# APPENDIX E

## 30% BASIS OF DESIGN REPORT

DECEMBER 2018

# 30% Basis of Design Report for Niles Canyon Quarry Reclamation


PREPARED FOR

Benchmark Resources
2515 East Bidwell Street
Folsom, CA 95630

PREPARED BY

Stillwater Sciences
2855 Telegraph Avenue, Suite 400
Berkeley, CA 94610


Stillwater Sciences

Suggested citation:
Stillwater Sciences. 2018. Basis of Design Report for Niles Canyon Quarry Reclamation. Prepared by Stillwater Sciences, Berkeley, California for Benchmark Resources, Folsom, California.

Cover photo: Aerial oblique of restoration project area. Photo taken by Stillwater Sciences 2017.

# Table of Contents



## Tables



## Figures



## Appendices

# 1 INTRODUCTION

Benchmark Resources contracted Stillwater Sciences to develop engineered restoration designs for the reconstruction of approximately 1,500 feet of channel back to its pre-existing channel location on the Niles Canyon Quarry property (hereafter, "Quarry creek"). The Draft Basis of Design (BOD) Report describes the preferred design based on field- and office-based analyses, as well as review and comment by landowners and a Technical Advisory Committee (TAC). The TAC members for this project include representatives from Benchmark Resources, Berlogar Stevens & Associates (BSA), Alameda County, U.S. Fish and Wildlife Service (USFWS), Regional Water Quality Control Board (RWQCB), U.S. Army Corps of Engineers (USACE). During the design and review process, opportunities and constraints within the project reach were identified and where feasible habitat enhancement features were incorporated. The 30% design is included in Appendix A and is analyzed in this report for feasibility in terms of permitting, constructability, long-term aquatic habitat enhancement, and geomorphic function/stability.

# 2 SITE DESCRIPTION

The Niles Canyon Quarry is located approximately one (1) mile west of Sunol, on the north side of State Highway 84 (Niles Canyon Road) at 5550 Niles Canyon Road. The property consists of four parcels owned by SRDC, Inc. (APN 96-115-2-4, 96-125-6-1, 6-2, and 6-3) totaling approximately 190 acres. The property is zoned A-Agricultural and has a General Plan designation of Resource Management and Larger Parcel Agricultural.

# 3 PROBLEM STATEMENT

The Quarry creek is impaired due to significant disturbance of the seasonal creek channel both in terms of the physical landscape and hydrologic function. There are numerous basins, ditches, and culverts along the channel that were constructed in association with quarry operations (Figure 1). The purpose of the proposed project is to restore the site by removing anthropogenic changes and reconstructing the stream channel to provide habitat connectivity from the lower quarry pad through the native channel reach to upper pad area.

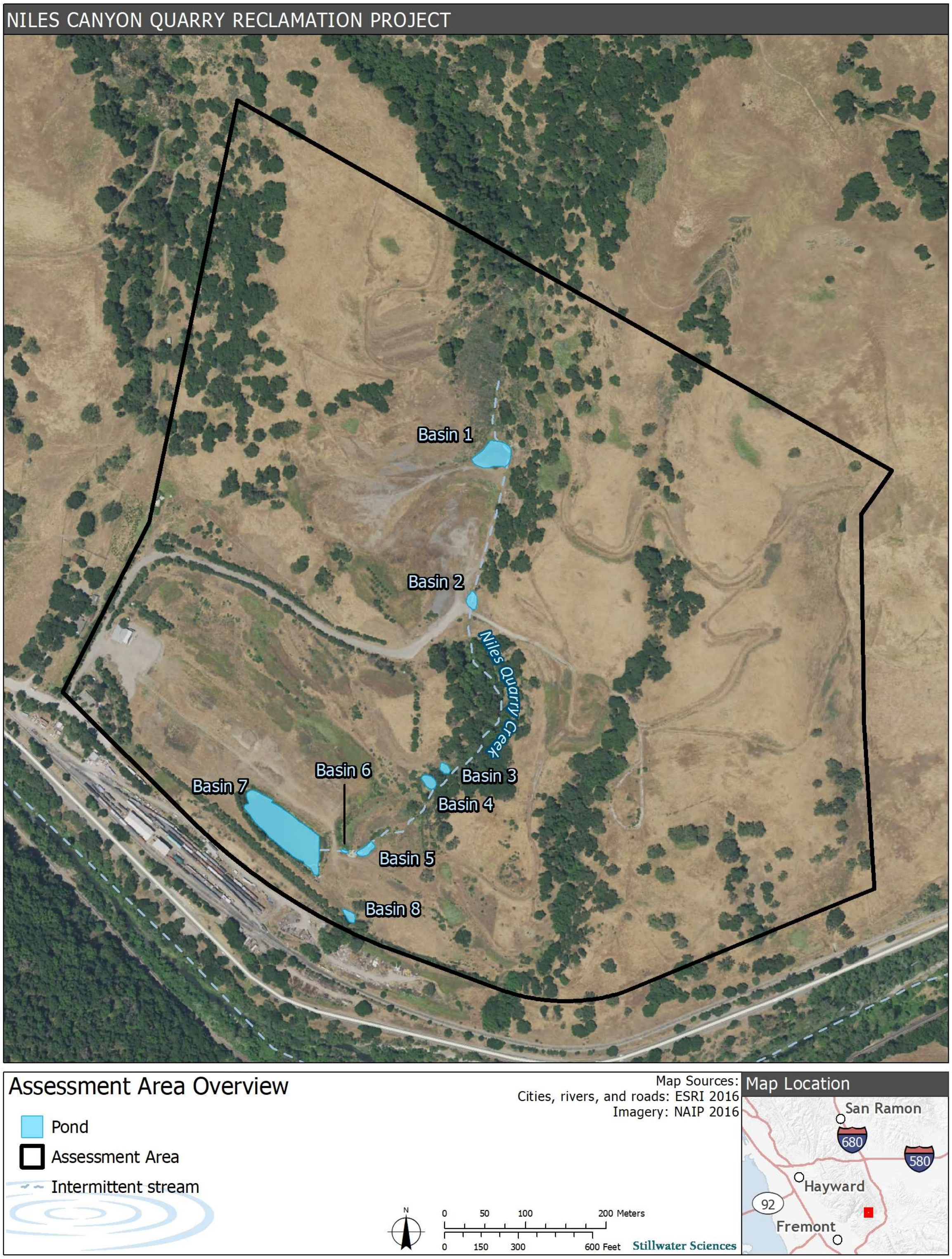



**Figure 1.** Vicinity map.

# 4 GEOLOGY AND TECTONICS

Niles Canyon is in the southeastern Diablo Range, a fault-bounded block of the California Coast Range, composed predominantly of Franciscan Assemblages structurally overlain by the Great Valley Complex (Wiegers 2004). This area is in a regime of transpressional deformation associated with NW-SE trending right lateral strike-slip faults that are part of the San Andreas Fault system. Niles Canyon Quarry lies 3.9 miles northeast of the Hayward Fault Zone, 2.6 miles northeast of the Chabot Fault Zone, and 1.8 miles southwest of the Calaveras Fault Zone. These right-lateral faults are all first-order splays of the San Andreas Fault system (Scholz et al. 2010). The Hayward Fault is actively creeping at a slip rate of 9 mm per year, offsetting streets, curbs, and other structures in the area and is known for causing large-scale historic earthquakes (Lienkaemper et al. 2012). On October 26, 1868, the Hayward fault ruptured causing a 6.8 magnitude earthquake resulting in 2 meters of horizontal displacement. One splay of the NW-SE trending Stonybrook Thrust Fault transects the immediate work area and Alameda Creek. The Niles Valley Syncline lies 2 miles to the east of Niles Canyon and trends NW-SE. These NW-SE trending faults and structures are attributed to the large-scale transpressional deformation associated with the San Andreas Fault Zone.

The lithology of the southwestern portion of Niles Canyon Quarry is primarily composed of Quaternary surficial deposits comprised of clay, silt, sand, gravels, and landslide rubble derived from rocks upslope. The northwestern portion of Niles Canyon is made up of Livermore gravels which consist of Pliocene to Pleistocene conglomerates, shale, and sandstone with minor occurrences of greywacke and siltstone (Graymer et al. 1996).

Soil mantled hillslopes in Niles Canyon Quarry are comprised of Los Osos and Millsholm soils, Rincon clay, and Yolo loam. Los Osos and Millholm soils, are composed of silt loam and silty clay derived from residuum weathered from sandstone and shale. Rincon clay is composed of clay loam, sandy clay, and stratified sandy loam to clay loam that has been derived from sandstones and shales. Yolo loam is made up of very fine to fine sand and sandy loam derived from Franciscan metamorphic and sedimentary rock.

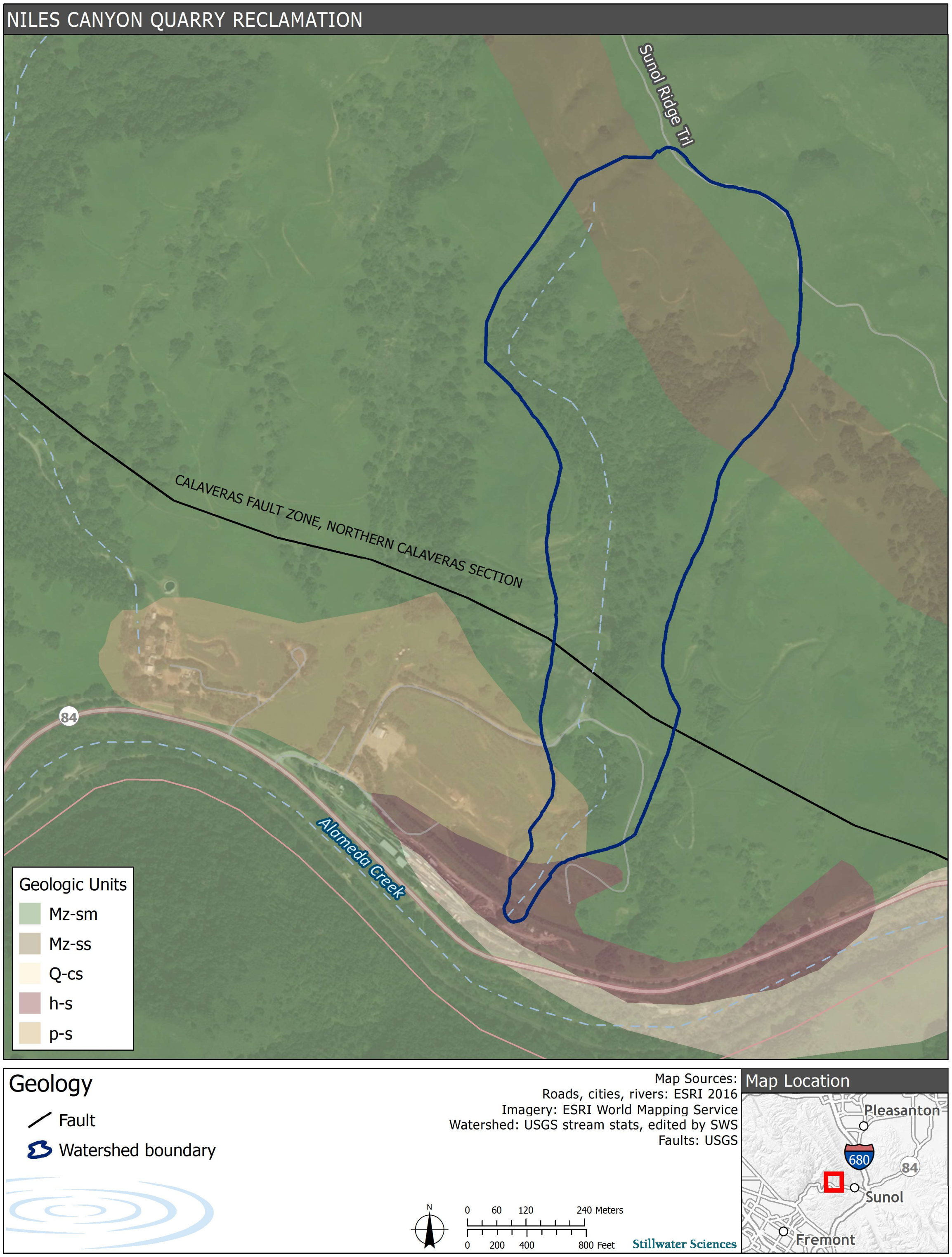



**Figure 2.** Generalized geologic map of the Niles Canyon Quarry watershed and project vicinity.

# 5 GEOMORPHOLOGY

Hillslope and stream channel morphologies in Niles Canyon are similar to those found throughout the Diablo Range, due to the prevalence of the underlying Franciscan Coastal Belt terranes. Although there is variability among the terranes, the rock strength in Coast Belt rocks commonly leads to steep ridge and valley topography with systematic drainage networks. Shallow and deep-seated landslides in the Niles Canyon region are generally triggered by rainfall or earthquakes and commonly occur in mélange and less competent sedimentary units.

Stillwater conducted a geomorphic assessment to identify and evaluate the primary characteristics and controls on erosion, sediment transport, and deposition within project reaches. The extent of the ephemeral Quarry Creek was traversed and assessed by (1) quantifying channel geometry, (2) identifying channel bed and bank sediment characteristics, (3) identifying potential sediment sources, (4) mapping areas of accelerated erosion, and (5) evaluating land use impacts on overall channel morphology.

The upper reach of the channel is characterized by narrow, steep-walled, soil-mantled canyon slopes that are covered by California sagebrush (Artemisia californica) and valley oaks (Quercus agrifolia). The channel bank in this reach is composed of easily erodible sediments that are poorly consolidated and non-lithified. These deposits contain angular to sub-rounded sedimentary clasts in a fine matrix. The channel bed in this reach is comprised of debris-flow derived materials ranging from silt to small boulders. The constricted upper reach of the channel exhibits cascade morphology with intermittent small wood debris littered throughout. The channel widens from 5 ft at the upper end of the reach to 23 ft as it approaches Basin 1.

Hillslopes on the western side of Basin 1 contain small shallow landslides which have exposed bedrock and lead to downslope scree accumulation. Downstream of Basin 1, the channel passes through a 36-inch diameter, 500-foot-long, concrete culvert to Basin 2. This basin has a 24-inch, 150-foot-long, CMP overflow culvert to the native channel reach. The channel cross-section between Basin 2 and Basin 3 is approximately 6 ft wide. The native channel reach is incised into debris flow deposits, composed of unsorted angular sediments, that form terraces along the channel. Alternating right bank and left bank terrace deposits are associated with meandering/sinuous flows. The debris flow terraces extend from the Culvert 2 outlet to the backwater of Basin 3. The channel cross section widens from 6 to 12 feet as it flows into Basin 3. The channel bed in this reach is composed of angular shales, mudstones, and sandstones, ranging from pea gravel (2-8 mm) to cobbles (64-128 mm). A 36-inch diameter, 60-foot-long, iron culvert routes the water from Basin 3 to Basin 4 and passes through a stable, well-vegetated berm with no evidence of tension cracking or accelerated erosion. A 12-inch iron inlet culvert is buried on the western edge of Basin 3 due to sediment accumulation. Directly downstream of Basin 4 the channel is routed through a split culvert made up of two 24-inch diameter, 40-foot-long, steel culverts that pass through a second well-vegetated, stable berm. The two culverts from Basin 4 split flow by allowing sheet flow to Basin 5 and an engineered swale. The engineered swale flows toward partially-plugged Culvert 4 and is then routed through a man-made ditch that also discharges into Basin 5. Reworked quarry fill is located between the outlet of Basin 4 and detention Basin 7. The fill is composed of well-sorted grey shale and mudstone sediments ranging from 2-16 mm, with sparse (< 20%) coarser sediment. Extensive gullying is observed along the lower portion of the eastern access road, approximately 625 ft upslope from detention Basin 7. Gullying stretches for approximately 125 ft along the northeastern side of the access road and incises soils down to 4 feet near the plugged inlet of Culvert 6.

The channel has an average slope of 13 percent although Culvert 2 from Basin 2 to the native -channel reach has a very steep 37 percent slope that connects the upper reach and native mid-channel. The Quarry Creek can be split into three reaches with average slopes and downstream boundary summarized below in **Table 1**.

**Table 1.** Summary of average reach slopes

| Reach Name | Downstream Boundary | Average Slope |
|---|---|---|
| Upper | Basin 2 | 14% |
| Native | Basin 5 | 21% |
| Lower | Basin 7 | 8% |


**Figure 3.** Project area map

# 6 TOPOGRAPHIC DATA

## 6.1 Field Survey

Stillwater staff conducted field surveys using a total station and differential GPS. The primary goals of the field effort were to: (1) survey cross sections spaced approximately every 200 feet along the channel thalweg to be used for hydraulic modeling; (2) obtain additional topographic data in areas where potential habitat enhancement activities are proposed; and (3) survey existing features (e.g., buildings, trees, roads, and fences). A survey grade GPS unit (approximately 0.03 feet horizontal accuracy and 0.05 feet vertical accuracy) was used to establish survey control points. These control points were used to orient the surveys and relate them to a projected coordinate system so that they could be combined with existing Light Detecting and Ranging (LiDAR) topographic data. All elevations and horizontal positions shown in the plans use the local coordinate system based on these control points.

## 6.2 Merging Field and LiDAR Data

The field survey data was merged with 2006 LiDAR data from U. S. Geological Survey: Alameda County LiDAR project. The first step in merging the topographic data sets was to overlay the new field data on the LiDAR DEMs in AutoCAD Civil3D (CAD) to check for general consistency between the two datasets. Once consistency was confirmed, new ground surfaces were created based on the field-surveyed topography and combined with the LiDAR DEMs to create a new existing ground surface DEM for each project reach. Because the extent of the topo survey was limited to the areas described above, constructing a merged terrain model from the available LiDAR and topo survey data required interpolation and interpretation of ground surface elevations in some areas lacking data and/or resolution. Due to the limited accuracy of the LiDAR data especially in the near-channel portion of the project area, it was used only to provide general topographic context and approximate elevations for areas not characterized with field-based topographic data. The extent of the area where field-based topographic data was collected is shown on Sheet 2 of the Design Plans (Appendix B)

# 7 HYDROLOGIC AND HYDRAULIC ANALYSIS

## 7.1 Existing Hydrologic Studies Summary

As part of the Stillwater reviewed two previous drainage analysis studies of Niles Canyon Quarry conducted by Ruggeri-Jensen-Azar (RJA) in December of 2011 to assess runoff volumes, drainage capacities, and other hydrological parameters pertinent to removal of all existing culverts and restoration. RJA delineated five sub-basins in Niles Canyon Quarry: Upper Basin (48.3 ac), Northeast Basin (43.2 ac), Mid Basin (41 ac), Quarry Basin (33.6 ac), and East Basin (7.1 ac). The first four drain to Detention Basin 7 while the East Basin contributes overland flow to Culvert #9 downstream of the basin.

The cumulated runoff of the sub-basins to Detention Basin 7 was determined to be 158 cfs with additional runoff from this east basin area of 6.6 cfs. It was concluded that Culvert #9 would have an adequate capacity of 127 cfs to convey 100-year peak flow of the drainage (RJA, 2011) for the existing routing scheme.

In response to SMARA review an additional hydrological assessment was conducted by EMKO Environmental, Inc. in 2016 to address peak runoff associated with 20-year, 1-hour storm events as per requirements to evaluate the largest discharge value. EMKO concluded that the 20-year, 1-hour storm event discharge would be 88.8 cfs and is a conservative over-estimate due to the assumption that the peak runoff from each sub-basin will reach the downslope edge of the site at the same time (EMKO, 2016).

Since the peak runoff from the 20-year, 1-hour storm event (88 cfs) is substantially less than that from the 100-year, 24-hour storm event, (158 cfs) the storm water management recommendations presented in the RJA study comply with the requirements of SMARA Section 3706(d).

## 7.2 Hydraulic Overview

To understand the flow dynamics that will act on the proposed instream features and to estimate flooding potential at the project site, flow hydraulics were modeled using the U.S. Army Corps of Engineers' (USACE) *Hydrologic Engineering Center's River Analysis System (*HEC-RAS). HEC-RAS is a one-dimensional hydraulic model that is widely used for floodplain mapping and estimating general flow characteristics. This one-dimensional model assumes uniform flow direction and constant velocity distribution within the channel and floodplain portion of each cross section. Flow is modeled based on topography at a channel cross section without considering the effects of channel topography between cross sections. Therefore, it is important that these limitations are closely considered during hydraulic model setup, calibration, and application.

## 7.3 Discharges

Discharges used in the Niles Canyon Quarry hydraulic model are listed in the bottom row of Table 1. These flows have been taken from the previous hydrologic reports previously mentioned listed in the top two rows of the table.

**Table 2.** Flood frequency discharge estimates for the Niles Canyon Quarry Project Reach.

| Discharge location and description: | 100-yr discharge (CFS) | 20-yr discharge (CFS) |
|---|---|---|
| RJA Ruggeri-Jensen-Azar (166.1 sq mi) | 158 | |
| EMKO (xx sq mi) | | 88.8 |
| **Hydraulic Model Discharges** | **158** | |

## 7.4 Hydraulic Modeling

### 7.4.1 Proposed conditions hydraulic modeling

Existing conditions topography used for the HEC-RAS model was primarily taken from the new topographic data collected by Stillwater Sciences in October 2017 that included the Niles Canyon Quarry channel within the primary project reaches and two bridges. This new survey data was combined with LiDAR as previously described. Plan view locations of all HEC-RAS cross-sections are shown on Figure 5.

Cross-sections of the channel were cut from the Triangular Irregular Network (TIN) surface in AutoCAD and exported directly to HEC-RAS in order to create the hydraulic model. Initially, the Manning's n roughness values used in HEC-RAS were 0.5 for the channel, based on the HEC-RAS Reference Manual recommendations for a "steep, non-vegetated channel, with step banks with a channel bottom composed of cobbles and large boulders"; and 0.60 for all banks and floodplains based on a conservative value for "light brush and trees in summer". Flow was modeled in a subcritical regime with a known water surface depth downstream boundary condition at basin full for all flow stages.

### 7.4.2 Proposed conditions hydraulic model results

The proposed average channel stream velocity and mean total shear value results from HEC-RAS for 100-year flows are shown on Table 3. The proposed conditions WSEs and floodplain extents for the 100-year storm event is shown on Figure 4 and Figure 5 respectively. A full tabulation of hydraulic model outputs is included in Appendix B describing flow velocity and shear forces throughout the project reach.

**Table 3.** HEC-RAS model outputs for average channel velocity and shear for the modeled project reach.

| Flow Metrics | Average existing total velocity (feet per second) | Average existing total shear (pounds per square foot) |
|---|---|---|
| 100-year | 4.8 | 1.7 |

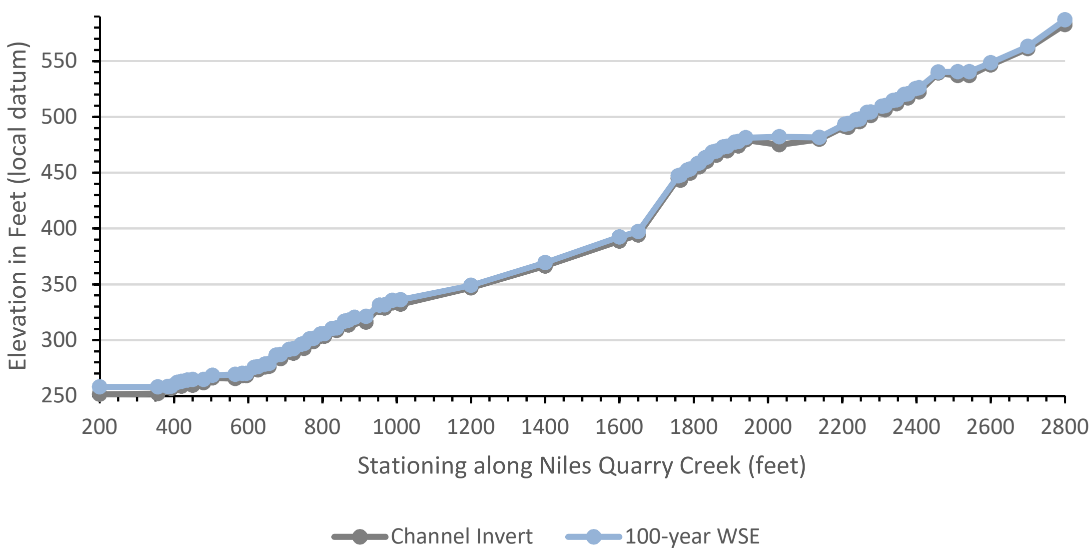



**Figure 4.** Modeled proposed conditions 100-year water surface elevation in the project reach

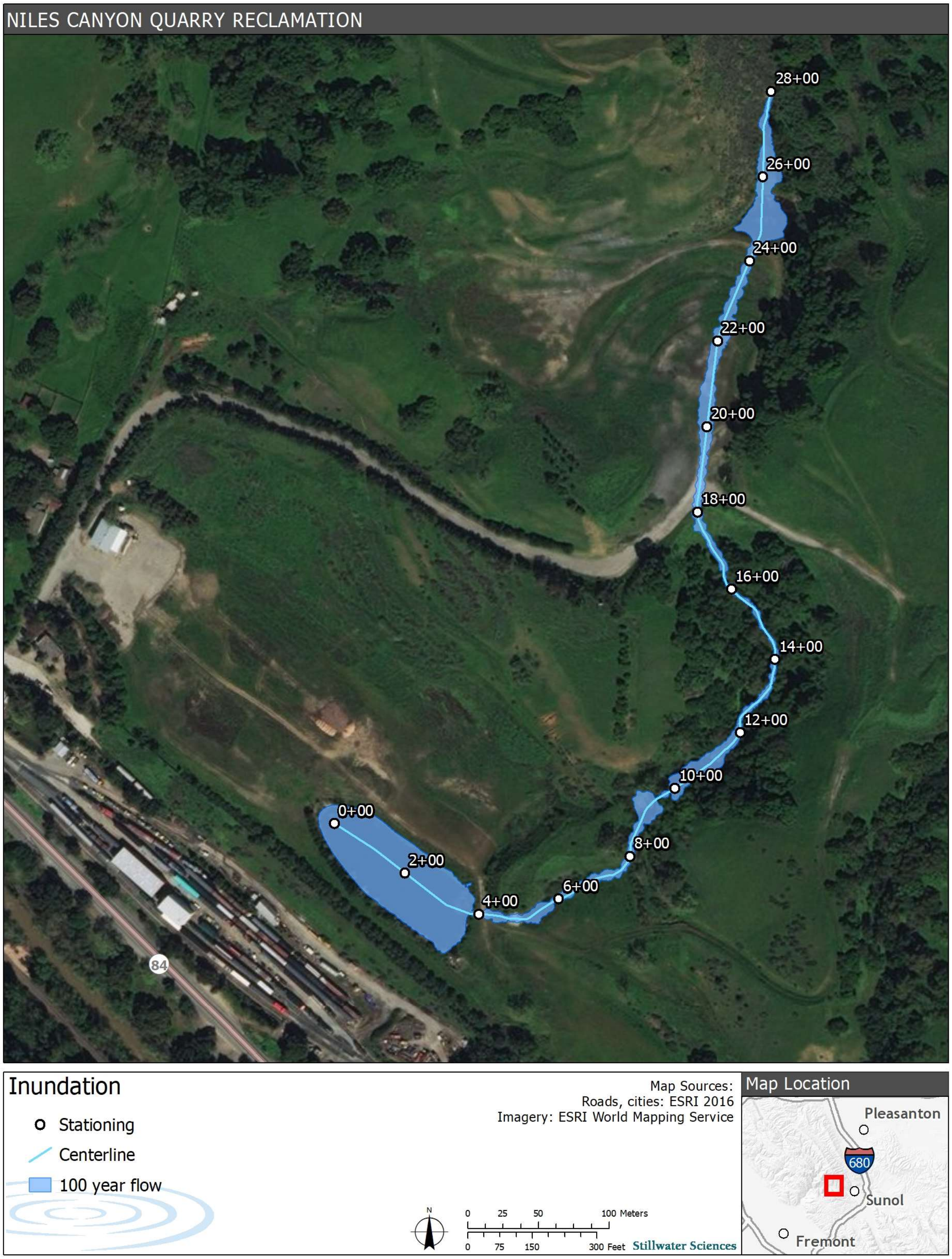



**Figure 5.** 100-year flow modeled water surface elevations within the project reach.

# 8 IMPLEMENTATION

## 8.1 Proposed Features

During the project design process and TAC field meeting, the majority of the project design team and TAC members were in general consensus regarding proposed project features for stream reaches upstream and downstream of the natural channel reach. For these reaches rock and boulder structures are proposed that will provide the following instream benefits:

1. **CRLF Habitat** –During construction detention Basin 7 would be dewatered for a duration during construction activities to reduce bullfrog habitation adjacent to the identified CRLF habitat locations at Basins 4-6. In addition, thinning of wetland plants in Basin 1 would increase habitat suitability for CRLF by improving water quality impaired from excess organic debris.
2. **Channel Stabilization** –Channel stability is a concern throughout the project area, especially in the Culvert 2 restoration area. Structures in these key locations will be designed to protect the channel and banks from erosion by placing rock ramps and plunge pools at approximately 30-foot increments. The typical structure configuration is depicted in the design plans in Appendix A.

A key consideration in the design of these proposed habitat enhancement and bank stabilization features is promote long-term stability and durability to reduce the potential risk of failure and damage to downstream infrastructure. In addition to the issues associated with culverts, the seasonal channel and surrounding landscape in the lower portion of the site have been heavily disturbed. Based on field observations and review of the hydrologic data, there is no “partial fix” design solution that we feel comfortable proposing or supporting. An engineered restoration design is needed to stabilize the channel for the long-term, by returning runoff flow paths to more natural alignments and constructing a new channel with bioengineering and rock armor.

## 8.2 Changing Site Conditions

Due to the dynamic nature of instream projects, significant changes to the project site could occur between the date that design plans are finalized and construction. To address these potential changes, it is strongly recommended that the engineer and regulatory agency staff is closely involved in the final construction planning process including a site visit to determine if site conditions have changed since the Design Plans were finalized. If changes did occur at the site, modifications to the design may be necessary and should be completed by the engineer with input from the client, regulatory agencies, the landowner, and Alameda County.

## 8.3 Post-Construction Monitoring and Maintenance

It is recommended that post-construction monitoring and/or maintenance is conducted in relation to disturbed areas.

### 8.3.1 Implementation effectiveness monitoring

Following project completion, As-built Design Plans should be created so that the actual constructed project can be compared to the proposed project. In addition, restoration effectiveness monitoring should be conducted using the appropriate protocols. The purpose of these activities is to ensure that specific restoration goals were met as described in the Design Plans.

### 8.3.2 Riparian plant maintenance

It is recommended that a "3-5 year plant maintenance and replacement" clause is included in the contract with the landscape contractor who is hired to perform the project revegetation, as described in the project specifications. Three to five years of plant survival maintenance and monitoring is likely to be required as a part of project permitting.

# 9 LITERATURE CITED

EMKO Environmental. 2016. Results of SMARA Surface Runoff Evaluation Niles Canyon Quarry. EMKO Environmental, Inc. Mountain View, CA.

Lienkaemper, J.J., McFarland, F.S., Simpson, R.W., Bilham R.G., Ponce, D.A., Boatwright, J.J., Caskey, S.J. 2012. Long-Term Creep Rates on the Hayward Fault: Evidence for Controls on the Size and Frequency of Large Earthquakes. Bulletin of the Seismological Society of America, Vol 102, No. 1, pp. 31-34.

RJA (Ruggeri-Jensen-Azar). 2011. Niles Canyon Quarry Drainage Analysis. Ruggeri-Jensen-Azar. Rocklin, CA.

R.W. Graymer, D.L. Jones, and E.E. Brabb. 1992. Preliminary geologic map emphasizing bedrock formations in Alameda County, California: A digital database. Scale 1:75,000. Available at https://ngmdb.usgs.gov/Prodesc/proddesc_22969.htm [Accessed June, 2018].\

Scholz, C.H., Ryosuke, A., Shaw, B.E. 2010. The mechanics of first order splay faulting: The strike-slip case. Journal of Structural Geology, Vol 32, 1, pp.118-126.

Stillwater Sciences. 2016. Niles Canyon Quarry-Existing Conditions, Hydrology Peer Review, and Conceptual Design Recommendations. Technical Memorandum. Prepared by Stillwater Sciences, Berkeley, California for Benchmark Resources.

USACE (United States Army Corps of Engineers). 2015. HEC-RAS 5.0 River Analysis System.

Wiegers, M.O. 2004. Evaluation for earthquake induced landslide hazard in the Niles 7.5-Minute Quadrangle, Alameda County, California: California Geological Survey Hazard Zone Report 098, Section 2, pp. 29-50.

# Appendices

# Appendix A

# 30% Design Plans

# NILES CANYON QUARRY RECLAMATION
# 30% DESIGN
## ALAMEDA COUNTY, CA

### GENERAL NOTES, TERMS, & CONDITIONS:

1. **DESIGN INTENT.** THESE DRAWINGS REPRESENT THE GENERAL DESIGN INTENT TO BE IMPLEMENTED AND CONTRACTOR IS RESPONSIBLE FOR ALL ITEMS SHOWN ON THESE PLANS. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING THE PROJECT MANAGER FOR ANY CLARIFICATIONS OR FURTHER DETAILS NECESSARY TO ACCOMMODATE ACTUAL SITE CONDITIONS. ANY DEVIATION FROM THESE PLANS WITHOUT THE COUNTY'S REPRESENTATIVE APPROVAL ARE AT THE CONTRACTOR'S OWN RISK AND EXPENSE. NOTIFY PROJECT MANAGER IMMEDIATELY OF ANY UNEXPECTED AND CHANGED CONDITIONS, SAFETY HAZARDS, AND ENVIRONMENTAL PROBLEMS ENCOUNTERED.

2. **JOB SITE CONDITIONS AND CONTRACTOR RESPONSIBILITY.** CONTRACTOR SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR SITE CONDITIONS DURING THE COURSE OF THE CONSTRUCTION OF THIS PROJECT, INCLUDING THE SAFETY OF ALL PERSONS AND PROPERTY, AND ALL ENVIRONMENTAL PROTECTION ELEMENTS, WHETHER SHOWN ON THESE DRAWINGS OR NOT. CONTRACTOR SHALL FOLLOW ALL APPLICABLE CONSTRUCTION AND SAFETY REGULATIONS. THESE REQUIREMENTS SHALL APPLY CONTINUOUSLY AND WILL NOT BE LIMITED TO NORMAL WORKING HOURS. THE CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE COUNTY OR THE ENGINEER (STILLWATER SCIENCES) HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPT FROM LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE MRC OR ENGINEER.

3. **DAMAGE.** CONTRACTOR SHALL EXERCISE CARE TO AVOID DAMAGE TO EXISTING PUBLIC AND PRIVATE PROPERTY, INCLUDING NATIVE TREES AND SHRUBS, AND OTHER PROPERTY IMPROVEMENTS. IF CONTRACTOR CAUSES DAMAGES TO SUCH ITEMS, HE SHALL BE RESPONSIBLE FOR REPAIR OR REPLACEMENT IN LIKE NUMBER, KIND, CONDITION, AND SIZE. ANY SUCH COST MAY BE DEDUCTED BY OWNER FROM MONIES DUE CONTRACTOR UNDER THIS CONTRACT.

4. **LIMITS OF WORK, ACCESS, STAGING AND MOBILIZATION AREAS.** THE APPROXIMATE LIMITS OF WORK ARE SHOWN ON THE DRAWINGS. EXACT LIMITS OF WORK, POINTS OF INGRESS-EGRESS, CREEK CHANNEL ACCESS, MOBILIZATION, STAGING, AND WORK AREAS WILL BE FLAGGED IN THE FIELD BY THE ENGINEER. EQUIPMENT MAINTENANCE AND FUELING MUST OCCUR OUTSIDE OF THE CHANNEL AREA AS DESCRIBED IN THE ENVIRONMENTAL PERMITS FOR THE PROJECT.

5. **WORK IN STREAM CHANNELS AND STREAM DIVERSIONS.** ALL WORK INVOLVING USE OF HEAVY EQUIPMENT MUST BE COMPLETED FROM TOP OF BANK UNLESS A SPECIFIC POINT OF CREEK CHANNEL ACCESS HAS BEEN APPROVED AND IS SHOWN ON THE PLANS, AND THEN ONLY IN NON-LIVE WATER AS DEFINED BY CDFW. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING THE DEWATERING PLAN DEPICTED IN THIS PLAN SET.

5.1. CONTRACTOR IS RESPONSIBLE FOR REMOVAL AND DISPOSING OF ALL WATER CONTROL STRUCTURES AND EQUIPMENT.

5.2. THE CONTRACTOR SHALL FURNISH, INSTALL, AND OPERATE ALL OTHER NECESSARY MACHINERY, APPLIANCES, AND EQUIPMENT TO DIVERT FLOWING WATER AROUND WORK AREAS, AND TO KEEP EXCAVATIONS AND TRENCHES REASONABLY FREE FROM WATER DURING CONSTRUCTION. CONTRACTOR SHALL DISPOSE OF THE WATER SO AS NOT TO CAUSE INJURY TO PUBLIC OR PRIVATE PROPERTY, OR TO CAUSE A NUISANCE OR A MENACE TO THE PUBLIC, OR TO DEGRADE WATER QUALITY. HE SHALL AT ALL TIMES HAVE ON HAND SUFFICIENT PUMPING EQUIPMENT AND MACHINERY IN GOOD WORKING CONDITION FOR ALL ORDINARY EMERGENCIES AND SHALL HAVE AVAILABLE AT ALL TIMES COMPETENT MECHANICS FOR THE OPERATION OF ALL PUMPING EQUIPMENT. IF THE CONTRACTOR CHOOSES TO USE A PUMPING SYSTEM FOR ANY PORTION OF THE WATER CONTROL WORK, HE SHALL HAVE ADEQUATE BACK-UP EQUIPMENT TO INSURE THE CONTINUOUS OPERATION OF THE EQUIPMENT.

5.3. THE CONTRACTOR SHALL AT ALL TIMES PROVIDE FOR THE ADEQUATE RETURN FLOW OF DIVERSIONS BELOW THE PROJECT SITE. THE CONTRACTOR MAY TEMPORARILY DIVERT WATER DURING CONSTRUCTION, AS OUTLINED IN THE APPROVED STREAM DIVERSION AND WATER CONTROL PLAN. THIS MAY INCLUDE FOR INSTANCE, VISQUEEN AND STRAW BALE OR SAND BAG DIVERSION DIKES AND PIPING SYSTEMS. RETURN FLOW SHALL BE FILTERED THROUGH FILTER CLOTH, STRAW BALES AND/OR THROUGH A SERIES OF STILLING BASINS WHEN REQUIRED.

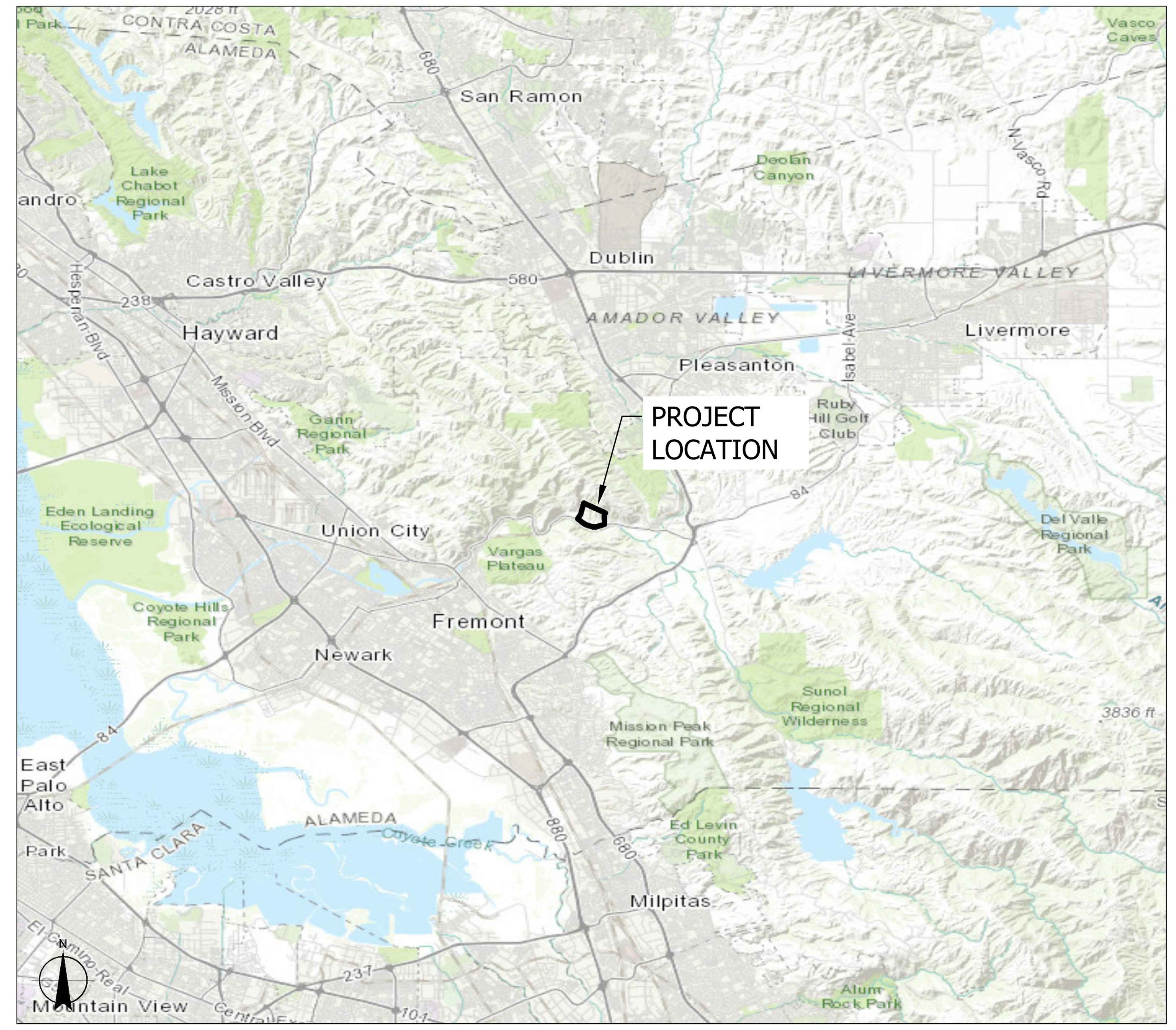
5.4. TURBID DEWATERING FLOWS SHALL BE PUMPED INTO A HOLDING FACILITY OR SPRAYED OVER A LARGE AREA OUTSIDE THE STREAM CHANNEL TO ALLOW FOR NATURAL FILTRATION OF SEDIMENTS. AT NO TIME SHALL TURBID WATER FROM THE HOLDING FACILITY BE ALLOWED BACK INTO THE STREAM CHANNEL UNTIL WATER IS CLEAR OF SILT.

5.5. ALL HEAVY EQUIPMENT MUST HAVE A SUPPLY OF SORBENT PADS AVAILABLE TO CLEAN-UP GREASE, OIL, OR FUEL THAT DRIPS OR SPILLS INTO THE STREAM CHANNEL. SORBENT BOOMS MUST BE PLACED DOWNSTREAM FROM LOCATIONS WHERE MACHINERY IS EXPECTED TO CROSS THE STREAM CHANNEL. USED PADS AND BOOMS ARE TO BE DISPOSED OF PROPERLY AT CONTRACTOR'S EXPENSE.

