Engineering Summary for Quarry 1

Post-Mining Topography (PMT) Design at the GCC Tijeras Plant

Prepared for:

GCC Rio Grande Inc.
11783 Highway 337 South
Tijeras, New Mexico 87123

Prepared by:

Water & Earth Technologies, Inc.
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December 30, 2019

I, Richard Spotts, state that the information presented in the report entitled "Engineering Summary for Quarry 1 PMT Design at the GCC Tijeras Plant" prepared for GCC Rio Grande Inc. dated December 13, 2019, was prepared by me or a person(s) under my supervision and is correct to the best of my knowledge and information.

Richard Spotts

12/13/2019

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Introduction

Water & Earth Technologies, Inc. (WET) has prepared this post-mining topography (PMT) design for Quarry 1 at the GCC Rio Grande Inc. Tijeras Plant (GCC). WET used a geomorphic design approach for development of the PMT at Quarry 1. The PMT consists of an undulating surface created by numerous small ridges and drains. The result is a complex topography with short concave slopes and numerous slope aspects. The goal of this PMT design is to create a stable landform that blends into the surrounding terrain, supporting revegetation diversity, and optimizing geomorphic stability.

Quarry 1 has a predominant aspect of east-northeast and drains directly into Sediment Pond 1. There is still some limestone that will be mined in Quarry 1 before reclamation activities can proceed. GCC provided WET with a projected surface at the end of mining that was the basis for development of the PMT.

PMT Design

The Quarry 1 reclamation area comprises about 27.2 acres with a relatively steep mean gradient of 22.8 percent. There is no upgradient watershed that runs onto Quarry 1. Stormwater runoff for the entire area is ephemeral and is routed through small drains into Sediment Pond 1. The Quarry 1 PMT design uses short slope lengths to minimize surface erosion.

Maximum Slope Length and Drainage Density

The Revised Universal Soil Loss Equation (RUSLE) was used to predict soil detachment rates with a limit of 4.4 tons/ac/year as a guideline for design. Inputs for RUSLE included an R-Factor of 27, a K-Factor of 0.33 for topdressing, a C-Factor for reclamation of 0.12, with LS-Factors calculated for five different slope gradients that are encountered in the Quarry 1 PMT design. These input parameters have previously been used successfully at the geomorphic reclamation in Quarry 4 at GCC Tijeras Plant. Maximum slope lengths for slope gradients ranging from 15 percent through 50 percent are presented below (Table 1).

Table 1. Maximum Slope Lengths for Slope Gradients to Limit Hillslope Erosion

Slope	Maximum Slope Length (ft)
50%	30 ft
33%	55 ft
25%	87 ft
20%	137 ft
15%	273 ft

Drainage density is the measurement of the total length of all streams per unit area of drainage basin. The Quarry 1 PMT was designed with a high drainage density to accommodate steep slopes, local soils, and worst-case conditions. The drainage density for Quarry 1 is 451 linear feet/acre.

Hydrology and Hydraulics

The Quarry 1 PMT drains are designed to safely pass the 100-year, 24-hour storm event. The Quarry 1 PMT design has Small Drains, Medium Drains, and one Large Drain. The Small Drains have watershed areas of about 1 to 2 acres with steep channel gradients between 15 and 25 percent. As two or more Small Drains combine, they become Medium Drains. At the lower end of the PMT design, two Medium Drains combine to form a Large Drain.

SEDCAD 4.0 was used for hydrologic and hydraulic modeling of the designed drains. Peak discharges during the 100-year, 24-hour storm was modeled for incremental watershed sizes from ½ acre up to 1.83 acres, which encompasses the size range of all the Small Drains. Similarly, peak discharge was modeled for seven additional watersheds ranging in size from 2 acres up to 10.48 acres that correspond with Medium Drains. Peak discharge for the 100-year, 24-hour storm was modeled for one watershed for the Large Drain.

The hydrologic input parameters included: 1) the 100-year, 24-hour rainfall depth of 3.55 inches as specified in NOAA Atlas 14, 2) a New Mexico Type II-65 rainfall distribution, 3) a curve number of 77, and 4) watershed areas as measured from the PMT at various design points. Results of the hydrologic analysis are summarized below (Table 2). The Channel Utility feature within SEDCAD 4.0 was used for hydraulic analysis for the designed drains. Peak discharge for the 100-year, 24-hour storm was applied to the drains at various channel gradients occurring within the PMT.

Drain Design

This PMT design follows geomorphic reclamation principles that emphasize concave drainage gradient profiles. As drainage area and flow rate increases, the channel gradient decreases; this design approach serves to balance erosional and depositional forces and optimize topographic stability. To achieve adequate landform stability, twenty-six drains are included in the Quarry 1 PMT design. Two small drains flow directly into Sediment Pond 1, with the remaining sub-watersheds and their respective drains forming a dendritic complex watershed network that flows into Sediment Pond 1 at the opposite end from its outlet. This larger watershed includes Small, Medium, and Large Drains.

The Small Drains have a 3-foot bottom width, are least 2-feet deep and have sideslopes that are 4h:1v or flatter. The Small Drains will be constructed from a compacted rocky soil that consists of 70% 6-inch minus rock, by volume, and 30% soil, by volume. The largest Small Drain is D1 with an area of 1.83 acres. Sub-watershed D1 was used for channel design in the SEDCAD Channel Utility to ensure at least 1 foot of freeboard above the peak water surface elevation and for calculating rock size (Table 2).

As the Small Drains flow together, they become Medium Drains. The SEDCAD Channel Utility was used to model six medium drainage locations, ranging in watershed area from 2.0 acres up to 10.48 acres. These drain designs have sideslopes 4h:1v or flatter, a 5-foot bottom width and at least 2 feet of depth. The Medium Drains will be constructed from a compacted rocky soil that consists of 70% 6-inch minus rock, by volume, and 30% soil, by volume.

The Large Soil Riprap Drain will be constructed for one short reach, approximately 70-feet long, beginning at the confluence of drains D1 and D24 and ending in Sediment Pond 1. This is the largest drain with a total watershed area of 24.39 ac. It has a moderate gradient of 5.3 percent. The Large Soil Riprap Drain has an 8-foot bottom width with at least 2 feet of depth and 4h:1v sideslopes. Soil Riprap consists of a mixture of 65% riprap and 35% native soil. The riprap will have a D50 of 6-inches as specified in the Drawings. Soil Riprap will be placed and compacted into the subgrade to achieve a dense mass that is virtually free of voids.

The rock and riprap for these drains is intended to be sourced locally from the Tijeras Limestone Mine, and from excavation of Quarry 1, if possible. If bedrock or gravelly material is encountered during excavation of the drains at final grade, then over-excavation and replacement with riprap is not required. Significant voids in channel linings are not permitted. A site Engineer shall observe and approve channel lining placement during construction.

Table 2. Hydrologic and Channel Size Summary

Hydrologic Parameters		Channel Parameters					
Watershed Area (ac)	Q100 (cfs)	Bottom Width (ft)	Flow Depth (ft)	Channel Depth (ft)	Sideslope (Z:1)	Channel Protection	Channel Size
0.50	1.3	3.0	0.14	2.0	4.0	Rocky Mixture	Small
1.00	2.5	3.0	0.17	2.0	4.0	Rocky Mixture	Small
1.83	4.6	3.0	0.30	2.0	4.0	Rocky Mixture	Small
2.00	5.0	3.0	0.35	2.0	4.0	Rocky Mixture	Small
4.27	10.8	5.0	0.33	2.0	4.0	Rocky Mixture	Medium
4.57	11.5	5.0	0.39	2.0	4.0	Rocky Mixture	Medium
7.21	18.2	5.0	0.47	2.0	4.0	Rocky Mixture	Medium
8.64	21.8	5.0	0.53	2.0	4.0	Rocky Mixture	Medium
10.43	26.3	5.0	0.66	2.0	4.0	Rocky Mixture	Medium
10.48	26.4	5.0	0.69	2.0	4.0	Rocky Mixture	Medium
24.39	61.4	8.0	0.83	2.0	4.0	6-inch Soil Riprap	Large

Topography

The final PMT design controls erosion by limiting slope length and including many small topographic undulations formed by drains, ridges, sub-ridges and sub-valleys. The ridges and drain form the general PMT, while the sub-ridges and sub-valleys are subtle grading features that are intended to direct overland flow into the drains and limit slope length. The final Drawings specify that all drains, ridges, sub-ridges, and sub-valleys must be present in the final constructed surface. Topdressing will be placed at a minimum depth of 2 feet, thereby establishing the final reclaimed surface. Topdressing will not be placed within the cross-sectional areas of the drains.

Grading Tolerances

Machine control is specified for subgraded and final graded surfaces. Digital files of the surfaces will be provided to the party responsible for construction. Tolerance for the final grade is plus or minus 1-foot. A close tolerance is required due to the importance of achieving slope gradients and lengths, and smooth channel profiles. Deviations outside of the grading tolerance must be approved by a site Engineer. In addition to topographic tolerances, the final graded surface must include all topographic features including drains, ridges, sub-ridges and sub-valleys.

Performance Standards

The performance standards presented here will be used to determine when, and if, repairs are necessary to the PMT. The performance standards consider both hillslope stability and channel stability. Repair work, including the method of repair and urgency of repair should be discussed and agreed upon with New Mexico Mining and Minerals Division (MMD) prior to implementation. In the early years following final reclamation (suggested years 1 through year 5), it may be permissible to observe erosion and determine if vegetation is able to mature and stabilize the area without additional management inputs, if determined appropriate by a site Engineer and MMD.

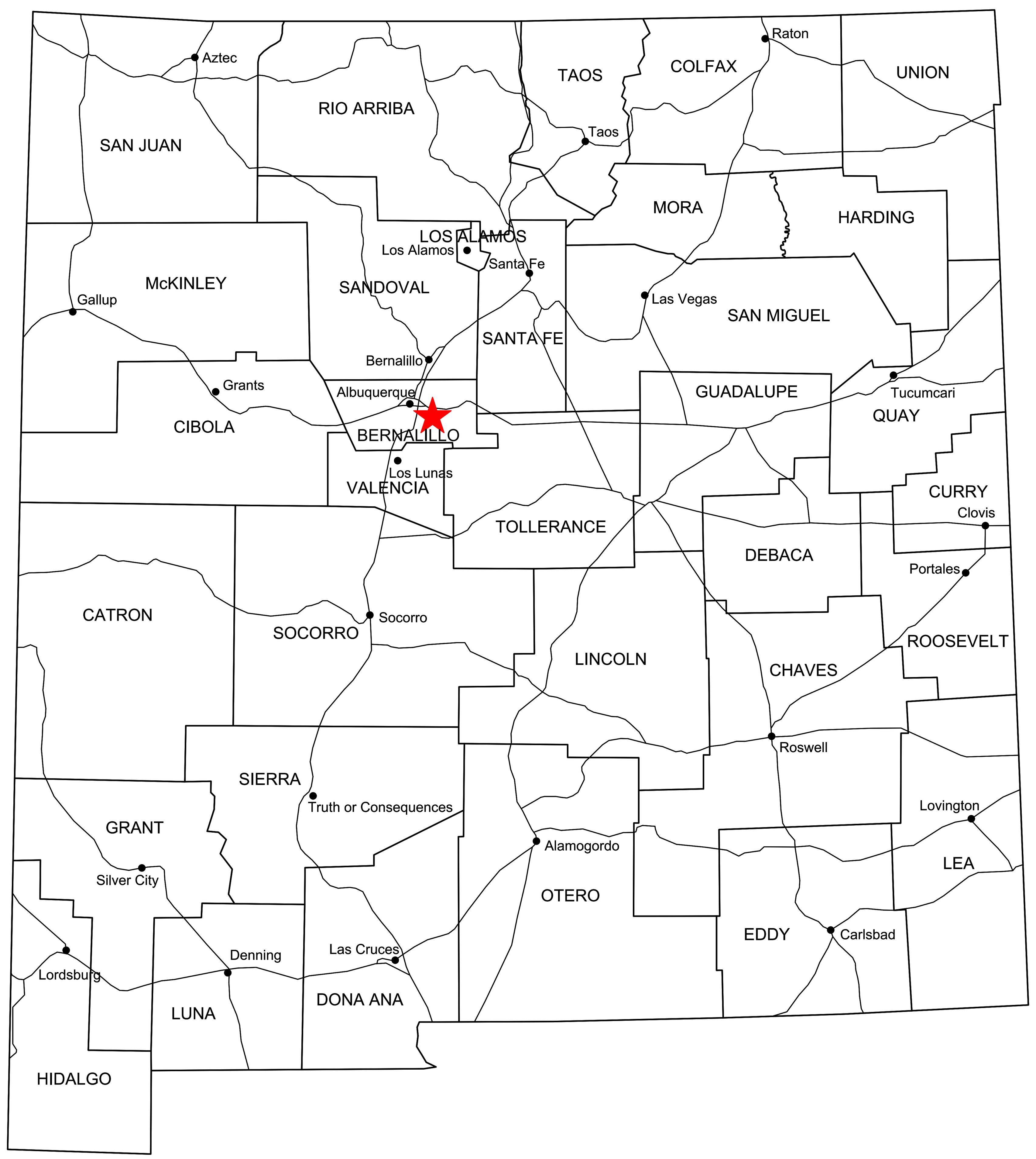
1. If a hillslope contains numerous parallel rills and gullies, at least 6 inches deep, that are clearly systemic with no vegetation colonizing the rilled area, then repairs will become necessary. Isolated rills and gulleys do not require repair unless they threaten the integrity of the overall landform.
2. If significant vertical incision occurs in the drains at the reach scale (i.e., greater than 1-foot deep) then repairs will become necessary. The reach scale is defined as a distance equal to 10 times the channel width, measured at the peak water surface elevation for the 100-year, 24-hour storm.
3. If significant lateral erosion occurs in the drains resulting in destabilization of the landform sideslopes, or results in erosion outside of the compacted rocky soil lining, then repairs will become necessary. Destabilizing the landform sideslopes is defined as oversteepening such that vegetation fails to establish on the landform sideslope above the drain (ie. Greater than 2-feet above the drain invert).

Conclusion

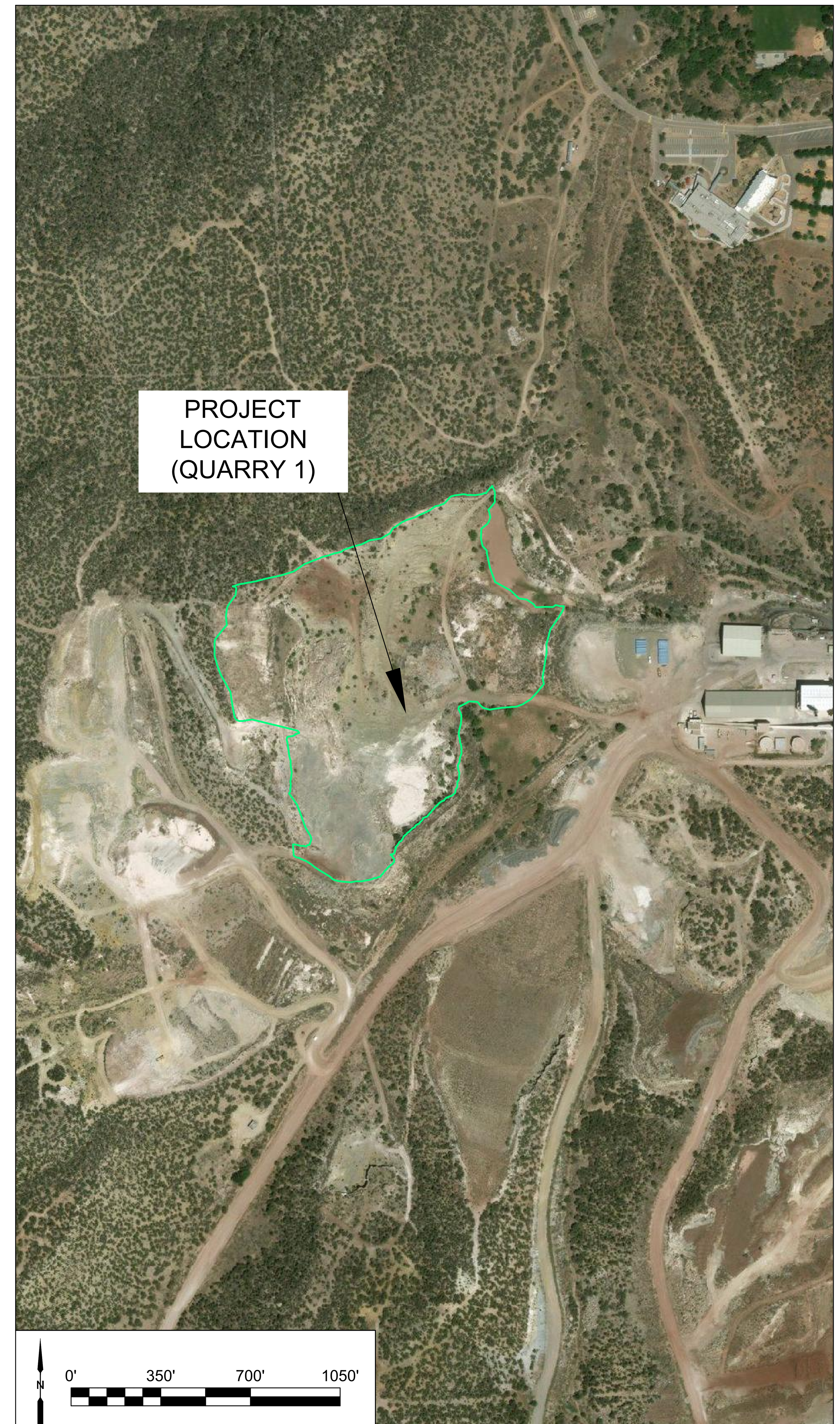
In this PMT design hydrologic, hydraulic, and erosion analyses were conducted for worst-case conditions. Geomorphic reclamation principles were used to design the PMT for a stable surface with topographic diversity. As the reclaimed area matures and vegetation becomes established, the PMT is expected to function as a natural system without the need for regular maintenance. This PMT design package includes final grading topography, drain design, and performance standards.

QUARRY 1 POST-MINING TOPOGRAPHY (PMT) DESIGN
TIJERAS, BERNALILLO COUNTY, NEW MEXICO
DECEMBER 13, 2019

STATE OF NEW MEXICO



PROJECT LOCATION



CLIENT:

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11783 HIGHWAY 337 SOUTH
TIJERAS, NM, 87123

GCC

ENGINEER:

WATER & EARTH TECHNOLOGIES, INC.
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Water & Earth TECHNOLOGIES

DRAWING INDEX:

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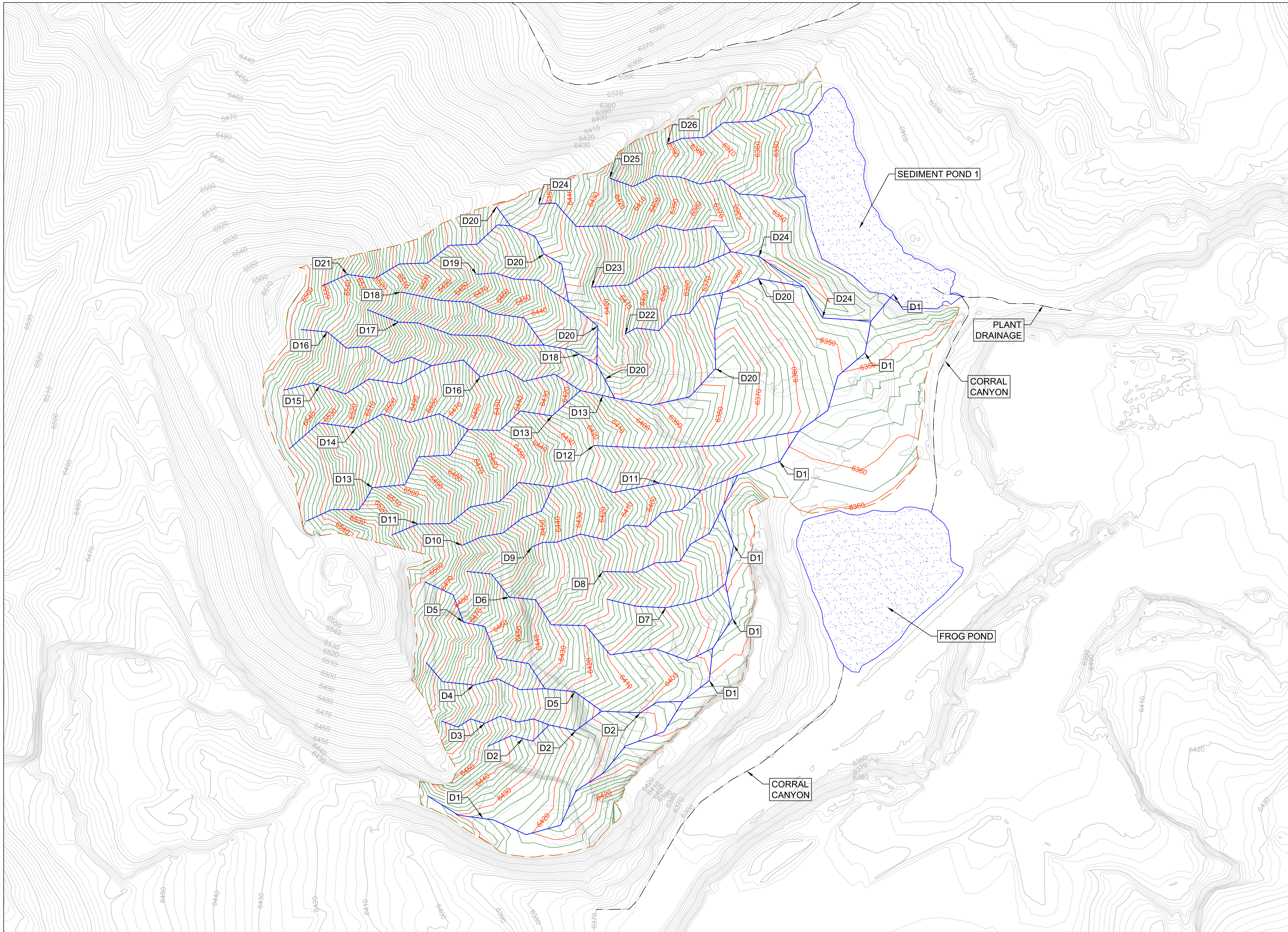
14	QUARRY 1 GEOMORPHIC GRADING DETAILS

RICHARD SPOTTS NEW MEXICO 15772 LICENSED PROFESSIONAL ENGINEER

Richard Spotts
12/13/2019

QUARRY 1 PMT DESIGN	
QUARRY 1 COVER SHEET	CONTRACTOR SHEET NO. WET 1 OF 14
	DWG. NO.
	REVISION / DATE 12/13/2019



GEOMORPHIC GRADING BOUNDARY
DRAIN CENTERLINE
EXISTING INDEX CONTOUR (10-FT INTERVAL)
EXISTING INTERMEDIATE CONTOUR (2-FT INTERVAL)
PROPOSED INDEX CONTOUR (10-FT INTERVAL)
PROPOSED INTERMEDIATE CONTOUR (2-FT INTERVAL)
EXISTING EPHEMERAL DRAINAGE
POND LOCATIONS

N

0' 100' 200' 300'

NOTES

1. FINAL SURFACE CONFIGURATION SHOWN. THIS INCLUDES A MINIMUM 2-FT COVER OF SUITABLE PLANT GROWTH MEDIUM.
2. CONSTRUCTION OF FINAL GRADED AND SUBGRADED SURFACE TO BE COMPLETED WITH MACHINE CONTROL EQUIPMENT.
3. DIGITAL DATA SHALL BE PROVIDED BY THE ENGINEER IN A FORMAT THAT IS COMPATIBLE WITH MACHINE CONTROL TECHNOLOGY FOR BOTH FINAL AND SUBGRADE.
5. FINAL REGRADED LANDFORM TOPOGRAPHY SHALL BE WITHIN +/- 1 FT OF THE DESIGNED TOPOGRAPHY (VERTICAL AND HORIZONTAL ELEVATIONS).
6. THE FINAL GRADE SURFACE SHALL BE DEEP RIPPED ON THE CONTOUR PRIOR TO SEEDING AND MULCHING.
7. SURFACE ROUGHENING AND RIPPING OF FINAL COMPACTED SURFACE SHALL NOT OCCUR IN CHANNEL BOTTOMS OR ON SIDE SLOPES.

