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November 13, 1995

Mr. Don Nunes
Senior Civil Engineer
City of Gilroy
7351 Rosanna Street
Gilroy, CA 95020-6141

Dear Don:

Enclosed is the report for the Uvas Creek Overflow Floodplain Delineation project. The report outlines the existing flooding problem in the study area and describes how the FEMA-mandated levee failure scenarios were arrived at. The report also shows the floodplain area and water surface elevations for existing land use conditions.

To assist the City with administering a sound floodplain management program in the study area, the report describes the future floodplain delineation based on full "build-out" in the study area. A "Sector Map" is included to help determine where areas of 50 percent, 75 percent or full blockage of flood flows would be permissible. The definition of "blockage" is included as is a sample calculation. In addition, a discussion of structure, landscape and fencing blockages is included.

Also mentioned in the report are two potential "structural" methods of eliminating or drastically reducing the flooding in the study area. However, either would probably require significant expenditures of both money and time.

Part of the final delivery items is a "large" map showing the future water surface elevations and the three development sectors. This reproducible will be delivered under separate cover. If you have any questions please give me a call.

Very truly yours,
SCHAAF & WHEELER



3/31/95

James R. Schaaf, PhD, PE

Enclosure

**CITY OF GILROY - UVAS CREEK OVERFLOWS
FLOODPLAIN MANAGEMENT STUDY**

Prepared for:

The City of Gilroy

November 13, 1995

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CITY OF GILROY - UVAS CREEK OVERFLOWS

FLOODPLAIN MANAGEMENT STUDY

1.0 BACKGROUND AND SCOPE

1.1 General

The purpose of this study is to provide a floodplain management plan that would minimize flooding and flood damage risks in existing and future developments in the study area. The study area contains lands of the City of Gilroy as well as the County of Santa Clara, and is bounded roughly by the Southern Pacific Railroad (SPRR) on the west, 10th Street and State Highway 152 on the north, Llagas Creek on the east, and Gilroy's treatment plant ponds on the south. The area south of the treatment plant pond levees (near Southside Drive) remains delineated as Zone A, as no new detailed analysis was performed for this area.

1.2 Existing 100-Year Flood Potential

Insufficient capacity of Uvas Creek downstream of Thomas Road, combined with structural fill which could cause significant blockage of the left overbank of the creek, would result in approximately 4700 cfs spilling out of Uvas Creek and continuing generally eastward toward the SPRR. These Uvas Creek overflows would enter the study area just north of the SPRR underpass at U.S. Highway 101.

1.3 Present and Proposed Developments

Currently the study area is largely undeveloped, with the exception of three main areas. Industrial complexes cover most of the area between the SPRR and Rossi Lane, and a mixture of commercial and industrial development is typical in the triangle formed by U.S. 101, the SPRR, and 10th Street. Gilroy Foods is located between Old Miller Slough and Llagas Creek and some industrial development has begun along Highway 152.

The current general plan obtained from the City of Gilroy in August 1995 indicates that almost the entire area between Southside Drive and the U.S. Highway 101 / State Highway 152 interchange is to be zoned as general industrial. The currently planned street layout is shown on the Future Conditions Map included with this report. For the purpose of this analysis, all future roads are assumed to be built at grade and will therefore pose no blockage threat to floodwaters.

2.0 STUDY PROCEDURES AND RESULTS

This section describes the study procedures and assumptions used in this analysis. The blockage criteria are discussed as well as the impacts of future development.

2.1 General

The SPRR is built on a 5 to 10 foot high berm between 10th Street and Gilroy's treatment plant ponds. Local accounts indicate that during the 1986 flood, floodwaters partially eroded the railroad's ballast as they flowed along the railroad underneath U.S. 101. The railroad levee is not certified by the Federal Emergency Management Agency (FEMA), and is, therefore, subject to FEMA's levee failure criteria, which requires levee failure to be considered during hydraulic analyses. Two levee conditions were determined to produce the maximum water surface elevations (WSEL's) for different regions of the study area: complete failure, and partial failure (between 10th Street and the U.S. 101 overpass).

2.1.1 Complete Failure

Uvas Creek overflows forced into the study area along the failed SPRR between U.S. 101 and 10th Street would have two routes of escape: under U.S. 101 along Luchessa Avenue and under U.S. 101 along the failed SPRR site. The flow split was determined based on normal depth calculations, with total flow balanced at a constant WSEL upstream of the freeway. The vast majority of the flow would pass through the railroad site, and a small portion would cross under the freeway on Luchessa Avenue. The energy grade would not be high enough to cause water to overtop the freeway.

The ground downstream of U.S. 101 along the failed SPRR berm slopes both parallel to the railroad and at about a 45 degree angle to it, across the study area toward the outlet in Llagas Creek. The location of the outlet is just downstream of the confluence of Llagas Creek and Old Miller Slough. About 70 percent of the flow which comes through the SPRR underpass would cross over the railroad site and continue toward Llagas Creek. The other 30 percent would remain on the right overbank and continue parallel to the railroad where it would ultimately rejoin Uvas Creek.

