APPENDIX A – FIELD RECONNAISSANCE MAPPING AND PHOTOGRAPHS

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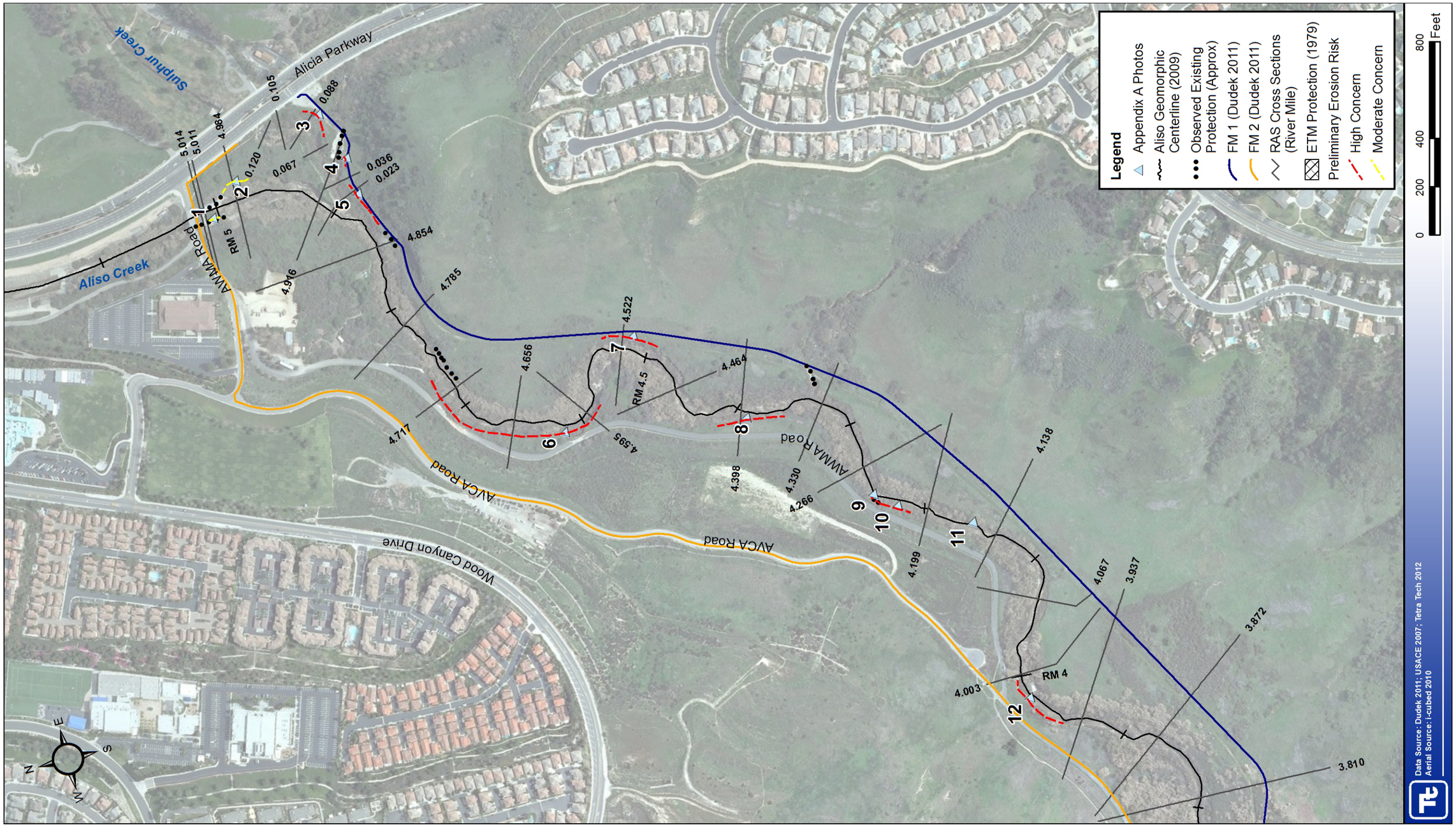
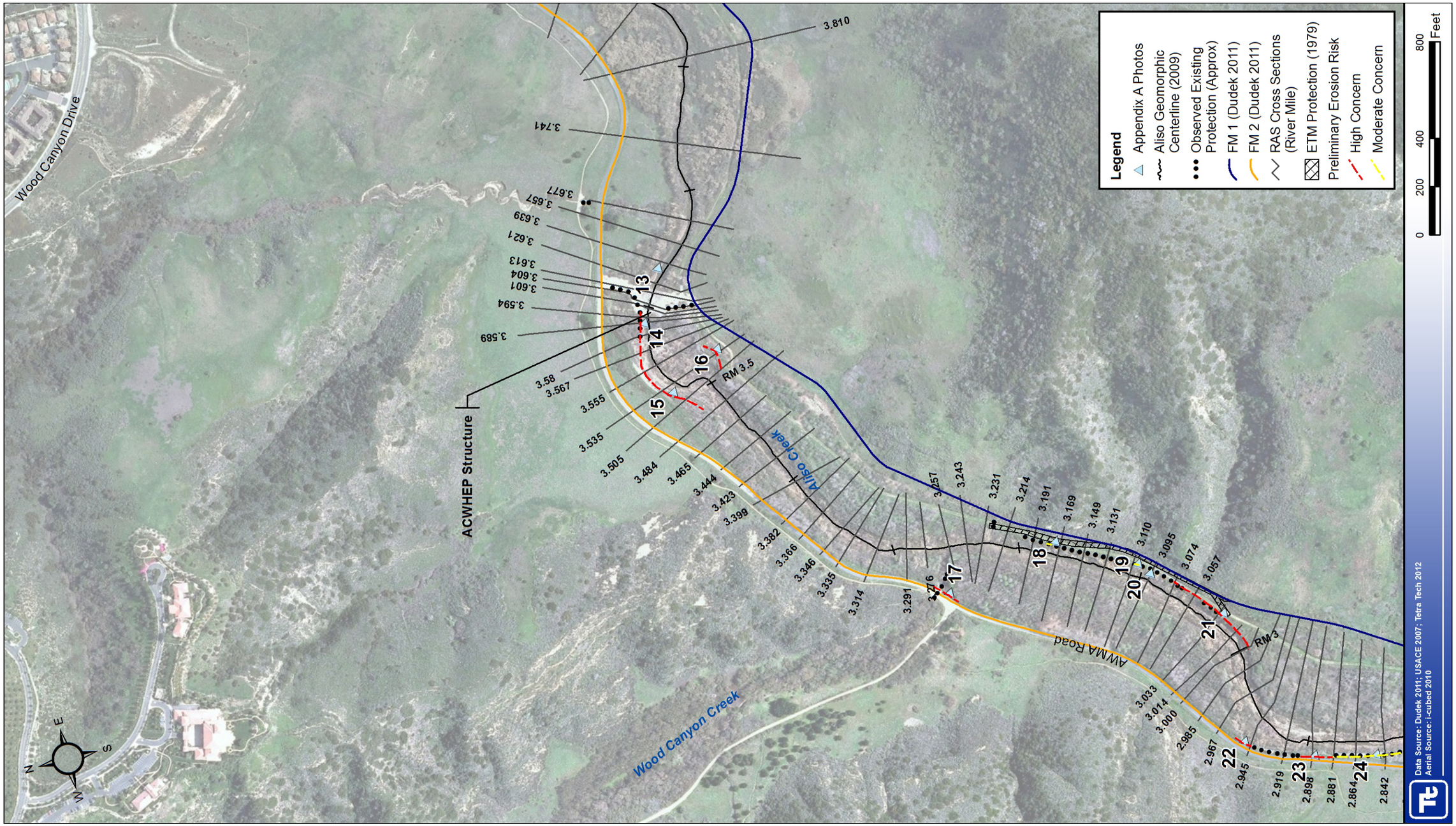

