

**TECHNICAL MEMORANDUM**

**TO:** Mr. Nicholas Ponticello, P.E., Ponticello Enterprises, Inc.

**FROM:** Mr. Michael C. Nowlan, P.E., CFM (CA 055954), Wood Rodgers, Inc.  
Mr. Jonathan Kors, P.E. (CA 059538), Wood Rodgers, Inc.

**DATE:** May 13, 2020

**SUBJECT:** Woodland Research and Technical Park – Storm Drainage Review

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Under Professional Services Agreement No. 000754 with the City of Woodland (City), Wood Rodgers, Inc. (Wood Rodgers) is providing a review of the revised drainage plan for the Woodland Research and Technical Park (WRTP) (Project) in the Spring Lake Master Plan Remainder Area (located east of State Route 113 (SR 113) and north of County Road 25A), within the City of Woodland . The proposed drainage system supporting the development was prepared by Cunningham Engineering Company (CEC) and is described in the Technical Memorandum entitled: Woodland Research and Technical Park Stormwater Management dated January 31, 2020, which is an update to the revised submission dated November 1, 2018. Wood Rodgers’ review findings are discussed below.

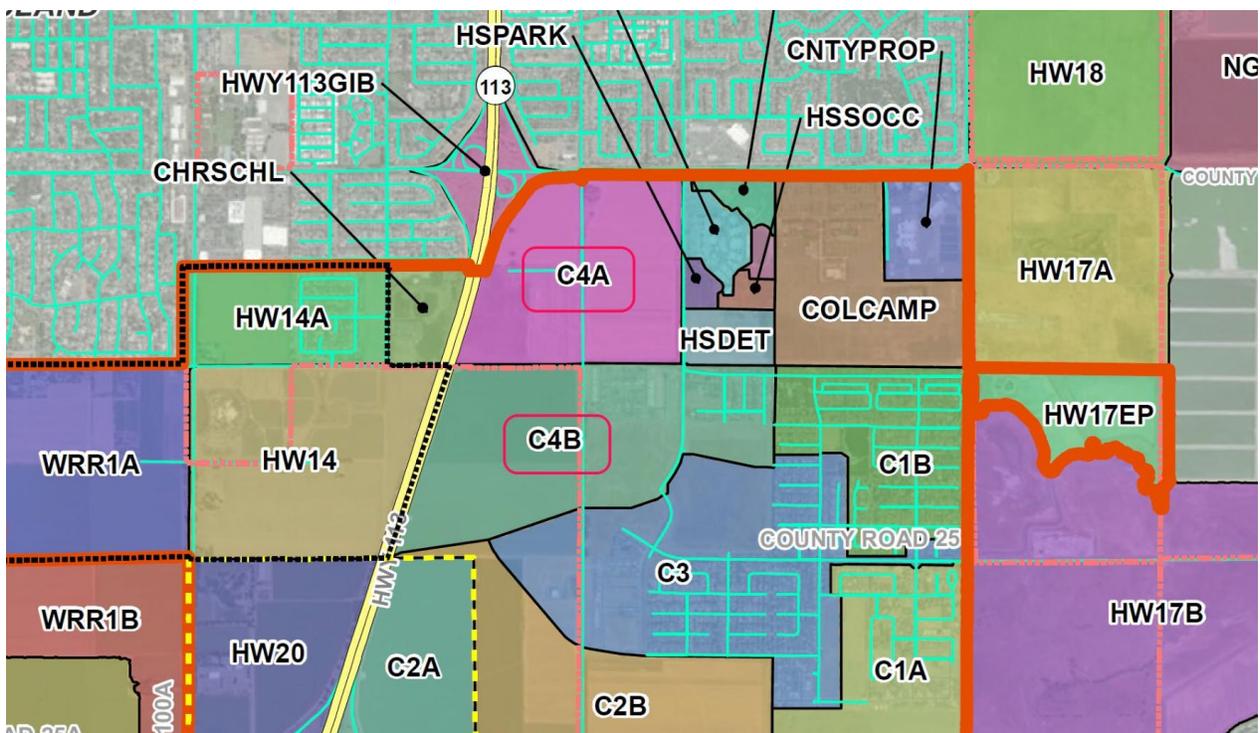
Primary Remaining Issue – Farmers Central Drainage Corridor

Wood Rodgers reviewed the calculations and documentation provided by Cunningham Engineering (Drainage Analysis 1, or DA1) and compared it with information and analysis performed by Wood Rodgers under the Storm Drainage Facilities Master Plan for the South Urban Growth Area along the Farmers Central drainage corridor (Drainage Analysis 2, or DA2). Wood Rodgers completed DA 2 in 2017, while DA1 was provided by CEC in March 2020. The following paragraphs outline the differences between the DA1 and DA2 analyses and Wood Rodgers’ recommendations as to how they should be reconciled.

