Brief Explanations of the Hydraulic Study Figures

(Stetson Engineers, 9/28/2018)

FIGURE 1 – Locations of Nokomis/Madrone Bridges and other “foreseeable” projects in the Ross Valley Watershed, and the Nokomis/Madrone bridge opening sizes under the existing condition and the three design alternatives (Low Soffit Design, Midway Soffit Design, and High Soffit Design). Purpose: (1) to provide an overall view of the foreseeable projects within the Ross Valley watershed and (2) to show the difference in bridge openings between existing and the three alternatives conditions.

FIGURE 2 – HEC-RAS model-simulated in-channel water surface profiles under the existing condition and the three design alternatives of the Nokomis/Madrone bridges for the 10-year (Q10), 25-year (Q25), and 100-year (Q100) flood events along San Anselmo Creek from Saunders Ave Bridge in San Anselmo to Sir Francis Drake Bridge crossing in Ross. Purpose: to show the effect of the Nokomis/Madrone bridge replacements, in conjunction with the watershed-wide foreseeable projects, on lowering the in-channel WSE profiles and reducing the hydraulic obstructions.

FIGURE 3 – Zoom-in view of the HEC-RAS model-simulated in-channel water surface profiles under the existing condition and the three design alternatives of the Nokomis/Madrone bridges along San Anselmo Creek within the Nokomis/Madrone neighborhood for the 10-year flood event. The blue line is the WSE profile under the existing condition, the green line is the WSE profile for the low soffit design under the foreseeable projects condition, the red line is the WSE profile for the midway soffit design under the foreseeable projects condition, and the dark brown line is the WSE profile for the high soffit design under the foreseeable projects condition.

FIGURE 4 – Same as FIGURE 3, but with the 25-year flood event.

FIGURE 5 – Same as FIGURE 3, but with the 100-year flood event.

FIGURE 6 – HEC-RAS model-simulated floodplain inundation depth change between the existing condition and the three design alternatives of the Nokomis/Madrone bridges for the 25-year flood event. Purpose: to provide the plan view of the floodplain inundation depth reduction benefits achieved by the Nokomis/Madrone bridge replacement projects in conjunction with the watershed-wide foreseeable projects, as a result of their effects on lowering the in-channel WSE profiles which keeps more water in the channel and less water to the floodplain.

FIGURE 7 – HEC-RAS model-simulated floodplain inundation depth change between the three design alternatives of the Nokomis/Madrone bridges for the 25-year flood event. Purpose: to provide the plan view of the floodplain inundation depth differences between the three design alternatives.

FIGURE 1

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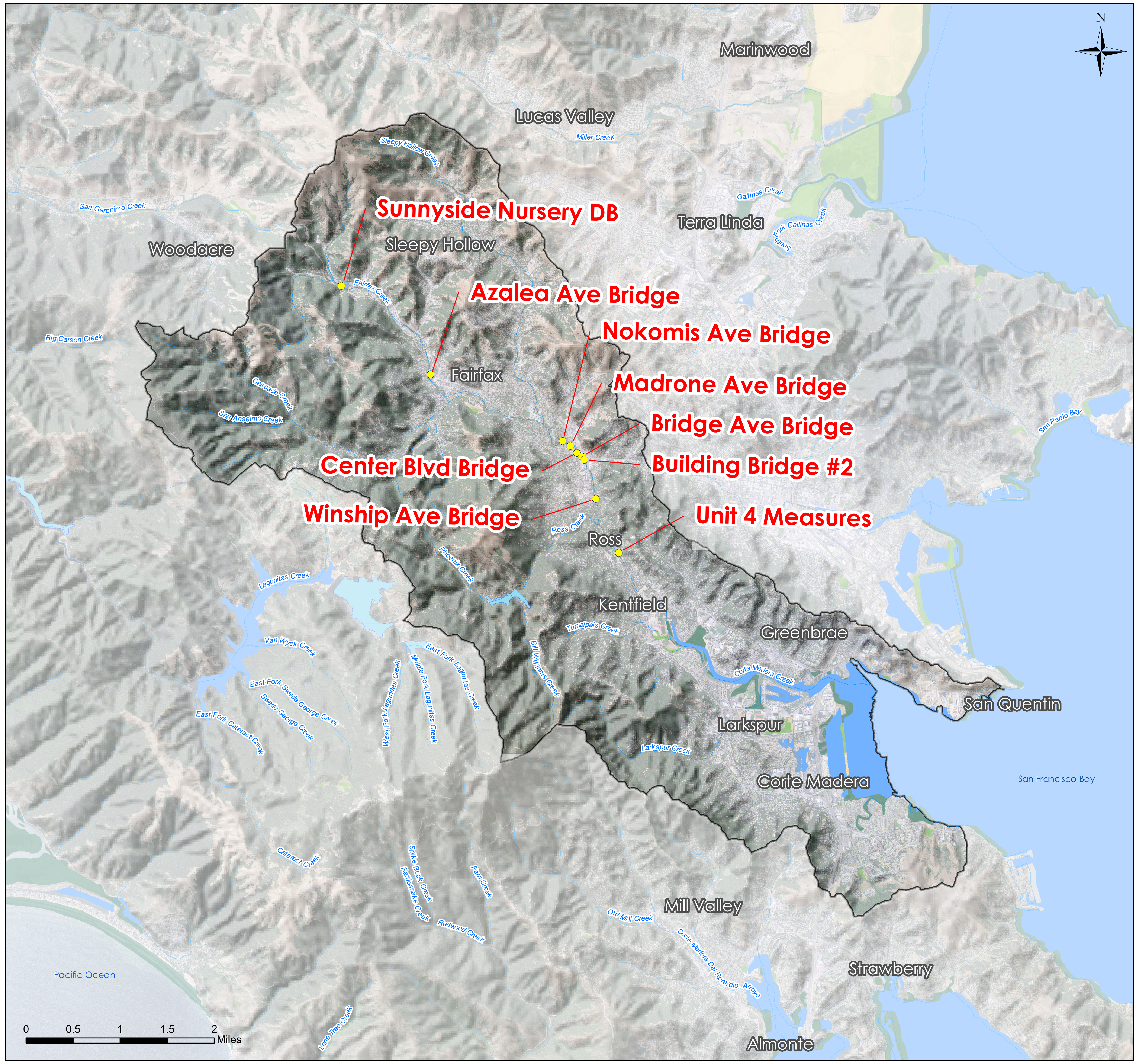
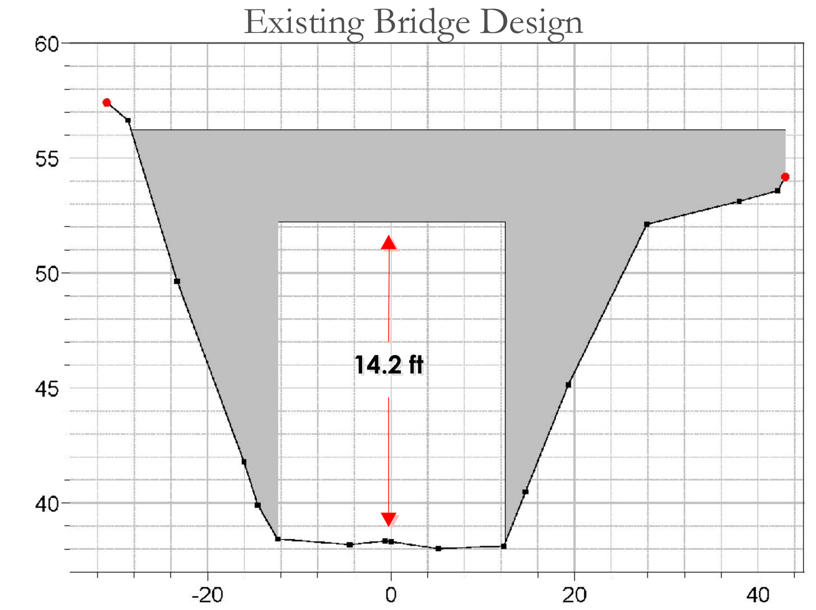
DESIGN ALTERNATIVES
NOKOMIS AND MADRONE BRIDGES