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SEAL
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12/13/2019

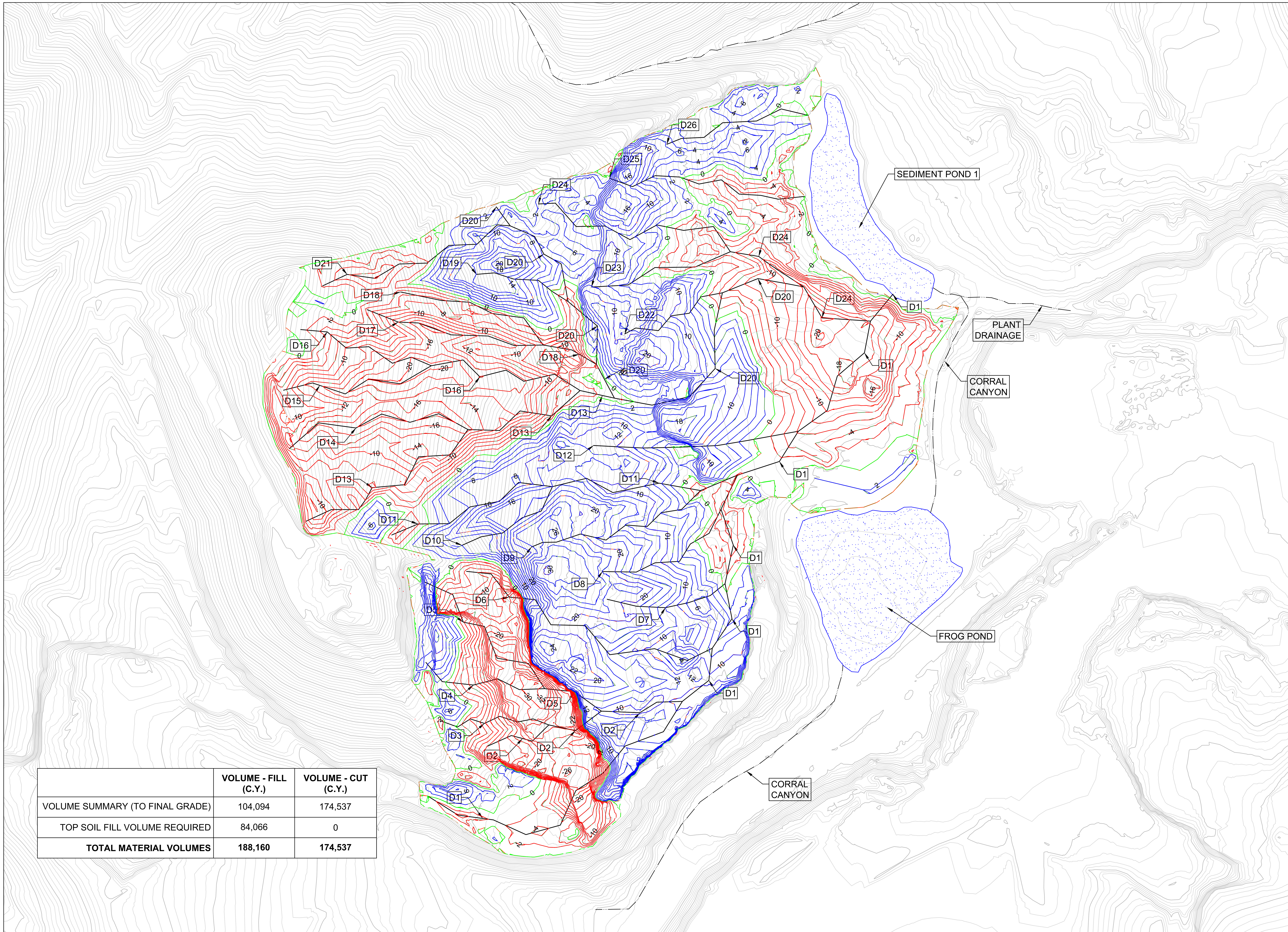
QUARRY 1 PMT DESIGN

REFERENCES		REFERENCES		REVISIONS							REVISIONS						
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	BY	CKD	APP	CLIENT	DATE	DESCRIPTION	NO.	BY	CKD	APP	CLIENT	DATE	DESCRIPTION

GCC
GCC TIJERAS

QUARRY 1 SITE OVERVIEW AND FINAL GRADING PLAN

CONTRACTOR SHEET NO.
WET 2 OF 14
DWG. NO.
REVISION
DATE
12/13/2019



	VOLUME - FILL (C.Y.)	VOLUME - CUT (C.Y.)
VOLUME SUMMARY (TO FINAL GRADE)	104,094	174,537
TOP SOIL FILL VOLUME REQUIRED	84,066	0
TOTAL MATERIAL VOLUMES	**188,160**	**174,537**

GEOMORPHIC GRADING BOUNDARY
DRAIN CENTERLINE
EXISTING INDEX CONTOUR (10-FT INTERVAL)
EXISTING INTERMEDIATE CONTOUR (2-FT INTERVAL)
ISOMETRIC CUT DEPTH LINES
ISOMETRIC FILL DEPTH LINES
DAYLIGHT LOCATIONS (0' DEPTH CUT/FILL)
EXISTING EPHEMERAL DRAINAGE
POND LOCATIONS

N

0' 100' 200' 300'

NOTES

1. CUT-FILL REPRESENTATIVE OF FINAL SURFACE CONFIGURATION. SUBGRADE (NO TOPSOIL) GRADING WILL REQUIRE 2 FEET OF ADDITIONAL CUT TO ALLOW FOR PROPER COVER MATERIAL PLACEMENT ON TOP (NOT REFLECTED IN VOLUMES OR MAGNITUDE OF CUTS AND FILLS).

   IF TOPSOIL MATERIAL WITH A MINIMUM DEPTH OF 2' IS ENCOUNTERED DURING CONSTRUCTION, FURTHER EXCAVATION IS NOT REQUIRED IN THESE LOCATIONS. THIS CONDITION IS ANTICIPATED IN SOME LOCATIONS.

2. EXISTING GROUND CONFIGURATION ASSUMES THAT LIMESTONE HAS BEEN REMOVED (AS INDICATED BY GCC). VOLUMES ARE BASED ON POST LIMESTONE REMOVAL

3. CONSTRUCTION OF FINAL GRADED AND SUBGRADED SURFACE TO BE COMPLETED WITH MACHINE CONTROL EQUIPMENT.

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QUARRY 1 PMT DESIGN

REFERENCES		REFERENCES		REVISIONS							REVISIONS						
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	BY	CKD	APP	CLIENT	DATE	DESCRIPTION	NO.	BY	CKD	APP.	CLIENT	DATE	DESCRIPTION

GCC

GCC TIJERAS

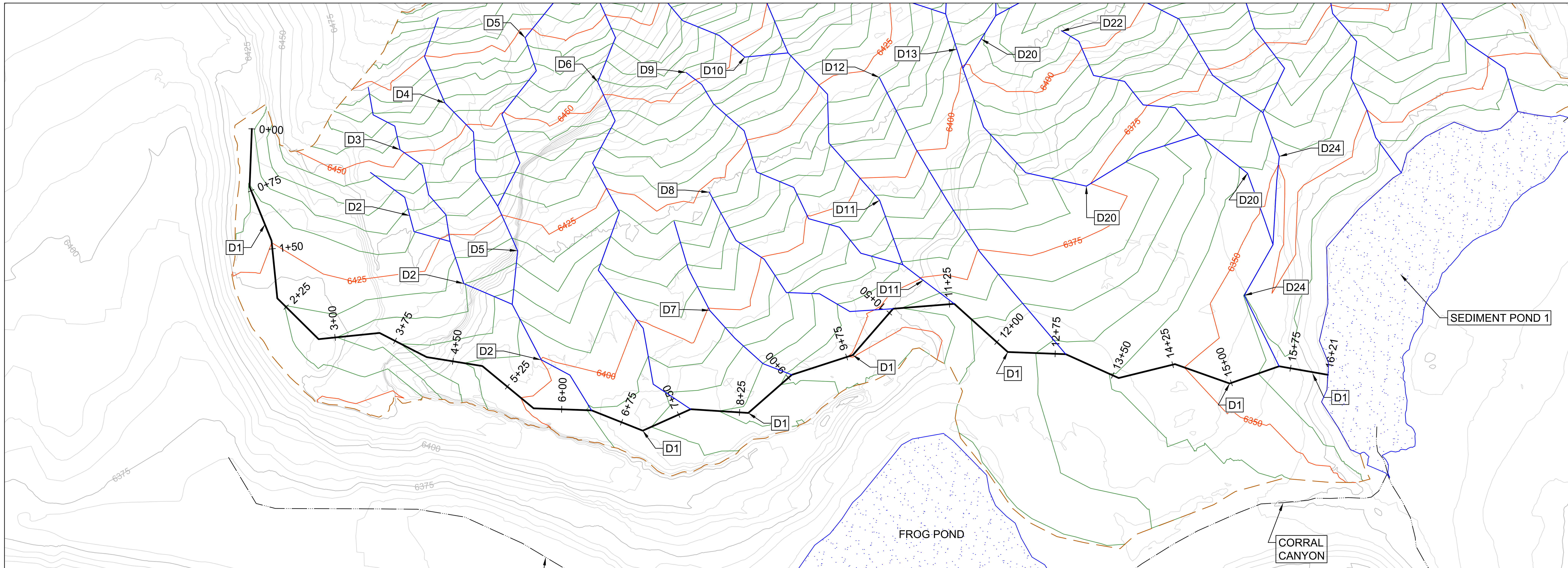
QUARRY 1
CUT/FILL MAP & CONSTRUCTION
VOLUME SUMMARY

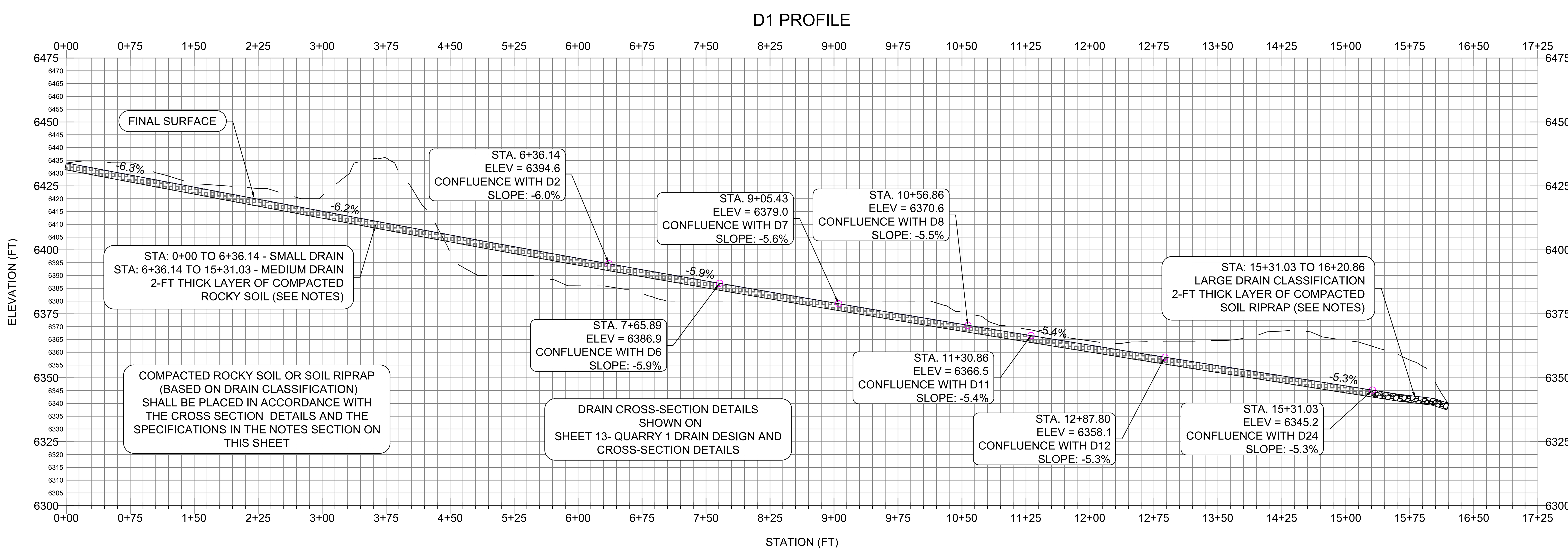
CONTRACTOR SHEET NO. WET 3 OF 14

DWG. NO.

REVISION

DATE 12/13/2019





- GEOMORPHIC GRADING BOUNDARY
- DRAIN ALIGNMENTS OF INTEREST
- DRAIN CENTERLINE
- EXISTING INDEX CONTOUR (25-FT INTERVAL)
- EXISTING INTERMEDIATE CONTOUR (5-FT INTERVAL)
- PROPOSED INDEX CONTOUR (25-FT INTERVAL)
- PROPOSED INTERMEDIATE CONTOUR (5-FT INTERVAL)
- EXISTING EPHEMERAL DRAINAGE
- EXISTING GRADE PROFILE
- PROPOSED FINAL GRADE PROFILE

N

0' 75' 150' 225'

NOTES

1. FINAL SURFACE TOPOGRAPHY SHOWN. THIS INCLUDES A MINIMUM 2-FOOT COVER OF SUITABLE PLANT GROWTH MEDIUM.

2. THE TYPICAL SMALL DRAIN AND TYPICAL MEDIUM DRAIN SHALL BE CONSTRUCTED FROM A COMPACTED ROCKY SOIL. THE ROCKY SOIL LINER WILL CONSIST OF AT LEAST 70% STONE, BY VOLUME, AND MAY INCLUDE UP TO 30% SOIL, BY VOLUME.
   - 2.1. THE STONE IN THE ROCKY SOIL LINER WILL BE HARD AND HIGHLY WEATHER-RESISTANT.
   - 2.2. THE STONE IN THE ROCKY SOIL LINER WILL BE SIZED AS 6" MINUS.
   - 2.3. THE STONE AND NATIVE SOIL MATERIAL SHALL BE MIXED PRIOR TO PLACEMENT.
   - 2.4. THE SUBGRADE SHALL BE ROUGHENED PRIOR TO ROCKY SOIL LINER PLACEMENT. THE ROCKY SOIL LINER SHALL BE PLACED AND THEN COMPACTED INTO THE SUBGRADE WITH SUITABLE EQUIPMENT TO ACHIEVE A DENSE MASS OF THAT IS VIRTUALLY FREE OF VOIDS.
   - 2.5. MOISTURE CONDITIONING SHALL BE USED TO INCREASE COMPACTION IF NATIVE SOILS ARE RELATIVELY DRY. THE COMPACTED ROCKY SOIL LINER SHALL NOT BE COVERED WITH TOPSOIL. SURFACE ROUGHENING OF THE FINAL COMPACTED SURFACE SHALL NOT OCCUR IN CHANNEL BOTTOMS OR SIDESLOPES.

3. THE TYPICAL LARGE RIPRAP DRAIN SHALL BE CONSTRUCTED WITH SOIL RIPRAP. SOIL RIPRAP SHALL CONSIST OF APPROXIMATELY 65% RIPRAP AND 35% SOIL, BY VOLUME.
   - 3.1. THE RIPRAP SHALL CONSIST OF A WELL-GRADED MIXTURE OF STONE. LARGER STONE SHALL PREDOMINATE, WITH SUFFICIENT SMALLER SIZES TO FILL VOIDS BETWEEN STONES.
   - 3.2. THE DIAMETER OF THE LARGEST STONE SIZES SHOULD BE NO GREATER THAN 2 TIMES THE D50 SIZE.
   - 3.3. PRIOR TO MIXING WITH NATIVE SOILS, THE RIPRAP SHALL HAVE THE FOLLOWING GRADATION:
     - DMIN = 3 INCHES
     - D50 = 6 INCHES
     - DMAX = 9 INCHES
   - 3.4. THE RIPRAP SHALL BE HARD, ANGULAR AND HIGHLY WEATHER RESISTANT. THE RATIO OF LENGTH TO THICKNESS OF ANGULAR STONES SHALL NOT EXCEED 2.
   - 3.5. RIPRAP AND NATIVE SOIL MATERIAL SHALL BE MIXED PRIOR TO PLACEMENT.
   - 3.6. THE SUBGRADE SHALL BE ROUGHENED PRIOR TO SOIL RIPRAP PLACEMENT. SOIL RIPRAP SHALL BE PLACED AND THEN COMPACTED INTO THE SUBGRADE WITH SUITABLE EQUIPMENT TO ACHIEVE A DENSE MASS OF SOIL RIPRAP THAT IS VIRTUALLY FREE OF VOIDS.
   - 3.7. MOISTURE CONDITIONING SHALL BE USED TO INCREASE COMPACTION IF NATIVE SOILS ARE RELATIVELY DRY. THE SOIL RIPRAP SURFACE SHALL NOT BE COVERED WITH TOPSOIL. SURFACE ROUGHENING OF THE FINAL COMPACTED SURFACE SHALL NOT OCCUR IN CHANNEL BOTTOMS OR SIDESLOPES.

