed and installed in accordance with Section 30.03.030. (Ord. 2391 § 1, 2012)

4.9.4 IMPACTS AND MITIGATION MEASURES

This section describes the standards of significance and methodology utilized to analyze and determine the proposed project's potential impacts related to hydrology and water quality. A discussion of the project's impacts, as well as mitigation measures where necessary, is also presented.

Standards of Significance

According to CEQA Guidelines, an impact is considered significant if the proposed project would result in any of the following:

- Violate any water quality standards or waste discharge requirements;
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted);
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site;
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;
- Otherwise substantially degrade water quality;
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows;
- Fail to provide applicable urban level of flood protection (protection from or removal from 200-year floodplain) pursuant to the California Government Code Section 65007;
- Expose people or structures to significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam;

- Result in inundation by seiche, tsunami or mudflow; or,
- Conflict, or create an inconsistency, with any applicable plan, policy, or regulation adopted for the purpose of avoiding or mitigating environmental effects related to hydrology and water quality.

Issues Not Discussed Further

The project area is not located near any large bodies of water that would pose a seiche or tsunami hazard. The nearest large body of water, Lake Berryessa, is located approximately 26 miles west of the project site. In addition, the project site is relatively flat and is not located near any physical or geologic features that would produce a mudflow hazard. Therefore, no impact would occur related to inundation by seiche, tsunami, or mudflow. Issues related to seiche, tsunami, and mudflow hazards are not further discussed.

In addition, the proposed project does not include housing. Therefore, no impact would occur related to placing housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.

Therefore, issues related to placing housing within a flood hazard area, and providing the applicable urban level of flood protection, are not further discussed.

Method of Analysis

Watermark Engineering Drainage Studies for MRIC Site

The Drainage Study prepared for the proposed project by Watermark Engineering presents the following:

- Review of the Mace Ranch Drainage Study completed in 1991;
- Significant updates of both land use and facilities to reflect current conditions;
- Greater detail and analysis of storm drain system along Alhambra Boulevard;
- Use of a more robust computer model to evaluate existing conditions and the potential impact of the MRIC development;
- Check on the previous Mace Ranch Drainage Study and constructed facilities with the separate model.
- Alternative analysis of the capacity of the MDC;
- Conceptual layout of MRIC drainage facilities, including local attenuation storage;
- Conceptual water quality treatment program;
- Preliminary evaluation of transferring available onsite storage farther downstream; and
- Review of FEMA Flood Maps.

Additional drainage analysis for the project was provided by Watermark Engineering in the Drainage Technical Memorandum. In general, Watermark's additional drainage analysis focused on the potential increase in downstream ponding that could occur from the increase in

runoff volume resulting from the proposed MRIC. Watermark evaluated three scenarios relating to different storm events.

West Yost Technical Reviews

West Yost Associates was retained by the City of Davis Public Works Department to perform a technical review of the drainage analysis prepared by Watermark Engineering. A technical review memorandum was prepared by West Yost for Watermark's June 15, 2015 *Drainage Study for Mace Ranch Innovation Center*.

Watermark Engineering Drainage Study for Mace Triangle Site

Watermark Engineering prepared a conceptual drainage analysis for the Mace Triangle site in order to evaluate the pre- and post-project peak runoff rates from the site and expected increase in volume of runoff attributable to future development of the Mace Triangle.

An XP-SWMM analysis was made to estimate the detention storage necessary to attenuate the 100-year, 24-hour peak flow.

Innovation Center Flood Elevation and Inundation Area Increase Study

The City of Davis Public Works Department retained West Yost Associates to assist the City with calculating the potential increases in downstream ponding associated with the innovation center projects' runoff volumes under the 10-year, 100-year and 200-year floodplain water surface elevations (WSE).

To gain an understanding of the potential increases in downstream flood WSEs and inundation areas due to the development of the proposed project, a range of predevelopment WSEs were evaluated, including:

- Lowest Flood Water Level – The lowest possible WSE that would likely block the flow into the Yolo Bypass and cause flooding in the study area is about 17 feet NAVD88. This Lowest Flood Water Level will have the smallest associated flooded area and consequently will have the largest potential increases in WSEs and flood inundation area due to the development of the Innovation Centers.
- Highest Flood Water Level Contained on City Owned Property – The City owns several parcels between the Yolo Bypass and the City. The highest elevation on which floodwater can pool and still be contained on the City owned parcels is about 19 feet NAVD88.
- 10-Year Water Level – The April 2, 2002 FEMA Flood Insurance Study for Yolo County provides a 10-year WSE in the Yolo Bypass at the upstream side of the railroad (where the Mace Ranch Drain enters the Yolo Bypass) of about 24.80 feet NGVD29. This is equivalent to 27.34 feet NAVD88.
- 100-Year Water Level – The FEMA Flood Insurance Rate Map Number 06113C0610G (June 18, 2010) for Yolo County provided a 100-year WSE in

the Yolo Bypass at the upstream side of the railroad (where the Mace Ranch Drain enters the Yolo Bypass) between 29 and 30 feet NAVD88. For this study, a 100-year WSE of 29.50 feet NAVD88 was used.

- 200-Year Water Level – The California Department of Water Resources FloodSAFE Program published a 200-year flood map for the City (June 26, 2013), and indicated the 200-year WSE is 32.00 feet NAVD88. This is the highest WSE considered during this study. Consequently, it will have the smallest predicted increases in WSE and flood area. This water level would only occur in the study area if there was a Yolo Bypass levee failure.

None of the WSEs listed above are known to an accuracy of 0.01 foot. However, for this study, elevations are reported to an accuracy of 0.01-foot because the potential changes in the WSEs from the development of the innovation center are very small, and it is the potential change in WSEs that are being evaluated.

Project Impacts and Mitigation Measures

The following discussion of impacts is based on the implementation of the proposed project in comparison with the standards of significance identified above. The discussions and mitigation measures presented below apply to both the MRIC and the Mace Triangle unless otherwise stated.

4.9-1 Substantially alter the existing drainage pattern of the site or area, or create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site. Based on the analysis below and with implementation of mitigation, the impact is *less than significant.*

The proposed project, when complete, would result in new impervious surfaces and thus an incremental reduction in the amount of natural soil surfaces available for the infiltration of rainfall and runoff, thereby generating additional runoff during storm events. Additional runoff could contribute to the flood potential of natural stream channels or contribute runoff that could exceed the capacity of the City's stormwater drainage system.

MRIC

The following discussion will address the two important aspects of hydrology as they relate to the project's stormwater runoff – rate of runoff and volume of runoff.

Rate of Runoff

When the MRIC is developed, the on-site impervious area will increase, leading to faster runoff rates. The increased rate of runoff will be attenuated using on-site facilities. The

conceptual design of the on-site drainage facilities is to minimize the use of storm drains. Rather, runoff will be conveyed along shallow landscaped corridors that will flow to the buffer areas at the northern and southern edges. From there, the runoff will be conveyed to the eastern buffer area where it will flow towards the MDC. The northern, southern, and eastern buffer areas will provide a combination of conveyance and detention storage via wide relatively shallow areas that may be "benched" as the runoff moves toward the MDC. Maximum discharge from each of the north and south buffer areas will be in the range of 15 to 25 cfs (total combined contribution estimated to be between 30 to 50 cfs), and will outfall into the MDC, near the eastern boundary of MRIC site, probably separate for the existing detention basin.

In addition to the on-site facilities, the MDC will likely be modified through the MRIC site, but will be designed to meet the original design criteria. The MDC was originally designed as a trapezoidal channel with a 15-foot bottom width, 2V to 1H side slopes, a channel slope of 0.0007 feet per foot, and a Manning's roughness of 0.040. A City maintenance program exists to help maintain the design capacity. Table 4.9-1 provides a summary of the design flows.