ROSS VALLEY WATERSHED FORESEEABLE PROJECTS

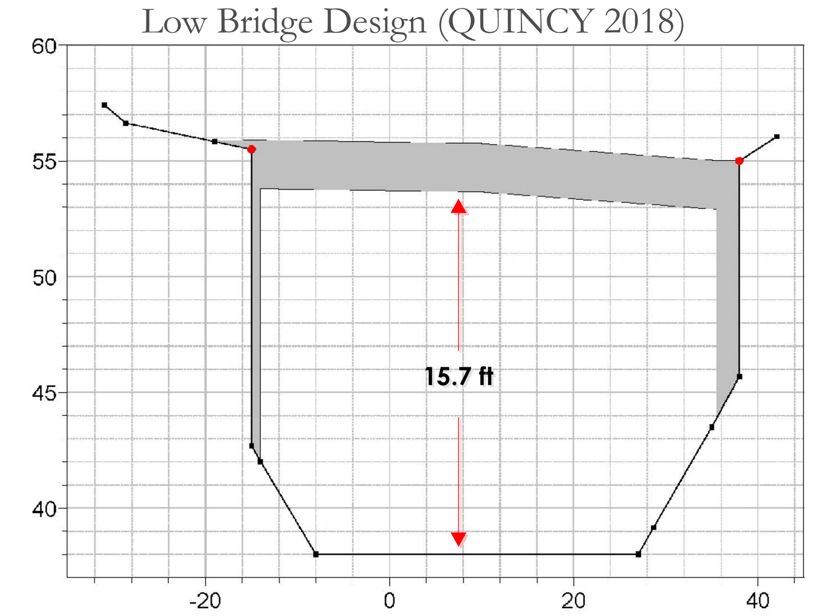


MADRONE BRIDGE DESIGN ALTERNATIVES

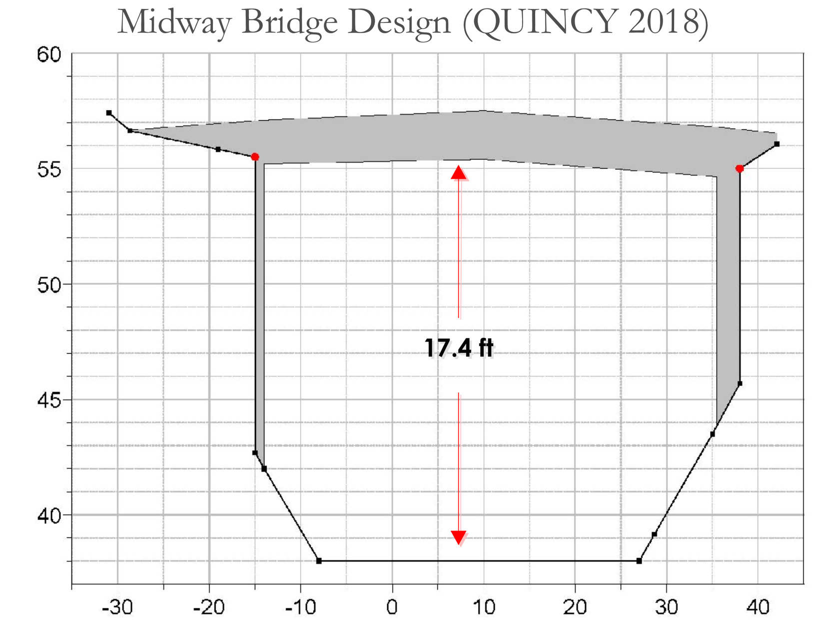
Existing Bridge Design



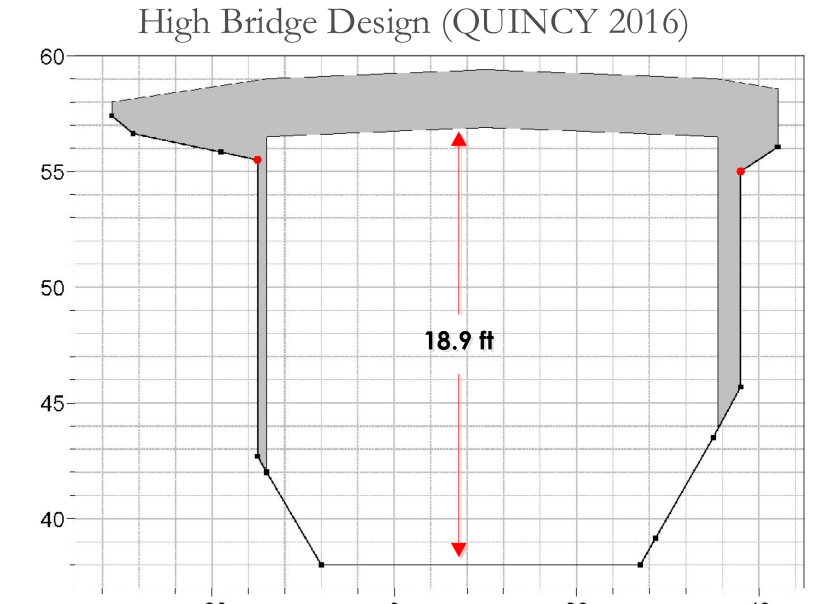
Low Bridge Design (QUINCY 2018)



Midway Bridge Design (QUINCY 2018)

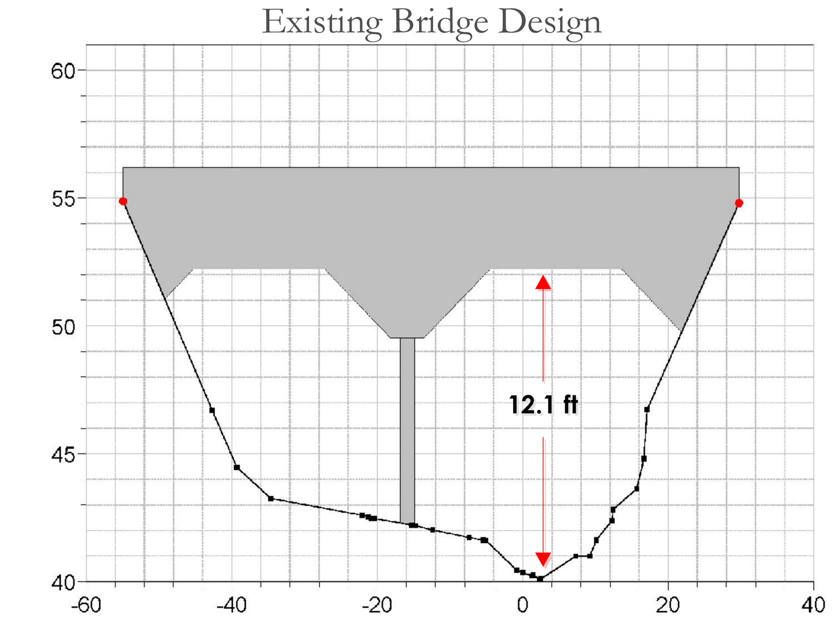


High Bridge Design (QUINCY 2016)