The pipe sizes and horizontal alignments and transitions from 60-inch-diameter pipe to 72-inch-diameter pipe along the Farmers Central Road alignment downstream of SR 113 are essentially the same between DA1 and DA2. However, the elevations of the storm drain pipeline do not match between DA1 and DA2. The invert elevations for the segment immediately downstream of SR 113 are lower in DA1 by up to 2.4 feet. Both DA1 and DA2 are intending to express elevation data within the same vertical datum (North American Vertical Datum of 1988 (NAVD 88)); therefore, the differences are not due to datum. Efforts to define the pipe in DA2 were based on information available at the time, with the modeling for DA2 being essentially completed in 2014. The pipeline west of Pioneer Avenue was constructed more recently than the modeling done in DA2, and record drawings that were provided by Cunningham Engineering for these pipelines are

dated post-2014. The elevation information within DA1 is, therefore, more recent and assumed to more accurately represent constructed conditions.

Because the storm drain located upstream of Pioneer Avenue was not constructed in 2014, the definition of the sub-watersheds and tributary pipelines in DA2 were based on planning estimates available at the time of modeling. The DA2 effort defined the watersheds north and south of the Farmers Central Road alignment in more of a lumped fashion, with the C4A and C4B watersheds shown in the excerpt below from the Storm Drainage Facilities Master Plan (SDFMP) document under DA2 (see **Exhibit 1**, below). Both the C4A and C4B watersheds are modeled as draining into the Farmers Central drainage corridor at Pioneer Avenue under DA2.



**EXHIBIT 1**

The DA2 was never updated to reflect as-constructed conditions, nor was the DA2 effort necessarily intended to provide detailed hydraulic grade line (HGL) information for all tributary pipelines. The Farmers Central drainage corridor was modeled to size regional detention basins and confirm the channel/trunk capacities needed to drain detention basins.

While DA2 did model dynamic flow and volume conditions for the 100-year design conditions, it did not calculate the 10-year flow/flood conditions, which is required to be analyzed when developing design-level storm drainage improvements for City plan review. The calculations under DA1 performed a 10-year analysis using Rational Method steady flow calculations. Given these differences, a limited peak flow and capacity comparison can be made at this time. The peak

flow in the 60-inch pipeline located immediately downstream of SR 113 under DA2 is 124 cfs for the Ultimate Development, 100-year conditions. This flow is comprised mostly of outflow from the West Regional Detention (WRD) basin (109 cfs), with a few small inflows entering downstream of the WRD outlet. The same pipeline is calculated to have a flow capacity (Qcap) of 123.6 cfs from the DA1 spreadsheet calculations. The next downstream point of comparison is the combined flow condition at Pioneer Avenue, which is a valid comparison point because it should have all the hydrologic inflow areas reaching this location fully accounted for in both DA1 and DA2. In DA2 the capacity of the large (double) culverts and Farmers Central Channel downstream of Pioneer Avenue are sufficient because the dynamic DA2 modeling shows that the combined 100-year flow is contained in the channel, pipe and street capacities (i.e.: no structure flooding occurs upstream).

The key location where the proposed Research and Technical Park will connect to the Farmers Central drainage corridor is at Harry Lorenzo Avenue, which was not modeled in detail under DA2. To accurately calculate a dynamic HGL downstream of SR 113 in DA2 at Harry Lorenzo Avenue, it would require breaking up the C4A and C4B watersheds in order to drain the proper portion of these watersheds into the Farmers Central drainage corridor and to adjust the invert elevations to as-constructed conditions. The DA1 spreadsheet shows a Qcap of 144.5 cfs for the underground pipe just downstream of Harry Lorenzo Avenue. Neither analysis fully models the entire Farmers Central drainage corridor for both the 10-year and 100-year storm events, dynamically accounting for storage, timing and underground and overland capacity. The dynamic analysis in DA2 does account for all contributing areas and pipe sizes (flow capacity), but it does not accurately predict conditions at Harry Lorenzo Avenue. This is because the DA2 analysis does not drain portions of C4A and C4B into the system at this location (as currently planned by the DA1 analysis west of Harry Lorenzo Avenue). At SR 113 and at Pioneer Avenue, the DA2 analysis indicates that the 100-year conditions are flowing within capacity, which is a strong indication that the system is not deficient in the SDFMP, but only needs to be verified in more detail at Harry Lorenzo Avenue.

To be more confident of the HGL conditions along the Farmers Central drainage corridor, we recommend incorporating the as-constructed details for pipes and street grades into the newest SDFMP modeling. The current contract with the City will accommodate making this change to the combined flood model covering the entire City. We do not recommend updating the South Area stand-alone model from 2014.

While the December 4, 2018 memorandum provides a recommended condition of approval that addresses the primary remaining issue, additional language is recommended below:

Recommended Language for Condition of Approval:

*The developer will incorporate the results of the future analysis performed by the City (currently underway) under the City-wide update to the Woodland Storm Drainage Facilities Master Plan. This will establish the 10-year storm event and 100-year storm event conditions for the Farmers Central Drainage Corridor under full build-out conditions in accordance with City design criteria.*

Additional Remaining Issue

In addition to all previous review comments and recommendations made in previous memoranda, Wood Rodgers recommends the following condition of approval be considered:

The developer will fully evaluate the runoff from the California Department of Transportation (Caltrans) right-of-way affecting the Project, in particular the runoff within the interchange of County Road 25A and State Route 113, and will adjust all on-site drainage designs to accommodate routing of Caltrans runoff through the Project.