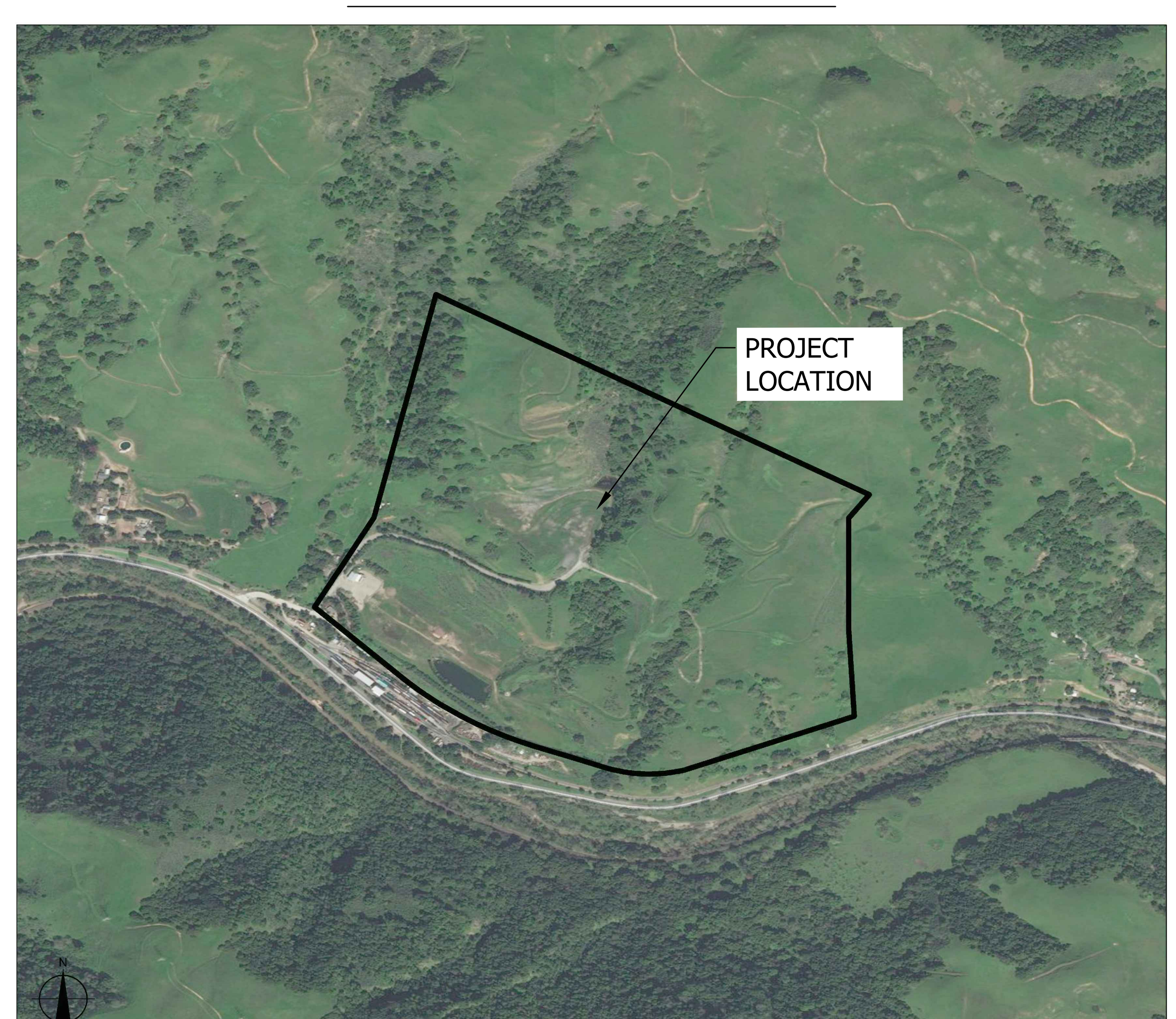
6. **EARTHWORK QUANTITIES.** CONTRACTOR IS RESPONSIBLE FOR ALL EARTHWORK, INCLUDING GRADING, PROVISION AND PLACEMENT OF ROCK MEETING SIZE LIMITS, AS SHOWN ON DRAWINGS, AND DISPOSAL OF ALL EXCESS SOIL AND RUBBLE. EARTHWORK QUANTITIES, INCLUDING GRADING, PLACED ROCK RIP-RAP AND OFF-HAUL QUANTITY ESTIMATES PROVIDED BY THE ENGINEER ARE ESTIMATES ONLY. COUNTY AND ENGINEER DO NOT, EXPRESSLY OR OTHERWISE BY IMPLICATION, EXTEND ANY WARRANTY TO EARTHWORK CALCULATIONS

7. **THE** FOLLOWING PERMITS ARE REQUIRED FOR THIS PROJECT, THE CONTRACTOR SHALL BE GIVEN COPIES OF ALL THE PERMITS, SHALL BECOME FAMILIAR WITH THE PERMIT REQUIREMENTS, AND SHALL BE RESPONSIBLE FOR ADHERENCE TO AND CONFORMANCE WITH ALL PERMIT CONDITIONS.
   SEC. 404 PERMIT ISSUED BY US ARMY CORPS OF ENGINEERS
   1601/1603 STREAMBED ALTERATION AGREEMENT ISSUED BY CA DEPT. FISH & WILDLIFE
   WATER QUALITY CERTIFICATION, BY SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD US
   FISH AND WILDLIFE SERVICE CONSULTATION AND IMPLEMENTATION RECOMMENDATIONS NATIONAL
   MARINE FISHERIES SERVICE CONSULTATION AND IMPLEMENTATION RECOMMENDATIONS.
8. AREAS TO BE GRADED SHALL BE CLEARED OF ALL VEGETATION INCLUDING ROOTS AND OTHER UNSUITABLE MATERIAL FOR A STRUCTURAL FILL, THEN SCARIFIED TO A DEPTH OF 6 INCHES PRIOR TO PLACING OF ANY FILL.
9. AREAS WITH EXISTING SLOPES WHICH ARE TO RECEIVE FILL MATERIAL SHALL BE KEYED AND BENCHED.
10. FILL MATERIAL SHALL BE SPREAD IN LIFTS NOT EXCEEDING 6 INCHES IN COMPACTED THICKNESS, MOISTENED OR DRIED AS NECESSARY TO NEAR OPTIMUM MOISTURE CONTENT AND COMPACTED BY AN APPROVED METHOD. FILL MATERIAL SHALL BE COMPACTED TO A MINIMUM OF 90% MAXIMUM DENSITY AS DETERMINED BY 1957 ASTM D - 1557 - 91 MODIFIED PROCTOR (AASHO) TEST OR SIMILAR APPROVED METHODS.
11. CUT SLOPES SHALL NOT EXCEED A GRADE OF 1.5 HORIZONTAL TO 1 VERTICAL. FILL AND COMBINATION FILL AND CUT SLOPES SHALL NOT EXCEED 2 HORIZONTAL TO 1 VERTICAL. SLOPES OVER THREE FEET IN VERTICAL HEIGHT SHALL BE PLANTED WITH APPROVED PERENNIAL OR TREATED WITH EQUALLY APPROVED EROSION CONTROL MEASURES PRIOR TO FINAL INSPECTION.
12. BEST MANAGEMENT PRACTICES FOR CONSTRUCTION ACTIVITIES: ERODED SEDIMENTS AND OTHER POLLUTANTS MUST BE RETAINED ONSITE AND MAY NOT BE TRANSPORTED FROM THE SITE VIA SHEET FLOW, SWALES, AREA DRAINS, NATURAL DRAINAGE COURSES, OR WIND. STOCKPILES OF EARTH AND OTHER CONSTRUCTION RELATED MATERIALS MUST BE PROTECTED FROM BEING TRANSPORTED FROM THE SITE BY THE FORCES OF WIND OR WATER. FUELS, OILS, SOLVENTS, AND OTHER TOXIC MATERIALS MUST BE STORED IN ACCORDANCE WITH THEIR LISTING AND ARE NOT TO CONTAMINATE THE SOIL AND SURFACE WATERS. ALL APPROVED STORAGE CONTAINERS ARE TO BE PROTECTED FROM THE WEATHER. SPILLS MAY NOT BE WASHED INTO THE DRAINAGE SYSTEM. EXCESS OR WASTE CONCRETE MAY NOT BE WASHED INTO PUBLIC WAY OR ANY OTHER DRAINAGE SYSTEM. PROVISIONS MUST BE MADE TO RETAIN CONCRETE WASTES ON SITE UNTIL THEY CAN BE DISPOSED AS A SOLID WASTE. TRASH AND CONSTRUCTION RELATED SOLID WASTE MUST BE DEPOSITED INTO A COVERED WASTE RECEPTACLE TO PREVENT CONTAMINATION OF RAINWATER AND DISPERSAL BY WIND. SEDIMENTS AND OTHER MATERIAL MAY NOT BE TRACKED FROM TO THE SITE BY VEHICLE TRAFFIC.

### VICINITY MAP




### PROJECT LOCATION MAP




| Sheet List Table | |
|---|---|
| Sheet Number | Sheet Title |
| 1 | TITLE SHEET |
| 2 | EXISTING CONDITIONS |
| 3 | STAGING, DEMOLITION, ACCESS & SITE PROTECTION |
| 4 | EXISTING PLAN & PROFILE - STA. 0+00 TO 10+50 |
| 5 | EXISTING PLAN & PROFILE - STA. 10+50 TO 21+00 |
| 6 | EXISTING PLAN & PROFILE - STA. 21+00 TO END |
| 7 | PROPOSED SHEET INDEX OVERVIEW |
| 8 | LOWER CHANNEL - PLAN & PROFILE |
| 9 | LOWER CHANNEL - SECTIONS |
| 10 | MIDDLE CHANNEL - PLAN & PROFILE |
| 11 | MIDDLE CHANNEL - SECTIONS |
| 12 | UPPER CHANNEL - PLAN & PROFILE |
| 13 | BASIN 7 OUTFALL CHANNEL - PLAN, PROFILE & SECTIONS |
| 14 | ROAD GRADING - PLAN & SECTIONS |
| 15 | LOWER PAD FEATURES |
| 16 | UPPER CHANNEL FEATURES |
| 17 | EROSION CONTROL & PLANTING DETAILS |
| 18 | DETAILS |

### EARTHWORK ESTIMATES:

CUT: 18,000 CY

IMPORT:
750 CY 1-3 TON RIPRAP ROCK
250 CY ½-1 TON RIPRAP ROCK
100 CY ESM

FILL: 900 CY ON-SITE

BALANCED ON-SITE (SLOPE REPAIR AREAS BY OTHERS): 17,100 CY

### ABBREVIATIONS AND SYMBOLS:

(E) EXISTING

(E) PROPOSED

EXISTING TREE (SURVEYED)

EXISTING TREE (APPROXIMATE LOCATION)

3 / 8 — FIGURE # ON SHEET / SHEET #

NILES CANYON QUARRY RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA

Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705 P: (510) 848-8098

PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

REGISTERED PROFESSIONAL ENGINEER
No. 79688
9-30-20
EXPIRES
CIVIL
STATE OF CALIFORNIA

TITLE SHEET



IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE - ADJUST ACCORDINGLY

LAST SAVED: 11/16/2018 PLOT DATE: 11/16/2018 PLOT STYLE: ----


NILES CANYON QUARRY RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA

Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705 P: (510) 848-8098

PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

REGISTERED PROFESSIONAL ENGINEER JOEL MONSCHKE No. 79688 9-30-20 EXPIRES CIVIL STATE OF CALIFORNIA

OVERVIEW

SHEET 2 OF 19

IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE – ADJUST ACCORDINGLY

LAST SAVED: 11/16/2018 PLOT DATE: 11/16/2018 PLOT STYLE: ----

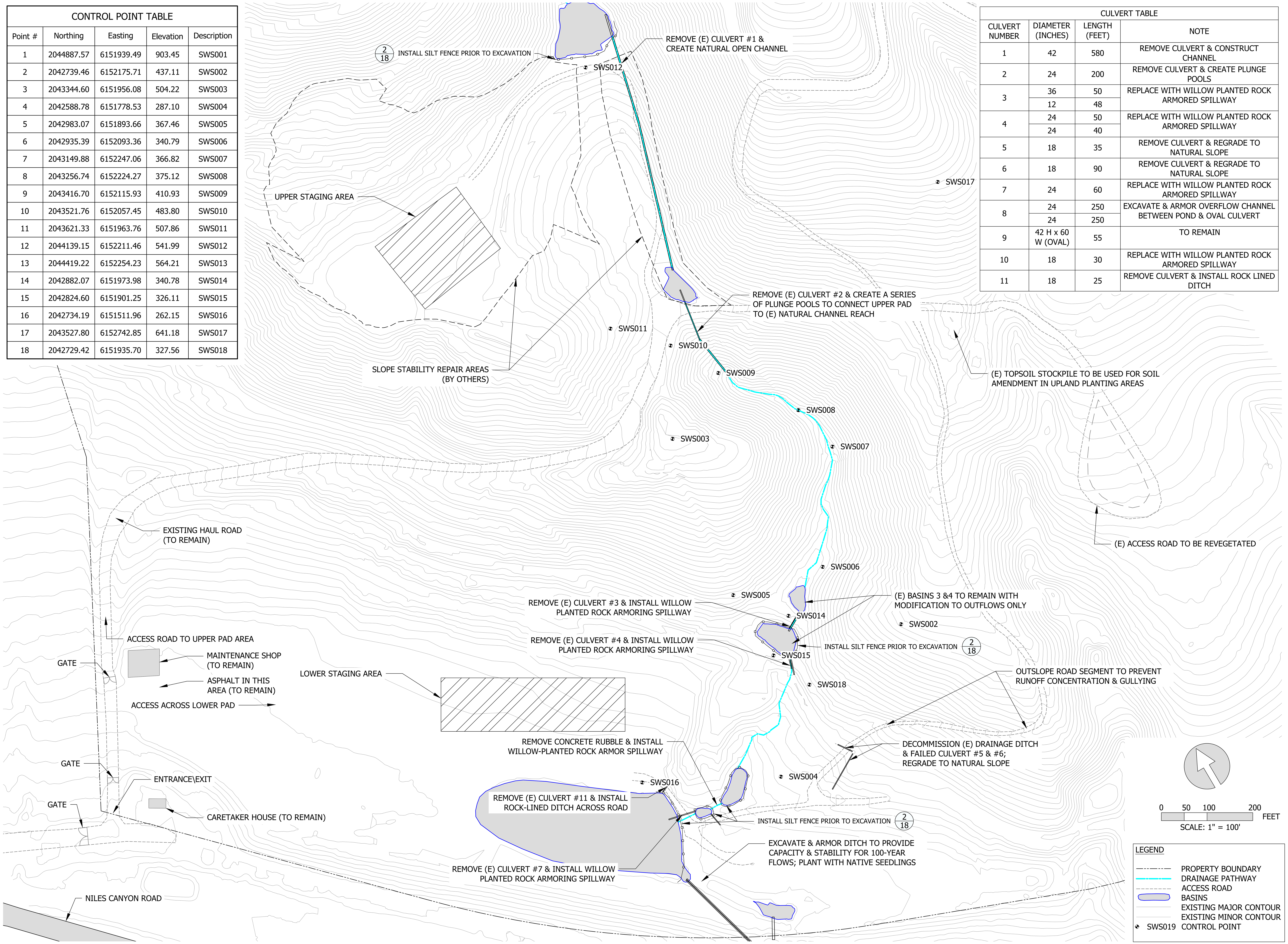
Z:\DATA\652.00_NILES_CANYON\ACAD\2_MODEL\652.00_EXISTING.DWG

CONTROL POINT TABLE

| Point # | Northing | Easting | Elevation | Description |
|---|---|---|---|---|
| 1 | 2044887.57 | 6151939.49 | 903.45 | SWS001 |
| 2 | 2042739.46 | 6152175.71 | 437.11 | SWS002 |
| 3 | 2043344.60 | 6151956.08 | 504.22 | SWS003 |
| 4 | 2042588.78 | 6151778.53 | 287.10 | SWS004 |
| 5 | 2042983.07 | 6151893.66 | 367.46 | SWS005 |
| 6 | 2042935.39 | 6152093.36 | 340.79 | SWS006 |
| 7 | 2043149.88 | 6152247.06 | 366.82 | SWS007 |
| 8 | 2043256.74 | 6152224.27 | 375.12 | SWS008 |
| 9 | 2043416.70 | 6152115.93 | 410.93 | SWS009 |
| 10 | 2043521.76 | 6152057.45 | 483.80 | SWS010 |
| 11 | 2043621.33 | 6151963.76 | 507.86 | SWS011 |
| 12 | 2044139.15 | 6152211.46 | 541.99 | SWS012 |
| 13 | 2044419.22 | 6152254.23 | 564.21 | SWS013 |
| 14 | 2042882.07 | 6151973.98 | 340.78 | SWS014 |
| 15 | 2042824.60 | 6151901.25 | 326.11 | SWS015 |
| 16 | 2042734.19 | 6151511.96 | 262.15 | SWS016 |
| 17 | 2043527.80 | 6152742.85 | 641.18 | SWS017 |
| 18 | 2042729.42 | 6151935.70 | 327.56 | SWS018 |

CULVERT TABLE

| CULVERT NUMBER | DIAMETER (INCHES) | LENGTH (FEET) | NOTE |
|---|---|---|---|
| 1 | 42 | 580 | REMOVE CULVERT & CONSTRUCT CHANNEL |
| 2 | 24 | 200 | REMOVE CULVERT & CREATE PLUNGE POOLS |
| 3 | 36 | 50 | REPLACE WITH WILLOW PLANTED ROCK ARMORED SPILLWAY |
| | 12 | 48 | |
| 4 | 24 | 50 | REPLACE WITH WILLOW PLANTED ROCK ARMORED SPILLWAY |
| | 24 | 40 | |
| 5 | 18 | 35 | REMOVE CULVERT & REGRADE TO NATURAL SLOPE |
| 6 | 18 | 90 | REMOVE CULVERT & REGRADE TO NATURAL SLOPE |
| 7 | 24 | 60 | REPLACE WITH WILLOW PLANTED ROCK ARMORED SPILLWAY |
| 8 | 24 | 250 | EXCAVATE & ARMOR OVERFLOW CHANNEL BETWEEN POND & OVAL CULVERT |
| | 24 | 250 | |
| 9 | 42 H x 60 W (OVAL) | 55 | TO REMAIN |
| 10 | 18 | 30 | REPLACE WITH WILLOW PLANTED ROCK ARMORED SPILLWAY |
| 11 | 18 | 25 | REMOVE CULVERT & INSTALL ROCK LINED DITCH |




# NILES CANYON QUARRY RECLAMATION
# 30% DESIGN

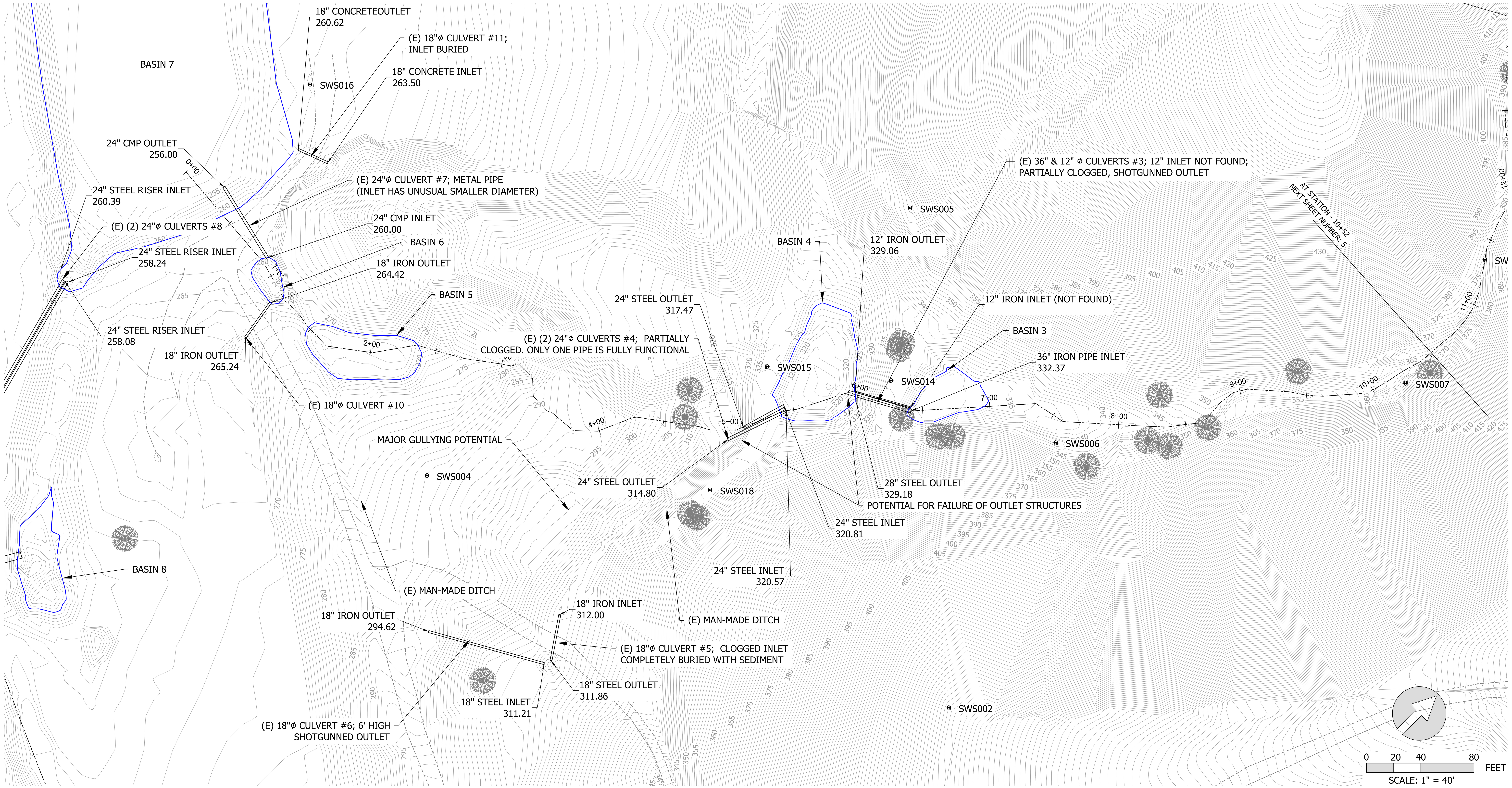
ALAMEDA COUNTY, CA


Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705
P: (510) 848-8098

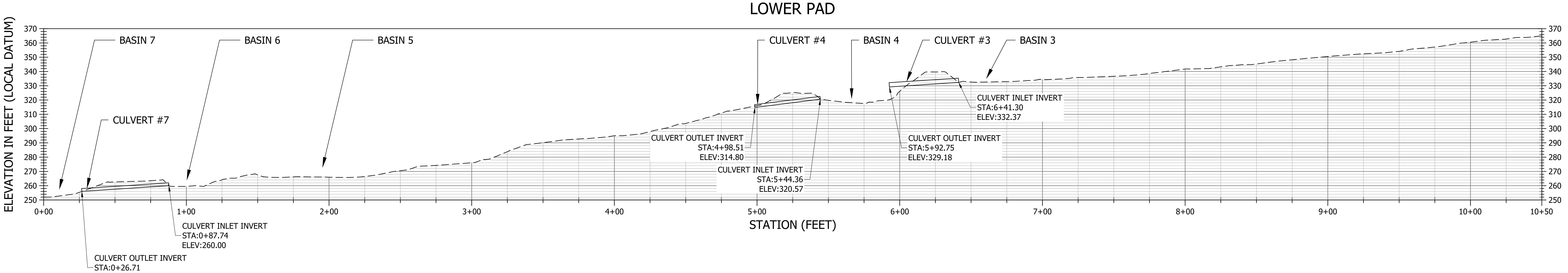

PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

## STAGING, DEMOLITION, ACCESS & SITE PROTECTION




## LOWER PAD




NILES CANYON QUARRY RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA

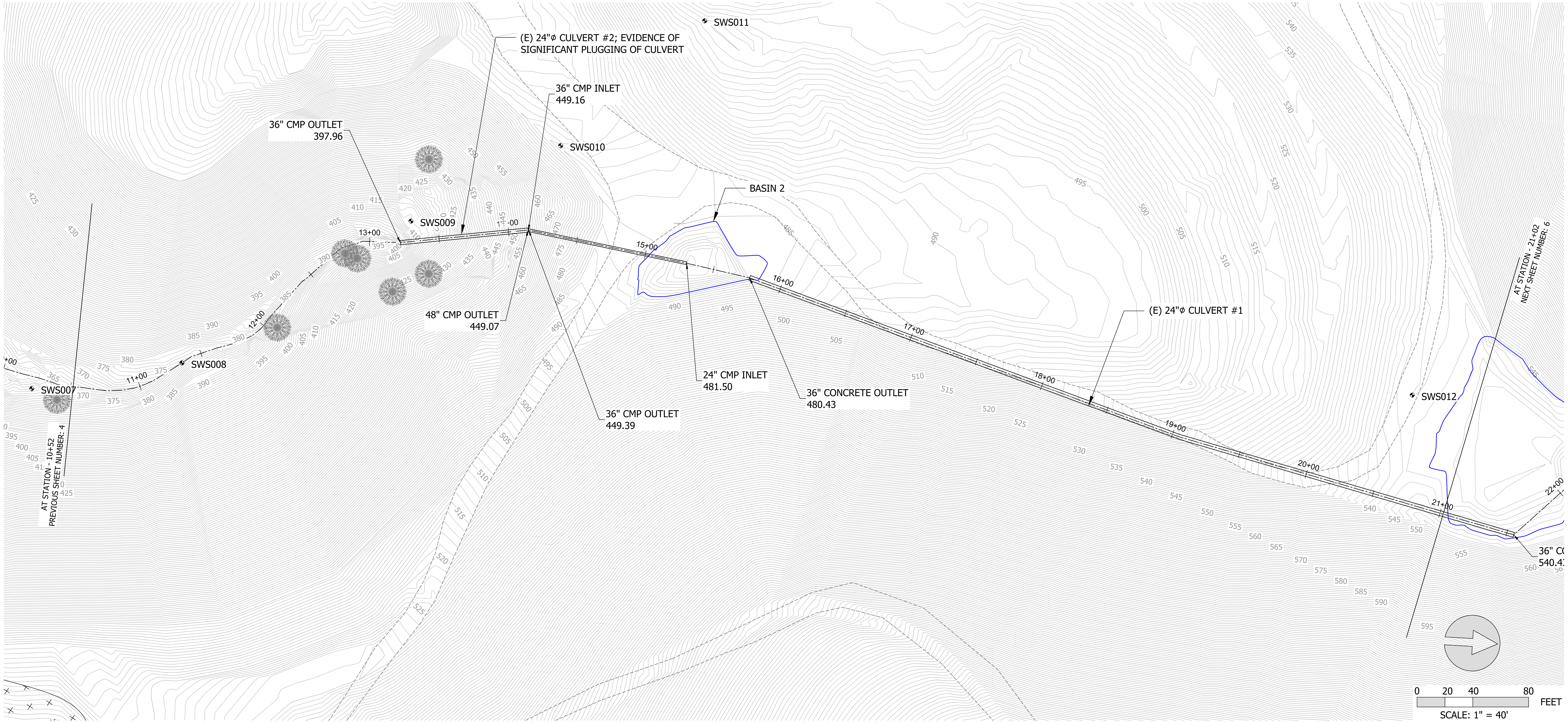
Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705 P: (510) 848-8098

PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

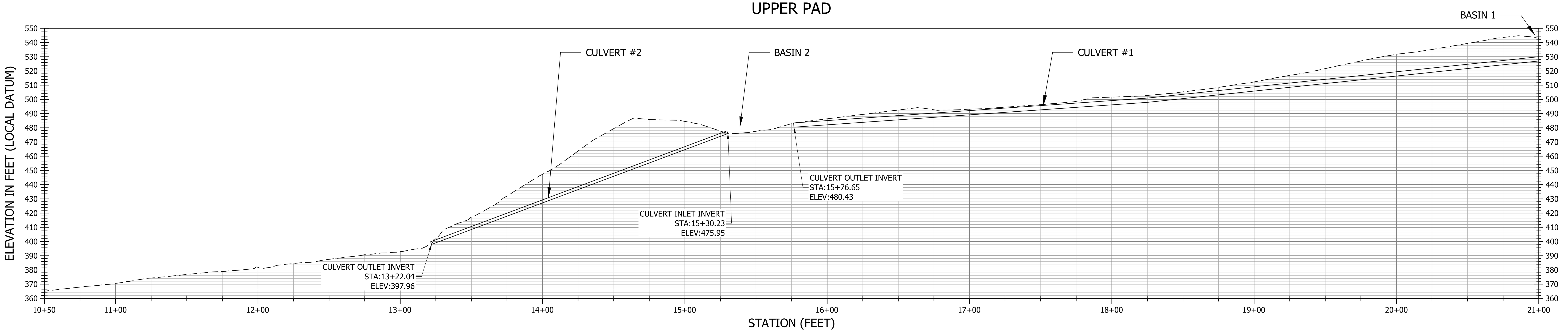
DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

EXISTING PLAN & PROFILE
STA. 0+00 TO 10+50

SHEET 4 OF 19




## UPPER PAD




NILES CANYON QUARRY RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA

Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705
P: (510) 848-8098

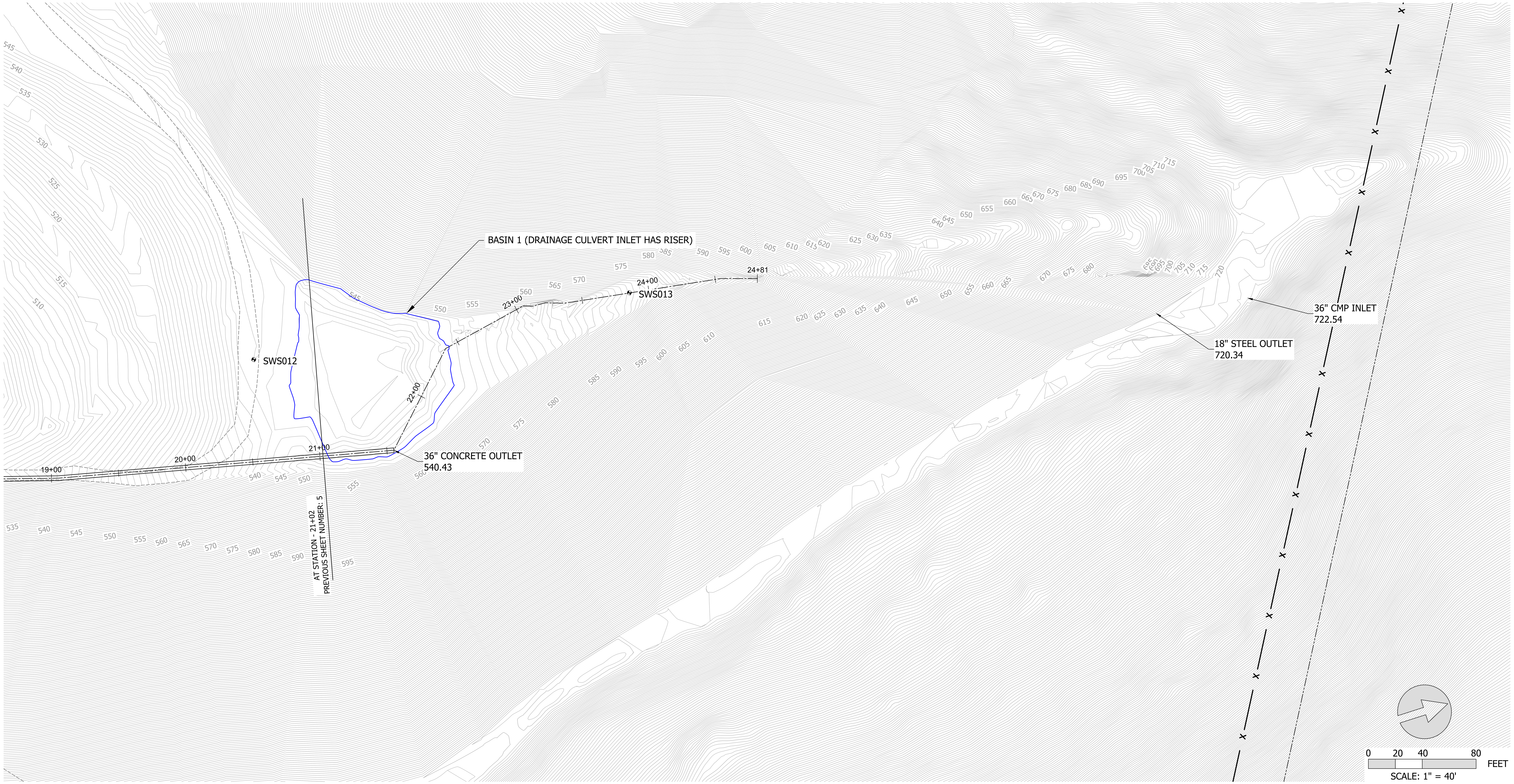
PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

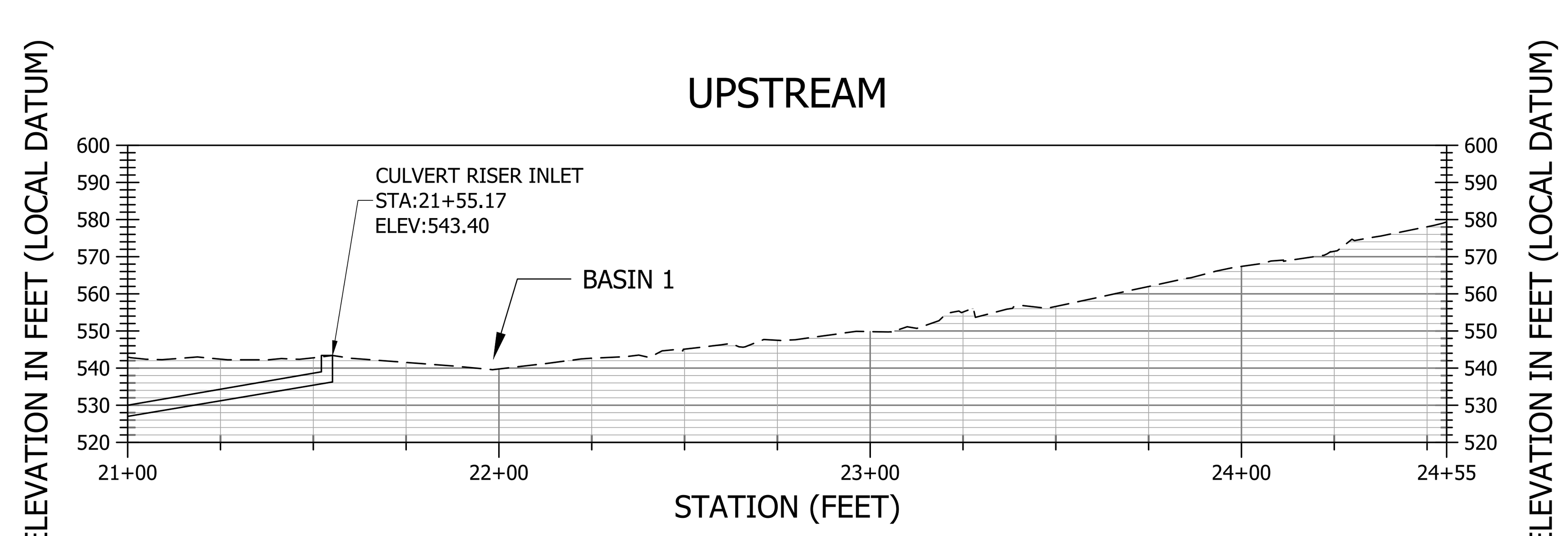
DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

REGISTERED PROFESSIONAL ENGINEER JOEL MONSCHKE No. 79688 9-30-20 EXPIRES CIVIL STATE OF CALIFORNIA

# EXISTING PLAN & PROFILE STA. 10+50 TO 21+00

SHEET 5 OF 19




NILES CANYON QUARRY RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA

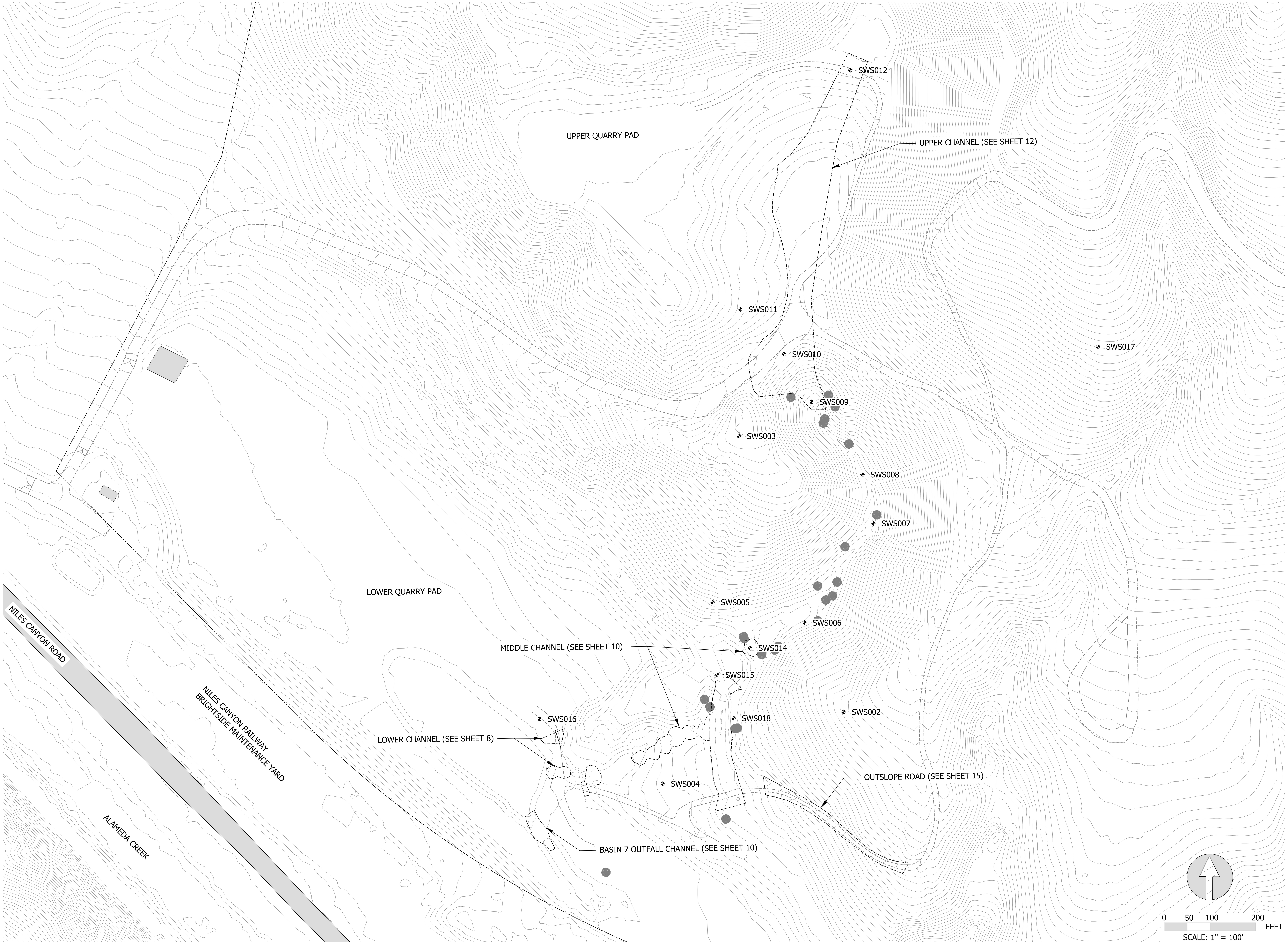

Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705
P: (510) 848-8098


PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

REGISTERED PROFESSIONAL ENGINEER JOEL MONSCHKE No. 79688 EXPIRES 9-30-20 CIVIL STATE OF CALIFORNIA

# EXISTING PLAN & PROFILE STA. 21+00 TO END




NILES CANYON QUARRY RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA

Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705
P: (510) 848-8098

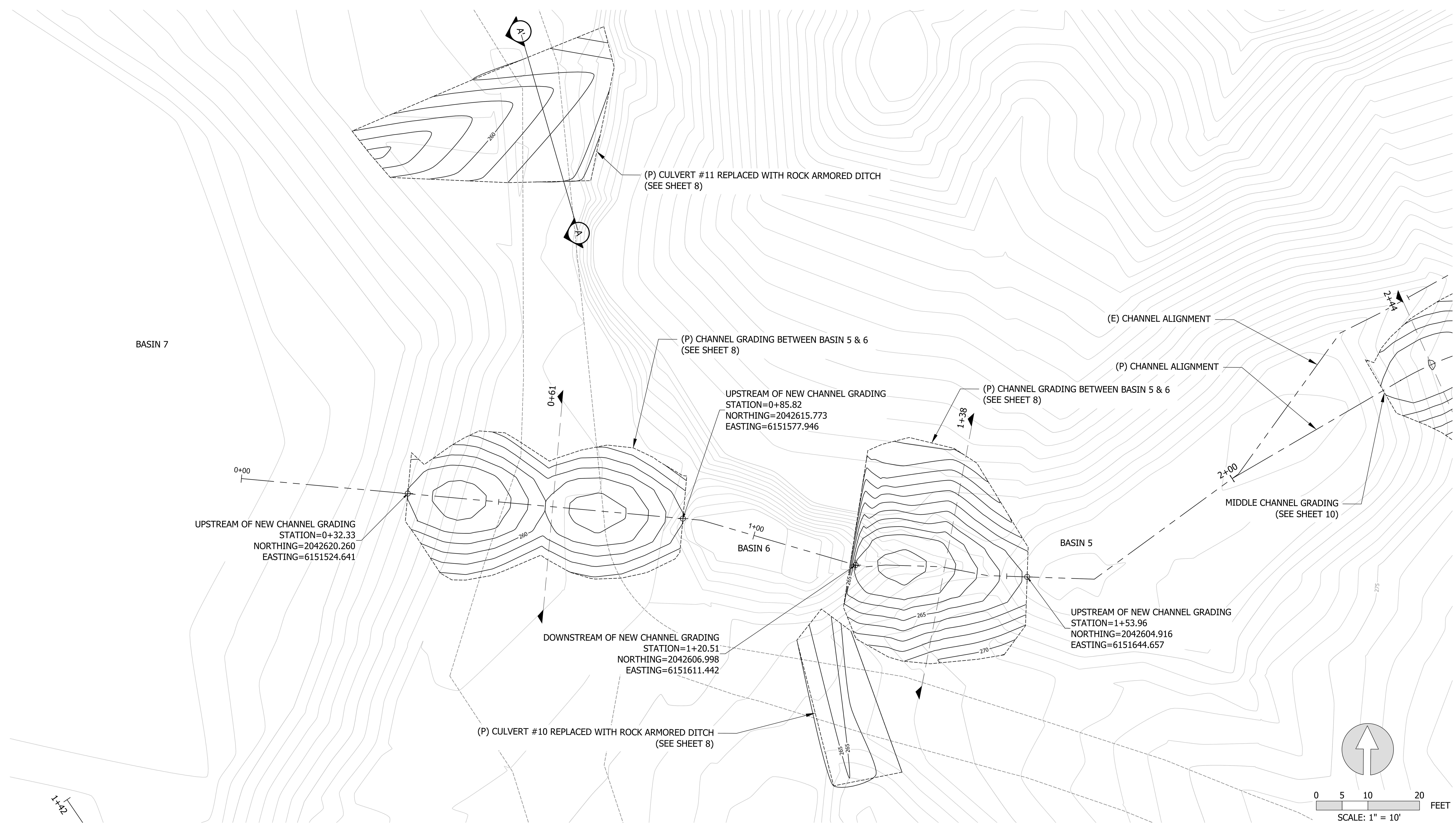
PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

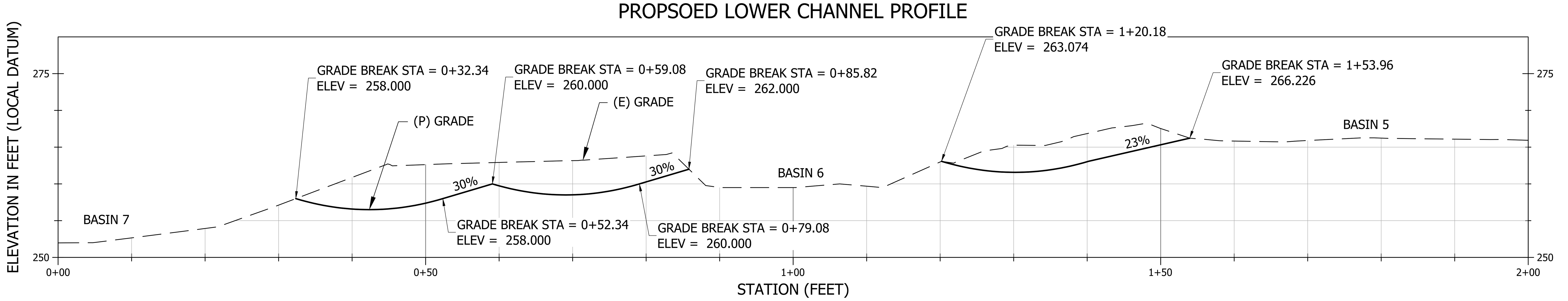
REGISTERED PROFESSIONAL ENGINEER JOEL MONSCHKE No. 79688 9-30-20 EXPIRES CIVIL STATE OF CALIFORNIA

