Michael S. Thomas, P.E.
235 Montgomery Street, Suite 706
San Francisco, California 94104
Phone: (415) 298-7403

May 17, 2016

TSD Engineering, Inc.
31 Natoma Street, Ste. 160
Folsom, California 95630
Attention: Mr. Casey Feickert

Re: Meritage Homes – Granite Bay Sites Whitehawk I and Whitehawk II Hydrology and Hydraulics Study and Preliminary Design Recommendations

Dear Casey:

This letter report presents the findings of our review of hydrologic and hydraulic conditions at the Meritage Homes project sites, Whitehawk I and Whitehawk II and preliminary design recommendations for proposed roadway crossings at these sites. This report has been revised to incorporate new information in response to Placer County Flood Control and Water Conservation District Comments by letter dated March 1, 2016.

**Hydrology**

The project sites are currently undeveloped parcels located on the south side of Douglas Boulevard between Sierra College Road and Barton Road, as shown on Figure No. 1.

Site Whitehawk I comprises approximately 17-acres of land characterized as Oak Woodland. A small portion of Whitehawk I at the northwest corner of the site flows to the north and west, away from the site and through a separate drainage way that merges with Strap Ravine downstream of Sierra College Boulevard. The balance of the site drains directly to Strap Ravine which traverses the site from east to west, for a distance of approximately 1100 feet. Strap Ravine generally slopes 0.5-percent across the site. The site's existing topography is characterized by rolling slopes ranging between flat to 20-percent. Soils at the site are composed of NRCS hydrologic group B and D. Type B soils are limited in their extent to the streambed of Strap Ravine and the balance of the site is dominated by hydrologic group D soils, which have relatively low infiltration potential and generate relatively high rates of runoff.

Site Whitehawk II comprises approximately 33-acres of land characterized as Oak Woodland. The site is also traversed from east to west by Strap Ravine, for a distance of approximately 1230-feet. Strap Ravine has a general slope of 1.5-percent as it crosses the site. An unnamed tributary also traverses the site diagonally from southeast to northwest for a distance of approximately 495-feet. The unnamed tributary has a poorly defined channel, due to past mining activities. The tributary flows into and through an existing pond before merging with Strap Ravine. The slope of the tributary ranges from flat to 20-percent. Existing topography at Whitehawk II is knobby and characterized by intermittent low and high areas. Slopes are highly variable across the existing terrain. Soils at the site are composed of NRCS hydrologic group B and D. Type B soils are limited in their extent to the streambed of Strap Ravine and the balance of the site is dominated by hydrologic group D soils, which have relatively low infiltration potential and generate relatively high rates of runoff.

Existing site conditions for Site Whitehawk I are shown on Figure No. 2 and for Site Whitehawk II on Figure No. 3.

Sites Whitehawk I and Whitehawk II sites are proposed to be subdivided and developed as single-family residential parcels. Proposed site conditions for Site Whitehawk I is shown on Figure No. 4 and Site Whitehawk II on Figure No. 5. The hydrology of Site Whitehawk II was previously studied by Civil

Solutions, Inc. in 2008 (CSI 2008). The hydrology presented in CSI 2008 was based on the JMM 1992 HEC-2 model of the Dry Creek Watershed. The report identified that the off-site flow contribution coming through the unnamed tributary was 187 cubic feet per second (cfs). Subsequently, in 2011, a restudy of hydrology of the Dry Creek Watershed was published by Civil Solutions, Inc. and RBF Consulting (CSI/RBF 2011). Data from both of these prior studies was used to examine the proposed projects at sites Whitehawk I and Whitehawk II.

In the case of the former report, the 187 cfs flow rates for the unnamed tributary was used as the preliminary design basis for recommendations for the reconstruction of the tributary. This flow rate from the 1992 JMM study, represents flow that would occur with the full-build out of the General Plan. The flow rate for the unnamed tributary based on the CSI/RBF 2011 study is 101 cfs. Preliminary design of recommendations for the tributary are described in the Hydraulics section below.

In the case of the latter study, the HEC-HMS model (file name:2007_100YR24H_LC5A_At0) for the 100-year, 24-hour storm, was used to assess the hydrologic impact on Strap Ravine flow rates, associated with the proposed development of Sites Whitehawk I and Whitehawk II. Other storm frequencies including the 2-year, 10-year and 25-year were also analyzed and the results are presented in Table No. 1. These models represent the current land development conditions not the full build-out of the General Plan. Figure No. 6 shows the sub-watershed boundaries in the vicinity of the project sites.

The project sites are predominately located in the watershed sub-basins SR5B, SR5C, with a small portion of Site Whitehawk I at its northwest corner, located within SR5F.To assess the impact of the proposed project on the flows in Strap Ravine, the model input for sub-watersheds SR5C and SR5B were revised to increase the percent imperviousness of the sub-watersheds to account for the imperviousness of the proposed improvements. For this analysis, the small portion of Site Whitehawk I that is SR5F was lumped into the imperviousness adjustment made for SR5C. A range of imperviousness, from 35-percent to 65-percent, was examined. The results of this impact analysis are provided in Table No. 1 which illustrates a very minor increase of approximately 0.25-percent. These results indicate that the peak flow rates of the proposed sites are within the range of values that underlie the 2011 Update. More detailed site specific hydrologic analysis will be needed to support the final design of site storm drains and would be required if analysis of the flow attenuation provided by the on-site pond is desired.

**Hydraulics**

The HEC-RAS computer model was used to analyze the water surface profiles along Strap Ravine as it crosses sites Whitehawk I and Whitehawk II, and, in combination with existing site topography, the limits of inundation associated with the 100-year storm. To perform the analysis, MST used the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) model, as the starting point for the analysis. The FIS model was prepared in 1994-1995 and used the U.S. Army Corps of Engineers (USACE) Hydraulic Engineering Center (HEC) water surface profiles computer model (HEC-2) to determine the water surface profiles for the 10-year, 50-year and 100-year flood events. The 100-year flood event was used for the purposes of this study; it represents the flood that has a 1-percent chance of occurrence in any given year (1-percent annual chance of occurrence).

The FIS flow rate of 850 cfs, for the 100-year flood event, was used to assess floodplain limits and proposed project impacts. A comparison of this flow rate with those estimated by subsequent studies is presented in Table No. 2.

The HEC-2 computer model was superseded by the USACE HEC-RAS model. Therefore, the FIS model was converted to HEC-RAS. Only a portion of the HEC-2 model was needed for the analysis so the model data set was truncated to focus on that reach of Strap Ravine that is relevant to this study. The shortened model comprises that portion of Strap Ravine commencing at Sierra College Boulevard and extending upstream through Whitehawk I and Whitehawk II to a point upstream of the Whitehawk II. A comparison of the results of the HEC-2 and HEC-RAS models is presented in Table No.3 and illustrates that the HEC-RAS model reasonably duplicates the previous HEC-2 model results.

Since completion of the FIS study, a new culvert crossing was installed at Greyhawk Drive, downstream of site Whitehawk I. The HEC-RAS version of the FIS model was modified to incorporate the new culvert

crossing to develop the "Corrected FIS" model. Data for the new crossing was extracted from construction drawings provided by Placer County Engineering and Surveying Division for the Gladstone Park Development Project dated May, 2000. The results demonstrate that the new culvert crossing reduces 100-year water surface elevations in Strap Ravine but the reduction tapers to zero on the downstream side of site Whitehawk I.

Current site topography for sites Whitehawk I and Whitehawk II, dated January 7, 2015, was provided to MST by TSD Engineering, Inc. Current site topography was used to update FIS cross-section data, where FIS sections fell within the limits of the current topography. The Corrected FIS model was updated to incorporate the new topographic data and constitutes the "Existing Condition" model for the project.

Sites Whitehawk I and Whitehawk II each include a road crossing over Strap Ravine. The HEC-RAS model was used to evaluate the road crossings by superimposing preliminary site grading plans onto the Existing Conditions model. Crossings were modeled as bridges to enable retention of the existing channel form in the calculations. The modeled configuration for both sites represents a clear span of 50-feet (modeled as ConSpan precast arches). Final form of the crossing may vary from that represented in the preliminary analysis, but would need to provide equivalent or greater conveyance capacity. Table No. 3 presents the results for each of the models described above. Table No. 4 presents the results of the FIS floodplain encroachment analysis for the various models described above. Commentary is provided in the tables to assist the reader with understanding the differences in the results produced by the models and the specific model revisions that drive those results.

Table Nos. 5 and 6 are profile tables tabulated by the HEC-RAS computer model. These tables provide data for each cross section in the models and the calculated results are for the full-buildout flow of 850 cfs in Strap Ravine.

Figures No. 2 and 3 show the extent of the existing floodplain limits for Sites Whitehawk I and Whitehawk II, respectively; the existing FIS floodway/floodplain limits based on the Flood Insurance Rate Map (FIRM) panel and the FEMA 100-year water surface elevations imposed on the current site topography are shown. Also shown are the 100-year water surface elevations based on the existing conditions HEC-RAS model. The extent of the floodplain limits for the proposed project are depicted on Figures No. 4 and 5, for Whitehawk I and Whitehawk II, respectively.

Figure No. 7 shows a comparison of the ground profiles and 100-year water surface elevations for the various models. There is a notable difference between the Corrected FIS model and the Existing Condition model on the upstream side of Whitehawk II. This difference was examined by comparing the FIS topographic work map, the map used to prepare the FIS model, with the current topography, and by comparing the FIS model input at Section 18075 to the FIS topographic work map. The differences between the data sources are illustrated on Figure No. 8. Using current topographic data the water surface profile is reduced by approximately 3-feet at Section 18075.

The HEC-RAS computer model was also used to evaluate the hydraulics of the unnamed tributary crossing Whitehawk II. The analysis was performed to determine preliminary design dimensions for reconstruction of the unnamed tributary; a preliminary definition of the channel depth and width, and width of adjacent floodplains.

The preliminary channel design was based on the 187 cfs, 100-year flow rate for the tributary presented in CSI 2008. The preliminary design uses a stream slope of 0.6% with intermittent channel drop steps. Roughness coefficients are 0.04 for the main channel and 0.05 for the floodplain, consistent with the values presented in the Placer County Stormwater Management Manual. The existing condition area of inundation associated with the unnamed tributary, is shown on Figure No. 9. The proposed reconstructed channel alignment is also shown on Figure No. 9 along with the preliminary design profile and typical cross-section for the reconstructed channel.

**Design Recommendations**

The following preliminary design recommendations are provided with this report and conform to the requirements of the Placer County Stormwater Manual:

1. The preliminary design of roadway crossings over Strap Ravine provide a clear span over the main channel but may include adjacent conveyance elements within the floodplain to create a multiple span opening. The spans should be designed to provide a cumulative flow area of 280 square feet at Whitehawk I and 200 SF at Whitehawk II, inclusive of a 33% safety factor, in accordance with the Placer County Stormwater Manual.

2. Roadway profiles should be designed to provide a minimum freeboard of 2-feet between the low chord of the crossing and the computed 100-year water surface. The road surface should be a minimum of 4-feet above the computed water surface elevation, but increased for utility crossings, to maintain minimum depth of cover and bedding materials for the utilities.

3. The Placer County Stormwater Management Manual indicates that the 100-year water surface elevation should be 1-foot below building pads. On Site Whitehawk I, the building pad elevations for Lots 11, 12 and 13 do not provide the minimum amount of freeboard and should be raised to provide a minimum pad elevation of 1-foot above the regulatory 100-year flood elevation. We recommend that the minimum pad elevation be set at 2-feet above the regulatory 100-year flood elevation if the lot is next to a bridge (see Lots 10 and 11 on Whitehawk I).