Legend
Appendix A Photos
Aliso Geomorphic Centerline (2009)
Observed Existing Protection (Approx)
FM 1 (Dudek 2011)
FM 2 (Dudek 2011)
RAS Cross Sections (River Mile)
ETM Protection (1979)
Preliminary Erosion Risk
High Concern
Moderate Concern
0 200 400 800 Feet
Data Source: Dudek 2011; USACE 2007; Tetra Tech 2012
Aerial Source: I-cubed 2010
Aliso Creek
Sulphur Creek
Alicia Parkway
AMMA Road
AVCA Road
Wood Canyon Drive
RM 5
RM 4.5
RM 4
5.014
5.011
4.964
4.916
4.854
4.785
4.717
4.656
4.595
4.522
4.464
4.398
4.330
4.266
4.199
4.138
4.067
4.003
3.937
3.872
3.810
0.105
0.088
0.120
0.067
0.036
0.023
1
2
3
4
5
6
7
8
9
10
11
12
N
E
S
W

Figure A-1


Legend
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High Concern
Moderate Concern
0 200 400 800 Feet
Data Source: Dudek 2011; USACE 2007; Tetra Tech 2012
Aerial Source: I-cubed 2010
Wood Canyon Drive
ACWHEP Structure
Aliso Creek
Wood Canyon Creek
AWMA Road
RM 3.5
RM 3
13
14
15
16
17
18
19
20
21
22
23
24
3.810
3.741
3.677
3.657
3.639
3.621
3.613
3.604
3.601
3.594
3.589
3.58
3.567
3.555
3.535
3.505
3.484
3.465
3.444
3.423
3.399
3.382
3.366
3.346
3.335
3.314
3.291
3.276
3.257
3.243
3.231
3.214
3.191
3.169
3.149
3.131
3.110
3.095
3.074
3.057
3.033
3.014
3.000
2.985
2.967
2.945
2.919
2.898
2.881
2.864
2.842
N
E
S
W

Figure A-2

N
E
S
W
AWMA Road
Aliso Creek
RM 3
RM 2.5
RM 2
S-bend
Abandoned Oxbow
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
3.276
3.257
3.243
3.231
3.214
3.191
3.169
3.149
3.131
3.110
3.095
3.074
3.057
3.033
3.014
3.000
2.985
2.967
2.945
2.919
2.898
2.881
2.864
2.842
2.823
2.802
2.784
2.768
2.753
2.736
2.713
2.692
2.668
2.649
2.634
2.594
2.565
2.544
2.509
2.479
2.459
2.434
2.412
2.392
2.355
2.342
2.334
2.312
2.277
2.264
2.243
2.233
2.208
2.191
2.167
2.149
2.131
2.113
2.097
2.076
2.056
2.035
2.013
1.986
1.971
1.955
1.904
1.887
1.865
1.817
1.789
Legend
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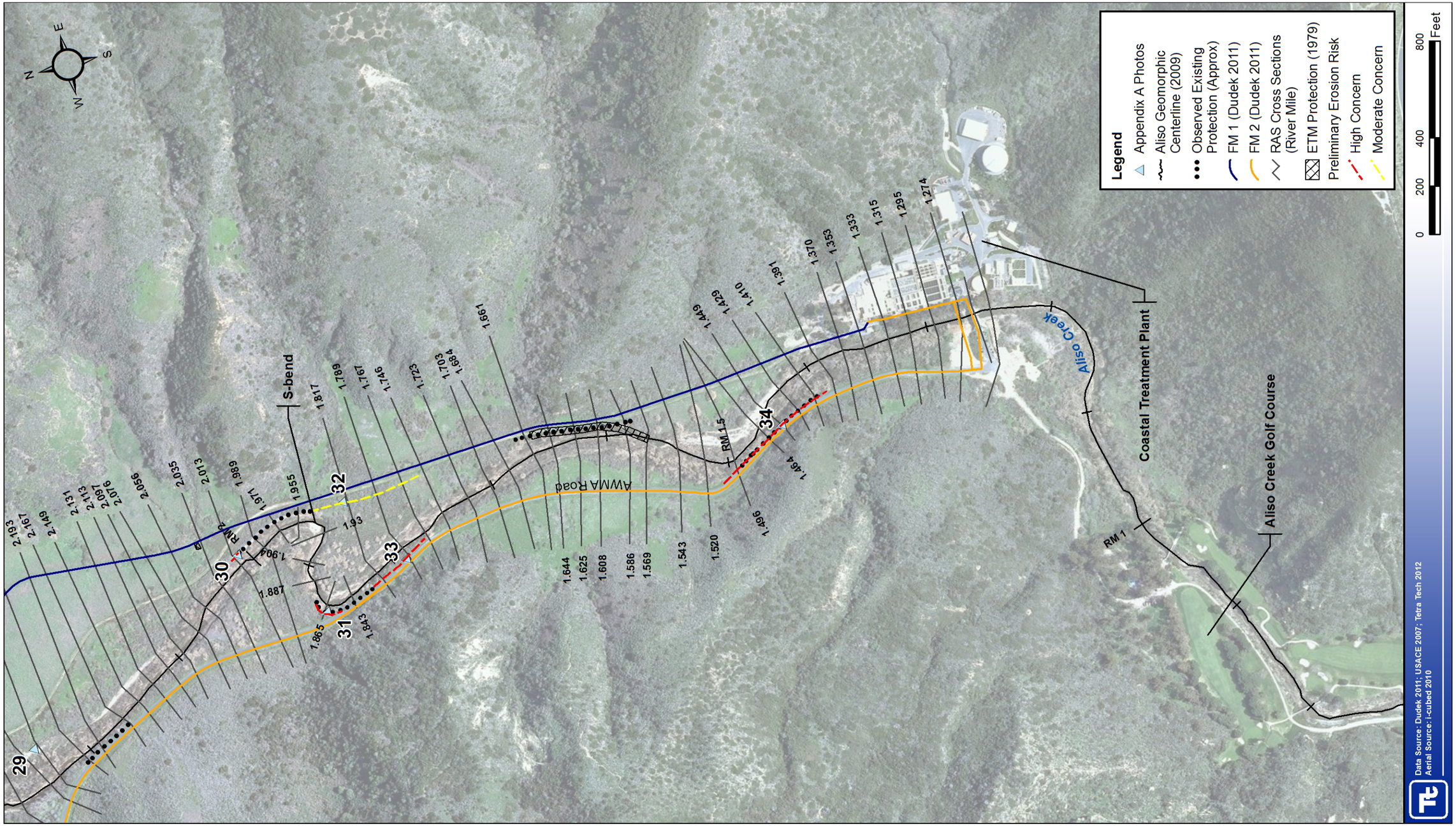
RAS Cross Sections (River Mile)
ETM Protection (1979)
Preliminary Erosion Risk
High Concern
Moderate Concern
0
200
400
800
Feet
Data Source: Dudek 2011; USACE 2007; Tetra Tech 2012
Aerial Source: i-cubed 2010