PROPOSED SHEET INDEX OVERVIEW

SHEET 7 OF 19




PROPSOED LOWER CHANNEL PROFILE




NILES CANYON QUARRY RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA

Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705
P: (510) 848-8098

PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

REGISTERED PROFESSIONAL ENGINEER
JOEL MONSCHKE
No. 79688
9-30-20
EXPIRES
CIVIL
STATE OF CALIFORNIA

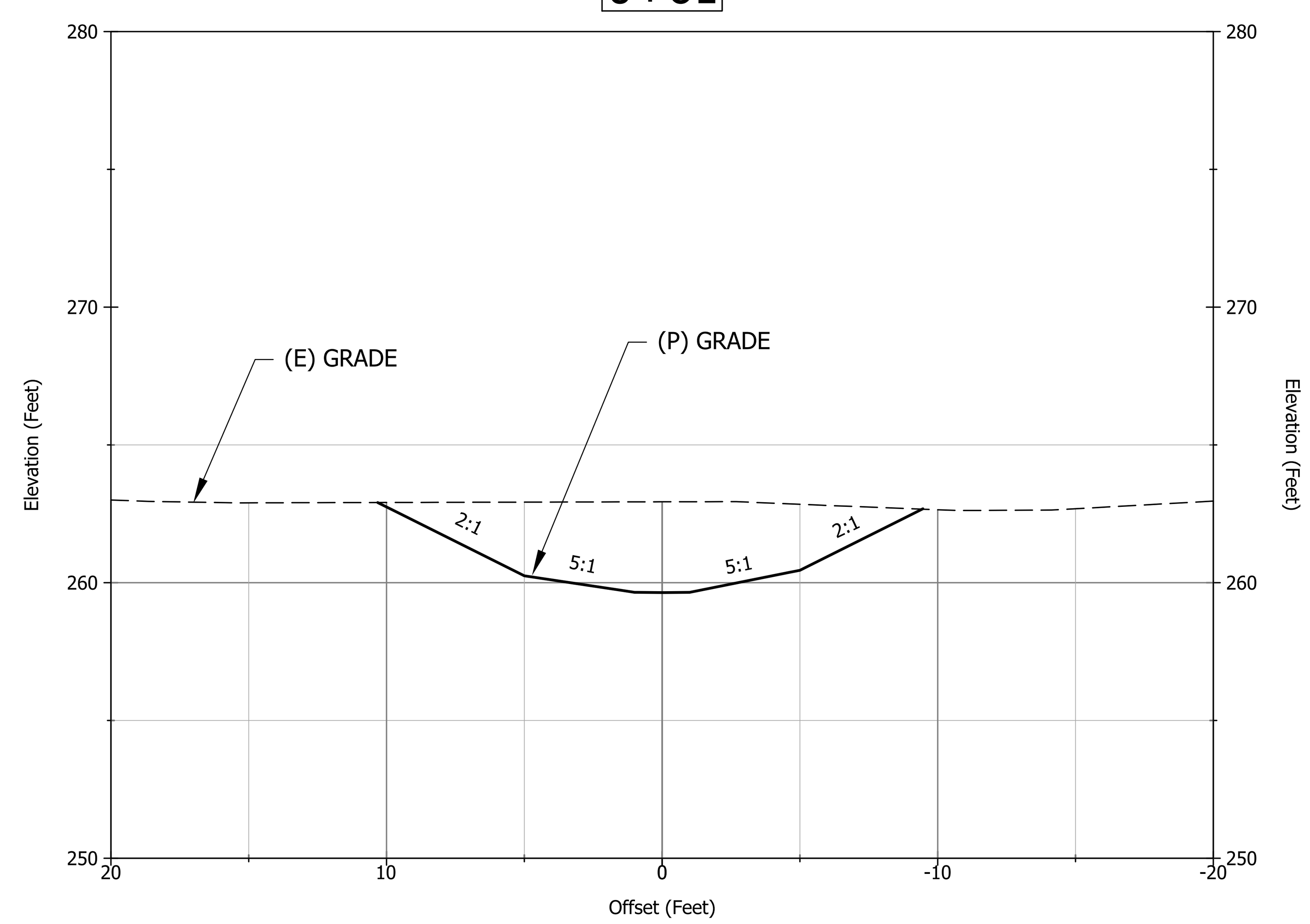
LOWER CHANNEL - PLAN & PROFILE

SHEET 8 OF 19

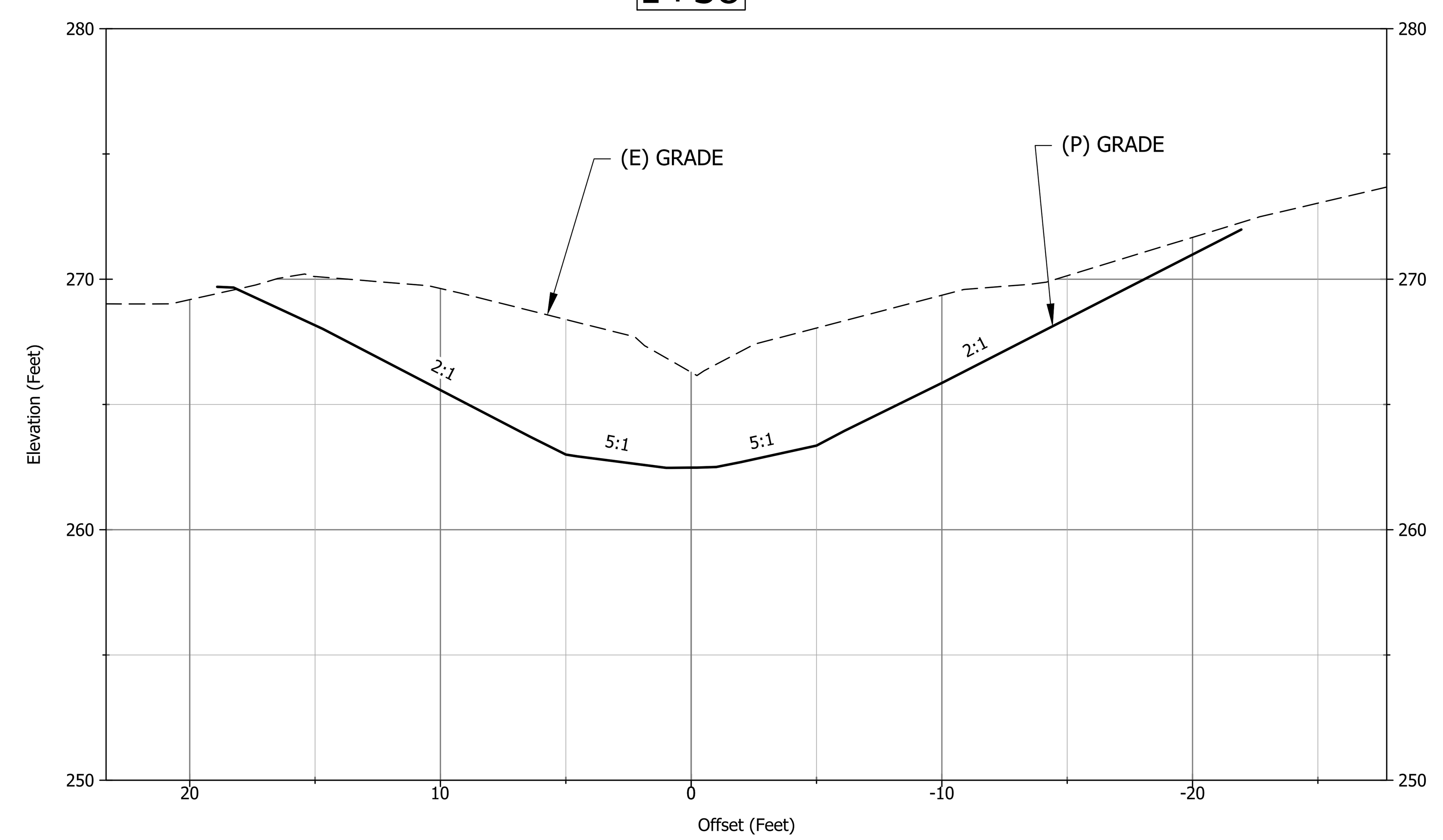
IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE - ADJUST ACCORDINGLY

LAST SAVED: 11/16/2018 PLOT DATE: 11/16/2018 PLOT STYLE: ----

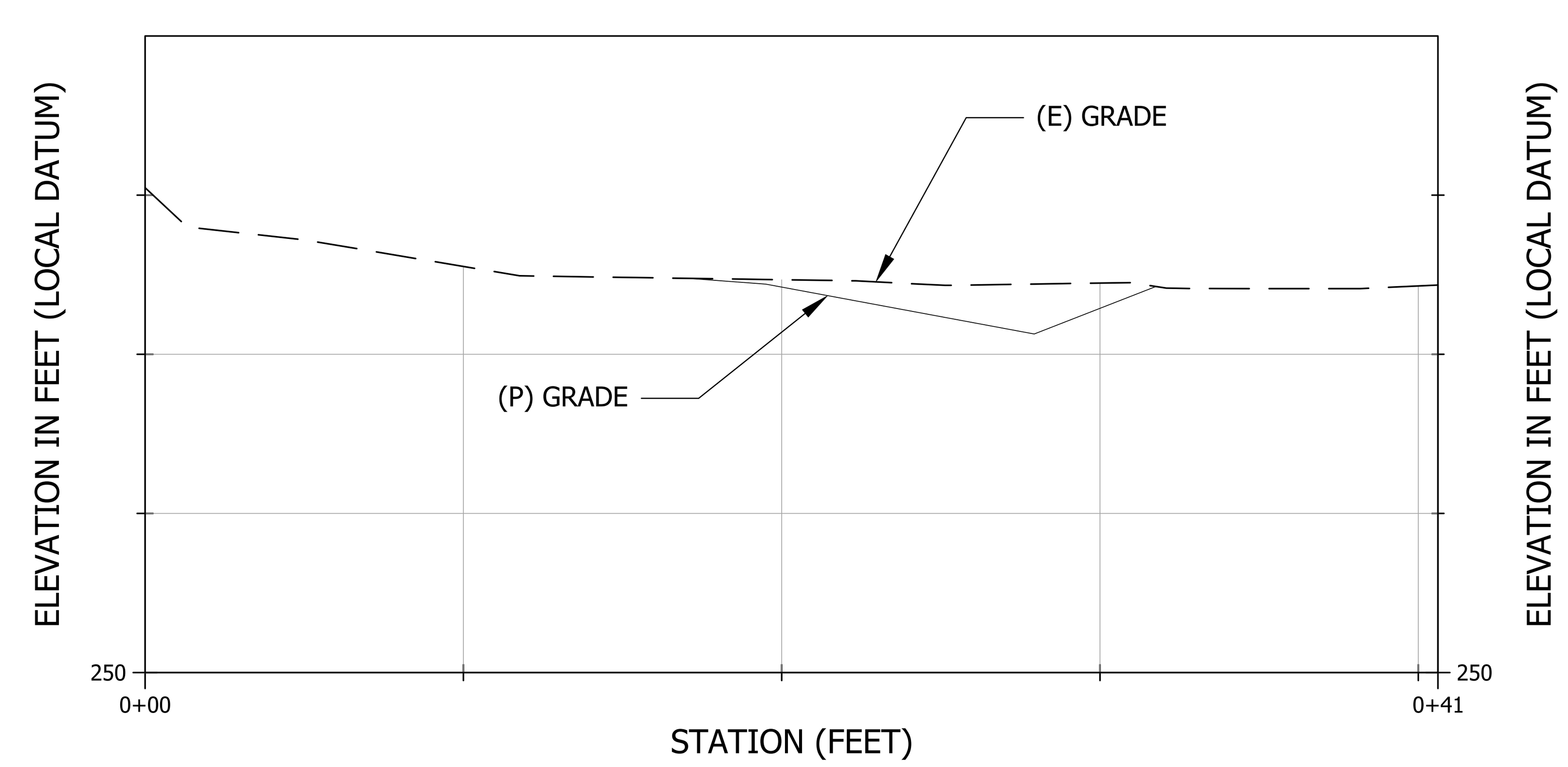
## 0+61




## 1+38




## SECTION A-A' ARMORED DITCH (TYP.)




LEGEND

| | |
|---|---|
| - - - - | EXISTING GRADE |
| ——— | PROPOSED GRADE |

NILES CANYON QUARRY RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA


Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705 P: (510) 848-8098

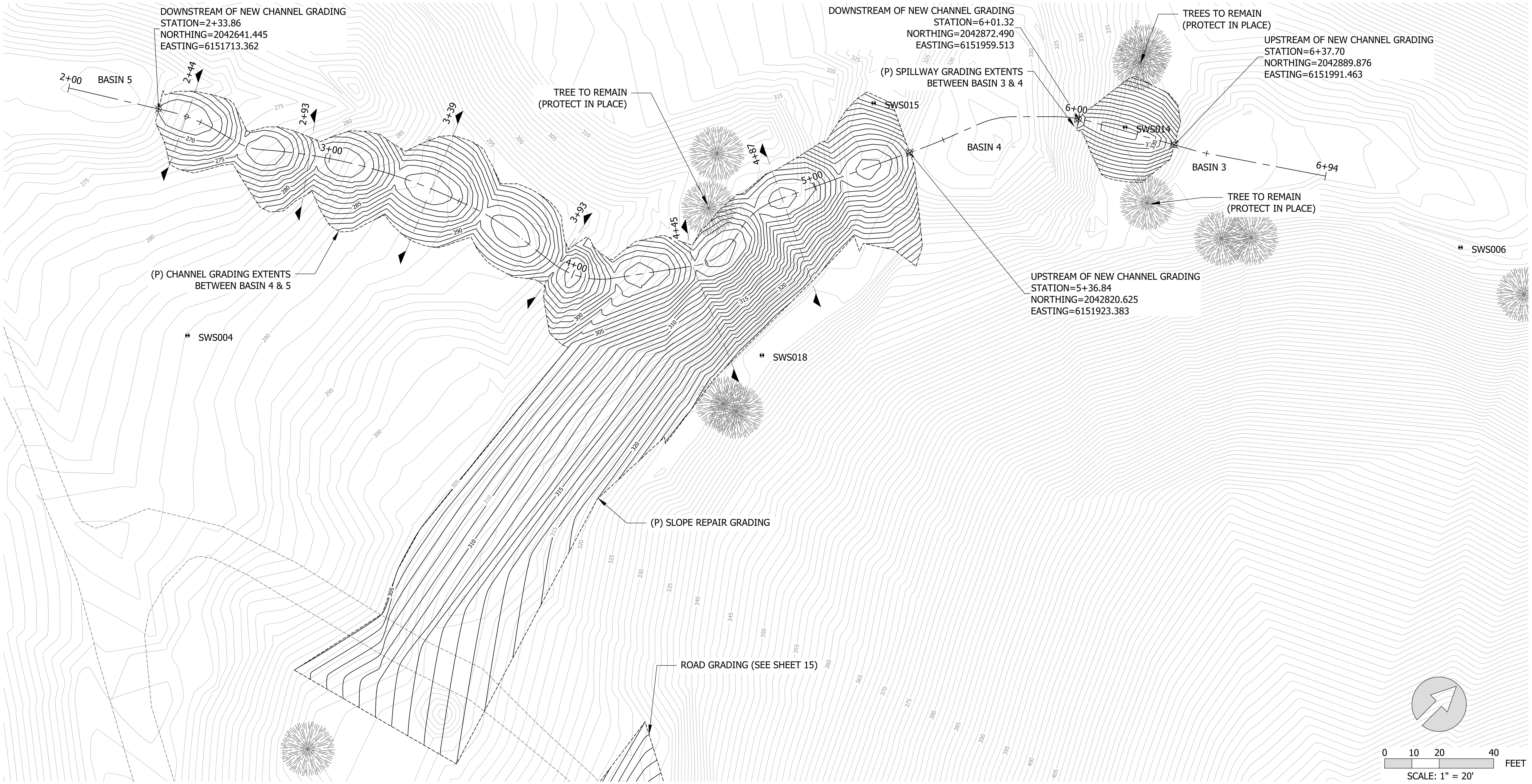

PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

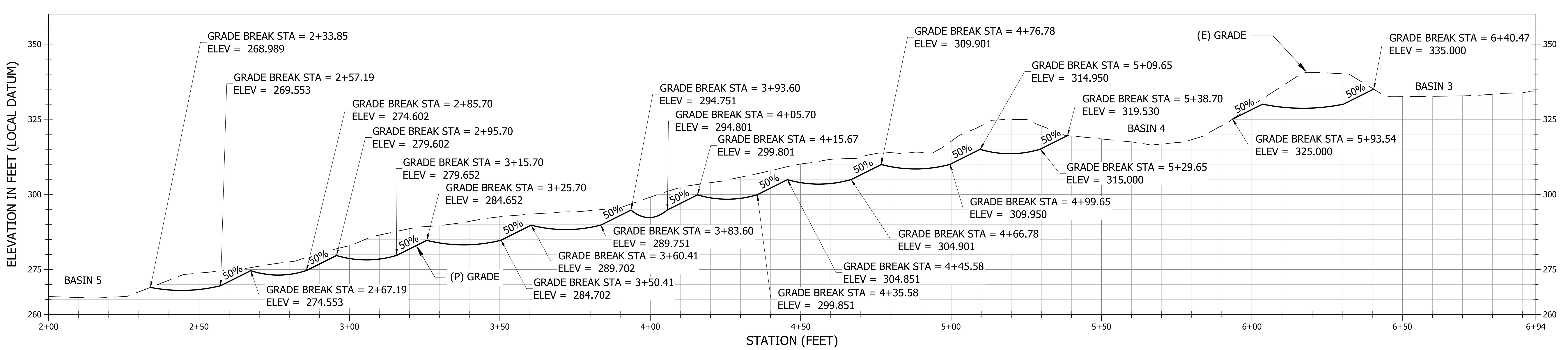
REGISTERED PROFESSIONAL ENGINEER JOEL MONSCHKE No. 79688 9-30-20 EXPIRES CIVIL STATE OF CALIFORNIA

LOWER CHANNEL - SECTIONS

SHEET 9 OF 19




PROPOSED MIDDLE CHANNEL PROFILE




NILES CANYON QUARRY RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA

Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705
P: (510) 848-8098

PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

REGISTERED PROFESSIONAL ENGINEER
JOEL MONSCHKE
No. 79688
9-30-20
EXPIRES
CIVIL
STATE OF CALIFORNIA

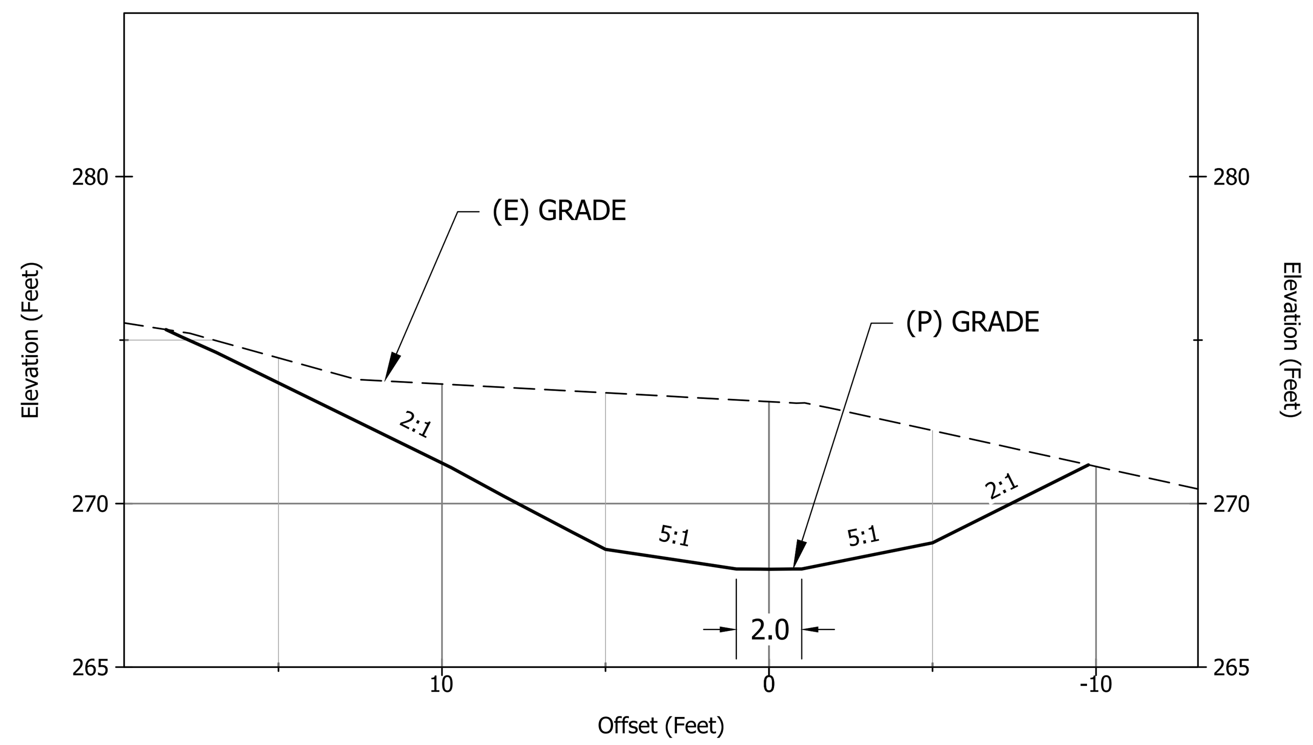
MIDDLE CHANNEL - PLAN & PROFILE



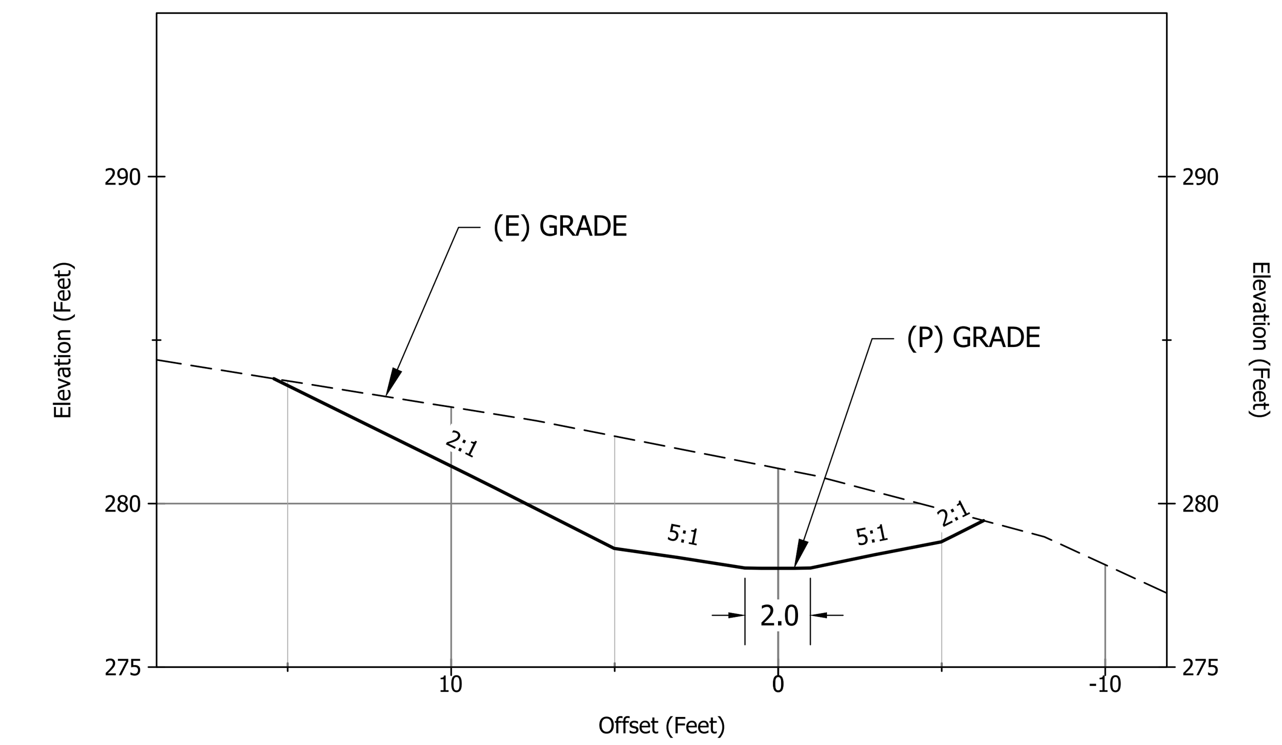
IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE - ADJUST ACCORDINGLY

LAST SAVED: 11/16/2018 PLOT DATE: 11/16/2018 PLOT STYLE: -----

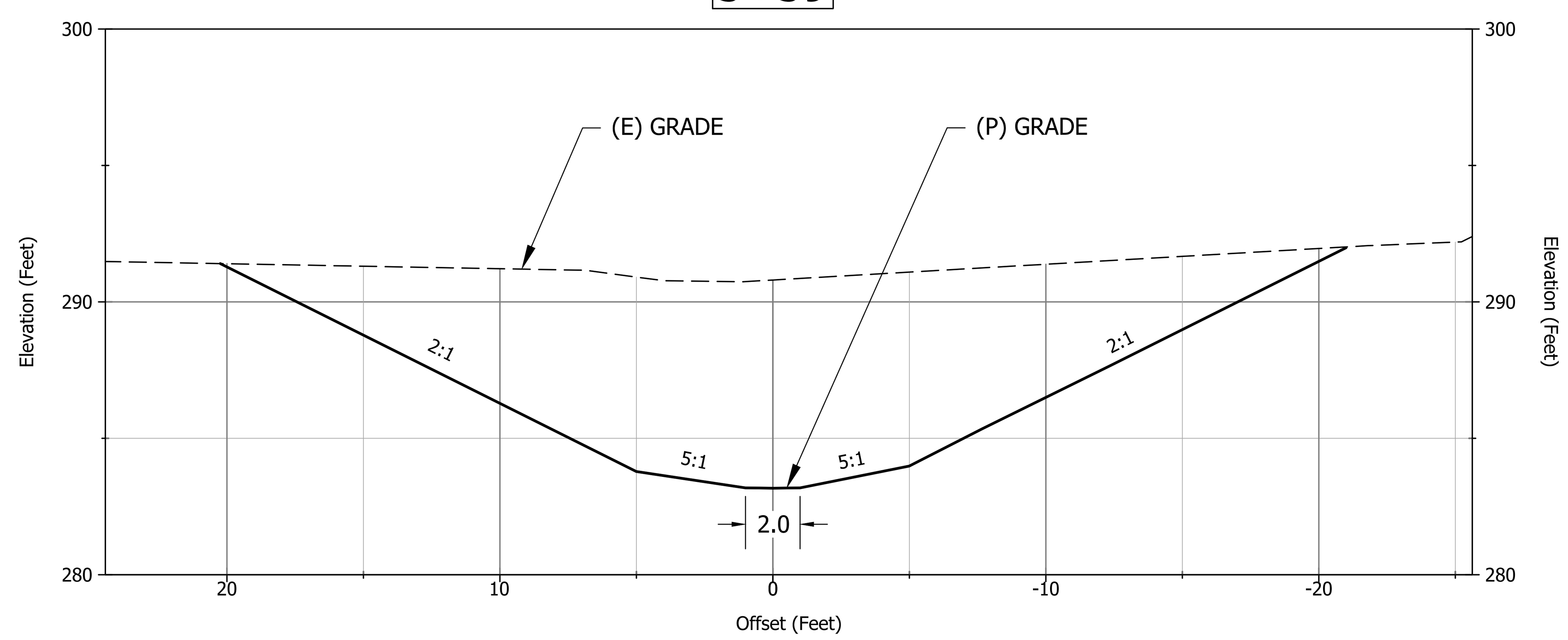
2+44



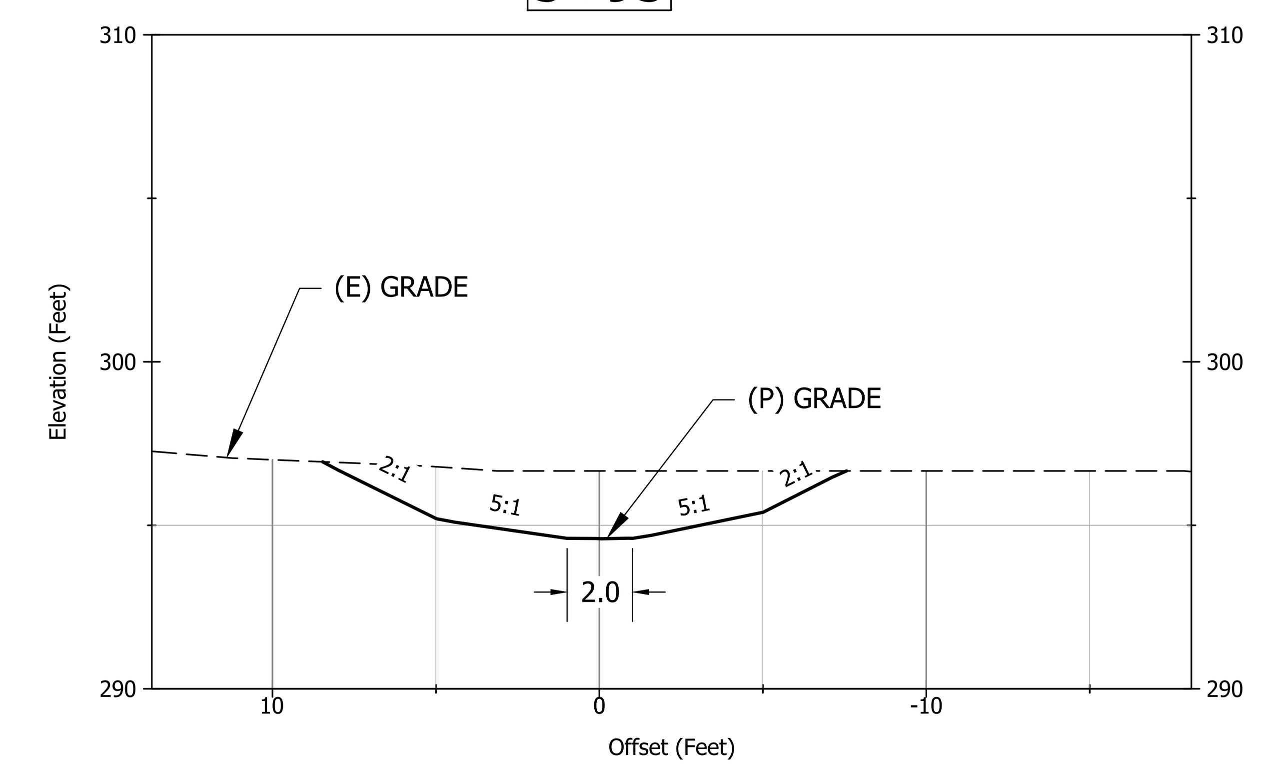

2+93



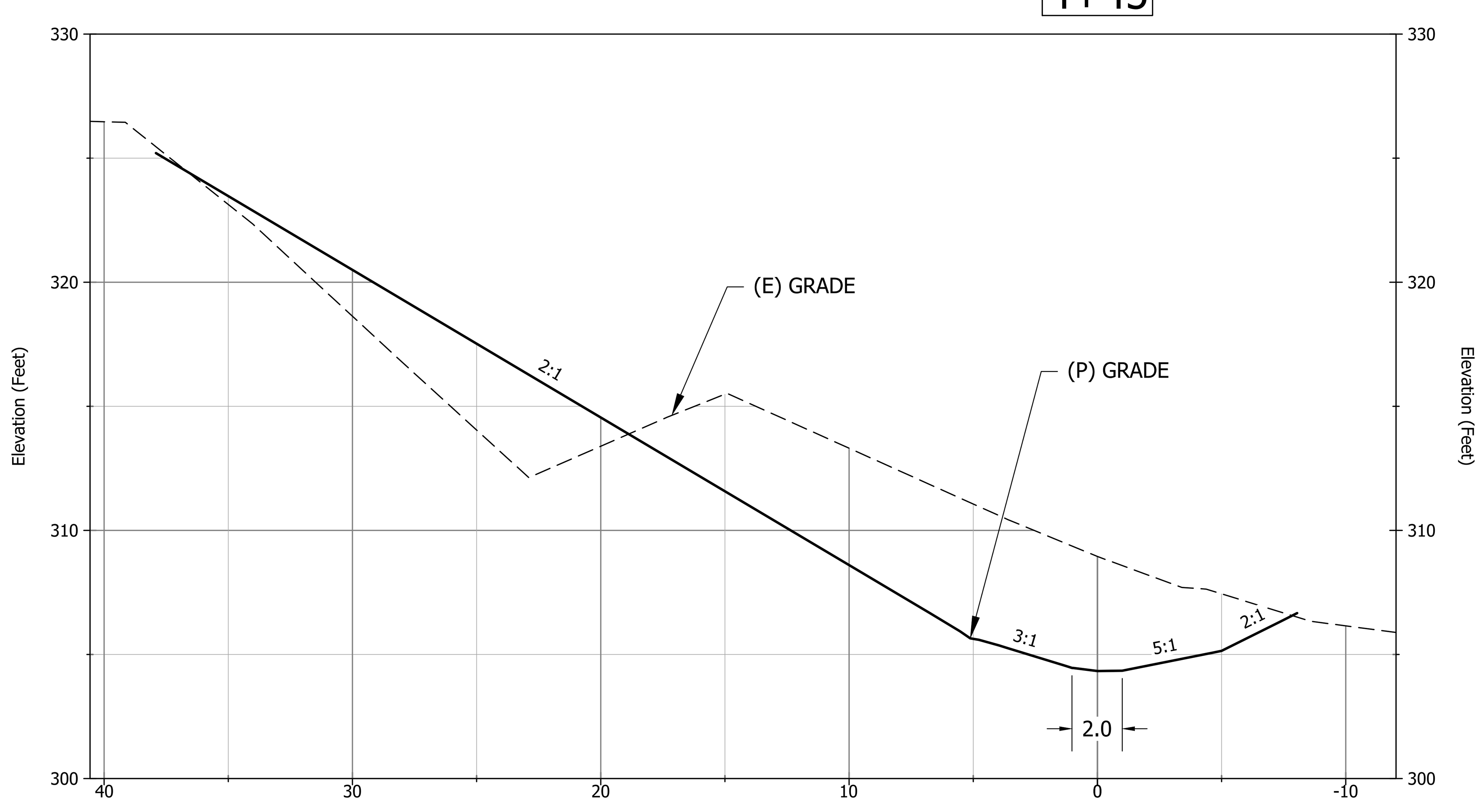

3+39



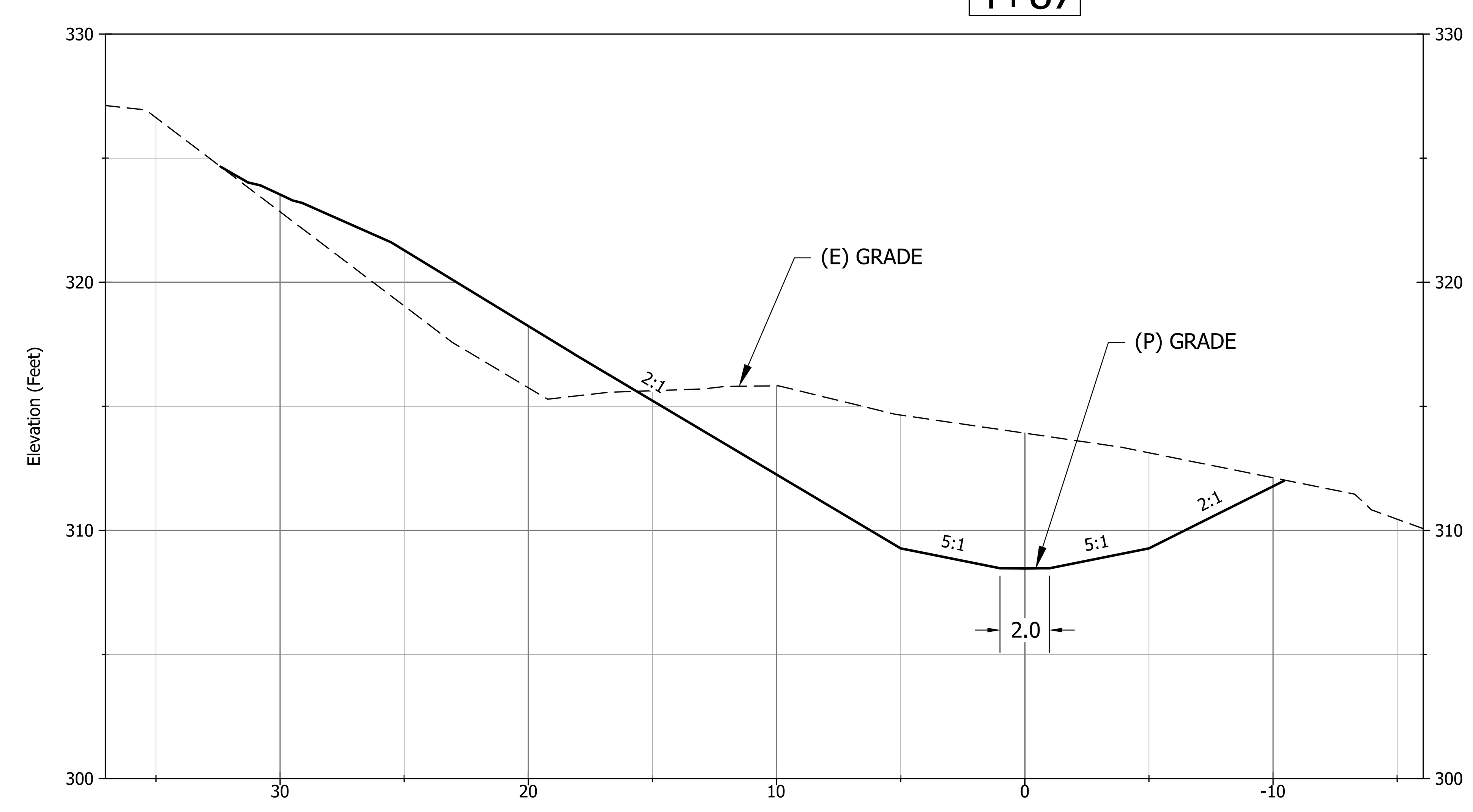

3+93




4+45




4+87




LEGEND

| | |
|---|---|
| – – – – | EXISTING GRADE |
| ——— | PROPOSED GRADE |

# NILES CANYON QUARRY RECLAMATION
# 30% DESIGN

ALAMEDA COUNTY, CA


Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705
P: (510) 848-8098


PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

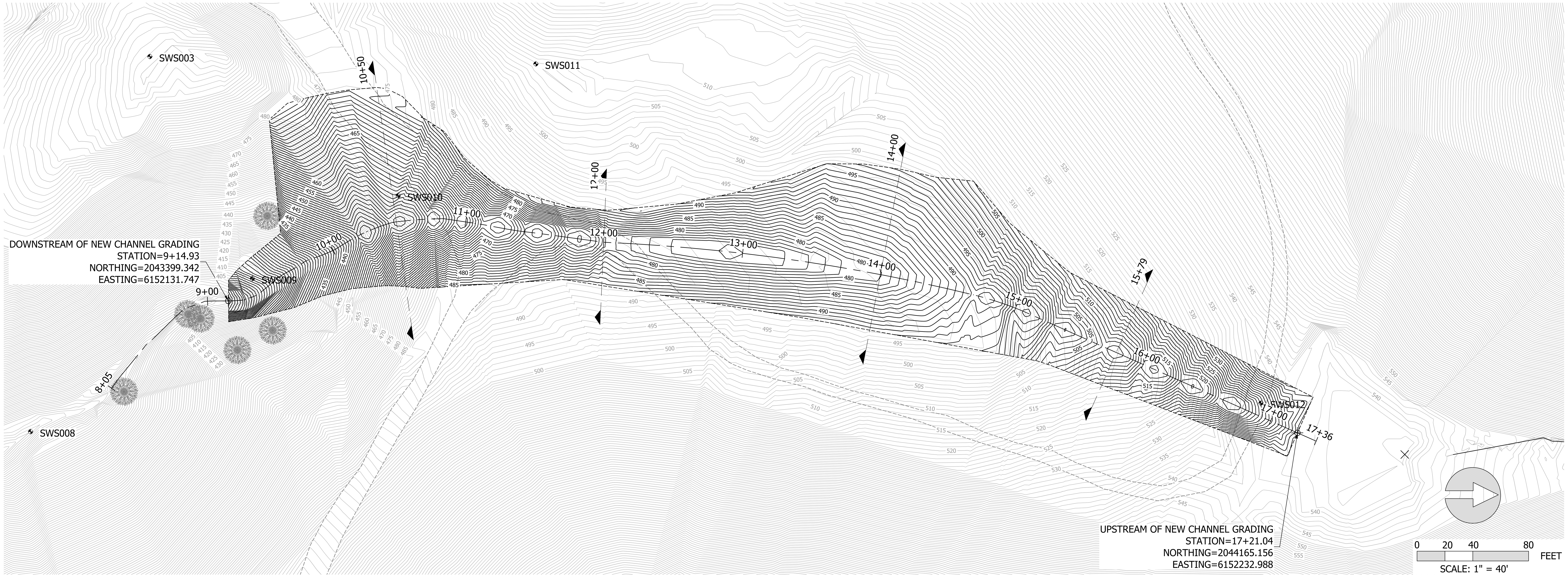
REGISTERED PROFESSIONAL ENGINEER
JOEL MONSCHKE
No. 79688
9-30-20
EXPIRES
CIVIL
STATE OF CALIFORNIA

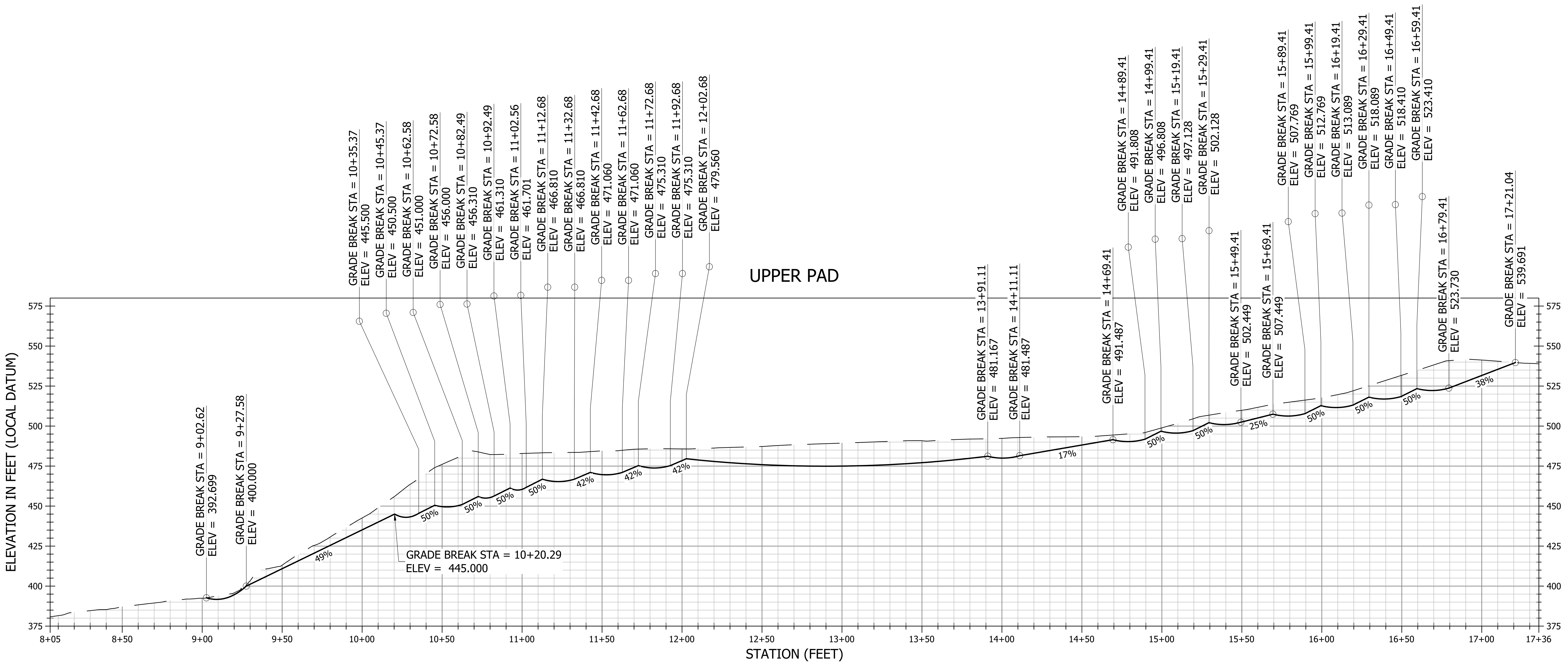
## MIDDLE CHANNEL - SECTIONS

SHEET 11 OF 19

IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE – ADJUST ACCORDINGLY

LAST SAVED: 11/16/2018 PLOT DATE: 11/16/2018 PLOT STYLE: ----




NILES CANYON QUARRY RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA

Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705
P: (510) 848-8098

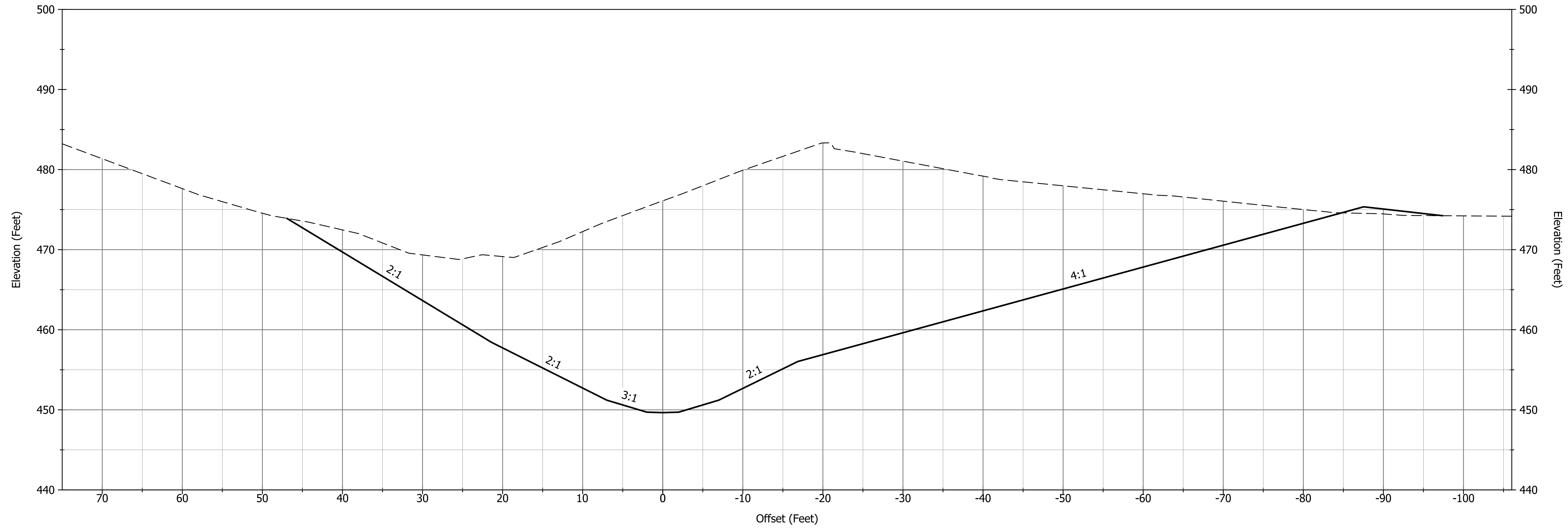
PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

