

TECHNICAL MEMORANDUM

Kamman Hydrology & Engineering, Inc.

7 Mt. Lassen Drive, Suite B-250, San Rafael, CA 94903

Telephone: (415) 491-9600

Facsimile: (415) 680-1538

E-mail: Greg@KHE-Inc.com

Date: November 5, 2008
To: Jack Curley
From: Stephanie Lapine and Greg Kamman
Subject: Lower West Creek Drainage Improvement Assessment

Introduction

Kamman Hydrology & Engineering, Inc. (KHE) assisted the Marin County Flood Control and Water Conservation District with an expanded technical study to assess existing drainage conditions and to identify opportunities to alleviate flooding of properties adjacent to West Creek between Cecilia Way and Tiburon Boulevard in Tiburon, California (hereafter referred to as Lower West Creek). The current study expanded on the initial West Creek flood mitigation assessment presented to Marin County Flood Control and Water Conservation District in “West Creek Drainage Improvement Assessment, Tiburon, California” (KHE, July 2006). The 2006 study focused on the area upstream of Cecilia Way, between Via Los Altos and Cecilia Way (hereafter referred to as Upper West Creek).

The scope of work was prepared in response to a request made by the Flood Control Zone 4 Advisory Board at their October 24, 2007 public meeting. At this meeting, landowners along Lower West Creek expressed concern that proposed improvements in Upper West Creek may influence and increase the potential for flooding at downstream properties. Scoped tasks included:

- Evaluate and quantify the existing flood conditions along Lower West Creek between Cecilia Way and Tiburon Boulevard in Tiburon, California;
- Identify and assess the feasibility for opportunities to alleviate future flooding along Lower West Creek; and
- Present a conceptual design for a preferred alternative solution.

The work included supporting hydrologic, hydraulic, and geomorphic feasibility and design assessments. Development and analysis of a potential flood reduction strategy relied on expanding the coverage of the existing computer-based hydraulic model to simulate existing and proposed project conditions.

Hydrographic Surveys and Hydraulic Model Development

Expanding the existing West Creek hydraulic model required detailed reconnaissance, channel dimensions, and slope between Cecilia Way and Tiburon Boulevard. A detailed survey of this reach (completed by KHE on June 2, 2008) provided the necessary model input cross-sections, generally from fence line to fence line, within the creek channel.

Preliminary modeling using the KHE survey data indicated that floodwaters could potentially surpass fence lines and enter onto private property. At this stage of the study, results were discussed with Jack Curley, Capital Planning and Project Manager for Marin County Flood Control and Water Conservation District.

Based on the potential for flooding beyond fence lines under large rainfall events, the County decided to undertake a supplemental topographic survey to include elevation data of local streets and private properties adjacent to the creek. The County survey was provided to KHE in order to supplement the hydraulic model and determine the likely extent of flooding of adjacent properties.

Both detailed creek survey data, completed by KHE, and supplemental data provided by the County, were incorporated into the hydraulic model. The resulting model includes twin 55" x 62" oval CMP culverts beneath Tiburon Boulevard. Downstream project conditions utilize a spring high tide event elevation of 5.35', corresponding to the tide occurring during the New Year's Eve storm event on December 31, 2005. **Figure 1** illustrates the revised model geometry in Lower West Creek including cross-section and road crossing locations.

Sometime after the KHE survey was completed, Marin County maintenance crews dredged portions of Lower West Creek, removing sediment and vegetation immediately downstream of the Cecilia Way Bridge and an "island" of sediment which had built up at the 90-degree bend adjacent to the Pamela Court Pump Station. Additionally, at least one homeowner on the east side of the creek (left bank facing downstream) repaired their fence and removed adjacent vegetation. These improvements are not reflected in the model but will most likely serve to improve flood water surface elevations, making results conservative at best.

Results of Hydraulic Model Simulations

A suite of model simulations were completed for existing conditions as well as project conditions pursuant to Alternative F in Upper West Creek (KHE, July 2006). Alternative F incorporates full levee construction along the left bank and raised access roadway bed along the right bank for a section of creek upstream of Cecilia Way.