Table 4.9-1
Summary of Design Flows along Mace Drainage Channel

Location	Design 100-yr flow (cfs)	Depth of Flow (ft)
Downstream of Mace Blvd.	255[1]	4.8
Downstream of Detention Basin	225	4.5
At the Eastern Boundary of MRIC	260	4.9
Upstream of County Road 105	273	5.0
Downstream of County Road 105	305	5.3
Downstream of Schultz Crossing	313	5.4
Downstream of Swingle PG&E Pumping Station	330	5.5

Notes:
[1] Based on recent updated modeling
cfs = cubic feet per second

Source: Watermark Engineering, Inc. June 15, 2015

The original MDC Improvement Plans show the channel depth to be a minimum of seven (7) feet deep along the entire length, except the reach through the MRIC site. Recent topographic data indicate this reach is also at least seven (7) feet deep. Downstream of the improved section of the channel, downstream of the Swingle PG&E site, the Railroad Channel is not as deep but much wider.

It is expected that both the channel and detention basin will be reconfigured to be more compatible with the Innovation Center. Conceptual designs of the conveyance corridor and detention facilities that are being considered include the following:

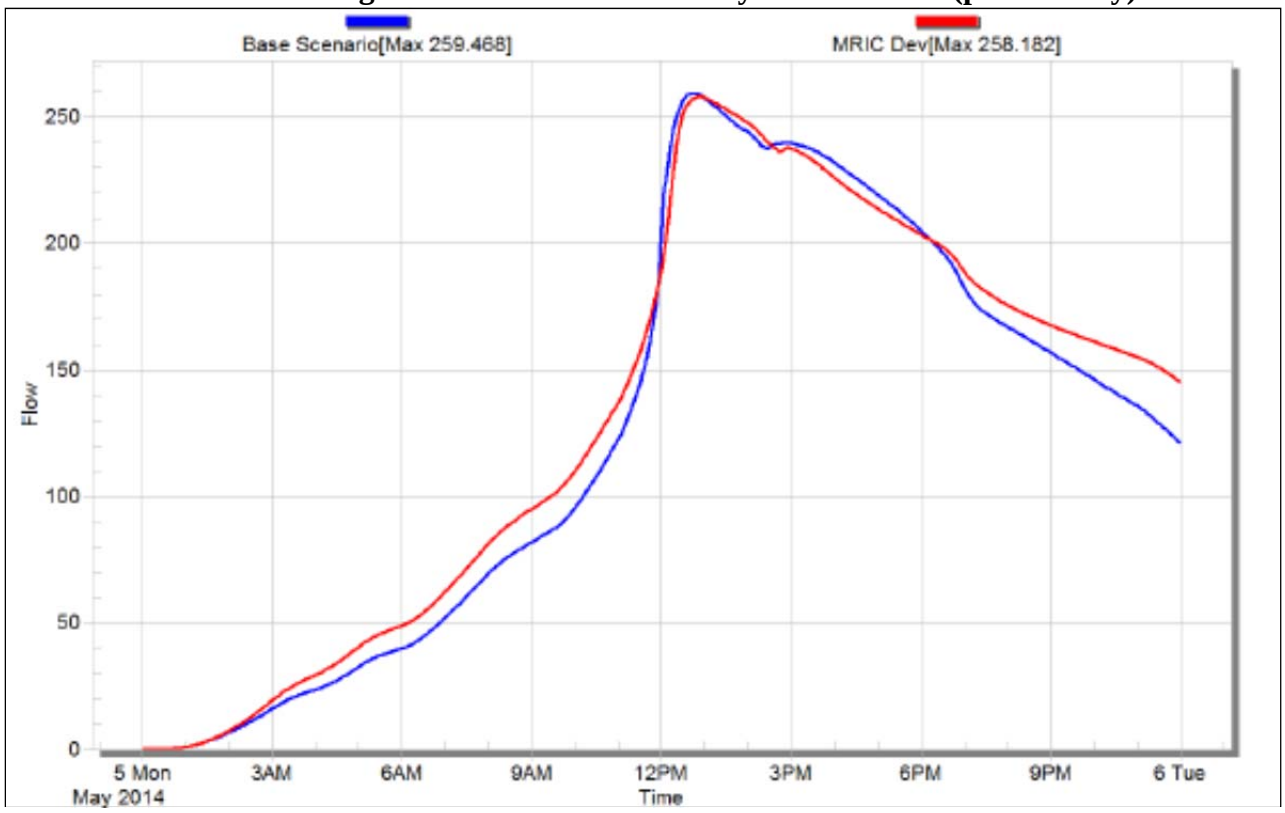
- Extension of the storm drains from Mace Boulevard, approximately 700 feet farther east to provide better access at the eastern portion of MRIC and to alleviate safety concerns at

the proposed Oval area of MRIC. The storm drain will consist of three 72-inch concrete pipes. The hydraulic grade line to convey 255 cfs in these pipes is 0.0005 ft/ft, the same that exists today in the open channel. This means that water levels upstream of Mace Boulevard will not significantly change as a result of the pipe installation.

- Farther downstream, the MDC may be configured to include a low-flow pipe or low-flow channel, coupled with a high-flow channel. If a low-flow channel is used, water depths will be designed to provide a healthy environment for mosquito fish. It is expected that the high flow channel will be landscaped and maintained to be viewed as an amenity. The preliminary channel shape is trapezoidal, with a 10-foot bottom width and 4:1 side slopes.
- The applicant intends to reduce the size of the existing on-site detention basin, and reconfigure it with varied side-slopes and a more rounded shape (see Figure 3-19 of the Project Description). It would be an offline storage facility and only fill during extreme storm events, and be fully landscaped with pedestrian access and recreational uses.

The design will be such that the combination of attenuated on-site flows and the reconfigured channel and off-line detention will reduce 100-year flows leaving the developed MRIC to the original design capacity of 260 cfs. This means that there will be no increase in the rate of flow leaving MRIC, and consequently, no downstream impacts related to the existing capacity of the MDC. Figure 4.9-3 shows the preliminary model results that show no increase in downstream flow.

Figure 4.9-3
Plot of Flows along MDC at Eastern Boundary of MRIC Site (preliminary)



Source: Watermark Engineering, Inc. June 15, 2015 Drainage Report [Attachment 6]

As noted previously, a vehicle crossing exists at the curved section of the MDC, just east of the MRIC site; and the two channels are connected by two 24-inch CMPs. One pipe is located at the channel slow lines, and the other is several feet higher. The connection represents a significant bottleneck along the MDC. Any potential overtopping of flood waters as a result of the bottleneck is addressed by the interim overland release facilities currently in place. In addition, the risk of damage is low because structures in the affected area do not currently exist. The proposed project would be required to connect the Phase 1 and Phase 2 channels.

Volume of Runoff

For MRIC, the rate of runoff will be attenuated on-site, as described above, such that peak runoff will mimic existing conditions. However, the volume of runoff is expected to increase as a result of development. During most rainstorms, this increased volume is unnoticed as the channel conveys all of the collected runoff to the Yolo Bypass.

There are about 7.5 square miles of land that drain to the eastern terminus of the Railroad Channel at the Yolo Bypass, into which the MDC flows. This includes about 730 acres of Mace Ranch and about 4,100 acres of agricultural land west of the Covell Drain and bounded by the Willow Slough Bypass levee to the north, the UPRR to the south, and the Yolo Bypass levee to the east. During typical rainstorms, runoff from this area discharges into the Yolo Bypass.

When there is heavy and prolonged rainfall in Northern California, flow in the Yolo Bypass rises. High flow in the Bypass creates backwater and can completely stop MDC flows from entering the Bypass. When this occurs, runoff from the 7.5-square mile tributary area ponds "behind" the Bypass levee and will remain there until the ponded water level is higher than the Bypass water level. In addition, during extreme storm events, and when the Bypass is high, both the Covell Drain and then North Davis Drain overflow to the east, adding runoff volume to the ponding area east of the Bypass levee.