4. If ConSpan or similar precast arches are used to span the main channel of Strap Ravine, the footings of the spans should be placed below the scour depth but not less than 5-feet below the existing channel bottom.

5. For reconstruction of the channel of the unnamed tributary, the preliminary design of the channel should incorporate a channel slope of approximately 0.6 percent or less, but not less than 0.2%. Drop steps should be incorporated into the preliminary design along the length of the channel to accommodate elevation changes across the site.

6. Preliminary design of drop structures should incorporate plunge pools and energy dissipation. Cumulative drop over the length of a drop structure should be limited to approximately 1-foot.

7. Drop structures should be constructed of rock of sufficient size to prevent displacement during high flow events.

8. The preliminary design of rock drop structures should incorporate a choker course of aggregates beneath the structure rocks. The choker course should be of sufficient thickness and grain size distribution to prevent the lateral migration of underlying soils through the drop structure rock. Voids between drop structure rocks should be completely filled using hand placement of chinking and choker coarse materials and careful placement of the individual rocks comprising the drop structure.

9. The preliminary design of drop structures shall incorporate measures to prevent flanking of the structure during high flow, including armoring of the floodplains to the height of calculated 100-year water surface elevation. Floodplain armoring may be covered by top soil and vegetated.

If you have any questions or require any further information, please call me at the above number or e-mail me at michael.thomas.pe.@gmail.com.

Sincerely,

Michael S. Thomas, P.E.
Consulting Civil Engineer
Reg. No. C46957

Attachments:

Attachment A – Tables

Attachment B – Figures

Attachment C – HEC-RAS Model Files (CD)

# Attachment A – Tables

Table No. 1 – Results of HEC-HMS Model for Proposed Project

Table No. 2 – Comparison of Predicted Flow Rates from Various Sources

Table No. 3 – 100-yr HEC-RAS Water Surface Elevation Results

Table No. 4 – Floodplain Encroachment Analysis Results

Table No. 5 – HEC-RAS 100-Year Profile Table for Existing Conditions

Table No. 6 – HEC-RAS 100-year Profile Table for Proposed Conditions

# Attachment C – HEC-RAS Model Files

CD with HEC-HMS Model Files

Table 1 - Results of HEC-HMS Model for Proposed Project
5/17/2016

*Point of Comparison: Downstream of Whitehawk I*
*HEC-HMS Node: YSR5B*

| Model Description | Peak Flow Rate(cfs) | | | | Notes |
|---|---|---|---|---|---|
| | 2-yr | 10-yr | 25-yr | 100-yr | |
| 2011 Update to the Dry Creek Watershed Flood Control Plan (Existing Conditions) | 59.3 | 355.9 | 545.8 | 838.5 | SR5B: 15% Impervious<br>SR5C: 30.3% Impervious |
| with Whitehawk I and Whitehawk II Site at 35% impervious | 60.2 | 357.3 | 547.2 | 840.1 | SR5B: 19.4% Impervious<br>SR5C: 36% Impervious |
| with Whitehawk I and Whitehawk II Site at 65% impervious | 60.8 | 358.3 | 548 | 840.8 | SR5B: 22% Impervious<br>SR5C: 40% Impervious |

*Point of Comparison: Sierra College Blvd*
*HEC-HMS Node: USR5C2*

| Model Description | Peak Flow Rate(cfs) | | | | Notes |
|---|---|---|---|---|---|
| | 2-yr | 10-yr | 25-yr | 100-yr | |
| 2011 Update to the Dry Creek Watershed Flood Control Plan (Existing Conditions) | 58.1 | 282.9 | 445.4 | 717.2 | SR5B: 15% Impervious<br>SR5C: 30.3% Impervious |
| with Whitehawk I and Whitehawk II Sites at 35% impervious | 59.0 | 284.7 | 447.1 | 719 | SR5B: 19.4% Impervious<br>SR5C: 36% Impervious |
| with Whitehawk I and Whitehawk II Sites at 65% impervious | 59.6 | 285.9 | 448.2 | 720 | SR5B: 22% Impervious<br>SR5C: 40% Impervious |

Table 2 - Comparison of Predicted Flow Rates from Various Sources

| Data Source | Event | Flow (cfs) |
|---|---|---|
| FEMA HEC-2 Model Input | 100-yr | 850 |
| | | |
| Dry Creek Watershed Flood Control Plan, 2011 Update | 100-yr 1989 JMM | 854 |
| | 100-yr 1992 Corrected | 512 |
| | 100-yr 2007-current | 684 |
| | 100-yr Future JMM | 1112 |
| | 100-yr Future Unmitigated | 751 |
| | 100-yr Build-out w/ LID and projects | 808 |

Note: This flow was used in hydraulic analysis.

*Data Source Descriptions*

*1. FIS flow rate from FEMA HEC-2 Model input "QT" record*

*2. Dry Creek 2011 Update, Table G.3 100-YEAR, Sierra College Blvd, HEC-RAS Section ID 11366.1*

## Table 3 - 100-yr HEC-RAS Water Surface Elevation Results

4/15/2016

| Location | | | 100-year Water Surface Elevation (ft) | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|
| FIS Cross Section | FIS River Station | FEMA Model River Station | FIS Regulatory Floodplain [1] | HEC-2 Model Output [2] | HEC-2 Model imported to HEC-RAS Output [3] | HEC-RAS Model updated new Greyhawk Drive culvert [4] | HEC-RAS Model updated with existing site conditions [5,6] | HEC-RAS Model updated with proposed bridges [6,7] | |
| | | 11070 | | 215.3 | 215.3 | 213.7 | 216.3 | 216.3 | |
| | | 11270 | | 215.4 | 215.4 | 215.4 | 215.7 | 215.7 | |
| Culvert at Sierra College Blvd | | | | | | | | | |
| | *11660* | 11345 | | 220.0 | 220.0 | 220.0 | 220.0 | 220.0 | |
| M | 11755 | 11395 | 220.1 | 220.1 | 220.1 | 220.1 | 220.1 | 220.1 | |
| N | 12305 | 11945 | 220.5 | 220.5 | 220.6 | 220.6 | 220.6 | 220.6 | |
| | | 12285 | | 223.7 | 223.8 | 223.8 | 223.8 | 223.8 | |
| | | 12475 | | 224.8 | 224.8 | 224.8 | 224.8 | 224.8 | |
| O | 13115 | 12755 | 227.0 | 227.0 | 227.0 | 225.0 | 226.6 | 226.6 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| | | 12790 | | 233.6 | 234.0 | 226.2 | 227.5 | 227.5 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| Culvert at Grey Hawk Drive | | | | | | | | | |
| | *13235* | 12890 | | 234.6 | 234.0 | 227.2 | 230.4 | 230.4 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| | | 12950 | | 236.6 | 237.1 | 233.3 | 233.3 | 233.3 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| | | 13055 | | 236.6 | 237.2 | 234.4 | 234.4 | 234.4 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| | | 13280 | | 236.6 | 237.2 | 234.4 | 234.4 | 234.4 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| P | 13820 | 13460 | 236.6 | 236.6 | 237.2 | 234.3 | 234.3 | 234.3 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| | | 13930 | | 236.7 | 237.2 | 236.1 | 236.1 | 236.1 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| | 14920 | 14560 | *244.0* | 244.0 | 244.0 | 244.0 | 244.0 | 244.0 | D/S OF Whitehawk I site by 105 ft |
| Q | 15450 | 15090 | 249.0 | 249.0 | 249.0 | 249.0 | 249.2 | 249.2 | Change in WSEL due to updated existing site conditions |
| Bridge Crossing at GB-17 Site | | | | | | | | | |

| Location | | | 100-year Water Surface Elevation (ft) | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|
| FIS Cross Section | FIS River Station | FEMA Model River Station | FIS Regulatory Floodplain [1] | HEC-2 Model Output [2] | HEC-2 Model imported to HEC-RAS Output [3] | HEC-RAS Model updated new Greyhawk Drive culvert [4] | HEC-RAS Model updated with existing site conditions [5,6] | HEC-RAS Model updated with proposed bridges [6,7] | |
| R | 16220 | 15860 | 254.3 | 254.3 | 254.3 | 254.3 | 252.8 | 252.7 | U/S of Whitehawk I site by 95 ft, change in WSEL due to updated existing site conditions |
| | *16780* | 16420 | *256.8* | 256.7 | 256.7 | 256.7 | 256.0 | 256.1 | D/S of Whitehawk II site by 63 ft, change in WSEL due to updated existing site conditions |
| | *17225* | 16865 | *261.2* | 261.3 | 261.3 | 261.3 | 260.9 | 260.9 | Change in WSEL due to updated existing site conditions |
| Bridge Crossing at GB-33 Site | | | | | | | | | |
| S | 17850 | 17490 | 265.8 | 265.8 | 265.8 | 265.8 | 267.3 | 267.4 | Change in WSEL due to updated existing site conditions |
| | *18435* | 18075 | *275.2* | 275.3 | 275.3 | 275.3 | 273.3 | 273.3 | U/S of Whitehawk II site by 0 ft, change in WSEL due to updated existing site conditions |
| T | 18920 | 18560 | 279.4 | 279.4 | 279.5 | 279.5 | 278.2 | 278.2 | Reduction in WSEL due to updated existing site conditions at D/S STA 18075 |
| U | 19400 | 19040 | 282.2 | 282.2 | 282.3 | 282.3 | 282.8 | 282.8 | |
| | | 19570 | | 292.9 | 292.9 | 292.9 | 292.9 | 292.9 | |
| | | 19910 | | 295.9 | 295.9 | 295.9 | 295.9 | 295.9 | |

Notes:

1. WSELs from FEMA Flood Insurance Study Placer County, California, revised November, 2001, Table 7 Floodway Data for Strap Ravine. Note that River Stations and WSELs written in italics were interpolated from Flood Profiles for Strap Ravine, pages 153P and 154P.
2. WSELs from FEMA HEC-2 Model output received from FEMA (file: STRAP.OUT)
3. WSELs from FEMA HEC-2 Model imported to HEC-RAS (HEC-RAS output)
4. WSELs from HEC-RAS Model updated new Greyhawk Drive culvert based on as-built drawings for the Gladstone Park Development project, dated May, 2000. As-built drawings were provided by Placer County Engineering & Surveying Division (HEC-RAS output)
5. WSELs from HEC-RAS Model updated with existing site conditions based on site topography dated January 7, 2015 from TSD Engineering (HEC-RAS output)
6. Results updated to reflect additional cross sections requested by PCFCWCD, March 1st, comment letter.
7. WSELs from HEC-RAS Model updated with proposed bridge crossings based on preliminary site design for Meritage Homes developments Whitehawk I and Whitehawk II (HEC-RAS output)