Model simulation results of floods having between 2- and 100-year recurrence intervals indicate that flood water surface elevations in Lower West Creek do not change between existing conditions and Alternative F project conditions, as illustrated in the flood water profiles of **Figure 2**. However, model simulation results indicate that under existing

conditions (i.e., prior to improvements upstream), flood-prone conditions already existed between river stations 38+63 and 37+69, and between river stations 34+60 and 33+92, as illustrated in **Figure 3**. Under existing conditions, the properties on the left bank (east side) of Lower West Creek, immediately upstream and adjacent to the Pamela Court Pump Station, are subject to flooding or near-flooding during storm events having a 25-year recurrence or greater. Properties immediately downstream of Cecilia Way Bridge are subject to flooding or near-flooding during storm events having a 100-year recurrence or greater¹. These properties include 242 Cecilia Way, 45 Pamela Court, and 30 Pamela Court.

Recommended Flood Reduction Strategy

The only feasible alternative to prevent flooding of private properties along the east bank of Lower West Creek is to build a small levee in either the backyards of private properties or along the fence lines of the properties. Widening and deepening the channel will not prevent flooding because the area is subject to tidal influence. **Figure 4** and **Figure 5** illustrate a plan view and a profile of preliminary improvements suggested for 242 Cecilia Way and 45 and 30 Pamela Court.

The 242 Cecilia Way location necessitates a levee ranging from one to two feet high to provide 100-year flood protection to the house and back yard. The levee must stretch from the sidewalk near the wing wall at Cecilia Way (Sta. 38+63) to the fence which follows the property line perpendicular to the creek (Sta. 37+69). The approximately 94 foot (length) levee, assuming one-half foot of freeboard, provides flood protection to an elevation of 8.5 feet. The 100-year water surface in this area ranges from 7.9 to 7.7 feet elevation. The need for this levee may possibly be eliminated with regular dredging of the creek in this location.

Preliminary improvements at 45 and 30 Pamela Court, upstream of the Pamela Court Pump Station, necessitate a levee ranging from one-half to one and one-half feet high to provide 100-year flood protection to the two houses and back yards. The levee must stretch from Sta. 34+60 near the bend in the creek, through Sta. 33+92, ending at the concrete pad of the Pamela Court Pump Station. The approximately 93 foot (length) levee, assuming one-half foot of freeboard, provides flood protection to an elevation of 7.5 feet. The 100-year water surface in this area ranges from 6.7 to 7.0 feet elevation. The back yards at 45 and 30 Pamela Court currently slope to drain to the concrete driveway of the pump station and the ditch parallel to Tiburon Blvd. leading to the intake sump.