The local storm event occurring over the City would not necessarily be the same magnitude of storm event that occurred over Northern California causing high water levels in the Yolo Bypass. Also, the duration of the high water levels in the Yolo Bypass would probably last much longer than the duration of flooding from the local storm. Thus, to develop a "worst case" evaluation, it was assumed that the water levels would block the flow into the Yolo Bypass for the full duration of the local storm events occurring over the City and Yolo County. This means that all of the increase in runoff from the MRIC would contribute to increased flooding in the study area west of the Yolo Bypass. The drainage engineers for the MRIC have estimated the increase in runoff from the MRIC for various, larger storm events, as summarized in Table 4.9-2. The increase in runoff from the Triangle for various, larger storm events, has also been estimated and shown in Table 4.9-2, given that the Mace Triangle is included in the approval process for the MRIC. These increases in runoff volumes were verified by West Yost Associates as reasonable through a preliminary evaluation of the total design storm rainfall depths applied to the proposed impervious areas on the Innovation Centers.

Table 4.9-2
Increases in Runoff Volumes Resulting from MRIC Site

Local Storm Event	Triangle Increase in Runoff Volume, ac-ft	MRIC Increase in Runoff Volume, ac-ft	Total Volume Increase, ac-ft
10-Year, 24-Hour	2.0	20	22
100-Year 24-Hour	2.5	26	29
100-Year, 10-Day	6.7	63	70
200-Year, 10-Day	7.2	68	75

Source: Watermark Engineering, Inc., June 15, 2015

MRIC Volume Increase

For this evaluation, it was assumed that the MDC flow is blocked from entering the Yolo Bypass. This assumption results in all of the flow from the MRIC site contributing to the flooding in the MDC Watershed on the land-side of the western Yolo Bypass levee.

As shown in Table 4.9-3, the development of the MRIC results in a range of increases in WSEs and inundation areas:

- The largest increase in flood WSE and inundation area are 0.11 feet and 25.7 acres.
- For 100-year and 200-year flood levels, the increase in flood WSEs is less than 0.01 feet, and the increase in inundation area is less than 3.7 acres.

Mace Triangle Volume Increase

For this evaluation, it was assumed that the Railroad drain flow is blocked from entering the Yolo Bypass. This assumption results in all of the flow from the Triangle Site contributing to the flooding in the MDC Watershed on the land-side of the western Yolo Bypass levee.

As shown in Table 4.9-4, the development of the Mace Triangle results in a range of increases in WSEs and inundation areas:

- The largest increase in flood WSE and inundation area are 0.01 feet and 2.5 acres.
- For 100-year and 200-year flood levels, the increase in flood WSEs is less than 0.01 feet, and the increase in inundation area is less than 0.4 acres.

The City has determined that the 100-year, 10-day increase in runoff volume resulting from the post-project condition needs to be addressed as part of the proposed project. The total volume of increased runoff during the 100-year, 10-day storm event is projected to be approximately 70 ac-ft (MRIC = 63 ac-ft; Mace Triangle = 6.7 ac-ft; see Table 4.9-2). At this time, two engineering solutions have been identified.

Table 4.9-3

Increases in Flood WSE and Inundation Areas West of the Yolo Bypass Due to Development of the Mace Ranch Innovation Center

Local Storm	Predevelopment WSE, ft,NAVD88	Predevelopment Flooded Area, acres	Predevelopment Flooded Volume, ac-ft	Increase in Volume of Runoff from Development (from Table 1), ac-ft	Post Development Flooded Volume, ac-ft	Post Development WSE, ft, NAVD88	Development Related Increase in WSE, ft, NAVD88	Post Development Flooded Area, acres	Development Related Increase in Flooded Area, acres
Lowest Flood Water Level (WSE = 17 feet NAVD88)									
10-Year, 24-Hour	17.00	119.2	239.4	20.0	259.4	17.08	0.08	139.0	19.8
100-Year 24-Hour	17.00	119.2	239.4	26.0	265.4	17.11	0.11	144.9	25.7
Highest Flood Water Level on City Owned Property (WSE = 19 feet NAVD88)									
10-Year, 24-Hour	19.00	623.2	1,098.3	20.0	1,118.3	19.03	0.03	631.9	8.7
100-Year 24-Hour	19.00	623.2	1,098.3	26.0	1,124.3	19.04	0.04	634.5	11.3
10-Year Water Level (WSE = 27.34 feet NAVD88)									
10-Year, 24-Hour	27.34	3,694.3	18,689.7	20.0	18,709.7	27.35	0.01	3,696.0	1.6
100-Year 24-Hour	27.34	3,694.3	18,689.7	26.0	18,715.7	27.35	0.01	3,696.5	2.1
100-Year Water Level (WSE = 29.5 feet NAVD88)									
10-Year, 24-Hour	29.50	4,314.8	27,258.0	20.0	27,278.0	29.50	0.00	4,316.0	1.2
100-Year 24-Hour	29.50	4,314.8	27,258.0	26.0	27,284.0	29.51	0.01	4,316.4	1.5
100-Year, 10-Day	29.50	4,314.8	27,258.0	63.0	27,321.0	29.51	0.01	4,318.5	3.7
200-Year Water Level (WSE = 32 feet NAVD88)									
10-Year, 24-Hour	32.00	4,970.4	38,828.6	20.0	38,848.6	32.00	0.00	4,971.2	0.7
100-Year 24-Hour	32.00	4,970.4	38,828.6	26.0	38,854.6	32.01	0.01	4,971.4	0.9
100-Year, 10-Day	32.00	4,970.4	38,828.6	63.0	38,891.6	32.01	0.01	4,972.7	2.3
200-Year, 10-Day	32.00	4,970.4	38,828.6	68.0	38,896.6	32.01	0.01	4,972.9	2.5

Source: West Yost Associates. Innovation Center Flood Elevation and Inundation Area Increase Study. May 15, 2015.

Table 4.9-4

Increases in Flood WSE and Inundation Areas West of the Yolo Bypass Due to Development of the Triangle Area Development

Local Storm	Predevelopment WSE, ft,NAVD88	Predevelopment Flooded Area, acres	Predevelopment Flooded Volume, ac-ft	Increase in Volume of Runoff from Development (from Table 1), ac-ft	Post Development Flooded Volume, ac-ft	Post Development WSE, ft, NAVD88	Development Related Increase in WSE, ft, NAVD88	Post Development Flooded Area, acres	Development Related Increase in Flooded Area, acres
Lowest Flood Water Level (WSE = 17 feet NAVD88)									
10-Year, 24-Hour	17.00	119.2	239.4	2.0	241.4	17.01	0.01	121.2	2.0
100-Year 24-Hour	17.00	119.2	239.4	2.5	241.9	17.01	0.01	121.7	2.5
Highest Flood Water Level on City Owned Property (WSE = 19 feet NAVD88)									
10-Year, 24-Hour	19.00	623.2	1,098.3	2.0	1,100.3	19.00	0.00	624.1	0.9
100-Year 24-Hour	19.00	623.2	1,098.3	2.5	1,100.8	19.00	0.00	624.3	1.1
10-Year Water Level (WSE = 27.34 feet NAVD88)									
10-Year, 24-Hour	27.34	3,694.3	18,689.7	2.0	18,691.7	27.34	0.00	3,694.5	0.2
100-Year 24-Hour	27.34	3,694.3	18,689.7	2.5	18,692.2	27.34	0.00	3,694.5	0.2
100-Year Water Level (WSE = 29.5 feet NAVD88)									
10-Year, 24-Hour	29.50	4,314.8	27,258.0	2.0	27,260.0	29.50	0.00	4,315.0	0.1
100-Year 24-Hour	29.50	4,314.8	27,258.0	2.5	27,260.5	29.50	0.00	4,315.0	0.1
100-Year, 10-Day	29.50	4,314.8	27,258.0	6.7	27,264.7	29.50	0.00	4,315.2	0.4
200-Year Water Level (WSE = 32 feet NAVD88)									
10-Year, 24-Hour	32.00	4,970.4	38,828.6	2.0	38,830.6	32.00	0.00	4,970.5	0.1
100-Year 24-Hour	32.00	4,970.4	38,828.6	2.5	38,831.1	32.00	0.00	4,970.5	0.1
100-Year, 10-Day	32.00	4,970.4	38,828.6	6.7	38,835.3	32.00	0.00	4,970.7	0.2
200-Year, 10-Day	32.00	4,970.4	38,828.6	7.2	38,835.8	32.00	0.00	4,970.7	0.3

Source: West Yost Associates. Innovation Center Flood Elevation and Inundation Area Increase Study. May 15, 2015.