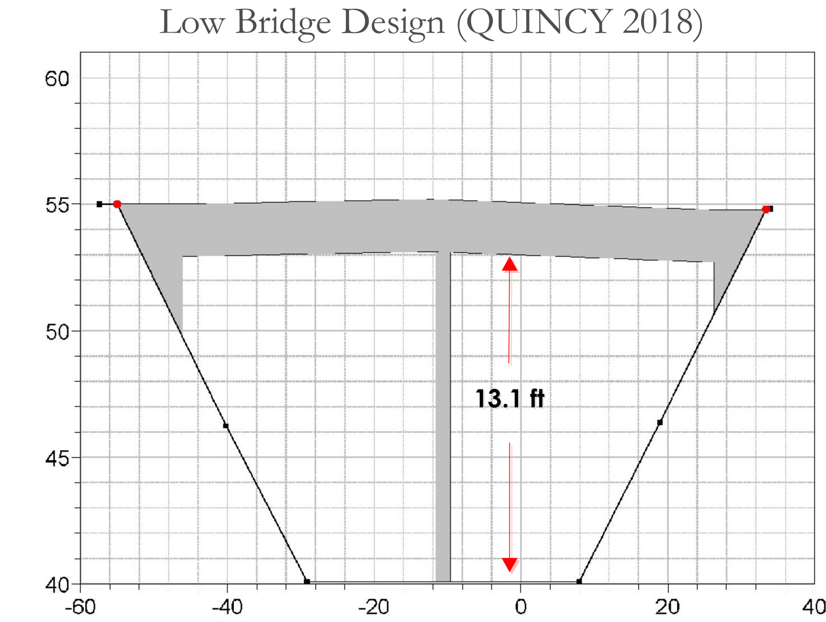


NOKOMIS BRIDGE DESIGN ALTERNATIVES

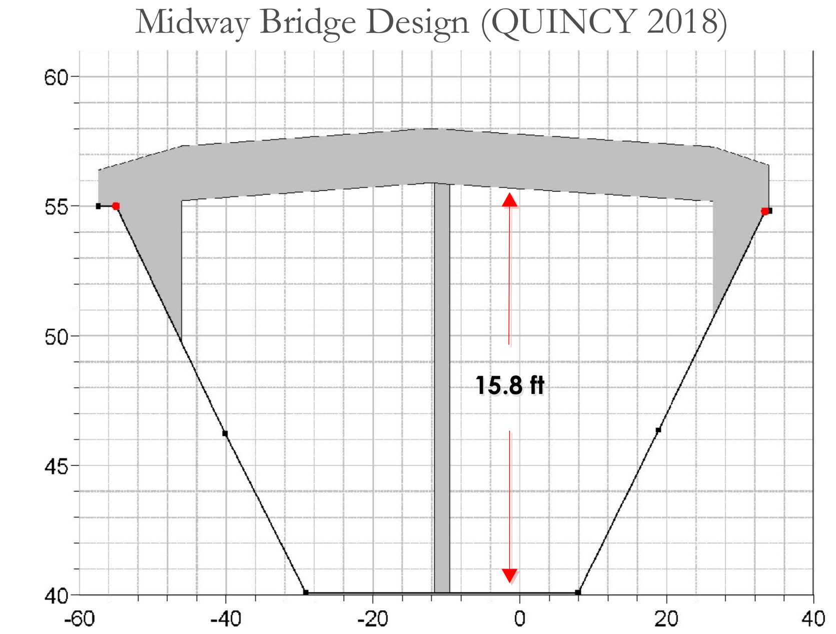
Existing Bridge Design



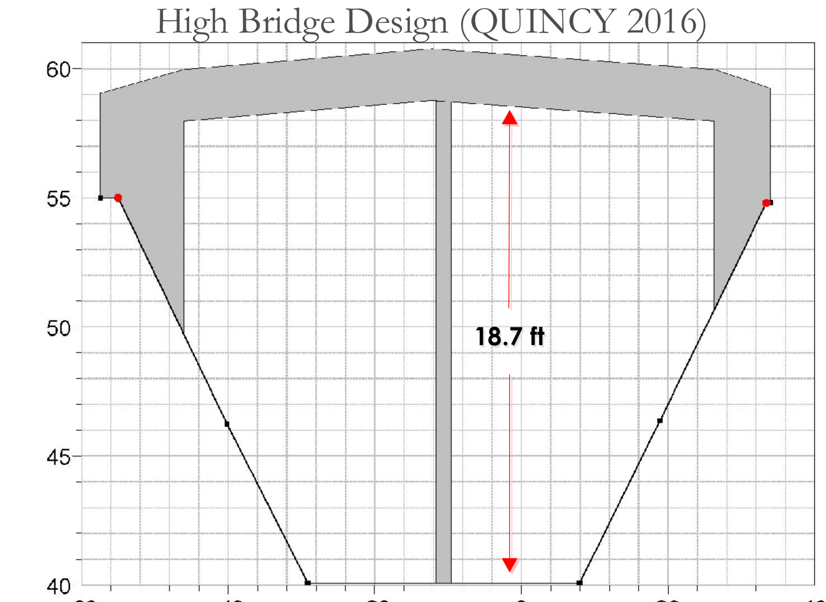
Low Bridge Design (QUINCY 2018)



Midway Bridge Design (QUINCY 2018)



High Bridge Design (QUINCY 2016)



Legend
Ground
Bank Station

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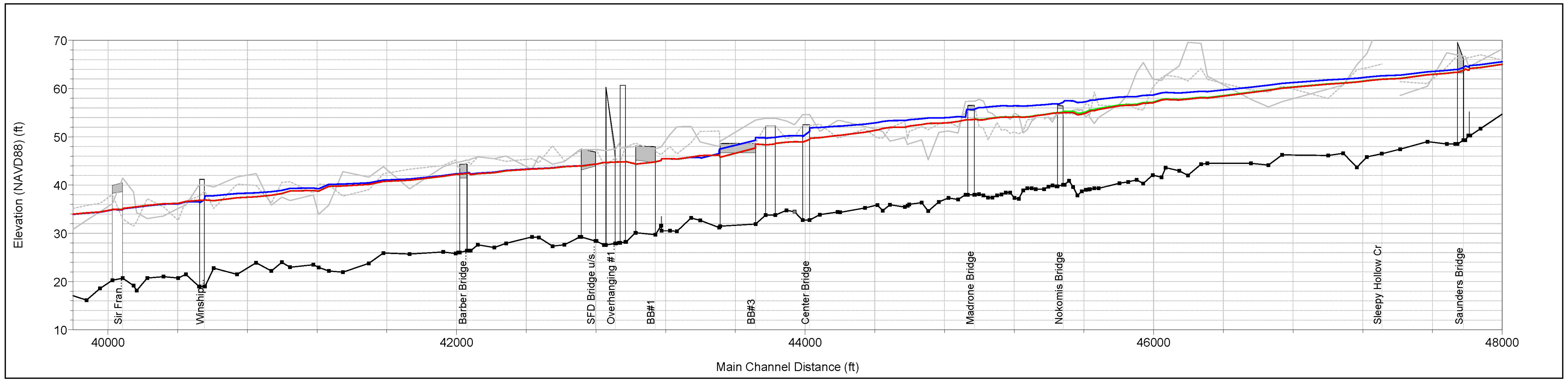
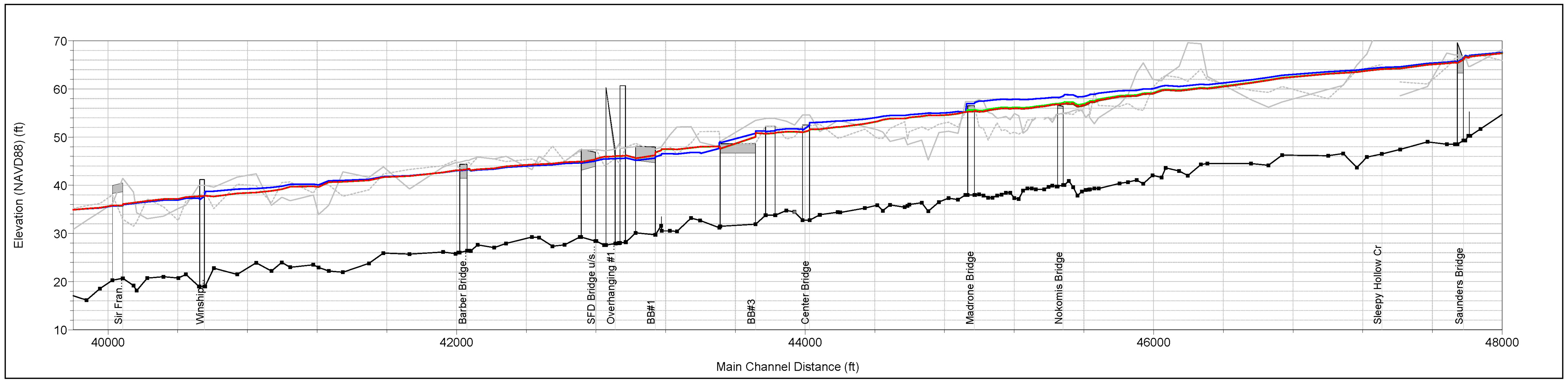
HEC-RAS MODEL SIMULATED WSE PROFILES