Overall Surface Drainage Configuration

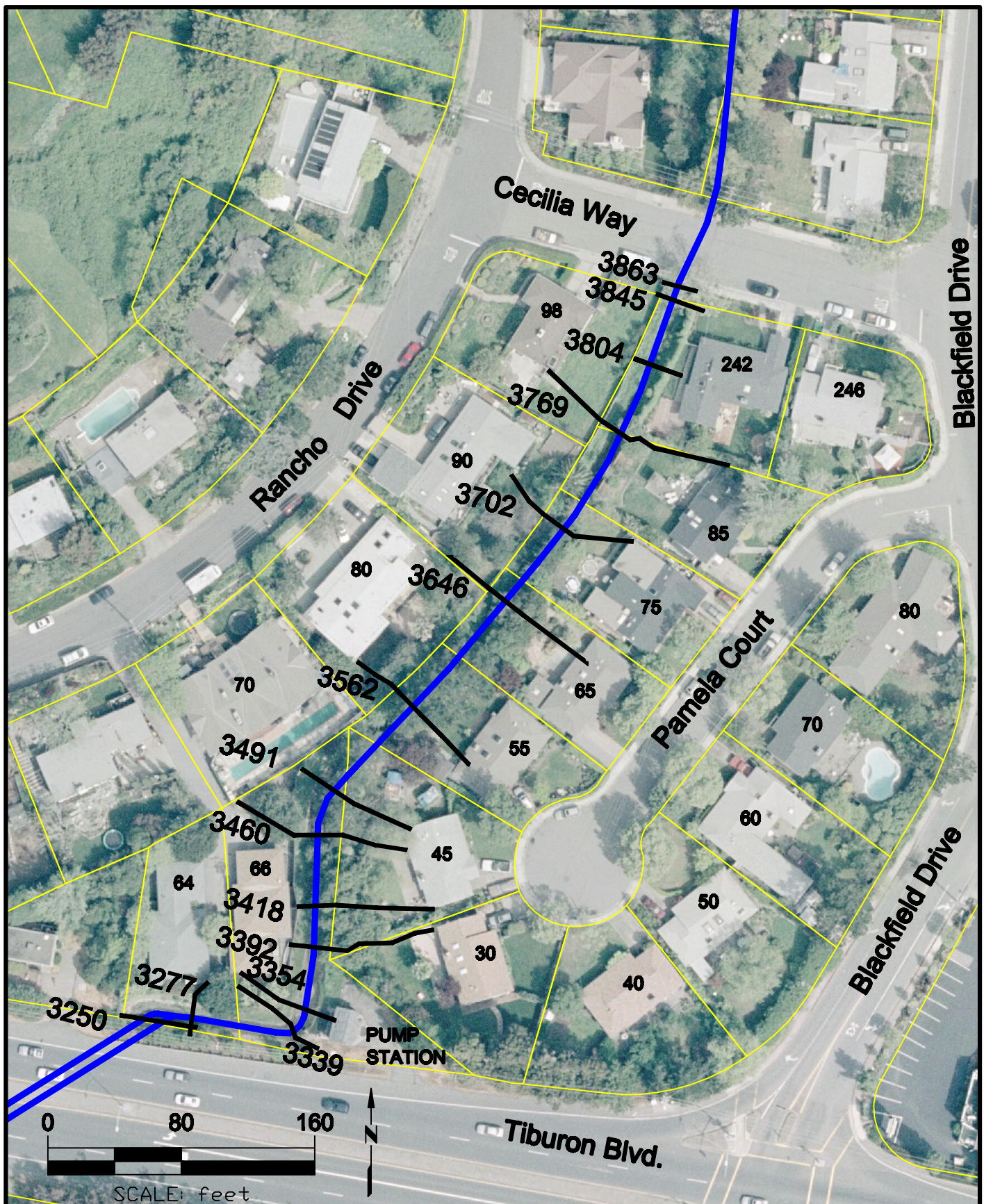

Along the west bank of Lower West Creek, Rancho Drive property owners' backyard elevations are above a concurrent 100-year flood elevation and high tide in Richardson Bay. Flooding along the opposite (east) bank is discussed above. Beyond the top of the

¹ Dredging of the channel immediately downstream of Cecelia Bridge may have alleviated the potential for flooding at this location.

east bank of Lower West Creek, the back yards of the odd-numbered properties along Pamela Court generally tend to slope towards the street. Along the east side of Pamela Court, even-numbered property front yards generally slope towards Pamela Court whereas back yards slope towards Blackfield Drive.

Drain inlets along Pamela Court direct flow to the Pamela Court Pump Station and drainage is pumped into the creek. Any blockage of drain inlets, or complete power outages at the pump station, will result in localized ponding of rainwater on Pamela Court. Water has no outlet until it can flow overland across 30 Pamela Court towards the pump station or the drainage ditch leading to the pump station that borders the north side of Tiburon Boulevard. Although the proposed levee at 30 and 45 Pamela Court will prevent overbank flooding from the creek, it may hinder overland drainage from Pamela Court to the creek.