Complete failure of the railroad results in worst case conditions for the area downstream of section 70, and in the area just downstream from the SPRR between U.S. 101 and the City's treatment plant ponds. See the Existing Conditions Map for the location of the cross sections.

2.1.2 Partial Failure

Much of the conveyance under the freeway is taken away when the railroad is considered to be intact from the U.S. 101 overpass to the treatment plant ponds. This restriction causes a backwater effect which pushes much of the flow into the area upstream of U.S. 101 between the SPRR and 10th Street. Three inlets to the study area are then formed - under U.S. 101 along Luchessa Avenue, under U.S. 101 along the SPRR, and over U.S. 101 near the Princeville Drain. The flow split calculations were performed assuming weir flow over the freeway and normal depth down Luchessa Avenue and along the SPRR, by balancing the total flow against a constant energy grade at the freeway.

Partial failure of the railroad results in worst case water surface elevation conditions for the areas downstream of U.S. 101 along Luchessa Avenue and near the Princevalle Drain, as well as in the area upstream of U.S. 101.

A summary of the flow splits is shown in the following table.

100-YEAR DISCHARGES, cfs			
	Under U.S. 101 along SPRR	Under U.S. 101 along Luchessa Avenue	Over U.S. 101
Total Failure of SPRR	4400	300	0
Partial Failure of SPRR	760*	1250	830
* 760 cfs represents the amount of flow that would cross under the freeway into the study area. The remainder of the 4700 cfs continues along the right overbank, outside the study area.			

2.2 Existing Conditions

2.2.1 Hydraulic Modelling

The "rule-of-thumb" expansion ratio of 4:1 was applied to determine the effective flow areas downstream of the inlets to the study area. In developing the existing conditions model it was assumed that the area bounded by U.S. 101, Rossi Lane, the SPRR, and the extension of Southside Drive to the SPRR was fully developed to approximately 75% blockage, and the remainder of the study area was existing ground without blockage.

The treatment plant pond levees would direct the overflow floodwaters into the outlet at Llagas Creek. The 100-year water surface elevation data obtained from the Santa Clara Valley Water District indicates that the water level in Llagas Creek at this location is sufficiently below the channel banks; therefore, beginning the hydraulic model at critical depth at the outlet at Llagas Creek appears appropriate.

2.2.2 Resulting Floodplain

The floodplain delineated on the Existing Conditions Map included with this report represents worst case at each cross section. Average depths in the study area range from about one and a half to two feet. The ineffective flow area just south of Southside Drive shows depths of flooding up to six feet. Flood waters become trapped in this area by the treatment plant pond levees and the raised roadway.

2.3 Future Conditions

2.3.1 Blockage

Guidelines have been developed regarding blockage criteria. The study area has been divided into three sectors:

Sector 1	Approximately 50% blockage allowed.
Sector 2	Approximately 75% blockage allowed.
Sector 3	Area of ineffective flow. No restrictions regarding blockage.

The term "blockage" is defined as anything above natural ground. Blockage is computed by taking cross sections perpendicular to the direction of flow. The ratio of the sum of all individual blockages to the total length of the cross section must be less than or equal to the prescribed blockage limit for the applicable sector. Blockage criteria must be met for every possible cross section drawn perpendicular to the direction of flow. An example of the computation is included in Appendix A.

2.3.2 Hydraulic Modelling

The "rule-of-thumb" expansion ratio of 4:1 was applied to determine the effective flow areas downstream of the inlets to the study area. Cross sections were defined with the appropriate blockage values according to the sector criteria.

The treatment plant pond levee would direct the floodwaters into the outlet at Llagas Creek. The 100-year water surface elevation data obtained from the Santa Clara Valley Water District indicates that the water level in Llagas Creek at this location is sufficiently below the channel banks; therefore beginning the hydraulic model at critical depth at the outlet at Llagas Creek appears appropriate.

2.3.3 Resulting Floodplain

The floodplain delineated on the future conditions map represents worst case at each cross section. Average depths range from about one and a half to two feet.

2.3.4 Impacts of Future Development

The most seriously impacted area of existing development is near the intersection of Southside Drive and Rossi Lane, between sections 60 and 70 (see the floodplain delineation maps for location of cross sections). The increase in water surface elevation in this area due to future development would be about one-half foot. The impacts of allowing the area designated as Sector 1 to develop to 75% blockage were investigated during the analysis; however, resulting increases in water surface elevations in the location described above would be about eight-tenths to one foot over existing

conditions. This increase was considered unacceptable and the recommended blockage criteria was reduced to 50 percent.

The areas (presently undeveloped) between sections 60 and 75 would see about a three- to five-tenths of a foot increase in water surface elevations resulting from future conditions. The area just downstream from the weir inlet to the study area over U.S. 101 would also see this small increase in water surface elevation. Depths in this area range from about one and a half to two feet.

There would be no impact on water surface elevations in the area upstream of U.S. 101 due to future conditions.