Replacement Storage Alternative

The first option involves storing the increased runoff volume off-site, until such time that the bypass flows recede and MDC and Railroad drain flows can enter the Yolo Bypass through the existing bypass levee culvert. In order to accomplish this, a portion of an off-site field could be lowered to store the increased incremental volume. The applicant has identified a potential off-site location, which is the easternmost parcel owned by the City of Davis, adjacent to the MDC and Yolo Bypass levee (APN 033-300-015; 204 acres; see Figure 4.9-4). Although this parcel is the applicant's preferred location due to the fact that it is some of the lowest agricultural land in the area, the other two, City-owned parcels, between the MRIC site and the parcel adjacent to the Yolo Bypass levee, could alternatively be lowered to provide the necessary storage (APN 033-300-001: 248 acres; and 300-650-006: 327 acres). If one of these higher City-owned properties is lowered, then some field ponding would occur at the lower elevations, adjacent to the levee, before the storage benefits are realized.

To accommodate the increased volume from MRIC and the Mace Triangle during major storm events, the lowered area would be relatively shallow, approximately 1-foot deep, depending on the footprint selected. The maximum excavation should be limited to 2.5 feet, unless there are compelling reasons for a deeper excavation. Topsoil would be removed and stockpiled, the selected area excavated to the design depth, and the topsoil then spread back over the lowered field.

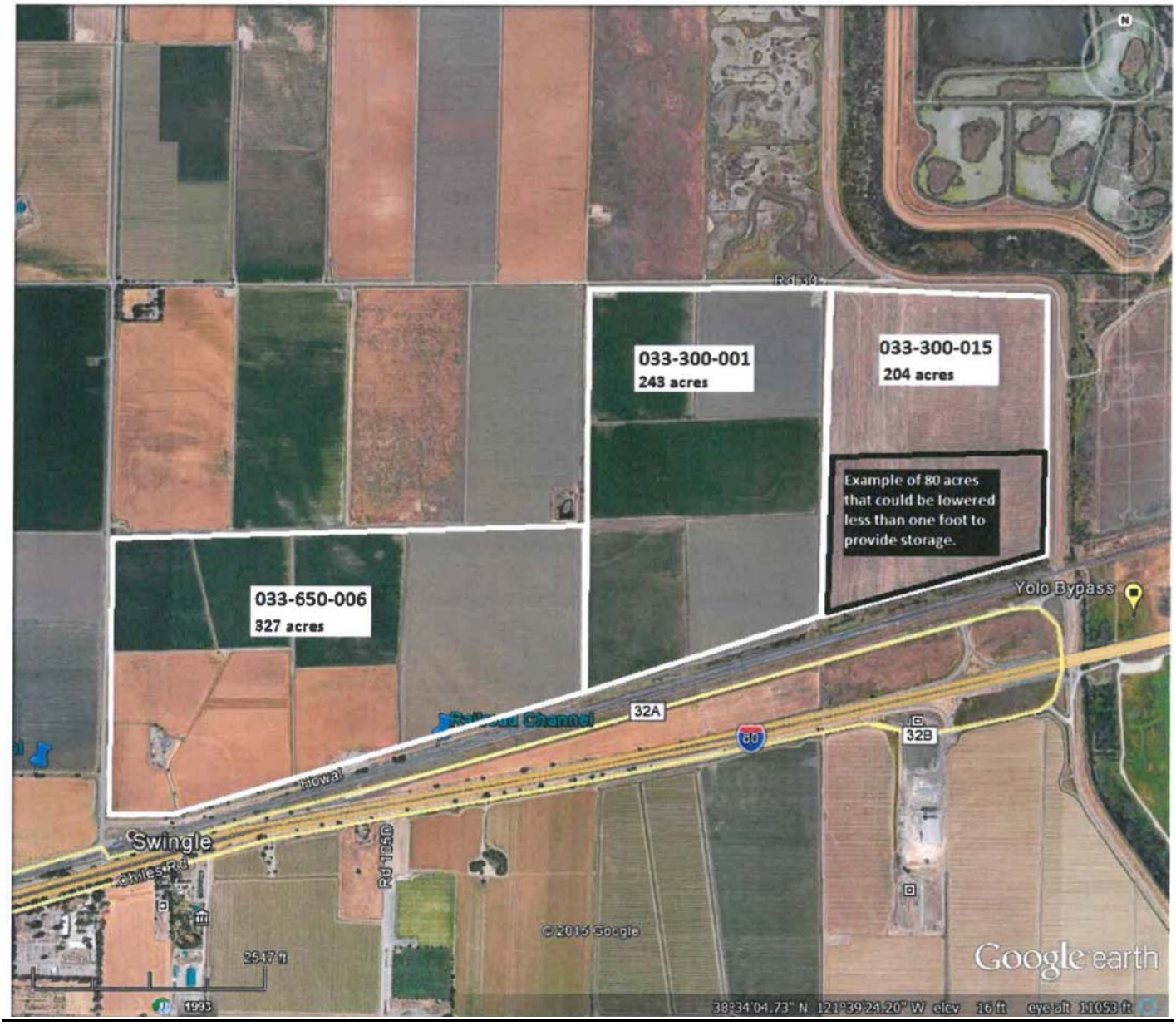
The field would be returned with the same slopes so that irrigation would continue in a manner similar to existing conditions. Drainage patterns would not be changed and the small elevation change will not adversely impact the irrigation methodology.

Ponding in this area occurs as a result of both heavy, local rainfall, and when the bypass has high flow that restricts or blocks the local outflow. Extent and duration of ponding is completely dependent on both local runoff and the water elevation in the bypass. Regardless, the off-site volumetric storage would be available whenever significant ponding would occur. This approach will allow for continued agricultural operations, but provide detention storage during major storm events, when the bypass is flowing at a high level.

Pumping Alternative

An alternative method to convey the increased runoff volume into the bypass, when the outfall is blocked by high water in the bypass, consists of a small pump station. The pump station would have a capacity of approximately three cfs, and could be a permanent installation or a portable trailer-mounted unit. It would take approximately 12 days to pump about 70 ac-ft of water, resulting from post-project runoff in the 100-year, 10-day storm event.

Figure 4.9-4
Conceptual Location of MRIC and Triangle Off-site Detention Area



A permanent installation would be sited near the existing outfall. Pump intake would be in the railroad channel and the conveyance pipe would go "over" the bypass levee, rather than "through" the levee, in order to maintain levee integrity. No impact to the Yolo Bypass would be expected because the pump would be used only when there is at least moderately high flow in the bypass, at least 10,000 cfs.

Similarly, a portable trailer-mounted, self-contained pump could be used. It could be stored at City facilities when not in use, and set up for pumping in several hours. The portable pump would require fewer and/or less rigorous approvals from the Flood Protection Board. It could also be used at other locations.

Mace Triangle

Rate of Runoff

It is anticipated that potential future development of up to 71,056 sf of research/Office/R&D and/or ancillary retail could occur on the Mace Triangle, which would increase the amount of impervious surface area. For the conceptual drainage analysis, it was assumed that the Park-and-Ride lot impervious surface area would not change, but the Ikedas percent impervious surface cover would increase from 20 to 90 percent, and the easternmost parcel from two to 90 percent.

Conceptual design criteria and facilities for the Mace Triangle are as follows:

- The increased rate of flow as a result of development will be attenuated to mimic existing conditions.
- On-site drainage facilities will be some combination of surface and pipe conveyance to a detention basin at the east end of the Mace Triangle.
- The outfall pipe from the detention basin is sized to restrict outflow to be equal or less than existing conditions.