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Richard Spotts 12/13/2019

QUARRY 1 PMT DESIGN

REFERENCES		REFERENCES		REVISIONS							REVISIONS						
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	BY	CKD	APP	CLIENT	DATE	DESCRIPTION	NO.	BY	CKD	APP.	CLIENT	DATE	DESCRIPTION

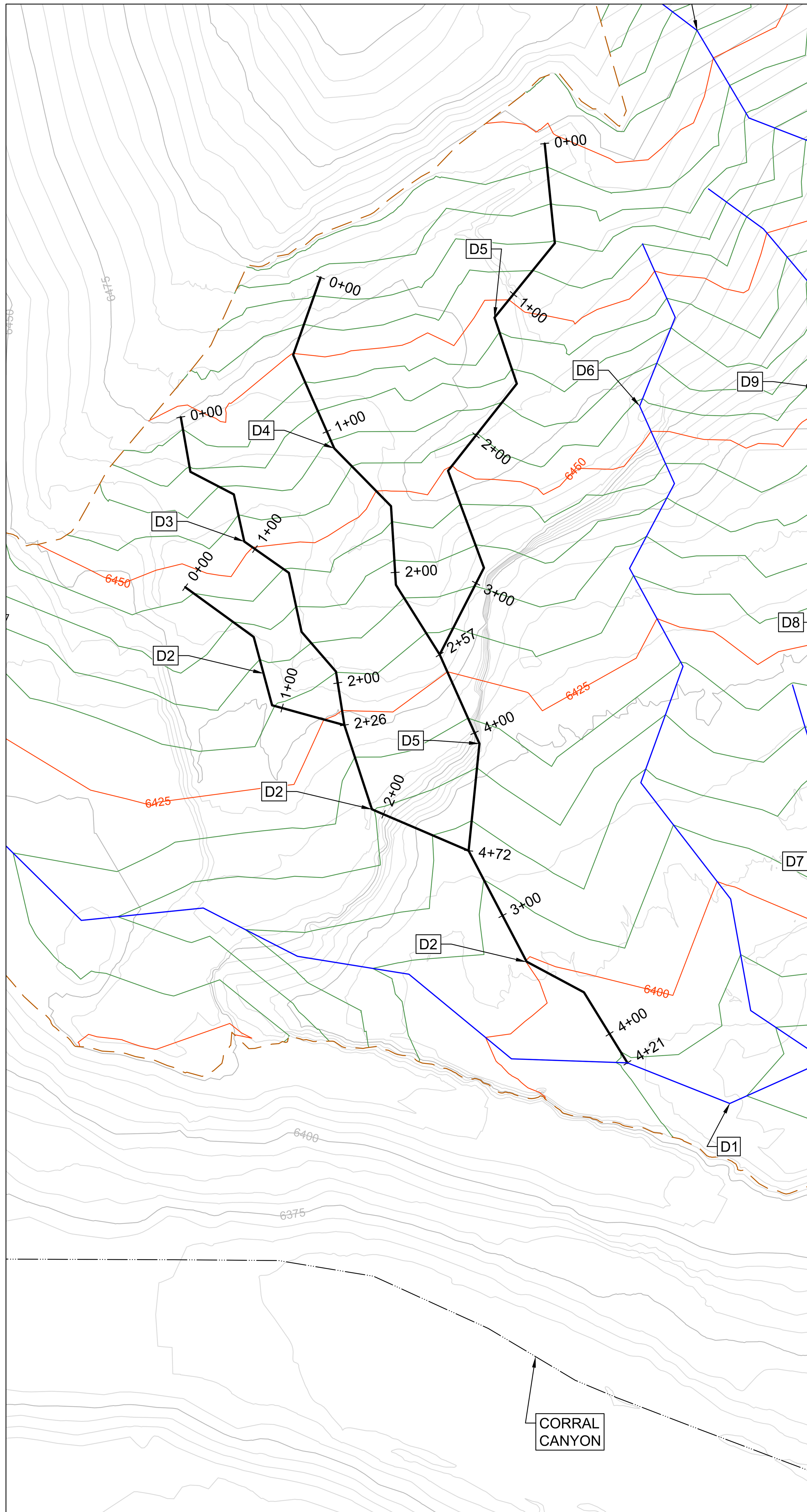
GCC TIJERAS

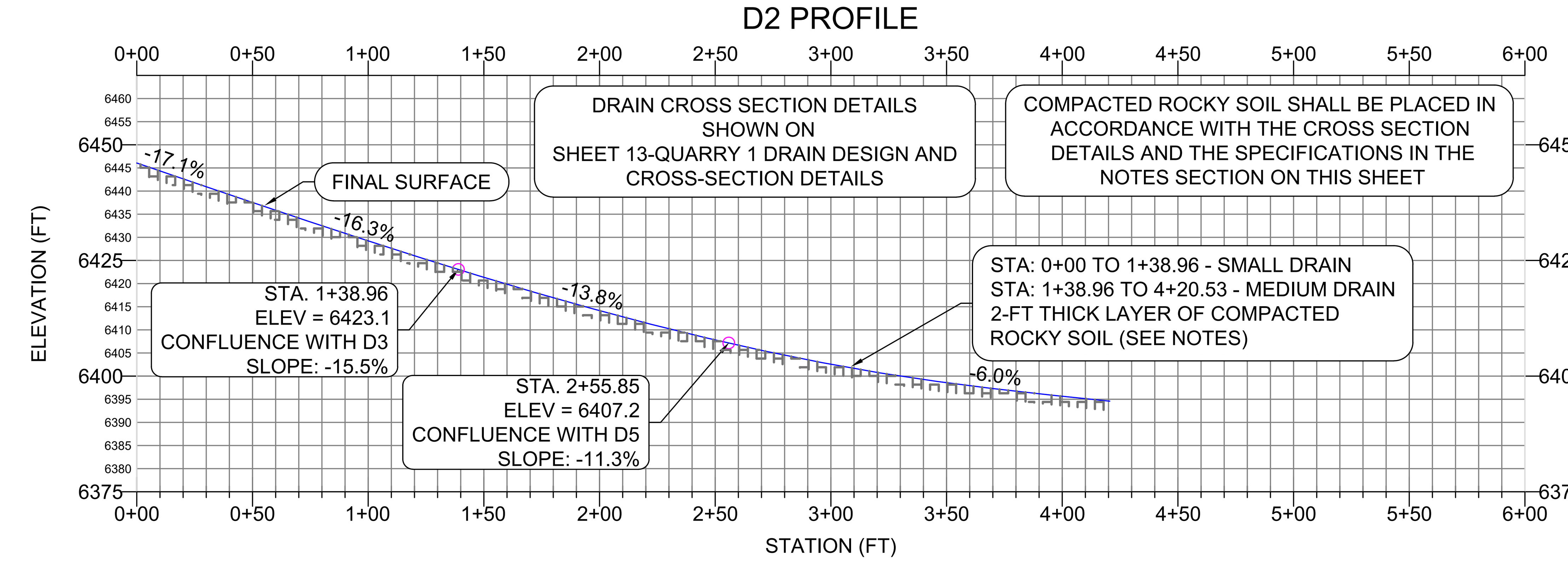
QUARRY 1
DRAIN D1 PLAN AND PROFILE

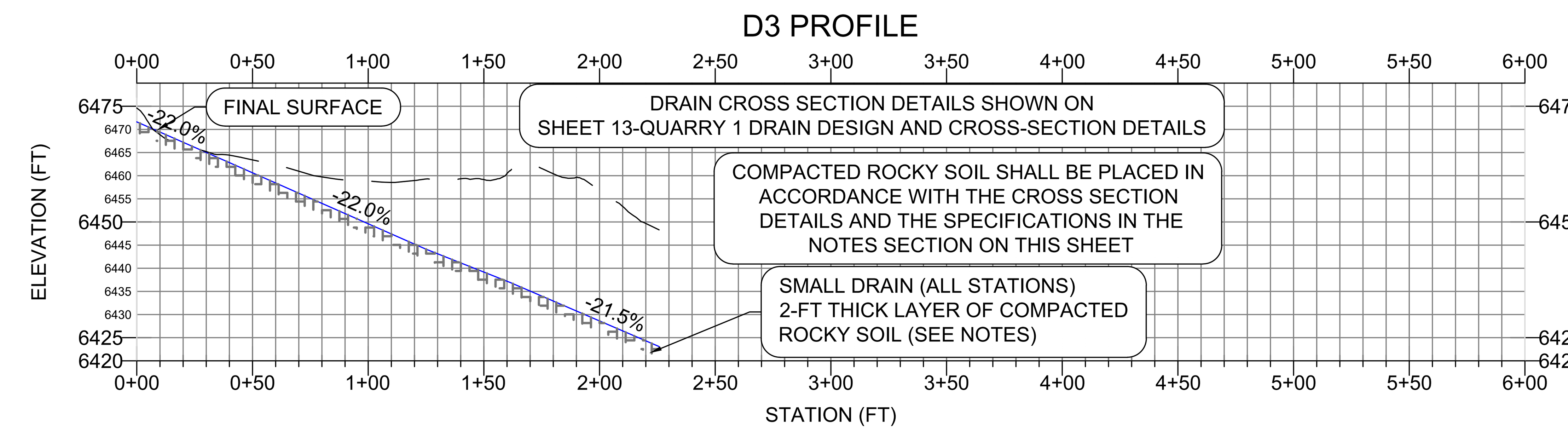
CONTRACTOR SHEET. NO.
WET 4 OF 14

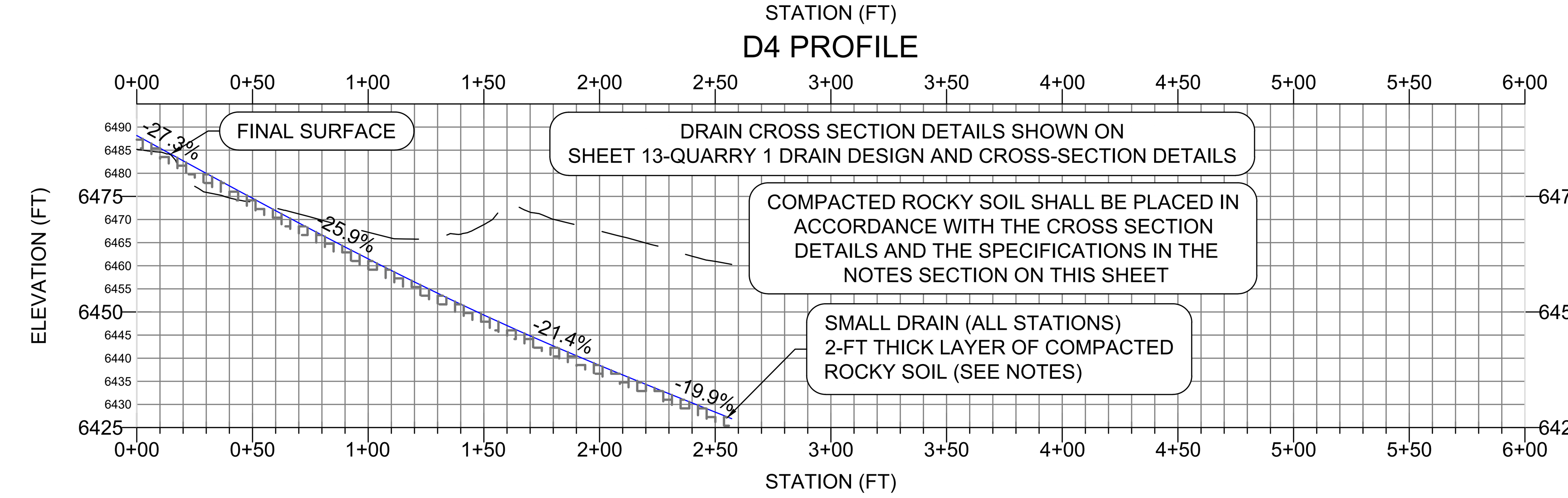
DWG. NO.

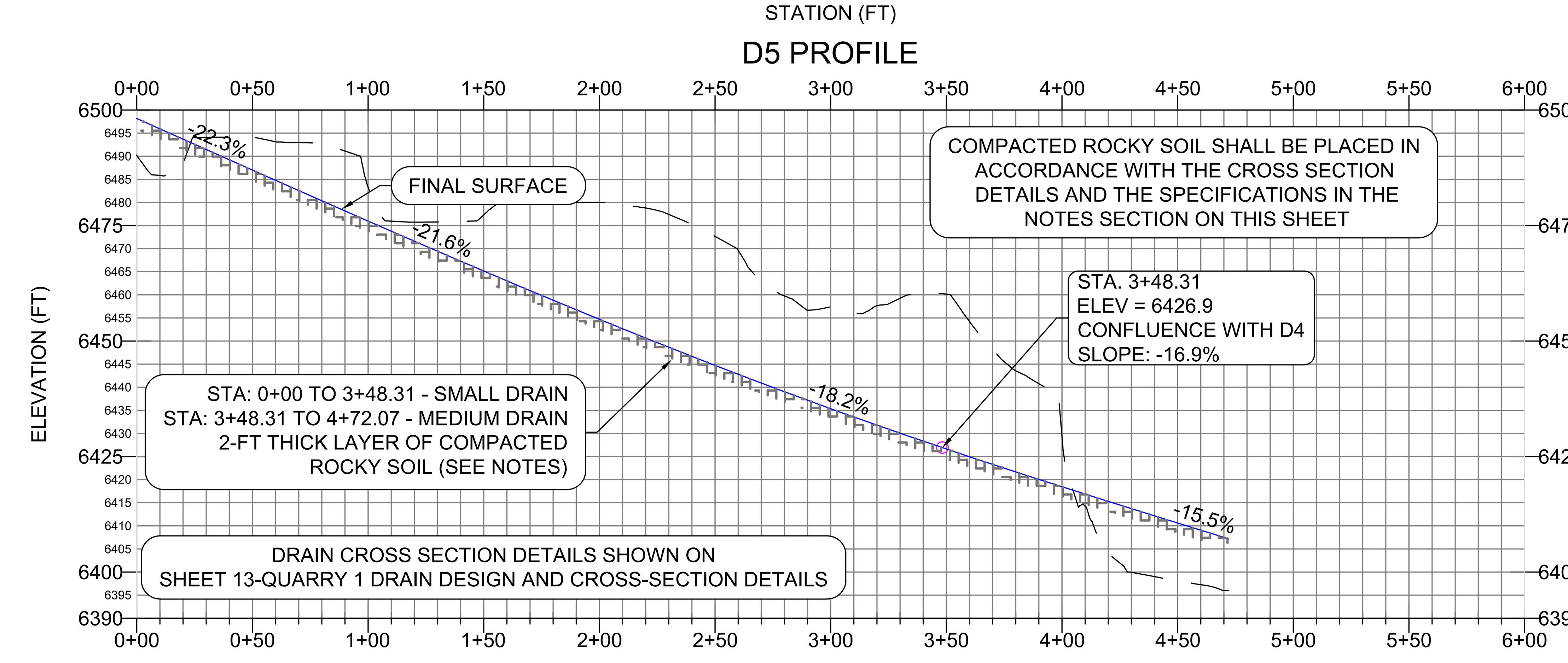
REVISION | DATE 12/13/2019











GEOMORPHIC GRADING BOUNDARY
DRAIN ALIGNMENTS OF INTEREST
DRAIN CENTERLINE
EXISTING INDEX CONTOUR (25-FT INTERVAL)
EXISTING INTERMEDIATE CONTOUR (5-FT INTERVAL)
PROPOSED INDEX CONTOUR (25-FT INTERVAL)
PROPOSED INTERMEDIATE CONTOUR (5-FT INTERVAL)
EXISTING EPHEMERAL DRAINAGE
EXISTING GRADE PROFILE
PROPOSED FINAL GRADE PROFILE

0' 50' 100' 150'

NOTES

1. FINAL SURFACE TOPOGRAPHY SHOWN. THIS INCLUDES A MINIMUM 2-FOOT COVER OF SUITABLE PLANT GROWTH MEDIUM.
2. THE TYPICAL SMALL DRAIN AND TYPICAL MEDIUM DRAIN SHALL BE CONSTRUCTED FROM A COMPACTED ROCKY SOIL. THE ROCKY SOIL LINER WILL CONSIST OF AT LEAST 70% STONE, BY VOLUME, AND MAY INCLUDE UP TO 30% SOIL, BY VOLUME.
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   - 2.3. THE STONE AND NATIVE SOIL MATERIAL SHALL BE MIXED PRIOR TO PLACEMENT.
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   - 2.5. MOISTURE CONDITIONING SHALL BE USED TO INCREASE COMPACTION IF NATIVE SOILS ARE RELATIVELY DRY. THE COMPACTED ROCKY SOIL LINER SHALL NOT BE COVERED WITH TOPSOIL. SURFACE ROUGHENING OF THE FINAL COMPACTED SURFACE SHALL NOT OCCUR IN CHANNEL BOTTOMS OR SIDESLOPES.
3. THE TYPICAL LARGE RIPRAP DRAIN SHALL BE CONSTRUCTED WITH SOIL RIPRAP. SOIL RIPRAP SHALL CONSIST OF APPROXIMATELY 65% RIPRAP AND 35% SOIL, BY VOLUME.
   - 3.1. THE RIPRAP SHALL CONSIST OF A WELL-GRADED MIXTURE OF STONE. LARGER STONE SHALL PREDOMINATE, WITH SUFFICIENT SMALLER SIZES TO FILL VOIDS BETWEEN STONES.
   - 3.2. THE DIAMETER OF THE LARGEST STONE SIZES SHOULD BE NO GREATER THAN 2 TIMES THE D50 SIZE.
   - 3.3. PRIOR TO MIXING WITH NATIVE SOILS, THE RIPRAP SHALL HAVE THE FOLLOWING GRADATION:
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   - 3.4. THE RIPRAP SHALL BE HARD, ANGULAR AND HIGHLY WEATHER RESISTANT. THE RATIO OF LENGTH TO THICKNESS OF ANGULAR STONES SHALL NOT EXCEED 2.
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SEAL
RICHARD SPOTTS NEW MEXICO 15772 LICENSED PROFESSIONAL ENGINEER
Richard Spotts 12/13/2019

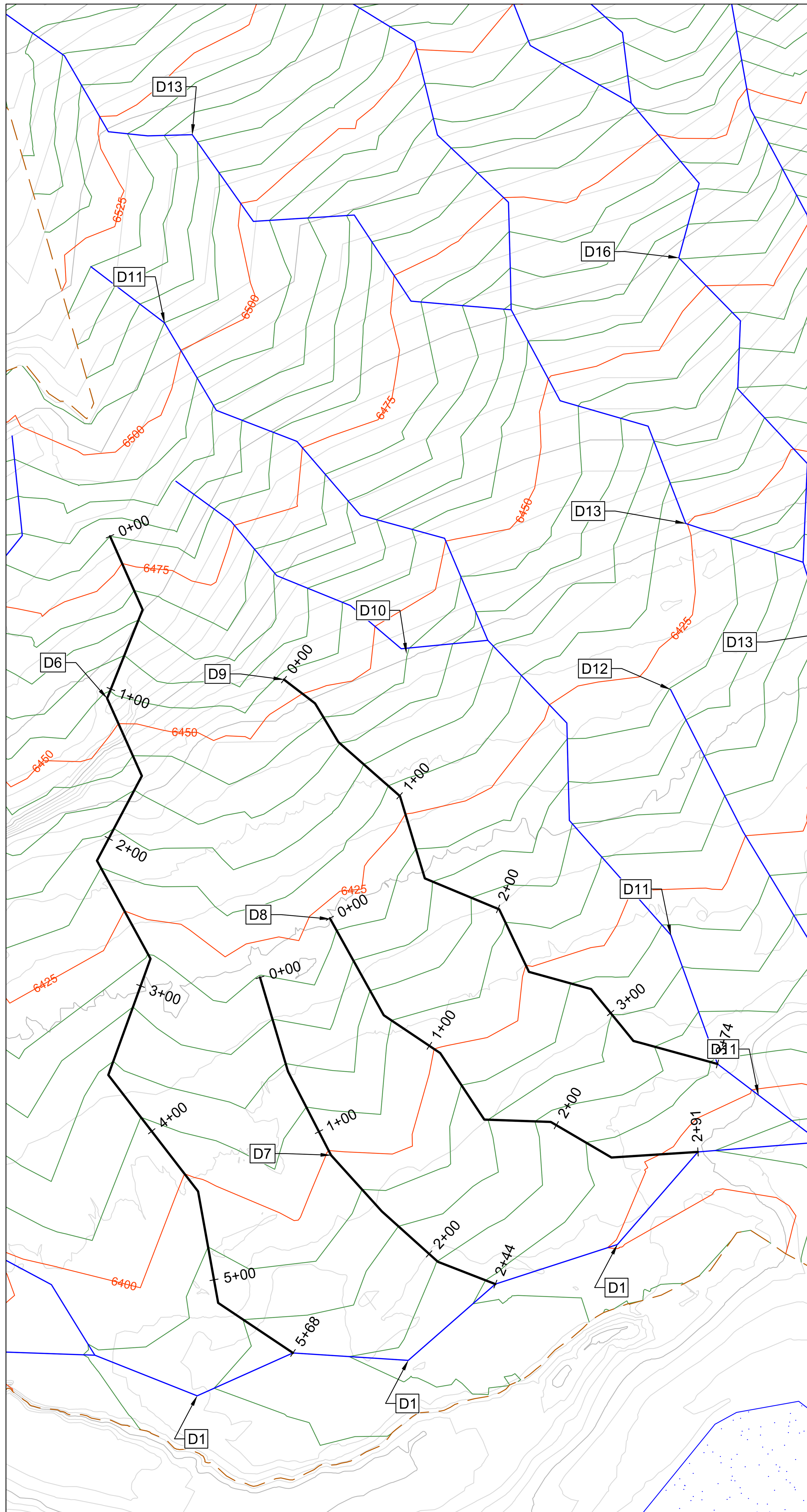
QUARRY 1 PMT DESIGN

REFERENCES		REFERENCES		REVISIONS							REVISIONS						
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	BY	CKD	APP	CLIENT	DATE	DESCRIPTION	NO.	BY	CKD	APP.	CLIENT	DATE	DESCRIPTION

GCC
GCC TIJERAS

QUARRY 1
DRAINS D2, D3, D4 & D5 PLANS AND PROFILES

CONTRACTOR SHEET. NO.
WET 5 OF 14
DWG. NO.
REVISION
DATE
12/13/2019



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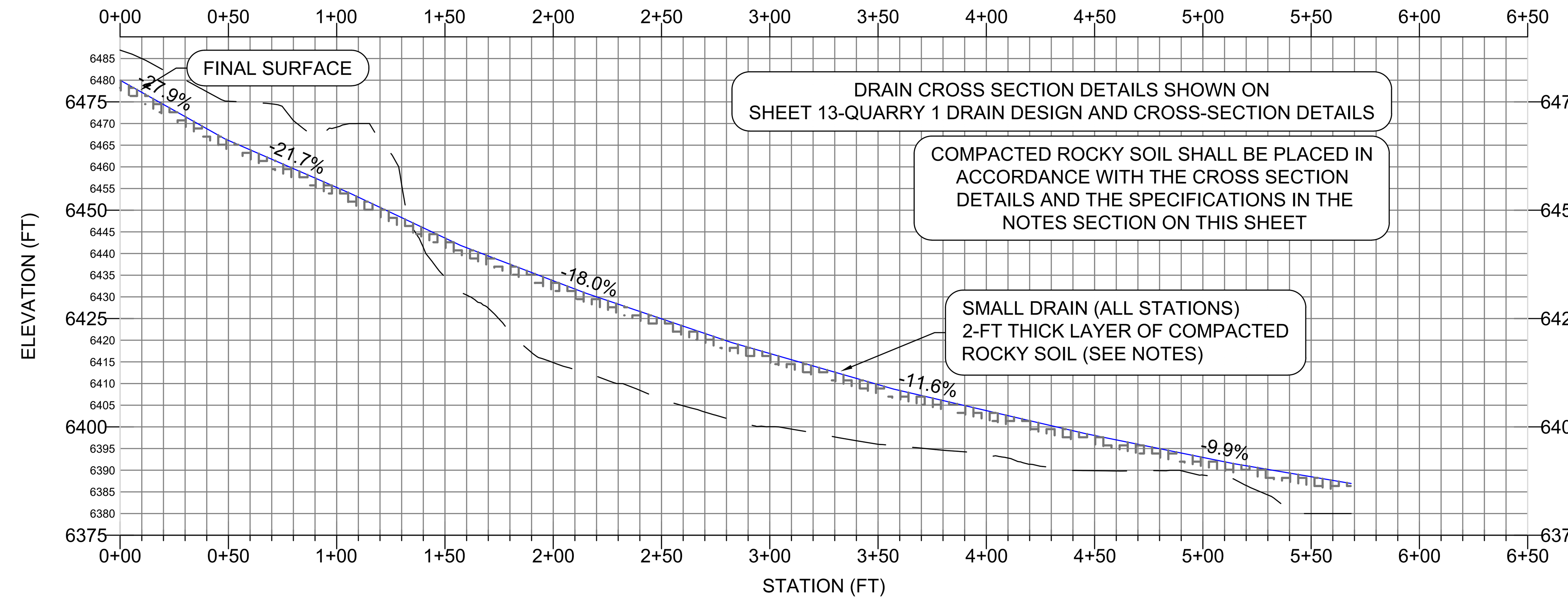