BETWEEN EXISTING CONDITION AND PROJECTS COMPLETION AT SELECTED FLOOD LEVELS

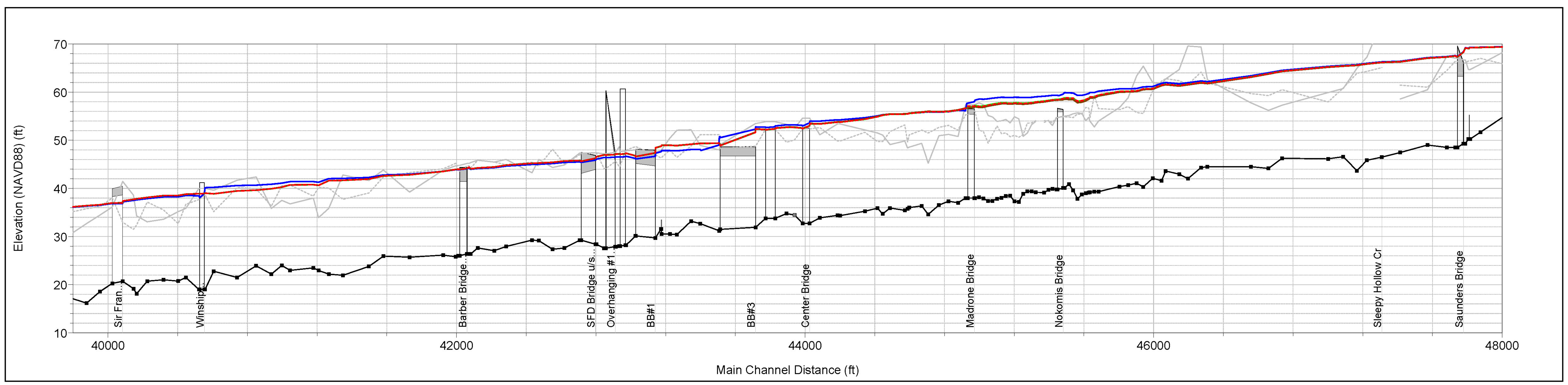
10-YEAR FLOOD



25-YEAR FLOOD



100-YEAR FLOOD



WATER SURFACE PROFILE COMPARISON BETWEEN EXISTING CONDITION AND PROJECTS COMPLETION

EXISTING CONDITION
- Current condition without any of the projects described herein

NOKOMIS AND MADRONE BRIDGE DESIGN ALTERNATIVES:
- Low Bridge Design (Quincy 2018)
- Midway Bridge Design (Quincy 2018)
- High Bridge Design (Quincy 2016)

FORESEEABLE PROJECTS:
- Sunnyside DB (Preferred 33 acft)
- Building Bridge #2 complete removal (CH2M 2018)
- Replacement of Azalea Ave Bridge (CIC 2018)
- Replacement of Center Blvd Bridge (QEI 2018)
- Replacement of Bridge Ave Bridge (QEI 2018)
- Replacement of Winship Ave Bridge (Quincy 2017)
- Unit 4 Measures 1-3 (Stetson 2008)

Legend

- Nokomis/Madrone #3 (High) + FS
- Nokomis/Madrone #4 (Midway) + FS
- Nokomis/Madrone #2 (Low) + FS
- Existing
- Channel Bed
- Left Bank
- Right Bank

Notes:
WSE profiles are based on computer model simulations. Model is under-going peer review by USACE. Model results are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

FIGURE 3

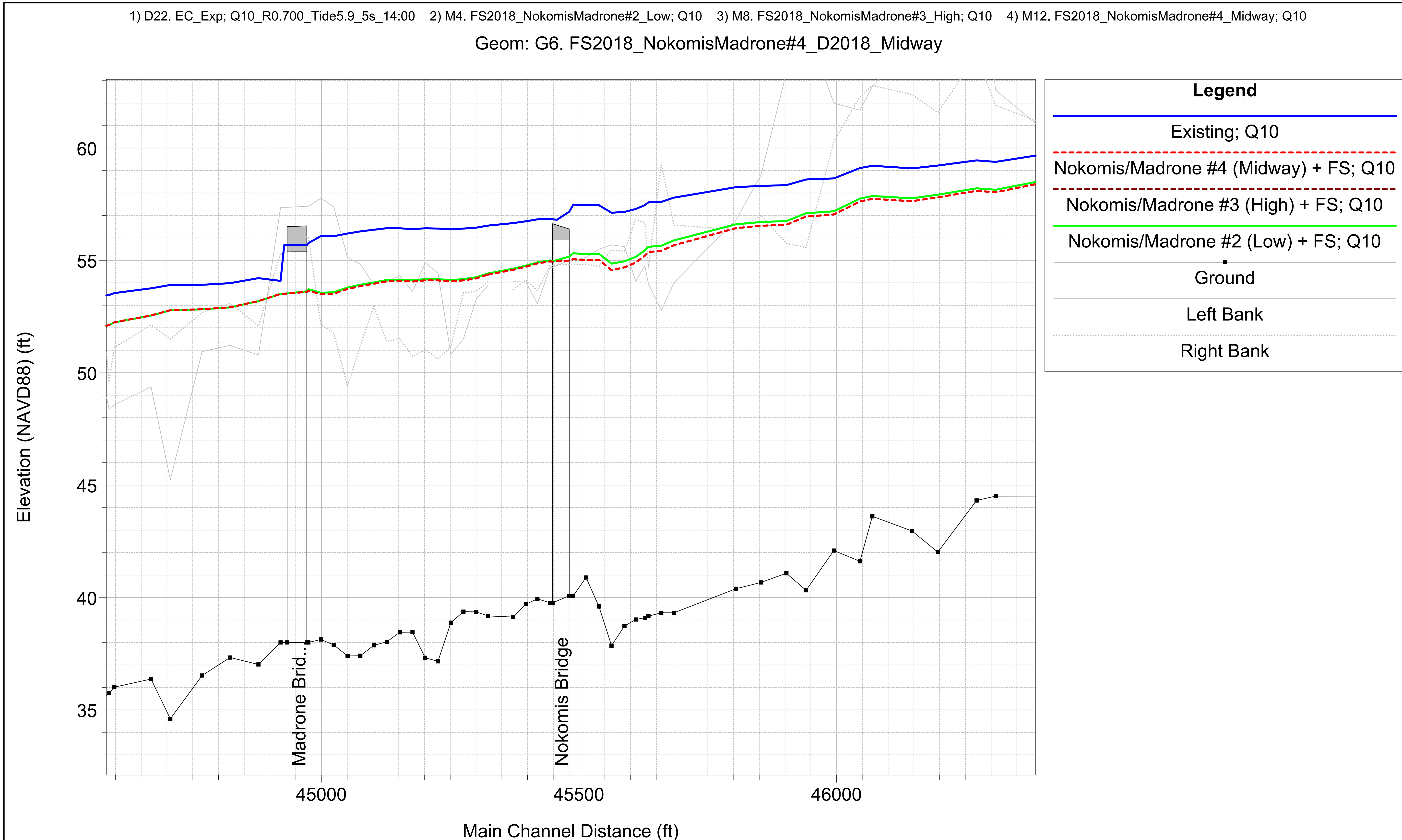

1) D22. EC_Exp; Q10_R0.700_Tide5.9_5s_14:00 2) M4. FS2018_NokomisMadrone#2_Low; Q10 3) M8. FS2018_NokomisMadrone#3_High; Q10 4) M12. FS2018_NokomisMadrone#4_Midway; Q10
Geom: G6. FS2018_NokomisMadrone#4_D2018_Midway
Legend
Existing; Q10
Nokomis/Madrone #4 (Midway) + FS; Q10
Nokomis/Madrone #3 (High) + FS; Q10
Nokomis/Madrone #2 (Low) + FS; Q10
Ground
Left Bank
Right Bank
Elevation (NAVD88) (ft)
60
55
50
45
40
35
Madrone Brid...
Nokomis Bridge
45000
45500
46000
Main Channel Distance (ft)