WSEL = Water Surface Elevation

## Table 4 - Comparison of Floodplain Encroachment Analysis

4/15/2016

| Location | | | 100-year Water Surface Elevation (ft) | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|
| FIS Cross Section | FIS River Station | FEMA Model River Station | FIS Regulatory Floodplain [1] | HEC-2 Model Output [2] | HEC-2 Model imported to HEC-RAS Output [3] | HEC-RAS Model updated new Greyhawk Drive culvert [4] | HEC-RAS Model updated with existing site conditions [5,6] | HEC-RAS Model updated with proposed bridges [6,7] | |
| | | 11070 | | 215.4 | 215.4 | 215.4 | 216.3 | 216.3 | |
| | | 11270 | | 215.8 | 215.8 | 215.8 | 215.8 | 215.8 | |
| Culvert at Sierra College Blvd | | | | | | | | | |
| | *11660* | 11345 | | 220.0 | 220.0 | 220.0 | 219.8 | 219.8 | |
| M | 11755 | 11395 | 220.1 | 220.1 | 220.1 | 220.1 | 220.3 | 220.3 | |
| N | 12305 | 11945 | 220.5 | 220.5 | 220.6 | 220.6 | 221.1 | 221.1 | |
| | | 12285 | | 223.7 | 223.8 | 223.8 | 224.0 | 224.0 | |
| | | 12475 | | 224.8 | 224.8 | 224.8 | 224.9 | 224.9 | |
| O | 13115 | 12755 | 227.0 | 227.0 | 227.0 | 225.0 | 226.8 | 226.8 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| | | 12790 | | 233.6 | 234.0 | 226.2 | 227.5 | 227.5 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| Culvert at Grey Hawk Drive | | | | | | | | | |
| | *13235* | 12890 | | 234.6 | 234.0 | 227.2 | 230.4 | 230.4 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| | | 12950 | | 236.5 | 237.1 | 233.3 | 233.3 | 233.3 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| | | 13055 | | 236.6 | 237.2 | 234.3 | 234.7 | 234.7 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| | | 13280 | | 236.6 | 237.2 | 234.7 | 234.7 | 234.7 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| P | 13820 | 13460 | 236.6 | 236.6 | 237.2 | 234.8 | 234.6 | 234.6 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| | | 13930 | | 236.9 | 237.3 | 237.1 | 236.6 | 236.6 | Reduction in WSEL due to revised culvert regime at Grey Hawk Drive |
| | 14920 | 14560 | *244.0* | 244.0 | 244.0 | 244.0 | 244.0 | 244.0 | D/S OF Whitehawk I site by 105 ft |
| Q | 15450 | 15090 | 249.0 | 249.2 | 249.2 | 249.2 | 249.5 | 249.5 | Change in WSEL due to updated existing site conditions |
| Bridge Crossing at GB-17 Site | | | | | | | | | |

| Location | | | 100-year Water Surface Elevation (ft) | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|
| FIS Cross Section | FIS River Station | FEMA Model River Station | FIS Regulatory Floodplain [1] | HEC-2 Model Output [2] | HEC-2 Model imported to HEC-RAS Output [3] | HEC-RAS Model updated new Greyhawk Drive culvert [4] | HEC-RAS Model updated with existing site conditions [5,6] | HEC-RAS Model updated with proposed bridges [6,7] | |
| R | 16220 | 15860 | 254.3 | 254.5 | 254.5 | 254.5 | 252.9 | 252.9 | U/S of Whitehawk I site by 95 ft, change in WSEL due to updated existing site conditions |
| | *16780* | 16420 | *256.8* | 256.7 | 256.7 | 256.7 | 256.0 | 256.7 | D/S of Whitehawk II site by 63 ft, change in WSEL due to updated existing site conditions |
| | *17225* | 16865 | *261.2* | 261.3 | 261.3 | 261.3 | 260.9 | 260.9 | Change in WSEL due to updated existing site conditions |
| Bridge Crossing at GB-33 Site | | | | | | | | | |
| S | 17850 | 17490 | 265.8 | 265.9 | 266.0 | 266.0 | 267.4 | 267.4 | Change in WSEL due to updated existing site conditions |
| | *18435* | 18075 | *275.2* | 275.2 | 275.2 | 275.2 | 273.3 | 273.3 | U/S of Whitehawk II site by 0 ft, change in WSEL due to updated existing site conditions |
| T | 18920 | 18560 | 279.4 | 280.3 | 280.4 | 280.4 | 278.8 | 278.8 | Reduction in WSEL due to updated existing site conditions at D/S STA 18075 |
| U | 19400 | 19040 | 282.2 | 282.7 | 282.8 | 282.8 | 283.0 | 283.0 | |
| | | 19570 | | 293.0 | 293.1 | 293.1 | 293.1 | 293.1 | |
| | | 19910 | | 296.4 | 296.5 | 296.5 | 296.5 | 296.5 | |

Notes:

1. WSELs from FEMA Flood Insurance Study Placer County, California, revised November, 2001, Table 7 Floodway Data for Strap Ravine. Note that River Stations and WSELs written in italics were interpolated from Flood Profiles for Strap Ravine, pages 153P and 154P.
2. WSELs from FEMA HEC-2 Model output received from FEMA (file: STRAP.OUT)
3. WSELs from FEMA HEC-2 Model imported to HEC-RAS (HEC-RAS output)
4. WSELs from HEC-RAS Model updated new Greyhawk Drive culvert based on as-built drawings for the Gladstone Park Development project, dated May, 2000. As-built drawings were provided by Placer County Engineering & Surveying Division (HEC-RAS output)
5. WSELs from HEC-RAS Model updated with existing site conditions based on site topography dated January 7, 2015 from TSD Engineering (HEC-RAS output)
6. Results updated to reflect additional cross sections requested by PCFCWCD, March 1st, comment letter.
7. WSELs from HEC-RAS Model updated with proposed bridge crossings based on preliminary site design for Meritage Homes developments Whitehawk I and Whitehawk II (HEC-RAS output)

WSEL = Water Surface Elevation

# TABLE 5
# HEC-RAS PROFILE TABLE FOR 100-YEAR FULL BUILD-OUT FLOW AND EXISTING SITE CONDITIONS
# 4/16/2016

HEC-RAS Plan: AddedXS River: RIVER-1 Reach: Reach-1 Profile: PF 1

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Reach-1 | 19910 | PF 1 | 850.00 | 292.50 | 295.94 | | 295.97 | 0.002285 | 1.39 | 621.71 | 250.67 | 0.15 |
| Reach-1 | 19570 | PF 1 | 850.00 | 288.40 | 292.93 | 292.93 | 294.30 | 0.012794 | 11.05 | 108.14 | 41.36 | 0.94 |
| Reach-1 | 19040 | PF 1 | 850.00 | 278.60 | 282.81 | | 283.10 | 0.003962 | 4.42 | 206.40 | 95.34 | 0.48 |
| Reach-1 | 18560 | PF 1 | 850.00 | 274.70 | 278.23 | 278.23 | 278.97 | 0.026399 | 8.29 | 126.01 | 81.78 | 1.10 |
| Reach-1 | 18075 | PF 1 | 850.00 | 271.00 | 273.26 | | 273.45 | 0.003886 | 3.55 | 248.50 | 147.92 | 0.45 |
| Reach-1 | 17747 | PF 1 | 850.00 | 266.40 | 270.07 | 270.04 | 271.14 | 0.014978 | 8.38 | 107.15 | 54.24 | 0.93 |
| Reach-1 | 17646 | PF 1 | 850.00 | 265.50 | 268.53 | 268.53 | 269.47 | 0.017087 | 7.82 | 111.34 | 65.42 | 0.96 |
| Reach-1 | 17562 | PF 1 | 850.00 | 264.60 | 267.90 | | 268.15 | 0.003596 | 4.46 | 233.73 | 134.56 | 0.47 |
| Reach-1 | 17490 | PF 1 | 850.00 | 263.60 | 267.33 | | 267.79 | 0.006829 | 5.72 | 180.68 | 120.06 | 0.63 |
| Reach-1 | 17265 | PF 1 | 850.00 | 262.50 | 266.64 | | 266.87 | 0.002382 | 3.88 | 220.23 | 73.96 | 0.38 |
| Reach-1 | 17180 | PF 1 | 850.00 | 262.00 | 266.18 | | 266.58 | 0.004744 | 5.10 | 173.72 | 74.17 | 0.53 |
| Reach-1 | 17130 | PF 1 | 850.00 | 261.40 | 265.96 | | 266.35 | 0.004347 | 4.98 | 175.69 | 71.76 | 0.51 |
| Reach-1 | 17080 | PF 1 | 850.00 | 261.36 | 264.71 | 264.71 | 265.78 | 0.014052 | 8.58 | 111.69 | 57.20 | 0.91 |
| Reach-1 | 16865 | PF 1 | 850.00 | 257.70 | 260.92 | 260.92 | 261.78 | 0.020019 | 7.41 | 114.74 | 68.19 | 1.01 |
| Reach-1 | 16420 | PF 1 | 850.00 | 252.16 | 256.01 | | 256.27 | 0.003151 | 4.08 | 219.11 | 103.19 | 0.43 |
| Reach-1 | 15860 | PF 1 | 850.00 | 250.00 | 252.79 | | 253.30 | 0.010236 | 5.80 | 154.05 | 100.81 | 0.74 |
| Reach-1 | 15752 | PF 1 | 850.00 | 248.00 | 252.78 | | 252.90 | 0.001206 | 2.85 | 341.94 | 167.73 | 0.28 |
| Reach-1 | 15405 | PF 1 | 850.00 | 247.23 | 250.91 | 250.74 | 251.84 | 0.012676 | 7.97 | 123.47 | 83.17 | 0.86 |
| Reach-1 | 15310 | PF 1 | 850.00 | 246.80 | 250.98 | | 251.10 | 0.001636 | 3.00 | 343.08 | 172.55 | 0.31 |
| Reach-1 | 15225 | PF 1 | 850.00 | 246.20 | 250.90 | | 250.99 | 0.000844 | 2.59 | 393.63 | 186.28 | 0.24 |
| Reach-1 | 15130 | PF 1 | 850.00 | 245.71 | 249.63 | 249.63 | 250.54 | 0.015613 | 7.69 | 116.26 | 81.31 | 0.92 |
| Reach-1 | 15090 | PF 1 | 850.00 | 246.00 | 249.24 | | 249.41 | 0.004368 | 3.65 | 280.31 | 208.86 | 0.48 |
| Reach-1 | 14560 | PF 1 | 850.00 | 241.00 | 244.02 | 244.02 | 244.79 | 0.021044 | 7.04 | 120.76 | 80.44 | 1.01 |
| Reach-1 | 13930 | PF 1 | 850.00 | 230.80 | 236.12 | 235.24 | 236.43 | 0.005137 | 4.52 | 205.36 | 209.08 | 0.53 |
| Reach-1 | 13460 | PF 1 | 850.00 | 230.60 | 234.31 | | 234.52 | 0.004294 | 4.50 | 271.36 | 179.34 | 0.50 |
| Reach-1 | 13280 | PF 1 | 850.00 | 229.10 | 234.38 | | 234.40 | 0.000208 | 1.40 | 917.25 | 383.51 | 0.12 |
| Reach-1 | 13055 | PF 1 | 850.00 | 228.60 | 234.35 | | 234.37 | 0.000098 | 1.08 | 1016.71 | 255.41 | 0.08 |
| Reach-1 | 12950 | PF 1 | 850.00 | 228.50 | 233.29 | 233.29 | 234.23 | 0.013602 | 8.16 | 122.03 | 72.93 | 0.88 |
| Reach-1 | 12890 | PF 1 | 850.00 | 225.14 | 230.35 | 228.62 | 231.13 | 0.001010 | 7.10 | 119.80 | 30.09 | 0.55 |
| Reach-1 | 12857.5 | | Culvert | | | | | | | | | |
| Reach-1 | 12790 | PF 1 | 850.00 | 224.00 | 227.49 | 227.49 | 229.23 | 0.003834 | 10.59 | 80.29 | 27.95 | 1.00 |
| Reach-1 | 12755 | PF 1 | 850.00 | 223.90 | 226.62 | | 226.74 | 0.003693 | 2.79 | 336.16 | 226.32 | 0.35 |
| Reach-1 | 12475 | PF 1 | 850.00 | 221.50 | 224.79 | | 225.13 | 0.010557 | 4.84 | 206.03 | 172.53 | 0.60 |
| Reach-1 | 12285 | PF 1 | 850.00 | 219.40 | 223.76 | 222.48 | 224.02 | 0.003539 | 4.17 | 229.71 | 218.83 | 0.45 |
| Reach-1 | 11945 | PF 1 | 850.00 | 218.30 | 220.59 | 220.59 | 220.97 | 0.029046 | 6.83 | 179.52 | 213.42 | 1.12 |
| Reach-1 | 11395 | PF 1 | 850.00 | 212.40 | 220.13 | | 220.14 | 0.000085 | 1.10 | 1103.73 | 297.74 | 0.08 |
| Reach-1 | 11345 | PF 1 | 850.00 | 212.10 | 220.00 | 215.84 | 220.11 | 0.000031 | 3.29 | 1078.12 | 288.90 | 0.21 |
| Reach-1 | 11307.5 | | Culvert | | | | | | | | | |