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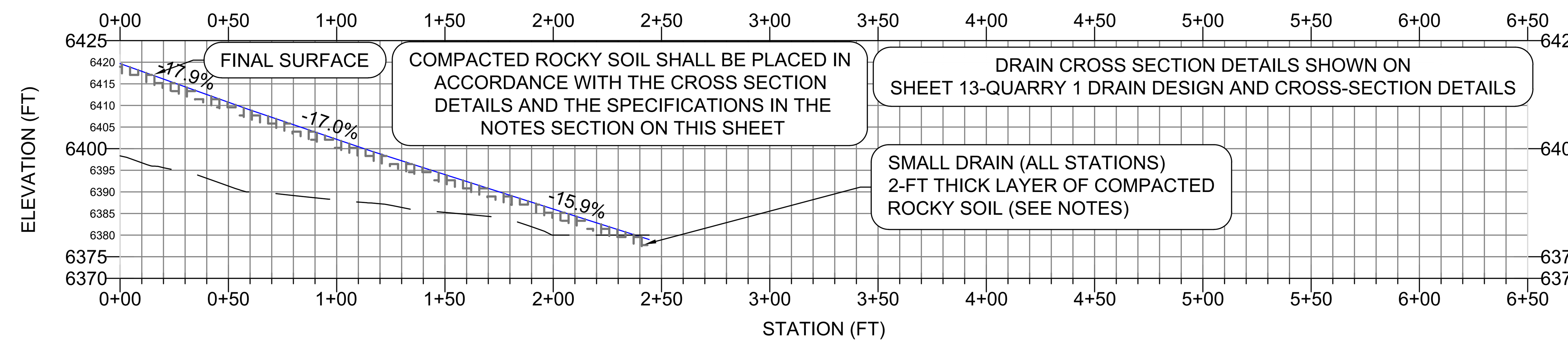

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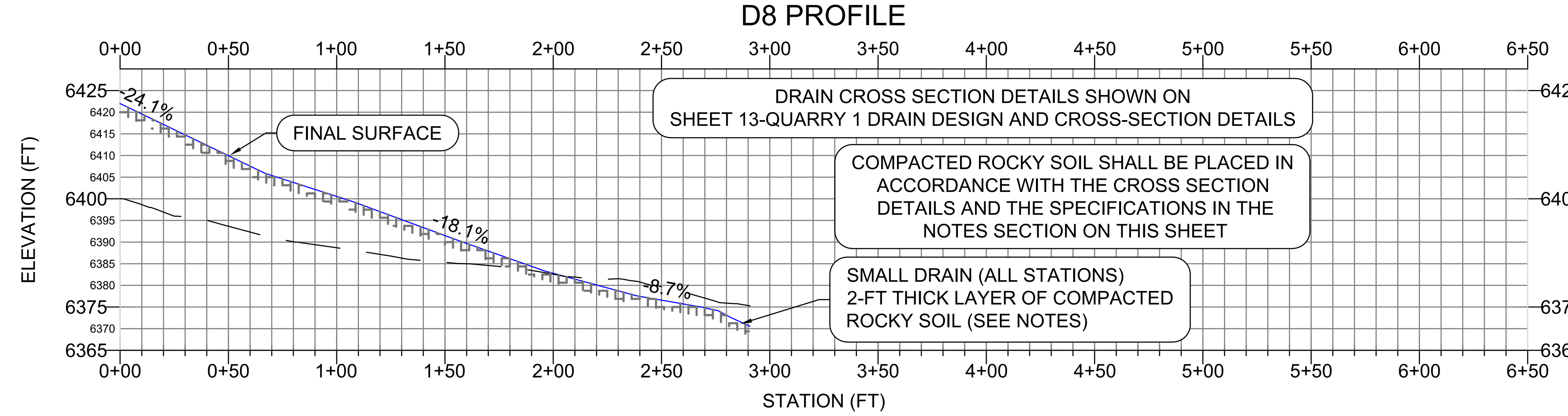

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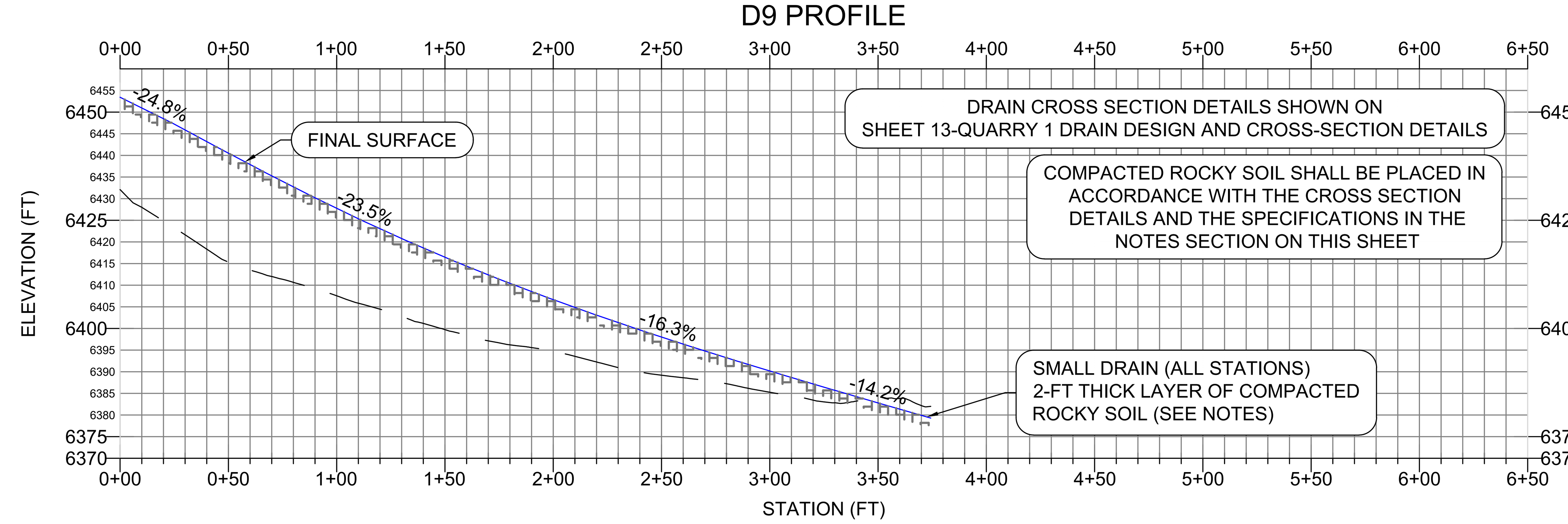

GEOMORPHIC GRADING BOUNDARY
DRAIN ALIGNMENTS OF INTEREST
DRAIN CENTERLINE
EXISTING INDEX CONTOUR (25-FT INTERVAL)
EXISTING INTERMEDIATE CONTOUR (5-FT INTERVAL)
PROPOSED INDEX CONTOUR (25-FT INTERVAL)
PROPOSED INTERMEDIATE CONTOUR (5-FT INTERVAL)
EXISTING EPHEMERAL DRAINAGE
EXISTING GRADE PROFILE
PROPOSED FINAL GRADE PROFILE

N

0' 50' 100' 150'

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Richard Spotts
12/13/2019

QUARRY 1 PMT DESIGN

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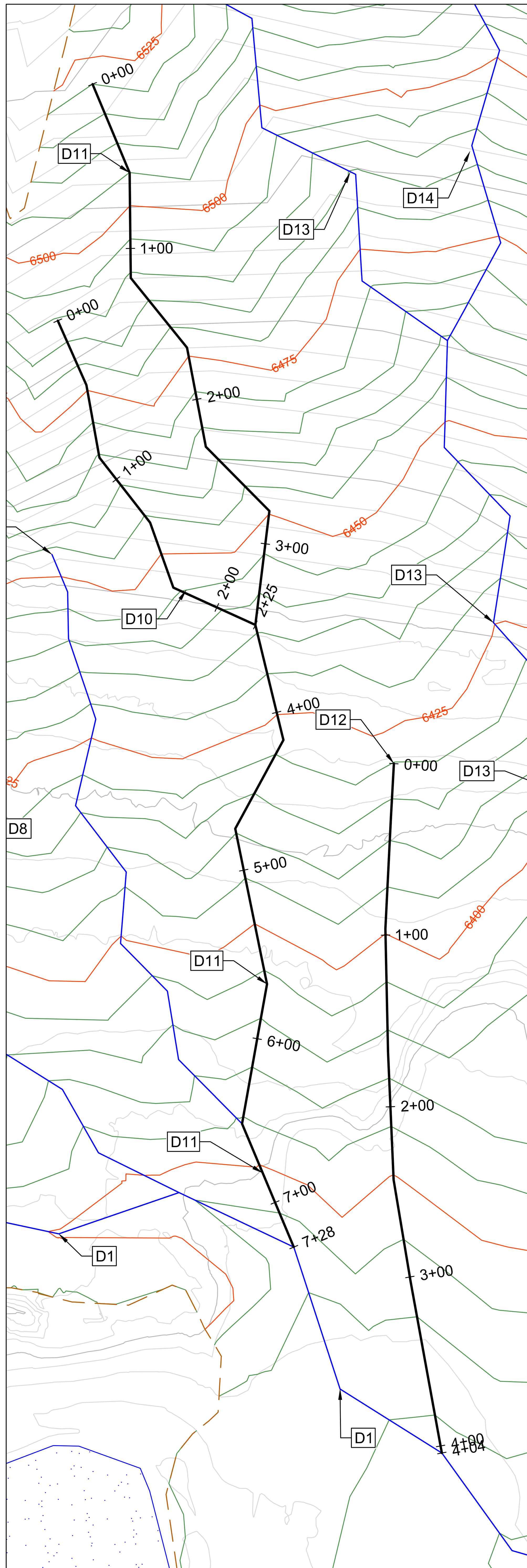
GCC
GCC TIJERAS

QUARRY 1
DRAINS D6, D7, D8 & D9 PLANS AND PROFILES

CONTRACTOR SHEET. NO.
WET 6 OF 14
DWG. NO.
REVISION
DATE
12/13/2019



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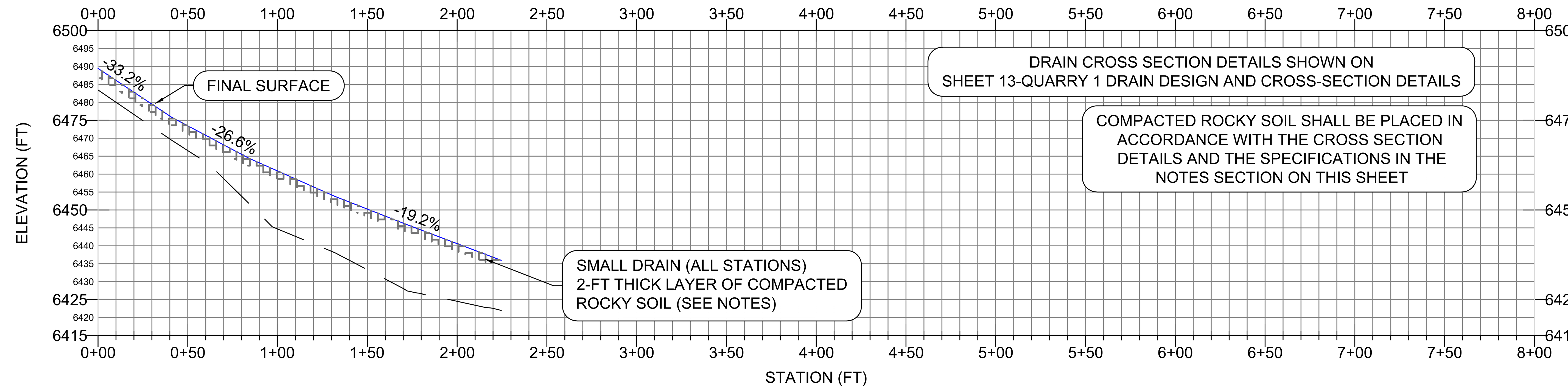

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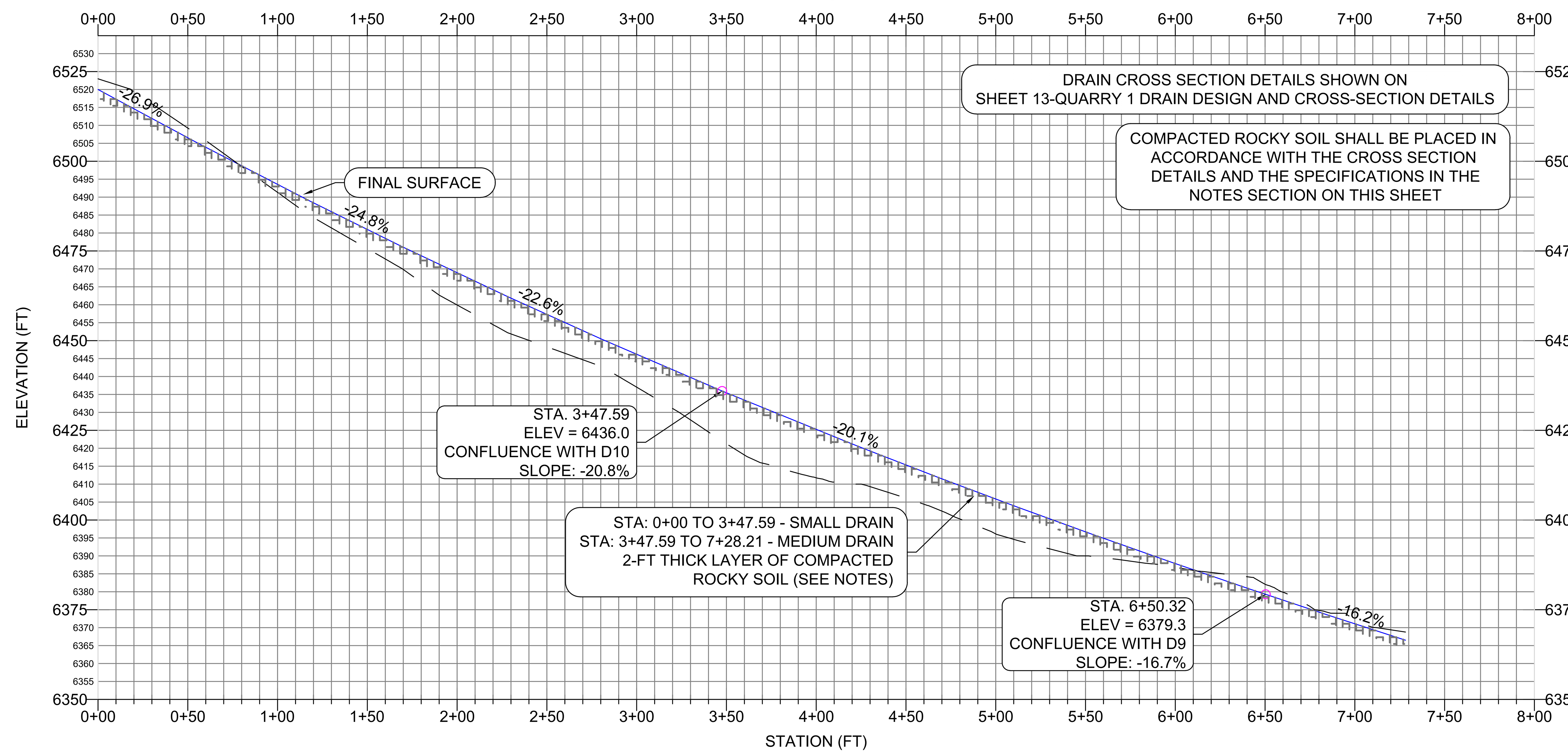

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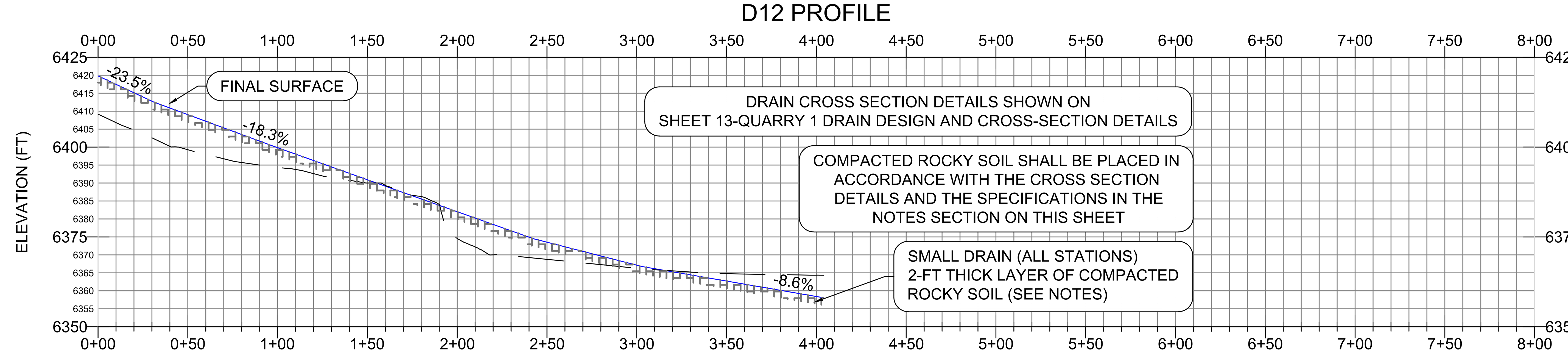

GEOMORPHIC GRADING BOUNDARY
DRAIN ALIGNMENTS OF INTEREST
DRAIN CENTERLINE
EXISTING INDEX CONTOUR (25-FT INTERVAL)
EXISTING INTERMEDIATE CONTOUR (5-FT INTERVAL)
PROPOSED INDEX CONTOUR (25-FT INTERVAL)
PROPOSED INTERMEDIATE CONTOUR (5-FT INTERVAL)
EXISTING EPHEMERAL DRAINAGE
EXISTING GRADE PROFILE
PROPOSED FINAL GRADE PROFILE

N

0' 50' 100' 150'

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SEAL

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12/13/2019

REFERENCES		REFERENCES		REVISIONS							REVISIONS						
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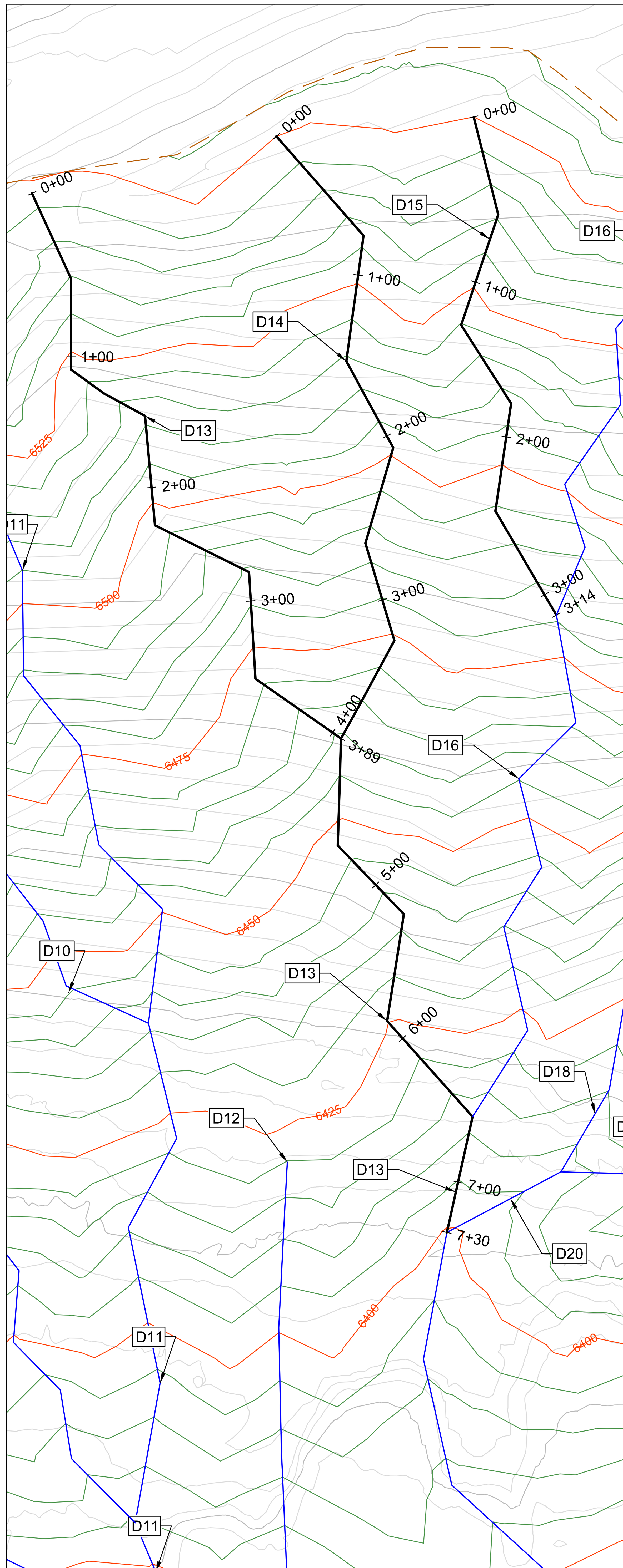
GCC
GCC TIJERAS