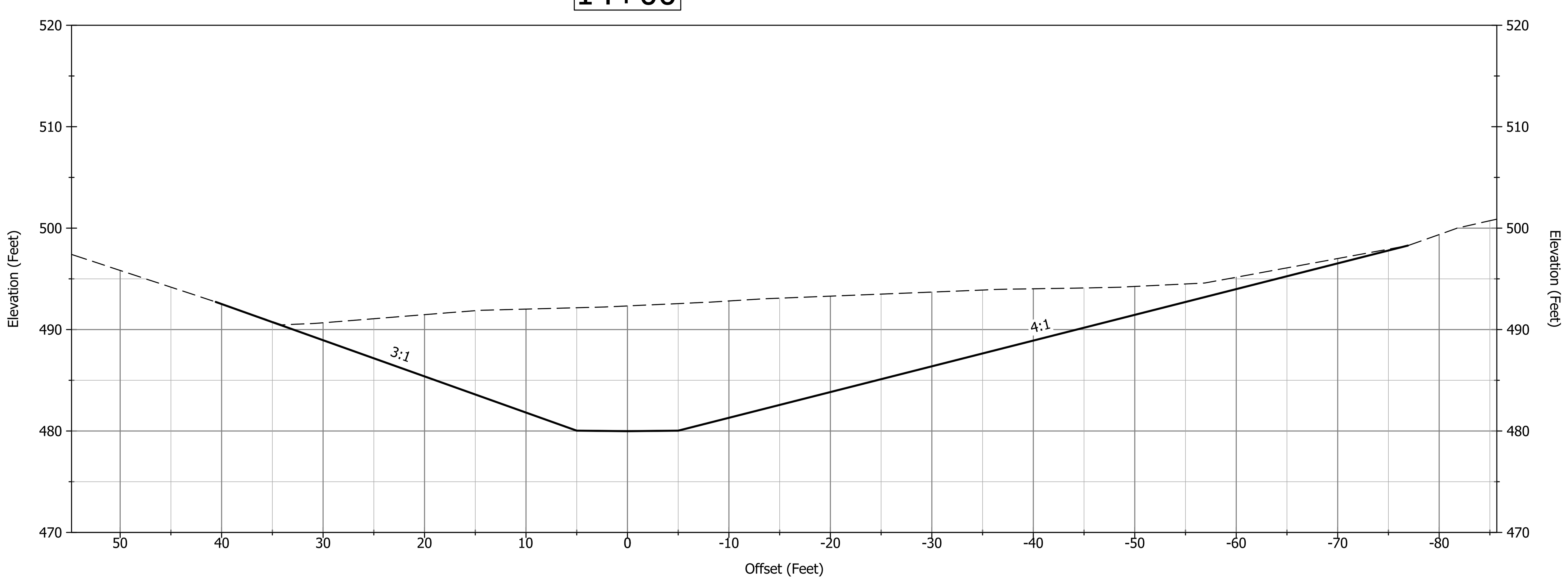
UPPER CHANNEL - PLAN & PROFILE

SHEET 12 OF 19

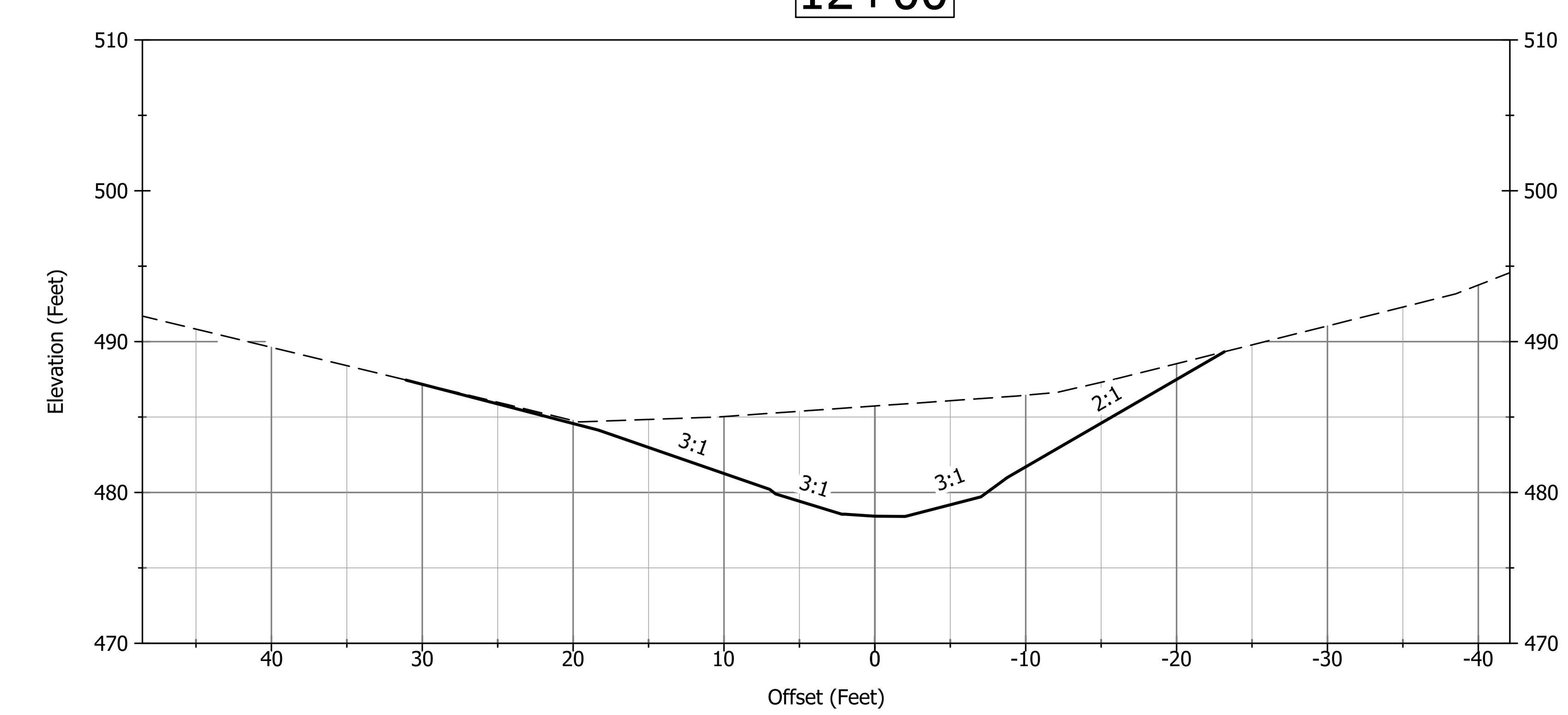
## 10+50



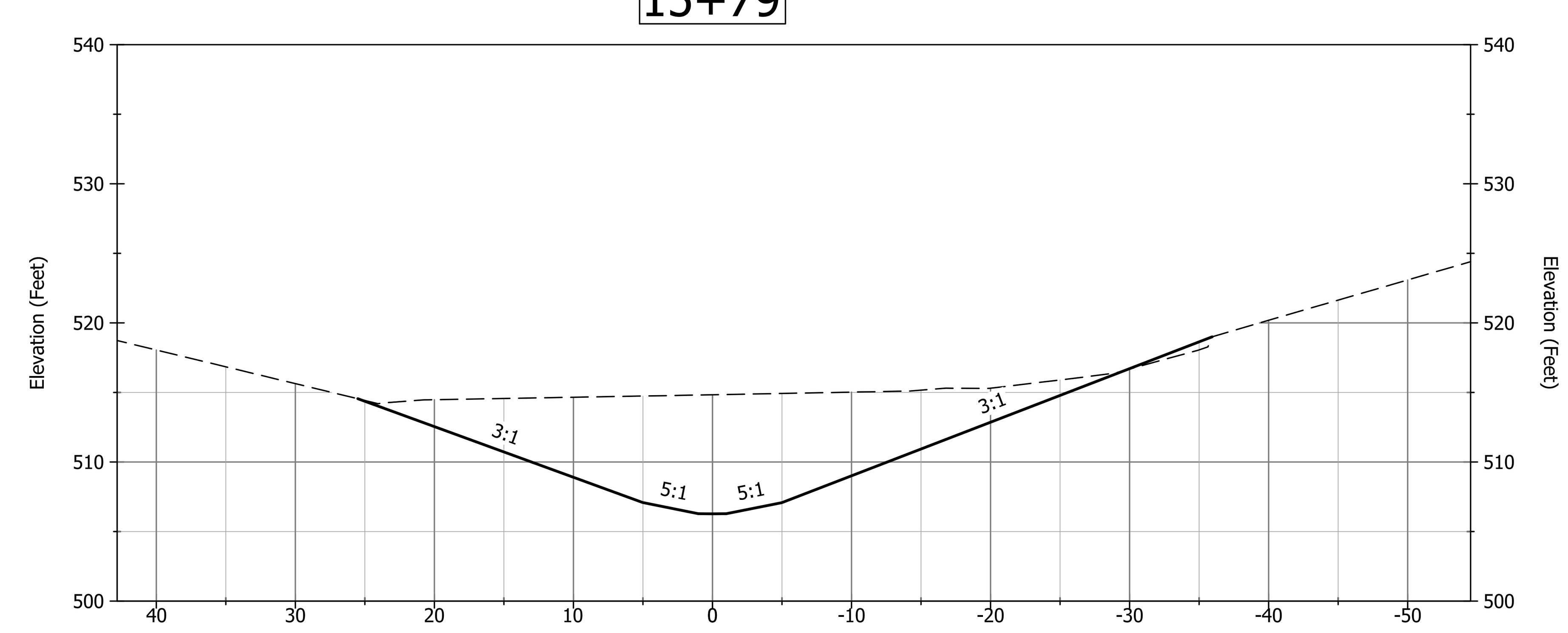

## 14+00




## 12+00




## 15+79




LEGEND
- - - EXISTING GRADE
—— PROPOSED GRADE

NILES CANYON QUARRY RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA


Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705 P: (510) 848-8098


PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

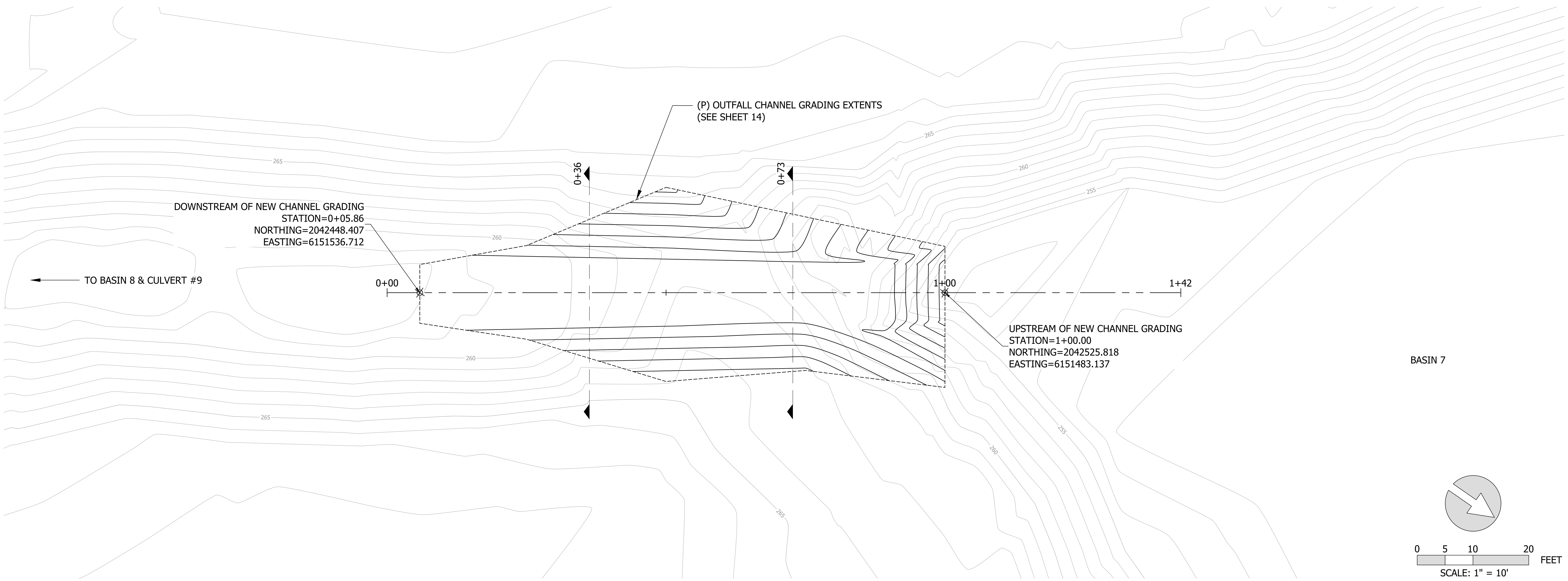
REGISTERED PROFESSIONAL ENGINEER JOEL MONSCHKE No. 79688 9-30-20 EXPIRES CIVIL STATE OF CALIFORNIA

UPPER CHANNEL - SECTIONS

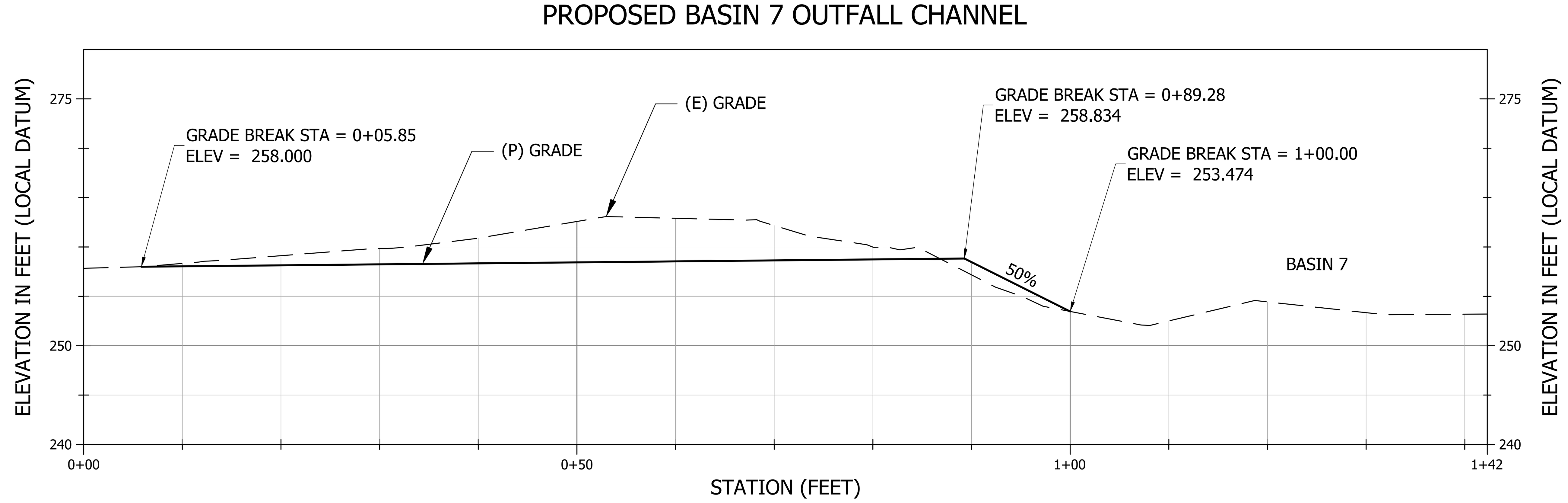
SHEET 13 OF 19

IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE - ADJUST ACCORDINGLY

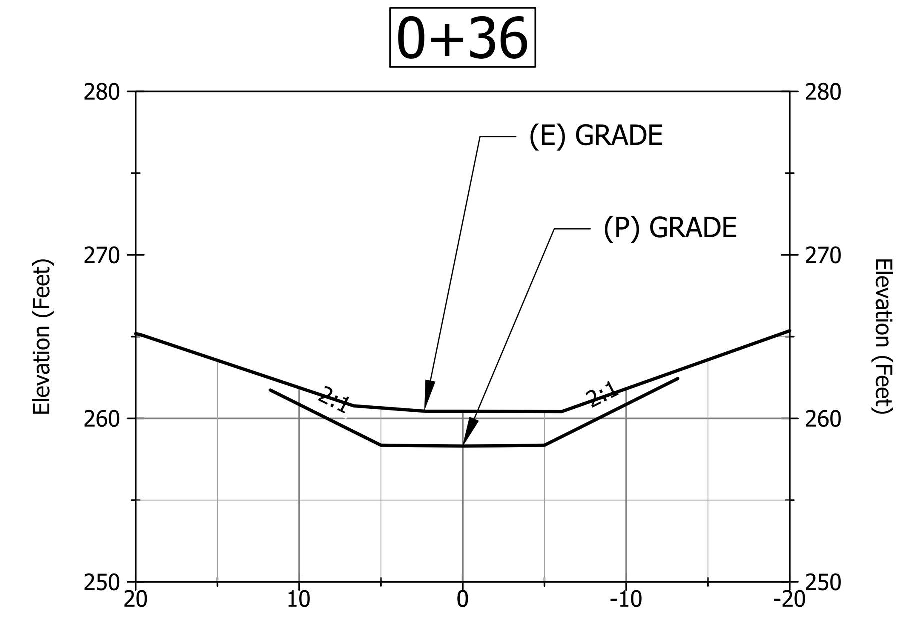
LAST SAVED: 11/16/2018 PLOT DATE: 11/16/2018 PLOT STYLE: ----



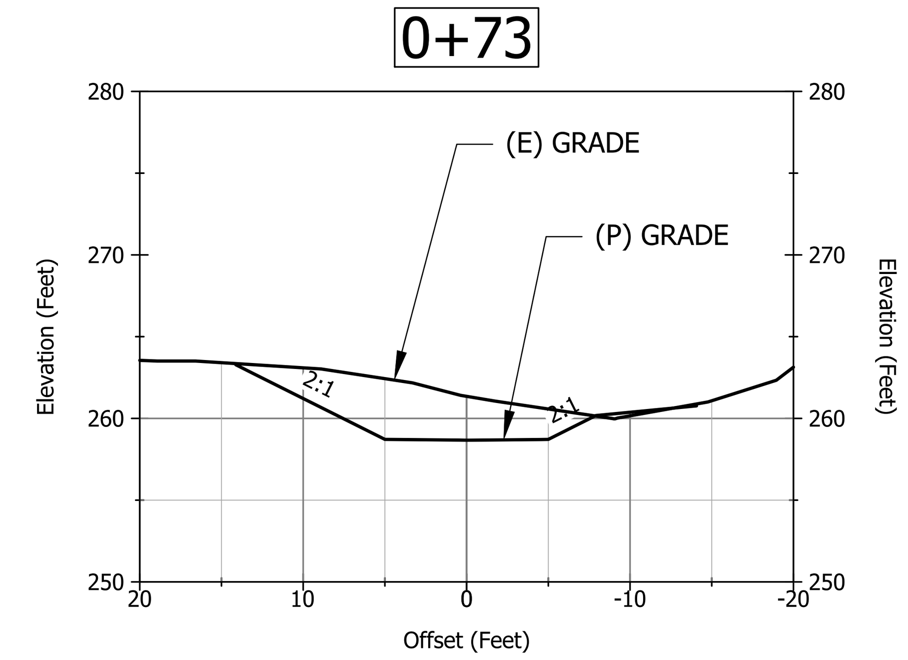

PROPOSED BASIN 7 OUTFALL CHANNEL




0+36




0+73




NILES CANYON QUARRY RECLAMATION
30% DESIGN

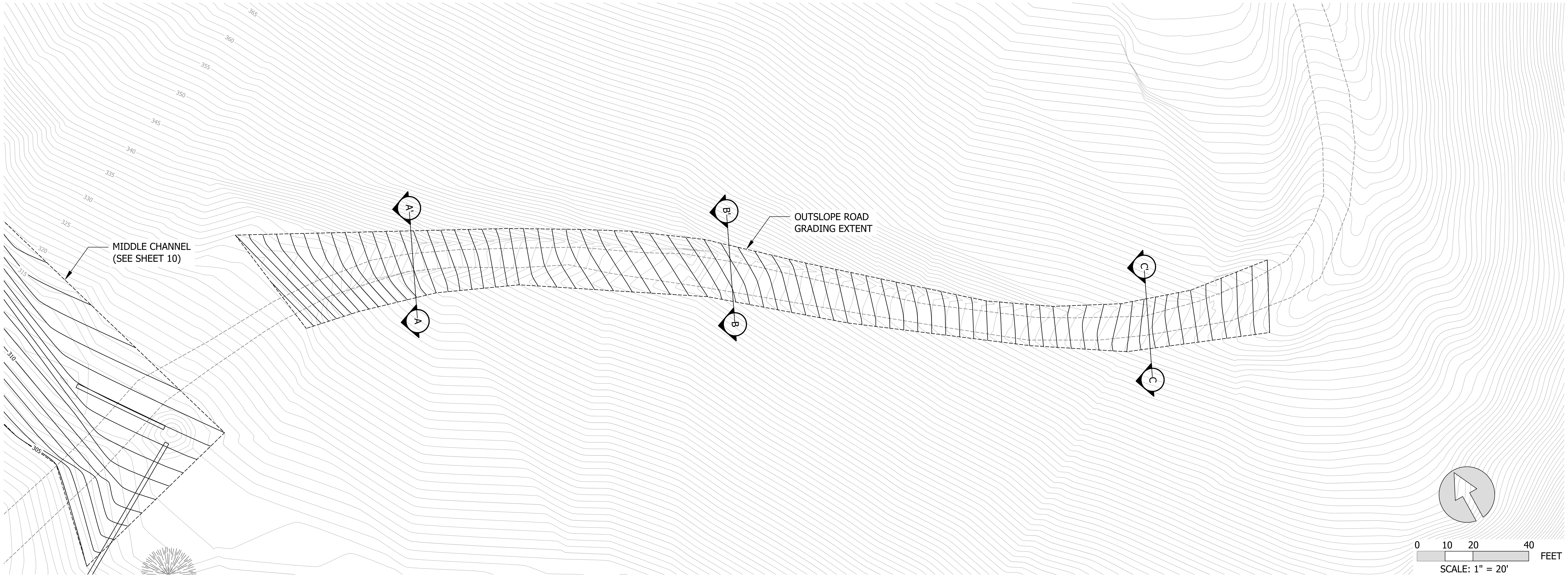
ALAMEDA COUNTY, CA


Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705 P: (510) 848-8098

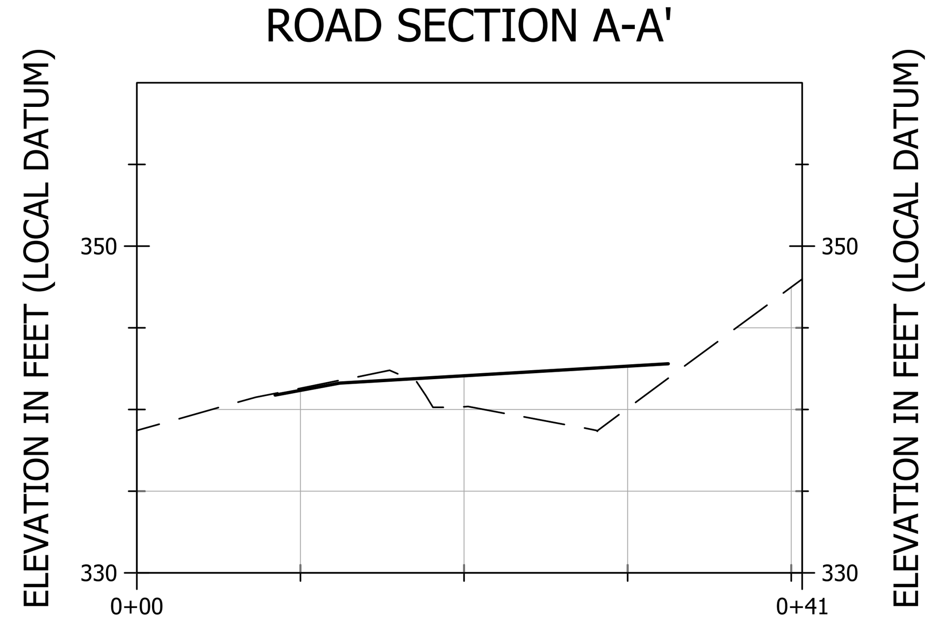

PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

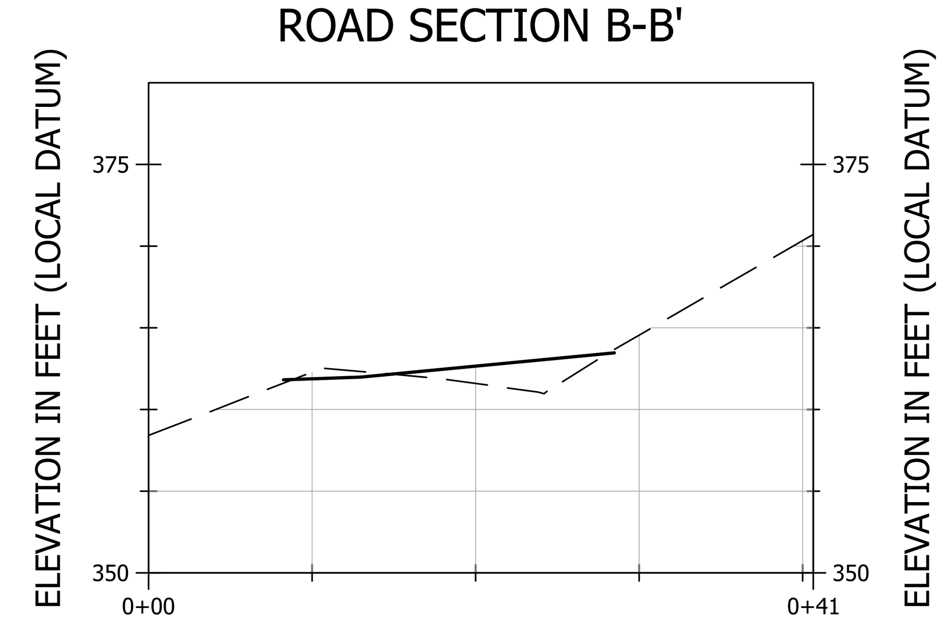
BASIN 7 OUTFALL CHANNEL -PLAN, PROFILE & SECTIONS



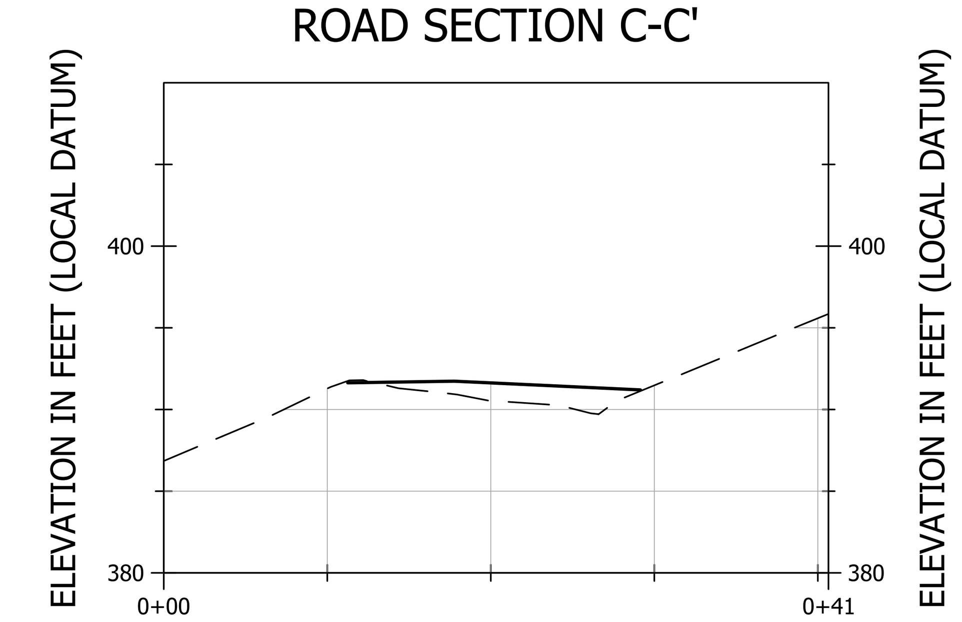

## ROAD SECTION A-A'




## ROAD SECTION B-B'




## ROAD SECTION C-C'




LEGEND

- EXISTING GRADE
- PROPOSED GRADE

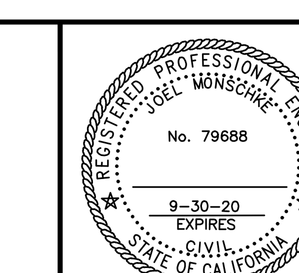
# NILES CANYON QUARRY RECLAMATION
## 30% DESIGN

ALAMEDA COUNTY, CA


Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705
P: (510) 848-8098


PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

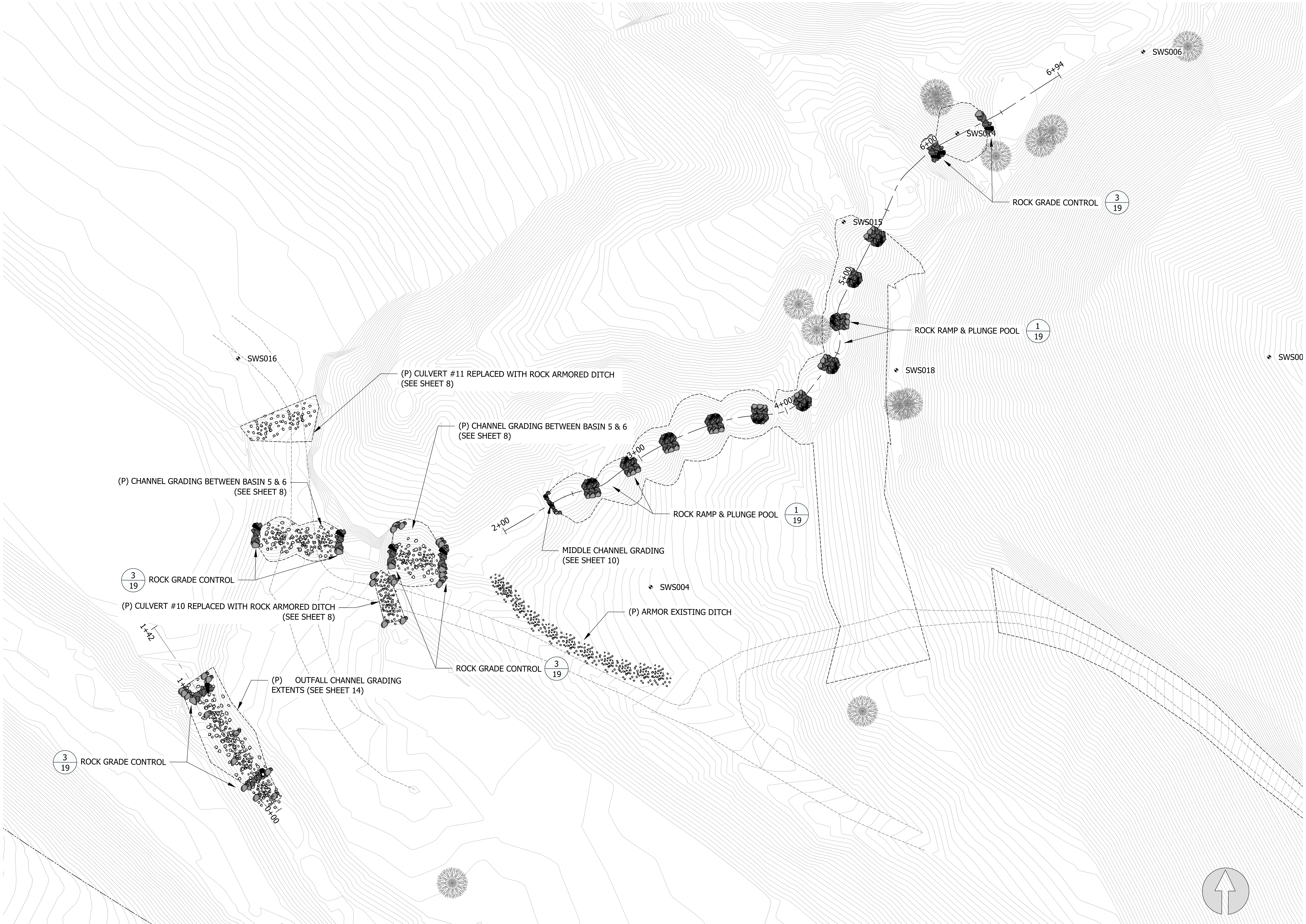
DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----




## ROAD GRADING - PLAN & SECTIONS



IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE – ADJUST ACCORDINGLY
LAST SAVED: 11/16/2018 PLOT DATE: 11/16/2018 PLOT STYLE: ----




0 10 20 40 FEET

SCALE: 1" = 20'

NOTE: ENGINEERED STREAMBED MATERIAL (ESM) TO BE PLACED THOUGH OUT CHANNEL BE EXTENTS (SEE DETAIL 2 - ROCK SIZING & VOLUME ON SHEET 19)

# NILES CANYON QUARRY RECLAMATION 30% DESIGN

ALAMEDA COUNTY, CA


Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705
P: (510) 848-8098


PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

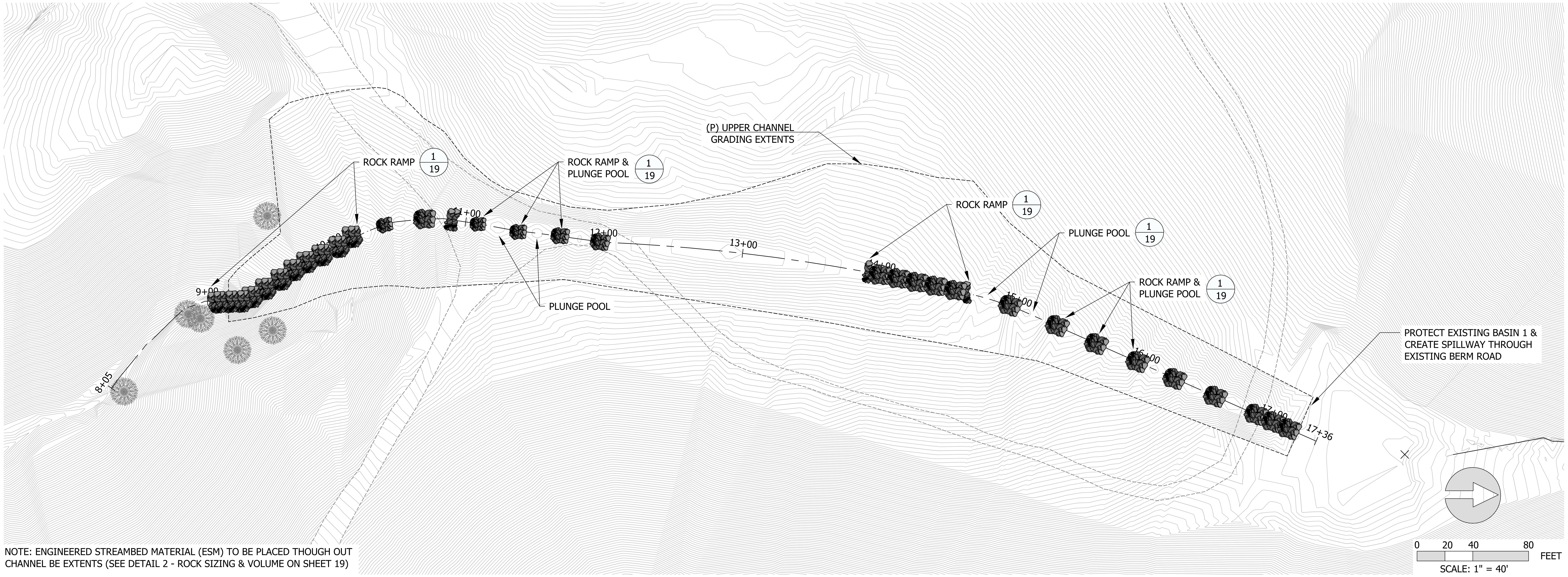
REGISTERED PROFESSIONAL ENGINEER JOEL MONSCHKE No. 79688 9-30-20 EXPIRES CIVIL STATE OF CALIFORNIA

## LOWER PAD FEATURES

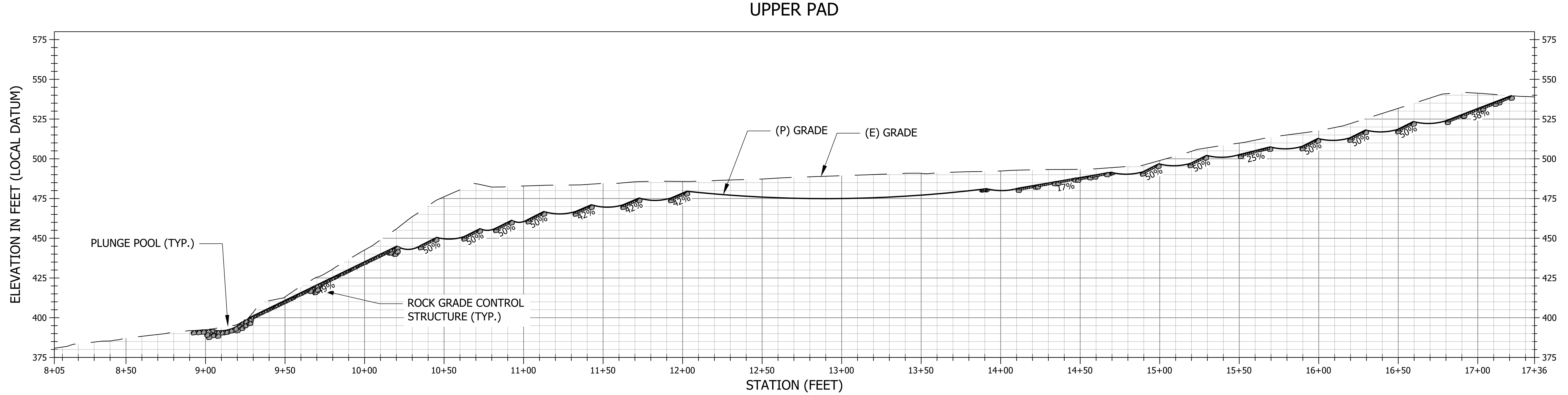
SHEET 16 OF 19

IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE - ADJUST ACCORDINGLY

LAST SAVED: 11/16/2018 PLOT DATE: 11/16/2018 PLOT STYLE: ----




UPPER PAD




NILES CANYON QUARRY
RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA


Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705
P: (510) 848-8098


PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

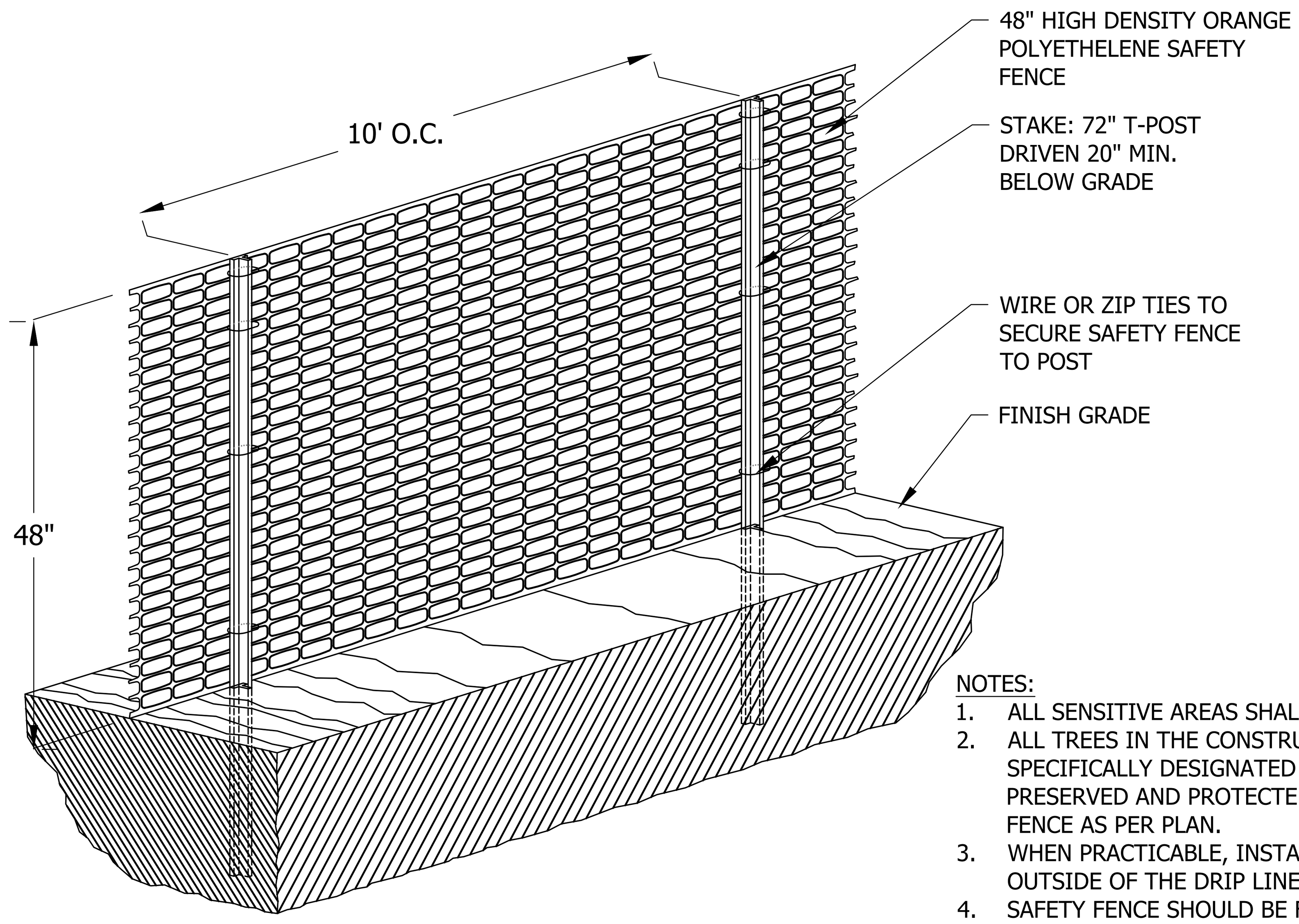
REGISTERED PROFESSIONAL ENGINEER
JOEL MONSCHKE
No. 79688
9-30-20
EXPIRES
CIVIL
STATE OF CALIFORNIA

UPPER CHANNEL
FEATURES

SHEET 17 OF 19

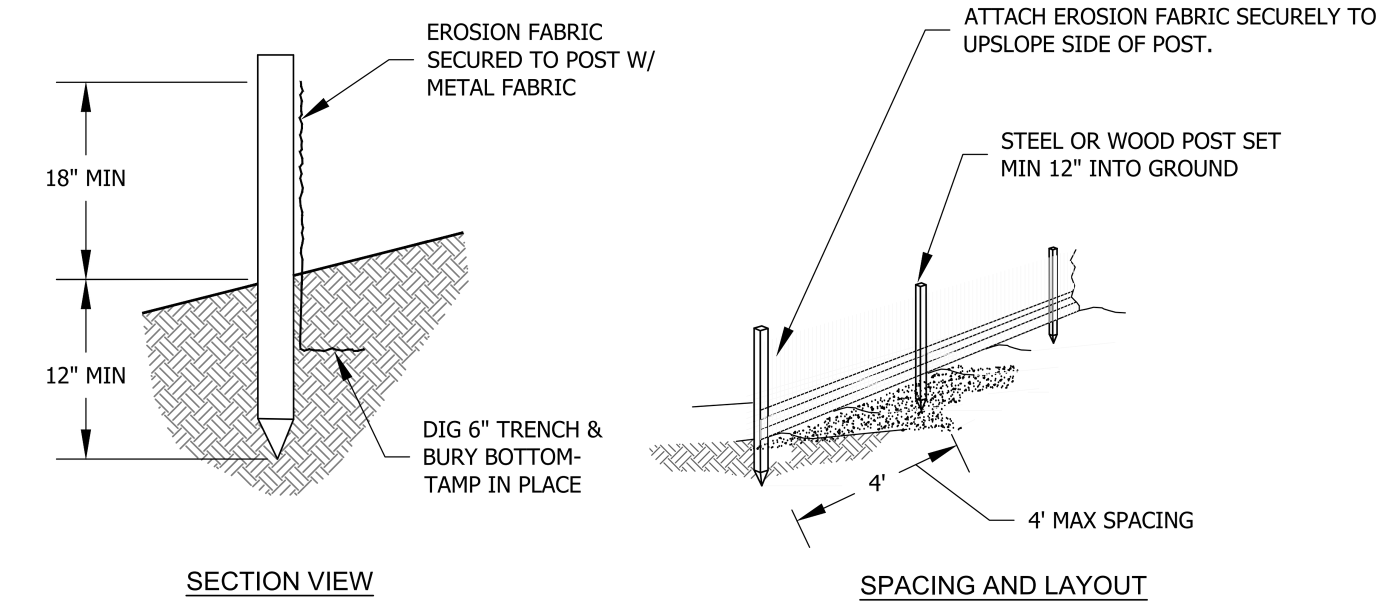
IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE - ADJUST ACCORDINGLY

LAST SAVED: 11/16/2018 PLOT DATE: 11/16/2018 PLOT STYLE: ----

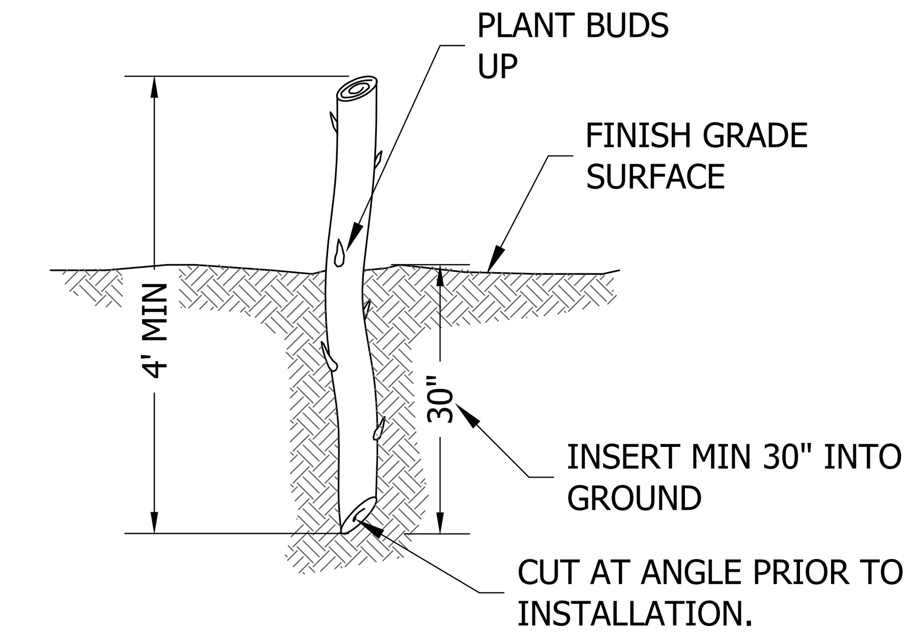



NOTES:
1. ALL SENSITIVE AREAS SHALL BE PROTECTED AS PER PLAN.
2. ALL TREES IN THE CONSTRUCTION AREA NOT SPECIFICALLY DESIGNATED FOR REMOVAL SHALL BE PRESERVED AND PROTECTED WITH HIGH VISIBILITY FENCE AS PER PLAN.
3. WHEN PRACTICABLE, INSTALL HIGH VISIBILITY 3 FEET OUTSIDE OF THE DRIP LINE OF THE TREE.
4. SAFETY FENCE SHOULD BE FASTENED SECURELY TO THE T-POSTS.
5. THE FENCING MUST REMAIN IN PLACE DURING ALL PHASES OF CONSTRUCTION; ANY CHANGE OF THE PROTECTIVE FENCING MUST BE APPROVED.