TABLE 5
HEC-RAS PROFILE TABLE FOR 100-YEAR FULL BUILD-OUT FLOW AND EXISTING SITE CONDITIONS
4/16/2016

HEC-RAS Plan: AddedXS River: RIVER-1 Reach: Reach-1 Profile: PF 1 (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Reach-1 | 11270 | PF 1 | 850.00 | 211.65 | 215.69 | 215.39 | 217.29 | 0.000727 | 10.16 | 83.65 | 211.82 | 0.89 |
| Reach-1 | 11070 | PF 1 | 850.00 | 211.90 | 216.30 | 214.48 | 216.35 | 0.000948 | 1.96 | 481.87 | 224.86 | 0.21 |

# TABLE 6 -
# HEC-RAS PROFILE TABLE FOR 100-YEAR FULL BUILD-OUT FLOW AND PROPOSED SITE CONDITIONS
# 4/16/2016

HEC-RAS Plan: StrapPropBri River: RIVER-1 Reach: Reach-1 Profile: PF 1

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Reach-1 | 19910 | PF 1 | 850.00 | 292.50 | 295.94 | | 295.97 | 0.002285 | 1.39 | 621.71 | 250.67 | 0.15 |
| Reach-1 | 19570 | PF 1 | 850.00 | 288.40 | 292.93 | 292.93 | 294.30 | 0.012794 | 11.05 | 108.14 | 41.36 | 0.94 |
| Reach-1 | 19040 | PF 1 | 850.00 | 278.60 | 282.81 | | 283.10 | 0.003962 | 4.42 | 206.40 | 95.34 | 0.48 |
| Reach-1 | 18560 | PF 1 | 850.00 | 274.70 | 278.23 | 278.23 | 278.97 | 0.026399 | 8.29 | 126.01 | 81.78 | 1.10 |
| Reach-1 | 18075 | PF 1 | 850.00 | 271.00 | 273.26 | | 273.45 | 0.003886 | 3.55 | 248.51 | 147.92 | 0.45 |
| Reach-1 | 17747 | PF 1 | 850.00 | 266.40 | 270.07 | 270.04 | 271.14 | 0.014983 | 8.38 | 107.14 | 54.23 | 0.93 |
| Reach-1 | 17646 | PF 1 | 850.00 | 265.50 | 268.53 | 268.53 | 269.47 | 0.017076 | 7.82 | 111.35 | 65.43 | 0.96 |
| Reach-1 | 17562 | PF 1 | 850.00 | 264.60 | 267.90 | | 268.16 | 0.003581 | 4.46 | 234.08 | 134.63 | 0.47 |
| Reach-1 | 17490 | PF 1 | 850.00 | 263.60 | 267.35 | | 267.80 | 0.006593 | 5.65 | 183.27 | 120.48 | 0.62 |
| Reach-1 | 17265 | PF 1 | 850.00 | 262.50 | 266.71 | | 266.93 | 0.002219 | 3.80 | 225.25 | 74.48 | 0.37 |
| Reach-1 | 17180 | PF 1 | 850.00 | 262.00 | 266.19 | 265.22 | 266.64 | 0.004978 | 5.37 | 158.54 | 74.26 | 0.55 |
| Reach-1 | 17155 | | Bridge | | | | | | | | | |
| Reach-1 | 17130 | PF 1 | 850.00 | 261.40 | 265.88 | | 266.36 | 0.005137 | 5.57 | 154.69 | 70.52 | 0.56 |
| Reach-1 | 17080 | PF 1 | 850.00 | 261.36 | 264.71 | 264.71 | 265.78 | 0.014052 | 8.58 | 111.69 | 57.20 | 0.91 |
| Reach-1 | 16865 | PF 1 | 850.00 | 257.70 | 260.92 | 260.92 | 261.78 | 0.020071 | 7.42 | 114.62 | 68.16 | 1.01 |
| Reach-1 | 16420 | PF 1 | 850.00 | 252.16 | 256.05 | 254.82 | 256.30 | 0.002999 | 4.02 | 223.12 | 104.22 | 0.42 |
| Reach-1 | 15860 | PF 1 | 850.00 | 250.00 | 252.72 | 252.48 | 253.28 | 0.011750 | 6.05 | 146.66 | 98.36 | 0.78 |
| Reach-1 | 15752 | PF 1 | 850.00 | 248.00 | 252.70 | | 252.83 | 0.001321 | 2.94 | 330.91 | 165.93 | 0.29 |
| Reach-1 | 15405 | PF 1 | 850.00 | 247.23 | 251.44 | | 251.95 | 0.005829 | 6.11 | 178.92 | 112.63 | 0.60 |
| Reach-1 | 15310 | PF 1 | 850.00 | 246.80 | 251.35 | 249.64 | 251.52 | 0.001607 | 3.23 | 263.52 | 174.42 | 0.32 |
| Reach-1 | 15260 | | Bridge | | | | | | | | | |
| Reach-1 | 15225 | PF 1 | 850.00 | 246.20 | 250.85 | | 251.10 | 0.001695 | 4.00 | 212.32 | 183.64 | 0.34 |
| Reach-1 | 15130 | PF 1 | 850.00 | 245.71 | 249.63 | 249.63 | 250.54 | 0.015613 | 7.69 | 116.26 | 81.31 | 0.92 |
| Reach-1 | 15090 | PF 1 | 850.00 | 246.00 | 249.24 | | 249.41 | 0.004368 | 3.65 | 280.31 | 208.86 | 0.48 |
| Reach-1 | 14560 | PF 1 | 850.00 | 241.00 | 244.02 | 244.02 | 244.79 | 0.021044 | 7.04 | 120.76 | 80.44 | 1.01 |
| Reach-1 | 13930 | PF 1 | 850.00 | 230.80 | 236.12 | 235.24 | 236.43 | 0.005137 | 4.52 | 205.36 | 209.08 | 0.53 |
| Reach-1 | 13460 | PF 1 | 850.00 | 230.60 | 234.31 | | 234.52 | 0.004294 | 4.50 | 271.36 | 179.34 | 0.50 |
| Reach-1 | 13280 | PF 1 | 850.00 | 229.10 | 234.38 | | 234.40 | 0.000208 | 1.40 | 917.25 | 383.51 | 0.12 |
| Reach-1 | 13055 | PF 1 | 850.00 | 228.60 | 234.35 | | 234.37 | 0.000098 | 1.08 | 1016.71 | 255.41 | 0.08 |
| Reach-1 | 12950 | PF 1 | 850.00 | 228.50 | 233.29 | 233.29 | 234.23 | 0.013602 | 8.16 | 122.03 | 72.93 | 0.88 |
| Reach-1 | 12890 | PF 1 | 850.00 | 225.14 | 230.35 | 228.62 | 231.13 | 0.001010 | 7.10 | 119.80 | 30.09 | 0.55 |
| Reach-1 | 12857.5 | | Culvert | | | | | | | | | |
| Reach-1 | 12790 | PF 1 | 850.00 | 224.00 | 227.49 | 227.49 | 229.23 | 0.003834 | 10.59 | 80.29 | 27.95 | 1.00 |
| Reach-1 | 12755 | PF 1 | 850.00 | 223.90 | 226.62 | | 226.74 | 0.003693 | 2.79 | 336.16 | 226.32 | 0.35 |
| Reach-1 | 12475 | PF 1 | 850.00 | 221.50 | 224.79 | | 225.13 | 0.010557 | 4.84 | 206.03 | 172.53 | 0.60 |
| Reach-1 | 12285 | PF 1 | 850.00 | 219.40 | 223.76 | 222.48 | 224.02 | 0.003539 | 4.17 | 229.71 | 218.83 | 0.45 |
| Reach-1 | 11945 | PF 1 | 850.00 | 218.30 | 220.59 | 220.59 | 220.97 | 0.029046 | 6.83 | 179.52 | 213.42 | 1.12 |
| Reach-1 | 11395 | PF 1 | 850.00 | 212.40 | 220.13 | | 220.14 | 0.000085 | 1.10 | 1103.73 | 297.74 | 0.08 |

# TABLE 6 -
# HEC-RAS PROFILE TABLE FOR 100-YEAR FULL BUILD-OUT FLOW AND PROPOSED SITE CONDITIONS
# 4/16/2016

HEC-RAS Plan: StrapPropBri River: RIVER-1 Reach: Reach-1 Profile: PF 1 (Continued)

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Reach-1 | 11345 | PF 1 | 850.00 | 212.10 | 220.00 | 215.84 | 220.11 | 0.000031 | 3.29 | 1078.12 | 288.90 | 0.21 |
| Reach-1 | 11307.5 | | Culvert | | | | | | | | | |
| Reach-1 | 11270 | PF 1 | 850.00 | 211.65 | 215.69 | 215.39 | 217.29 | 0.000727 | 10.16 | 83.65 | 211.82 | 0.89 |
| Reach-1 | 11070 | PF 1 | 850.00 | 211.90 | 216.30 | 214.48 | 216.35 | 0.000948 | 1.96 | 481.87 | 224.86 | 0.21 |