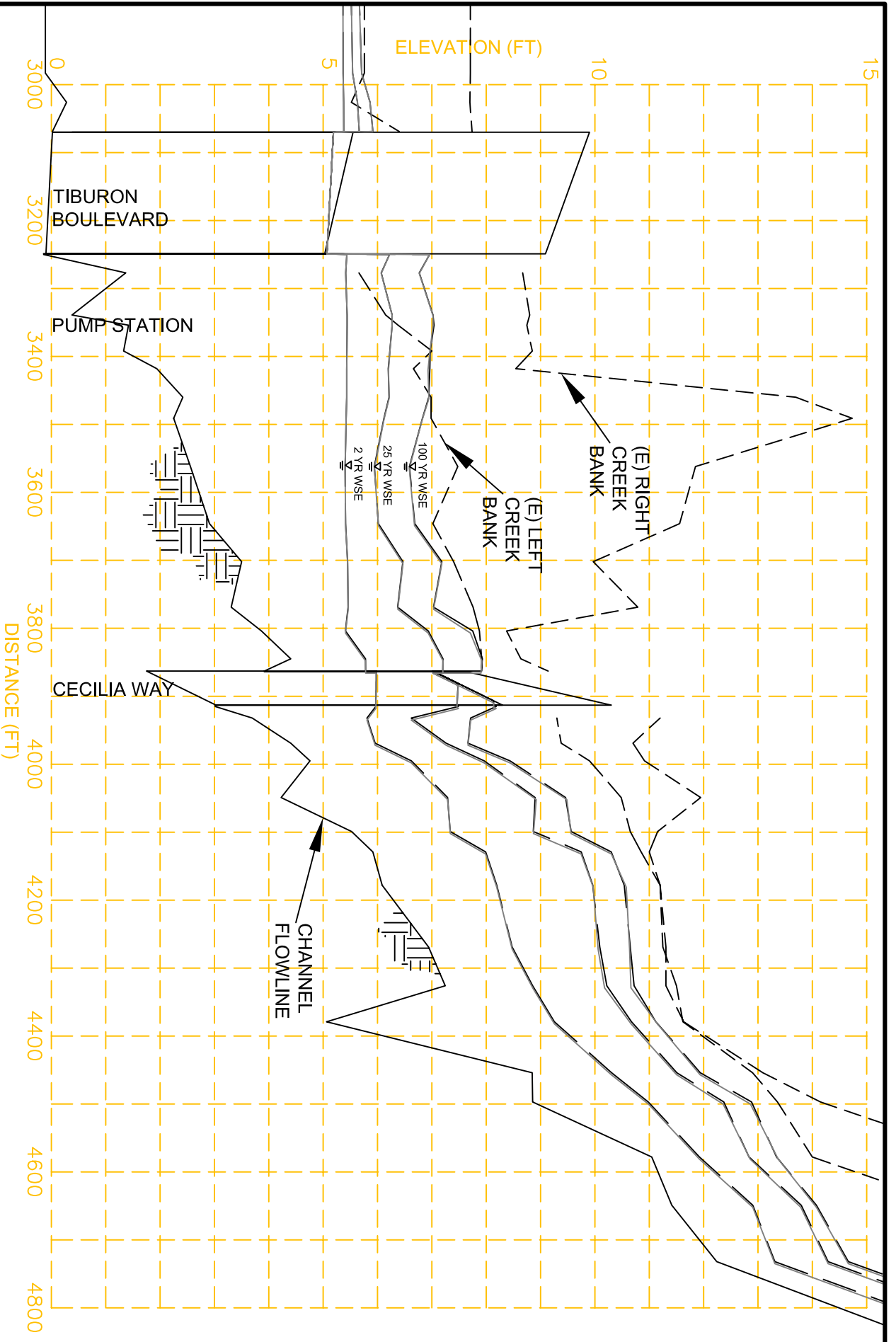
Blocked drain inlets at Blackfield Drive behind 50 Pamela Court may prevent flow from reaching the pump station until it can flow overland to the drainage ditch bordering the north side of Tiburon Boulevard leading to the Pamela Court Pump Station. The centerline of Tiburon Boulevard is likely higher in elevation than Blackfield Drive, potentially causing localized ponding at the intersection. Although Blackfield Drive exhibits one-half foot clearance between gutter and top of curb, the concave nature of the road beds at the intersection coupled with any blocked drain inlets or pump station outages could intensify flooding in the area.