1 **SENSITIVE AREA & TREE PROTECTION**
Scale = NTS



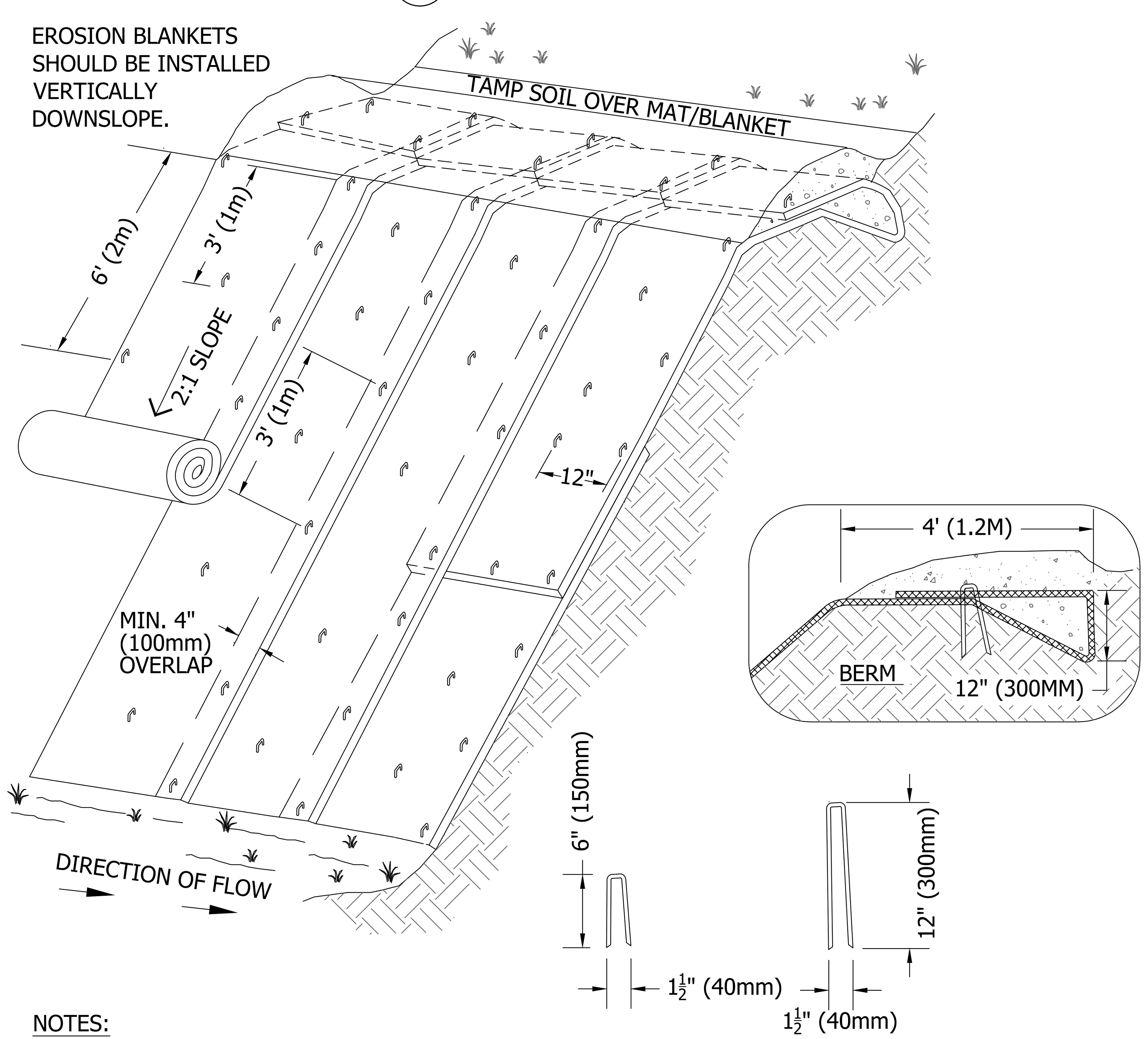

2 **SILT FENCING**
Scale = NTS




NOTES:

1. WILLOW STAKE SPECIES SHALL BE A MIX OF SPECIES PRESENT AT AND ADJACENT TO THE WORK SITE
2. EACH STAKE SHALL BE 1.5" - 3" THICK AT THE BOTTOM TO FACILITATE ROOT GROWTH AFTER TREATMENT WITH ROOTING HORMONE
3. INSERT MIN 30" INTO GROUND
4. INSTALL STAKES CONCURRENTLY WITH ROCK AND LOG STRUCTURES AND THEN BACKFILL WITH NATIVE SOIL TO PROMOTE ROOTING

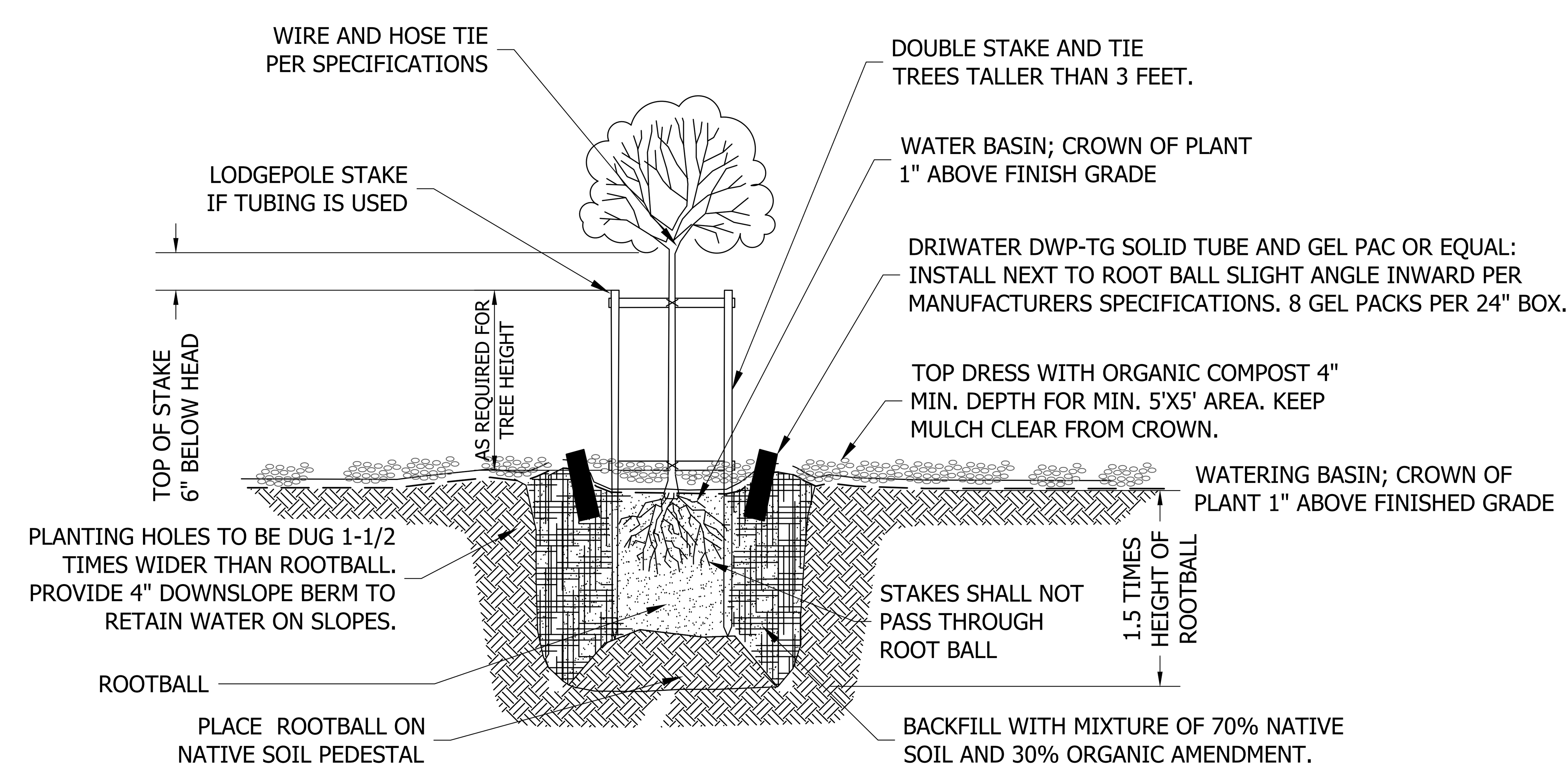
3 **WILLOW STAKING**
Scale = NTS




NOTES:

1. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS. MATS/ BLANKETS SHALL HAVE GOOD SOIL CONTACT.
2. APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.
3. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.

4 **EROSION CONTROL FABRIC**
Scale = NTS




5 **TREE PLANTING**
Scale = NTS

NILES CANYON QUARRY RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA

Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705
P: (510) 848-8098

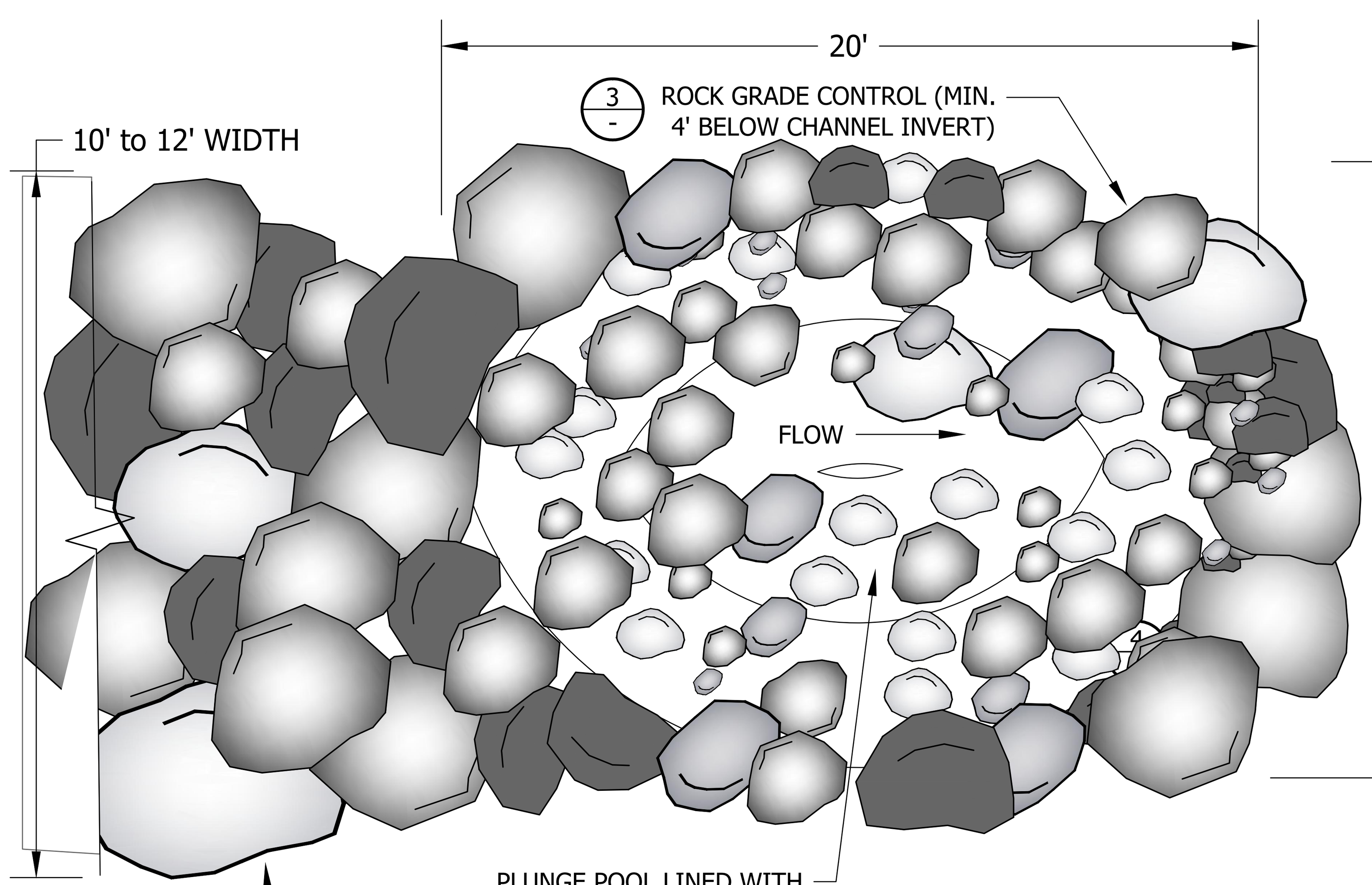
PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

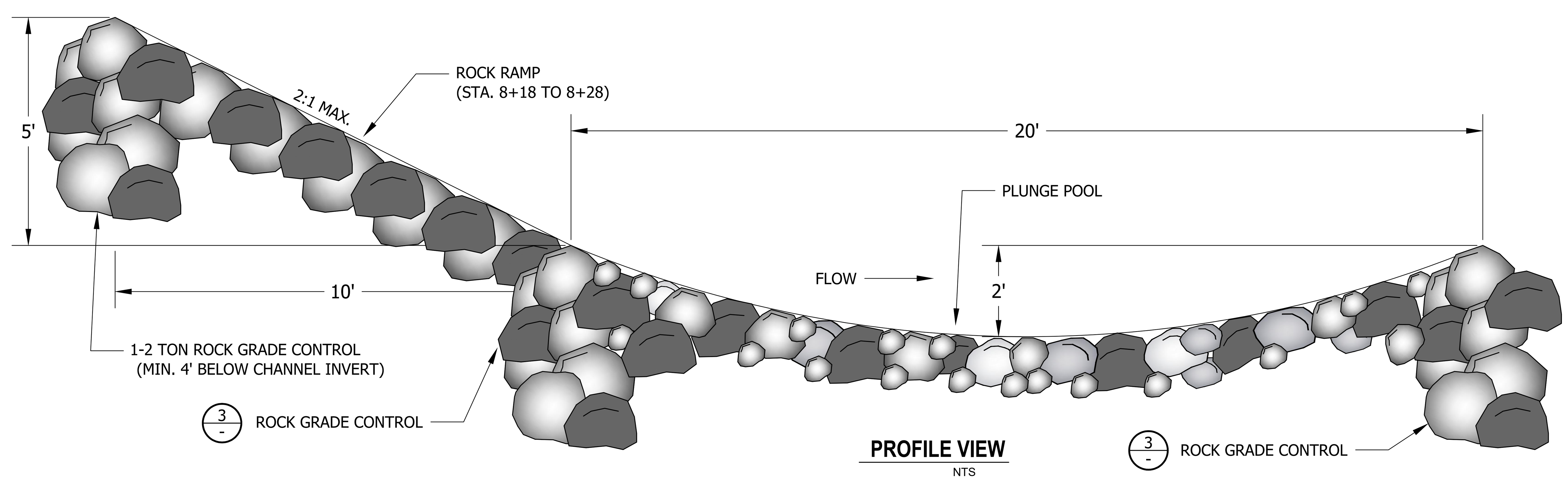
REGISTERED PROFESSIONAL ENGINEER
JOEL MONSCHKE
No. 79688
EXPIRES 9-30-20
CIVIL
STATE OF CALIFORNIA

EROSION CONTROL & PLANTING DETAILS

SHEET 18 OF 19




**PLAN VIEW**
NTS

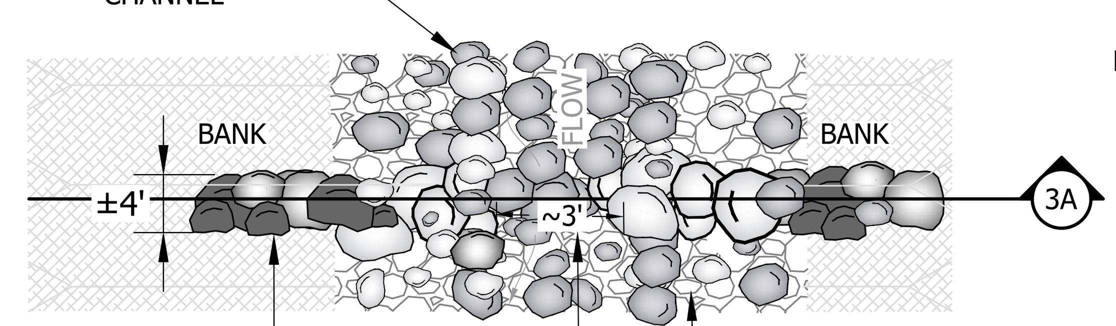


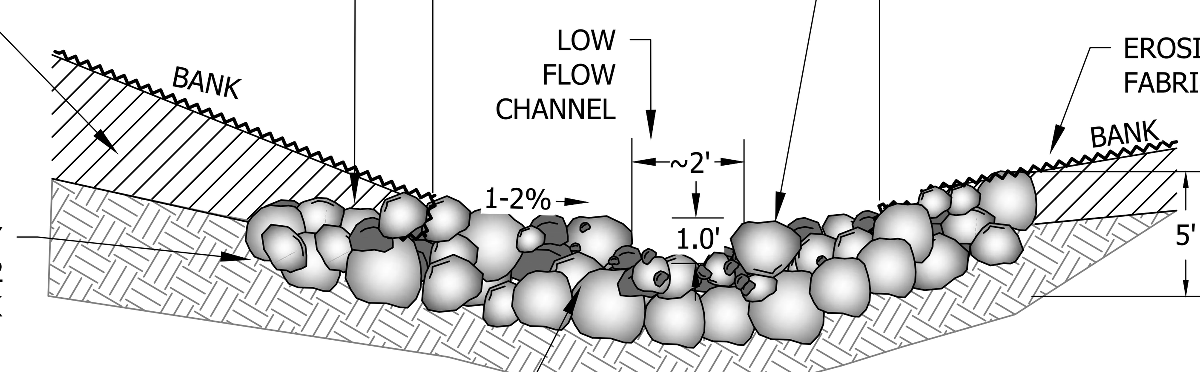

**PROFILE VIEW**
NTS

1 **ROCK RAMP & PLUNGE POOL**
Scale = NTS

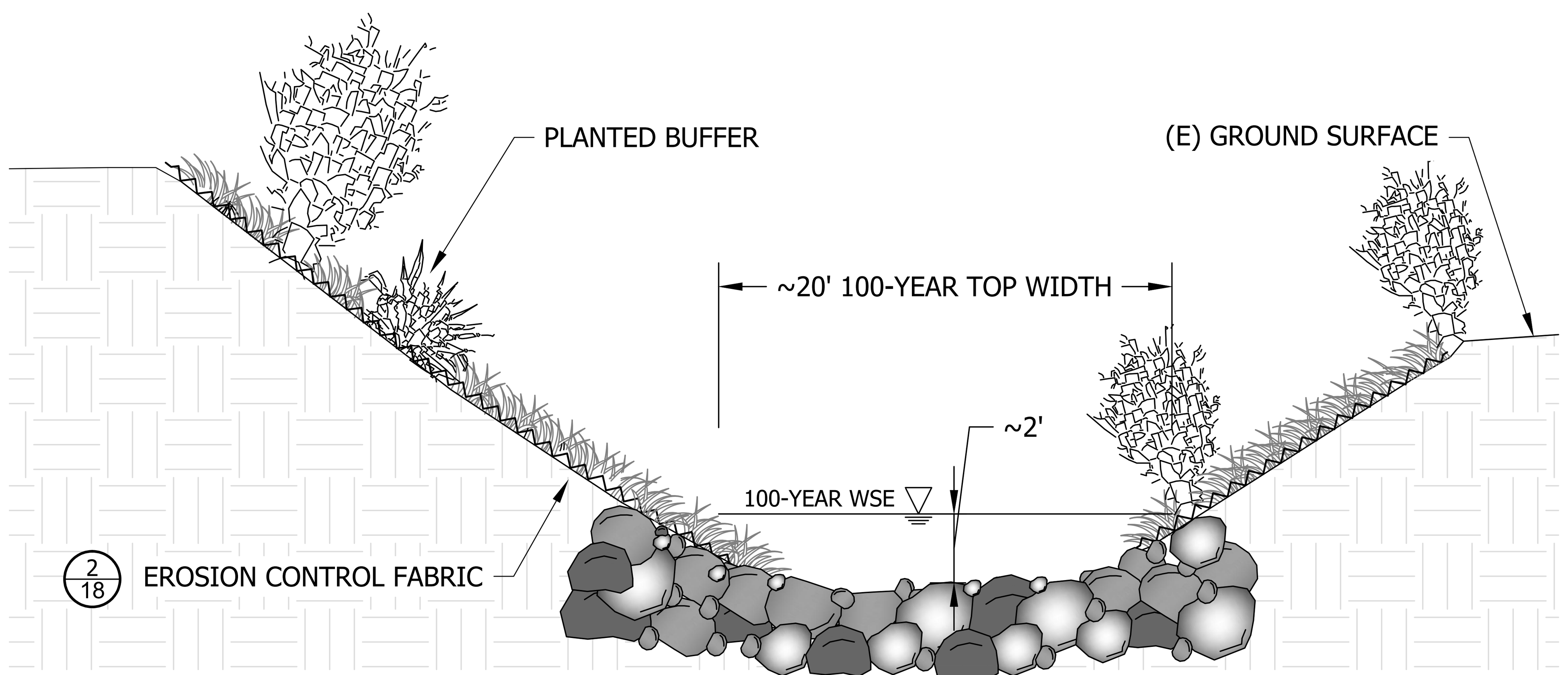
| | ENGINEERED STREAMBED MATERIAL (ESM)* |
|---|---|
| CHANNEL ARMORING BOULDERS<br>1-3 TON______________30 - 60" | SIZE (INCHES) %PASSING<br>D84 15"-18"<br>D50 10"<br>D30 6"<br>D16 1"<br>D0 SAND |
| GRADE CONTROL STRUCTURES<br>• INDIVIDUALLY PLACED 1-3 TON ROCK.<br>• BACKFILL WITH ESM | |
| RSP FOR ROCK RAMP<br>• 1/2-1 TON______________30" - 60"<br>• BACKFILL WITH ESM | *ESM SHALL CONTAIN A MIN OF 10% AND MAX OF 15% NATIVE ON-SITE SOIL. |
| TOTAL VOLUME OF ROCK<br>ROCK SLOPE PROTECTION (RSP) (1/2 - 1 TON): 250 CUBIC YARDS<br>BOULDERS (1 - 3 TON): 750 CUBIC YARDS<br>ENGINEERED STREAMBED MATERIAL: 200 CUBIC YARDS | |

2 **ROCK SIZING & VOLUME**
Scale = NTS

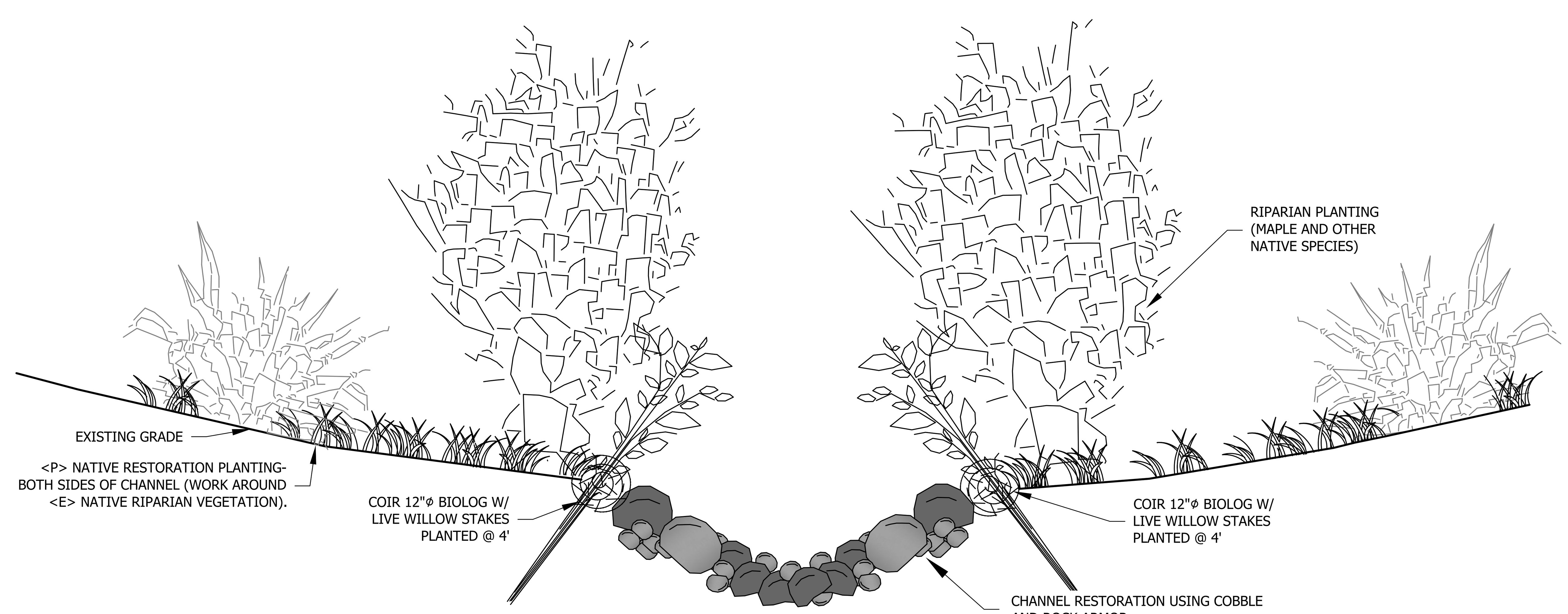



3 **GRADE CONTROL PLAN & SECTION VIEW**
Scale = NTS




4 **TYPICAL CHANNEL SECTION**
Scale = NTS




5 **BIO-TECHNICAL CHANNEL RESTORATION DETAIL**
Scale = NTS

NILES CANYON QUARRY RECLAMATION
30% DESIGN

ALAMEDA COUNTY, CA

Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 400
BERKELEY, CA 94705
P: (510) 848-8098

PROJECT NUMBER: 652.00
SCALE: AS NOTED
DATE: 11/16/2018

DESIGN: CL
DRAWN: CL
CHECKED: JM
APPROVED: ----

REGISTERED PROFESSIONAL ENGINEER JOEL MONSCHKE No. 79688 EXPIRES 9-30-20 CIVIL STATE OF CALIFORNIA

DETAILS

SHEET 19 OF 19

# Appendix B

# HEC-RAS Hydraulic Model Outputs

HEC-RAS Plan: 100 year River: NILES Reach: NILES Profile: 100-year

| Reach | River Sta | Profile | W.S. Elev | Crit W.S. | Min Ch El | E.G. Slope | Vel Chnl | Vel Total | Shear LOB | Shear ROB | Shear Total | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (ft/s) | (lb/sq ft) | (lb/sq ft) | (lb/sq ft) | (sq ft) | (ft) | |
| NILES | 2800 | 100-year | 586.83 | 586.83 | 582.73 | 0.026911 | 9.53 | 7.57 | 1.81 | 1.24 | 2.72 | 20.88 | 9.61 | 0.90 |
| NILES | 2700 | 100-year | 563.15 | 563.15 | 560.96 | 0.027339 | 6.40 | 5.62 | 1.00 | 0.13 | 1.87 | 28.14 | 24.58 | 0.90 |
| NILES | 2600 | 100-year | 548.45 | 548.45 | 546.42 | 0.029139 | 5.01 | 4.32 | 0.59 | 0.30 | 1.21 | 36.59 | 53.94 | 0.88 |
| NILES | 2541.89 | 100-year | 540.46 | | 536.86 | 0.003026 | 2.50 | 2.23 | 0.10 | | 0.25 | 70.79 | 52.96 | 0.32 |
| NILES | 2511.26 | 100-year | 540.51 | | 536.97 | 0.000104 | 0.67 | 0.62 | 0.01 | 0.01 | 0.02 | 253.89 | 90.09 | 0.07 |
| NILES | 2458.59 | 100-year | 540.25 | 540.25 | 539.13 | 0.049923 | 4.07 | 3.69 | 1.26 | | 1.40 | 42.76 | 94.82 | 1.03 |
| NILES | 2406.56 | 100-year | 526.02 | | 522.31 | 0.004653 | 3.49 | 3.49 | | | 0.66 | 45.26 | 18.04 | 0.39 |
| NILES | 2397.16 | 100-year | 525.31 | 525.31 | 523.06 | 0.034973 | 6.95 | 6.95 | | | 3.05 | 22.74 | 15.44 | 1.01 |
| NILES | 2376.56 | 100-year | 520.61 | | 516.99 | 0.003948 | 3.33 | 3.29 | 0.07 | 0.06 | 0.53 | 47.98 | 20.89 | 0.37 |
| NILES | 2367.26 | 100-year | 519.97 | 519.97 | 517.78 | 0.035447 | 6.57 | 6.57 | | | 2.82 | 24.04 | 18.29 | 1.01 |
| NILES | 2346.54 | 100-year | 515.17 | | 511.68 | 0.003463 | 3.26 | 3.07 | 0.12 | 0.14 | 0.43 | 51.42 | 24.71 | 0.35 |
| NILES | 2337.18 | 100-year | 514.55 | 514.55 | 512.44 | 0.031547 | 6.54 | 6.35 | 0.51 | 0.40 | 2.29 | 24.87 | 20.94 | 0.97 |
| NILES | 2315.92 | 100-year | 510.01 | | 506.34 | 0.002980 | 2.90 | 2.85 | 0.07 | 0.04 | 0.39 | 55.50 | 25.33 | 0.32 |
| NILES | 2307.1 | 100-year | 509.41 | 509.41 | 507.26 | 0.035837 | 6.33 | 6.33 | | | 2.67 | 24.94 | 20.38 | 1.01 |
| NILES | 2276.42 | 100-year | 504.26 | | 501.05 | 0.005073 | 3.05 | 3.05 | | | 0.55 | 51.79 | 29.14 | 0.40 |
| NILES | 2267.37 | 100-year | 503.82 | 503.82 | 501.86 | 0.039768 | 5.39 | 5.39 | | | 2.16 | 29.30 | 33.40 | 1.02 |
| NILES | 2246.36 | 100-year | 497.85 | 497.85 | 495.71 | 0.035733 | 6.38 | 6.38 | | | 2.70 | 24.77 | 19.96 | 1.01 |
| NILES | 2236.75 | 100-year | 497.36 | 497.36 | 495.96 | 0.042473 | 4.91 | 4.89 | | 0.39 | 1.86 | 32.30 | 45.53 | 1.02 |
| NILES | 2215.39 | 100-year | 493.98 | | 490.40 | 0.002186 | 2.86 | 2.14 | 0.16 | 0.13 | 0.23 | 73.73 | 42.74 | 0.29 |
| NILES | 2207.25 | 100-year | 493.48 | 493.48 | 491.39 | 0.023252 | 6.46 | 4.83 | 0.89 | 0.89 | 1.39 | 32.74 | 33.83 | 0.87 |
| NILES | 2138.36 | 100-year | 481.65 | 481.65 | 480.00 | 0.031408 | 6.51 | 6.31 | 0.45 | 0.58 | 2.29 | 25.04 | 20.94 | 0.97 |
| NILES | 2030.6 | 100-year | 482.03 | | 474.96 | 0.000125 | 0.97 | 0.93 | 0.01 | 0.01 | 0.03 | 169.27 | 38.17 | 0.07 |
| NILES | 1940.32 | 100-year | 481.19 | 481.19 | 479.31 | 0.034676 | 6.89 | 6.89 | 0.07 | | 2.97 | 22.93 | 15.79 | 1.00 |
| NILES | 1920.28 | 100-year | 477.92 | | 473.90 | 0.002101 | 2.90 | 2.73 | 0.10 | 0.10 | 0.32 | 57.98 | 21.94 | 0.28 |
| NILES | 1910.28 | 100-year | 477.21 | 477.21 | 475.04 | 0.034779 | 6.83 | 6.83 | | | 2.97 | 23.14 | 16.14 | 1.01 |
| NILES | 1889.57 | 100-year | 473.55 | | 469.63 | 0.002929 | 2.89 | 2.89 | | | 0.44 | 54.69 | 20.74 | 0.31 |
| NILES | 1879.96 | 100-year | 472.83 | 472.83 | 470.64 | 0.035084 | 6.83 | 6.83 | | | 2.98 | 23.13 | 16.26 | 1.01 |
| NILES | 1860.44 | 100-year | 469.18 | | 465.40 | 0.003373 | 3.01 | 3.01 | | | 0.48 | 52.53 | 21.13 | 0.34 |
| NILES | 1849.91 | 100-year | 468.46 | 468.46 | 466.27 | 0.035063 | 6.79 | 6.79 | | | 2.95 | 23.27 | 16.54 | 1.01 |
| NILES | 1835.18 | 100-year | 463.89 | | 460.13 | 0.003510 | 3.07 | 3.07 | | | 0.50 | 51.53 | 20.70 | 0.34 |
| NILES | 1830.27 | 100-year | 463.22 | 463.22 | 461.03 | 0.034742 | 6.80 | 6.80 | | | 2.95 | 23.25 | 16.37 | 1.01 |
| NILES | 1814.97 | 100-year | 458.52 | | 455.05 | 0.004870 | 3.48 | 3.48 | | | 0.66 | 45.45 | 19.30 | 0.40 |
| NILES | 1810.27 | 100-year | 457.91 | 457.91 | 455.70 | 0.034844 | 6.71 | 6.71 | | | 2.89 | 23.54 | 16.97 | 1.00 |
| NILES | 1789.8 | 100-year | 453.04 | | 449.57 | 0.004630 | 3.27 | 3.27 | | | 0.59 | 48.35 | 22.27 | 0.39 |
| NILES | 1782.87 | 100-year | 452.41 | 452.41 | 450.18 | 0.035437 | 6.62 | 6.62 | | | 2.85 | 23.88 | 17.89 | 1.01 |
| NILES | 1764.22 | 100-year | 447.72 | | 443.11 | 0.001040 | 2.31 | 2.00 | 0.07 | 0.09 | 0.17 | 78.88 | 28.76 | 0.21 |
| NILES | 1758.07 | 100-year | 447.01 | 447.01 | 444.77 | 0.035296 | 6.75 | 6.75 | | | 2.93 | 23.42 | 16.87 | 1.01 |
| NILES | 1650 | 100-year | 397.30 | 397.30 | 393.97 | 0.041775 | 8.10 | 8.10 | | | 4.01 | 19.52 | 9.79 | 1.01 |
| NILES | 1600 | 100-year | 392.23 | 392.23 | 388.54 | 0.041238 | 8.12 | 8.12 | | | 4.02 | 19.45 | 9.69 | 1.01 |
| NILES | 1399.95 | 100-year | 369.30 | 369.30 | 366.11 | 0.036857 | 7.48 | 7.48 | | | 3.45 | 21.12 | 12.39 | 1.01 |
| NILES | 1200 | 100-year | 349.03 | 349.03 | 346.56 | 0.036505 | 6.50 | 6.50 | 0.13 | | 2.76 | 24.32 | 18.99 | 1.01 |
| NILES | 1010.07 | 100-year | 336.16 | | 332.04 | 0.000267 | 1.10 | 1.06 | 0.01 | 0.02 | 0.05 | 148.55 | 48.13 | 0.10 |
| NILES | 987.49 | 100-year | 335.51 | 335.51 | 333.25 | 0.039354 | 6.92 | 5.92 | 2.38 | | 2.72 | 26.68 | 22.32 | 1.02 |
| NILES | 967.13 | 100-year | 331.52 | 331.52 | 328.63 | 0.036266 | 7.77 | 7.76 | | 0.22 | 3.53 | 20.36 | 11.37 | 1.01 |
| NILES | 953.17 | 100-year | 331.29 | 331.29 | 329.07 | 0.035872 | 5.14 | 4.87 | | 0.61 | 1.64 | 32.47 | 42.78 | 0.95 |
| NILES | 916.9 | 100-year | 321.14 | | 316.13 | 0.000137 | 0.77 | 0.75 | 0.01 | 0.01 | 0.03 | 209.60 | 69.44 | 0.07 |
| NILES | 886.47 | 100-year | 320.35 | 320.35 | 318.18 | 0.034039 | 6.76 | 6.76 | | | 2.91 | 23.38 | 16.32 | 1.00 |
| NILES | 870.24 | 100-year | 317.66 | | 313.54 | 0.001921 | 2.66 | 2.57 | 0.07 | 0.06 | 0.29 | 61.42 | 23.60 | 0.27 |
| NILES | 859.65 | 100-year | 316.87 | 316.87 | 314.70 | 0.033752 | 7.08 | 7.05 | 0.20 | 0.25 | 2.92 | 22.43 | 15.35 | 1.00 |
| NILES | 837.64 | 100-year | 310.81 | | 308.46 | 0.005144 | 2.77 | 2.67 | | 0.57 | 0.53 | 59.20 | 33.67 | 0.39 |
| NILES | 826.31 | 100-year | 310.20 | 310.20 | 309.45 | 0.039001 | 3.38 | 5.72 | | 3.41 | 2.58 | 27.61 | 24.81 | 0.89 |
| NILES | 805.48 | 100-year | 305.79 | 305.67 | 303.41 | 0.023448 | 6.02 | 5.48 | | 0.71 | 1.70 | 28.82 | 23.50 | 0.83 |
| NILES | 795.17 | 100-year | 305.51 | 305.51 | 303.38 | 0.040145 | 5.56 | 5.56 | | | 2.26 | 28.42 | 30.53 | 1.02 |
| NILES | 775.02 | 100-year | 301.36 | | 298.39 | 0.012647 | 4.22 | 4.22 | | | 1.12 | 37.48 | 25.13 | 0.61 |
| NILES | 765.39 | 100-year | 300.97 | 300.97 | 299.39 | 0.040782 | 5.34 | 5.34 | | | 2.13 | 29.61 | 34.40 | 1.01 |
| NILES | 749.78 | 100-year | 296.71 | | 292.32 | 0.002081 | 2.58 | 2.58 | | | 0.34 | 61.24 | 21.03 | 0.27 |
| NILES | 743.15 | 100-year | 296.24 | 296.24 | 294.24 | 0.038957 | 5.67 | 5.67 | | | 2.31 | 27.87 | 28.81 | 1.02 |
| NILES | 721.6 | 100-year | 292.30 | | 288.25 | 0.002463 | 2.64 | 2.64 | | | 0.37 | 59.94 | 23.42 | 0.29 |
| NILES | 710.16 | 100-year | 291.53 | 291.53 | 289.38 | 0.034854 | 6.89 | 6.89 | | | 3.01 | 22.95 | 15.81 | 1.01 |
| NILES | 687.56 | 100-year | 287.05 | | 283.19 | 0.002998 | 2.84 | 2.84 | | | 0.43 | 55.71 | 22.62 | 0.32 |
| NILES | 675.51 | 100-year | 286.52 | 286.52 | 284.31 | 0.039371 | 5.79 | 5.79 | | | 2.39 | 27.27 | 27.08 | 1.02 |
| NILES | 656.36 | 100-year | 279.02 | 279.02 | 276.43 | 0.038302 | 5.87 | 5.87 | | | 2.43 | 26.91 | 25.36 | 1.00 |
| NILES | 645.42 | 100-year | 278.34 | 278.34 | 275.82 | 0.036368 | 6.70 | 6.70 | | | 2.92 | 23.59 | 17.27 | 1.01 |
| NILES | 626.41 | 100-year | 276.05 | | 273.10 | 0.007555 | 3.23 | 3.23 | | | 0.66 | 48.94 | 33.69 | 0.47 |
| NILES | 616.81 | 100-year | 275.55 | 275.55 | 274.03 | 0.038885 | 5.61 | 5.61 | | | 2.27 | 28.19 | 29.58 | 1.01 |
| NILES | 594.95 | 100-year | 270.22 | 270.17 | 268.00 | 0.031484 | 6.66 | 6.66 | | | 2.79 | 23.73 | 15.89 | 0.96 |
| NILES | 583.68 | 100-year | 269.95 | 269.95 | 268.14 | 0.038887 | 5.72 | 5.72 | | | 2.34 | 27.63 | 28.01 | 1.01 |
| NILES | 564.6 | 100-year | 269.17 | | 265.50 | 0.001112 | 1.78 | 1.78 | | | 0.17 | 88.83 | 35.80 | 0.20 |
| NILES | 503.92 | 100-year | 268.26 | 268.26 | 266.09 | 0.035218 | 6.70 | 6.70 | | | 2.90 | 23.57 | 17.18 | 1.01 |
| NILES | 479.98 | 100-year | 264.58 | | 261.63 | 0.011709 | 4.32 | 4.32 | | | 1.14 | 36.60 | 21.79 | 0.59 |
| NILES | 450 | 100-year | 264.68 | | 259.50 | 0.000811 | 1.80 | 1.80 | | | 0.16 | 87.71 | 24.84 | 0.17 |
| NILES | 436 | 100-year | 264.16 | 264.16 | 261.82 | 0.033740 | 5.67 | 5.67 | | | 2.23 | 27.84 | 25.54 | 0.96 |
| NILES | 420.09 | 100-year | 262.77 | | 258.51 | 0.002006 | 2.45 | 2.45 | | | 0.31 | 64.59 | 24.15 | 0.26 |
| NILES | 409.24 | 100-year | 262.02 | 262.02 | 259.86 | 0.034013 | 6.81 | 6.81 | | | 2.94 | 23.19 | 15.95 | 1.00 |
| NILES | 392.92 | 100-year | 258.69 | 258.69 | 256.53 | 0.034951 | 6.89 | 6.89 | | | 3.01 | 22.93 | 15.82 | 1.01 |
| NILES | 382.71 | 100-year | 258.22 | 258.22 | 257.43 | 0.047532 | 3.87 | 3.87 | | | 1.37 | 40.78 | 87.94 | 1.00 |
| NILES | 356.13 | 100-year | 258.00 | | 251.91 | 0.000006 | 0.20 | 0.20 | | | 0.00 | 792.74 | 171.95 | 0.02 |
| NILES | 200 | 100-year | 258.00 | 252.16 | 251.50 | 0.000004 | 0.18 | 0.18 | | | 0.00 | 857.76 | 159.28 | 0.01 |

# Appendix C

# Existing Conditions, Hydrology Peer Review, and Conceptual Design Recommendations

Stillwater Sciences
2855 Telegraph Ave, Suite 400, Berkeley, CA 94705
phone 510.848.8098 fax 510.848.8398

# TECHNICAL MEMORANDUM

| | |
|---|---|
| DATE: | 11 November 2016 |
| TO: | Andrew White, Benchmark Resources |
| FROM: | Joel Monschke, Stillwater Sciences |
| SUBJECT: | Niles Canyon Quarry—Existing Conditions, Hydrology Peer Review, and Conceptual Design Recommendations |

## 1 INTRODUCTION

Benchmark Resources contracted Stillwater Sciences to peer-review the 20-year/1-hour hydrology analysis of the seasonal creek at the Niles Canyon Quarry, conduct a site assessment related to reclamation of the Quarry, and develop conceptual restoration/rehabilitation designs for the seasonal creek. (Stillwater was also contracted to peer-review and provide recommendations on the Quarry revegetation plan; this task will be reported on separately.) Based on the review of the hydrology analyses (both the 20- and 100-year hydrology reports were reviewed) and observations made during the 29 August 2016 site assessment, there are a number of drainage features at the Quarry that have high potential to result in significant future erosion. Below, we summarize our observations from the site assessment, discuss our findings from the hydrology peer review, and propose conceptual restoration/rehabilitation treatments.