A summary of the drainage report findings are as follows:

- Existing conditions peak flow is about 9 cubic feet per second (cfs).
- Developed peak flow is about 24 cfs.
- Basin footprint about 0.5-acre.
- Basin depth is four to five feet.
- Basin outfall pipe flow ≈ 9 cfs.
- Required storage about 1.1 acre-feet (af).
- Basin side-slopes would be 4:1 or flatter.

A conceptual location for a single detention basin are shown in Figure 4.9-5. The single basin scenario assumes that the involved property owners agree to locate a single detention basin at the proposed location. If such an agreement is not reached, then each property owner would need to develop its own independent drainage system, either on a permanent basis, or temporary basis, until such time that a central detention facility is constructed. The detention basin and storm drain facilities would be designed to meet City design standards in place at the time of development.

Volume of Runoff

The increased runoff volume from the Mace Triangle site for several design storms, assuming full build out, is shown in Table 4.9-2 above. As discussed, the 100-year, 10-day storm event would result in an increased volume at the developed Mace Triangle site of 6.7 ac-ft. This volumetric increase could be addressed by replacement storage or a pump station, as discussed in detail above.

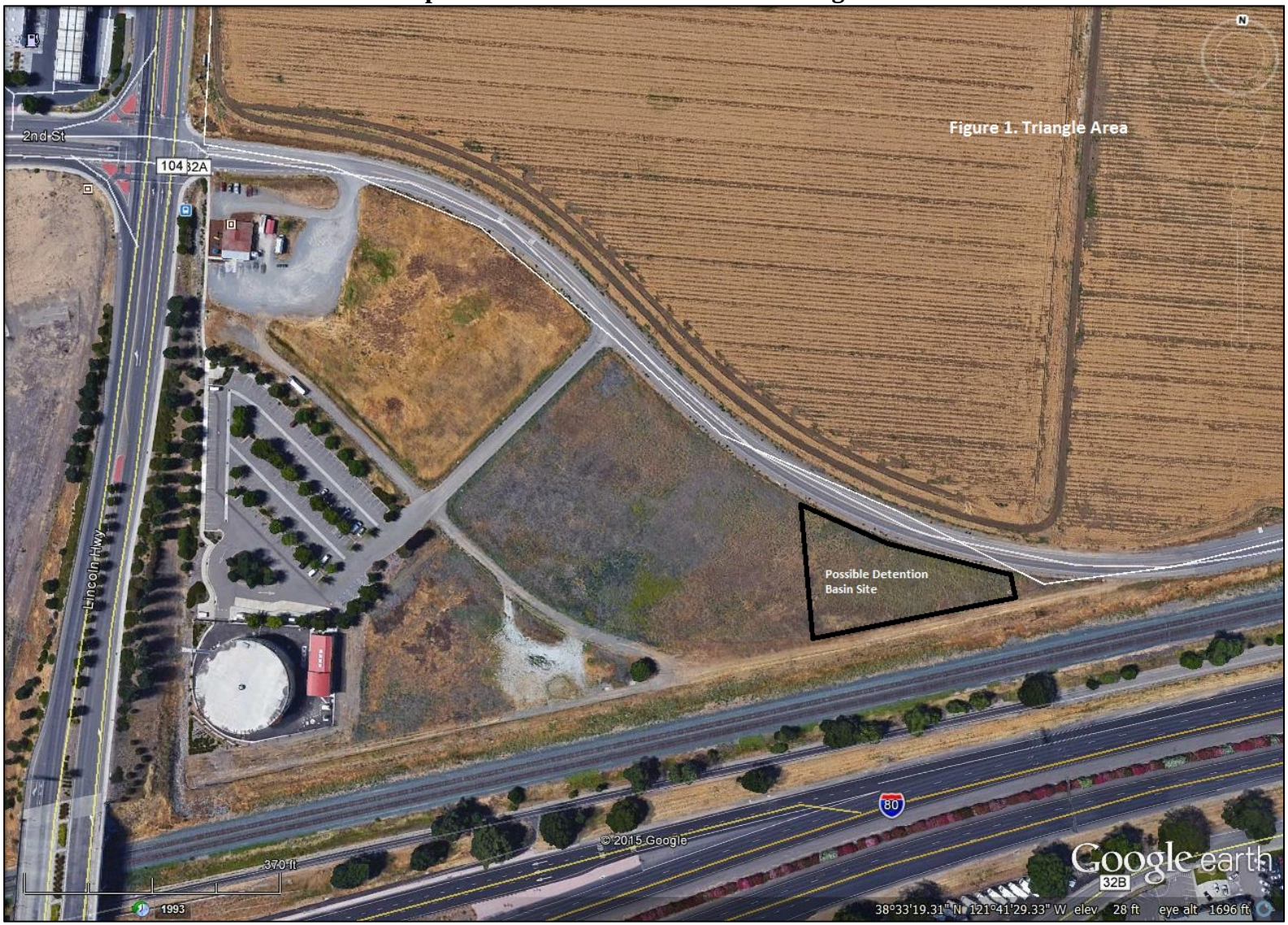
Conclusion

Development of the innovation center on the MRIC site would alter the existing drainage pattern of the site, and surrounding area, and would increase impervious surfaces on the site. The proposed innovation center design will be such that the combination of attenuated on-site flows and the reconfigured channel and off-line detention will reduce 100-year flows leaving the developed MRIC site to the original design capacity of 260 cfs. This means that there will be no increase in the rate of flow leaving MRIC, and consequently, no downstream impacts related to the existing capacity of the MDC. However, at this time, the drainage system design is conceptual.

In addition, with respect to the project's increase in the volume of runoff, the MRIC development needs to address this increased volume by either constructing off-site replacement storage, installing a pump station, or some other acceptable engineering alternative, as approved by the City of Davis. Otherwise, the project would result in an increase in downstream flooding of the City's agricultural property and adjacent properties during heavy storm events.

For the Mace Triangle, any future development on the Ikedas Parcel and adjacent agricultural parcel would increase impervious surfaces, thus contributing to increased peak flows. Without mitigation to ensure that the stormwater drainage system(s) for the Mace Triangle properties would sufficiently handle peak runoff from the project site, an adverse downstream impact could result. The increased runoff volume resulting from Mace Triangle development will also need to be addressed, similar to MRIC, by constructing off-site replacement storage, installing a pump station, or implementing another acceptable engineering solution.

Figure 4.9-5
Conceptual Detention Basin at Mace Triangle Site



Implementation of the following mitigation measures would reduce to a ***less-than-significant*** level the impacts associated with substantially altering the existing drainage pattern of the site or area, creating or contributing runoff water which would exceed the capacity of existing or planned stormwater drainage systems, and substantially increasing the rate or amount of surface runoff in a manner that would result in flooding on- or off-site.

Mitigation Measure(s)

MRIC

4.9-1(a) *In conjunction with submittal of the first final planned development for the MRIC, a design-level drainage report shall be submitted to the City of Davis Public Works Department for review and approval. The drainage report shall identify specific storm drainage design features to control the 100-year, 24-day increased runoff from the project site to ensure that the rate of runoff leaving the developed MRIC site does not exceed the original Mace Ranch Channel design capacity of 260 cfs. This may be achieved through: on-site conveyance and detention facilities, off-site detention or retention facilities, channel modification, or equally effective measures to control the rate and volume of runoff.*

The design-level drainage report shall include off-site drainage facilities sufficient to detain and control the increased runoff volume when the flow from the Mace Drainage Channel into the Yolo Bypass is blocked by high water levels in the Bypass. Preliminary estimates of increased runoff volumes are as much as 63 acre-feet. The final amount of runoff volume to be detained would be determined with the design-level drainage report. This could result in detaining run-off volume for an extended time period. During this time period, additional large storms could occur; thus, the proposed detention storage facilities shall also be able to manage (detain with a controlled release) the 100-year, 24-hour storm event.

The design-level drainage report shall also include design for detaining and controlling the increased run-off volume from the Mace Triangle site. Preliminary estimates of increased runoff volumes are as much as 7 acre-feet. The final amount of runoff volume to be detained would be determined with the design-level drainage report prepare for the MRIC.