FIGURE 4

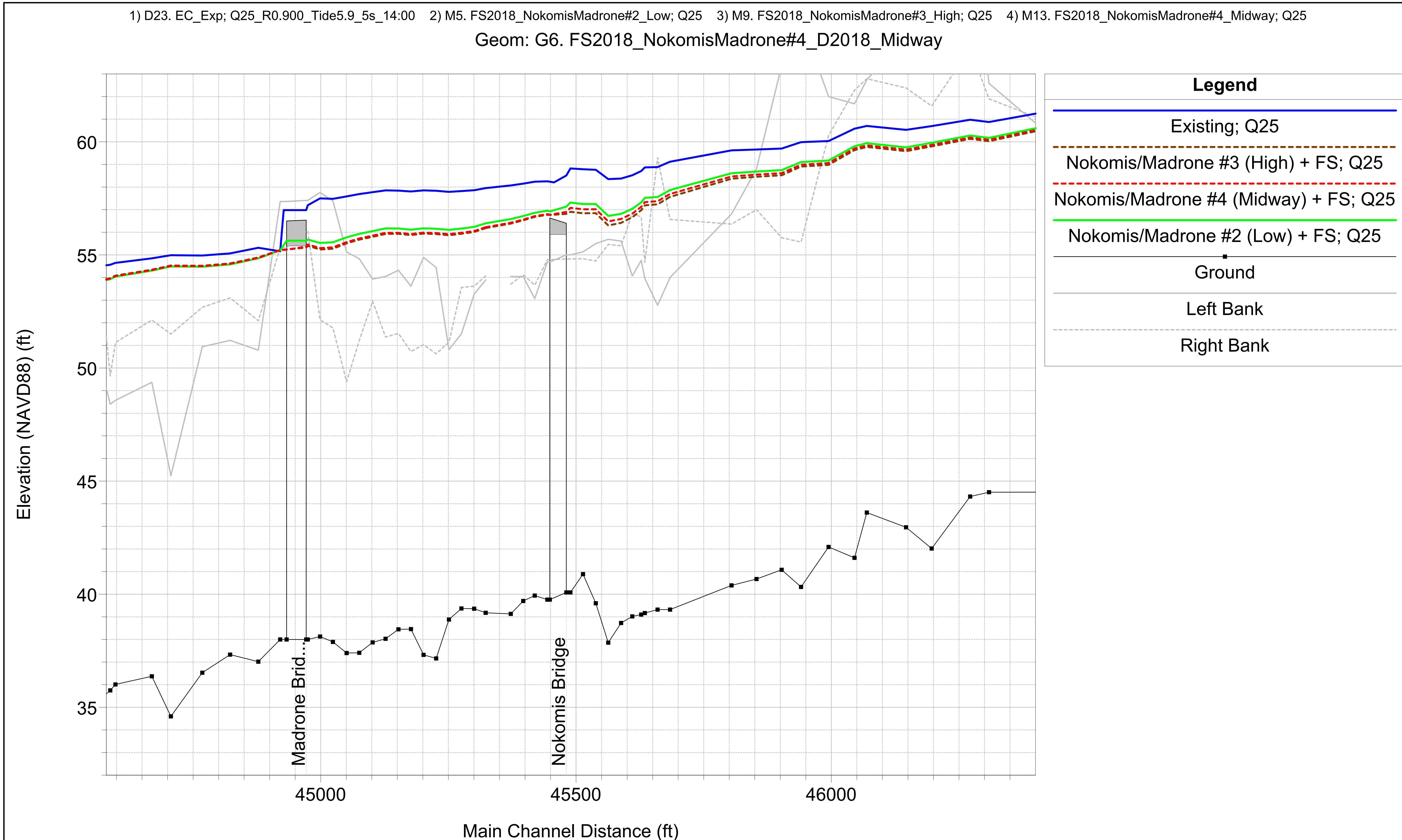
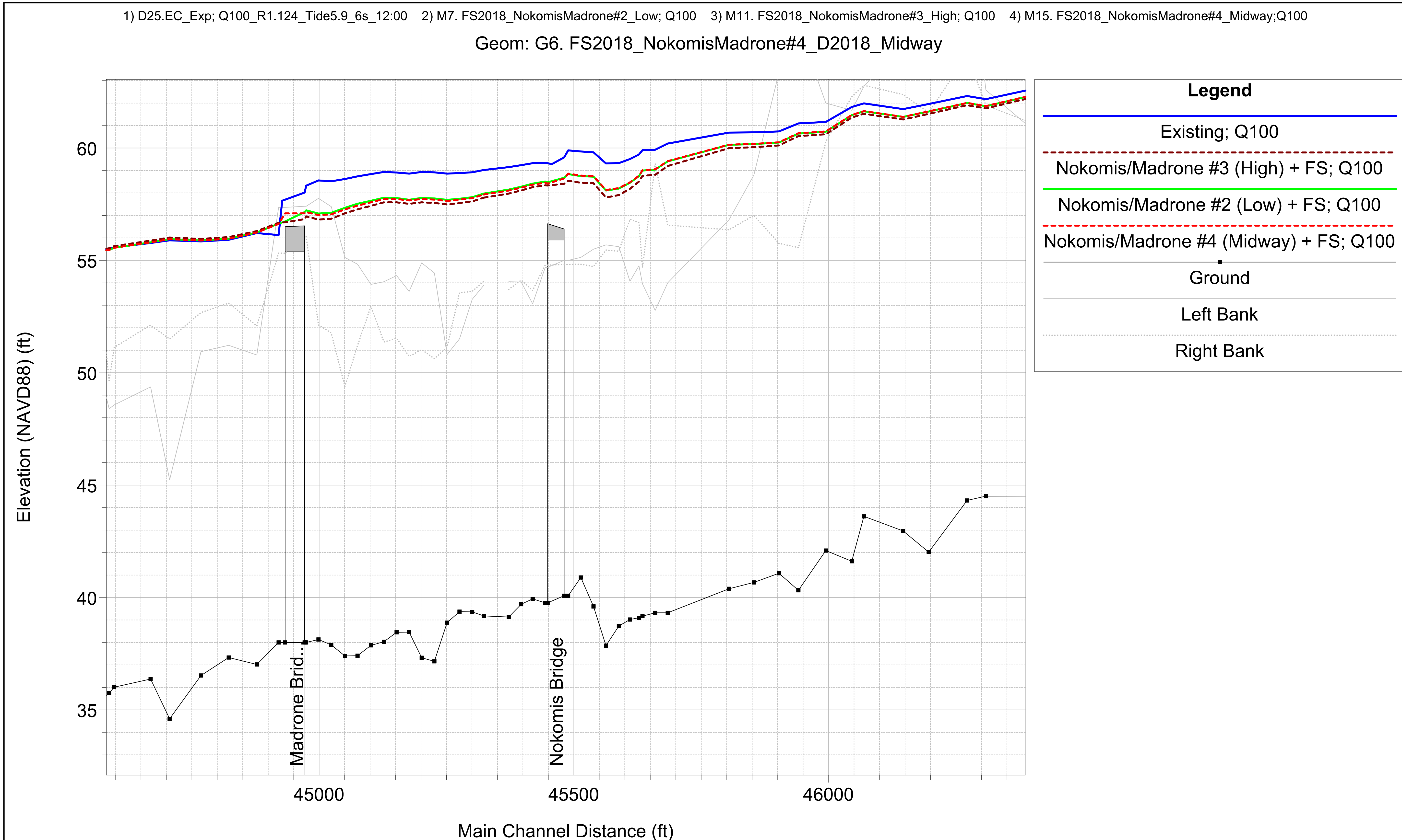

1) D23. EC_Exp; Q25_R0.900_Tide5.9_5s_14:00 2) M5. FS2018_NokomisMadrone#2_Low; Q25 3) M9. FS2018_NokomisMadrone#3_High; Q25 4) M13. FS2018_NokomisMadrone#4_Midway; Q25
Geom: G6. FS2018_NokomisMadrone#4_D2018_Midway
Elevation (NAVD88) (ft)
60
55
50
45
40
35
Madrone Brid...
Nokomis Bridge
45000
45500
46000
Main Channel Distance (ft)
Legend
Existing; Q25
Nokomis/Madrone #3 (High) + FS; Q25
Nokomis/Madrone #4 (Midway) + FS; Q25
Nokomis/Madrone #2 (Low) + FS; Q25
Ground
Left Bank
Right Bank

FIGURE 5


1) D25.EC_Exp; Q100_R1.124_Tide5.9_6s_12:00 2) M7. FS2018_NokomisMadrone#2_Low; Q100 3) M11. FS2018_NokomisMadrone#3_High; Q100 4) M15. FS2018_NokomisMadrone#4_Midway;Q100
Geom: G6. FS2018_NokomisMadrone#4_D2018_Midway
Legend
Existing; Q100
Nokomis/Madrone #3 (High) + FS; Q100
Nokomis/Madrone #2 (Low) + FS; Q100
Nokomis/Madrone #4 (Midway) + FS; Q100
Ground
Left Bank
Right Bank
Madrone Brid...
Nokomis Bridge
Elevation (NAVD88) (ft)
60
55
50
45
40
35
45000
45500
46000
Main Channel Distance (ft)