## 2 FIELD OBSERVATIONS

Overall, the seasonal creek channel has been heavily disturbed both in terms of the physical landscape and hydrologic function. As mapped in Appendix A, Sheet 1, there are numerous basins, ditches, and culverts along the channel. From a hydrologic and hydraulic perspective, there are three major areas of concern.

First, there is evidence of significant plugging at the inlet of Culvert 2 (see Appendix A, Sheet 1), a 24-inch diameter culvert that carries water under the main haul road in the middle of the property (see Appendix B, Photo 1). When this culvert is plugged, seasonal runoff will pond up behind it and eventually divert down the main haul road, and off site, potentially causing damage to neighboring properties and natural resources (see Appendix A, Sheet 1 for a visual depiction of existing and potential future flow paths).

Second, there are two constructed basins, one above and one below Culvert 3, that attenuate flow and capture sediment. Both basins have high potential for failure due to poorly installed and partially clogged culverts that drain each basin.

Third, below Culvert 4 runoff is routed away from the "natural" channel swale into an approximately 150-feet long man-made-ditch to the southeast. This ditch runs into a completely clogged culvert (Culvert 5), through a second shotgunned[1] culvert (Culvert 6), and then through another ditch until it eventually drains to the detention basin at the bottom of the quarry (see Appendix A, Sheet 1). This "drainage system" is poorly designed and has not been maintained. It will continue to degrade and likely cause severe erosion during future large rainfall events. Failure of Culverts 3–7 would lead to onsite erosion and gullying that could significantly increase the fine sediment content of runoff leaving the site and entering Alameda Creek. Additionally, the "natural" channel swale within this portion of the property has been heavily disturbed and appears to be filled with dirt and gravel.

## 3 HYDROLOGY ANALYSIS PEER REVIEW SUMMARY

We have reviewed both the 20- and 100-year runoff evaluation reports and generally concur with the results of the reports (the reports are provided in Appendices C and D, respectively). The two analyses use very different methods for calculating storm discharges, but the outcomes are generally consistent. The 20-year runoff evaluation used the Rational Method, which utilizes a simple mathematical formula and input data that is easy to review and double-check. The 100-year analyses used a more complex hydrologic modeling approach which is difficult to analyze in terms of specific formulas and calculations. However, using the 20-year storm event discharge of 88.8 cubic feet per second (cfs) as context, we believe that the estimated 100-year storm event discharge of 164.6 cfs is reasonable.

We also concur with the hydraulic analyses that the combination of three culverts that drain Basin 7 are capable of handling the 20- and 100-year storm event flows, with excavation of the "ditch" as proposed in Appendix D, Figure 2.

There was a significant omission in both of these reports, however, because they did not analyze the nine additional upstream culverts at the site. Many of these are not appropriately sized to carry 20- or 100-year flows and have high potential for failure, which will lead to significant erosion. Seven of the additional nine culverts are located along the channel's primary flow path (Culverts 1-7 shown on Appendix A, Sheet 1) and are thus of primary concern.

## 4 CULVERT SIZING RECOMMENDATIONS

The seven culverts are located within the downstream portion of the Mid Basin and along the eastern portion of the Quarry Basin, as denoted by the thick red line on Figure 1 below. It is critical that the culverts are properly sized so that 20-year flows do not exceed the culvert capacity and result in flow diversion and erosion. For simplicity, we assume that the 20-year discharge at each of the culverts are generated from the three upper basins (Upper Basin, NE Basin and Mid Basin), resulting in a discharge of 68.3 cfs (based on Appendix C, Table 1). We have also estimated that the 100-year discharge at each culvert is 121.8 cfs (based on Appendix D, page 17) These discharges may be slight overestimates for Culverts 1 and 2, and slight underestimates for Culverts 3–7. However, considering uncertainties associated with hydrologic

[1] "Shotgunned" refers to culvert outlets that stick out of the road prism into the air, typically causing larger scour gullies downslope. See Appendix B, Photo 7 for an example of a shotgunned culvert.

analyses, we believe that these discharge estimates are appropriate for determining culvert sizes and additional site-specific hydrologic analyses are not needed at this time.

Culvert dimensions required to carry peak flow discharges were determined through hydraulic modeling, using the U.S. Army Corps of Engineers' *Hydrologic Engineering Center's River Analysis System* (HEC-RAS). Table 1 summarizes conditions and recommendations for the drainage structures.

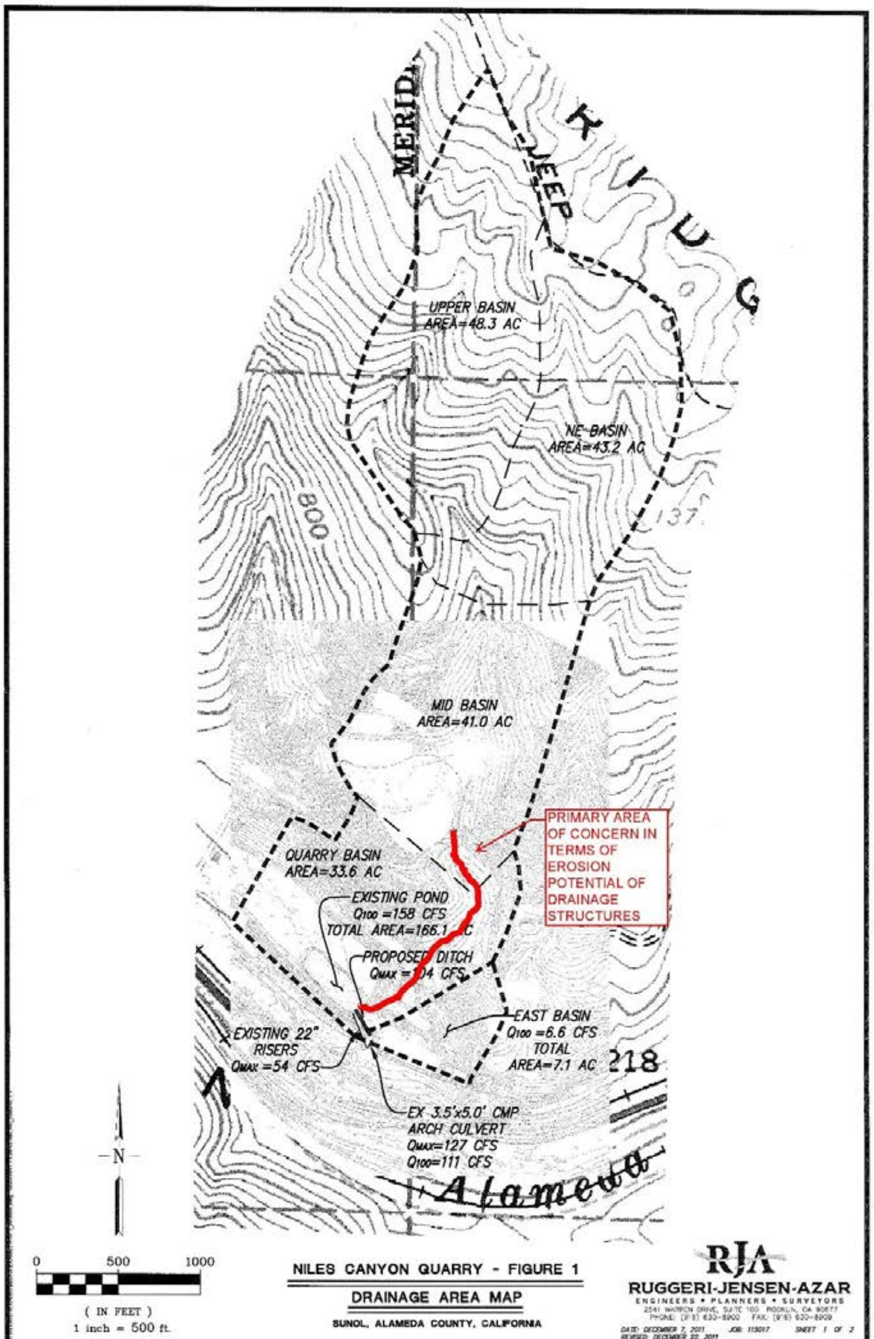



**Figure 1.** Primary area of concern in terms of culvert-related erosion potential; figure adapted from RJA 2015 (see Appendix D for full report).

**Table 1.** Summary of culvert conditions, capacity, and recommendations.

| Culvert number | Diameter | Current conditions | Estimated 20-year flow (cfs) | Estimated 100-year flow (cfs) | Flow capacity | Recommendation to meet SMARA requirements[2] |
|---|---|---|---|---|---|---|
| 1 | 42 inches | OK | 68.3 | 121.8 | 75 | Add rock armor at outlet (pending agency input) |
| 2 | 24 inches | Inlet partially smashed | 68.3 | 121.8 | 20 | Replace with 42-inch diameter pipe and long downspout |
| 3 | 36 inches and 12 inches | 12-inch diameter pipe completely plugged; outlet shotgunned | 68.3 | 121.8 | 55 | Replace with willow-planted rock armored spillway |
| 4 | 24 inches and 24 inches | Only one culvert appears functional | 68.3 | 121.8 | 30 | Replace with willow-planted rock armored spillway |
| 5 | 18 inches | Inlet completely plugged | 68.3 | 121.8 | 10 | Remove culvert and regrade to natural slope |
| 6 | 18 inches | Outlet shotgunned | 68.3 | 121.8 | 10 | Remove culvert and regrade to natural slope |
| 7 | 24 inches | Inlet and outlet comprised of different types of pipe | 68.3 | 121.8 | 20 | Replace with willow-planted rock armored spillway |
| 8 | 24 inches and 24 inches | OK | 88.8 | 165 | ~165 | Excavate and armor overflow channel between pond and oval culvert |
| 9 | 3 ½ foot height x 5 foot width oval | OK | | | | |
| 10 | 18 inches | OK | 3.3 | 7 | 10 | Add rock armor at outlet only (pending agency input) |
| 11 | 18 inches | Inlet completely plugged | Unknown | Unknown | 10 | Remove and install rock lined ditch |

As shown on Table 1, Culverts 2–7 are all significantly undersized to carry the 20-year storm flows. Appendix A, Sheet 1 shows likely flow diversion and erosion areas resulting from the potential failure of these drainage structures during large rainfall events.

# 5 CHANNEL RESTORATION/REHABILITATION RECOMMENDATIONS

In addition to the issues associated with culverts, the seasonal channel and surrounding landscape in the lower portion of the site have been heavily disturbed. Based on field observations and

[2] Based on culvert dimensions necessary to convey 20-year peak flows (per SMARA requirements); additional analyses and/or larger diameter culverts will be required to convey 100-year peak flows.

review of the hydrologic data, there is no "partial fix" design solution that we feel comfortable proposing or supporting. An engineered restoration design is needed to stabilize the channel for the long-term, by returning runoff flow paths to more natural alignments and constructing a new channel with bioengineering and rock armor. A preliminary conceptual design for our recommended channel restoration is shown in Appendix A, Sheet 2. To support this design, hydraulic and channel stability analyses will be needed to insure that the new channel can carry storm flows without being destabilized.

# 6 NEXT STEPS

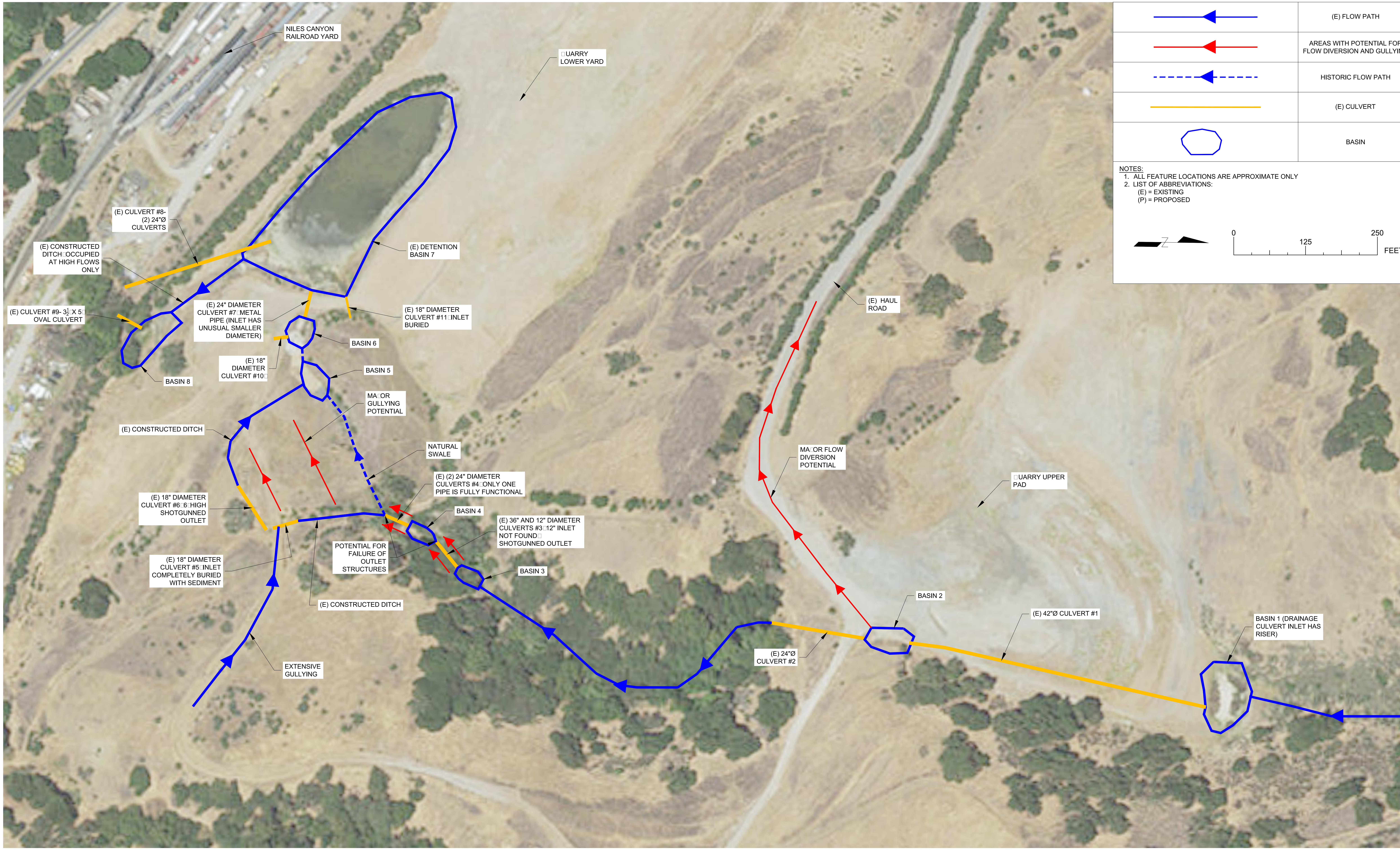
Channel restoration/rehabilitation at the Niles Canyon Quarry will require permits from the California Department of Fish and Wildlife, Regional Water Quality Control Board, and U.S. Army Corps of Engineers, as well as compliance with the California Environmental Quality Act (CEQA). It is also possible that after receiving agency input, additional restoration/rehabilitation will be required beyond what is proposed in the current conceptual design: we expect that agencies may request removal of Culvert 1 and additional channel restoration between Basins 1 and 2 (see Appendix A, Sheet 1).

To advance the channel restoration/rehabilitation design to the 65% level, a field-based topographic survey of all proposed work areas will be needed. It is also likely that 90% and 100% Design Plans and Specifications will be needed to guide construction at this complex site.

# Appendices

# Appendix A

# Conceptual Restoration/Rehabilitation Design



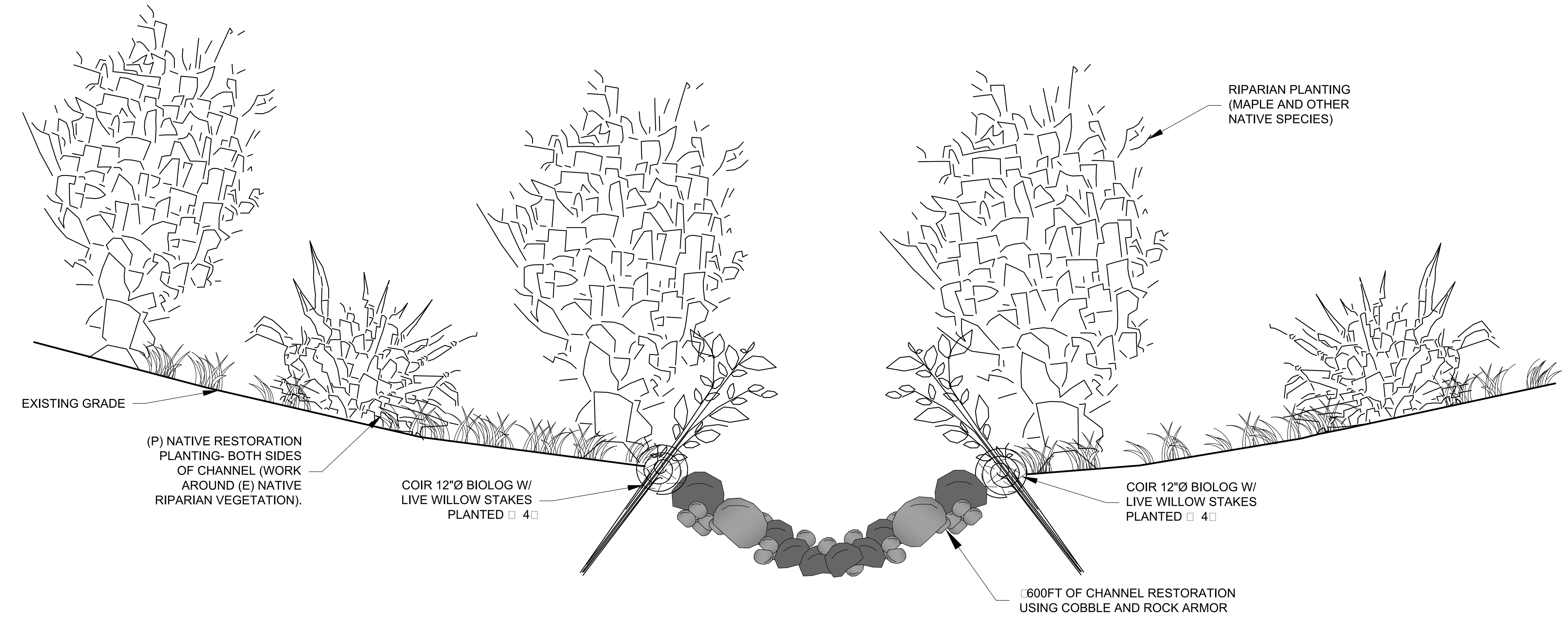

**NILES CANYON QUARRY REHABILITATION PROJECT**
NILES CANYON □UARRY
5500 NILES CANYON RD□SUNOL□CA
ALAMEDA COUNTY

Stillwater Sciences
www.stillwatersci.com

| | |
|---|---|
| De□□□: | □M |
| Dra□□: | □M |
| C□ec□ed: | EB |
| A□□rd: | |

**EXISTING CONDITIONS**

| | |
|---|---|
| S□e: D | Pr□ec□: 652.00 |
| Scale: | AS NOTED |
| Da□e: | 10-25-2016 |
| S□ee□: | 1 OF 2 |


1 **CHANNEL RESTORATION DETAIL**

NTS

**NILES CANYON QUARRY REHABILITATION PROJECT**
NILES CANYON UARRY
5500 NILES CANYON RD SUNOL CA
ALAMEDA COUNTY

Stillwater Sciences
www.stillwatersci.com

| | |
|---|---|
| De: | M |
| Dra: | M |
| Checked: | EB |
| A rd: | |

**CONCEPTUAL REHABILITATION DESIGN**

| | |
|---|---|
| Size: D | Project: 652.00 |
| Scale: | AS NOTED |
| Date: | 10-25-2016 |
| Sheet: | 2 OF 2 |

# Appendix B

# Photos

**Photo 1.** Outlet of Culvert 1 (top of photo), catchment basin, and inlet of Culvert 2 (bottom of photo). Evidence of clogging of Culvert 2 inlet in the form of sediment on top of culvert and heavy equipment bucket tooth marks on culvert.

**Photo 2.** Culvert 3 inlet; 2nd culvert inlet not located.

**Photo 3.** Shotgunned Culvert 3 outlets.

**Photo 4.** Clogged Culvert 4 inlets.

**Photo 5.** Culvert 4 outlet; 2nd culvert outlet not located.

**Photo 6.** Culvert 5 outlet and Culvert 6 inlet. Culvert 5 inlet completely buried with sediment.

**Photo 7.** Shotgunned Culvert 6 outlet.

**Photo 8.** Culvert 7 outlet.

**Photo 9.** Culvert 10 inlet.

**Photo 10.** Culvert 10 outlet.

**Photo 11.** Culvert 11 outlet.

# Appendix C

# 20-year, 1-hour Hydrologic Analyses

**_EMKO Environmental, Inc._**
**551 Lakecrest Dr.**
**El Dorado Hills, CA 95762-3772**
**(916)718-5511**
**akopania@sbcglobal.net**

September 19, 2016

SRDC, Inc.
1265 Montecito Ave.
Mountain View, CA 94043

Attention: Roy Ferrari

Subject: Results of SMARA Surface Runoff Evaluation
Niles Canyon Quarry

Dear Mr. Ferrari:

This letter presents the results of the surface runoff evaluation prepared for the Niles Canyon Quarry (California Mine ID No. 91-01-0003) consistent with the requirements of Section 3706 (d) of the Surface Mining and Reclamation Act (SMARA). Section 3706 (d) states:

> *Surface runoff and drainage from surface mining activities shall be controlled by berms, silt fences, sediment ponds, revegetation, hay bales, or other erosion control measures, to ensure that surrounding land and water resources are protected from erosion, gullying, sedimentation and contamination. Erosion control methods shall be designed to handle runoff from not less than the 20 year/1 hour intensity storm event.*

A previous drainage analysis was completed by Ruggeri-Jensen-Azar in December 2011, which is referred to as the Ruggeri study in this letter report. The Ruggeri study evaluated drainage conditions that would occur as a result of a 100-year, 24-hour storm event, in accordance with Alameda County standards. The Ruggeri study was included as Appendix F of the June 2014 Reclamation Plan Amendment for the Niles Canyon Quarry (SMP-34). In a letter dated July 1, 2015, the California Office of Mine Reclamation provided comments on the June 2014 Reclamation Plan Amendment, noting that the Ruggeri study did not evaluate the 20-year, 1-hour storm event as required by Section 3706(d) of SMARA.

Based on the July 1, 2015 comment from the Office of Mine Reclamation, EMKO Environmental, Inc. was retained to prepare an evaluation of the runoff from the 20-year, 1-hour storm event. A site reconnaissance was conducted on June 23, 2016 with Mr. Tom Bylund to observe site features that could affect surface runoff, including topography, soils, and existing and proposed drainage features. The drainage features observed included natural channels, ditches, culverts, retention basins, and stormwater best management practices (BMPs).

The Ruggeri study defined the sub-basins, or sub-watersheds, at the site and identified the acreages for each of these areas. Attachment 1 is a map from the Ruggeri study showing each sub-basin. Attachment 1 also shows the waterway lengths, waterway slopes, and ground slopes to the waterways for each sub-basin that were calculated as part of this study.

The Ruggeri study determined that the peak runoff from the site from a 100-year, 24-hour storm would be 158 cubic feet per second cfs) from the main site areas and an additional 6.6 cfs from a small area referred to as the East Basin. The Ruggeri study also identified the appropriate conveyance and detention facilities to manage the peak runoff, in accordance with Alameda County standards.

According to Fernando Gonzales of the Alameda County Department of Public Works, the appropriate standards to use for this evaluation are those presented in *Hydrology and Hydraulics Criteria Summary for Western Alameda County, Revised August 7, 1989* (personal communication, June 29, 2016). The 1989 Alameda County document is available at https://fremont.gov/DocumentCenter/Home/View/6328 (accessed June 29, 2016).

Attachment 2 presents a basic summary of the parameters used in this evaluation and charts from the 1989 Alameda County criteria showing the parameter selection. Table 1 provides a listing of the specific parameters used and the calculation results. The rainfall intensity was identified based on a mean annual precipitation of 24 inches, using Sheet 1 of the 1989 Alameda County document. The runoff coefficient was modified based on rainfall intensity and ground slope using Figure 10 of the Alameda County document. Separate calculations were prepared for each of the five sub-basins shown on the map in Attachment 1 because there is a wide variation in the slopes for each sub-basin.

As indicated in Table 1, the peak runoff from the 20-year, 1-hour storm event varies from 3.3 cfs to 23.7 cfs for the different sub-basins. The combined peak runoff from the five sub-basins is 88.8 cfs, which is about half of that determined in the Ruggeri study for the 20-year, 1-hour storm event. It should be noted that the 88.8 cfs value is considered to be a conservative over-estimate because it assumes that the peak runoff from each sub-basin will reach the downslope edge of the site at the same time. In reality, the peak runoff from the lower sub-basins will reach the downslope edge of the site before the peak runoff from the upper sub-basins can reach the same area, due to the longer flow path from the upper sub-basins.

Since the peak runoff from the 20-year, 1-hour storm event is substantially less than that from the 100-year, 24-hour storm event, the stormwater management recommendations presented in the Ruggeri study comply with the requirements of SMARA Section 3706(d).

I appreciate the opportunity to provide this evaluation for SRDC, Inc. Please do not hesitate to call me if you have any questions.

Sincerely,

***EMKO Environmental, Inc.***

A. Kopania

Dr. Andrew A. Kopania, P.G., C.H.
President and Principal Hydrogeologist
California Professional Geologist #4711
California Certified Hydrogeologist #HG31

**Table 1**

Modified Rational Method Analysis

20-year/1-hour Storm Event

Niles Canyon Quarry

Alameda County, California

| Parameter | Upper Basin | Northeast Basin | Mid-Basin | Quarry Basin | East Basin |
|---|---|---|---|---|---|
| Area (acres) | 48.3 | 43.2 | 41 | 33.6 | 7.1 |
| Length (ft) | 2860 | 2430 | 1680 | 1160 | 1030 |
| $H_1$ | 1885 | 1720 | 790 | 380 | 475 |
| $H_2$ | 880 | 790 | 380 | 260 | 260 |
| $\Delta H$ | 1005 | 930 | 410 | 120 | 215 |
| Waterway Slope (%) | 35 | 38 | 24 | 10 | 21 |
| Time of Concentration (Tc) | | | | | |
| Overland Flow Velocity (V, ft/sec) from Figure 4 | 5.8 | 6.2 | 4.8 | 3.2 | 4.6 |
| Tc = L/60V (minutes) | 8.2 | 6.5 | 5.8 | 6.0 | 3.7 |
| Rainfall Intensity (i) | | | | | |
| MAP (inches/yr) from Sheet 1 | 24 | 24 | 24 | 24 | 24 |
| Intensity Factor (interpolated from Sheet 1) | 0.0455 | 0.0455 | 0.0455 | 0.0455 | 0.0455 |
| Rainfall intensity for 20-yr/1-hr event (in/hr) | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 |
| Modified Runoff Coefficient (C') | | | | | |
| C | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Land slope to waterway (%) | 35 | 38 | 44 | 38 | 28 |
| C' (from Figure 10) | 0.45 | 0.47 | 0.5 | 0.47 | 0.42 |
| Peak Runoff | | | | | |
| Q = C' x i x A (cfs) | 23.7 | 22.2 | 22.4 | 17.2 | 3.3 |
| **Total (cfs)** | **88.8** | | | | |

# Attachment 1

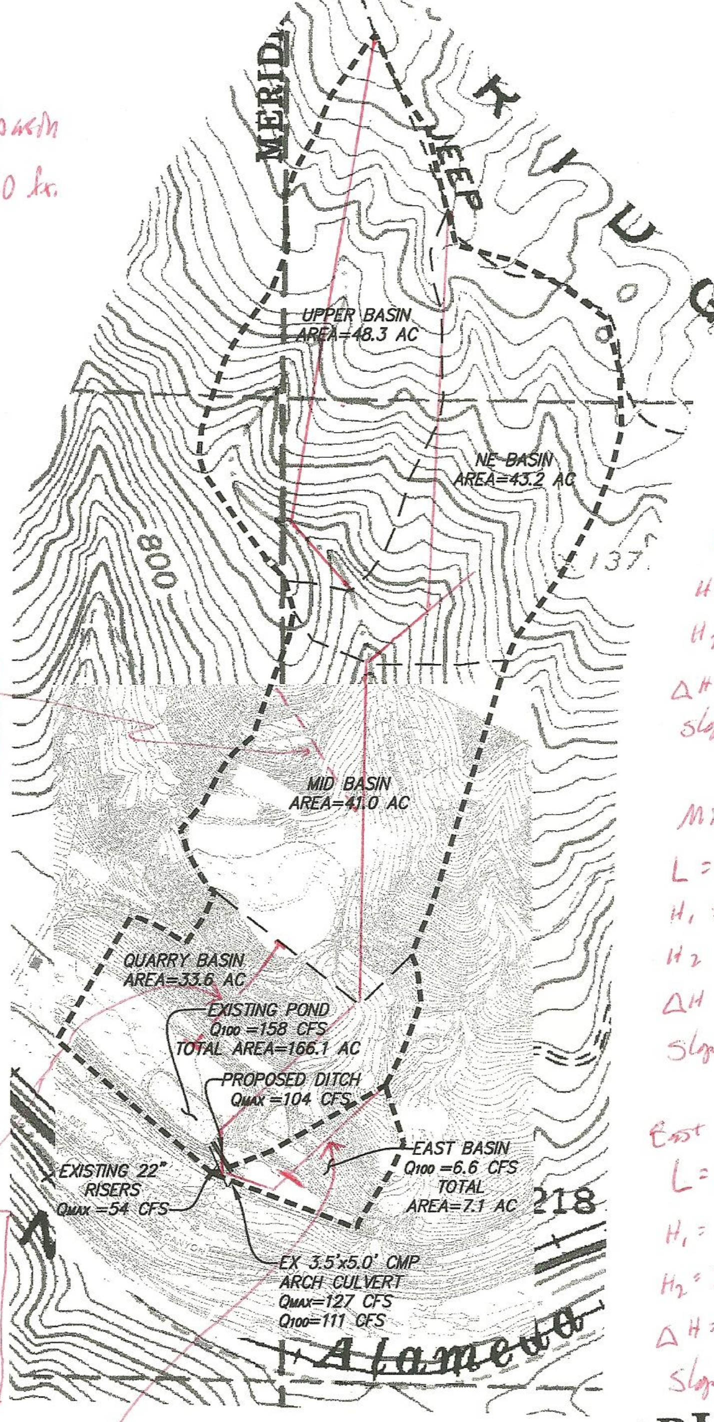
## Sub-Basin Map from Ruggeri–Jensen–Azar, 2011

Upper basin
$L = 2,860$ ft.
$H_1$ 1885'
$H_2 = 880'$
$\Delta H = 1005'$
slope = 35%

grand slope
$\frac{925 - 530}{860'} = 44\%$

Quarry Basin
$L = 1,160'$
$H_1 = 380'$
$H_2 = 260'$
$\Delta H \approx 120'$
slope = 10%

grand slope
$\frac{560 - 300}{680'} = 38\%$




NE Basin
$L = 2,430$ ft
$H_1 = 1720'$
$H_2 = 790'$
$\Delta H = 930'$
slope = 38%

Mid-Basin
$L = 1,680$ ft.
$H_1 = 790'$
$H_2 = 380'$
$\Delta H = 410'$
slope = 24%

East Basin
$L = 1030$
$H_1 = 475$
$H_2 = 260'$
$\Delta H = 215'$
slope = 21%

N

0 500 1000
( IN FEET )
1 inch = 500 ft.

NILES CANYON QUARRY - FIGURE 1
DRAINAGE AREA MAP
SUNOL, ALAMEDA COUNTY, CALIFORNIA

RJA
RUGGERI-JENSEN-AZAR
ENGINEERS • PLANNERS • SURVEYORS
2541 WARREN DRIVE, SUITE 100 ROCKLIN, CA 95677
PHONE: (916) 630-8900 FAX: (916) 630-8909

DATE: DECEMBER 7, 2011 JOB: 115017 SHEET 1 OF 2
REVISED: DECEMBER 22, 2011

grand slope $\frac{475 - 300}{635} = 28\%$

# Attachment 2

## Calculation Sheets and Pages from Alameda County, 1989

Nile Cyn. Quarry

Upperbasin 48.3 Ac.

MAP = 24"

Precip. Intensity Factor $(I_x)$

60 min (1 hr.)

15 yrs. = ~~0.048~~ 0.043

25 yrs. = 0.048

→ 20 yr = 0.0455

Precip Intensity = MAP × $I_x$

24" × 0.0455 = 1.09 in/hr.

Per Alameda Cty 1989 (pg. 3-4, eqn. 1-1)

< 640 ac. → Modified Rational Formula

$Q = C' \times i \times A$

Q in cfs

i = rainfall intensity in in/hr.

C' = runoff coeff. modified by slope + rainfall intensity

A = drainage area in acres

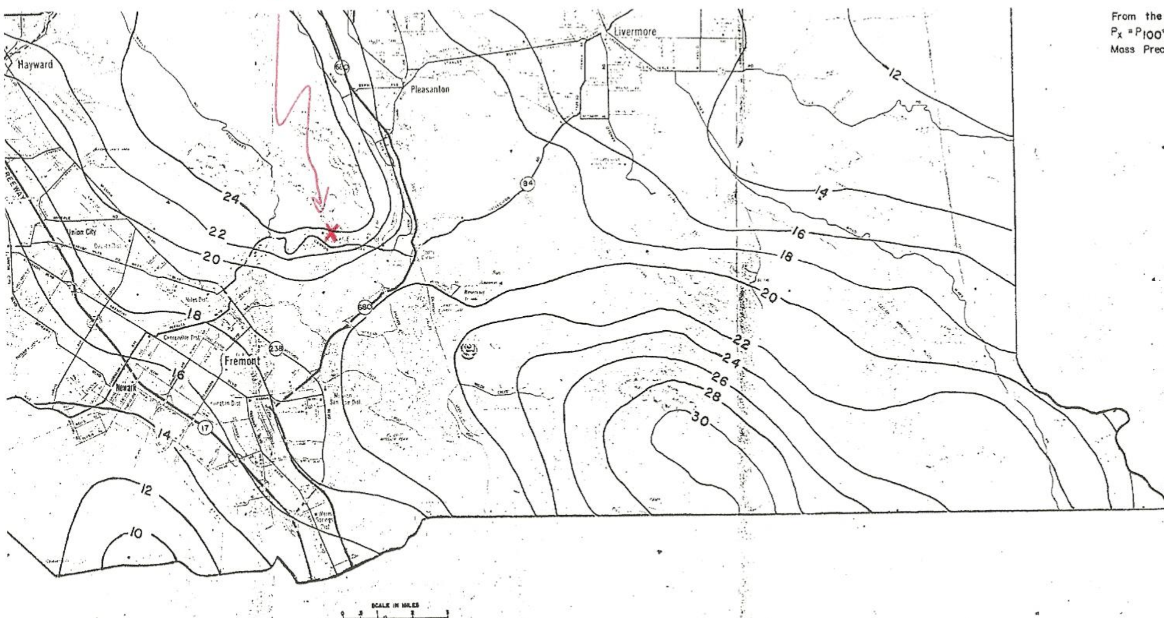
$T_c$ – undeveloped Watershed

$T_c = \frac{L}{60(V)}$

L = overland flow length, ft

V = overland flow vel. from Fig. 4

Site location




From the Unit Mass Precipitation Curve

$P_x = P_{100} = 0.24$

Mass Precipitation = $P_{100}$ x MAP = 0.24 x 23in = 5.52in

| REVISIONS | | | | |
|---|---|---|---|---|
| 5 | | | | |
| 4 | | | | |
| 3 | | | | |
| 2 | | | | |
| 1 | | | | |
| NO. | DESCRIPTION | BY | DATE | APVD |

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

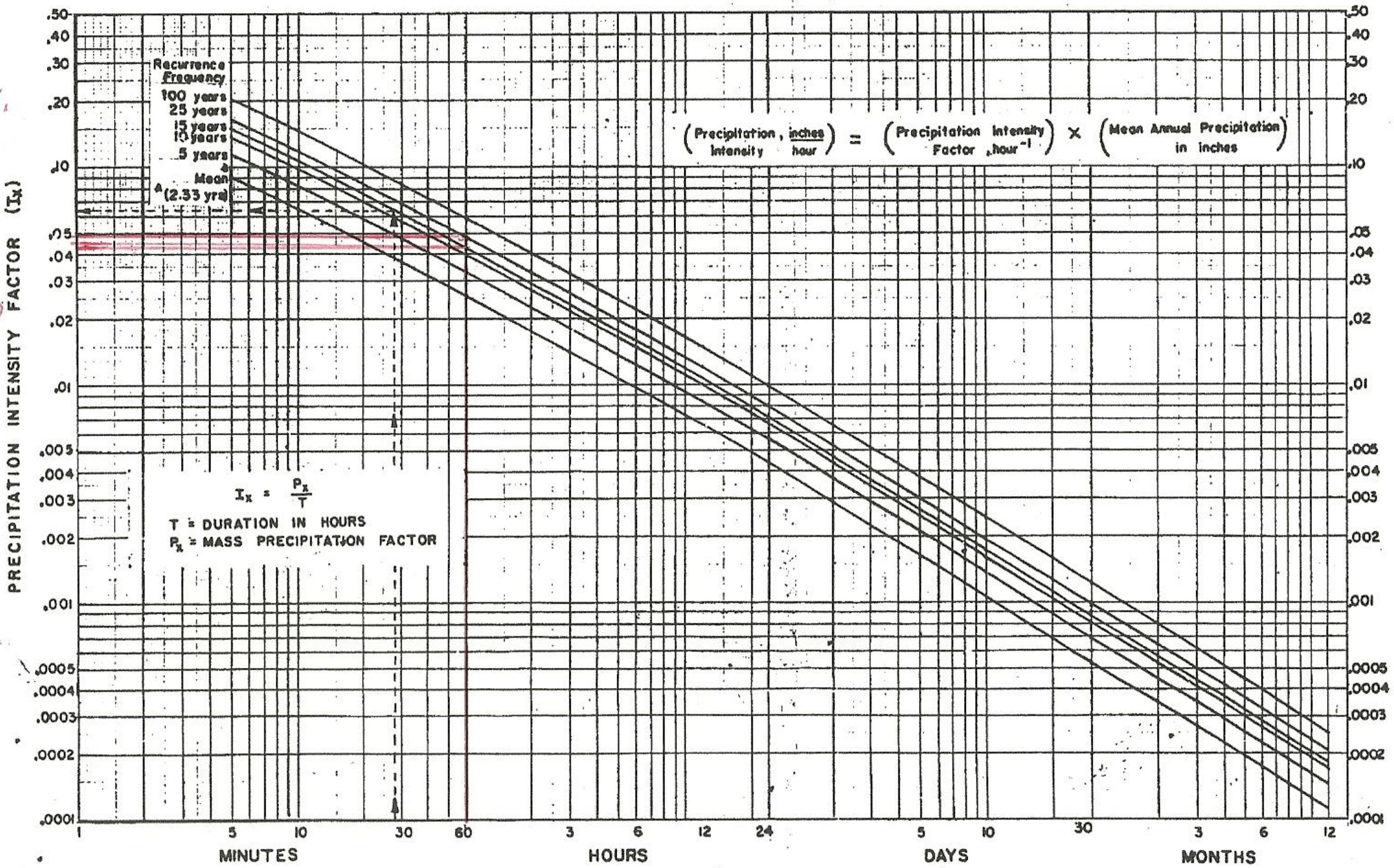
MEAN ANNUAL PRECIPITATION AND UNIT FREQUENCY-DURATION CURVES

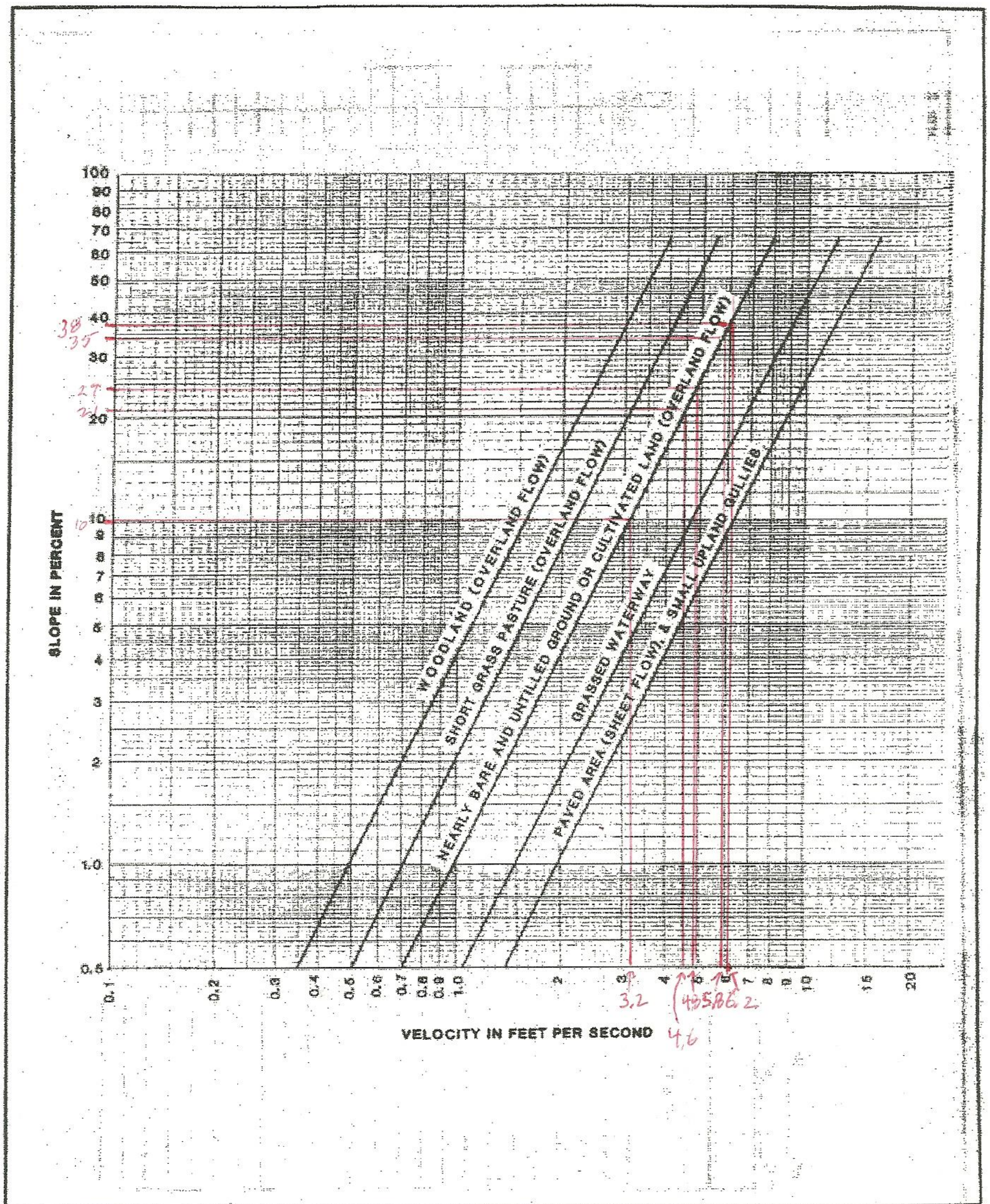
| | | | |
|---|---|---|---|
| DRAWN K.H. | TRACED | DATE AUGUST, 1981 | |
| CHECKED V. W. | | SCALE 1 = 10,000± | |
| APVL. REC. Jack A. Fitzsly | | FILE NO. MA-180 | SHEET NO. 1 OF 1 |
| APPROVED | | | |