Design-level recommendations provided in the drainage report shall be included in the improvements plans prior to their approval by the Davis Public Works Department.

4.9-1(b) *Prior to approval of the phase 1 improvement plans for the MRIC, the Public Works Department shall ensure that the plans include the development of the Phase 2 MDC improvements. The Phase 2*

improvements shall consist of removal of the two 24-inch corrugated metal pipes in order to provide a continuous channel between the Phase 1 and Phase 2 improvements.

Mace Triangle

4.9-1(c) In conjunction with submittal of each final planned development for the Mace Triangle, a design-level drainage report for the development shall be completed and submitted to the City of Davis Public Works Department for review and approval. The drainage report shall identify specific storm drainage design features to control the 100-year, 24-hour increased runoff from the project site. This may be achieved through: onsite conveyance and detention facilities, offsite detention or retention facilities, channel modification, or equally effective measures to control the rate and volume of runoff.

The design-level drainage report shall include off-site drainage facilities sufficient to detain and control the increased run-off volume when the flow from the Mace Drainage Channel into the Yolo Bypass is blocked by high water levels in the Bypass. Preliminary estimates of increased runoff volumes for the Mace Triangle site are as much as 7 acre-feet. The final amount of runoff volume to be detained for each proposed development would be determined with the design-level drainage report. This could result in detaining run-off volume for an extended time period. During this time period, additional large storms could occur; thus, the proposed detention storage facilities shall also be able to manage (detain with a controlled release) the 100-year, 24-hour storm event.

Design-level recommendations provided in the drainage report shall be included in the improvement plans prior to their approval by the Davis Public Works Department.

4.9-2 Violate any water quality standards or waste discharge requirements, provide substantial additional sources of polluted runoff, or otherwise substantially degrade water quality through erosion during construction. Based on the analysis below and with implementation of mitigation, the impact is *less than significant*.

Construction would require grading, excavation, and other construction-related activities that could cause soil erosion at an accelerated rate during storm events. All of these activities have the potential to affect water quality and contribute to localized violations of water quality standards if stormwater runoff from construction activities enters receiving waters.

Activities such as grading, excavation, and trenching for site improvements would result in the disturbance of on-site soils. The exposed soils have the potential to affect water quality in two ways: 1) suspended soil particles and sediments transported through

runoff; or 2) sediments transported as dust that eventually reach local water bodies. Spills or leaks from heavy equipment and machinery, staging areas, or building sites also have the potential to enter runoff. Typical pollutants include, but are not limited to, petroleum and heavy metals from equipment and products such as paints, solvents, and cleaning agents, which could contain hazardous constituents. Sediment from erosion of graded or excavated surface materials, leaks or spills from equipment, or inadvertent releases of building products could result in water quality degradation if runoff containing the sediment or contaminants should enter receiving waters in sufficient quantities. Impacts from construction-related activities would generally be short-term and of limited duration.

Because development at the MRIC site and possible future development at the Mace Triangle site would require construction activities that would result in a land disturbance greater than one acre, the applicants would be required by the State to obtain a General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit), which pertains to pollution from grading and project construction. Compliance with the Permit requires the projects applicant to file a Notice of Intent (NOI) with the SWRCB and prepare a SWPPP prior to construction. The SWPPP would incorporate BMPs in order to prevent, or reduce to the greatest feasible extent, adverse impacts to water quality from erosion and sedimentation. In addition, treatment of stormwater runoff would be addressed via the proposed on-site detention basins. The projects' required compliance with the SWRCB standards would ensure that construction activities would not result in degradation of downstream water quality.

Compliance with the following mitigation measures, requiring a SWPPP and implementation of BMPs during construction, would ensure that the projects' impacts to water quality during construction would be ***less than significant***.

Mitigation Measure(s)

MRIC and Mace Triangle

4.9-2 *Prior to initiation of any ground disturbing activities, the project applicant(s) for each discretionary development application shall prepare a Stormwater Pollution Prevention Plan (SWPPP), and implement Best Management Practices (BMPs) that comply with the General Construction Stormwater Permit from the Central Valley RWQCB, to reduce water quality effects during construction. Such BMPs may include: temporary erosion control measures such as silt fences, staked straw bales/wattles, silt/sediment basins and traps, check dams, geofabric, sandbag dikes, and temporary revegetation. The SWPPP shall be kept on-site and implemented during construction activities and shall be made available upon request to representatives of the City of Davis and/or RWQCB.*

4.9-3 Violate any water quality standards or waste discharge requirements, provide substantial additional sources of polluted runoff, or otherwise substantially degrade water quality during operations. Based on the analysis below, the impact is *less than significant.*

MRIC

The MRIC facilities (e.g., buildings, parking areas, and internal roads) would involve a substantial amount of new impervious surface. During the dry season, vehicles and other urban activities could release contaminants onto the impervious surfaces, where they would accumulate until the first storm event. During this initial storm event, or first flush, the concentrated pollutants would be transported via runoff to stormwater drainage systems. Anticipated runoff contaminants associated with the MRIC include sediment, pesticides, oil and grease, nutrients, metals, bacteria, and trash. It should be noted that some of these contaminants may be expected in the existing agricultural runoff from the MRIC site.

As discussed above, the MRIC includes on-site detention features, which would detain stormwater during major storm events, as well as remove pollutants from stormwater runoff. For example, along the MRIC site's northern and eastern edges, a 150-foot agricultural buffer is included. The first 100 feet of the buffer will include stormwater detention basin areas with water quality functions, as well as habitat value. The detention features within the agricultural buffer will be designed to receive flows from within the MRIC and, in storm events, detain and treat stormwater flows.

The detention facilities would treat stormwater through sedimentation and biological uptake of pollutants by surrounding vegetation, algae, and bacteria. While pollutants settle out within the basins, only the clean surface water within the basins would be allowed to exit into the MDC via outlet control structures. The facilities would be designed in accordance with all City guidelines. Furthermore, the MRIC would include Low Impact Development (LID) features throughout the site. For example, bioswales and rain gardens between the parking spaces would capture and filter runoff. Bioretention systems in conjunction with vegetated swales would be incorporated in planting strips or in open spaces and perimeter areas. Interconnected vegetated swales would be incorporated in the large parkways and medians as part of the roadway system to the extent possible. Bioswales and permeable paving in all parking areas would be encouraged to help reduce stormwater runoff.

In addition, drainage channels and swales would be designed to reduce the velocity of the stormwater flow and help to remove pollutants through the use of vegetated swales, water detention, landscape open space, gravel filters. Runoff control would be designed to mimic natural conditions as much as possible and protect water quality while utilizing existing drainage structures.

Each phase of MRIC development will be required to comply with the BMPs and criteria established in Chapter 30 of the Municipal Code. Through the preparation of

improvement and grading plans, these measures will be refined so that they will functionally minimize stormwater quality impacts. Consistency with the City of Davis Manual of Stormwater Quality Control Standards for New Development and Redevelopment, Municipal Code, and implementation of the BMPs included in the MRIC Planned Development Guidelines will ensure that the MRIC would have a less-than-significant impact on long-term stormwater quality.

Mace Triangle

Any future development on the Ikedas parcel and adjacent agricultural parcel, within the Mace Triangle site, would increase the amount of impervious surfaces on the site. Additional sources of polluted runoff, or degradation of water quality associated with development at the Mace Triangle site could be adverse. However, similar to the MRIC, any development will be required to comply with the BMPs and criteria established in the City of Davis Manual of Stormwater Quality Control Standards for New Development and Redevelopment and Municipal Code. Through the preparation of improvement and grading plans, these measures will be refined so that they will functionally minimize stormwater quality impacts. Consistency with the City of Davis Manual of Stormwater Quality Control Standards for New Development and Redevelopment and Municipal Code will ensure that any future Mace Triangle development would have a less-than-significant impact on long-term stormwater quality.