3.0 CONSTRUCTION ALTERNATIVES IN THE FLOODPLAIN

Several options are available which would allow a property owner to somewhat control the amount of blockage present on an individual site. Some examples are provided in the following paragraphs. However, prudent development controls in this flood-prone area need to be followed so as to allow appropriate construction.

3.1 Structures

Buildings are an obvious barrier to flow. The City of Gilroy floodplain management ordinance requires that the lowest adjacent grade of all structures be at or above the 100-year WSEL. It is recommended that the WSEL's shown on the Future Conditions Map be used but rounded to the nearest one-half foot, and that one foot of freeboard be added to this elevation. The orientation of structures with regard to the direction of flow can significantly affect the amount of blockage in a site, since blockages are always calculated perpendicular to the direction of flow. Note that any of the fill for the pad above natural ground is counted as blockage, not just the area enclosed by the walls of the building.

3.2 Landscape Berms

Since blockage is defined as any structure higher than natural ground, landscape berms built above natural ground would constitute blockage. Berms built parallel to the direction of flow would cause less blockage than those which are perpendicular, but care must be taken to plan for sufficient discontinuities (e.g. driveways, etc.) in the berm to allow flow to escape from one side to the other. In addition, berms built in the "hydraulic shadow" of a building pose no incremental obstruction above that due to the buildings themselves.

3.3 Fencing

Wrought iron fences with bar spacings of about 4-5 inches are the preferred alternative where fences are to be used. Chain link fences are not recommended. Although not themselves a solid barrier to flow, chain link fences tend to collect debris (e.g. grass, bushes, garbage, etc.) during high flow events. The debris in effect turns the chain link fence into a solid wall which may subsequently

block flow and raise the water surface behind the fence until enough force is built up to cause the fence to fail. Fences with break-away bottoms are another option but require more planning and design work to ensure a proper fit for the flood potential. If break-away fencing is used it is recommended that the opening be at the same elevation as that of the first floor of the building.

4.0 STRUCTURAL ALTERNATIVES

The following is a discussion of possible large scale projects which would reduce or eliminate Uvas Creek overflows in the study area. A discussion of these projects is not included so as to be considered as an immediate option to the floodplain management plan presented in the previous section. Rather these projects may be considered in the long run to eliminate or greatly reduce the flooding risk. Construction of these "structural" flood control projects would eliminate or reduce the severity of land use and building restrictions in the study area.

4.1 Uvas Creek Levee

The first option would be to eliminate the overflows from Uvas Creek from entering the study area by extending the Corps of Engineers levee to contain the 100-year flow. This would eliminate the flooding caused by insufficient capacity of Uvas Creek, but impacts further downstream would have to be considered. Extending the levee would not only be costly but would quite likely take a long time to be implemented.

4.2 Levee along Southern Pacific Railroad

The second option would be to reduce (but not eliminate) the amount of overflows entering the study area by building a FEMA certified levee along the north/east side of the SPRR, tied into the 101 freeway embankment and extending to the treatment pond levees. This new levee would have to tie into the treatment plant pond levees as well, and these levees would also have to be FEMA certified. A large amount of land along the railroad in the present study area would be lost in creating a levee large enough to meet FEMA standards. This alternative would simply push the floodwaters further downstream, and impacts to properties downstream would have to be evaluated as mentioned in the previous alternative.

5.0 MAPPING

Three maps have been included in this document:

- Uvas Creek Overflow Floodplain Delineation - Existing Conditions
- Future Conditions
- Sector Map

6.0 CONCLUSION

The study area is subject to flooding from overflows from Uvas Creek. While partially protected by the uncertified SPRR berm, the study area must be considered as subject to flooding under two hydraulic conditions: 1) the SPRR berm does not fail downstream of U.S. 101, and 2) the SPRR berm does fail in this area. The worst case flood condition on any property in the study area would be the condition that prevails for flood insurance purposes and for floodplain management purposes. Because there are no current plans to correct the flood problem and because there are pressures to develop the lands in the study area, a floodplain management solution has been proposed for the study area. Using fully-developed conditions under the City's current general plan, water surface elevations were predicted in the study area. Three Sectors were defined to control the amount of blockage any site could present to the passage of the overflow flood waters.

Areas in the ineffective flow areas have no criteria. Blockage could cover the entire site if desired. However, nearest adjacent grade for all structures would have to be set at the Future Conditions WSEL rounded up the nearest one-half foot plus one foot of freeboard.

Areas nearest Llagas Creek would have to be developed to have blockages no more than 50 percent. Any greater blockage would raise WSEL's on existing upstream buildings by more than one-half foot, which was considered unacceptable. Other areas could be developed with 75 percent blockage.

This floodplain management solution allows industrial development to take place if and only if the flood hazard is properly accounted for in the design and construction of the structures.

APPENDIX A

Sample Blockage Computation

Property located in Sector 2: maximum 75% blockage.

$$\begin{aligned} \% \text{ Blockage} &= \frac{\text{sum of individual blockages}}{\text{total length}} \\ &= \frac{75 + 200 + 100}{600} \\ &= \frac{375}{600} = 62.5\% \quad \text{OK} (< 75\%) \end{aligned}$$