# UNIT INTENSITY CURVES

25-yr.
0.048

15-yr.
0.043






| ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT | OVERLAND FLOW VELOCITY CHART | DATE: FEBRUARY 1987 |
|---|---|---|
| | | FIGURE 4 |

RUNOFF FACTOR SLOPE AND INTENSITY ADJUSTMENT CHART PG 1 OF 3

C = Initial Runoff Factor
C+Cs = Runoff Factor + Slope Adjustment
C` = Design Runoff Factor

To determine C` begin with the initial runoff factor C in the upper left of the chart. Draw a line to the right until you meet a ground slope greater than the average ground slope of the incremental drainage area. Next draw a line down until you reach a rainfall intensity greater than your design intensity. Next draw a line to the left to find your design runoff factor C`

| | BEGIN BELOW | .20 | .21 | .22 | .23 | .24 | .25 | .26 | .27 | .28 | .29 | .30 | .31 | .32 | .33 | .34 | .35 | .36 | .37 | .38 | .39 | .40 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | C + Cs | | | | | | | | | | | |
| | .20 | 2 | 3 | 4 | 5 | 6 | 7 | 9 | 10 | 11 | 13 | 14 | 16 | 17 | 19 | 20 | 22 | 24 | 25 | 27 | 29 | 31 | S |
| | .30 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 2 | 3 | 5 | 6 | 7 | 9 | 10 | 12 | 14 | 15 | 17 | L |
| | .40 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 2 | O |
| C | .50 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | next | P |
| | .60 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | next | E |
| | .70 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | next | |
| | .80 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | next | % |
| | .20 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | .21 | .57 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | .22 | .77 | .57 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | .23 | .93 | .78 | .58 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | .24 | 1.07 | .94 | .78 | .58 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | .25 | 1.20 | 1.08 | .94 | .79 | .59 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| C` | .26 | 1.33 | 1.21 | 1.09 | .93 | .79 | .59 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | I |
| = | .27 | 1.45 | 1.34 | 1.23 | 1.10 | .96 | .80 | .60 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | N |
| C | .28 | 1.58 | 1.47 | 1.36 | 1.24 | 1.11 | .97 | .81 | .60 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | T |
| + | .29 | 1.70 | 1.59 | 1.48 | 1.37 | 1.25 | 1.12 | .98 | .81 | .61 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | E |
| Cs | .30 | 1.82 | 1.72 | 1.61 | 1.50 | 1.38 | 1.26 | 1.13 | .99 | .82 | .61 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | N |
| + | .31 | 1.95 | 1.84 | 1.74 | 1.63 | 1.51 | 1.40 | 1.27 | 1.14 | 1.00 | .83 | .62 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | S |
| Ci | .32 | 2.08 | 1.97 | 1.86 | 1.76 | 1.65 | 1.53 | 1.41 | 1.29 | 1.15 | 1.01 | .84 | .62 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | I |
| | .33 | 2.21 | 2.10 | 2.00 | 1.89 | 1.78 | 1.66 | 1.55 | 1.43 | 1.30 | 1.17 | 1.02 | .84 | .63 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | T |
| | .34 | 2.35 | 2.24 | 2.13 | 2.02 | 1.91 | 1.80 | 1.68 | 1.57 | 1.44 | 1.31 | 1.18 | 1.03 | .85 | .63 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | Y |
| | .35 | 2.49 | 2.38 | 2.27 | 2.16 | 2.05 | 1.94 | 1.82 | 1.70 | 1.58 | 1.46 | 1.33 | 1.19 | 1.04 | .86 | .64 | .00 | ---- | ---- | ---- | ---- | ---- | |
| | .36 | 2.64 | 2.52 | 2.41 | 2.30 | 2.19 | 2.08 | 1.96 | 1.84 | 1.73 | 1.60 | 1.48 | 1.34 | 1.20 | 1.05 | .87 | .66 | .00 | ---- | ---- | ---- | ---- | I |
| | .37 | 2.79 | 2.68 | 2.56 | 2.45 | 2.34 | 2.22 | 2.10 | 1.99 | 1.87 | 1.75 | 1.62 | 1.50 | 1.36 | 1.22 | 1.06 | .88 | .65 | .00 | ---- | ---- | ---- | N |
| | .38 | 2.96 | 2.84 | 2.72 | 2.60 | 2.49 | 2.37 | 2.25 | 2.14 | 2.02 | 1.90 | 1.77 | 1.65 | 1.51 | 1.38 | 1.23 | 1.07 | .89 | .66 | .00 | ---- | ---- | / |
| | .39 | 3.13 | 3.01 | 2.89 | 2.77 | 2.65 | 2.53 | 2.41 | 2.29 | 2.17 | 2.05 | 1.92 | 1.80 | 1.67 | 1.53 | 1.39 | 1.25 | 1.08 | .90 | .66 | .00 | ---- | H |
| | .40 | 3.32 | 3.19 | 3.06 | 2.94 | 2.82 | 2.69 | 2.57 | 2.45 | 2.32 | 2.20 | 2.08 | 1.95 | 1.82 | 1.69 | 1.55 | 1.41 | 1.26 | 1.10 | .91 | .67 | .00 | R |
| | .41 | 3.52 | 3.38 | 3.25 | 3.12 | 2.99 | 2.87 | 2.74 | 2.61 | 2.49 | 2.36 | 2.24 | 2.11 | 1.98 | 1.85 | 1.71 | 1.58 | 1.43 | 1.28 | 1.11 | .92 | .68 | |
| | .42 | 3.73 | 3.59 | 3.45 | 3.32 | 3.18 | 3.05 | 2.92 | 2.79 | 2.66 | 2.53 | 2.40 | 2.27 | 2.14 | 2.01 | 1.88 | 1.74 | 1.60 | 1.45 | 1.29 | 1.12 | .93 | |
| | .43 | 3.96 | 3.81 | 3.67 | 3.53 | 3.39 | 3.25 | 3.11 | 2.98 | 2.84 | 2.71 | 2.58 | 2.44 | 2.31 | 2.18 | 2.04 | 1.90 | 1.77 | 1.62 | 1.47 | 1.31 | 1.14 | |
| | .44 | 4.21 | 4.06 | 3.90 | 3.75 | 3.61 | 3.46 | 3.32 | 3.18 | 3.04 | 2.90 | 2.76 | 2.62 | 2.49 | 2.35 | 2.21 | 2.08 | 1.94 | 1.79 | 1.65 | 1.49 | 1.33 | |
| | .45 | 4.49 | 4.32 | 4.16 | 4.00 | 3.84 | 3.69 | 3.54 | 3.39 | 3.25 | 3.10 | 2.96 | 2.82 | 2.67 | 2.53 | 2.39 | 2.25 | 2.11 | 1.97 | 1.82 | 1.67 | 1.51 | |
| | .46 | 4.79 | 4.61 | 4.44 | 4.27 | 4.10 | 3.94 | 3.78 | 3.62 | 3.47 | 3.32 | 3.17 | 3.02 | 2.87 | 2.73 | 2.58 | 2.44 | 2.29 | 2.15 | 2.00 | 1.85 | 1.70 | |
| | .47 | 5.12 | 4.93 | 4.74 | 4.56 | 4.39 | 4.21 | 4.04 | 3.88 | 3.71 | 3.55 | 3.40 | 3.24 | 3.09 | 2.94 | 2.79 | 2.64 | 2.49 | 2.34 | 2.19 | 2.04 | 1.88 | |
| | .48 | 5.49 | 5.28 | 5.08 | 4.89 | 4.70 | 4.51 | 4.33 | 4.15 | 3.98 | 3.81 | 3.64 | 3.48 | 3.32 | 3.16 | 3.00 | 2.85 | 2.69 | 2.54 | 2.39 | 2.23 | 2.08 | |
| | .49 | 5.90 | 5.68 | 5.46 | 5.25 | 5.04 | 4.84 | 4.65 | 4.46 | 4.27 | 4.09 | 3.91 | 3.74 | 3.57 | 3.40 | 3.24 | 3.07 | 2.91 | 2.75 | 2.59 | 2.43 | 2.28 | |
| | .50 | 6.37 | 6.13 | 5.89 | 5.66 | 5.43 | 5.22 | 5.00 | 4.80 | 4.60 | 4.40 | 4.21 | 4.03 | 3.84 | 3.67 | 3.49 | 3.32 | 3.15 | 2.98 | 2.82 | 2.65 | 2.49 | |
| | .51 | 6.90 | 6.63 | 6.37 | 6.12 | 5.87 | 5.63 | 5.40 | 5.18 | 4.96 | 4.75 | 4.54 | 4.34 | 4.15 | 3.96 | 3.77 | 3.59 | 3.41 | 3.23 | 3.06 | 2.88 | 2.71 | |
| | .52 | 7.51 | 7.21 | 6.92 | 6.64 | 6.37 | 6.11 | 5.86 | 5.61 | 5.37 | 5.14 | 4.92 | 4.70 | 4.49 | 4.28 | 4.08 | 3.88 | 3.69 | 3.50 | 3.32 | 3.14 | 2.96 | |
| | .53 | 8.23 | 7.88 | 7.56 | 7.25 | 6.94 | 6.65 | 6.37 | 6.10 | 5.84 | 5.58 | 5.34 | 5.10 | 4.87 | 4.64 | 4.42 | 4.21 | 4.01 | 3.80 | 3.61 | 3.41 | 3.22 | |
| | .54 | 9.05 | 8.67 | 8.30 | 7.95 | 7.61 | 7.28 | 6.97 | 6.66 | 6.37 | 6.09 | 5.82 | 5.55 | 5.30 | 5.05 | 4.81 | 4.58 | 4.36 | 4.14 | 3.93 | 3.72 | 3.52 | |
| | .55 | **** | 9.59 | 9.17 | 8.77 | 8.39 | 8.02 | 7.66 | 7.32 | 6.99 | 6.68 | 6.37 | 6.08 | 5.80 | 5.52 | 5.26 | 5.00 | 4.76 | 4.52 | 4.29 | 4.06 | 3.84 | |
| | .56 | **** | **** | **** | 9.75 | 9.31 | 8.89 | 8.48 | 8.09 | 7.72 | 7.36 | 7.02 | 6.69 | 6.37 | 6.07 | 5.77 | 5.49 | 5.22 | 4.95 | 4.70 | 4.45 | 4.21 | |
| | .57 | **** | **** | **** | **** | **** | 9.93 | 9.46 | 9.01 | 8.58 | 8.18 | 7.78 | 7.41 | 7.05 | 6.70 | 6.37 | 6.05 | 5.75 | 5.45 | 5.17 | 4.90 | 4.63 | |
| | .58 | **** | **** | **** | **** | **** | **** | **** | **** | 9.62 | 9.15 | 8.70 | 8.27 | 7.85 | 7.46 | 7.08 | 6.72 | 6.37 | 6.04 | 5.72 | 5.41 | 5.12 | |
| | .59 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | 9.81 | 9.31 | 8.83 | 8.37 | 7.93 | 7.51 | 7.12 | 6.74 | 6.37 | 6.02 | 5.69 | |
| | .60 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | 9.48 | 8.97 | 8.48 | 8.02 | 7.58 | 7.15 | 6.75 | 6.37 | |
| | .61 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | 9.67 | 9.13 | 8.61 | 8.11 | 7.64 | 7.20 | |
| | .62 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | 9.90 | 9.31 | 8.75 | 8.22 | |
| | .63 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | 9.51 | |
| | .64 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | |

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

# RUNOFF FACTOR ADJUSTMENT

DATE: FEBRUARY 1987

FIGURE 10

## RUNOFF FACTOR SLOPE AND INTENSITY ADJUSTMENT CHART PG 2 OF 3

C = Initial Runoff Factor
C+Cs = Runoff Factor + Slope Adjustment
C' = Design Runoff Factor

To determine C' begin with the initial runoff factor C in the upper left of the chart. Draw a line to the right until you meet a ground slope greater than the average ground slope of the incremental drainage area. Next draw a line down until you reach a rainfall intensity greater than your design intensity. Next draw a line to the left to find your design runoff factor C'

| | BEGIN BELOW | .40 | .41 | .42 | .43 | .44 | .45 | .46 | .47 | .48 | .49 | .50 | .51 | .52 | .53 | .54 | .55 | .56 | .57 | .58 | .59 | .60 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | C + Cs | | | | | | | | | | | |
| | .20 | 31 | 33 | 35 | 37 | 39 | 41 | 43 | 45 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | end | S |
| | .30 | 17 | 19 | 21 | 23 | 25 | 27 | 29 | 32 | 34 | 36 | 39 | 41 | 44 | 45 | ---- | ---- | ---- | ---- | ---- | ---- | end | L |
| | .40 | 2 | 4 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 20 | 22 | 25 | 27 | 30 | 33 | 36 | 39 | 42 | 45 | ---- | end | O |
| C | .50 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 3 | 4 | 6 | 9 | 11 | 14 | 17 | 20 | 24 | 27 | 31 | P |
| | .60 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 2 | E |
| | .70 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | next | |
| | .80 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | next | % |
| | .40 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | .41 | .68 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | .42 | .93 | .69 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | .43 | 1.14 | .94 | .69 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | .44 | 1.33 | 1.15 | .95 | .70 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| | .45 | 1.51 | 1.35 | 1.17 | .97 | .71 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | |
| C' | .46 | 1.70 | 1.54 | 1.37 | 1.19 | .98 | .72 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | I |
| = | .47 | 1.88 | 1.73 | 1.56 | 1.39 | 1.20 | .99 | .73 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | N |
| C | .48 | 2.08 | 1.92 | 1.76 | 1.59 | 1.41 | 1.22 | 1.01 | .74 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | T |
| + | .49 | 2.28 | 2.12 | 1.95 | 1.79 | 1.62 | 1.44 | 1.24 | 1.02 | .75 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | E |
| Cs | .50 | 2.49 | 2.32 | 2.16 | 1.99 | 1.82 | 1.65 | 1.46 | 1.26 | 1.04 | .76 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | N |
| + | .51 | 2.71 | 2.54 | 2.37 | 2.20 | 2.03 | 1.86 | 1.68 | 1.49 | 1.28 | 1.05 | .77 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | S |
| C1 | .52 | 2.96 | 2.78 | 2.60 | 2.43 | 2.25 | 2.08 | 1.90 | 1.71 | 1.51 | 1.31 | 1.07 | .78 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | I |
| | .53 | 3.27 | 3.04 | 2.85 | 2.67 | 2.49 | 2.31 | 2.12 | 1.94 | 1.74 | 1.54 | 1.33 | 1.09 | .79 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | T |
| | .54 | 3.52 | 3.32 | 3.12 | 2.93 | 2.74 | 2.55 | 2.36 | 2.17 | 1.98 | 1.78 | 1.58 | 1.36 | 1.11 | .81 | .00 | ---- | ---- | ---- | ---- | ---- | ---- | Y |
| | .55 | 3.84 | 3.63 | 3.42 | 3.22 | 3.01 | 2.82 | 2.62 | 2.42 | 2.22 | 2.02 | 1.82 | 1.61 | 1.38 | 1.13 | .82 | .00 | ---- | ---- | ---- | ---- | ---- | |
| | .56 | 4.21 | 3.98 | 3.75 | 3.53 | 3.32 | 3.11 | 2.90 | 2.69 | 2.49 | 2.28 | 2.08 | 1.86 | 1.65 | 1.41 | 1.15 | .84 | .00 | ---- | ---- | ---- | ---- | I |
| | .57 | 4.63 | 4.38 | 4.13 | 3.89 | 3.66 | 3.43 | 3.21 | 2.99 | 2.77 | 2.56 | 2.35 | 2.13 | 1.91 | 1.68 | 1.44 | 1.18 | .85 | .00 | ---- | ---- | ---- | N |
| | .58 | 5.12 | 4.84 | 4.56 | 4.30 | 4.04 | 3.79 | 3.55 | 3.32 | 3.09 | 2.86 | 2.64 | 2.41 | 2.19 | 1.96 | 1.73 | 1.48 | 1.20 | .87 | .00 | ---- | ---- | / |
| | .59 | 5.69 | 5.37 | 5.06 | 4.77 | 4.49 | 4.21 | 3.95 | 3.69 | 3.44 | 3.20 | 2.96 | 2.72 | 2.49 | 2.25 | 2.02 | 1.77 | 1.51 | 1.23 | .89 | .00 | ---- | H |
| | .60 | 6.37 | 6.01 | 5.66 | 5.32 | 5.00 | 4.70 | 4.40 | 4.12 | 3.84 | 3.58 | 3.32 | 3.06 | 2.82 | 2.57 | 2.32 | 2.08 | 1.82 | 1.55 | 1.26 | .92 | .00 | R |
| | .61 | 7.20 | 6.77 | 6.37 | 5.99 | 5.62 | 5.27 | 4.94 | 4.62 | 4.31 | 4.02 | 3.73 | 3.45 | 3.18 | 2.92 | 2.66 | 2.40 | 2.14 | 1.88 | 1.63 | 1.29 | .93 | |
| | .62 | 8.22 | 7.72 | 7.25 | 6.80 | 6.37 | 5.97 | 5.58 | 5.22 | 4.87 | 4.53 | 4.21 | 3.90 | 3.61 | 3.32 | 3.04 | 2.76 | 2.49 | 2.21 | 1.94 | 1.65 | 1.33 | |
| | .63 | 9.51 | 8.91 | 8.34 | 7.81 | 7.30 | 6.82 | 6.37 | 5.94 | 5.54 | 5.15 | 4.79 | 4.44 | 4.10 | 3.78 | 3.47 | 3.17 | 2.87 | 2.58 | 2.29 | 2.00 | 1.70 | |
| | .64 | **** | **** | 9.75 | 9.09 | 8.48 | 7.90 | 7.36 | 6.85 | 6.37 | 5.92 | 5.49 | 5.08 | 4.70 | 4.33 | 3.98 | 3.64 | 3.32 | 3.00 | 2.69 | 2.39 | 2.08 | |
| | .65 | **** | **** | **** | **** | **** | 9.31 | 8.64 | 8.02 | 7.43 | 6.89 | 6.37 | 5.89 | 5.43 | 5.00 | 4.60 | 4.21 | 3.84 | 3.49 | 3.15 | 2.82 | 2.49 | |
| | .66 | **** | **** | **** | **** | **** | **** | **** | 9.35 | 8.83 | 8.15 | 7.51 | 6.92 | 6.37 | 5.86 | 5.37 | 4.92 | 4.49 | 4.08 | 3.69 | 3.32 | 2.96 | |
| | .67 | **** | **** | **** | **** | **** | **** | **** | **** | **** | 9.85 | 9.05 | 8.30 | 7.61 | 6.97 | 6.37 | 5.82 | 5.30 | 4.81 | 4.36 | 3.93 | 3.52 | |
| | .68 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | 9.31 | 8.48 | 7.72 | 7.02 | 6.37 | 5.77 | 5.22 | 4.70 | 4.21 | |
| | .69 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | 9.62 | 8.70 | 7.85 | 7.08 | 6.37 | 5.72 | 5.12 | |
| | .70 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | 8.97 | 8.02 | 7.15 | 6.37 | |
| | .71 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | 9.31 | 8.22 | |
| | .72 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | |
| | .73 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | |
| | .74 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | |
| | .75 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | |
| | .76 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | |
| | .77 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | |
| | .78 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | |
| | .79 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | |
| | .80 | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | |

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

# RUNOFF FACTOR ADJUSTMENT

DATE: FEBRUARY 1987

FIGURE 10

# Appendix D

# 100-year, 24-hour Hydrologic Analyses

**To:** Fernando Gonzales, PE
ACFC& WCD

**From:** Chris Ruggeri, PE CR

**Date:** December 8, 2011
Revised 12/20/2011

**Subject:** Niles Quarry Drainage Analysis

**Background** – The Niles Canyon Quarry has been operating under an approved surface mining permit (SMP-34) since the mid 1990s. A Notice of Violation was issued on October 18th of this year. One of the Items included in this Notice is that a Hydrology Study originally required as a condition of the permit (Condition #41) has not been completed. The subject pond was constructed and has been functioning without incident since the time the Permit was issued.

**SMP-34 Condition #41** – *Permittee shall prepare a final hydrology and sedimentation pond study for submittal to the Director of Public Works by August 1, 1996. Permittee shall consult with Public Works staff during preparation of the study. The study shall address issues of, and establish criteria for, runoff volume, drainage capacity for that level of runoff, adequacy of capacity of the sedimentation pond to contain runoff from the 100-year, 24-hour storm event, and recommended improvements to meet these criteria. Upon approval by the Director of Public Works, the Permittee shall submit these and other necessary materials (possibly including a Storm Water Pollution Prevention Plan) to the Regional Water Quality Control Board, Region 2, to obtain an Industrial Storm Water Permit if necessary. Permittee shall install recommended improvements before excavation or disturbance beyond the area already disturbed prior to the date of approval for SMP-34.*

**Purpose** – The purpose of this study is to address the requirements of Condition #41 in a reasonable manner given that the site and pond have been operating for many years.

**Study Criteria – Per Condition #41, RJA has coordinated with Public Works to establish the following criteria for this study:**

- ***Runoff Volume***: Calculated for the 100 year, 24 hour storm per Alameda County standards. HEC-1 will be used to calculate the runoff.

- ***Drainage Capacity***: Refers to risers, pipes and/or spillways which discharge stormwater from the existing pond. No detention will be assumed in order to model a conservative condition where the pond is full when the peak flow is applied. Capacity shall be for the 100 year peak flow as noted above.

- ***Adequacy of Capacity***: Pond discharge facilities must convey the peak flow as noted above, with a minimum of 1.0 foot of free board to the top of bank (i.e., the overland release elevation of the pond).

- ***Recommended Improvements***: The pond and discharge facilities have been in place for many years. This study will verify the capacity of the existing facilities and if they are determined to be inadequate, will recommend and size additional facilities such that the required capacity is achieved.
- ***Industrial Stormwater Permit Requirements***: Since the Property has been operating under a valid Industrial Stormwater Permit for years without incident, sedimentation aspects of the study are considered to be addressed by past and ongoing compliance with Permit requirements and will not be required as part of this study.

**Runoff Volume Calculations** – Tributary areas were determined based on available topography and field verification, and are shown on Figure 1. Surface runoff to the pond was calculated using the HEC-1 program. The runoff to the pond is 158 cfs. An additional area tributary to an existing arch culvert downstream of the pond was also evaluated. This was done so capacity of the arch culvert could also be verified. The runoff of this area is 6.6 cfs. Runoff calculations are included as Appendix A.

**Drainage Capacity/Adequacy** – Two existing 22" CMP risers currently provide controlled discharge from the pond. These are shown on Figure 2. Calculations to evaluate the capacity of the risers are included in Appendix B. The total capacity of the 2 risers based on existing elevations and freeboard requirements is 54 cfs, which is inadequate to convey the calculated peak 100 year peak flow out of the pond.

**Recommended Improvements-Pond Discharge Facilities – Drainage Ditch** – Based on existing site conditions, an overflow ditch can be constructed which, in addition to the existing risers, will provide adequate capacity to convey 100 year flows from the pond. Calculations to size the ditch are included as Appendix C. Schematic design of the ditch is shown on Figure 2. The ditch has been sized to convey 104 cfs (the difference between the 100 year flow into the pond and the capacity of the two existing risers). The flow line of the ditch should be set to maintain 1.0 foot of free board from the 100 year water surface to the over land release elevation of the pond. Elevations shown on Figure 2 assume a 1% sloped ditch.

**Verification of Existing Arch Culvert Capacity** – The proposed ditch will convey runoff to another ponding area, which discharges to an existing 3.5' x 5' arch culvert. The 22" riser pipes terminate at the downstream end of the culvert (see Figure 2). Capacity of the culvert needs to be verified as adequate to convey the peak flow from the ditch plus its own independent tributary area.

As noted above, the ditch will convey 104 cfs to the upstream end of the culvert. Runoff calculations for the additional area tributary to the culvert are included in Appendix A, and show an additional 7 cfs draining to the culvert. These flows will be added directly to obtain a conservative maximum required capacity for the arch culvert.

The arch culvert will be in an "inlet control" condition, and must convey a total of 111 cfs. The maximum capacity of the culvert is approximately 127 cfs (see Appendix D). Since this is greater than the total calculated flow, the culvert is adequate.

**Additional Recommendations – Arch Culvert** – The upstream end of the culvert should be cleared of obstructions to maintain capacity.

## Study Summary

Pond:

- 100 year flow to pond: 158 cfs
- Capacity of Ex Risers: 54 cfs-not adequate to convey peak flow
- Design Capacity-Proposed Ditch: 104 cfs
- Total Capacity of Ditch and Risers: 158 cfs-adequate to convey peak flow

Peak Flow to Arch Culvert

- 100 Year Flow in Ditch: 104 cfs
- 100 Year Surface Runoff to Arch Culvert: 7 cfs
- Total 100 Year Flow to Arch Culvert: 111 cfs
- Maximum Culvert Capacity: 127 cfs-culvert is adequate to convey the peak flow

## Conclusions

- The existing 22" risers will convey 54 cfs from the pond. This is not adequate to convey 100 year peak flow.

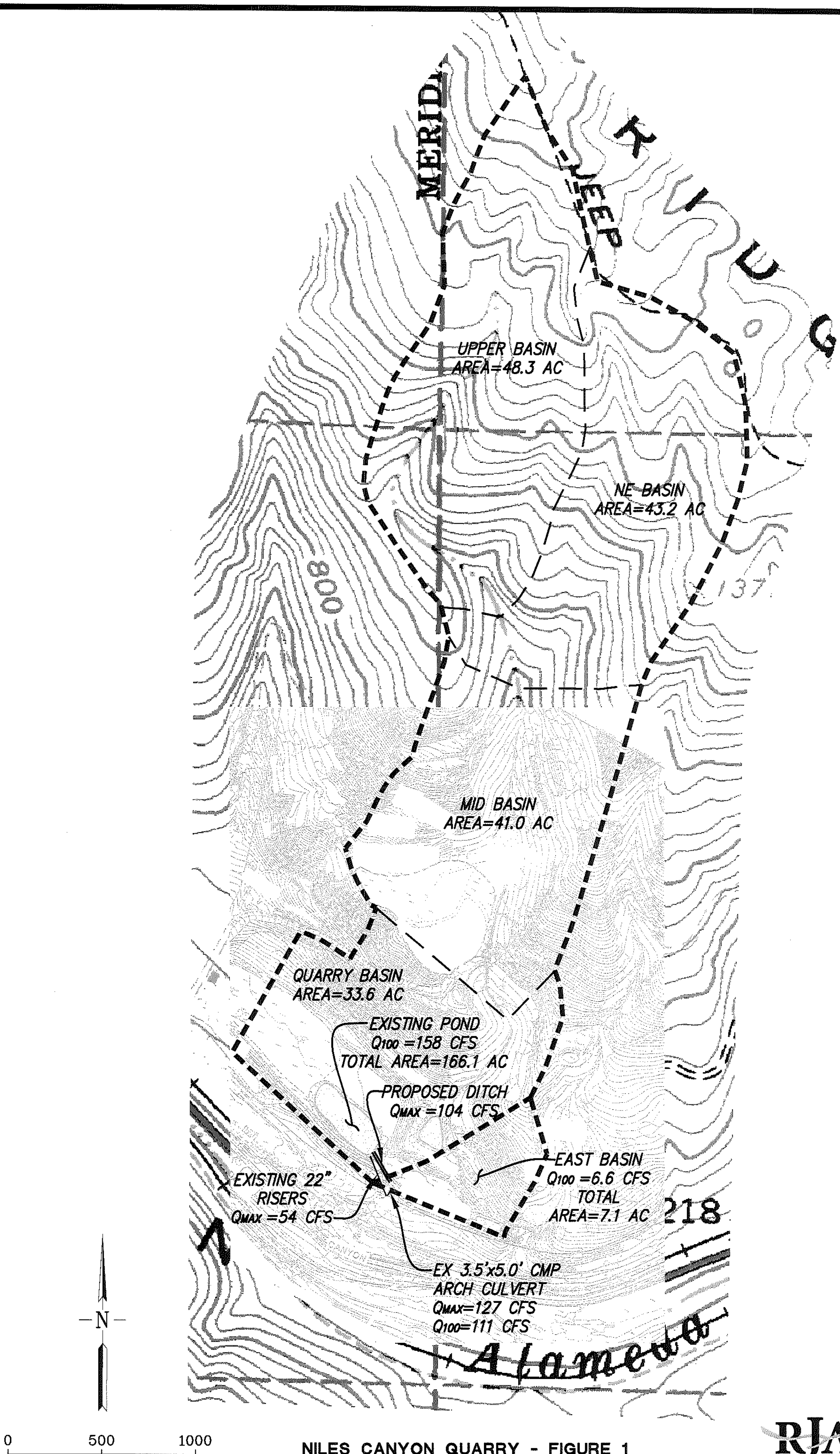
- A drainage ditch sized to convey 104 cfs, in addition to the existing 22" risers, will convey the 100 year peak flow from the pond.

- The existing Arch Culvert downstream of the pond is adequate to convey the 100 year peak flow from its tributary area and the ditch with a minimum freeboard of 1.0' to the pond release elevation.

## Figures



## List of Appendices



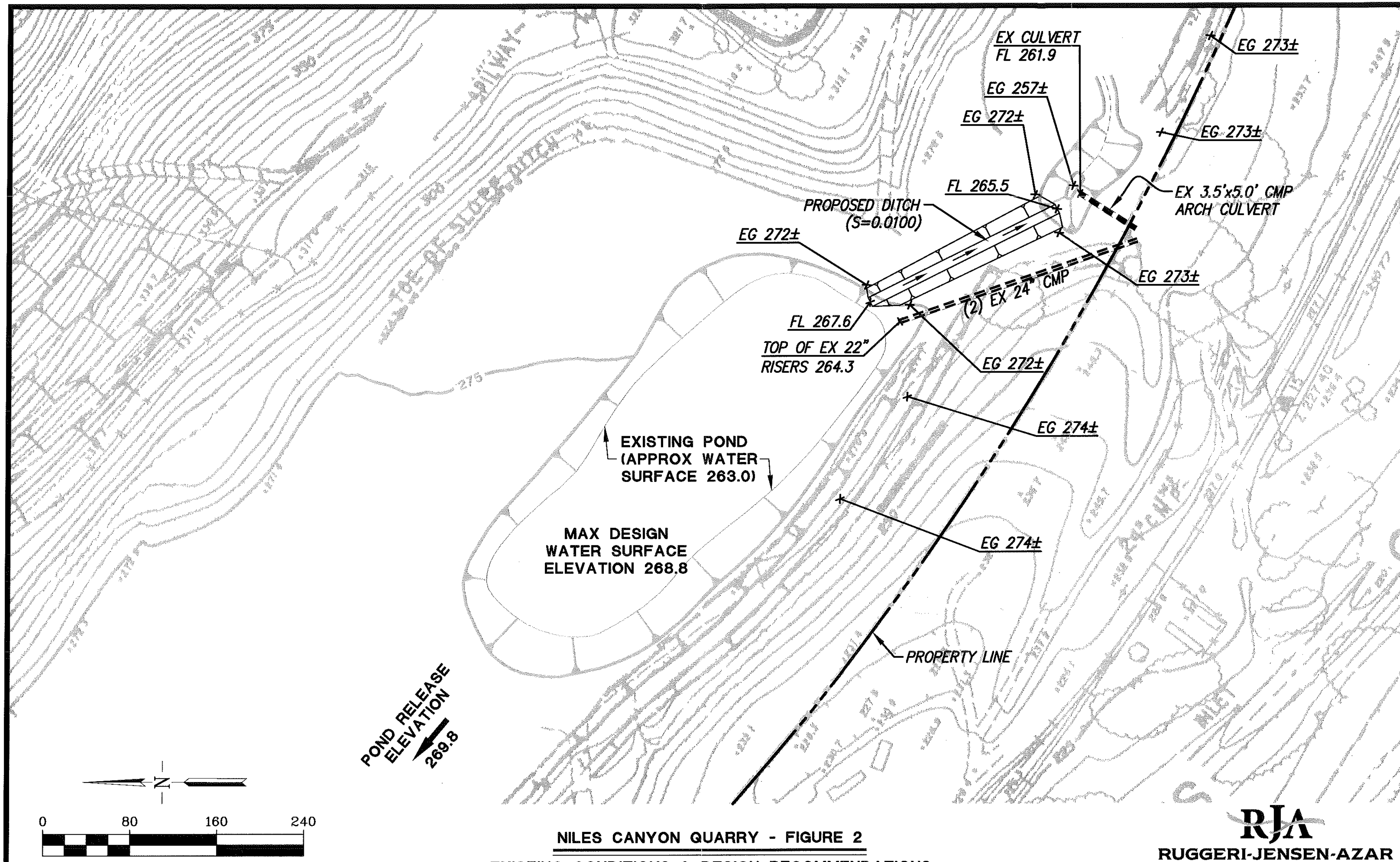

**NILES CANYON QUARRY - FIGURE 1**

**DRAINAGE AREA MAP**

SUNOL, ALAMEDA COUNTY, CALIFORNIA


RJA
RUGGERI-JENSEN-AZAR
ENGINEERS • PLANNERS • SURVEYORS
2541 WARREN DRIVE, SUITE 100 ROCKLIN, CA 95677
PHONE: (916) 630-8900 FAX: (916) 630-8909


DATE: DECEMBER 7, 2011 JOB: 115017 SHEET 1 OF 2
REVISED: DECEMBER 22, 2011




**NILES CANYON QUARRY - FIGURE 2**

**EXISTING CONDITIONS & DESIGN RECOMMENDATIONS**

SUNOL, ALAMEDA COUNTY, CALIFORNIA


RJA
RUGGERI-JENSEN-AZAR
ENGINEERS • PLANNERS • SURVEYORS
2541 WARREN DRIVE, SUITE 100 ROCKLIN, CA 95677
PHONE: (916) 630-8900 FAX: (916) 630-8909


DATE: DECEMBER 7, 2011 JOB: 115017 SHEET 2 OF 2

APPENDIX A

## Alameda County Type I Storm Distribution

Mean Annual Precipitation (MAP) = 24 in
Mass Precipitation Value (P100) = 0.2411
Mass Precipitation = P100 x MAP = 5.79 in

| Time (min) | Rainfall Ratio (Px/P24) | Rainfall Distribution | Rainfall Hyetograph |
|---|---|---|---|
| 0 | 0 | 0.0000 | 0 |
| 30 | 0.0135 | 0.0781 | 0.0781 |
| 60 | 0.0251 | 0.1452 | 0.0671 |
| 90 | 0.0382 | 0.2210 | 0.0758 |
| 120 | 0.0518 | 0.2997 | 0.0787 |
| 150 | 0.066 | 0.3819 | 0.0822 |
| 180 | 0.081 | 0.4687 | 0.0868 |
| 210 | 0.0967 | 0.5595 | 0.0908 |
| 240 | 0.1131 | 0.6544 | 0.0949 |
| 270 | 0.1304 | 0.7545 | 0.1001 |
| 300 | 0.1491 | 0.8628 | 0.1082 |
| 330 | 0.169 | 0.9779 | 0.1151 |
| 360 | 0.1903 | 1.1012 | 0.1233 |
| 390 | 0.2135 | 1.2354 | 0.1342 |
| 420 | 0.2389 | 1.3824 | 0.1470 |
| 450 | 0.2675 | 1.5479 | 0.1655 |
| 480 | 0.3001 | 1.7365 | 0.1886 |
| 510 | 0.3385 | 1.9587 | 0.2222 |
| 540 | 0.3862 | 2.2347 | 0.2760 |
| 570 | 0.457 | 2.6444 | 0.4097 |
| 600 | 0.5806 | 3.3596 | 0.7152 |
| 630 | 0.6975 | 4.0360 | 0.6764 |
| 660 | 0.7304 | 4.2264 | 0.1904 |
| 690 | 0.7552 | 4.3699 | 0.1435 |
| 720 | 0.776 | 4.4902 | 0.1204 |
| 750 | 0.7935 | 4.5915 | 0.1013 |
| 780 | 0.8093 | 4.6829 | 0.0914 |
| 810 | 0.8246 | 4.7715 | 0.0885 |
| 840 | 0.8379 | 4.8484 | 0.0770 |
| 870 | 0.8502 | 4.9196 | 0.0712 |
| 900 | 0.8616 | 4.9856 | 0.0660 |
| 930 | 0.8724 | 5.0481 | 0.0625 |
| 960 | 0.8826 | 5.1071 | 0.0590 |
| 990 | 0.8923 | 5.1632 | 0.0561 |
| 1020 | 0.9016 | 5.2170 | 0.0538 |
| 1050 | 0.9104 | 5.2679 | 0.0509 |
| 1080 | 0.9188 | 5.3165 | 0.0486 |
| 1110 | 0.9269 | 5.3634 | 0.0469 |
| 1140 | 0.9347 | 5.4085 | 0.0451 |
| 1170 | 0.9422 | 5.4519 | 0.0434 |
| 1200 | 0.9494 | 5.4936 | 0.0417 |
| 1230 | 0.9565 | 5.5347 | 0.0411 |
| 1260 | 0.9633 | 5.5740 | 0.0393 |
| 1290 | 0.9698 | 5.6117 | 0.0376 |
| 1320 | 0.9762 | 5.6487 | 0.0370 |
| 1350 | 0.9824 | 5.6846 | 0.0359 |
| 1380 | 0.9884 | 5.7193 | 0.0347 |
| 1410 | 0.9943 | 5.7534 | 0.0341 |
| 1440 | 1 | 5.7864 | 0.0330 |

Project: NilesQuarry
Simulation Run: Run 1 Subbasin: Upper Basin

Start of Run: 01Jan2012, 00:00 Basin Model: Ex-Niles
End of Run: 02Jan2012, 00:00 Meteorologic Model: ACFCD-24hr
Compute Time: 08Dec2011, 15:52:09 Control Specifications: 100-yr, 24-hr

| Date | Time | Precip (IN) | Loss (IN) | Excess (IN) | Direct Flow (CFS) | Baseflow (CFS) | Total Flow (CFS) |
|---|---|---|---|---|---|---|---|
| 01Jan2012 | 00:00 | | | | 0.0 | 0.0 | 0.0 |
| 01Jan2012 | 00:30 | 0.08 | 0.08 | 0.00 | 0.1 | 0.0 | 0.1 |
| 01Jan2012 | 01:00 | 0.07 | 0.06 | 0.00 | 0.3 | 0.0 | 0.3 |
| 01Jan2012 | 01:30 | 0.08 | 0.07 | 0.01 | 0.5 | 0.0 | 0.5 |
| 01Jan2012 | 02:00 | 0.08 | 0.07 | 0.01 | 0.8 | 0.0 | 0.8 |
| 01Jan2012 | 02:30 | 0.08 | 0.07 | 0.01 | 1.0 | 0.0 | 1.0 |
| 01Jan2012 | 03:00 | 0.09 | 0.07 | 0.01 | 1.3 | 0.0 | 1.3 |
| 01Jan2012 | 03:30 | 0.09 | 0.07 | 0.02 | 1.7 | 0.0 | 1.7 |
| 01Jan2012 | 04:00 | 0.09 | 0.07 | 0.02 | 2.0 | 0.0 | 2.0 |
| 01Jan2012 | 04:30 | 0.10 | 0.07 | 0.03 | 2.4 | 0.0 | 2.4 |
| 01Jan2012 | 05:00 | 0.11 | 0.08 | 0.03 | 2.9 | 0.0 | 2.9 |
| 01Jan2012 | 05:30 | 0.12 | 0.08 | 0.04 | 3.4 | 0.0 | 3.4 |
| 01Jan2012 | 06:00 | 0.12 | 0.08 | 0.04 | 4.0 | 0.0 | 4.0 |
| 01Jan2012 | 06:30 | 0.13 | 0.08 | 0.05 | 4.7 | 0.0 | 4.7 |
| 01Jan2012 | 07:00 | 0.15 | 0.09 | 0.06 | 5.6 | 0.0 | 5.6 |

| Date | Time | Precip (IN) | Loss (IN) | Excess (IN) | Direct Flow (CFS) | Baseflow (CFS) | Total Flow (CFS) |
|---|---|---|---|---|---|---|---|
| 01Jan2012 | 07:30 | 0.17 | 0.09 | 0.07 | 6.8 | 0.0 | 6.8 |
| 01Jan2012 | 08:00 | 0.19 | 0.10 | 0.09 | 8.2 | 0.0 | 8.2 |
| 01Jan2012 | 08:30 | 0.22 | 0.11 | 0.11 | 10.3 | 0.0 | 10.3 |
| 01Jan2012 | 09:00 | 0.28 | 0.12 | 0.15 | 13.6 | 0.0 | 13.6 |
| 01Jan2012 | 09:30 | 0.41 | 0.17 | 0.24 | 21.1 | 0.0 | 21.1 |
| 01Jan2012 | 10:00 | 0.72 | 0.25 | 0.47 | 39.2 | 0.0 | 39.2 |
| 01Jan2012 | 10:30 | 0.68 | 0.20 | 0.48 | 45.1 | 0.0 | 45.1 |
| 01Jan2012 | 11:00 | 0.19 | 0.05 | 0.14 | 21.9 | 0.0 | 21.9 |
| 01Jan2012 | 11:30 | 0.14 | 0.04 | 0.11 | 12.9 | 0.0 | 12.9 |
| 01Jan2012 | 12:00 | 0.12 | 0.03 | 0.09 | 9.7 | 0.0 | 9.7 |
| 01Jan2012 | 12:30 | 0.10 | 0.02 | 0.08 | 7.9 | 0.0 | 7.9 |
| 01Jan2012 | 13:00 | 0.09 | 0.02 | 0.07 | 7.1 | 0.0 | 7.1 |
| 01Jan2012 | 13:30 | 0.09 | 0.02 | 0.07 | 6.7 | 0.0 | 6.7 |
| 01Jan2012 | 14:00 | 0.08 | 0.02 | 0.06 | 6.0 | 0.0 | 6.0 |
| 01Jan2012 | 14:30 | 0.07 | 0.02 | 0.06 | 5.5 | 0.0 | 5.5 |
| 01Jan2012 | 15:00 | 0.07 | 0.01 | 0.05 | 5.1 | 0.0 | 5.1 |
| 01Jan2012 | 15:30 | 0.06 | 0.01 | 0.05 | 4.9 | 0.0 | 4.9 |
| 01Jan2012 | 16:00 | 0.06 | 0.01 | 0.05 | 4.6 | 0.0 | 4.6 |
| 01Jan2012 | 16:30 | 0.06 | 0.01 | 0.04 | 4.4 | 0.0 | 4.4 |
| 01Jan2012 | 17:00 | 0.05 | 0.01 | 0.04 | 4.2 | 0.0 | 4.2 |
| 01Jan2012 | 17:30 | 0.05 | 0.01 | 0.04 | 4.0 | 0.0 | 4.0 |