Figure A-3


Legend
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ETM Protection (1979)
Preliminary Erosion Risk
High Concern
Moderate Concern
0 200 400 800 Feet
Data Source: Dudek 2011; USACE 2007; Tetra Tech 2012
Aerial Source: i-cubed 2010
Aliso Creek Golf Course
Coastal Treatment Plant
Aliso Creek
AWMA Road
S-bend
RM 1
RM 1.5
RM 2
29
30
31
32
33
34
2.193
2.167
2.149
2.131
2.113
2.097
2.076
2.056
2.035
2.013
1.989
1.971
1.955
1.93
1.904
1.887
1.865
1.843
1.817
1.789
1.767
1.746
1.723
1.703
1.684
1.661
1.644
1.625
1.608
1.586
1.569
1.543
1.520
1.499
1.464
1.449
1.429
1.410
1.391
1.370
1.353
1.333
1.315
1.295
1.274

Figure A-4

34
Oversteep / Undercut Riprap

(looking u/s) Emergency rock placement? Near-vertical rock on bank. Stable toe. Geotechnically stable bank?

33
Oversteep Bank, Narrow Setback

(looking d/s) Potential for continued fluvial erosion. Bank not geotechnically stable. Top of unstable bank within 15 feet of AMWA Road.

32
Probable Future Incision

(looking d/s toward bend) Active erosion in chute (red shovel). Bend persists since pre-1930. Clay in toe of bank reduces rate of erosion/migration.

31
Flow Impingement, Narrow Setback

Active flow impingement above elevation of riprap revetment along bank. Narrow setback. Also concentrated runoff down the bank.

30
Flow Impingement

(looking d/s) Flood flows in Aliso Creek erode bank material upstream of existing riprap revetment.

29
Stable Bank

Downstream view of left bank, 2.5H:1V bank slope. Woody shrubs established across bank, stable toe along high flow chute.

No Photo Available

28
Tributary Crossing

Displacement of existing riprap allows headcut to propagate up the tributary.

27
Concentrated Runoff

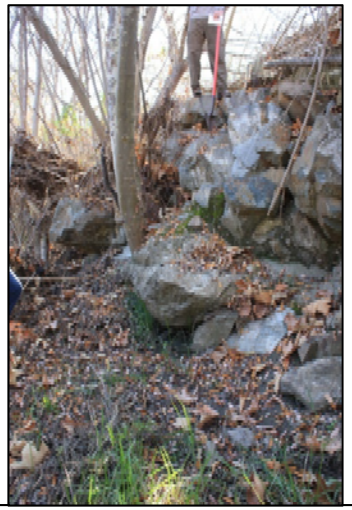
(looking d/s) Concentrated runoff from upland areas enters Aliso Creek by spilling across the bank, causing erosion.

26
Stable Bank

Landward view of inset floodplain with dense growth of tree-willows and sycamores. Approximately 100-foot buffer to toe of bank.

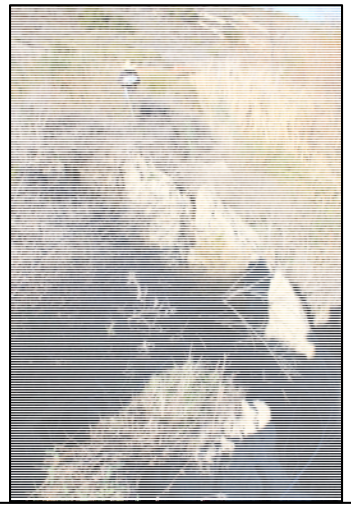
25
Tributary Crossing

Landward view up tributary channel incised 20 feet. Incision "checked" by culvert; road embankment and proposed alignment is geotechnically unstable.



24
Oversteep Riprap

(lookding d/s) Emergency rock placement? Near-vertical rock on bank. Geotechnically stable bank? Established trees and depositional berm minimize fluvial energy applied on the bank.



23
Slumping

(looking u/s) Slumping of full bank height into Aliso Creek.

22
Concentrated Runoff

(looking u/s) Wood Canyon overflow down AMWA Road enters Aliso Creek by spilling down the bank. A headcut is propagating up the flowpath toward the proposed alignment.

21
Leakage along Abandoned Pipe, Slumping, Impingement

(looking d/s) Leakage into abandoned irrigation line promotes slumping. Bank erosion exacerbated by flow impingement.

20
Stable Bank

Landward view of depositional berm and vegetation along toe of riprap revetment. Stable bank angle. Sycamore and tree-willows along toe.

No Photo Available

19
Slumping

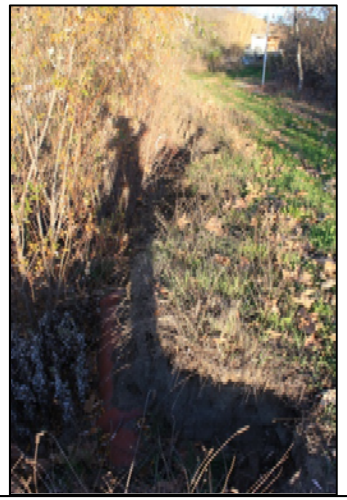
Local displacement of riprap revetment.

18
Slumping

(looking u/s) Slumping bank displaces riprap along upper bank; lower bank stabilized by depositional berm.