# Attachment B – Figures

Figure No. 1 – Project Site Location Map

Figure No. 2 – Whitehawk I Existing Site Conditions

Figure No. 3 – Whitehawk II Existing Site Conditions

Figure No. 4 – Whitehawk I Proposed Site Conditions

Figure No. 5 – Whitehawk II Proposed Site Conditions

Figure No. 6 – Watershed Boundaries

Figure No. 7 – Comparison of Ground Profiles

Figure No. 8 – Comparison of Cross Section Ground Data at River Station 18075

Figure No. 9 – Conceptual Design for Natural Channel

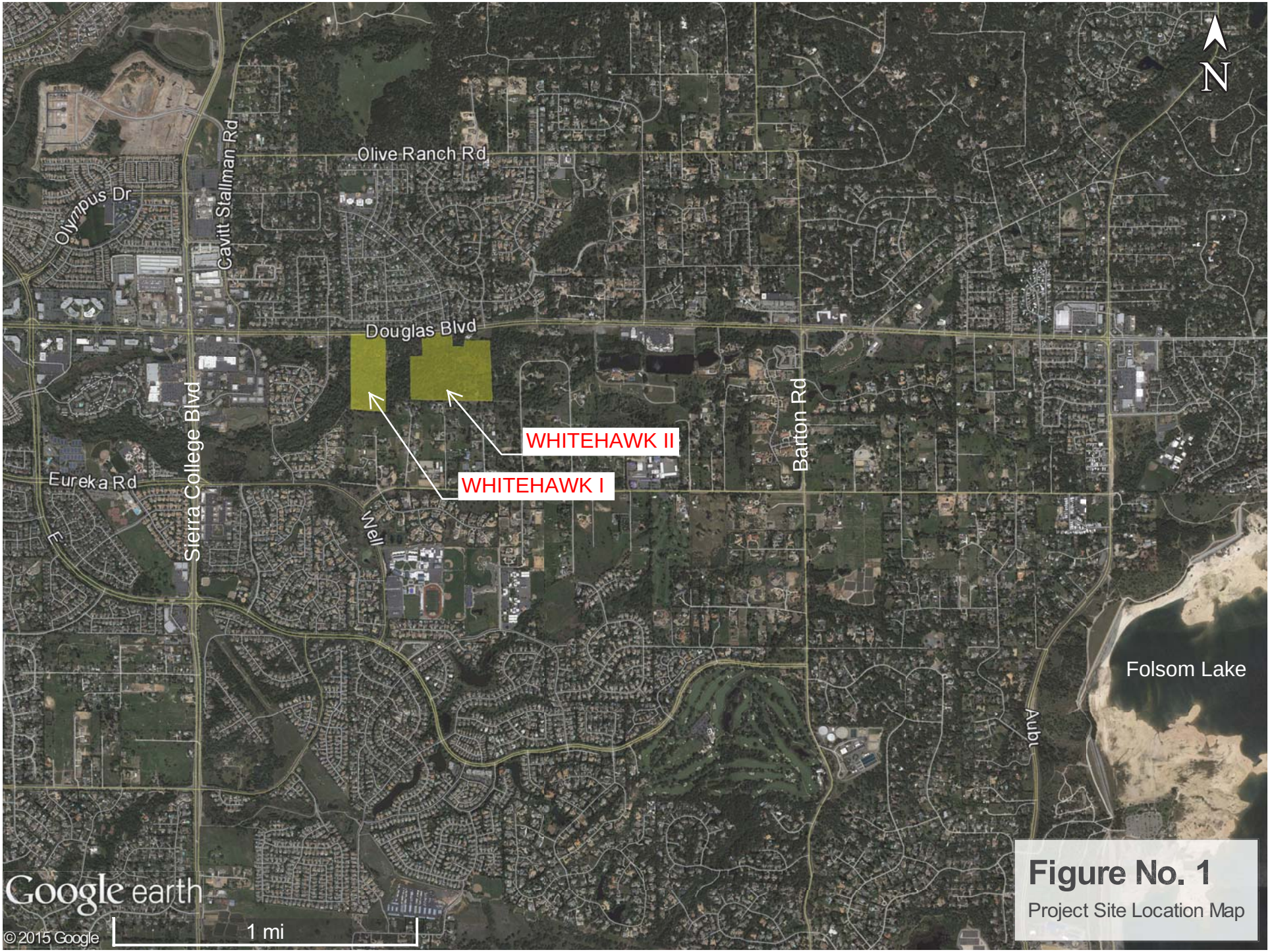
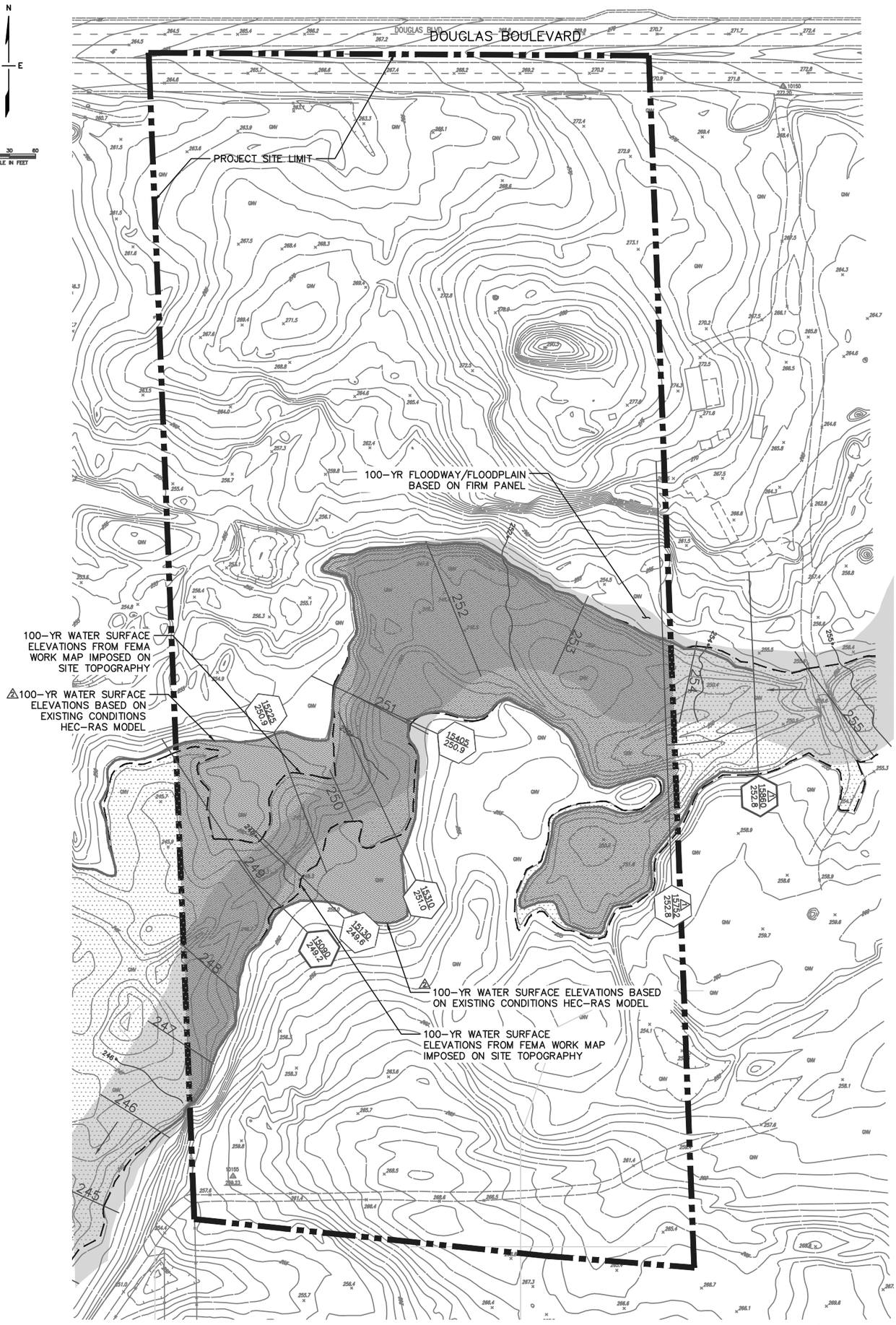



**Figure No. 1**

Project Site Location Map




## LEGEND/ABBREVIATIONS

| | |
|---|---|
| WSEL | WATER SURFACE ELEVATION |
| 250 | 100-YR WSEL FROM FIRM PANEL |
| 250 | 100-YR WSEL FROM FEMA MODEL |
| | 100-YR FLOODPLAIN/FLOODWAY BASED ON FIRM PANEL |
| | 100-YR WSEL FROM FEMA IMPOSED ON SITE TOPOGRAPHY |
| | 100-YR WSEL BASED ON EXISTING SITE CONDITIONS HEC-RAS MODEL |
| | WHITEHAWK I PROJECT SITE LIMIT |
| RIVER STA. WSEL | FEMA MODEL CROSS SECTION LOCATION WITH LABEL |
| STA WSEL | HECRAS CROSS SECTION LOCATION WITH RIVER STA AND WSEL LABEL |

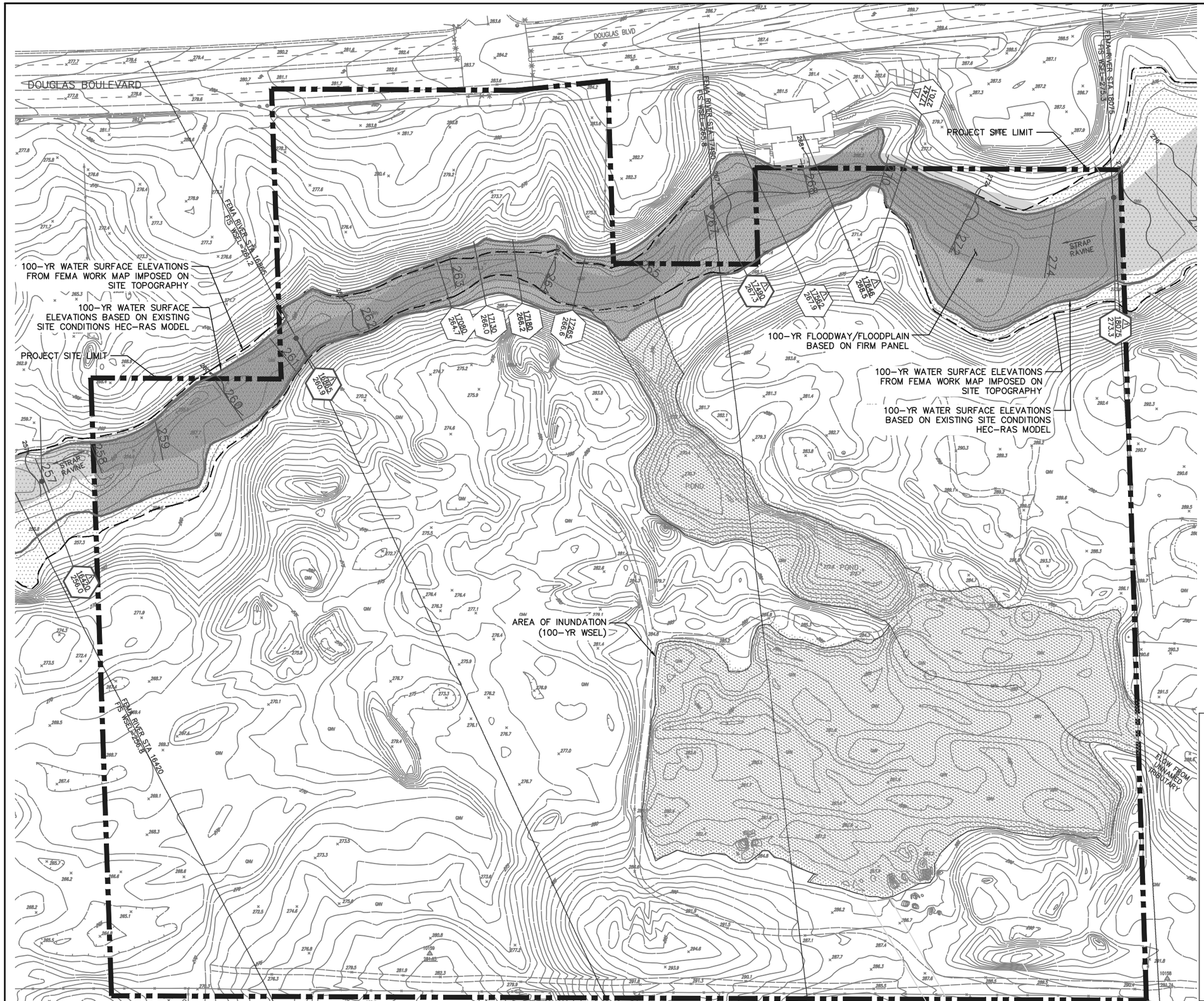
FULL SIZE SHEET: 24"x36"

| SHEET | DATE | SCALE | DRAWN |
|---|---|---|---|
| FIGURE NO. 2 | 5/20/2015 | 1"=60' | |

WHITEHAWK I EXISTING SITE CONDITIONS

MST
*Planning, Engineering and Construction Services*
Michael S. Thomas, P.E.
Consulting Civil Engineer
235 Montgomery St., Ste. 706, San Francisco, California 94104
Phone: (415) 298-7403 E-mail: michael.thomas.pe@gmail.com

| REVISIONS | BY |
|---|---|
| 1 04-15-2016 | |
| 2 05-17-2016 | |




## LEGEND/ABBREVIATIONS

| | |
|---|---|
| WSEL | WATER SURFACE ELEVATION |
| 250 | 100-YR WSEL FROM FIRM PANEL |
| 250 | 100-YR WSEL FROM FEMA MODEL |
| | 100-YR FLOODPLAIN/FLOODWAY BASED ON FIRM PANEL |
| | 100-YR WSEL FROM FEMA IMPOSED ON SITE TOPOGRAPHY |
| | 100-YR WSEL BASED ON EXISTING SITE CONDITIONS HEC-RAS MODEL |
| | WHITEHAWK II PROJECT SITE LIMIT |
| RIVER STA WSEL | FEMA MODEL CROSS SECTION LOCATION WITH LABEL |
| STA WSEL | HECRAS CROSS SECTION LOCATION WITH RIVER STA AND WSEL LABEL |
| | UNNAMED TRIBUTARY AREA OF INUNDATION |