Project: NilesQuarry
Simulation Run: Run 1 Subbasin: NE Basin

Start of Run: 01Jan2012, 00:00 Basin Model: Ex-Niles
End of Run: 02Jan2012, 00:00 Meteorologic Model: ACFCD-24hr
Compute Time: 08Dec2011, 15:31:52 Control Specifications: 100-yr, 24-hr

| Date | Time | Precip (IN) | Loss (IN) | Excess (IN) | Direct Flow (CFS) | Baseflow (CFS) | Total Flow (CFS) |
|---|---|---|---|---|---|---|---|
| 01Jan2012 | 00:00 | | | | 0.0 | 0.0 | 0.0 |
| 01Jan2012 | 00:30 | 0.08 | 0.08 | 0.00 | 0.1 | 0.0 | 0.1 |
| 01Jan2012 | 01:00 | 0.07 | 0.06 | 0.00 | 0.2 | 0.0 | 0.2 |
| 01Jan2012 | 01:30 | 0.08 | 0.07 | 0.01 | 0.5 | 0.0 | 0.5 |
| 01Jan2012 | 02:00 | 0.08 | 0.07 | 0.01 | 0.7 | 0.0 | 0.7 |
| 01Jan2012 | 02:30 | 0.08 | 0.07 | 0.01 | 0.9 | 0.0 | 0.9 |
| 01Jan2012 | 03:00 | 0.09 | 0.07 | 0.01 | 1.2 | 0.0 | 1.2 |
| 01Jan2012 | 03:30 | 0.09 | 0.07 | 0.02 | 1.5 | 0.0 | 1.5 |
| 01Jan2012 | 04:00 | 0.09 | 0.07 | 0.02 | 1.8 | 0.0 | 1.8 |
| 01Jan2012 | 04:30 | 0.10 | 0.07 | 0.03 | 2.2 | 0.0 | 2.2 |
| 01Jan2012 | 05:00 | 0.11 | 0.08 | 0.03 | 2.6 | 0.0 | 2.6 |
| 01Jan2012 | 05:30 | 0.12 | 0.08 | 0.04 | 3.1 | 0.0 | 3.1 |
| 01Jan2012 | 06:00 | 0.12 | 0.08 | 0.04 | 3.6 | 0.0 | 3.6 |
| 01Jan2012 | 06:30 | 0.13 | 0.08 | 0.05 | 4.3 | 0.0 | 4.3 |
| 01Jan2012 | 07:00 | 0.15 | 0.09 | 0.06 | 5.1 | 0.0 | 5.1 |

| Date | Time | Precip (IN) | Loss (IN) | Excess (IN) | Direct Flow (CFS) | Baseflow (CFS) | Total Flow (CFS) |
|---|---|---|---|---|---|---|---|
| 01Jan2012 | 07:30 | 0.17 | 0.09 | 0.07 | 6.1 | 0.0 | 6.1 |
| 01Jan2012 | 08:00 | 0.19 | 0.10 | 0.09 | 7.5 | 0.0 | 7.5 |
| 01Jan2012 | 08:30 | 0.22 | 0.11 | 0.11 | 9.4 | 0.0 | 9.4 |
| 01Jan2012 | 09:00 | 0.28 | 0.12 | 0.15 | 12.3 | 0.0 | 12.3 |
| 01Jan2012 | 09:30 | 0.41 | 0.17 | 0.24 | 19.1 | 0.0 | 19.1 |
| 01Jan2012 | 10:00 | 0.72 | 0.25 | 0.47 | 35.5 | 0.0 | 35.5 |
| 01Jan2012 | 10:30 | 0.68 | 0.20 | 0.48 | 40.9 | 0.0 | 40.9 |
| 01Jan2012 | 11:00 | 0.19 | 0.05 | 0.14 | 19.8 | 0.0 | 19.8 |
| 01Jan2012 | 11:30 | 0.14 | 0.04 | 0.11 | 11.7 | 0.0 | 11.7 |
| 01Jan2012 | 12:00 | 0.12 | 0.03 | 0.09 | 8.8 | 0.0 | 8.8 |
| 01Jan2012 | 12:30 | 0.10 | 0.02 | 0.08 | 7.2 | 0.0 | 7.2 |
| 01Jan2012 | 13:00 | 0.09 | 0.02 | 0.07 | 6.4 | 0.0 | 6.4 |
| 01Jan2012 | 13:30 | 0.09 | 0.02 | 0.07 | 6.1 | 0.0 | 6.1 |
| 01Jan2012 | 14:00 | 0.08 | 0.02 | 0.06 | 5.5 | 0.0 | 5.5 |
| 01Jan2012 | 14:30 | 0.07 | 0.02 | 0.06 | 5.0 | 0.0 | 5.0 |
| 01Jan2012 | 15:00 | 0.07 | 0.01 | 0.05 | 4.7 | 0.0 | 4.7 |
| 01Jan2012 | 15:30 | 0.06 | 0.01 | 0.05 | 4.4 | 0.0 | 4.4 |
| 01Jan2012 | 16:00 | 0.06 | 0.01 | 0.05 | 4.2 | 0.0 | 4.2 |
| 01Jan2012 | 16:30 | 0.06 | 0.01 | 0.04 | 4.0 | 0.0 | 4.0 |
| 01Jan2012 | 17:00 | 0.05 | 0.01 | 0.04 | 3.8 | 0.0 | 3.8 |
| 01Jan2012 | 17:30 | 0.05 | 0.01 | 0.04 | 3.6 | 0.0 | 3.6 |

Project: NilesQuarry
Simulation Run: Run 1 Subbasin: Mid Basin

Start of Run: 01Jan2012, 00:00 Basin Model: Ex-Niles
End of Run: 02Jan2012, 00:00 Meteorologic Model: ACFCD-24hr
Compute Time: 08Dec2011, 15:31:52 Control Specifications: 100-yr, 24-hr

| te | Time | Precip (IN) | Loss (IN) | Excess (IN) | Direct Flow (CFS) | Baseflow (CFS) | Total Flow (CFS) |
|---|---|---|---|---|---|---|---|
| 01Jan2012 | 00:00 | | | | 0.0 | 0.0 | 0.0 |
| 01Jan2012 | 00:30 | 0.08 | 0.08 | 0.00 | 0.1 | 0.0 | 0.1 |
| 01Jan2012 | 01:00 | 0.07 | 0.06 | 0.00 | 0.2 | 0.0 | 0.2 |
| 01Jan2012 | 01:30 | 0.08 | 0.07 | 0.01 | 0.4 | 0.0 | 0.4 |
| 01Jan2012 | 02:00 | 0.08 | 0.07 | 0.01 | 0.7 | 0.0 | 0.7 |
| 01Jan2012 | 02:30 | 0.08 | 0.07 | 0.01 | 0.9 | 0.0 | 0.9 |
| 01Jan2012 | 03:00 | 0.09 | 0.07 | 0.01 | 1.2 | 0.0 | 1.2 |
| 01Jan2012 | 03:30 | 0.09 | 0.07 | 0.02 | 1.4 | 0.0 | 1.4 |
| 01Jan2012 | 04:00 | 0.09 | 0.07 | 0.02 | 1.7 | 0.0 | 1.7 |
| 01Jan2012 | 04:30 | 0.10 | 0.07 | 0.03 | 2.1 | 0.0 | 2.1 |
| 01Jan2012 | 05:00 | 0.11 | 0.08 | 0.03 | 2.5 | 0.0 | 2.5 |
| 01Jan2012 | 05:30 | 0.12 | 0.08 | 0.04 | 2.9 | 0.0 | 2.9 |
| 01Jan2012 | 06:00 | 0.12 | 0.08 | 0.04 | 3.4 | 0.0 | 3.4 |
| 01Jan2012 | 06:30 | 0.13 | 0.08 | 0.05 | 4.0 | 0.0 | 4.0 |
| 01Jan2012 | 07:00 | 0.15 | 0.09 | 0.06 | 4.8 | 0.0 | 4.8 |

| te | Time | Precip (IN) | Loss (IN) | Excess (IN) | Direct Flow (CFS) | Baseflow (CFS) | Total Flow (CFS) |
|---|---|---|---|---|---|---|---|
| 01Jan2012 | 07:30 | 0.17 | 0.09 | 0.07 | 5.8 | 0.0 | 5.8 |
| 01Jan2012 | 08:00 | 0.19 | 0.10 | 0.09 | 7.0 | 0.0 | 7.0 |
| 01Jan2012 | 08:30 | 0.22 | 0.11 | 0.11 | 8.8 | 0.0 | 8.8 |
| 01Jan2012 | 09:00 | 0.28 | 0.12 | 0.15 | 11.6 | 0.0 | 11.6 |
| 01Jan2012 | 09:30 | 0.41 | 0.17 | 0.24 | 18.0 | 0.0 | 18.0 |
| 01Jan2012 | 10:00 | 0.72 | 0.25 | 0.47 | 33.4 | 0.0 | 33.4 |
| 01Jan2012 | 10:30 | 0.68 | 0.20 | 0.48 | 38.5 | 0.0 | 38.5 |
| 01Jan2012 | 11:00 | 0.19 | 0.05 | 0.14 | 18.7 | 0.0 | 18.7 |
| 01Jan2012 | 11:30 | 0.14 | 0.04 | 0.11 | 11.0 | 0.0 | 11.0 |
| 01Jan2012 | 12:00 | 0.12 | 0.03 | 0.09 | 8.3 | 0.0 | 8.3 |
| 01Jan2012 | 12:30 | 0.10 | 0.02 | 0.08 | 6.8 | 0.0 | 6.8 |
| 01Jan2012 | 13:00 | 0.09 | 0.02 | 0.07 | 6.0 | 0.0 | 6.0 |
| 01Jan2012 | 13:30 | 0.09 | 0.02 | 0.07 | 5.7 | 0.0 | 5.7 |
| 01Jan2012 | 14:00 | 0.08 | 0.02 | 0.06 | 5.1 | 0.0 | 5.1 |
| 01Jan2012 | 14:30 | 0.07 | 0.02 | 0.06 | 4.7 | 0.0 | 4.7 |
| 01Jan2012 | 15:00 | 0.07 | 0.01 | 0.05 | 4.4 | 0.0 | 4.4 |
| 01Jan2012 | 15:30 | 0.06 | 0.01 | 0.05 | 4.1 | 0.0 | 4.1 |
| 01Jan2012 | 16:00 | 0.06 | 0.01 | 0.05 | 3.9 | 0.0 | 3.9 |
| 01Jan2012 | 16:30 | 0.06 | 0.01 | 0.04 | 3.7 | 0.0 | 3.7 |
| 01Jan2012 | 17:00 | 0.05 | 0.01 | 0.04 | 3.6 | 0.0 | 3.6 |
| 01Jan2012 | 17:30 | 0.05 | 0.01 | 0.04 | 3.4 | 0.0 | 3.4 |

Project: NilesQuarry
Simulation Run: Run 1 Subbasin: Quarry Basin

Start of Run: 01Jan2012, 00:00 Basin Model: Ex-Niles
End of Run: 02Jan2012, 00:00 Meteorologic Model: ACFCD-24hr
Compute Time: 08Dec2011, 15:31:52 Control Specifications: 100-yr, 24-hr

| Date | Time | Precip (IN) | Loss (IN) | Excess (IN) | Direct Flow (CFS) | Baseflow (CFS) | Total Flow (CFS) |
|---|---|---|---|---|---|---|---|
| 01Jan2012 | 00:00 | | | | 0.0 | 0.0 | 0.0 |
| 01Jan2012 | 00:30 | 0.08 | 0.08 | 0.00 | 0.1 | 0.0 | 0.1 |
| 01Jan2012 | 01:00 | 0.07 | 0.06 | 0.00 | 0.3 | 0.0 | 0.3 |
| 01Jan2012 | 01:30 | 0.08 | 0.07 | 0.01 | 0.5 | 0.0 | 0.5 |
| 01Jan2012 | 02:00 | 0.08 | 0.07 | 0.01 | 0.8 | 0.0 | 0.8 |
| 01Jan2012 | 02:30 | 0.08 | 0.07 | 0.02 | 1.0 | 0.0 | 1.0 |
| 01Jan2012 | 03:00 | 0.09 | 0.07 | 0.02 | 1.3 | 0.0 | 1.3 |
| 01Jan2012 | 03:30 | 0.09 | 0.07 | 0.02 | 1.6 | 0.0 | 1.6 |
| 01Jan2012 | 04:00 | 0.09 | 0.07 | 0.03 | 1.9 | 0.0 | 1.9 |
| 01Jan2012 | 04:30 | 0.10 | 0.07 | 0.03 | 2.3 | 0.0 | 2.3 |
| 01Jan2012 | 05:00 | 0.11 | 0.07 | 0.04 | 2.7 | 0.0 | 2.7 |
| 01Jan2012 | 05:30 | 0.12 | 0.07 | 0.05 | 3.1 | 0.0 | 3.1 |
| 01Jan2012 | 06:00 | 0.12 | 0.07 | 0.06 | 3.6 | 0.0 | 3.6 |
| 01Jan2012 | 06:30 | 0.13 | 0.07 | 0.06 | 4.2 | 0.0 | 4.2 |
| 01Jan2012 | 07:00 | 0.15 | 0.07 | 0.08 | 5.0 | 0.0 | 5.0 |

| Date | Time | Precip (IN) | Loss (IN) | Excess (IN) | Direct Flow (CFS) | Baseflow (CFS) | Total Flow (CFS) |
|---|---|---|---|---|---|---|---|
| 01Jan2012 | 07:30 | 0.17 | 0.07 | 0.09 | 5.9 | 0.0 | 5.9 |
| 01Jan2012 | 08:00 | 0.19 | 0.08 | 0.11 | 7.1 | 0.0 | 7.1 |
| 01Jan2012 | 08:30 | 0.22 | 0.08 | 0.14 | 8.8 | 0.0 | 8.8 |
| 01Jan2012 | 09:00 | 0.28 | 0.10 | 0.18 | 11.5 | 0.0 | 11.5 |
| 01Jan2012 | 09:30 | 0.41 | 0.12 | 0.29 | 17.5 | 0.0 | 17.5 |
| 01Jan2012 | 10:00 | 0.72 | 0.18 | 0.54 | 31.9 | 0.0 | 31.9 |
| 01Jan2012 | 10:30 | 0.68 | 0.14 | 0.54 | 36.0 | 0.0 | 36.0 |
| 01Jan2012 | 11:00 | 0.19 | 0.03 | 0.16 | 17.3 | 0.0 | 17.3 |
| 01Jan2012 | 11:30 | 0.14 | 0.02 | 0.12 | 10.1 | 0.0 | 10.1 |
| 01Jan2012 | 12:00 | 0.12 | 0.02 | 0.10 | 7.6 | 0.0 | 7.6 |
| 01Jan2012 | 12:30 | 0.10 | 0.02 | 0.09 | 6.2 | 0.0 | 6.2 |
| 01Jan2012 | 13:00 | 0.09 | 0.01 | 0.08 | 5.5 | 0.0 | 5.5 |
| 01Jan2012 | 13:30 | 0.09 | 0.01 | 0.08 | 5.2 | 0.0 | 5.2 |
| 01Jan2012 | 14:00 | 0.08 | 0.01 | 0.07 | 4.7 | 0.0 | 4.7 |
| 01Jan2012 | 14:30 | 0.07 | 0.01 | 0.06 | 4.3 | 0.0 | 4.3 |
| 01Jan2012 | 15:00 | 0.07 | 0.01 | 0.06 | 4.0 | 0.0 | 4.0 |
| 01Jan2012 | 15:30 | 0.06 | 0.01 | 0.05 | 3.7 | 0.0 | 3.7 |
| 01Jan2012 | 16:00 | 0.06 | 0.01 | 0.05 | 3.5 | 0.0 | 3.5 |
| 01Jan2012 | 16:30 | 0.06 | 0.01 | 0.05 | 3.4 | 0.0 | 3.4 |
| 01Jan2012 | 17:00 | 0.05 | 0.01 | 0.05 | 3.2 | 0.0 | 3.2 |
| 01Jan2012 | 17:30 | 0.05 | 0.01 | 0.04 | 3.1 | 0.0 | 3.1 |

Project: NilesQuarry
Simulation Run: Run 1 Junction: Pond

Start of Run: 01Jan2012, 00:00 Basin Model: Ex-Niles
End of Run: 02Jan2012, 00:00 Meteorologic Model: ACFCD-24hr
Compute Time: 08Dec2011, 15:31:52 Control Specifications: 100-yr, 24-hr

| Date | Time | Inflow from R3 (CFS) | Inflow from Quarry Basin (CFS) | Outflow (CFS) |
|---|---|---|---|---|
| 01Jan2012 | 00:00 | 0.0 | 0.0 | 0.0 |
| 01Jan2012 | 00:30 | 0.2 | 0.1 | 0.3 |
| 01Jan2012 | 01:00 | 0.7 | 0.3 | 0.9 |
| 01Jan2012 | 01:30 | 1.3 | 0.5 | 1.8 |
| 01Jan2012 | 02:00 | 2.0 | 0.8 | 2.8 |
| 01Jan2012 | 02:30 | 2.8 | 1.0 | 3.8 |
| 01Jan2012 | 03:00 | 3.6 | 1.3 | 4.9 |
| 01Jan2012 | 03:30 | 4.5 | 1.6 | 6.1 |
| 01Jan2012 | 04:00 | 5.5 | 1.9 | 7.4 |
| 01Jan2012 | 04:30 | 6.5 | 2.3 | 8.8 |
| 01Jan2012 | 05:00 | 7.8 | 2.7 | 10.5 |
| 01Jan2012 | 05:30 | 9.2 | 3.1 | 12.4 |
| 01Jan2012 | 06:00 | 10.8 | 3.6 | 14.5 |
| 01Jan2012 | 06:30 | 12.8 | 4.2 | 17.0 |
| 01Jan2012 | 07:00 | 15.1 | 5.0 | 20.1 |

| Date | Time | Inflow from R3 (CFS) | Inflow from Quarry Basin (CFS) | Outflow (CFS) |
|---|---|---|---|---|
| 01Jan2012 | 07:30 | 18.2 | 5.9 | 24.1 |
| 01Jan2012 | 08:00 | 22.1 | 7.1 | 29.3 |
| 01Jan2012 | 08:30 | 27.7 | 8.8 | 36.5 |
| 01Jan2012 | 09:00 | 36.2 | 11.5 | 47.7 |
| 01Jan2012 | 09:30 | 55.2 | 17.5 | 72.7 |
| 01Jan2012 | 10:00 | 101.0 | 31.9 | 132.9 |
| 01Jan2012 | 10:30 | 121.8 | 36.0 | 157.9 |
| 01Jan2012 | 11:00 | 69.3 | 17.3 | 86.6 |
| 01Jan2012 | 11:30 | 39.4 | 10.1 | 49.5 |
| 01Jan2012 | 12:00 | 28.1 | 7.6 | 35.7 |
| 01Jan2012 | 12:30 | 22.7 | 6.2 | 28.9 |
| 01Jan2012 | 13:00 | 19.9 | 5.5 | 25.4 |
| 01Jan2012 | 13:30 | 18.7 | 5.2 | 23.9 |
| 01Jan2012 | 14:00 | 16.9 | 4.7 | 21.6 |
| 01Jan2012 | 14:30 | 15.5 | 4.3 | 19.8 |
| 01Jan2012 | 15:00 | 14.3 | 4.0 | 18.3 |
| 01Jan2012 | 15:30 | 13.5 | 3.7 | 17.3 |
| 01Jan2012 | 16:00 | 12.8 | 3.5 | 16.3 |
| 01Jan2012 | 16:30 | 12.2 | 3.4 | 15.5 |
| 01Jan2012 | 17:00 | 11.7 | 3.2 | 14.9 |
| 01Jan2012 | 17:30 | 11.1 | 3.1 | 14.2 |

Project: NilesQuarry
Simulation Run: Run 1 Subbasin: East basin

Start of Run: 01Jan2012, 00:00 Basin Model: Ex-Niles
End of Run: 02Jan2012, 00:00 Meteorologic Model: ACFCD-24hr
Compute Time: 08Dec2011, 15:31:52 Control Specifications: 100-yr, 24-hr

| Date | Time | Precip (IN) | Loss (IN) | Excess (IN) | Direct Flow (CFS) | Baseflow (CFS) | Total Flow (CFS) |
|---|---|---|---|---|---|---|---|
| 01Jan2012 | 00:00 | | | | 0.0 | 0.0 | 0.0 |
| 01Jan2012 | 00:30 | 0.08 | 0.08 | 0.00 | 0.0 | 0.0 | 0.0 |
| 01Jan2012 | 01:00 | 0.07 | 0.06 | 0.00 | 0.0 | 0.0 | 0.0 |
| 01Jan2012 | 01:30 | 0.08 | 0.07 | 0.01 | 0.1 | 0.0 | 0.1 |
| 01Jan2012 | 02:00 | 0.08 | 0.07 | 0.01 | 0.1 | 0.0 | 0.1 |
| 01Jan2012 | 02:30 | 0.08 | 0.07 | 0.01 | 0.2 | 0.0 | 0.2 |
| 01Jan2012 | 03:00 | 0.09 | 0.07 | 0.01 | 0.2 | 0.0 | 0.2 |
| 01Jan2012 | 03:30 | 0.09 | 0.07 | 0.02 | 0.2 | 0.0 | 0.2 |
| 01Jan2012 | 04:00 | 0.09 | 0.07 | 0.02 | 0.3 | 0.0 | 0.3 |
| 01Jan2012 | 04:30 | 0.10 | 0.07 | 0.03 | 0.4 | 0.0 | 0.4 |
| 01Jan2012 | 05:00 | 0.11 | 0.08 | 0.03 | 0.4 | 0.0 | 0.4 |
| 01Jan2012 | 05:30 | 0.12 | 0.08 | 0.04 | 0.5 | 0.0 | 0.5 |
| 01Jan2012 | 06:00 | 0.12 | 0.08 | 0.04 | 0.6 | 0.0 | 0.6 |
| 01Jan2012 | 06:30 | 0.13 | 0.08 | 0.05 | 0.7 | 0.0 | 0.7 |
| 01Jan2012 | 07:00 | 0.15 | 0.09 | 0.06 | 0.8 | 0.0 | 0.8 |

| Date | Time | Precip (IN) | Loss (IN) | Excess (IN) | Direct Flow (CFS) | Baseflow (CFS) | Total Flow (CFS) |
|---|---|---|---|---|---|---|---|
| 01Jan2012 | 07:30 | 0.17 | 0.09 | 0.07 | 1.0 | 0.0 | 1.0 |
| 01Jan2012 | 08:00 | 0.19 | 0.10 | 0.09 | 1.2 | 0.0 | 1.2 |
| 01Jan2012 | 08:30 | 0.22 | 0.11 | 0.11 | 1.5 | 0.0 | 1.5 |
| 01Jan2012 | 09:00 | 0.28 | 0.12 | 0.15 | 2.0 | 0.0 | 2.0 |
| 01Jan2012 | 09:30 | 0.41 | 0.17 | 0.24 | 3.1 | 0.0 | 3.1 |
| 01Jan2012 | 10:00 | 0.72 | 0.25 | 0.47 | 5.7 | 0.0 | 5.7 |
| 01Jan2012 | 10:30 | 0.68 | 0.20 | 0.48 | 6.6 | 0.0 | 6.6 |
| 01Jan2012 | 11:00 | 0.19 | 0.05 | 0.14 | 3.2 | 0.0 | 3.2 |
| 01Jan2012 | 11:30 | 0.14 | 0.04 | 0.11 | 1.9 | 0.0 | 1.9 |
| 01Jan2012 | 12:00 | 0.12 | 0.03 | 0.09 | 1.4 | 0.0 | 1.4 |
| 01Jan2012 | 12:30 | 0.10 | 0.02 | 0.08 | 1.2 | 0.0 | 1.2 |
| 01Jan2012 | 13:00 | 0.09 | 0.02 | 0.07 | 1.0 | 0.0 | 1.0 |
| 01Jan2012 | 13:30 | 0.09 | 0.02 | 0.07 | 1.0 | 0.0 | 1.0 |
| 01Jan2012 | 14:00 | 0.08 | 0.02 | 0.06 | 0.9 | 0.0 | 0.9 |
| 01Jan2012 | 14:30 | 0.07 | 0.02 | 0.06 | 0.8 | 0.0 | 0.8 |
| 01Jan2012 | 15:00 | 0.07 | 0.01 | 0.05 | 0.8 | 0.0 | 0.8 |
| 01Jan2012 | 15:30 | 0.06 | 0.01 | 0.05 | 0.7 | 0.0 | 0.7 |
| 01Jan2012 | 16:00 | 0.06 | 0.01 | 0.05 | 0.7 | 0.0 | 0.7 |
| 01Jan2012 | 16:30 | 0.06 | 0.01 | 0.04 | 0.6 | 0.0 | 0.6 |
| 01Jan2012 | 17:00 | 0.05 | 0.01 | 0.04 | 0.6 | 0.0 | 0.6 |
| 01Jan2012 | 17:30 | 0.05 | 0.01 | 0.04 | 0.6 | 0.0 | 0.6 |

Ruggeri - Jensen - Azar & Associates
ENGINEERS • PLANNERS • SURVEYORS

JOB NO: 115017
JOB NAME: Niles Quarry
DATE: 12/8/2011
PREPARED BY:
SHEET NO. 1 OF 6

UPPER BASIN

Initial $T_c = \frac{L}{60(v)}$ Eq. 1-2

$S = \frac{1890-1720}{616}$

$= 0.28$

$= \frac{616}{60(2.6)}$

$V = 2.6$ fps

$= 4$ min.

$T_c$ - natural channel

$Q = CIA$ $C = 0.44$ Unit rainfall factor = 0.228

$= (0.44)(5.47)(2.4)$ $i = 0.228 \times 24'' = 5.47$ in/hr

$\hookrightarrow$ Initial area MAP

$= 5.8$ cfs

$S = \frac{1720-880}{2748} = 0.306$

$\hookrightarrow$ length to end of basin

$V = 6$ fps Figure 7 - Natural Channel Flow Chart

$T_c$ (channel) $= \frac{2748}{6} = 7.6$ min

$T_c = 4 + 7.6 = 11.6$ min

SCS Unit Hydrograph

Lag $= 0.6\,T_c = 7.0$ min.

Curve Number = 70 Woods in good condition

Ruggeri - Jensen - Azar & Associates
ENGINEERS • PLANNERS • SURVEYORS



NE BASIN

Initial $T_c = \frac{L}{60(v)}$

$= \frac{380}{60(2.5)}$

$= 2.5 \text{ min}$

$S = \frac{1620-1525}{380}$

$= 0.25$

$V = 2.5 \text{ fps}$

$T_c$ - natural channel

$Q = CIA$ $C = 0.44$

$= (0.44)(6.12)(1.9)$

↳ Initial area

$= 5.1 \text{ cfs}$

unit rainfall factor = 0.255

$i = 0.255 \times 24" = 6.12 \text{ in/hr}$

$S = \frac{1525-760}{2010}$

$= 0.38$

$V = 6 \text{ fps}$ Figure 7

$T_c (\text{channel}) = \frac{2010}{6} = 5.6 \text{ min}$

$T_c = 2.5 + 5.6 = 8.1 \text{ min.}$

SCS Unit Hydrograph

$\text{Lag} = 0.6 T_c = 4.9 \text{ min}$

Curve Number = 70 Woods in good condition

Ruggeri - Jensen - Azar & Associates
ENGINEERS • PLANNERS • SURVEYORS

JOB NO:
JOB NAME:
DATE:
PREPARED BY:
SHEET NO. 3 OF 6

MID BASIN

Initial $T_c = \frac{L}{60(v)}$

$= \frac{380}{60(3.2)}$

$= 2$ min

$S = \frac{1160 - 1000}{380}$

$= 0.42$

$V = 3.2$ fps

$T_c$ - natural channel

$Q = CIA$ $C = 0.44$

unit rainfall factor = 0.292

$i = 0.292 \times 24'' = 7$ in/hr

$= (0.44)(7)(0.7)$

↳ initial area

$= 2$ cfs

$S = \frac{1000 - 400}{1700}$

$= 0.36$

$V = 6.5$ fps Figure 7

$T_c(\text{channel}) = \frac{1700}{6.5} = 4.4$ min

$T_c = 2 + 4.4 = 6.4$ min

SCS Unit Hydrograph

Lag $= 0.6 T_c = 3.8$ min

Curve Number = 70 woods in good condition

☐ Gilroy Phone (408) 848-0300 FAX (408) 848-0302
☐ Pleasanton Phone (925) 227-9100 FAX (925) 227-9300
☐ Rocklin Phone (916) 630-8900 FAX (925) 630-8909
☐ Walnut Creek Phone (925) 935-7710 FAX (925) 935-7763

Ruggeri - Jensen - Azar & Associates
ENGINEERS • PLANNERS • SURVEYORS

JOB NO:
JOB NAME:
DATE:
PREPARED BY:


QUARRY BASIN

Initial $T_c = \frac{L}{60(V)}$

$= \frac{330}{60(2.6)}$

$= 2.1$ min

$S = \frac{400-300}{330}$

$= 0.30$

$V = 2.6$ fps

$T_c$ - natural Channel

$Q = CIA$ $\quad C = 0.44$

$= (0.44)(7)(2.7)$

↳ initial area

$= 8$ cfs

unit rainfall factor = 0.292

$i = 0.292 \times 24'' = 7$ in/hr

$S = \frac{300-270}{1000}$

$= 0.03$

$V = 2$ fps

$T_c$ (channel) $= \frac{1000}{2} = 8.3$ min

$T_c = 2.1 + 8.3 = 10.4$ min

SCS Unit Hydrograph

Lag = $0.6 T_c = 6.2$ min

Curve Number = 77

67% - 70 Woods Good Condition

33% - 91 Graded - pervious

Composite CN = 77

☐ Gilroy
Phone (408) 848-0300
FAX (408) 848-0302

☐ Pleasanton
Phone (925) 227-9100
FAX (925) 227-9300

☐ Rocklin
Phone (916) 630-8900
FAX (925) 630-8909

☐ Walnut Creek
Phone (925) 935-7710
FAX (925) 935-7763

Ruggeri - Jensen - Azar & Associates
ENGINEERS • PLANNERS • SURVEYORS

JOB NO:
JOB NAME:
DATE:
PREPARED BY:



EAST BASIN

$$\text{Initial } T_C = \frac{L}{60(V)}$$

$$= \frac{750}{60(2.5)}$$

$$= 5 \text{ min.}$$

$$S = \frac{480-280}{750}$$

$$= 0.27$$

$$V = 2.5 \text{ fps}$$

SCS Unit Hydrograph

$\text{Lag} = 0.6 T_c = 3 \text{ min.}$

Curve Number = 70

☐ Gilroy
Phone (408) 848-0300
FAX (408) 848-0302

☐ Pleasanton
Phone (925) 227-9100
FAX (925) 227-9300

☐ Rocklin
Phone (916) 630-8900
FAX (925) 630-8909

☐ Walnut Creek
Phone (925) 935-7710
FAX (925) 935-7763

Ruggeri - Jensen - Azar & Associates
ENGINEERS • PLANNERS • SURVEYORS

JOB NO:
JOB NAME:
DATE:
PREPARED BY:


Reach 1 - Travel Time = 1 min. (Figure 7)

Reach 2 - Travel Time = 3 min (Figure 7)

Reach 3 - Travel Time = 2 min. (Figure 7)

☐ Gilroy Phone (408) 848-0300 FAX (408) 848-0302
☐ Pleasanton Phone (925) 227-9100 FAX (925) 227-9300
☐ Rocklin Phone (916) 630-8900 FAX (925) 630-8909
☐ Walnut Creek Phone (925) 935-7710 FAX (925) 935-7763

**Ruggeri - Jensen - Azar & Associates**
ENGINEERS • PLANNERS • SURVEYORS

JOB NO: 115017 - APPENDIX B
JOB NAME: NILES QUARRY
DATE: 12/05/11 - REV 12/20/11
PREPARED BY: CR
SHEET NO. 1 OF

# RISER CAPACITY CALCULATIONS

REFERENCES:

1. HAND BOOK OF HYDRAULICS; KING & BRATER

GIVEN: 1. SURVEYED TOP OF RISER ELEVATION: 264.3
2. POND TOP OF BANK (OVERLAND RELEASE): 269.8

ASSUMPTIONS: 1. SINCE 1 FOOT OF FREEBOARD IS REQUIRED, MAXIMUM WATER SURFACE ABOVE THE TOP OF RISERS IS ASSUMED AS 268.8

PER REFERENCE 1, RISER CAPACITY CAN BE CALCULATED FOR A SUBMERGED ORIFICE USING EQUATION 4-10: RISERS ARE 22" Φ

$$Q = Ca\sqrt{2gh}$$

WHERE:

Q = FLOW (CFS)
C = DISCHARGE COEFF.
a = CROSS SECTION AREA (SF)
g = GRAVITATIONAL CONST. (FT/SEC²)
h = HEIGHT OF WATER ABOVE RISER

C DETERMINED TO BE 0.60 PER REF 1, TABLE 4.3 & FIGURE 4-14

$$Q = (.60)(\pi)(.9167)^2\sqrt{2 \times 32.2 \times 4.5}$$

$Q = 26.97$ CFS

THE 2 EXISTING RISERS WILL CARRY A TOTAL OF ≈ $\boxed{54 \text{ CFS}}$

☐ Milpitas Phone (408) 934-1388 FAX (408) 934-1288
☐ Pleasanton Phone (925) 227-9100 FAX (925) 227-9300
☐ Walnut Creek Phone (925) 935-7710 FAX (925) 935-7763
☐ Marina Phone (831) 384-8500 FAX (831) 384-0800

Ruggeri - Jensen - Azar & Associates
ENGINEERS • PLANNERS • SURVEYORS

JOB NO: 115017 - APPENDIX C
JOB NAME: NILES QUARRY
DATE: 12/05/11 - REV 12/20/11
PREPARED BY: CR
SHEET NO. 1 OF

DITCH SIZING CALCULATION

REQUIRED DITCH CAPACITY SHALL BE THE PEAK FLOW INTO THE POND (APPENDIX A) LESS THE CAPACITY OF THE RISERS (APPENDIX B)

PEAK FLOW INTO POND : 158 CFS (APPENDIX A)
RISER CAPACITY : 54 CFS (APPENDIX B)

REQUIRED DITCH CAP. : 104 CFS

DITCH DESIGN PARAMETERS: TRAPEZOIDAL W 2:1 SIDE SLOPES
BASE WIDTH = 14.0'
MINIMUM SLOPE = 1.0%
MAXIMUM DESIGN VEL = 10 FPS
N = 0.03

THE ATTACHED MANNING CALCULATOR INCLUDES DITCH ANALYSIS PER THE ABOVE DESIGN PARAMETERS, STARTING WITH A 1% SLOPE AND INCREASING INCREMENTALLY UNTIL THE MAXIMUM VELOCITY IS EXCEEDED.

ALTHOUGH DITCHES WITH STEEPER SLOPES CAN BE USED, IT IS RECOMMENDED THAT A 1% SLOPE IS USED TO MINIMIZE VELOCITIES.

PER THE MANNING CALCULATOR, FLOW DEPTH IN THE DITCH WILL BE 1.2 FEET

OVERLAND RELEASE ELEVATION : 269.8
FREEBOARD REQ : - 1.0' => (100 YR WATER SURFACE)
FLOW DEPTH IN DITCH : - 1.2'

MAX ELEVATION - FLOW LINE OF DITCH AT POND : 267.6

Milpitas Phone (408) 934-1388 FAX (408) 934-1288
Pleasanton Phone (925) 227-9100 FAX (925) 227-9300
Walnut Creek Phone (925) 935-7710 FAX (925) 935-7763
Marina Phone (831) 384-8500 FAX (831) 384-0800

Ruggeri-Jensen-Azar & Associates
2541 Warren Drive
Rocklin Ca. 95677
Phone: (916) 630-8900
Fax: (916) 630-8909
Printed By: Niles Canyon Quarry Ditch Capacity
Printed: 12/20/2011 4:13:13 PM

****************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
****************************************************************************
Depth =1.206 Q =104. S =.01 'n'=.03 Base Width =14. Z =3. Vel=4.89 Y Crit=1.1

****************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
****************************************************************************
Depth =1.075 Q =104. S =.015 'n'=.03 Base Width =14. Z =3. Vel=5.61 Y Crit=1.1

****************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
****************************************************************************
Depth =.991 Q =104. S =.02 'n'=.03 Base Width =14. Z =3. Vel=6.19 Y Crit=1.1

****************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
****************************************************************************
Depth =.929 Q =104. S =.025 'n'=.03 Base Width =14. Z =3. Vel=6.66 Y Crit=1.1

****************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
****************************************************************************
Depth =.882 Q =104. S =.03 'n'=.03 Base Width =14. Z =3. Vel=7.08 Y Crit=1.1

****************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
****************************************************************************
Depth =.844 Q =104. S =.035 'n'=.03 Base Width =14. Z =3. Vel=7.45 Y Crit=1.1

****************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
****************************************************************************
Depth =.812 Q =104. S =.04 'n'=.03 Base Width =14. Z =3. Vel=7.79 Y Crit=1.1

****************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
****************************************************************************
Depth =.785 Q =104. S =.045 'n'=.03 Base Width =14. Z =3. Vel=8.1 Y Crit=1.1

****************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
****************************************************************************
Depth =.761 Q =104. S =.05 'n'=.03 Base Width =14. Z =3. Vel=8.39 Y Crit=1.1

****************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
****************************************************************************
Depth =.741 Q =104. S =.055 'n'=.03 Base Width =14. Z =3. Vel=8.65 Y Crit=1.1

****************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
****************************************************************************
Depth =.722 Q =104. S =.06 'n'=.03 Base Width =14. Z =3. Vel=8.91 Y Crit=1.1

****************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
****************************************************************************
Depth =.706 Q =104. S =.065 'n'=.03 Base Width =14. Z =3. Vel=9.14 Y Crit=1.1

************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
************************************************************************
Depth =.691  Q =104.  S =.07  'n'=.03  Base Width =14.  Z =3.  Vel=9.37  Y Crit=1.1

************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
************************************************************************
Depth =.677  Q =104.  S =.075  'n'=.03  Base Width =14.  Z =3.  Vel=9.58  Y Crit=1.1

************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
************************************************************************
Depth =.664  Q =104.  S =.08  'n'=.03  Base Width =14.  Z =3.  Vel=9.79  Y Crit=1.1

************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
************************************************************************
Depth =.653  Q =104.  S =.085  'n'=.03  Base Width =14.  Z =3.  Vel=9.98  Y Crit=1.1

************************************************************************
OPEN CHANNEL SOLUTION - TRAPEZOIDAL SHAPE
************************************************************************
Depth =.642  Q =104.  S =.09  'n'=.03  Base Width =14.  Z =3.  Vel=10.17  Y Crit=1.1

Ruggeri - Jensen - Azar & Associates
ENGINEERS • PLANNERS • SURVEYORS

JOB NO: 115017 - APPENDIX D
JOB NAME: NILES QUARRY
DATE: 12/05/11 - REV 12/20/11
PREPARED BY: CR
SHEET NO. 1 OF

ARCH CULVERT CAPACITY VERIFICATION

SUMMARY OF FLOW TO ARCH CULVERT:

DITCH: 104 CFS (SEE APPENDIX C)
SURFACE FLOW: 7 CFS (SEE APPENDIX A)

TOTAL FLOW TO ARCH CULVERT: 111 CFS

EXISTING ARCH CULVERT SIZE: 3.5' x 5.0' (42" x 60")
EXISTING ARCH CULVERT FLOW LINE = 261.9

MAXIMUM AVAILABLE HEAD:

269.8 (TOP OF BANK / POND OVERLAND REL.)
− 1.0' (FREEBOARD REQUIREMENT)
− 261.9 (FL OF EXISTING ARCH)

6.9' = MAXIMUM AVAILABLE HEAD

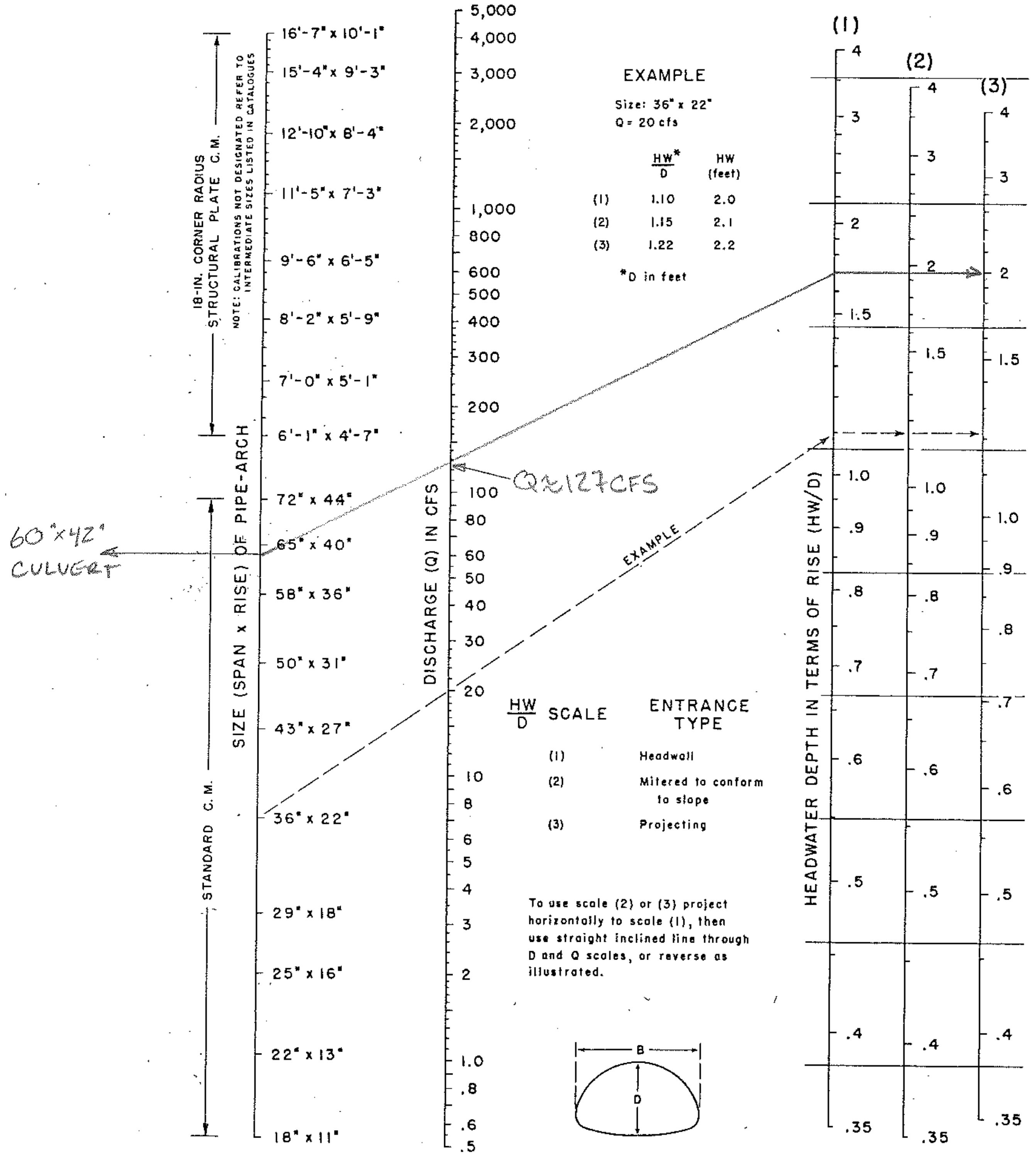
ATTACHED IS AN INSTITUTE OF TRANSPORTATION STUDIES, UNIVERSITY OF CALIFORNIA STREET & HIGHWAY DRAINAGE VOLUME 2 DESIGN CHART FOR CAPACITY OF ARCH CULVERTS WITH INLET CONTROL.

$\frac{Hw}{D} = \frac{6.9}{3.5} = 2.0$ ; ASSUME SCALE 3 FOR "PROJECTING" ENTRANCE TYPE

FROM THE CHART, MAX Q = 127 CFS

MAX Q > TOTAL FLOW TO CULVERT ∴ CULVERT IS ADEQUATE.

☐ Milpitas Phone (408) 934-1388 FAX (408) 934-1288
☐ Pleasanton Phone (925) 227-9100 FAX (925) 227-9300
☐ Walnut Creek Phone (925) 935-7710 FAX (925) 935-7763
☐ Marina Phone (831) 384-8500 FAX (831) 384-0800




HEADWATER DEPTH FOR C. M. PIPE-ARCH CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963