Conclusion

Development of the MRIC and any future development at the Mace Triangle would increase impervious surfaces that could transport urban pollutants during storm events. However, all development will be required to comply with the City of Davis' LID measures, as applicable, included in the City's Manual of Stormwater Quality Control Standards for New Development and Redevelopment and Municipal Code. Compliance with said Manual would ensure that the proposed project would have a ***less-than-significant*** impact on long-term stormwater quality

Mitigation Measure(s)
None required.

4.9-4 Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted). Based on the analysis below, the impact is *less than significant.*

The City relies solely on groundwater from the Yolo subbasin, 5-21.6, which is a portion of the larger Sacramento Valley groundwater basin, to provide water to residential, industrial, and commercial users. Surface and recycled water sources are not currently utilized. The proposed project's potable water demand would be provided entirely by the

City's water supply system. Impacts to the City's long-term water supply associated with serving the proposed project are discussed in detail in Section 4.15, Utilities, of this EIR. With respect to irrigation water, approximately 80 percent of the non-potable, irrigation water demand for the MRIC would be provided by an on-site irrigation well, with the remaining 20 percent provided by the City's potable water system. The proposed non-potable well and its localized effects to the groundwater aquifer are discussed in this section. It should be noted that impacts related to groundwater supply are discussed in Section 4.15, Utilities, of this EIR.

One hundred percent (100%) of the Mace Triangle's irrigation water demand would be supplied from the City's potable water system.

MRIC

The MRIC would involve an increase in impervious surfaces (e.g., buildings, parking areas, and internal roads) on the MRIC site, which would reduce the amount of natural soil surfaces available for the infiltration of rainfall and runoff to the underlying aquifer. However, the proposed MRIC would incorporate several parks and open space areas throughout the site, totaling approximately 64.6 acres of green space. Runoff from the developed portions of the MRIC site would drain to the on-site detention areas and the MDC. The aforementioned areas would provide an opportunity for groundwater recharge in the area.

As discussed in Section 4.2, Agriculture and Forest Resources, of this EIR, the MRIC site is principally made up of Capay silty clay (map symbol Ca) and Sycamore complex, drained (Sv) soils, both of which are considered to have low permeability. The infiltration rates of these soils are generally low provided the high amounts of clay and silt. Therefore, development of the innovation center would not be expected interfere substantially with groundwater recharge.

The MRIC applicant proposes to install a new irrigation well on-site to meet approximately 80 percent of the project's non-potable, irrigation water needs, the rest of which will be provided by the City's potable system. Two existing irrigation wells are located on-site, which are utilized to irrigate crops on approximately 185 acres each year. Therefore, utilization of groundwater at the site to meet a portion of the innovation center's irrigation demand would not be a new occurrence, which would be expected to lower the groundwater table and affect the production rate of preexisting wells. The on-site use of an irrigation well is considered by the City to be a feasible source of irrigation water for the project. The MRIC's irrigation water demand would be minimized by the use of drought tolerant landscaping and efficient fixtures.

The future landowners and users of the MRIC may also desire to utilize recycled water if and when it is made available from the City's WWTP. In order for recycled water to be provided to the MRIC site, off-site distribution infrastructure would need to be installed from the WWTP to the project site. While this off-site distribution infrastructure is not proposed by the MRIC applicant, the applicant has proposed to install recycled

water/purple pipe infrastructure within the MRIC, with pipe stubs at the property boundaries, in the event that the City, or another entity, constructs this infrastructure at some future date. Should the necessary off-site infrastructure be installed, recycled water from the City's WWTP can be supplied to the site at a future date.

Mace Triangle

Impervious surfaces currently exist on the Mace Triangle site at the Park-and-Ride lot, City water tank, and Ikedas Market. Although future development of the Mace Triangle would increase the amount of impervious surfaces on the site, development of the 16.58-acre site would not likely impact groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level. In addition, well water would not be utilized to provide irrigation water to the Mace Triangle. The WSA prepared for the innovation centers assumes that the City's water system would serve potable and non-potable water demands associated with the Mace Triangle. Therefore, impacts related to substantial depletion of groundwater supplies associated with the Mace Triangle would be less than significant.

Conclusion

Although the proposed project would increase the amount of impervious surfaces after development, soils beneath the overall site area have slow permeability, and the sites are not considered significant recharge areas. In addition, utilization of a groundwater well to meet a portion of the project's irrigation demand would not be expected to affect the local water table given the current ongoing use of irrigation wells to provide tomato crop irrigation. Therefore, the proposed project would not interfere substantially with groundwater recharge, and related impacts would be ***less than significant***.

Mitigation Measure(s)
None required.

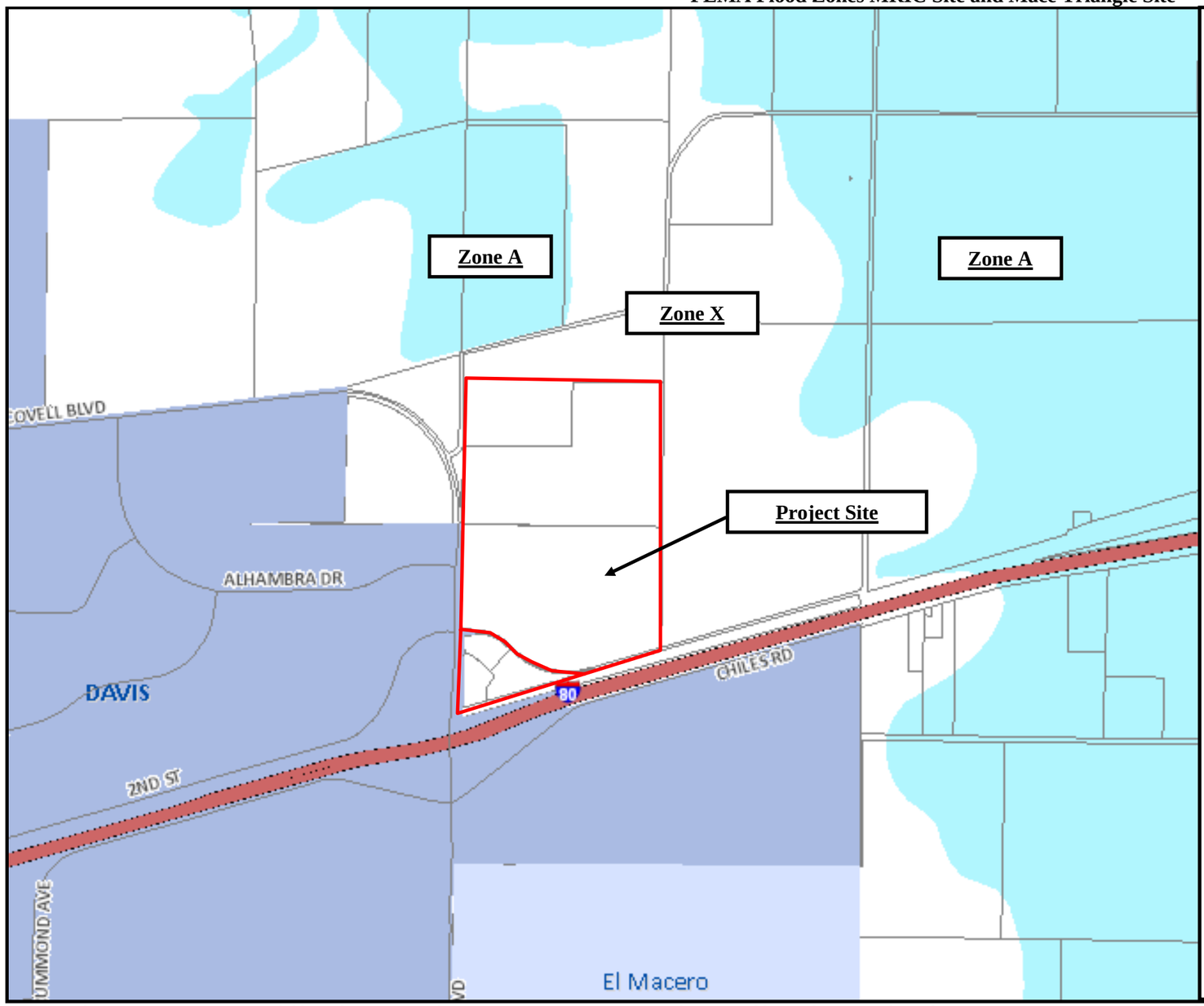
4.9-5 Place structures within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or flood hazard delineation map; or place within a 100-year floodplain structures which would impede or redirect flood flows; or expose people or structures to significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam. Based on the analysis below, the impact is *less than significant.*

MRIC

As shown in Figure 4.9-6, the entire MRIC site is located in Zone X on the applicable FIRM (Panels 604, 610, 612, and 620 of 785). Zone X is not considered a FEMA Special Flood Hazard Area.[16]

[16] Watermark Engineering, Inc. *Drainage Study for Mace Ranch Innovation Center [Attachment 7]*. June 15, 2015.