QUARRY 1 PMT DESIGN

QUARRY 1 DRAINS D10, D11 & D12 PLANS AND PROFILES

CONTRACTOR SHEET. NO. WET 7 OF 14
DWG. NO.
REVISION
DATE 12/13/2019



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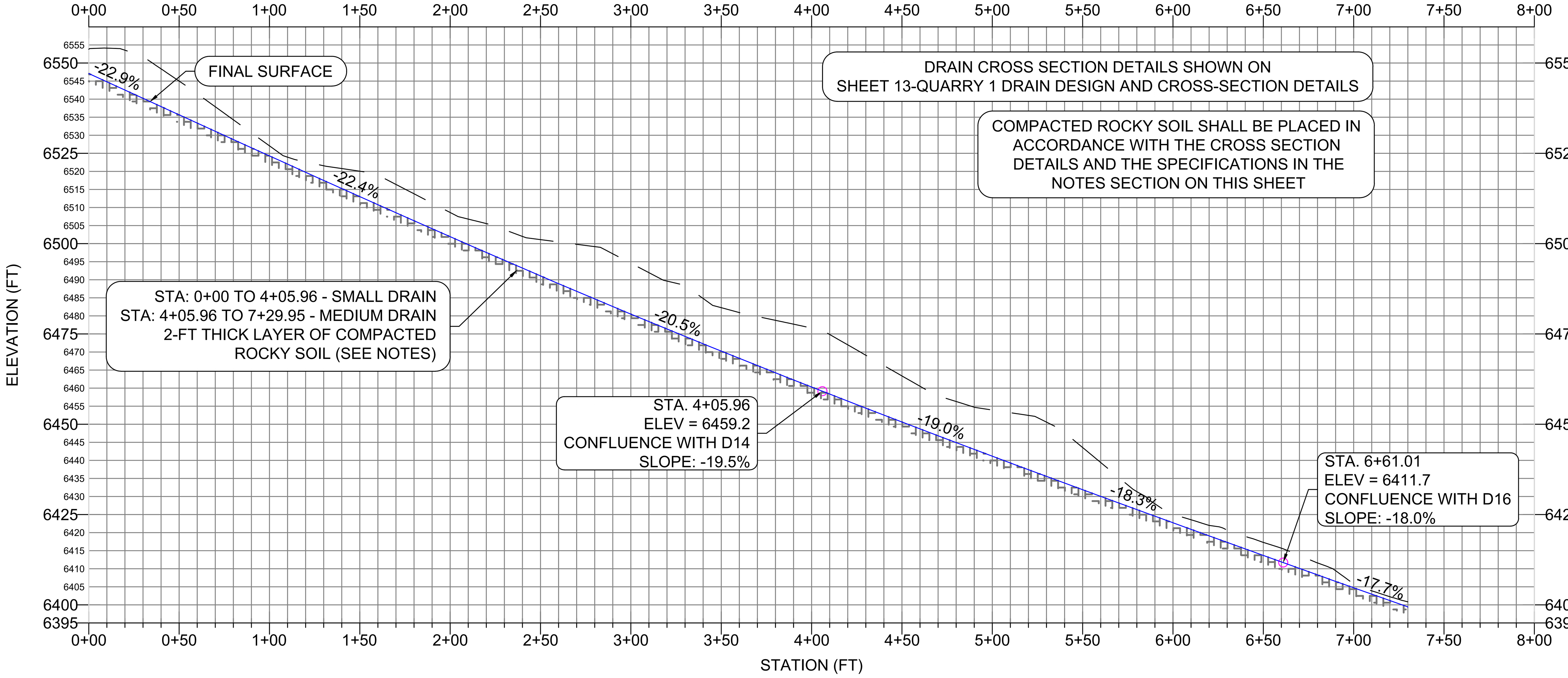

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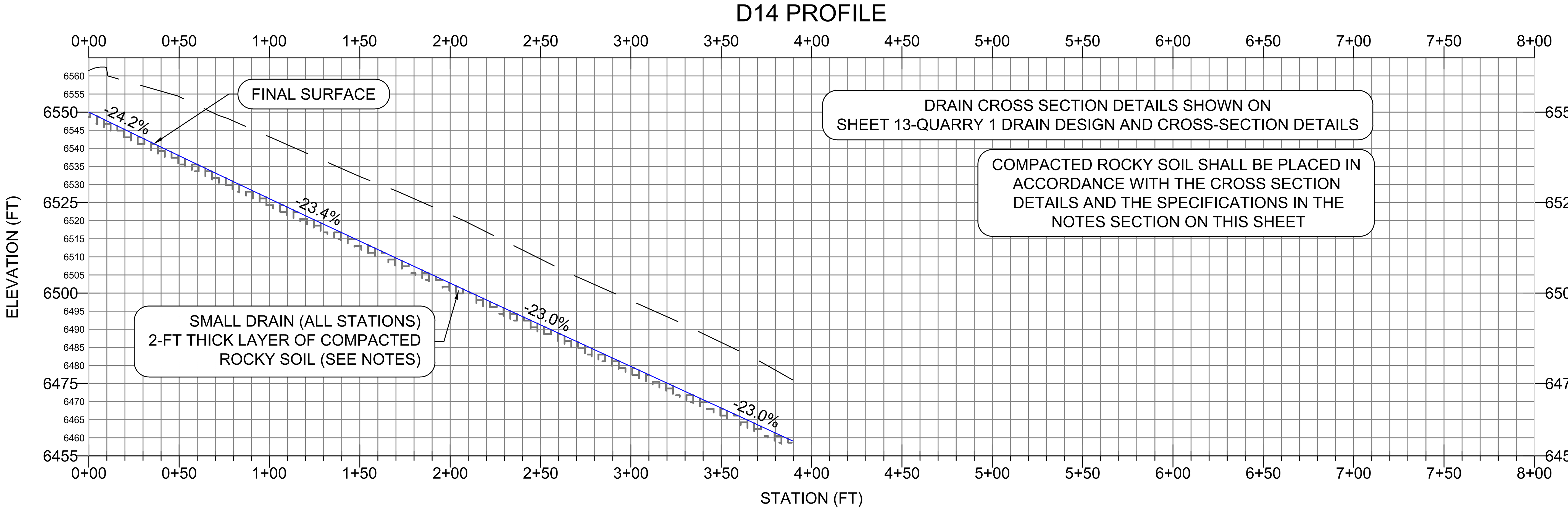

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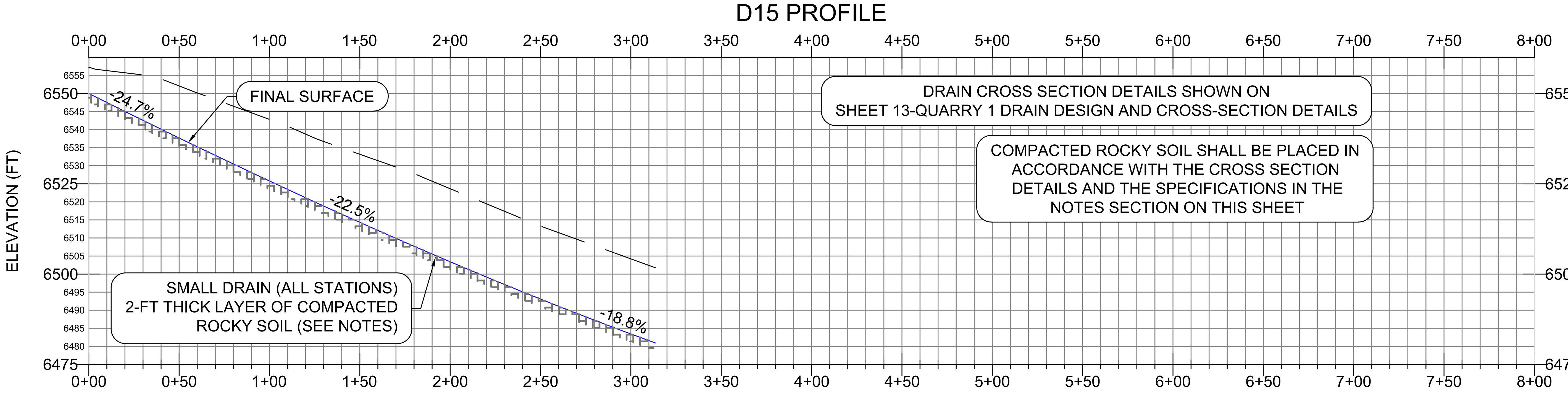

GEOMORPHIC GRADING BOUNDARY
DRAIN ALIGNMENTS OF INTEREST
DRAIN CENTERLINE
EXISTING INDEX CONTOUR (25-FT INTERVAL)
EXISTING INTERMEDIATE CONTOUR (5-FT INTERVAL)
PROPOSED INDEX CONTOUR (25-FT INTERVAL)
PROPOSED INTERMEDIATE CONTOUR (5-FT INTERVAL)
EXISTING EPHEMERAL DRAINAGE
EXISTING GRADE PROFILE
PROPOSED FINAL GRADE PROFILE

N

0' 50' 100' 150'

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12/13/2019

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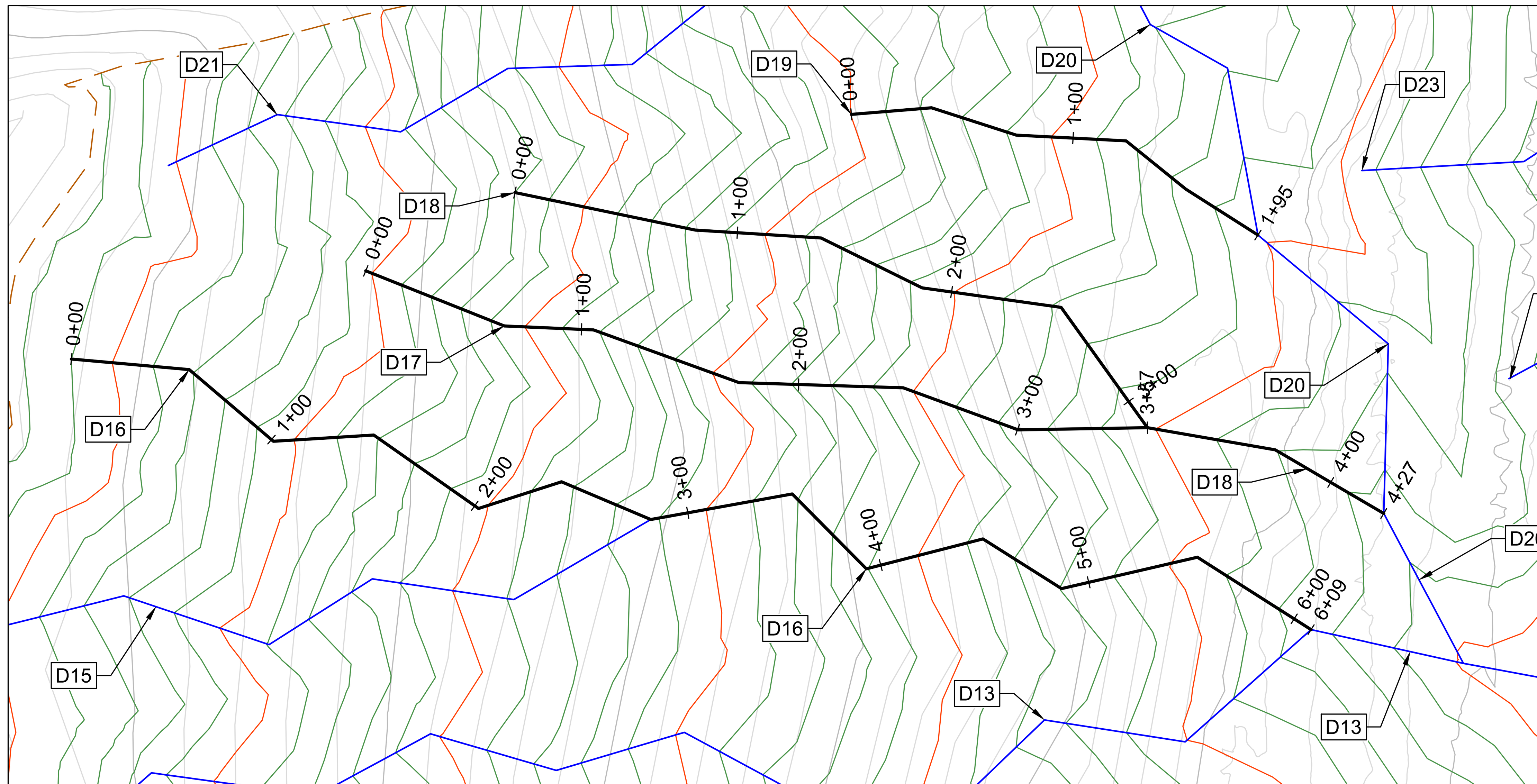
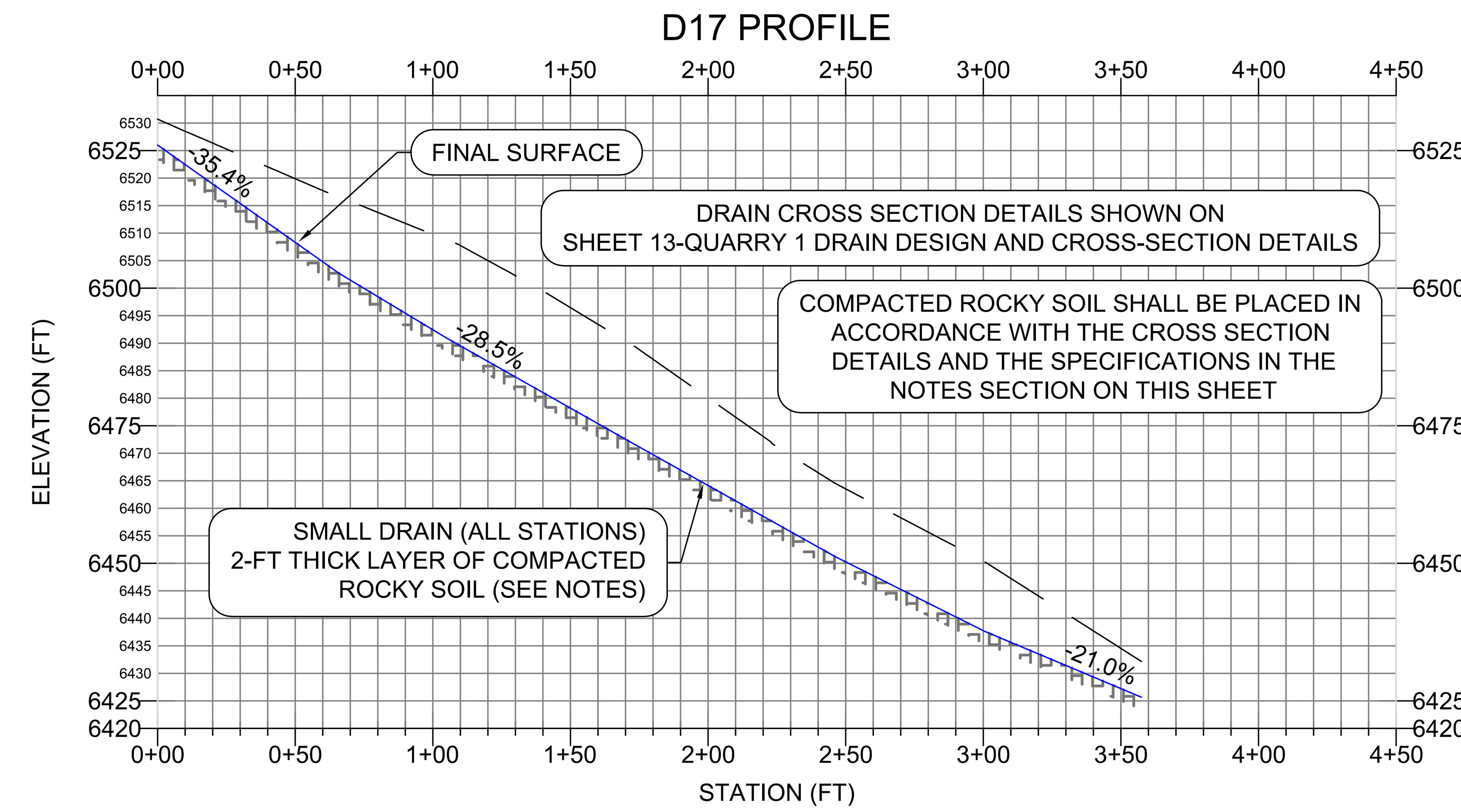
GCC
GCC TIJERAS

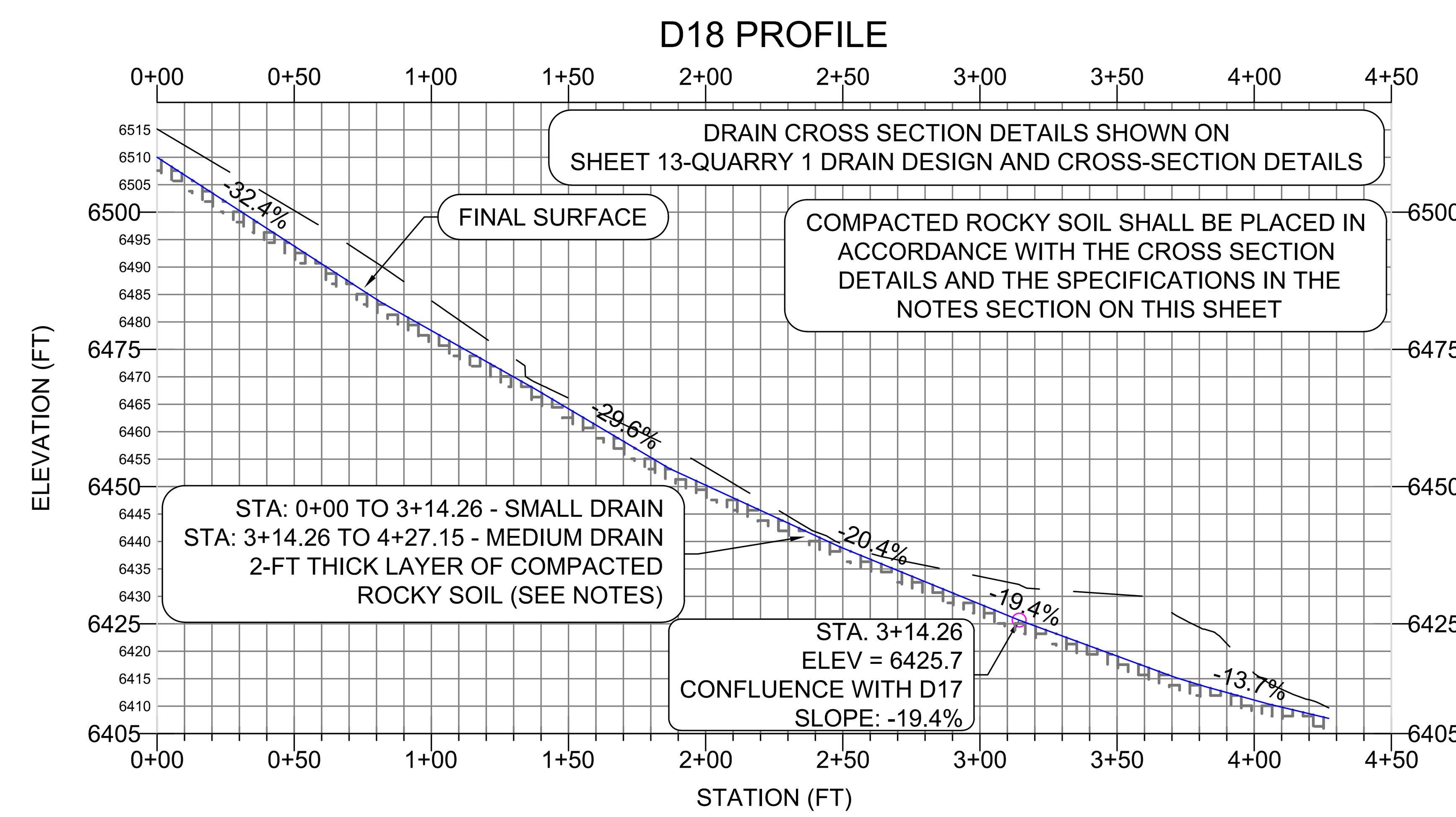
QUARRY 1 PMT DESIGN

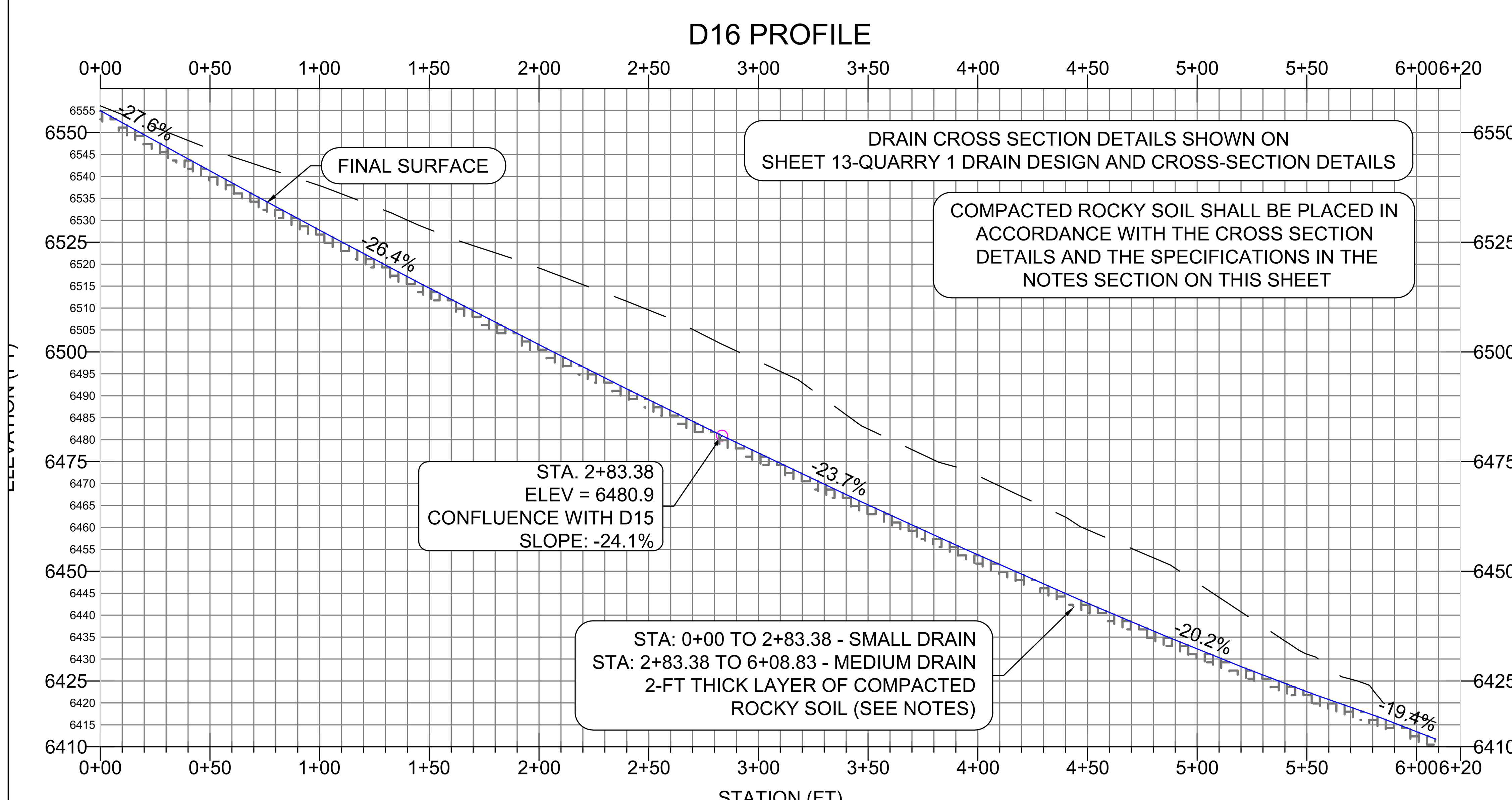
QUARRY 1
DRAINS D13, D14 & D15 PLANS AND PROFILES