FULL SIZE SHEET: 24"x36"

| REVISIONS | BY |
|---|---|
| 1 04-15-2016 | |


*Planning, Engineering and Construction Services*

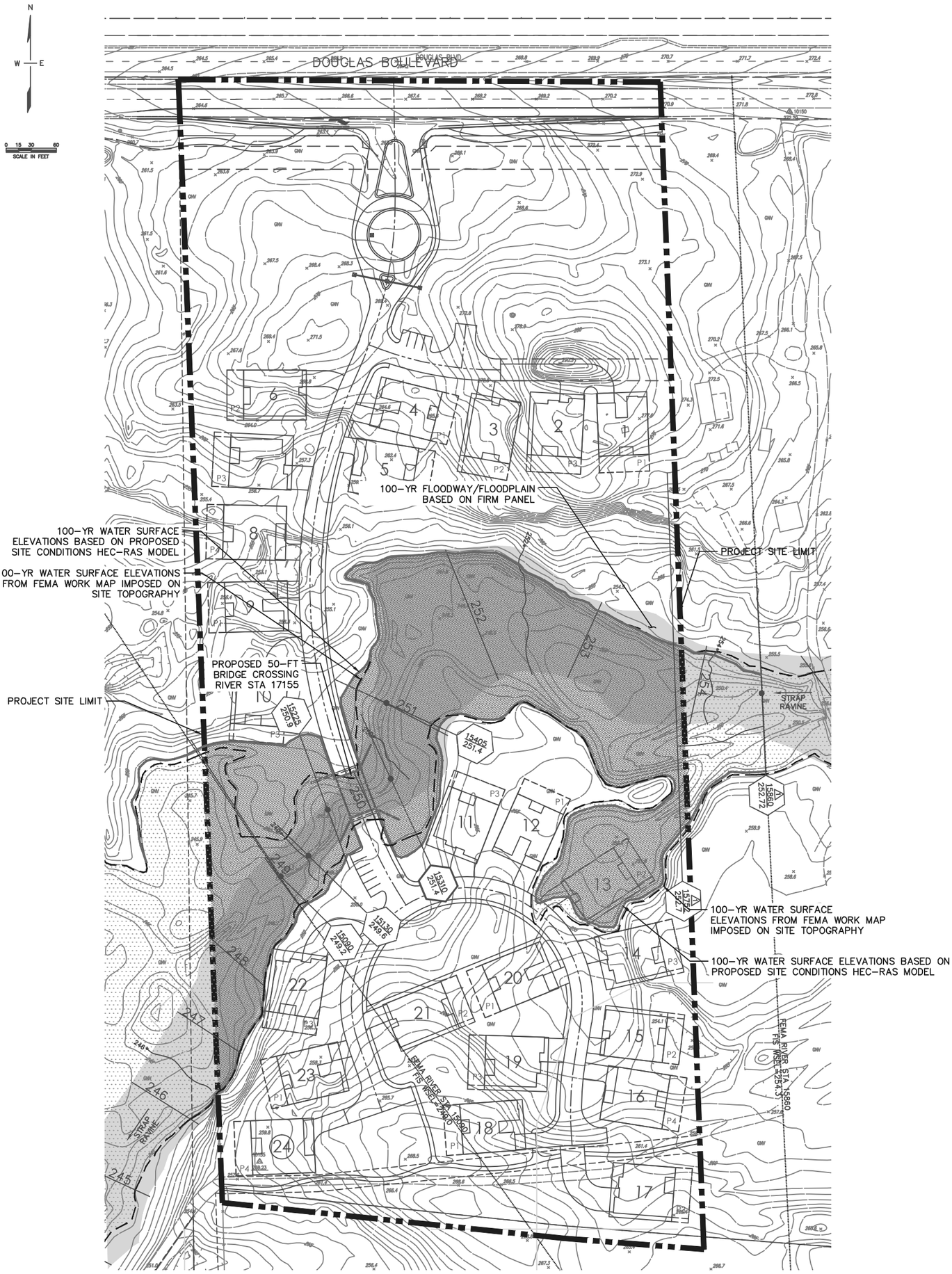
Michael S. Thomas, P.E.
Consulting Civil Engineer

235 Montgomery St., Ste. 706, San Francisco, California 94104
Phone: (415) 298-7403 E-mail: michael.thomas.pe@gmail.com

MST


WHITEHAWK II EXISTING SITE CONDITIONS

| | |
|---|---|
| DATE | 5/20/2015 |
| SCALE | 1"=60' |
| DRAWN | |
| SHEET | FIGURE NO. 3 |




## LEGEND/ABBREVIATIONS

| | |
|---|---|
| WSEL | WATER SURFACE ELEVATION |
| 250 | 100-YR WSEL FROM FIRM PANEL |
| 250 | 100-YR WSEL FROM FEMA MODEL |
| | 100-YR FLOODPLAIN/FLOODWAY BASED ON FIRM PANEL |
| | 100-YR WSEL FROM FEMA IMPOSED ON SITE TOPOGRAPHY |
| | 100-YR WSEL BASED ON PROPOSED SITE CONDITIONS HEC-RAS MODEL |
| | WHITEHAWK I PROJECT SITE LIMIT |
| RIVER STA / WSEL | FEMA MODEL CROSS SECTION LOCATION WITH LABEL |
| STA / WSEL | HECRAS CROSS SECTION LOCATION WITH RIVER STA AND WSEL LABEL |

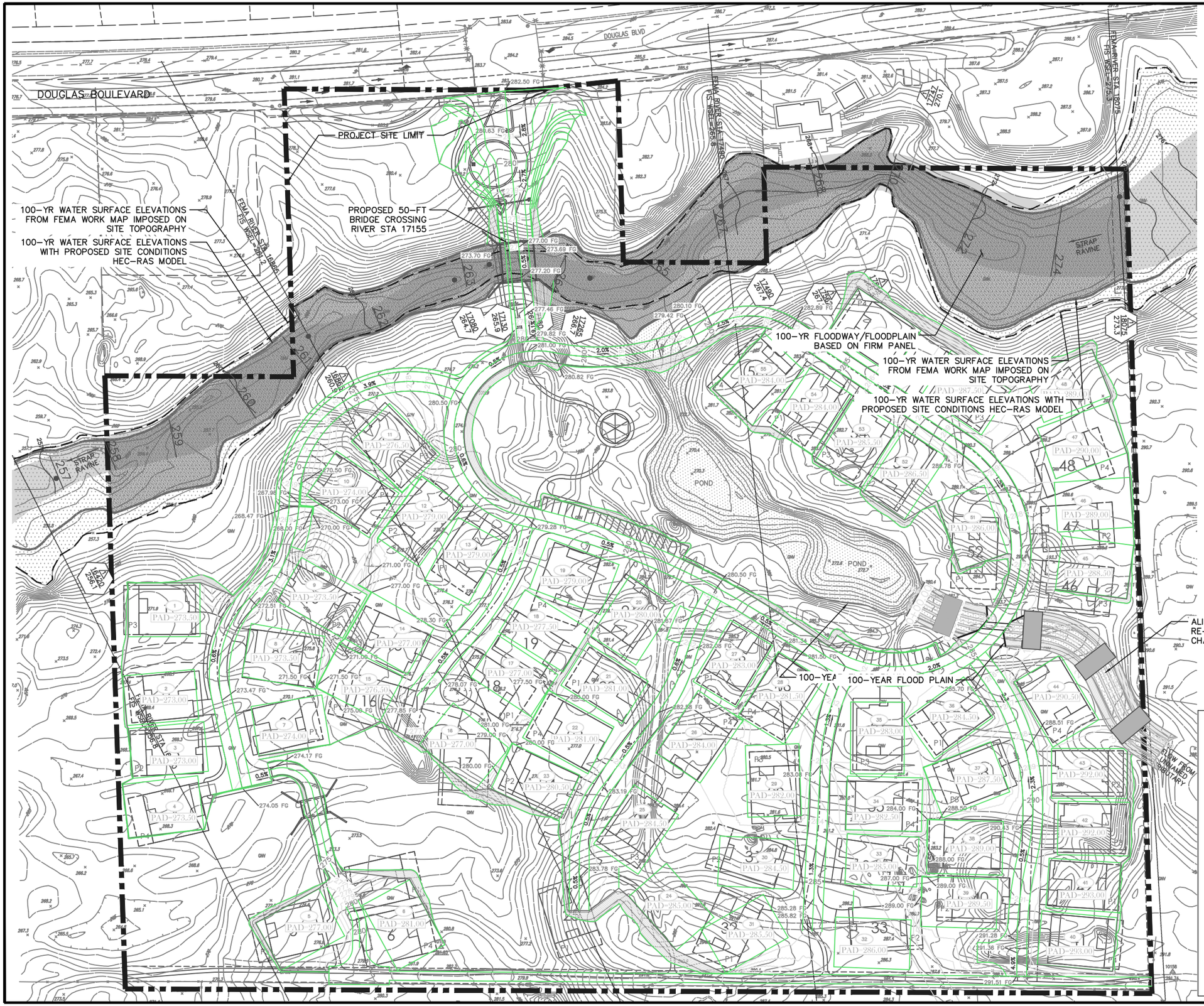
FULL SIZE SHEET: 24"x36"

| SHEET | DATE | SCALE | DRAWN |
|---|---|---|---|
| FIGURE NO. 4 | 5/20/2015 | 1"=60' | |

WHITEHAWK I PROPOSED SITE CONDITIONS

MST
*Planning, Engineering and Construction Services*
Michael S. Thomas, P.E.
Consulting Civil Engineer
235 Montgomery St., Ste. 706, San Francisco, California 94104
Phone: (415) 298-7403 E-mail: michael.thomas.pe@gmail.com

| REVISIONS | BY |
|---|---|
| △ 04-15-2016 | |




## LEGEND/ABBREVIATIONS

| | |
|---|---|
| WSEL | WATER SURFACE ELEVATION |
| 250 | 100-YR WSEL FROM FIRM PANEL |
| 250 | 100-YR WSEL FROM FEMA MODEL |
| | 100-YR FLOODPLAIN/FLOODWAY BASED ON FIRM PANEL |
| | 100-YR WSEL FROM FEMA IMPOSED ON SITE TOPOGRAPHY |
| | 100-YR WSEL BASED ON PROPOSED SITE CONDITIONS HEC-RAS MODEL |
| | WHITEHAWK II PROJECT SITE LIMIT |
| RIVER STA / WSEL | FEMA MODEL CROSS SECTION LOCATION WITH LABEL |
| STA / WSEL | HECRAS CROSS SECTION LOCATION WITH RIVER STA AND WSEL LABEL |
| | UNNAMED TRIBUTARY AREA OF INUNDATION |