17
Wood Canyon

Riverward view of area scoured by flows overtopping AMWA Road crossing.



16
VCP Exposed, Slumping

(looking u/s) Slumping due to pipe leakage or geotechnical instability; exposed sewer line.

15
Flow Impingement, Slumping

(looking d/s) Direct impingement of flood flows; slumped material at toe.

14
Undercut Riprap

Threatening ACWHEP diversion structure.

13
Stable Bank

(looking u/s) Low bank height, connected floodplain. Well-vegetated floodplain.

12
Flow Impingement

(looking d/s) Outside bend upstream of ACWHEP backwater influence, unstable bank.

11
Stable Bank

(looking u/s) Stability promoted by 6-foot high, vegetated, depositional berm along toe of bank. Floodplain connected, stable bank angle.

10
Upper Bank Instability

(looking u/s) Close proximity to alignment. Lower bank stable and vegetated, scarp along upper bank.

9
Impingement, Weathered Riprap

(looking u/s) Riprap revetment to protect against impingement is breaking down.

8
Upper Bank Geotechnical Instability

(looking u/s) Close proximity to pipe alignment, further widening as upper bank stabilizes.

7
Impingement & Concentrated Runoff

(Riverward view) Fluvial energy cutting into toe of alluvial fan; concentrated upland runoff contributes to bank failure.
Steep high bank actively failing.

6
Upper Bank Geotechnical Instability

(looking d/s) 30-ft high bank, nearly vertical.
Close proximity to AMWA Road.

5
Slumping

(looking d/s) No woody vegetation at toe to hold failed material. No room to lay back slope.

4
Local Scour

(looking d/s) Turbulence from water spilling off grouted rock is locally scouring the bank.

3
Flow Impingement

Riverward view of bend in Sulphur Creek where flood flows directly impinge on bank slope.

2
Upper Bank Geotechnical Instability

(looking u/s) Lower bank stabilized by dense woody vegetation; upper bank will continue to erode to achieve a stable bank angle.

1
Undercut Grouted Riprap

Likely due to scour over bridge drop; grout prevents rock from conforming to scour hole.

APPENDIX B – CROSS SECTION SCHEMATICS

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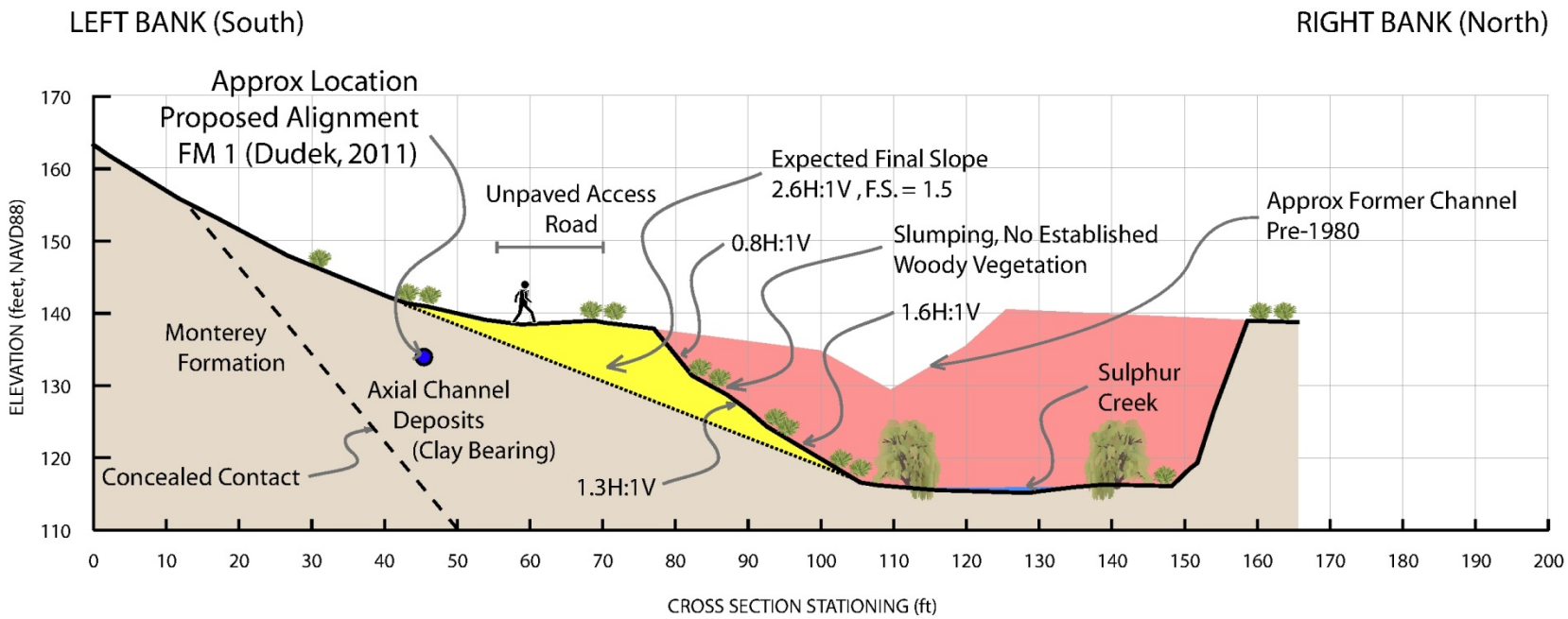

Figure B-1: Bank Slumping due to Geotechnically Unstable Slope

NOTES: Cross Section shown is of Sulphur Creek, 0.023 miles upstream of the Aliso Creek Confluence.

The left (south) bank is slumping due to geotechnical instabilities resulting from channel incision. Factors such as an overly steep bank slope, a slope height of around 20 feet, and a near absence of established woody vegetation along the slope (and particularly along the toe) contribute to the existing unstable bank. It is expected that further erosion of the bank will continue until the slope flattens to approximately 2.6H:1V. Using a factor of safety of 1.5, the stable bank slope is approximately 10 feet from the proposed pipeline alignment, and this distance is further reduced when the recommended setback equal to one-third the bank height is incorporated.