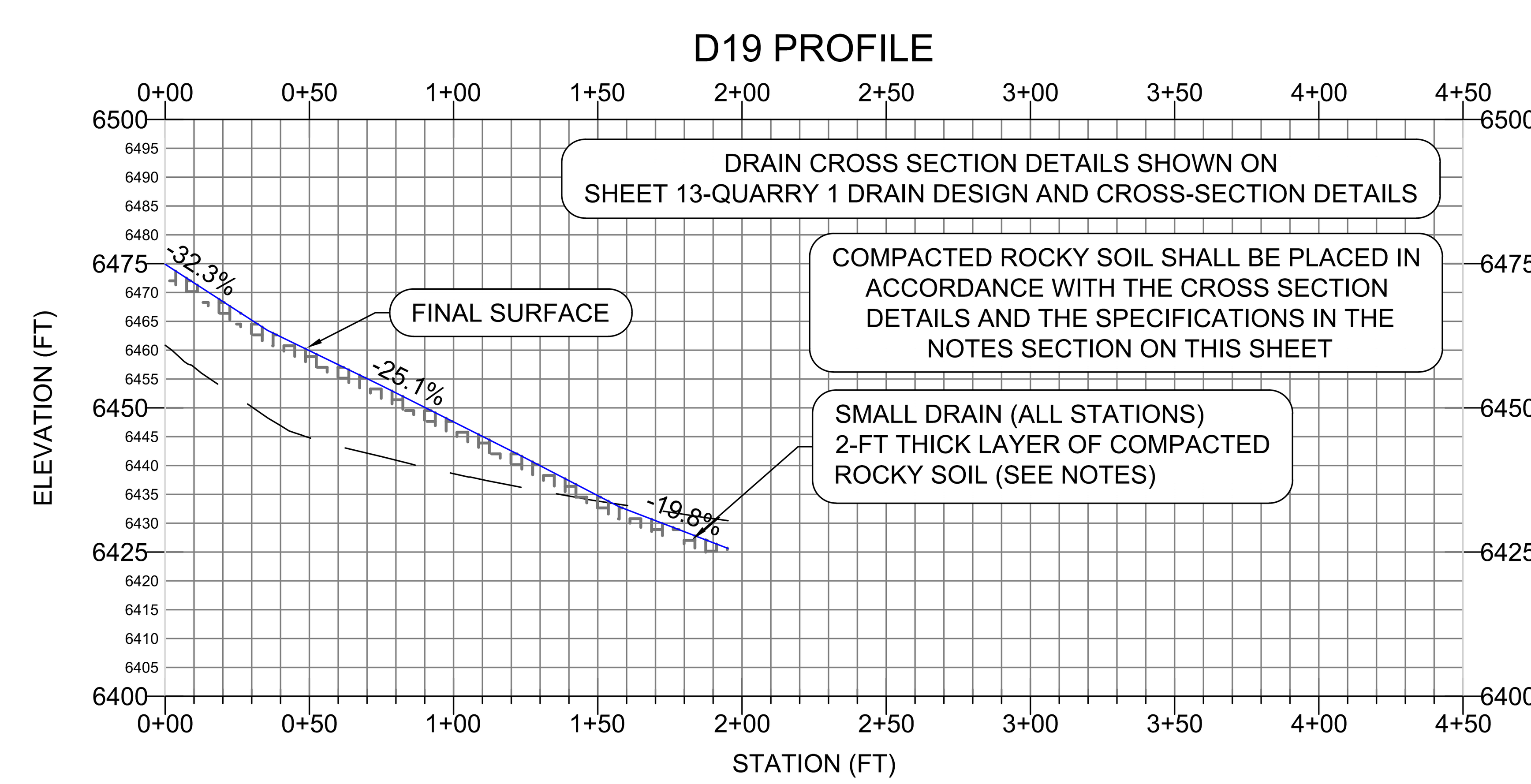
CONTRACTOR SHEET. NO.
WET 8 OF 14
DWG. NO.
REVISION
DATE
12/13/2019











GEOMORPHIC GRADING BOUNDARY
DRAIN ALIGNMENTS OF INTEREST
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EXISTING INDEX CONTOUR (25-FT INTERVAL)
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PROPOSED FINAL GRADE PROFILE

0' 50' 100' 150'

N

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SEAL
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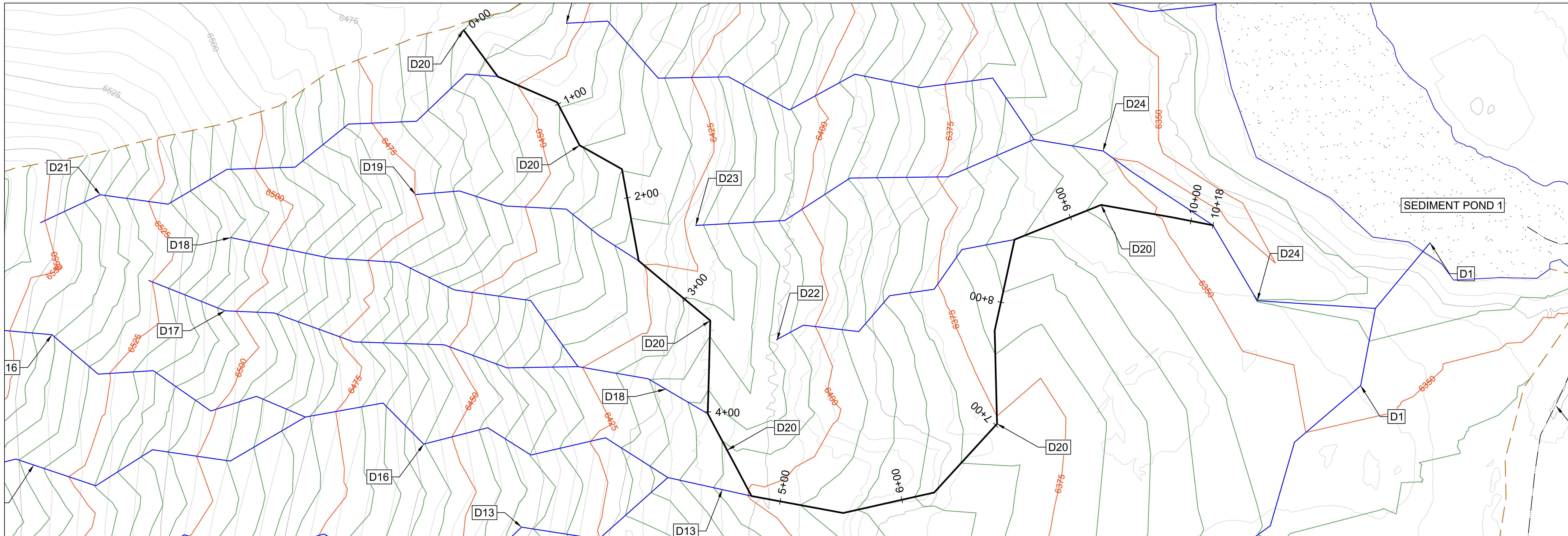
GCC
GCC TIJERAS

QUARRY 1
DRAINS D16, D17, D18 & D19
PLANS AND PROFILES

CONTRACTOR SHEET. NO.
WET 9 OF 14

DWG. NO.

REVISION | DATE
12/13/2019



- GEOMORPHIC GRADING BOUNDARY
- DRAIN ALIGNMENTS OF INTEREST
- DRAIN CENTERLINE
- EXISTING INDEX CONTOUR (25-FT INTERVAL)
- EXISTING INTERMEDIATE CONTOUR (5-FT INTERVAL)
- PROPOSED INDEX CONTOUR (25-FT INTERVAL)
- PROPOSED INTERMEDIATE CONTOUR (5-FT INTERVAL)
- EXISTING EPHEMERAL DRAINAGE
- EXISTING GRADE PROFILE
- PROPOSED FINAL GRADE PROFILE

0' 50' 100' 150'

N

NOTES

1. FINAL SURFACE TOPOGRAPHY SHOWN. THIS INCLUDES A MINIMUM 2-FOOT COVER OF SUITABLE PLANT GROWTH MEDIUM.
2. THE TYPICAL SMALL DRAIN AND TYPICAL MEDIUM DRAIN SHALL BE CONSTRUCTED FROM A COMPACTED ROCKY SOIL. THE ROCKY SOIL LINER WILL CONSIST OF AT LEAST 70% STONE, BY VOLUME, AND MAY INCLUDE UP TO 30% SOIL, BY VOLUME.
   - 2.1. THE STONE IN THE ROCKY SOIL LINER WILL BE HARD AND HIGHLY WEATHER-RESISTANT.
   - 2.2. THE STONE IN THE ROCKY SOIL LINER WILL BE SIZED AS 6" MINUS.
   - 2.3. THE STONE AND NATIVE SOIL MATERIAL SHALL BE MIXED PRIOR TO PLACEMENT.
   - 2.4. THE SUBGRADE SHALL BE ROUGHENED PRIOR TO ROCKY SOIL LINER PLACEMENT. THE ROCKY SOIL LINER SHALL BE PLACED AND THEN COMPACTED INTO THE SUBGRADE WITH SUITABLE EQUIPMENT TO ACHIEVE A DENSE MASS OF THAT IS VIRTUALLY FREE OF VOIDS.
   - 2.5. MOISTURE CONDITIONING SHALL BE USED TO INCREASE COMPACTION IF NATIVE SOILS ARE RELATIVELY DRY. THE COMPACTED ROCKY SOIL LINER SHALL NOT BE COVERED WITH TOPSOIL. SURFACE ROUGHENING OF THE FINAL COMPACTED SURFACE SHALL NOT OCCUR IN CHANNEL BOTTOMS OR SIDESLOPES.
3. THE TYPICAL LARGE RIPRAP DRAIN SHALL BE CONSTRUCTED WITH SOIL RIPRAP. SOIL RIPRAP SHALL CONSIST OF APPROXIMATELY 65% RIPRAP AND 35% SOIL, BY VOLUME.
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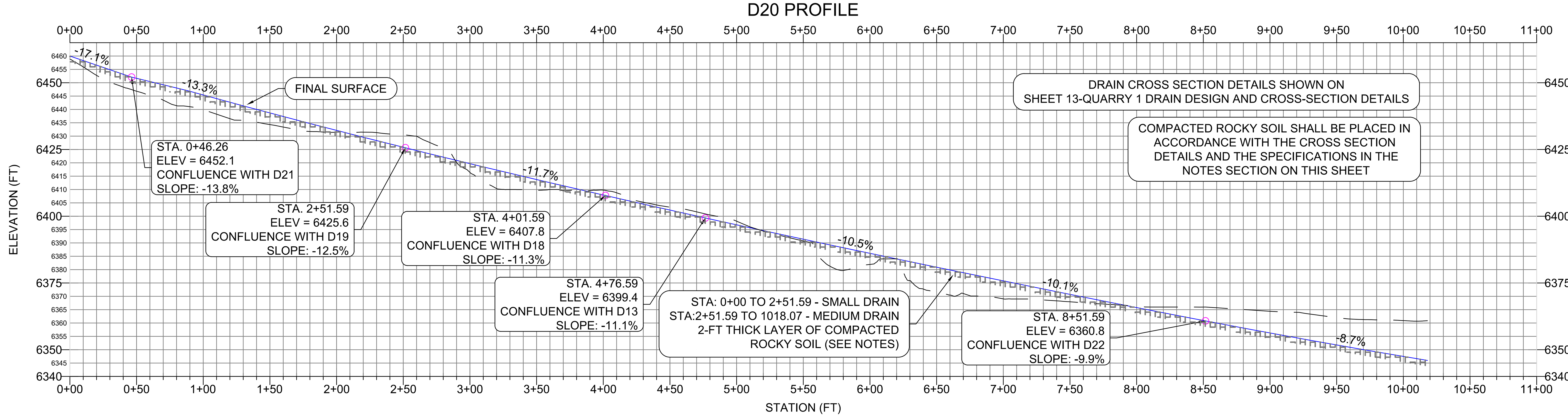
D20 PROFILE



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GCC TIJERAS

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SEAL

RICHARD SPOTTS
NEW MEXICO
15772
LICENSED PROFESSIONAL ENGINEER
Richard Spotts
12/13/2019

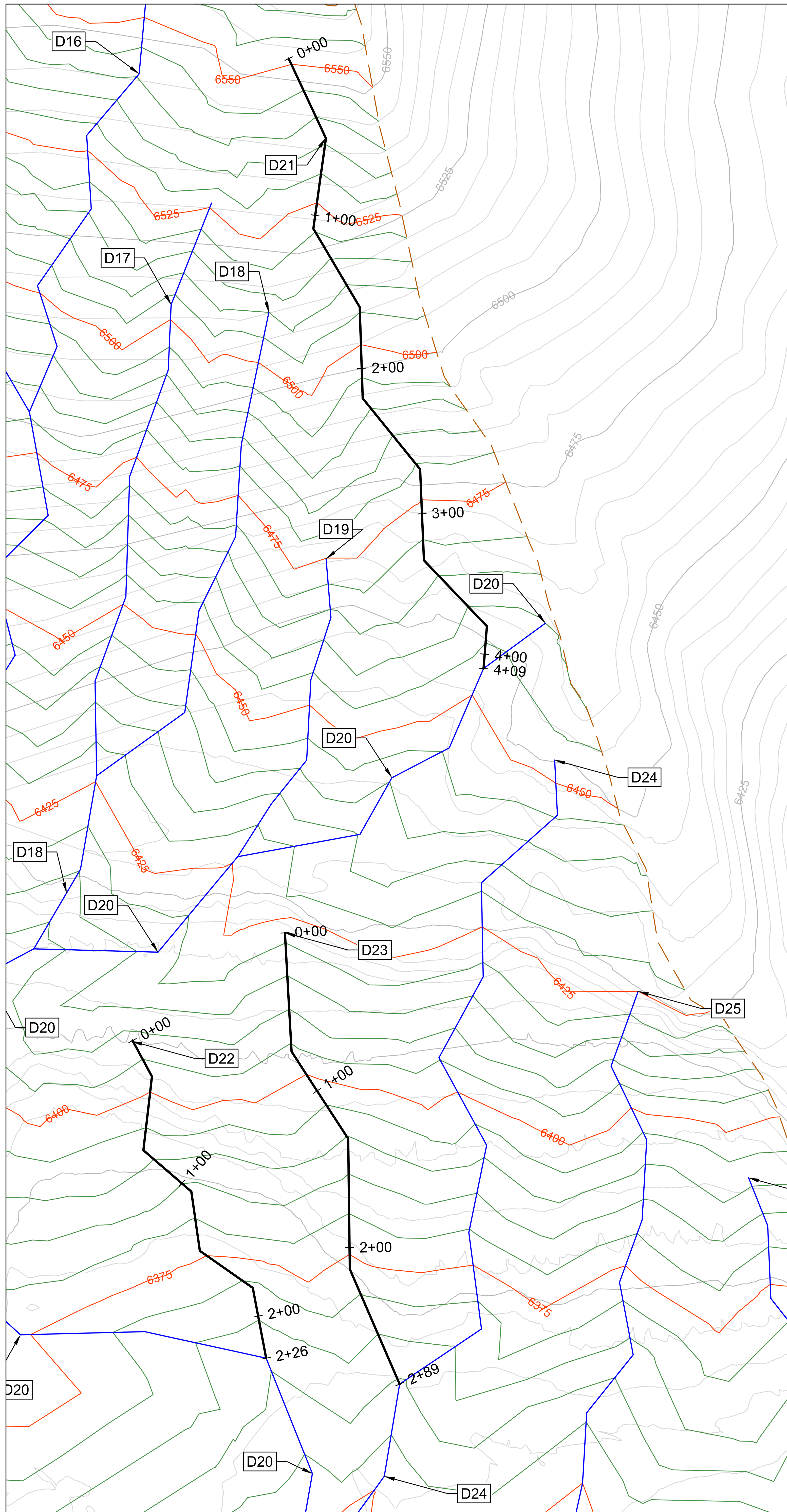
QUARRY 1 PMT DESIGN

CONTRACTOR SHEET. NO. WET 10 OF 14

QUARRY 1
DRAIN D20
PLAN AND PROFILE

DWG. NO.