FULL SIZE SHEET: 24"x36"

| REVISIONS | BY |
|---|---|
| 1 04-15-2016 | |

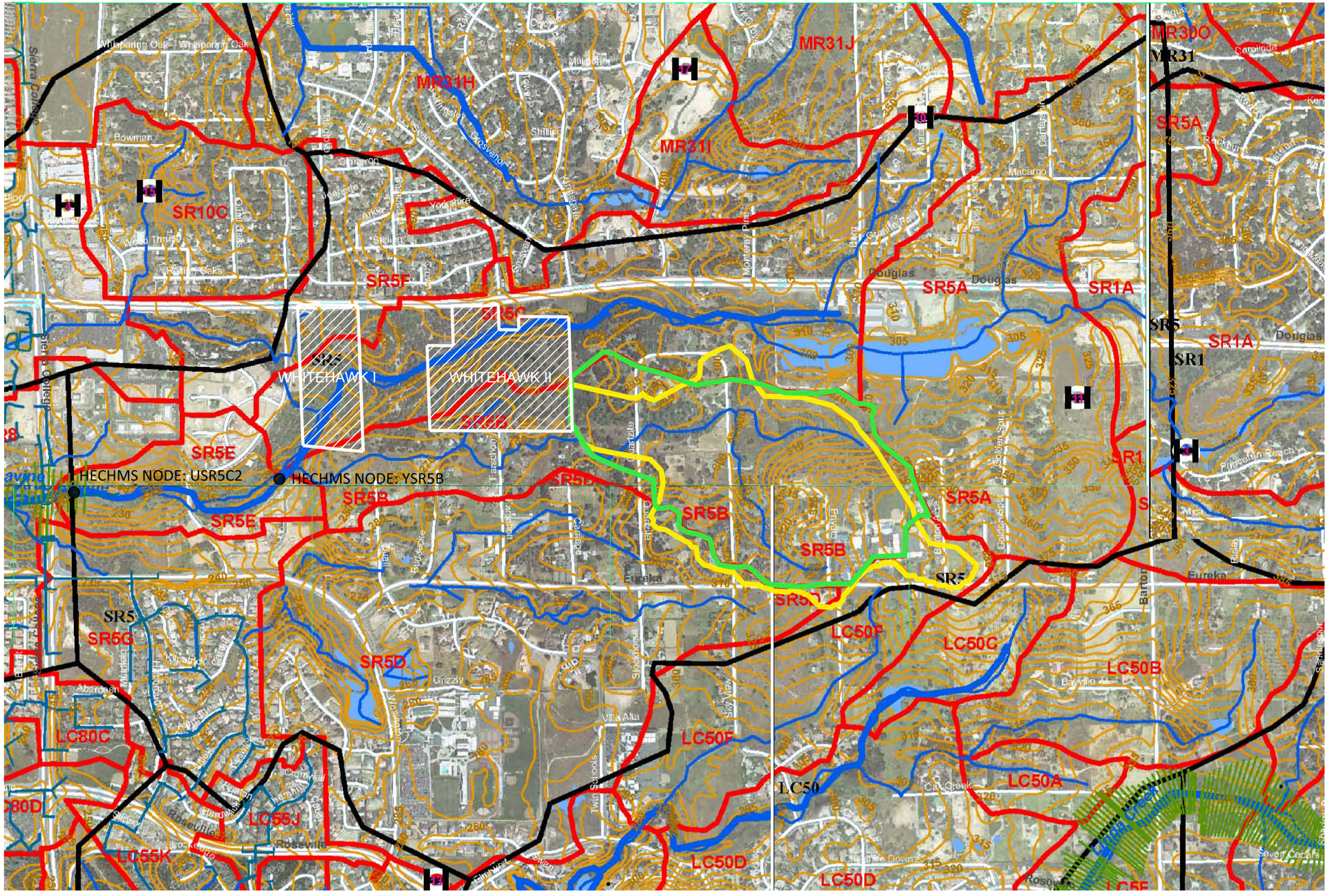

*Planning, Engineering and Construction Services*

Michael S. Thomas, P.E.
Consulting Civil Engineer
235 Montgomery St., Ste. 706, San Francisco, California 94104
Phone: (415) 298-7403 E-mail: michael.thomas.pe@gmail.com

MST


# WHITEHAWK II PROPOSED SITE CONDITIONS

| | |
|---|---|
| DATE | 5/20/2015 |
| SCALE | 1"=60' |
| DRAWN | |
| SHEET | FIGURE NO. 5 |




BACKGROUND MAP: PLATES 19, 24, & 25 FROM THE 2011 UPDATE TO THE DRY CREEK WATERSHED FLOOD CONTROL PLAN

LEGEND

- WATERSHED BOUNDARY FROM 2011 UPDATE TO THE DRY CREEK WATERSHED FLOOD CONTROL PLAN
- TRIBUTARY BOUNDARY FROM 2008 DRAINAGE REPORT FOR "THE RESIDENCES AT CREEKSIDE OAKS" PROJECT
- TRIBUTARY BOUNDARY MODIFIED FOR PRELIMINARY ANALYSIS

| REVISIONS | BY |
|---|---|
| | |
| | |
| | |
| | |


*Planning, Engineering and Construction Services*

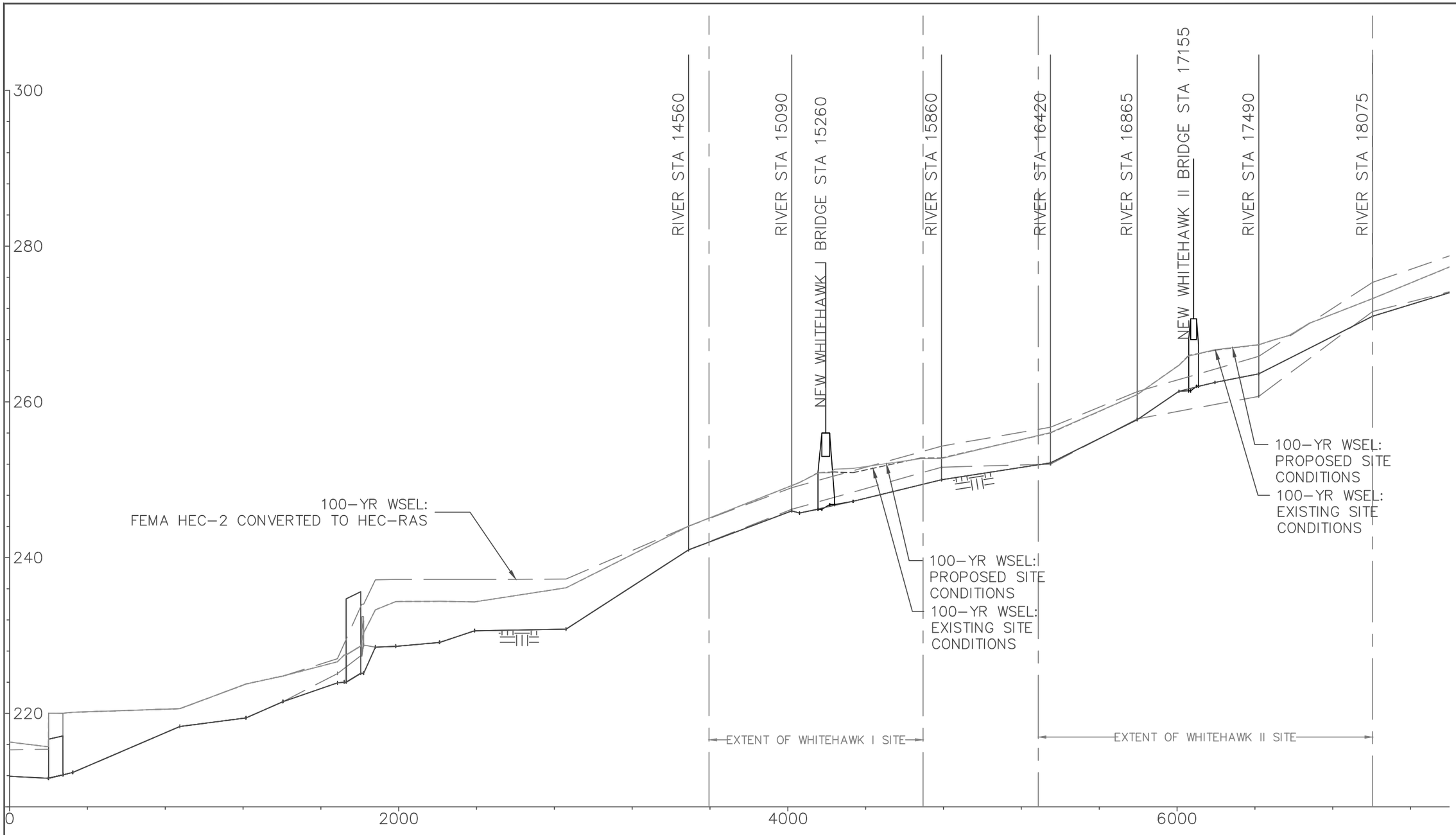
Michael S. Thomas, P.E.
Consulting Civil Engineer

235 Montgomery St., Ste. 706, San Francisco, California 94104
Phone: (415) 298-7403 E-mail: michael.thomas.pe@gmail.com

MST


WATERSHED BOUNDARIES

| | |
|---|---|
| DATE | 5/20/2015 |
| SCALE | N.T.S |
| DRAWN | |
| SHEET | FIGURE NO. 6 |




PROFILE LEGEND

- GROUND DATA FROM FEMA HEC-2 CONVERTED TO HEC-RAS
- GROUND DATA REVISED WITH EXISTING SITE CONDITIONS
- GROUND DATA FOR PROPOSED SITE CONDITIONS

| REVISIONS | BY |
|---|---|
| REV. APR. 2016 | |

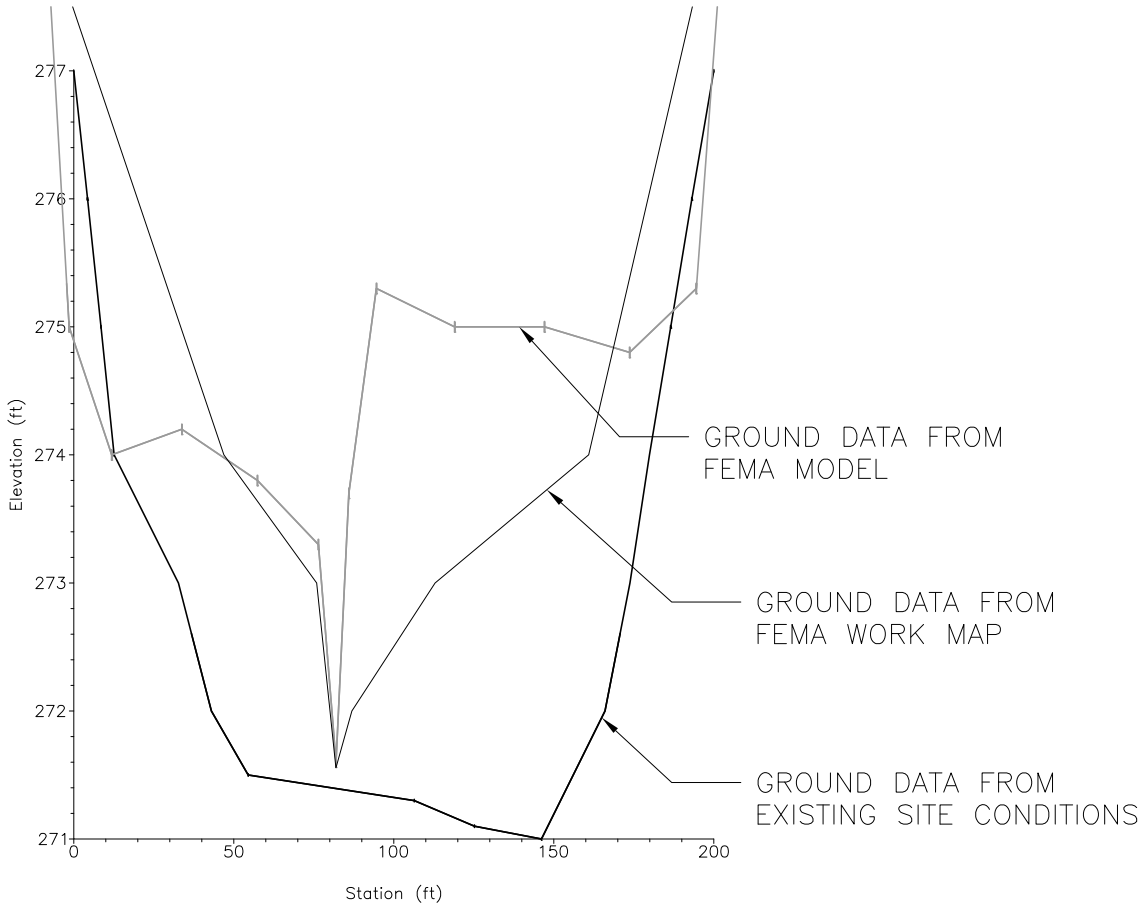
*Planning, Engineering and Construction Services*