**KAMMAN HYDROLOGY &
ENGINEERING, INC.**
7 Mount Lassen Dr., Ste. B250
San Rafael, CA 94903
(415) 491-8600

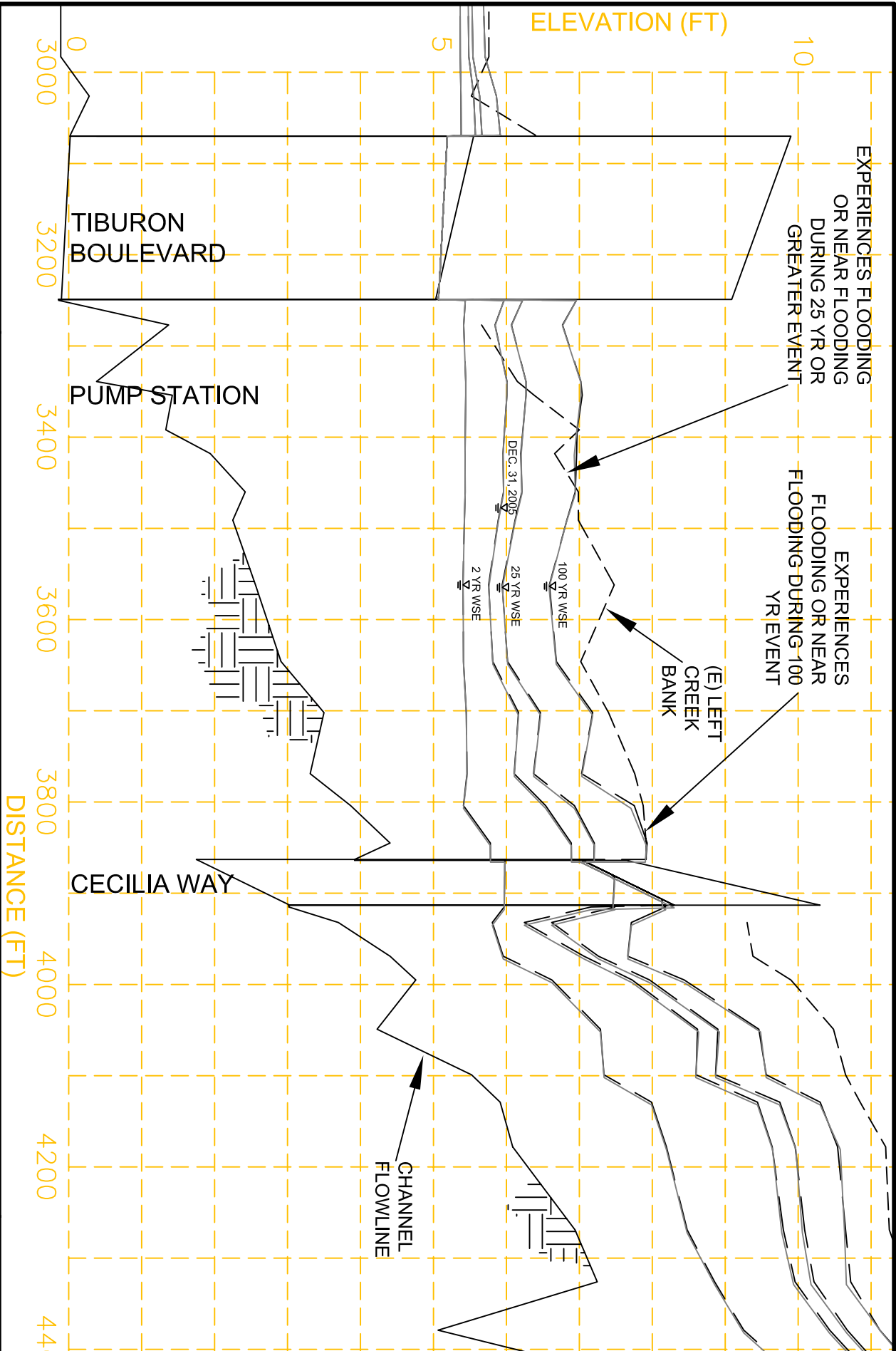
SITE MAP AND CROSS-SECTION LOCATIONS
LOWER WEST CREEK DRAINAGE IMPROVEMENT ASSESSMENT
Tiburon, California

FIGURE
1



KAMMAN HYDROLOGY & ENGINEERING, INC.
 7 Mount Lassen Dr., Ste. B250
 San Rafael, CA 94903
 (415) 491-9600