REVISION | DATE 12/13/2019



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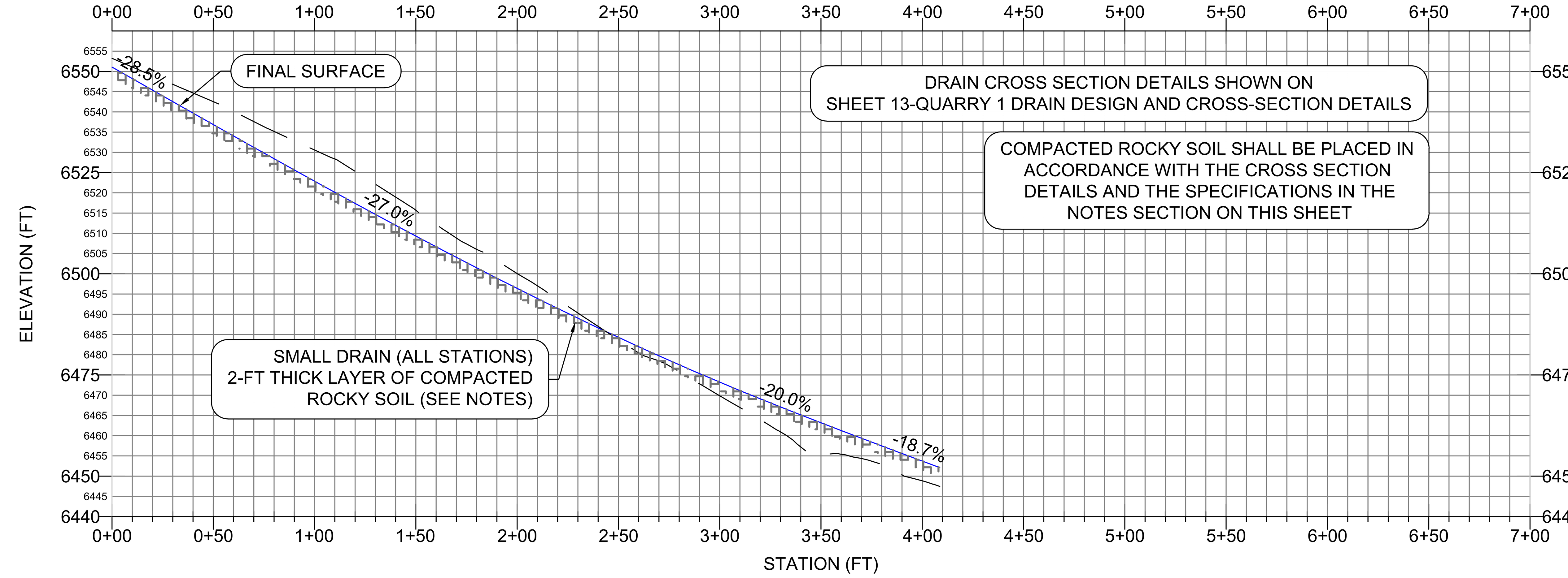

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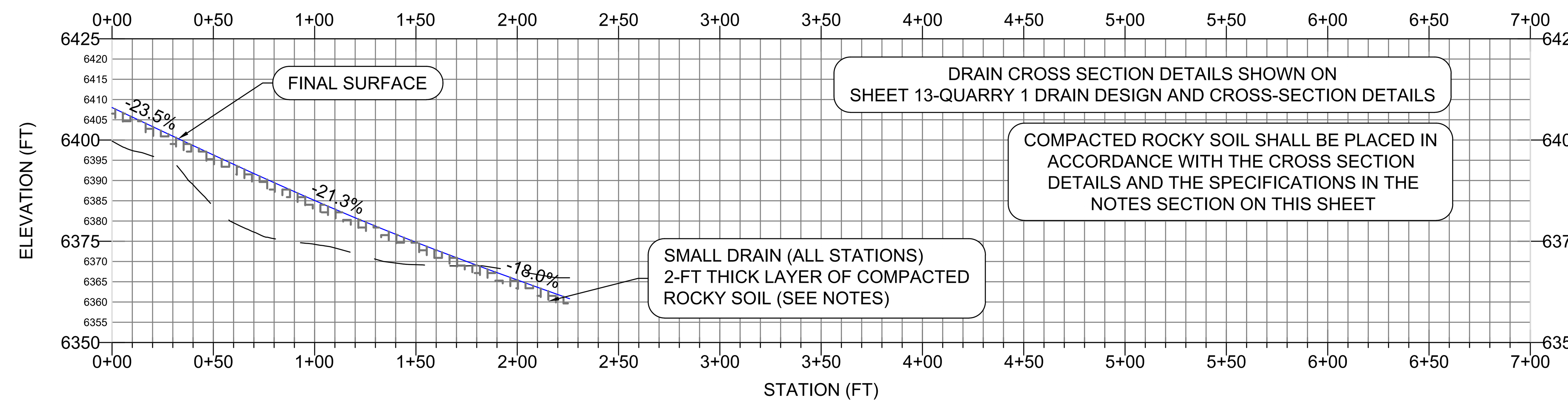

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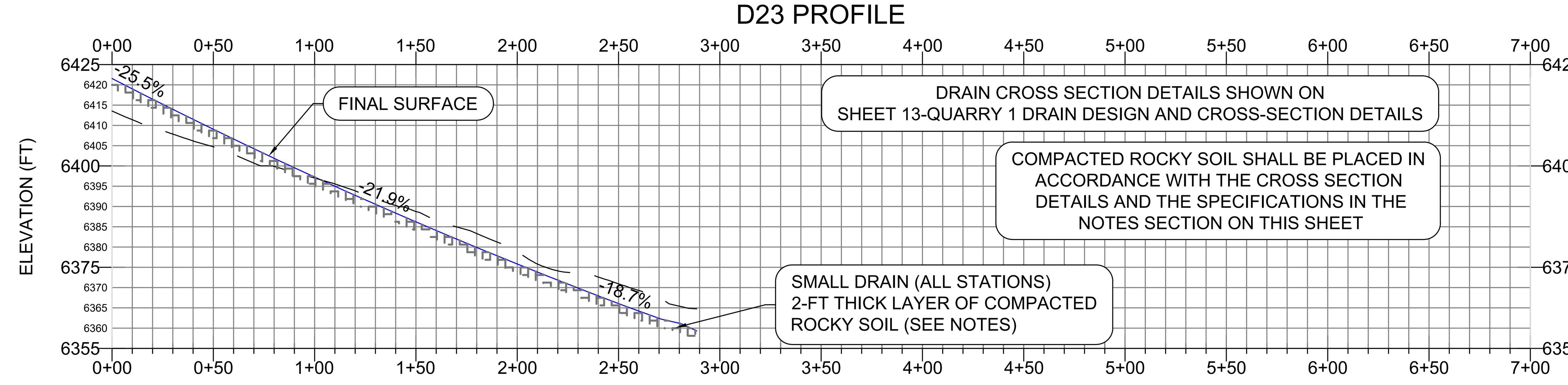

GEOMORPHIC GRADING BOUNDARY
DRAIN ALIGNMENTS OF INTEREST
DRAIN CENTERLINE
EXISTING INDEX CONTOUR (25-FT INTERVAL)
EXISTING INTERMEDIATE CONTOUR (5-FT INTERVAL)
PROPOSED INDEX CONTOUR (25-FT INTERVAL)
PROPOSED INTERMEDIATE CONTOUR (5-FT INTERVAL)
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EXISTING GRADE PROFILE
PROPOSED FINAL GRADE PROFILE

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SEAL

RICHARD SPOTTS NEW MEXICO 15772 LICENSED PROFESSIONAL ENGINEER

Richard Spotts
12/13/2019

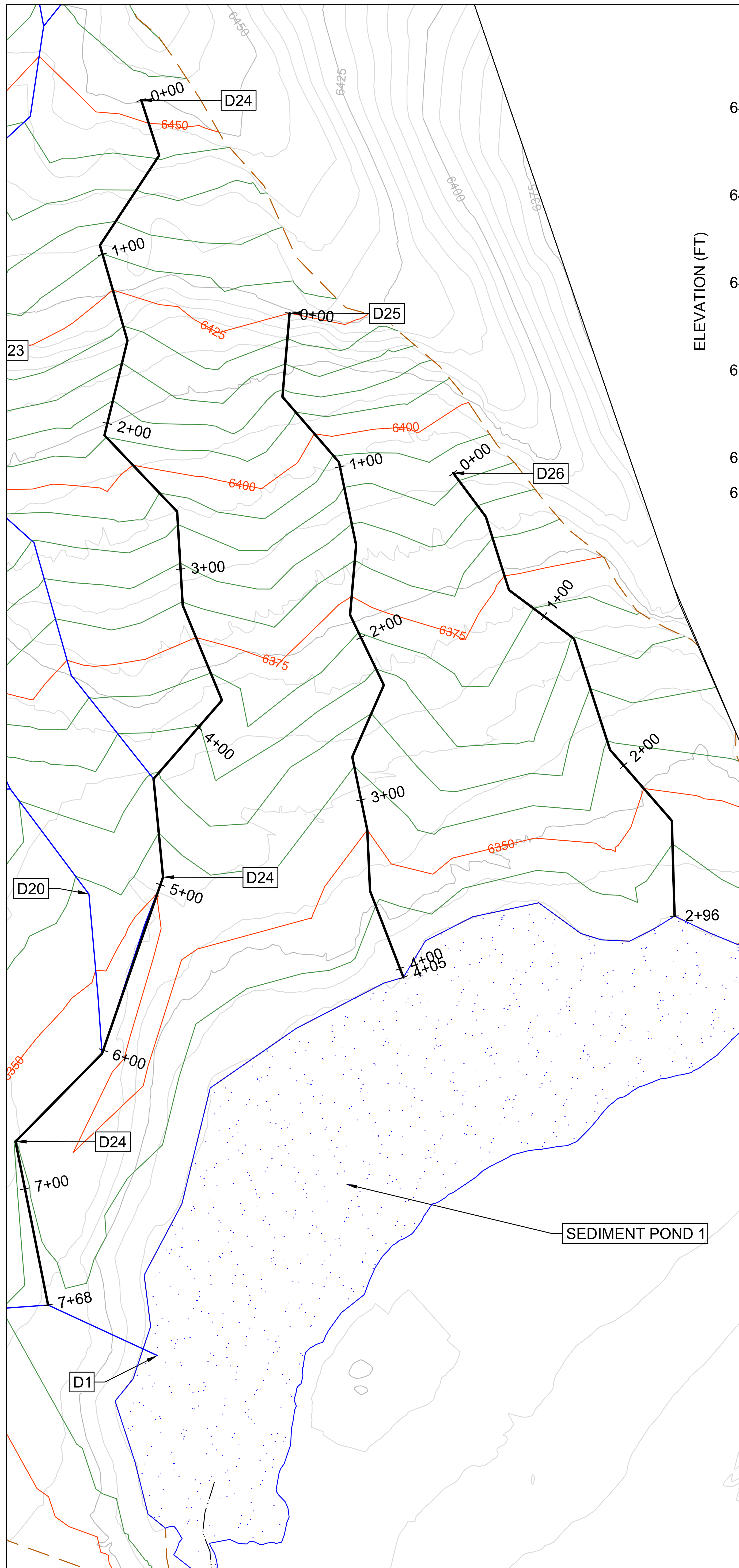
QUARRY 1 PMT DESIGN

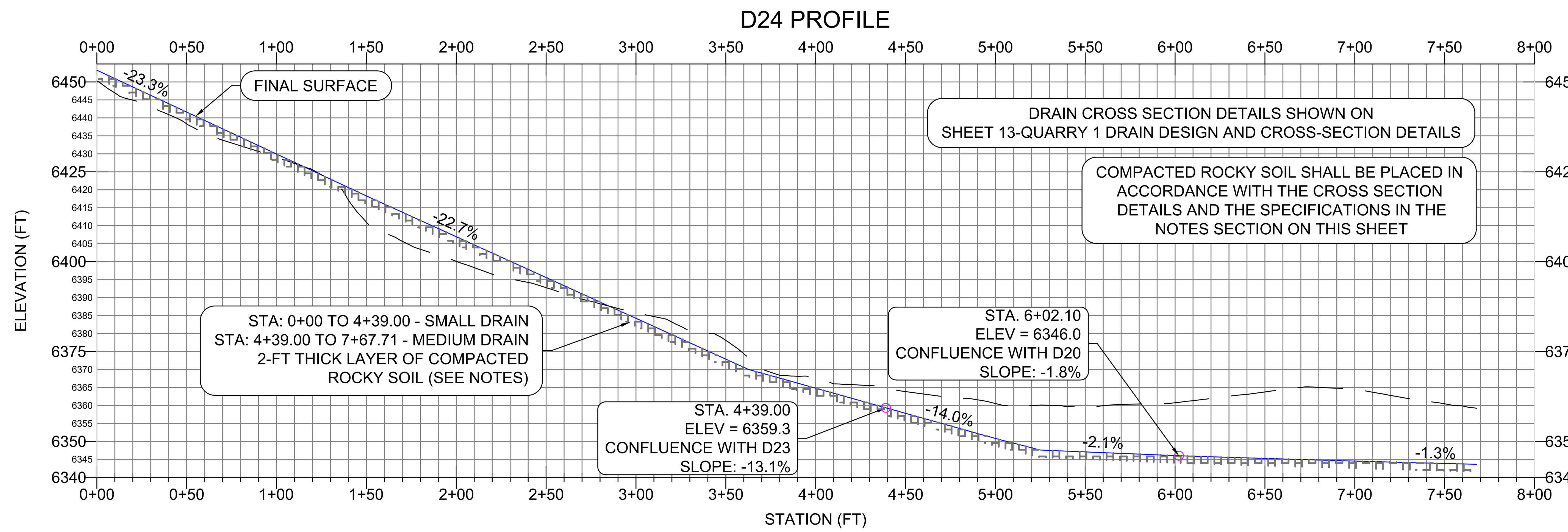
REFERENCES		REFERENCES		REVISIONS							REVISIONS						
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	BY	CKD	APP	CLIENT	DATE	DESCRIPTION	NO.	BY	CKD	APP.	CLIENT	DATE	DESCRIPTION

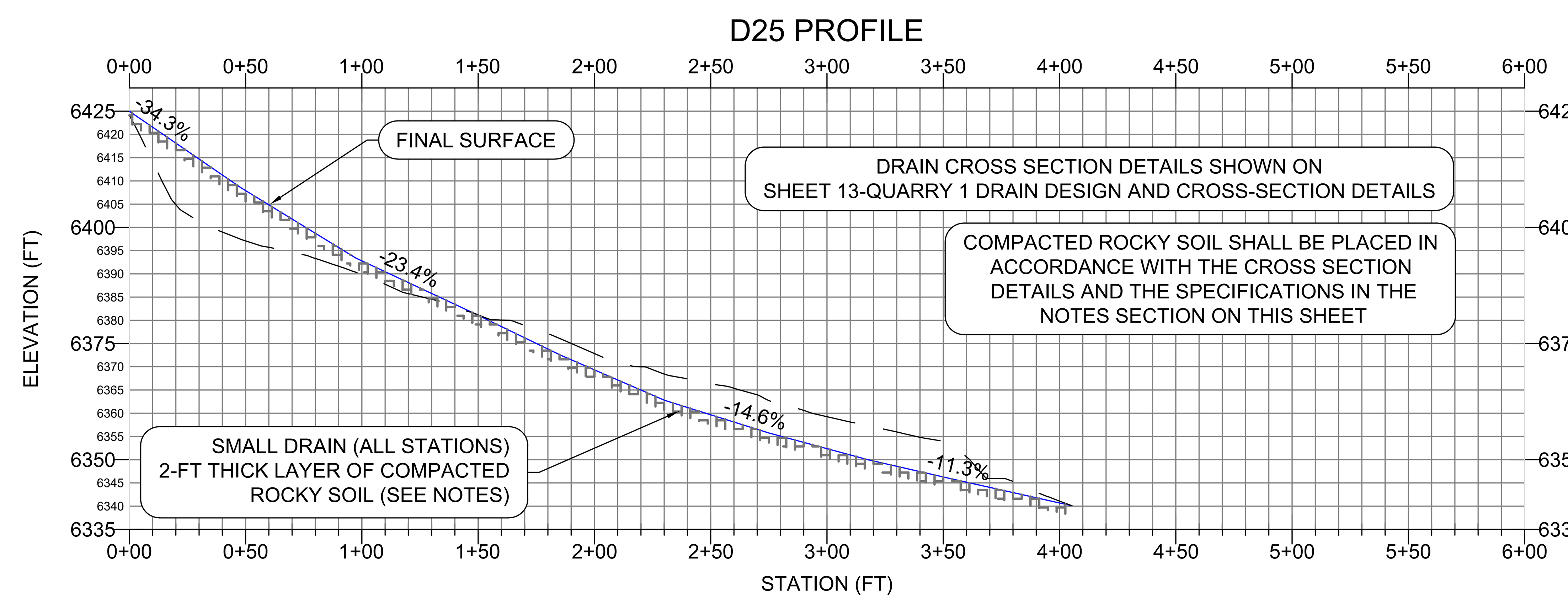
GCC
GCC TIJERAS

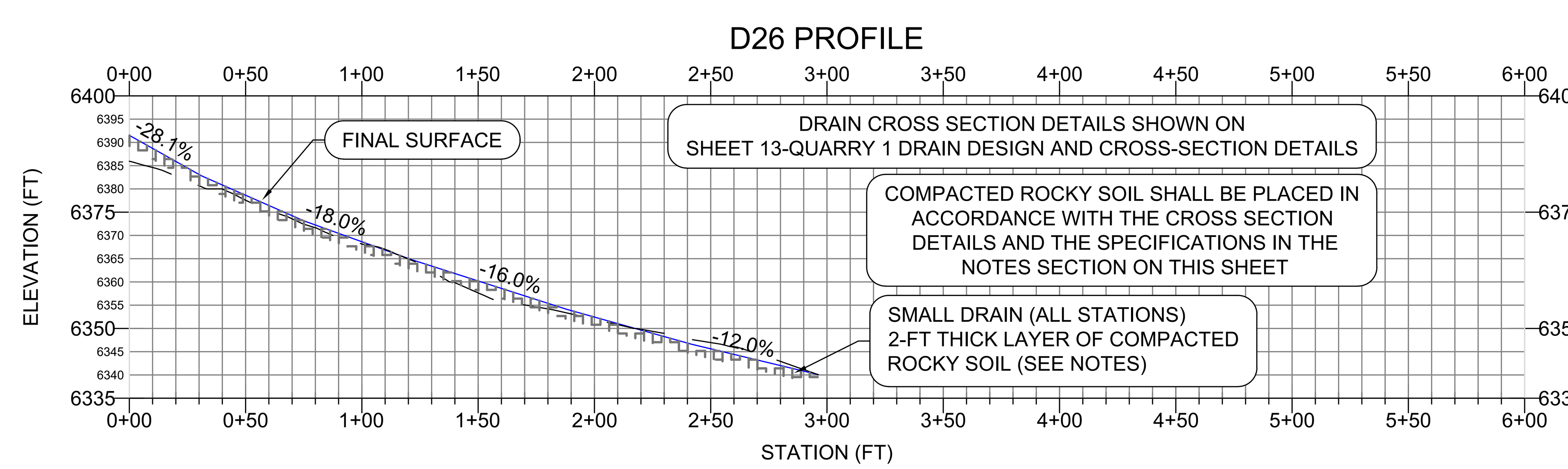
QUARRY 1
DRAINS D21, D22 & D23 PLANS AND PROFILES

CONTRACTOR SHEET. NO.
WET 11 OF 14
DWG. NO.
REVISION
DATE
12/13/2019









GEOMORPHIC GRADING BOUNDARY
DRAIN ALIGNMENTS OF INTEREST
DRAIN CENTERLINE
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0' 50' 100' 150'

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SEAL

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12/13/2019

QUARRY 1 PMT DESIGN

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GCC

GCC TIJERAS

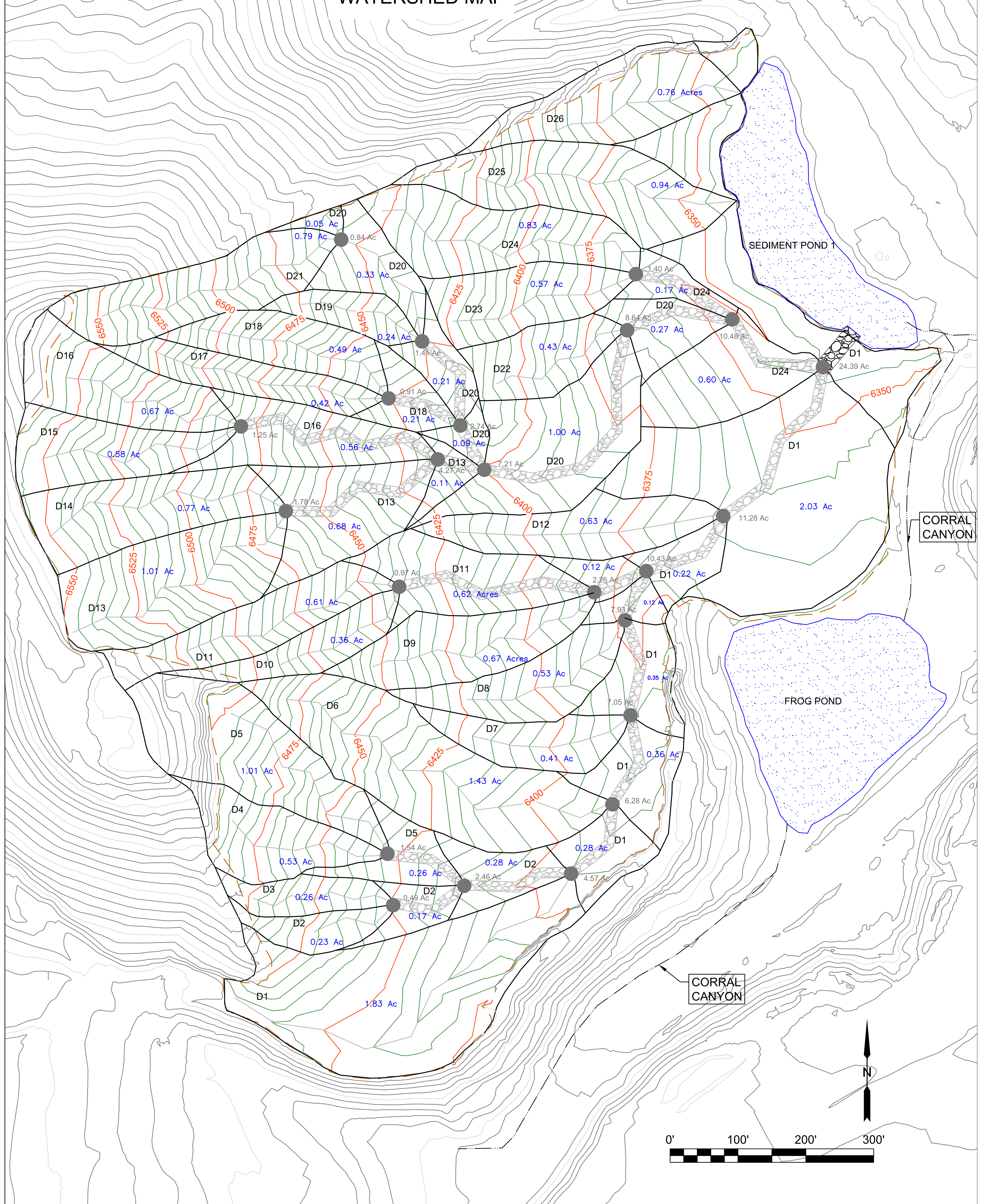
QUARRY 1
DRAINS D24, D25 & D26 PLANS AND PROFILES

CONTRACTOR SHEET. NO.
WET 12 OF 14

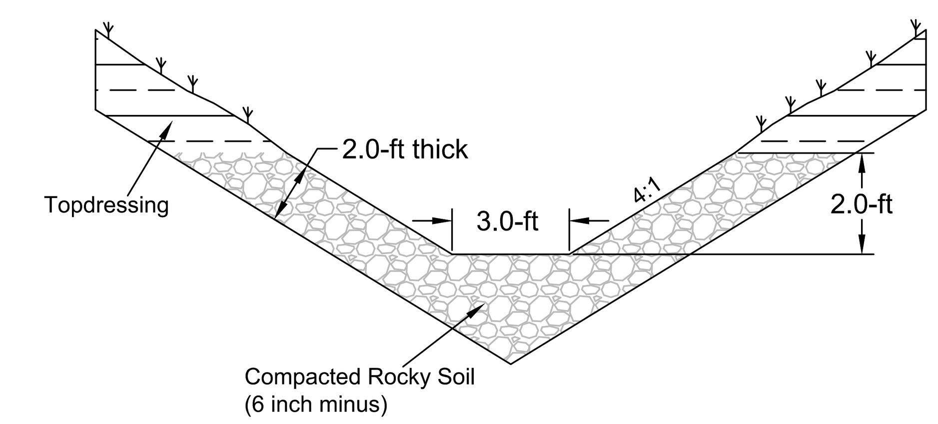
DWG. NO.