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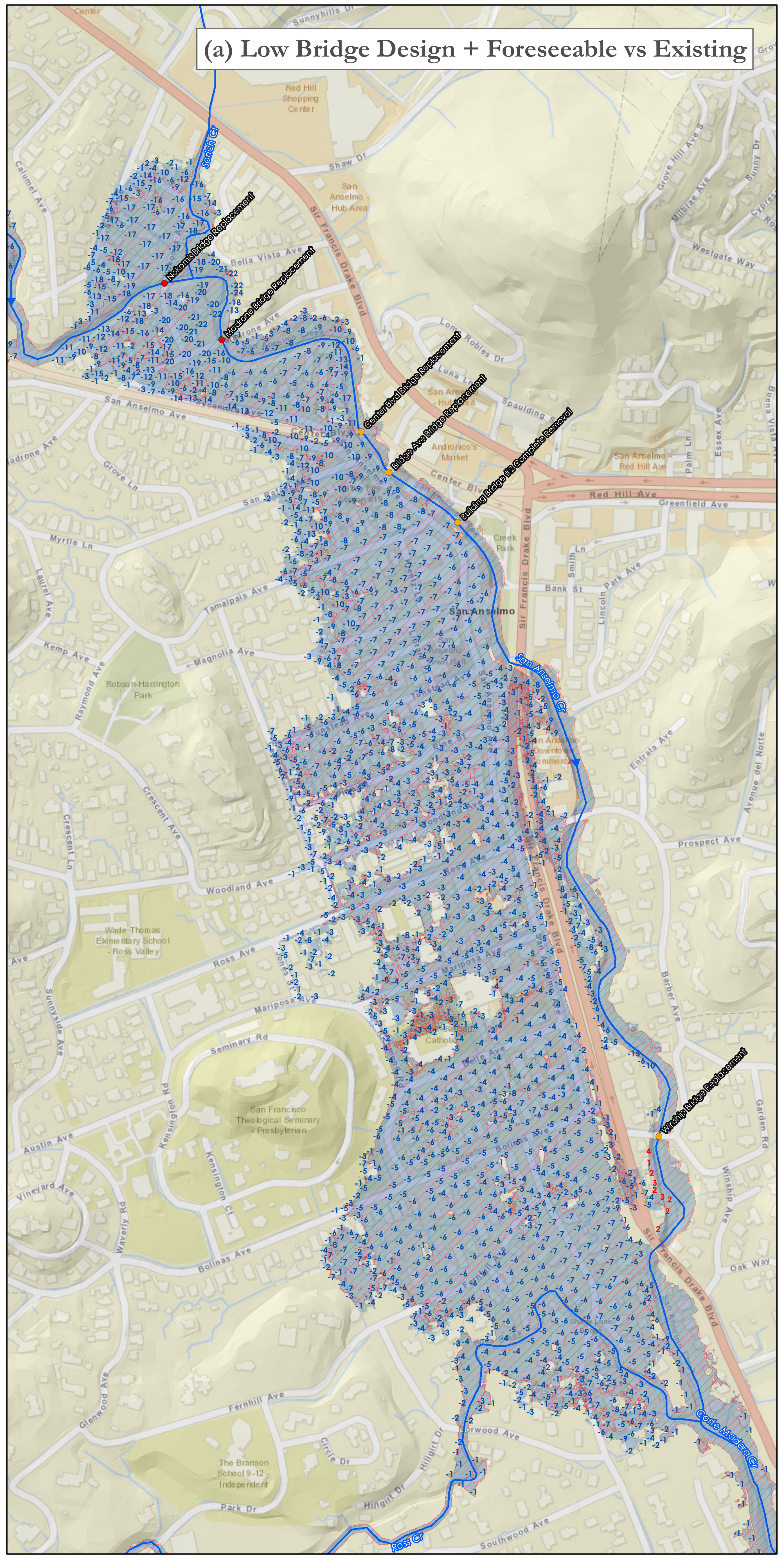
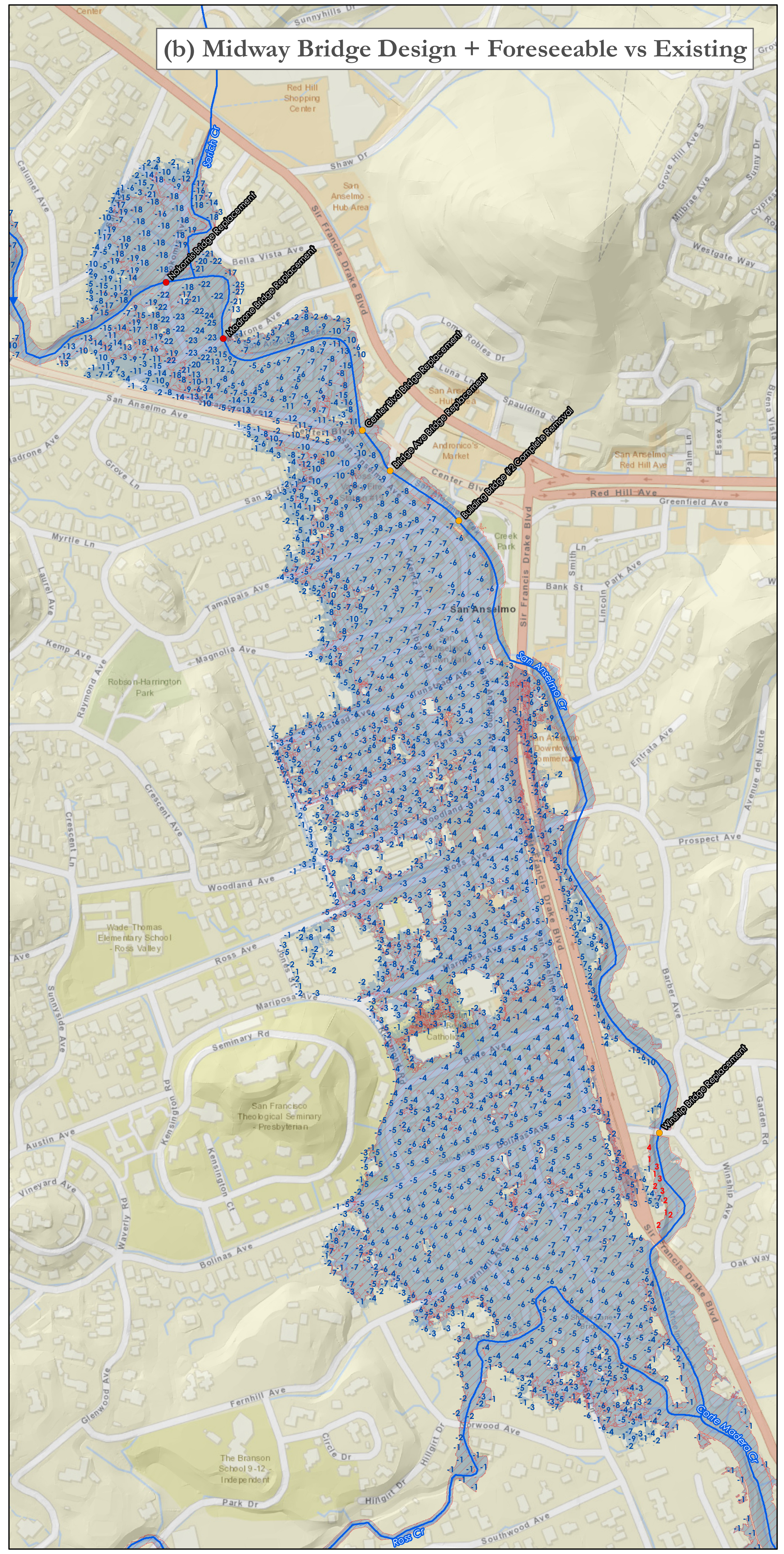
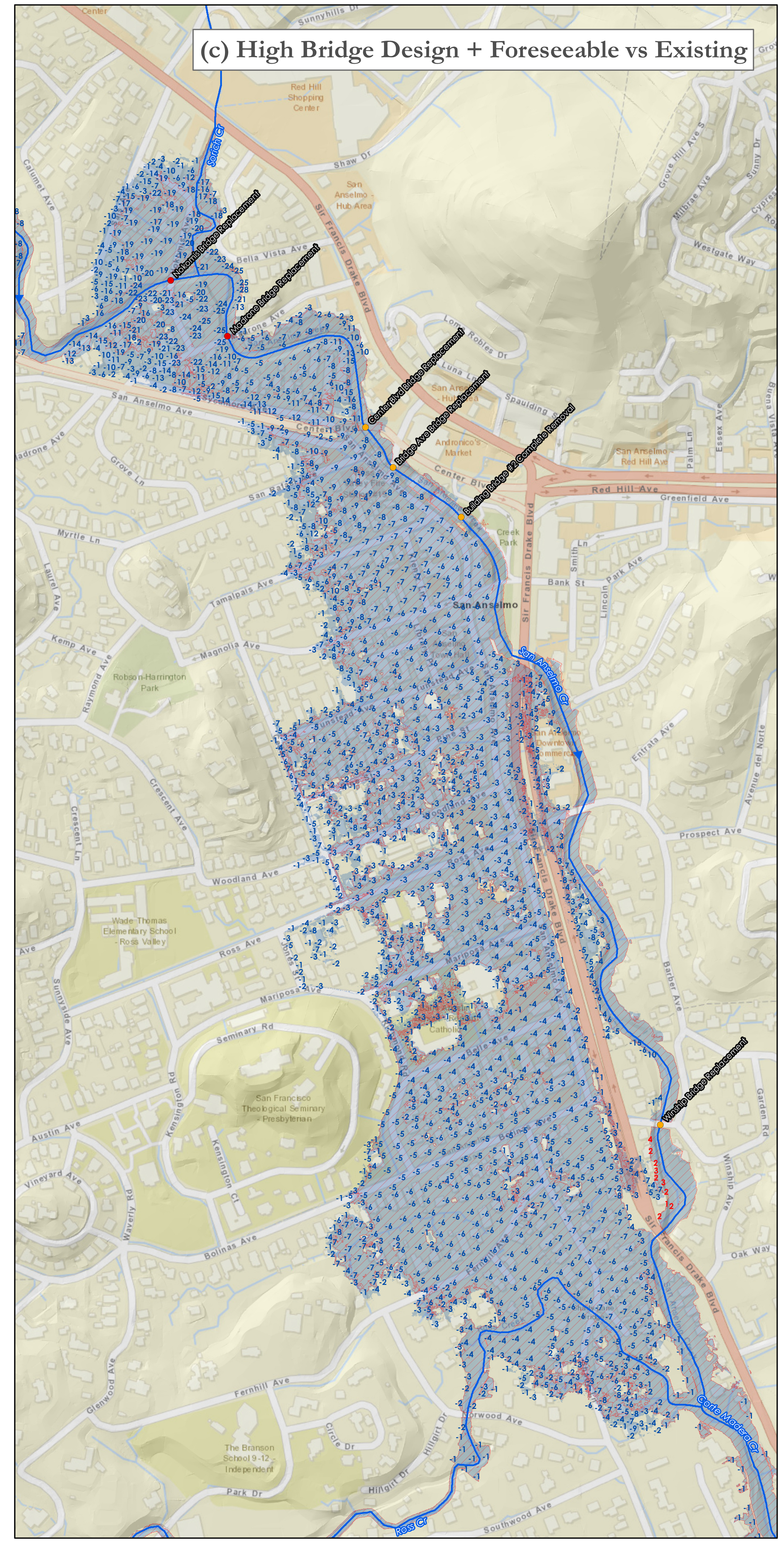
HEC-RAS MODEL SIMULATED WSE CHANGE MAPS
BETWEEN EXISTING CONDITION AND PROJECTS COMPLETION
25-YEAR FLOOD