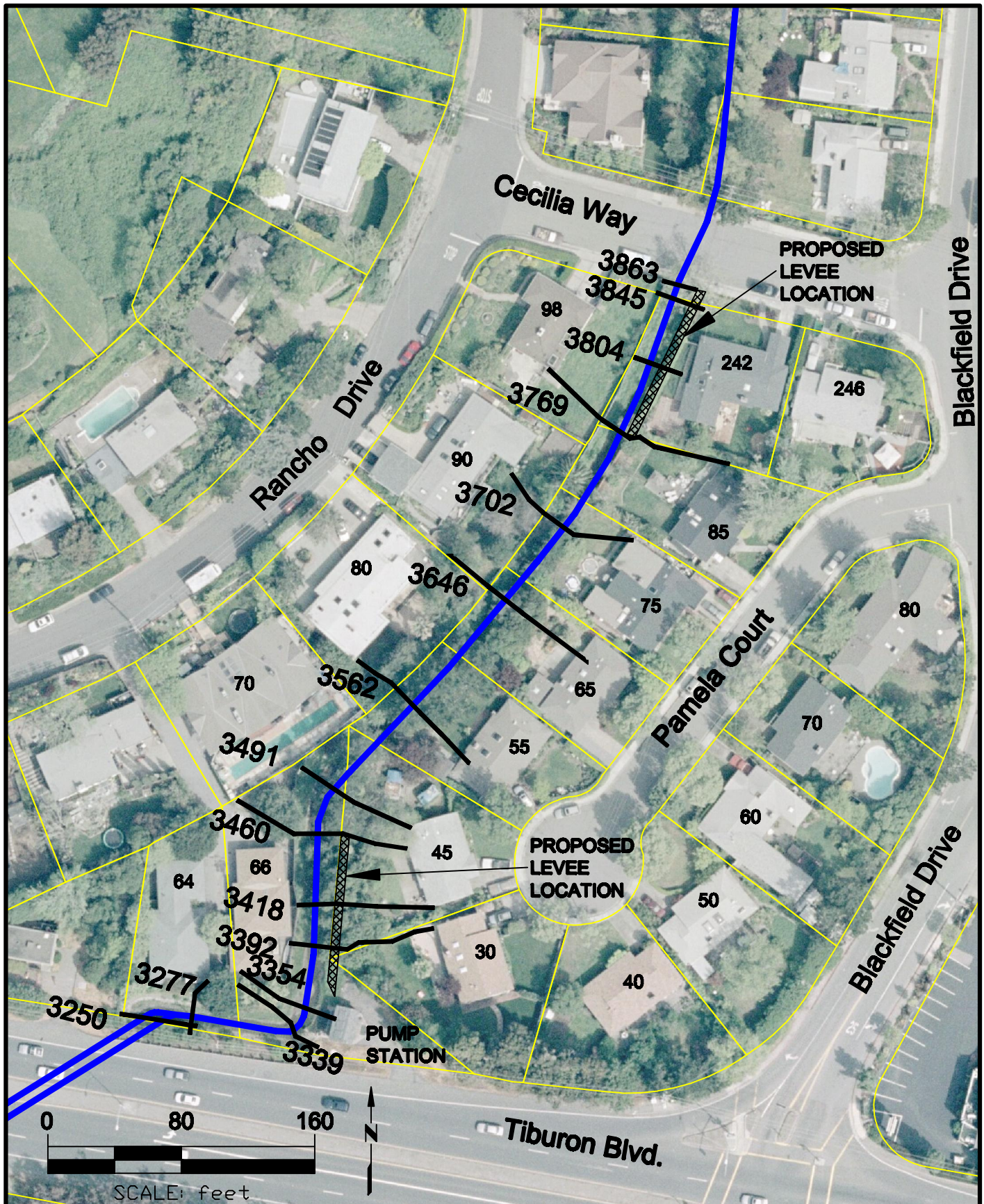
PROFILE EXISTING CONDITIONS VS. PROPOSED ALTERNATIVE F
 LOWER WEST CREEK DRAINAGE IMPROVEMENT ASSESSMENT
 Tiburon, California



KAMMAN HYDROLOGY &
ENGINEERING, INC.
7 Mount Lassen Dr., Ste. B250
San Rafael, CA, 94903
(415) 491-9600

FLOOD-PRONE LOCATIONS ON LEFT BANK
LOWER WEST CREEK DRAINAGE IMPROVEMENT ASSESSMENT
Tiburon, California

FIGURE
3



KAMMAN HYDROLOGY & ENGINEERING, INC.
 7 Mount Lassen Dr., Ste. B250
 San Rafael, CA 94903
 (415) 491-8600

PROPOSED LEVEE LOCATIONS
LOWER WEST CREEK DRAINAGE IMPROVEMENT ASSESSMENT
 Tiburon, California

FIGURE
4