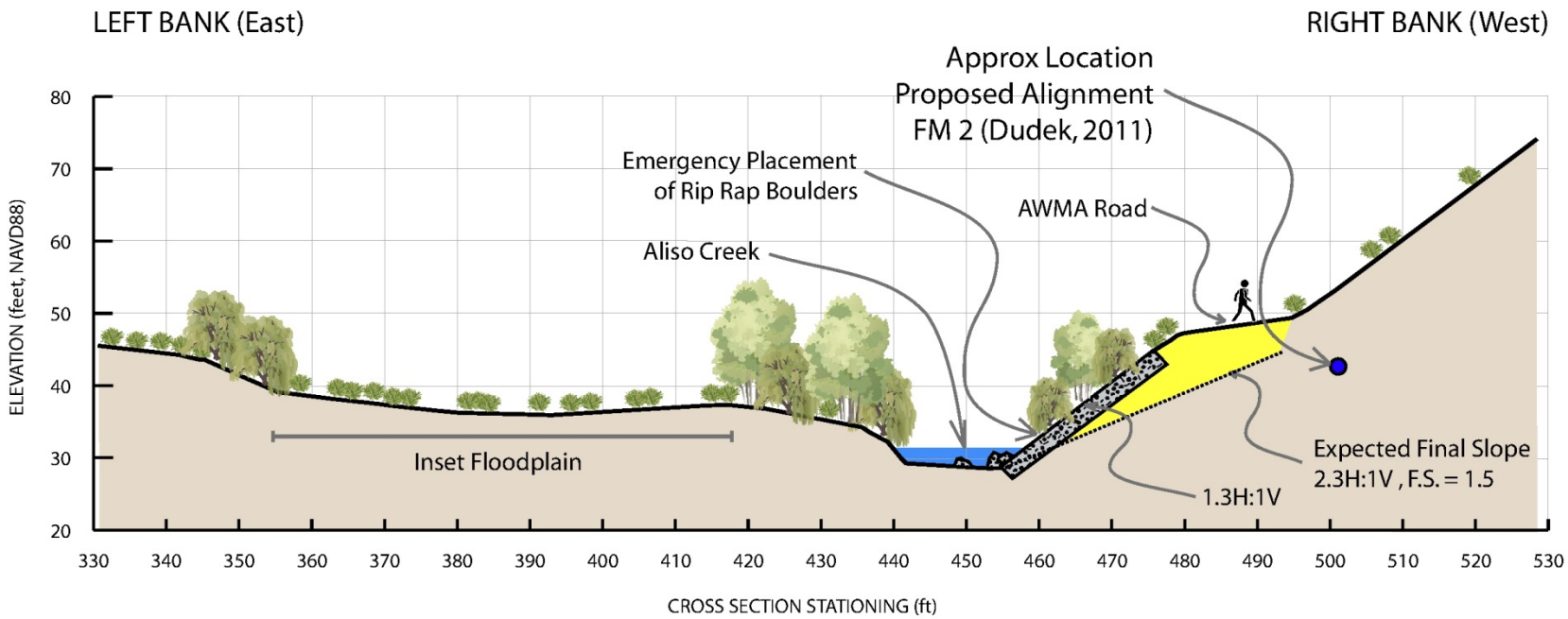

Figure B-2: Over-Steep Existing Riprap Revetment

NOTES: Cross Section shown is of Aliso Creek, 1.449 miles upstream of the Pacific Ocean.

Many of the existing bank protection measures appear to have been installed during emergency situations. For riprap revetments, this means the rock was probably dumped from top of bank, likely without any formal engineering design. As shown here, this can lead to measures that may not provide long-term protection to the bank or the proposed pipelines. Monitoring and maintenance of the protection is recommended as the future pipe alignment could be endangered if bank protection fails. In this example, if the protection was to fail, a stable bank slope would be within approximately 5 feet of the proposed alignment. This situation is representative of conditions at cross sections 1.496 to 1.410 (see **Table 3-3** in the main body of the report).

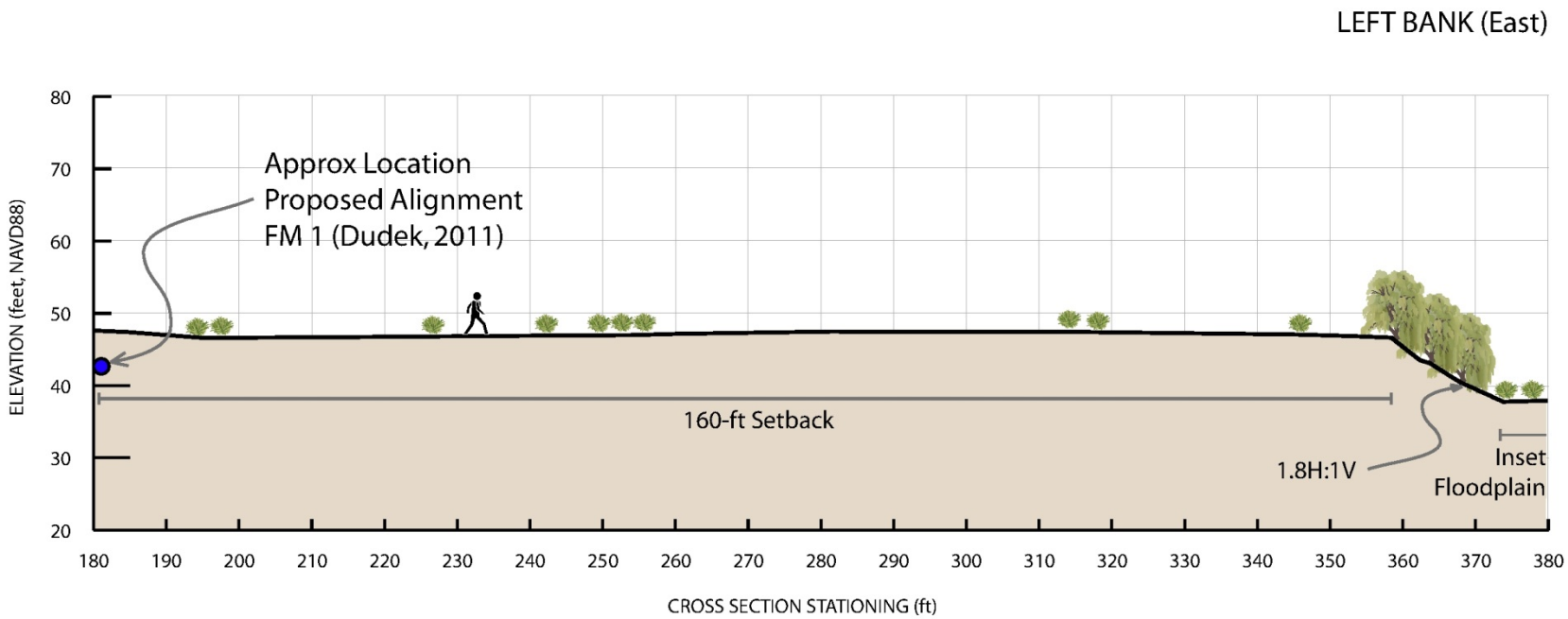

Figure B-3: Stable Bank Angle

NOTES: Cross Section shown is of Aliso Creek, 1.520 miles upstream of the Pacific Ocean.