Michael S. Thomas, P.E.
Consulting Civil Engineer
235 Montgomery St., Ste. 706, San Francisco, California 94104
Phone: (415) 298-7403 E-mail: michael.thomas.pe@gmail.com


MST

COMPARISON OF GROUND PROFILES

| | |
|---|---|
| DATE | 5/20/2015 |
| SCALE | N.T.S |
| DRAWN | |
| SHEET | FIGURE NO. 7 |




SCALE
HORIZONTAL 1"=60'
VERTICAL 1:40

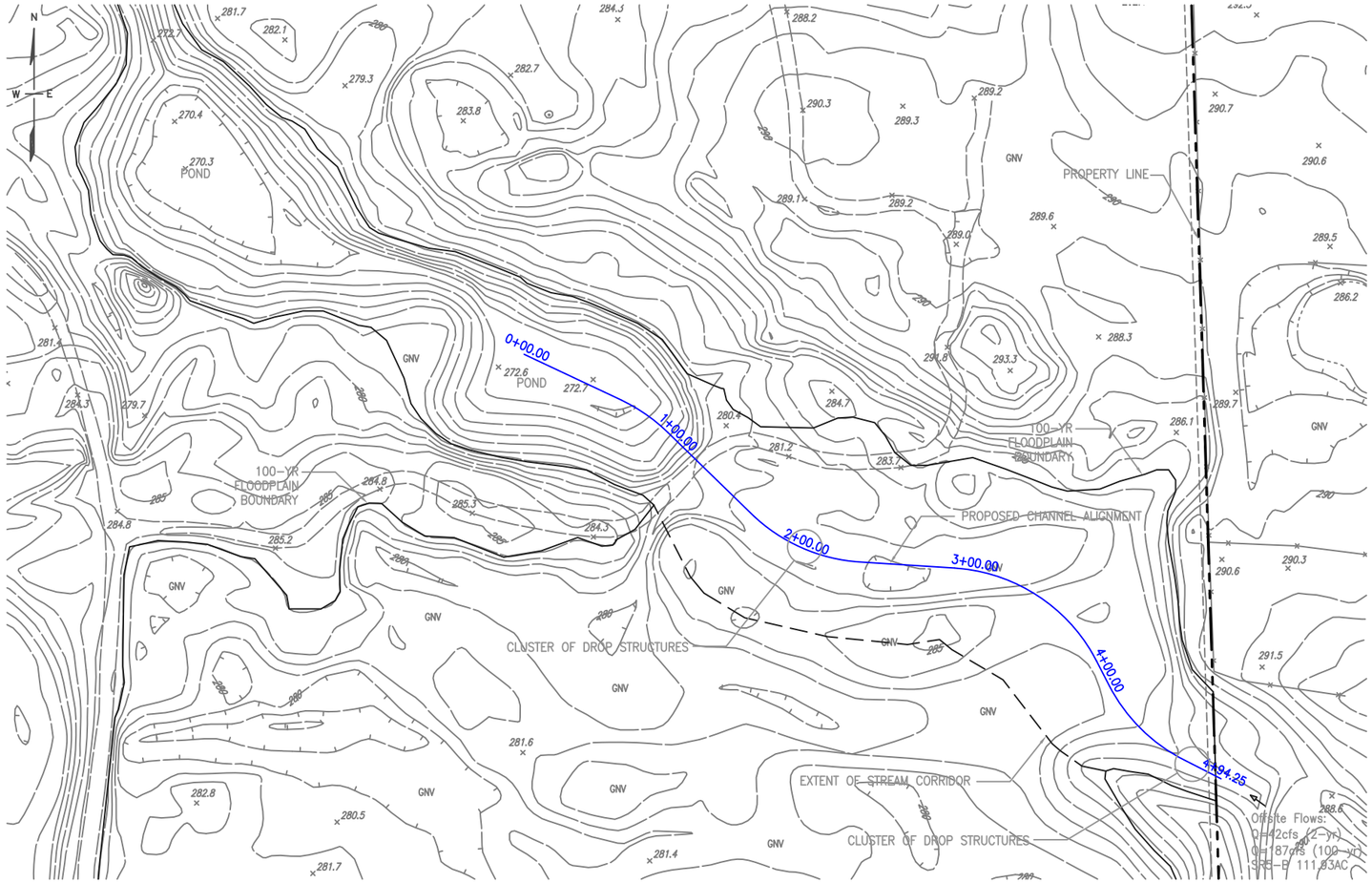
MST

*Planning, Engineering and Construction Services*

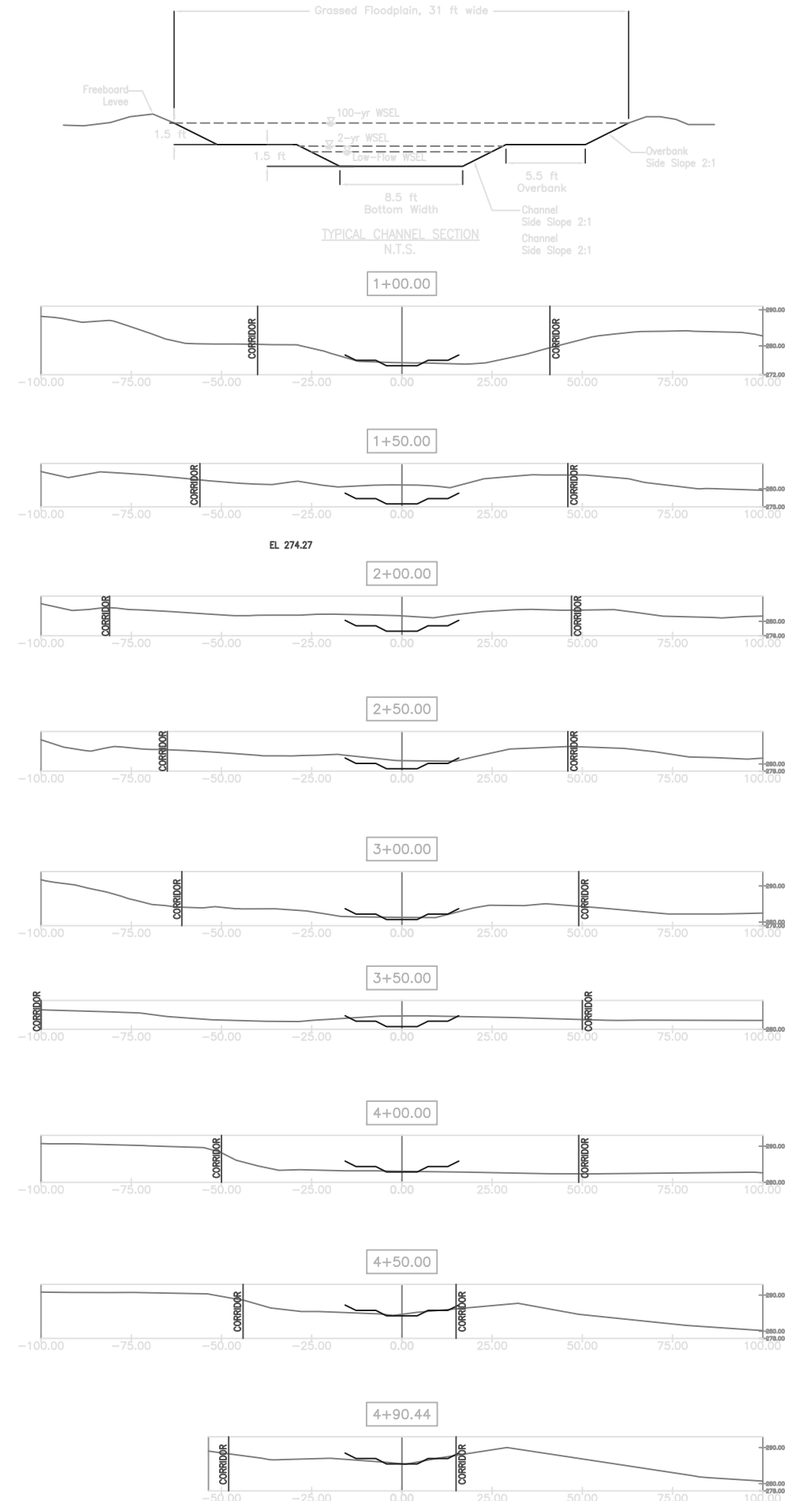
Michael S. Thomas, P.E.
Consulting Civil Engineer

235 Montgomery Street Suite 706, San Francisco, California 94104
Phone: (415) 298-7403 E-mail: michael.thomas.pe@gmail.com

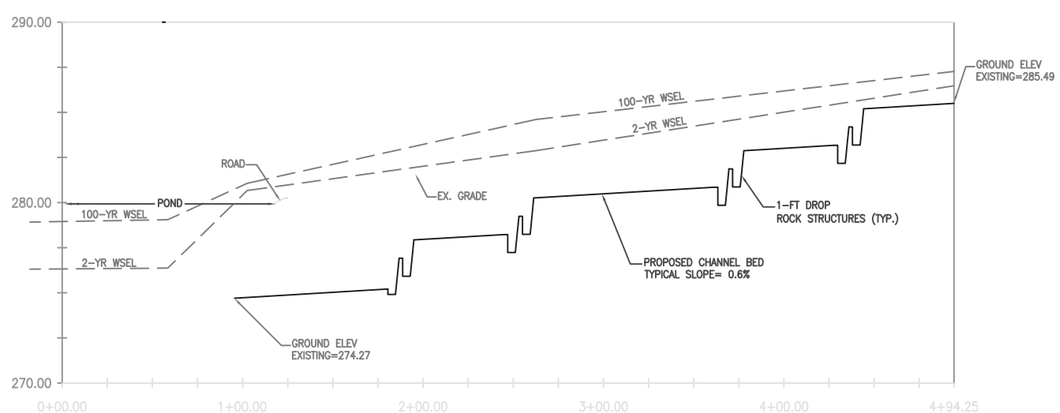
FIGURE NO. 8
COMPARISON OF CROSS SECTION
GROUND DATA AT RIVER STA 18075




CHANNEL ALIGNMENT
SCALE: 1"=40'




CHANNEL CROSS SECTIONS
SCALE: 1"=20'




CHANNEL PROFILE
SCALE: 1"=40'
HORIZONTAL 1:1
VERTICAL 10:1

0 10 20 40
SCALE IN FEET

FULL SIZE: 24"X36"

| REVISIONS | BY |
|---|---|
| | |
| | |
| | |
| | |
| | |


*Planning, Engineering and Construction Services*

Michael S. Thomas, P.E.
Consulting Civil Engineer

235 Montgomery St., Ste. 706, San Francisco, California 94104
Phone: (415) 298-7403 E-mail: michael.thomas.pe@gmail.com

MST


CONCEPTUAL DESIGN FOR NATURAL CHANNEL AT WHITEHAWK II

DATE 05/20/2015
SCALE AS NOTED
DRAWN

SHEET
FIGURE NO. 9