MAP SHOWING CHANGE IN WATER SURFACE EXTENT AND DEPTH BETWEEN EXISTING CONDITION AND PROJECTS COMPLETION

EXISTING CONDITION
- Current condition without any of the projects described herein

NOKOMIS AND MADRONE BRIDGE DESIGN ALTERNATIVES:
- Low Bridge Design (Quincy 2018)
- Midway Bridge Design (Quincy 2018)
- High Bridge Design (Quincy 2016)

FORESEEABLE PROJECTS:
- Sunnyside DB (Preferred 33 acft)
- Building Bridge #2 complete removal (CH2M 2018)
- Replacement of Azalea Ave Bridge (CIC 2018)
- Replacement of Center Blvd Bridge (QEI 2018)
- Replacement of Bridge Ave Bridge (QEI 2018)
- Replacement of Winship Ave Bridge (Quincy 2017)
- Unit 4 Measures 1-3 (Stetson 2008)

Legend

- Proposed Bridge Project
- Foreseeable Project
- Creek (flow direction)
- Project Inundation
- Existing Inundation

Number labeling convention (inches):
Blue = Project reduces WSE
Red = Project increases WSE

Notes:
Map is based on computer model simulations. Model is undergoing peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

0 150 300 450 600 Feet

N

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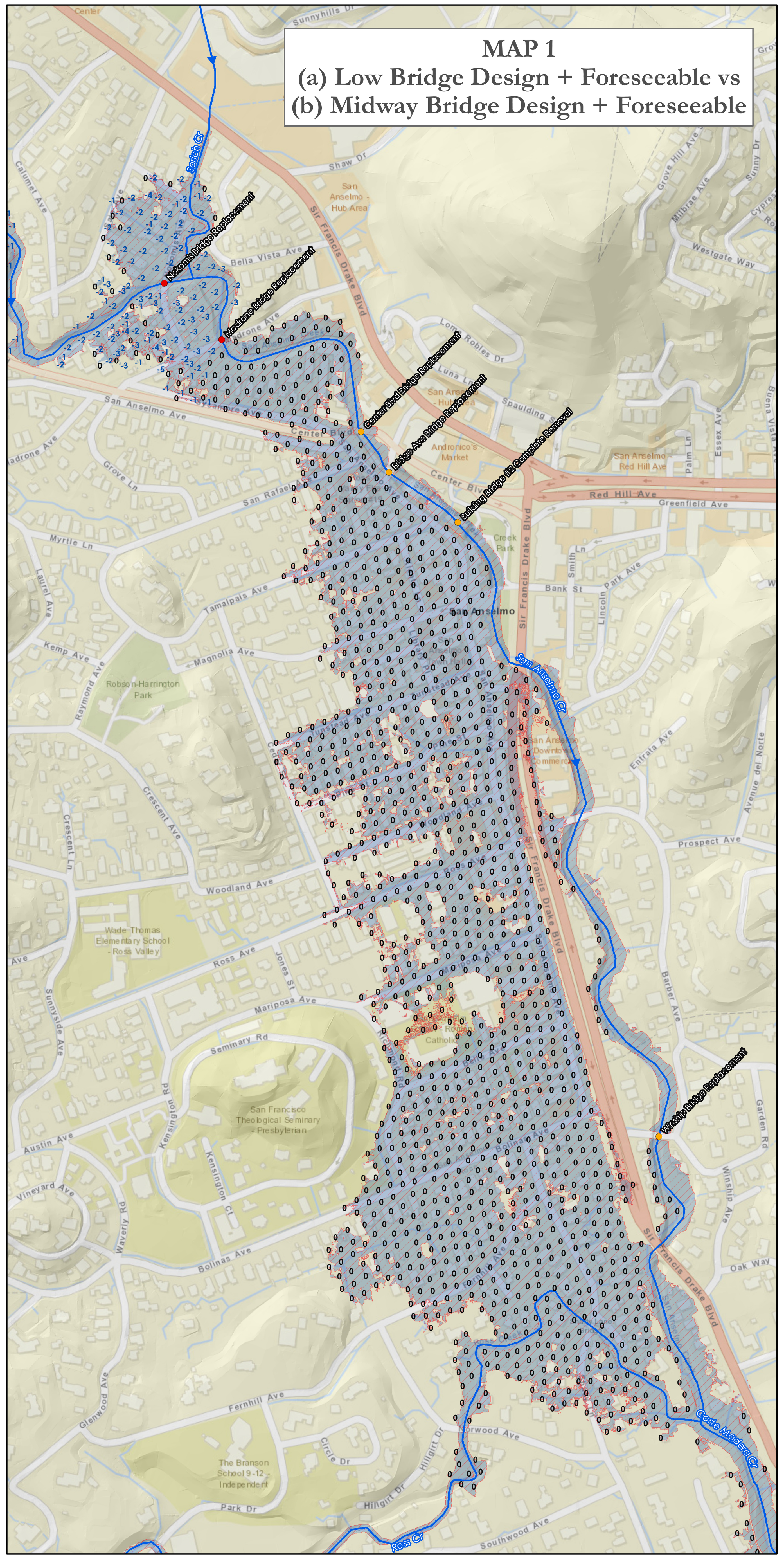
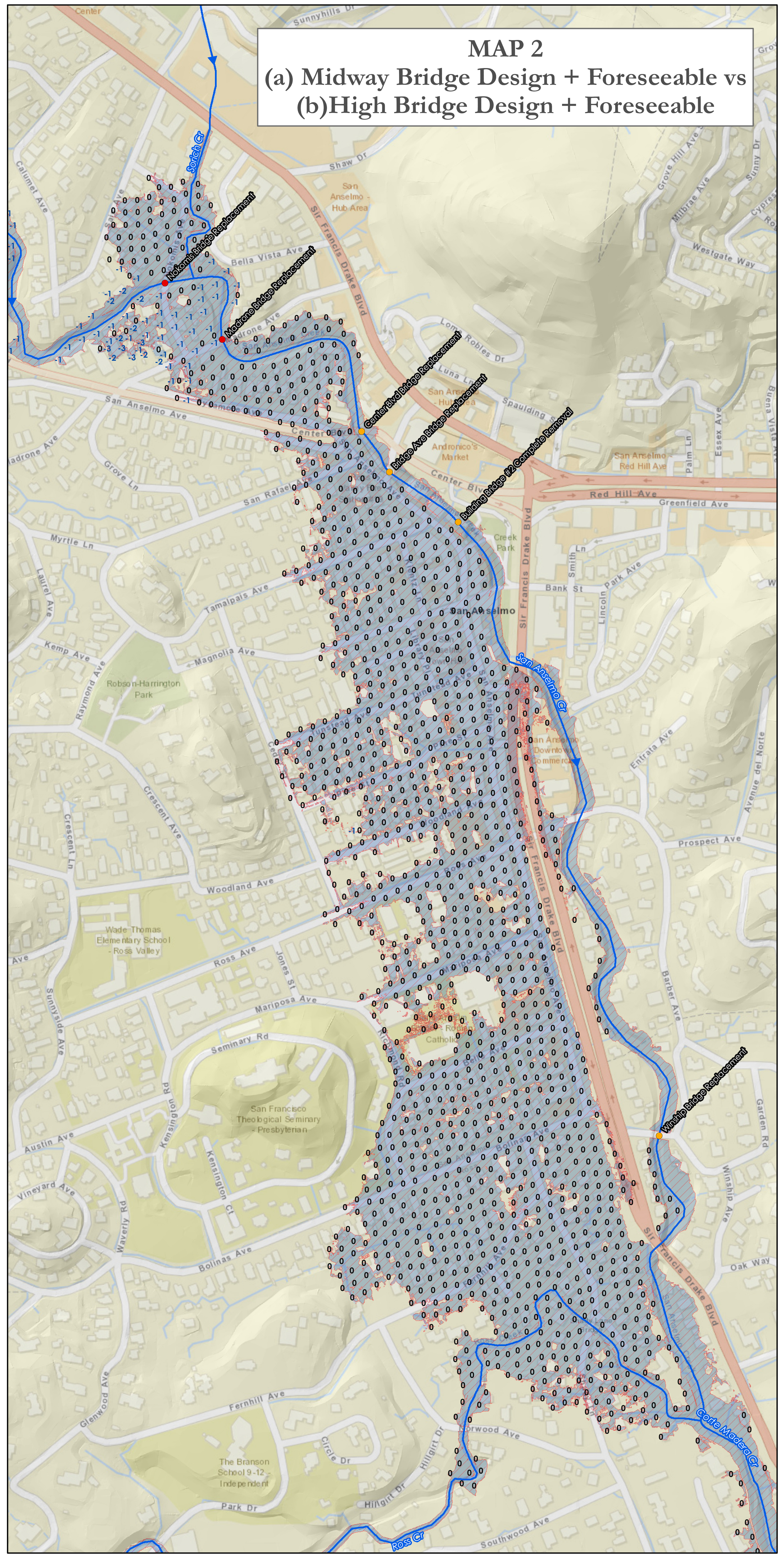
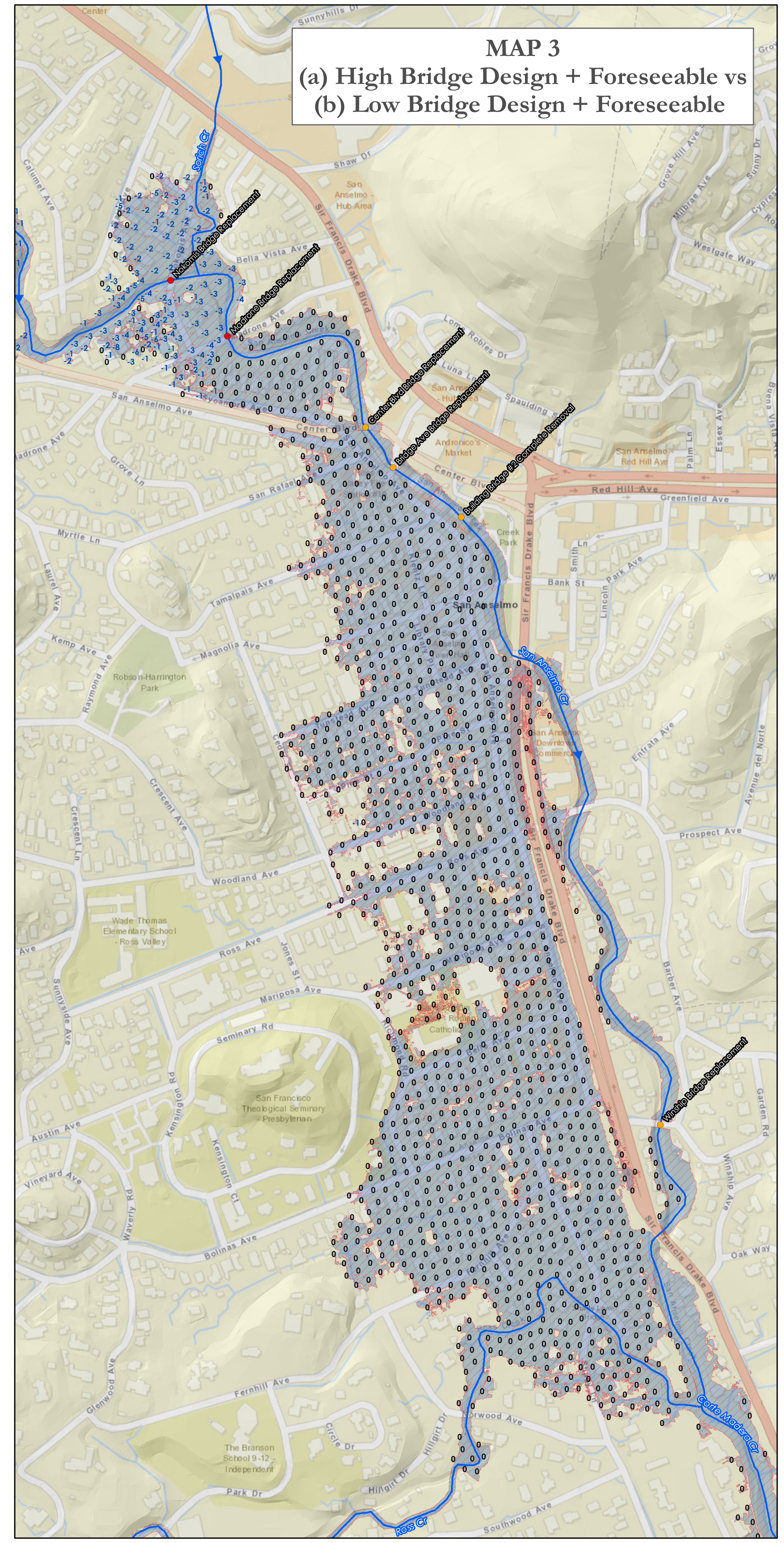
HEC-RAS MODEL SIMULATED WSE CHANGE MAPS