The proposed FM 1 alignment is setback 160 feet from the relatively stable left bank, as indicated by its low slope height, established woody vegetation, flatter slope angle, and the inset floodplain. Considering historical locations of the channel, there is low potential for the channel to avulse/migrate to a location that would threaten the future integrity of the proposed pipeline. This situation is representative of conditions at cross sections 1.543 to 1.449 (see **Table 3-2** in the main body of the report).

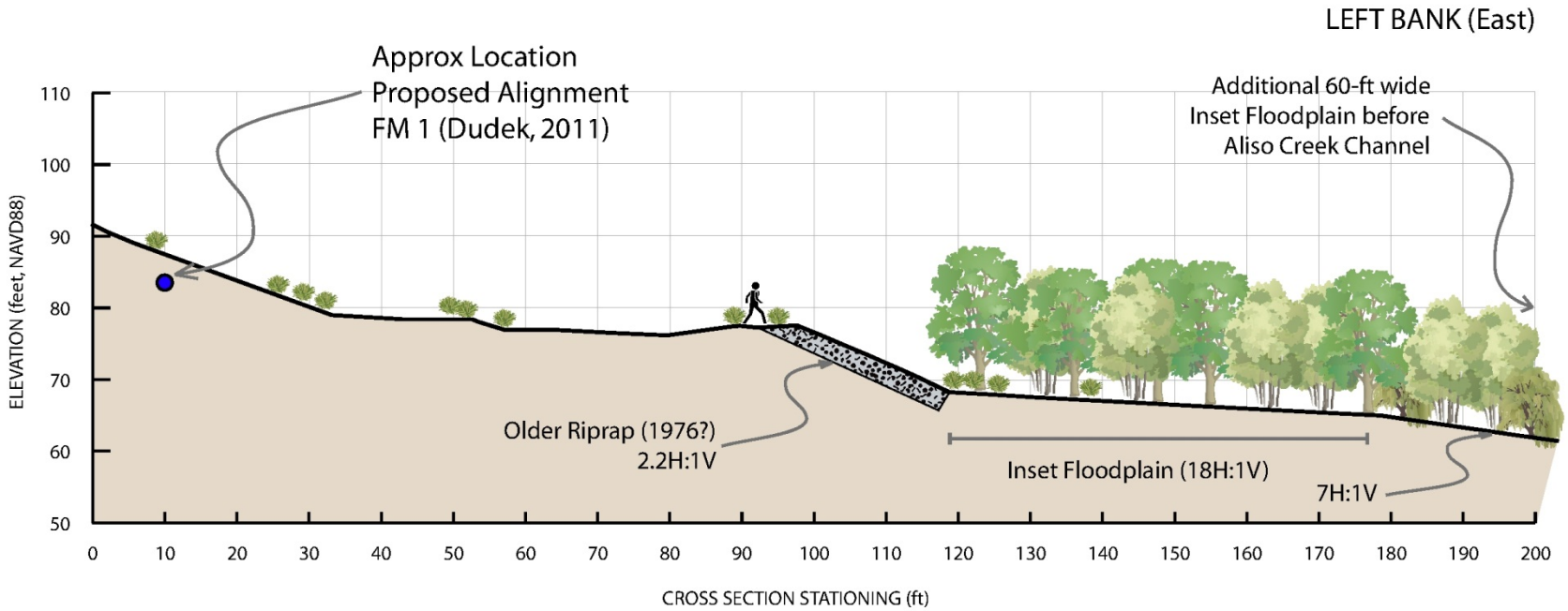

Figure B-4: Establishment of Inset Floodplain

NOTES: Cross Section shown is of Aliso Creek, 2.768 miles upstream of the Pacific Ocean.

Two inset floodplains are have developed between the channel and the toe of the riprap protection. These floodplains support established woody vegetation (e.g., tree willows and sycamore). The riprap was constructed at a stable slope. The proposed pipeline alignment is setback 90 feet from the top of the riprap protection. The potential for channel avulsions and bank erosion is low, so there is low long-term risk of pipeline damage from channel erosion. This situation is representative of conditions at cross sections 2.842 to 2.736 (see **Table 3-2** in the main body of the report).

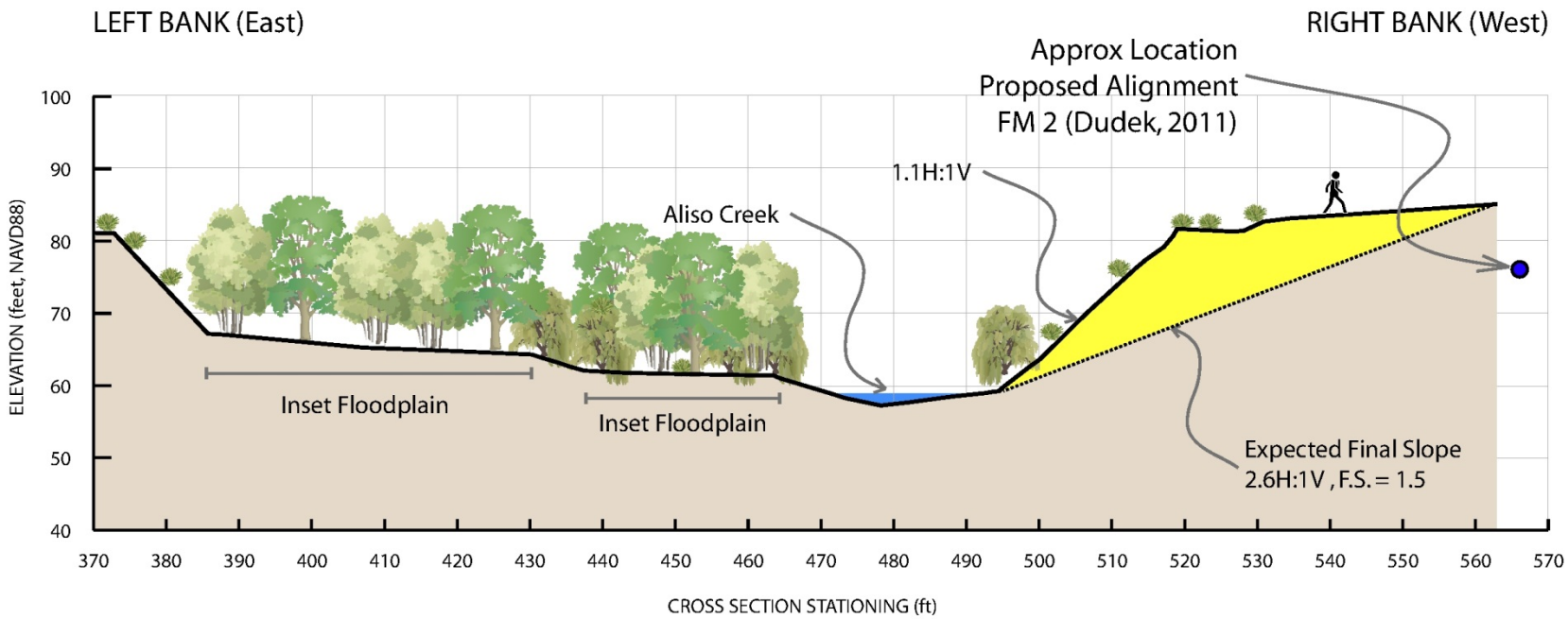

Figure B-5: Bank Instability due to Flow Impingement and Potential Bend Migration

NOTES: Cross Section shown is of Aliso Creek, 2.898 miles upstream of the Pacific Ocean.