Figure 4.9-6
FEMA Flood Zones MRIC Site and Mace Triangle Site



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.

Source: Yolo County. GIS Viewer. Available at: http://www.yolocounty.org/community-services/planning-public-works/geographic-information-system-gis/use-gis. Accessed on March April 8, 2015.

Zone X includes areas determined to be outside the 0.2 percent annual chance floodplain. Therefore, the entire MRIC site is not located within the regulatory floodplain, and the project would not place structures within a 100-year flood hazard area, place within a 100-year floodplain structures that would impede or redirect flood flows, or expose people or structures to a significant risk of loss, injury or death involving flooding.

In addition, while the increased runoff volume resulting from the MRIC's impervious surfaces could increase off-site flooding, the affected properties consist of farmland that does not contain any habitable structures. Furthermore, Mitigation Measure 4.9-1 would ensure that an increase in off-site ponding would not occur.

Mace Triangle

Figure 4.9-6 also shows that the Mace Triangle site is located in Zone X (Panel 612 of 785). As noted above, Zone X includes areas determined to be outside the 0.2 percent annual chance floodplain. Thus, impacts related to placing structures within a 100-year flood hazard area would not occur associated with the Mace Triangle.

Conclusion

Based on the above discussions, the proposed project would not place structures within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or flood hazard delineation map, or place within a 100-year floodplain structures which would impede or redirect flood flows. Therefore, impacts associated with the 100-year floodplain would be ***less than significant***.

Mitigation Measure(s)
None required.

4.9-6 Impacts related to conflicts, or creation of an inconsistency, with any applicable plan, policy, or regulation adopted for the purpose of avoiding or mitigating environmental effects related to hydrology and water quality. Based on the analysis below, the impact is *less than significant*.

In order to further demonstrate the proposed project's consistency with any applicable plan, policy, or regulation adopted for the purpose of avoiding or mitigating environmental effects related to hydrology and water quality, Table 4.9-5 includes a list of the relevant policies and a corresponding discussion of whether the City decision-makers can consider the project to be consistent with each policy. As demonstrated in the table, the proposed project is generally consistent with the applicable plan, policy, or regulation adopted for the purpose of avoiding or mitigating environmental effects related to hydrology and water quality. Therefore, the project would have a ***less-than-significant*** impact regarding policy consistency.

Mitigation Measure(s)
None required.

Table 4.9-5
Hydrology and Water Quality Policy Discussion

Policy		Project Consistency
Chapter 6, Water, of the Davis General Plan		
WATER 2.1	Provide for the current and long-range water needs of the Davis Planning Area, and for protection of the quality and quantity of groundwater resources.	As demonstrated in Section 15, Utilities, of this EIR, the City has sufficient long-term water supplies to serve the proposed project as well as cumulative development, including the Davis IC and Nishi projects. And while the applicant proposes to utilize an on-site irrigation well to meet 20 percent of the project's irrigation water demand, two on-site irrigation wells are currently being utilized to provide water for tomato crop irrigation. The on-site use of an irrigation well is considered by the City to be a feasible source of irrigation water for the project. The project's irrigation water demand would be minimized by the use of drought tolerant landscaping and efficient fixtures.
WATER 2.2	Manage groundwater resources so as to preserve both quantity and quality.	See discussion for Policy WATER 2.1.
WATER 2.3	Maintain surface water quality.	Surface water quality would be maintained by the project through preparation of a SWPPP and implementation of BMPs. As required by Mitigation Measure 4.9-2, the proposed project would be required to prepare and implement a SWPPP and BMPs during construction. The aforementioned measure would reduce potential water quality effects during construction. In addition, as noted above, all development will be required to incorporate LID features per the City's Manual of Stormwater Quality Control Standards for New Development and Redevelopment and Municipal Code. LID features, such as permeable pavements, bioretention ponds, and vegetated swales, would reduce potential water quality effects during operation.
WATER 3.1	Coordinate and integrate development of storm ponds and channels City-wide, to maximize recreational, habitat, and aesthetic benefits.	The on-site storm ponds have been conceptually designed to enhance recreational, habitat, and aesthetic benefits. For example, the proposed green space land uses would include natural open space and drainage areas along the northern and eastern edged of the property. The agricultural buffer along the periphery of the project site would include a bicycle and pedestrian path within the 50-foot transition area.

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Table 4.9-5
Hydrology and Water Quality Policy Discussion

Policy	Project Consistency
WATER 3.2 Coordinate and integrate design, construction, and operation of proposed stormwater retention and detention facilities City-wide, to minimize flood damage and improve water quality. Standard 3.2a All new development shall include drainage facilities that are designed to accommodate a minimum of a 10-year recurrence design flow. In addition, all new development shall route the 100-year recurrence event and appropriately mitigate for both the increase in flows from the site due to development, and for runoff volumes which have historically occurred on the site. Storm drainage facilities with open, naturalistic channels are encouraged, where feasible. Such facilities can minimize impacts on the city's system, add to the water table, and provide an open space amenity, although long term maintenance costs must be considered. In addition, properly designed plantings within and adjacent to drainage facilities can serve to treat urban runoff, reducing downstream impacts. Standard 3.2b New development's detention and retention facilities shall be designed so as not to cause significant negative impact to other drainage facilities in the watershed.	The proposed project includes a stormwater detention areas in order to minimize flood damage and improve water quality. Mitigation Measure 4.9-1 requires design-level drainage analyses to ensure that the drainage systems are designed to mitigate both the increase in flows from the project, and runoff volumes, which have historically occurred on the site. The drainage systems for the overall site would incorporate LID measures consistent with Chapter 30 of the Municipal Code. These LID measures would remove urban pollutants from site runoff prior to this runoff being discharged to the City's downstream system.

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Table 4.9-5
Hydrology and Water Quality Policy Discussion

Policy			Project Consistency
Chapter 19, Hazards, of the Davis General Plan			
HAZ 1.1	Site and design developments to prevent flood damage.		The MRIC site and Mace Triangle site are located in Flood Zone X. Zone X includes areas determined to be outside the 0.2 percent annual chance floodplain. Therefore, the proposed project would not place structures within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or flood hazard delineation map, or place within a 100-year floodplain structures which would impede or redirect flood flows. The project has been conceptually designed to prevent flood damage off-site by including on-site detention areas for stormwater storage.
	Standard 1.1a	No development shall occur in flood-prone areas, including all areas below an elevation of 25 feet, unless mitigation of flood risk is assured. Any mitigation proposed by the project proponent to mitigate flood risks shall demonstrate that the mitigation/design does not adversely impact other properties.	
	Standard 1.1b	Development shall not increase flood hazards or reduce the effectiveness of existing flood-control facilities.	
	Standard 1.1c	New development shall be designed to include measures to protect structures from a 100-year flood.	
	Standard 1.1d	New development shall include stormwater detention or retention ponds and other facilities, if necessary, to prevent flooding by surface-water runoff.	
HAZ 1.2	Continue to provide flood control improvements that are sensitive to wildlife habitat and open space preservation.		The proposed agricultural buffer would generate replacement storage for stormwater. In addition, as noted previously, the proposed MRIC would incorporate approximately 64.6 acres of green space throughout the project site. The buffer and open space areas would be preserved as open space and could provide wildlife habitat for species.