BETWEEN BRIDGE DESIGN ALTERNATIVES
25-YEAR FLOOD







MAP SHOWING CHANGE IN WATER SURFACE EXTENT AND DEPTH BETWEEN BRIDGE DESIGN ALTERNATIVES

EXISTING CONDITION
- Current condition without any of the projects described herein

NOKOMIS AND MADRONE BRIDGE DESIGN ALTERNATIVES:
- Low Bridge Design (Quincy 2018)
- Midway Bridge Design (Quincy 2018)
- High Bridge Design (Quincy 2016)

FORESEEABLE PROJECTS:
- Sunnyside DB (Preferred 33 acft)
- Building Bridge #2 complete removal (CH2M 2018)
- Replacement of Azalea Ave Bridge (CIC 2018)
- Replacement of Center Blvd Bridge (QEI 2018)
- Replacement of Bridge Ave Bridge (QEI 2018)
- Replacement of Winship Ave Bridge (Quincy 2017)
- Unit 4 Measures 1-3 (Stetson 2008)

Legend

Proposed Bridge Project
Foreseeable Project
Creek (flow direction)
Project (a) Inundation
Project (b) Inundation

Number labeling convention (inches):
Blue = Project reduces WSE
Black = Project does not change WSE
Red = Project increases WSE

Notes:
Map is based on computer model simulations. Model is undergoing peer review by USACE. Model results and map are subject to change. Historical data has shown that the actual change in inundation extent and depth may vary depending upon the characteristics of the rain storm and other factors.

0 150 300 450 600 Feet

N