The right bank is located along the outside of a bend. Flood flows impinge on the bank, and erode material from the toe. Failed material from the overly steep upper bank is not retained at the toe, so a berm that could reduce effective bank height cannot get established. The bank slope will continue to fail until a stable angle is reached. The new top of bank is projected to be within 10 feet of the proposed FM 2 alignment. If fluvial erosion causes the bend to migrate landward, the calculated stable top of bank location will translate an equal distance to any migration of the toe. The combined influences of geotechnical instabilities and bend migration present *High* erosion risk to the long-term integrity of the proposed FM 2 alignment.

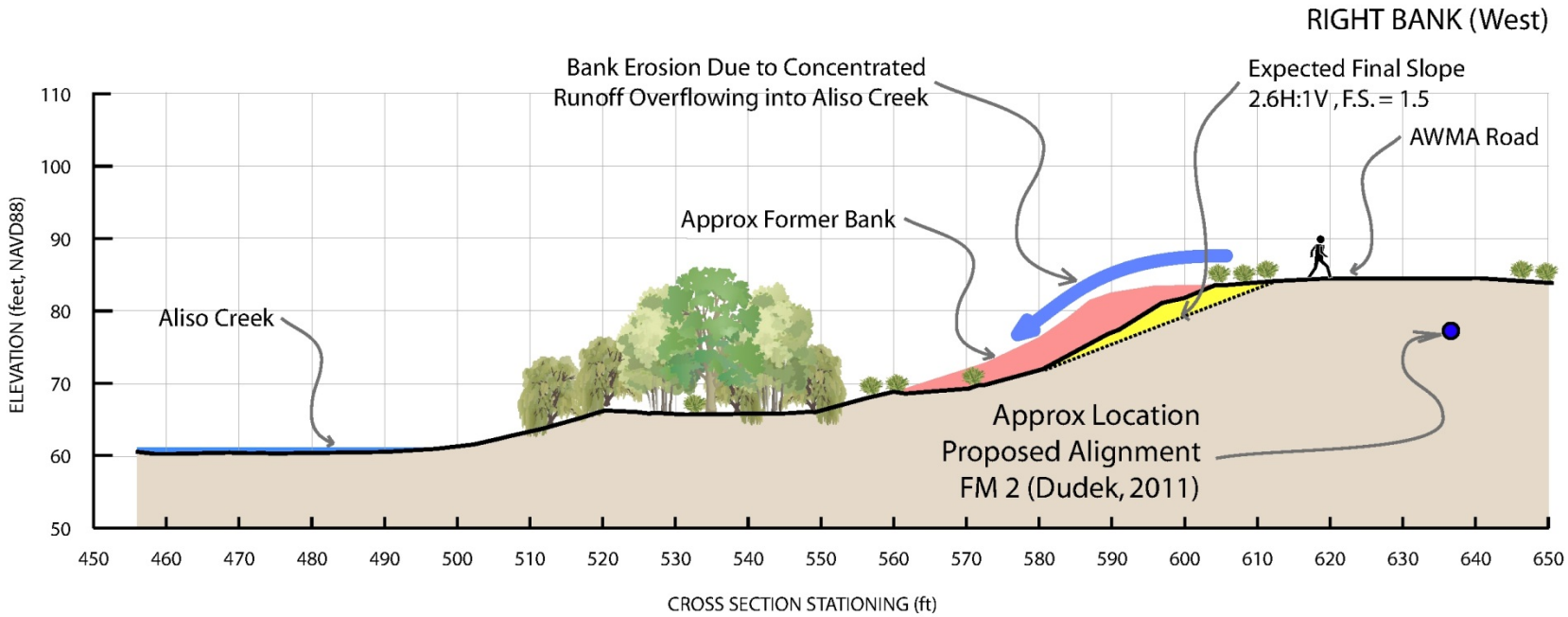

Figure B-6: Bank Erosion due to Concentrated Runoff along AMWA Road

NOTES: Cross Section shown is of Aliso Creek, 2.941 miles upstream of the Pacific Ocean.

Concentrated runoff flowing down AWMA Road spills over the bank into Aliso Creek. The runoff is concentrated on the road by a berm along one of the abandoned ACWHEP irrigation lines. The right bank is expected to continue eroding due to concentrated runoff flowing over the top of bank. Bank retreat may migrate into the FM 2 alignment without bank protection or diversion of the runoff. The geotechnically stable top of bank is projected to be within 25 feet of the proposed FM 2 alignment, but this distance does not account for additional erosion caused by the runoff.