REVISION
DATE
12/13/2019

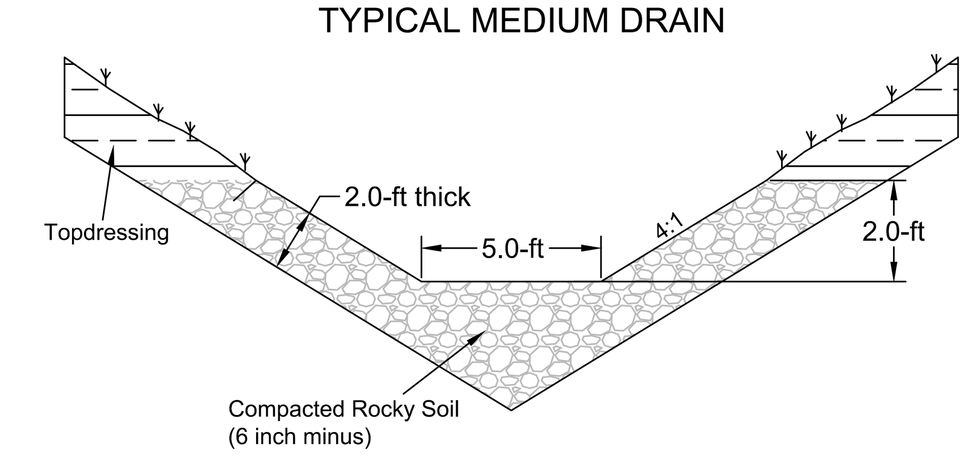
WATERSHED MAP



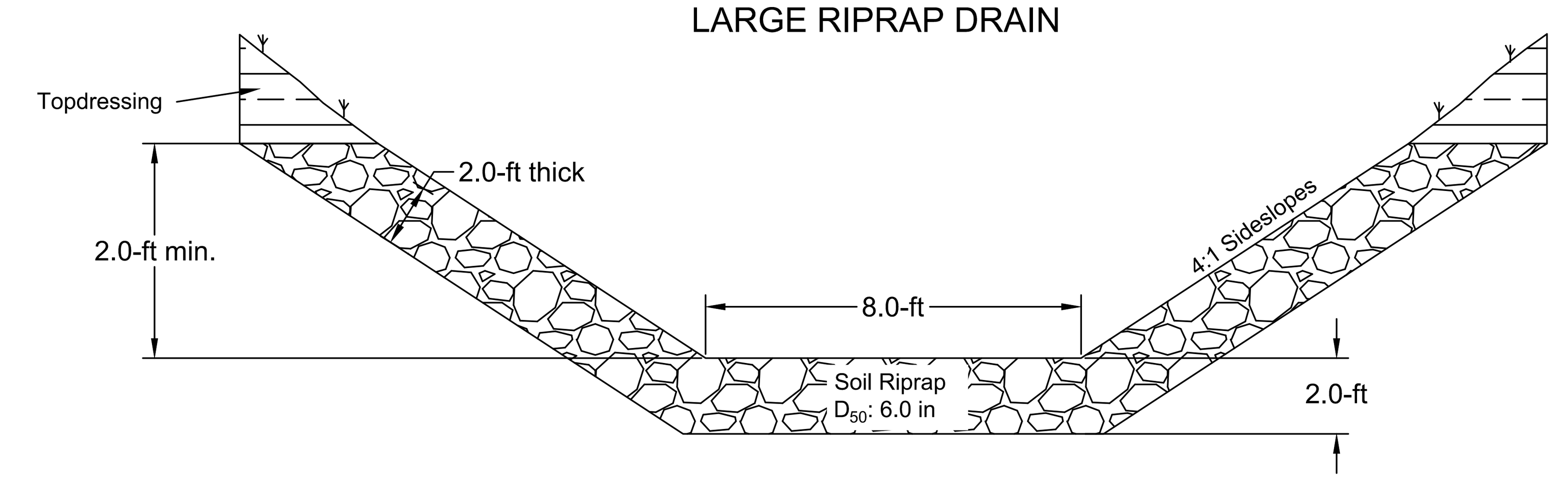
TYPICAL SMALL DRAIN



TYPICAL MEDIUM DRAIN



LARGE RIPRAP DRAIN



Hydrologic Parameters		Drain Parameters					
Watershed Area (ac)	Q100 (cfs)	Bottom Width (ft)	Flow Depth (ft)	Channel Depth (ft)	Sideslope (Z:1)	Drain Protection	Drain Size
0.50	1.3	3.0	0.14	2.0	4.0	Rocky Mixture	Small
1.00	2.5	3.0	0.17	2.0	4.0	Rocky Mixture	Small
1.83	4.6	3.0	0.30	2.0	4.0	Rocky Mixture	Small
2.00	5.0	3.0	0.35	2.0	4.0	Rocky Mixture	Small
4.27	10.8	5.0	0.33	2.0	4.0	Rocky Mixture	Medium
4.57	11.5	5.0	0.39	2.0	4.0	Rocky Mixture	Medium
7.21	18.2	5.0	0.47	2.0	4.0	Rocky Mixture	Medium
8.64	21.8	5.0	0.53	2.0	4.0	Rocky Mixture	Medium
10.43	26.3	5.0	0.66	2.0	4.0	Rocky Mixture	Medium
10.48	26.4	5.0	0.69	2.0	4.0	Rocky Mixture	Medium
24.39	61.4	8.0	0.83	2.0	4.0	6-inch Soil Riprap	Large

EXISTING INDEX CONTOUR (25-FT INTERVAL)
EXISTING INTERMEDIATE CONTOUR (5-FT INTERVAL)
PROPOSED INDEX CONTOUR (25-FT INTERVAL)
PROPOSED INTERMEDIATE CONTOUR (5-FT INTERVAL)
GEOMORPHIC GRADING BOUNDARY
SUBWATERSHED BOUNDARY
2.57 Ac SUBWATERSHED AREA (ACRES)
2.57 Ac CHANNEL CONFLUENCE AREA (ACRES)
SMALL DRAIN
MEDIUM DRAIN
LARGE RIPRAP DRAIN

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12/13/2019

QUARRY 1 PMT DESIGN

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GCC
GCC TIJERAS

QUARRY 1 DRAIN DESIGN & CROSS-SECTION DETAILS

CONTRACTOR SHEET. NO.
WET 13 OF 14
DWG. NO.
REVISION
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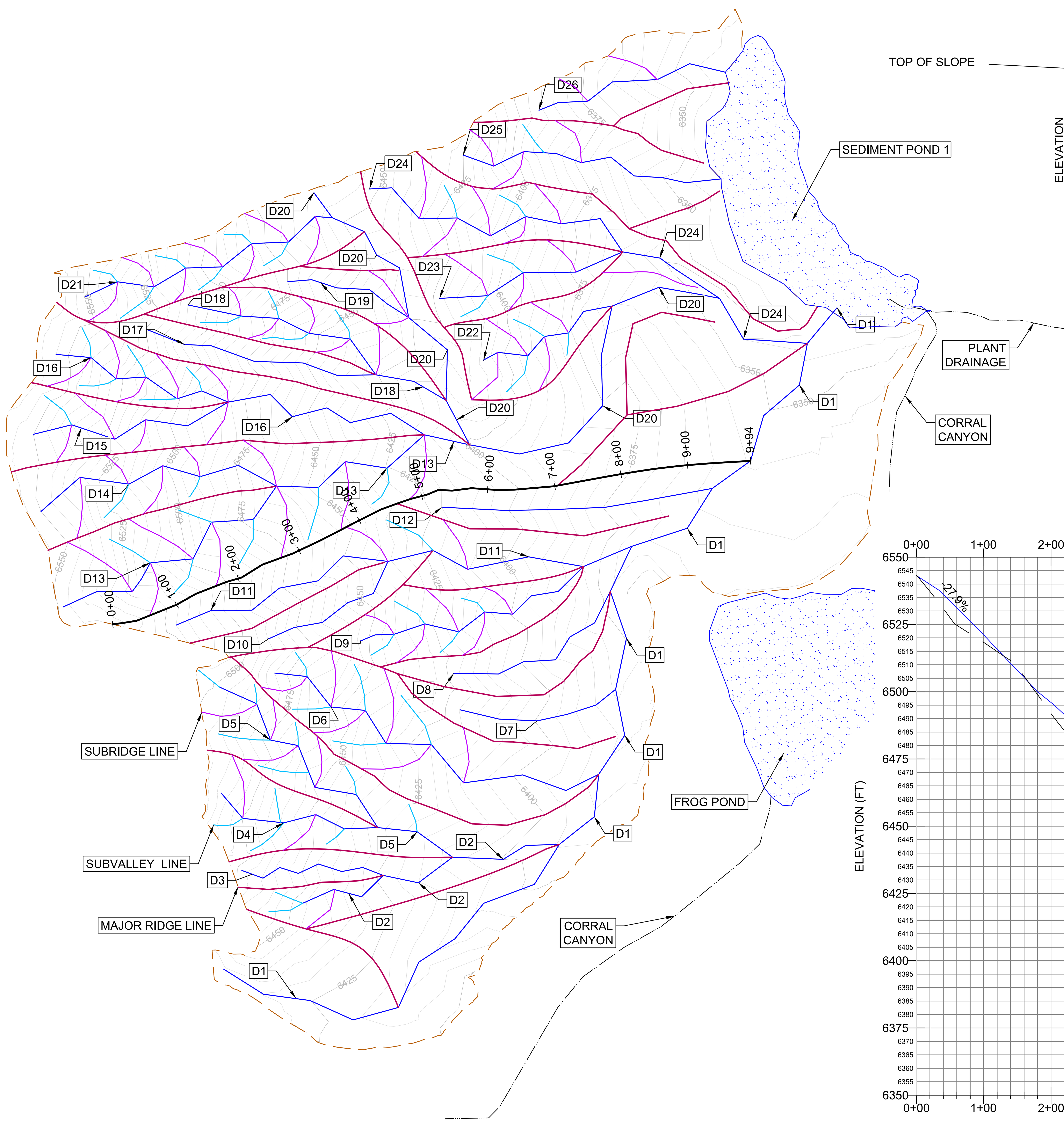
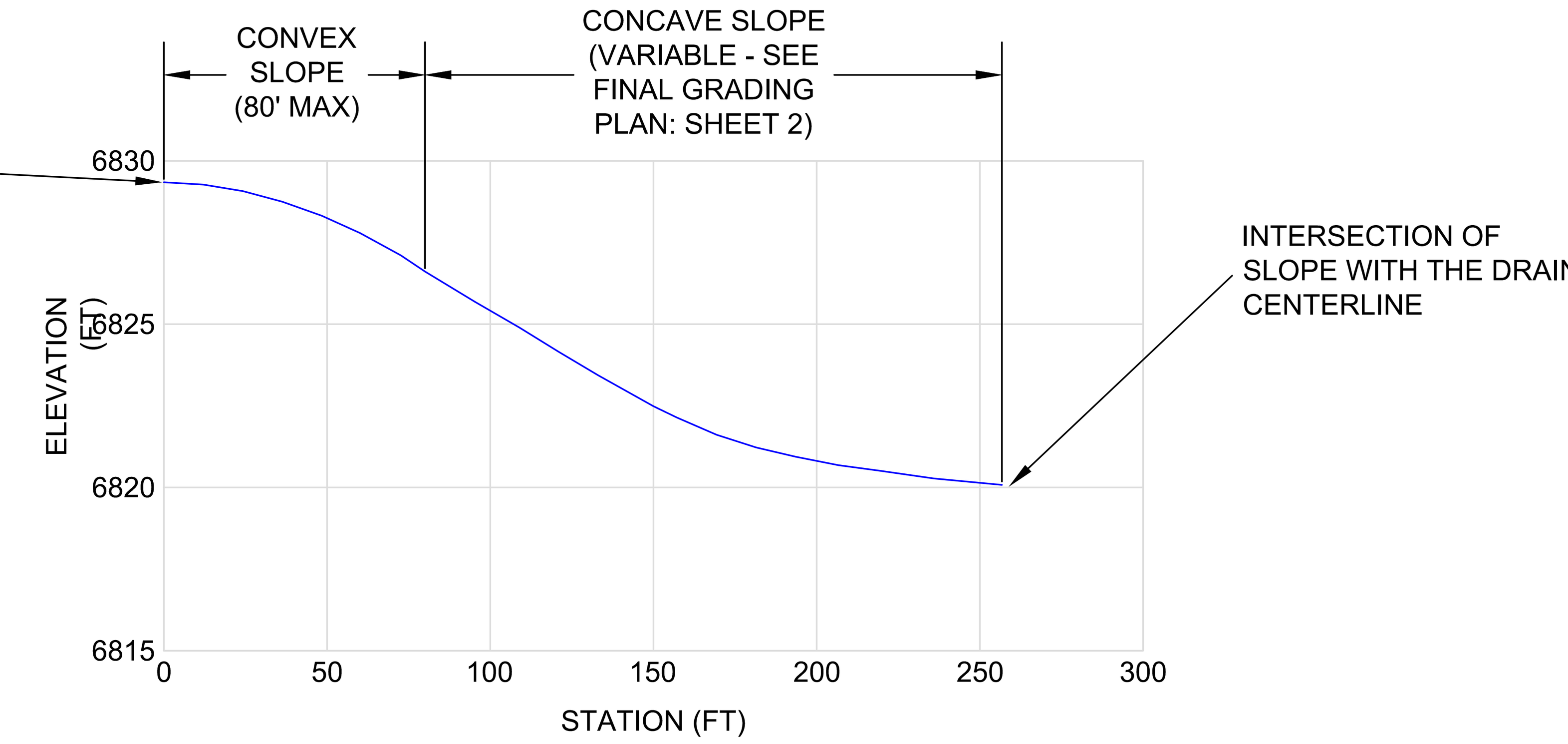
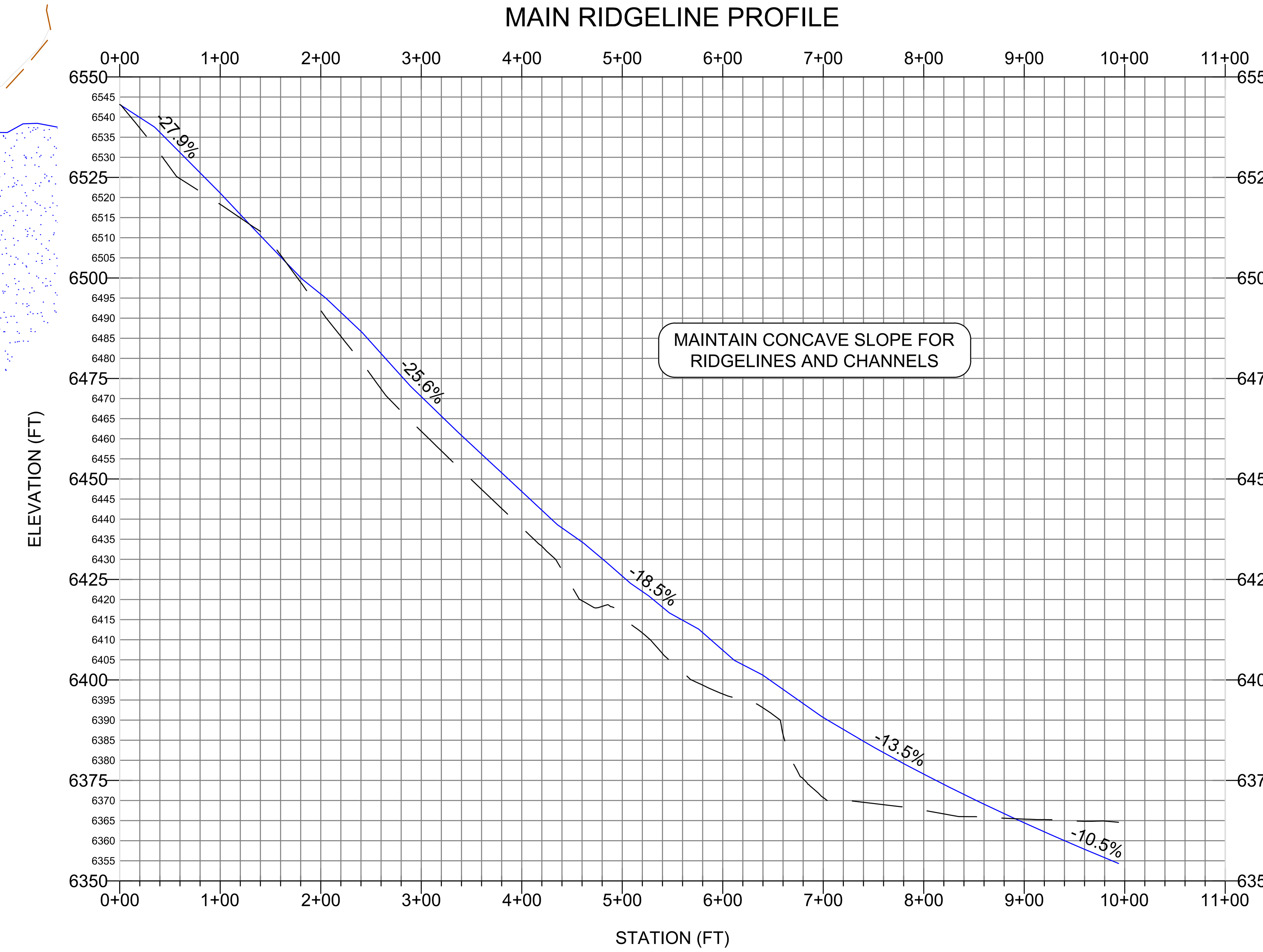


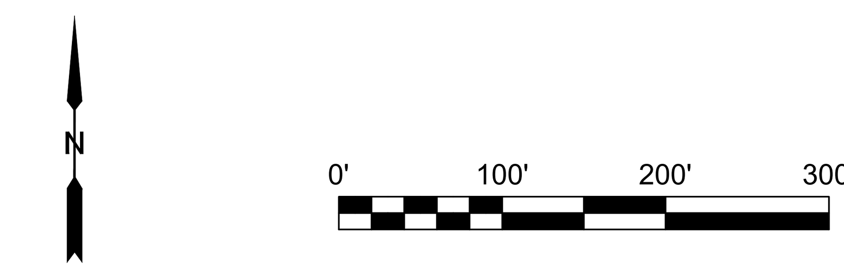
GRADED SLOPE PROFILE DETAIL



MAIN RIDGELINE PROFILE



GEOMORPHIC GRADING BOUNDARY
DRAIN CENTERLINE
MAJOR RIDGE LINES
SUBRIDGES
SUBVALLEYS
PROPOSED INDEX CONTOUR (25-FT INTERVAL)
PROPOSED INTERMEDIATE CONTOUR (5-FT INTERVAL)
EXISTING EPHEMERAL DRAINAGE
POND LOCATIONS



NOTES

1. ALL MAIN RIDGELINES MAY HAVE A CONVEX PROFILE FOR UP TO 80 FEET MEASURED FROM THE REGRADED LANDFORM BOUNDARY. BEYOND 80 FEET, MAIN RIDGELINES SHALL HAVE A CONCAVE PROFILE.
2. SUBRIDGES SHALL BE CONSTRUCTED AS SHOWN TO DEFINE THE OUTSIDE BEND POINTS FOR THE CHANNEL ALIGNMENT. SUBVALLEYS SHALL BE CONSTRUCTED AS SHOWN TO DEFINE THE INSIDE BEND POINTS FOR THE CHANNEL ALIGNMENT.
3. SUBRIDGES AND SUBRIDGE VALLEYS CAN HAVE A CONVEX PROFILE FOR UP TO 80 FEET MEASURED FROM THE MAIN RIDGE OR REGRADED LANDFORM BOUNDARY. BEYOND 80 FEET, SUBRIDGES AND SUBRIDGE VALLEYS SHALL HAVE A CONCAVE PROFILE.
4. GRADED SLOPE PROFILE DETAIL IS A TYPICAL PROFILE, FOLLOW FINAL GRADE GRADING PLAN FOR LANDFORM CONFIGURATION.
5. FINAL REGRADED LANDFORM TOPOGRAPHY SHALL BE WITHIN +/- 1-FT OF THE DESIGNED TOPOGRAPHY (VERTICAL AND HORIZONTAL ELEVATIONS).
6. SEE SHEETS 4 THROUGH 12 FOR DRAIN PROFILES AND DETAILED INFORMATION.
7. CONSTRUCTION OF FINAL GRADED AND SUBGRADED SURFACE TO BE COMPLETED WITH MACHINE CONTROL.
8. DIGITAL DATA SHALL BE PROVIDED BY THE ENGINEER IN A FORMAT THAT IS COMPATIBLE WITH MACHINE CONTROL TECHNOLOGY.

Water & Earth TECHNOLOGIES
1225 RED CEDAR CIRCLE, SUITE A
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SEAL

RICHARD SPOTTS NEW MEXICO 15772 LICENSED PROFESSIONAL ENGINEER

Richard Spotts 12/13/2019

QUARRY 1 PMT DESIGN

REFERENCES		REFERENCES		REVISIONS							REVISIONS						
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	BY	CKD	APP	CLIENT	DATE	DESCRIPTION	NO.	BY	CKD	APP.	CLIENT	DATE	DESCRIPTION

GCC

GCC TIJERAS

QUARRY 1
GEOMORPHIC GRADING DETAILS

CONTRACTOR SHEET NO.
WET 14 OF 14

DWG. NO.

REVISION | DATE 12/13/2019