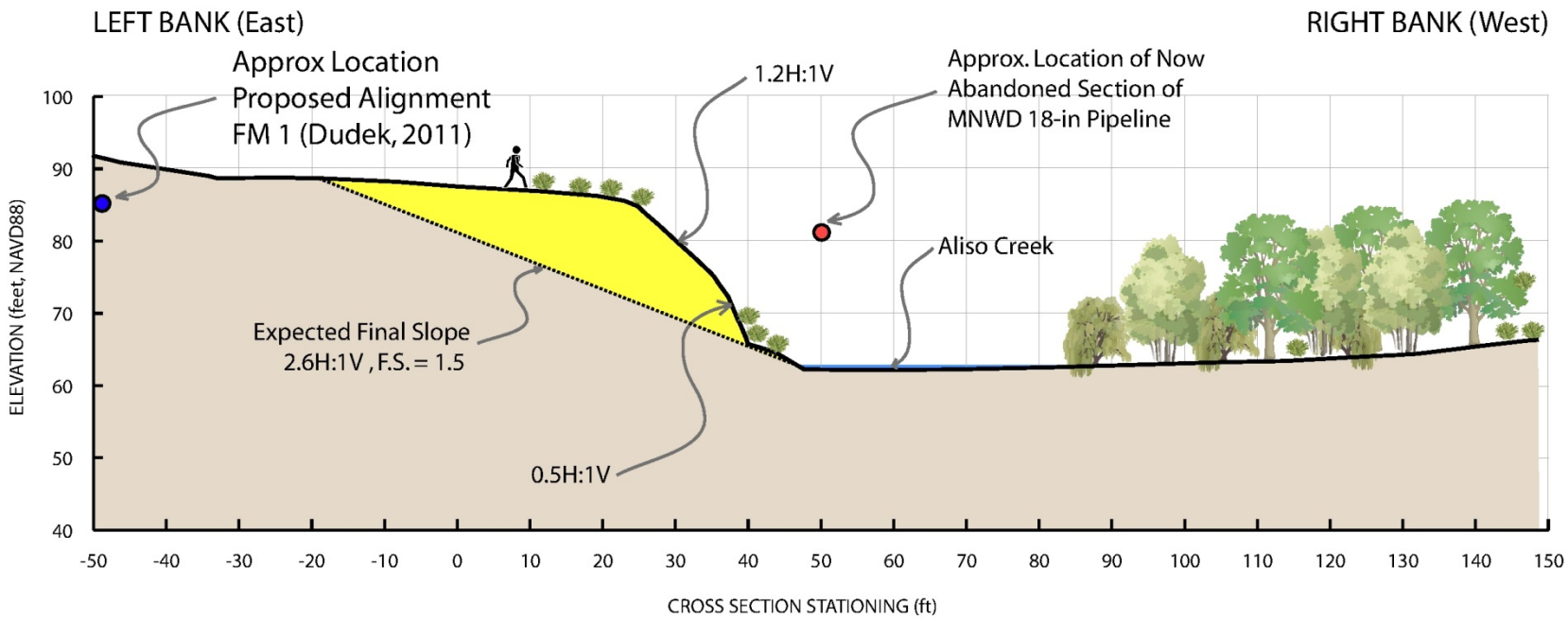

Figure B-7: Existing Exposure of East (Left) Bank Infrastructure

NOTES: Cross Section shown is of Aliso Creek, 3.014 miles upstream of the Pacific Ocean.

The abandoned ACWHEP irrigation pipelines in the left bank appear to have provided seepage pathways into the bank. Slump failures apparently initiated by seepage from the pipeline were observed. The left bank is expected to lay back to a stable slope of 2.6H:1V. Due to fluvial erosion potential it is expected that there will be continued erosion along outside of bend in the channel, progressing towards the proposed FM 1 alignment. Active erosion has already eroded a section of the 18-inch diameter vitrified clay pipe sewer line; a new line has been installed and the eroded section has been abandoned in place. This situation is representative of conditions at cross sections 3.033 to 3.000 (see **Table 3-2** in the main body of the report).

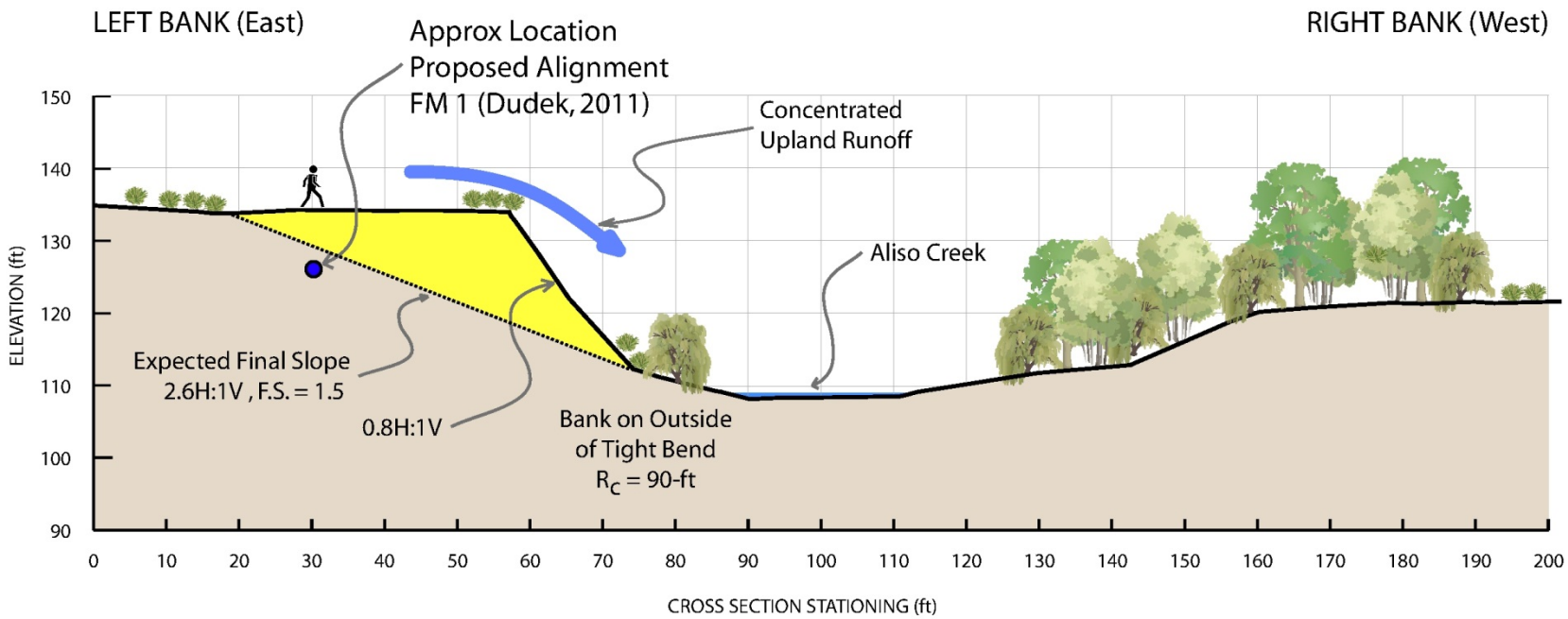

Figure B-8: Bank Erosion Exacerbated by Concentrated Upland Runoff

NOTES: Cross Section shown is of Aliso Creek, 4.522 miles upstream of the Pacific Ocean.

Instability of the left bank is caused by unstable geotechnical conditions, fluvial erosion around the outside of a bend, and concentrated upland runoff spilling down the bank. The left bank is being cut into alluvial fan deposits, and the concentrated runoff flowing across the fan spills into Aliso Creek over the top of bank. The left bank is expected to fail geotechnically to a stable slope of 2.6H:1V. The proposed FM 1 alignment is at the calculated stable bank slope plus the recommended setback. The risk of geotechnical erosion is *Moderate*, but when coupled with the upland runoff and the potential for bend migration into the fan deposits, the erosion risk over the 50-year design life of the proposed FM 1 alignment is *High*.