FREEPORT-McMoRAN

Tyrone Operations
P.O. Box 571
Tyrone, NM 88065

June 20, 2023

Via Electronic &
Certified Mail #70150640000476264558
Return Receipt Requested

Mr. Brad Reid
New Mexico Environment Department
Groundwater Quality Bureau
Mining Environmental Compliance Section
P.O. Box 5469
Santa Fe, NM 87502

Via Electronic &
Certified Mail #70150640000476264541
Return Receipt Requested

Ms. Carmen Rose
Energy, Minerals & Natural Resources Dept
Mining and Minerals Division
Mining Act Reclamation Program
1220 South St. Francis Drive
Santa Fe, NM 87505

Dear Messrs. Reid and Rose:

Re: Task 3 Precipitation Analysis for Closure
Freeport-McMoRan Chino and Tyrone Mines

Freeport-McMoRan Chino and Tyrone Mines (Chino and Tyrone) have completed Task 3 of the Precipitation Analysis Workplan for Closure approved by NMED and MMD in a joint letter dated September 3, 2021. The Task 3 report from WSP is attached.

If you have any questions, please contact me at 575-912-5773 or Ms. Sherry Burt-Kested at 575-912-5927.

Sincerely,

Thomas L. Shelley

Thomas L. Shelley
Environmental Services Manager

Attachments
20230620-102
20230620-001

ecc. Kevin Myers, MMD
DJ Ennis, MMD

REPORT

Closure Surface Water Conveyances Precipitation Analysis Task 3

Chino and Tyrone Mines

Submitted to:

Tom Shelley

Environmental Manager, Tyrone Mine
Freeport-McMoRan Tyrone Inc.
PO Box 571
Tyrone, New Mexico 88065

Submitted by:

WSP USA Inc.

177 N. Church Avenue, Suite 1105 Tucson, Arizona, USA 85701

+1 520 888 8818

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June 16, 2023

Distribution List

Tom Shelley

Sherry Burt-Kested

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APPENDICES

1.0 INTRODUCTION

Freeport McMoRan Incorporated (FMI) New Mexico Operations engaged WSP USA Inc. (WSP) to carry out Task 3 of the approved Precipitation Analysis Workplan for closure surface water conveyances at the Chino and Tyrone mine sites. The intent of the study is to assess the adequacy of stormwater conveyance under projected climate change conditions (evaluated in Task 2) for both planned closure structures documented in the most current Closure Closeout Plans (CCPs) for the Chino and Tyrone mines and conveyance structures constructed at existing reclaimed facilities at both sites.

This report was prepared to summarize the methodology, hydrology and hydraulic calculations, and results of the conveyance assessments. The assessments covered the following facilities and structure types:

- sites:
  - Chino Mine
  - Tyrone Mine
- facilities
  - CCP facilities
  - existing reclaimed facilities
- conveyance types:
  - top channels
  - bench channels (includes bench channels and access ramp channels)
  - downchutes (includes downdrains, spillways, and ridge/valley channels)

2.0 SCOPE OF ASSESSMENT

This Closure Surface Water Conveyances Precipitation Analysis was conducted based on specific regulatory agency permit conditions and subsequent meetings with FMI representatives and other project stakeholders. Key documents reviewed in developing the scope of work associated with the assessment included the following:

- *Chino Discharge Permit 1340. Condition C110.C and Tyrone Permit GR010RE Rev 09-1 -Precipitation Workplan Analysis for Closure workplan submitted by Freeport-McMoRan Chino Mines Company on behalf of both Chino and Tyrone Mines (Freeport-McMoRan)*, dated May 21, 2021.
- The New Mexico Environment Department's (NMED's) and Energy, Minerals and Natural Resources Department (EMNRD), Mining and Minerals Division's (MMD's) joint agency *Conditional Approval of the Precipitation Analysis Work Plan, DP-1340, DP-1341, and Tyrone Permit GR010RE Rev 09-1; Freeport-McMoRan Chino and Tyrone Mines*, dated September 3, 2021.
- *Climate Change Projections for the Chino/Tyrone, New Mexico Mine.* Report prepared by Applied Weather Associates, LLC (AWA). October 2022.
- *Chino Mine Closure/Closeout Plan Update – Freeport-McMoRan Chino Mines Company*. Report prepared by Golder Associates Inc. (Golder). February 14, 2018.
- *2013 Tyrone Mine Closure/Closeout Plan Update – Freeport-McMoRan Tyrone Inc.* Report prepared by Golder. Revised July 30, 2019.

The Precipitation Analysis Workplan (Freeport-McMoRan 2021) was submitted to the NMED and the EMNRD MMD on May 21, 2021, in fulfillment of Condition C110.C of DP-1340 and Condition 9.W.2 of Tyrone Permit GR0I0RE Rev 09-1, which require submittal of a workplan to evaluate, in part, present climatological site condition data and forward projections to determine the adequacy of the design of stormwater structures proposed at closure. The joint agency (NMED and EMNRD MMD) September 3, 2021 Conditional Approval (2021) of the Precipitation Analysis Workplan also specified that existing stormwater structures be included in the analysis along with those proposed at closure.

Chino and Tyrone submitted the Task 2 Climate Change Projections report (AWA 2022) in January 2023.

The scope of the Task 3 precipitation analysis was split between conceptual CCP surface water conveyance structures and existing surface water conveyance structures constructed on reclaimed facilities across both the Chino and Tyrone mine sites. The conceptual CCP facilities were analyzed to determine the capacities of the worst-case example of each conveyance structure type across the entirety of each mine site. The main conceptual CCP structures evaluated were the top surface channels, downchutes, and bench channels.

For CCP facilities, the longest top channel, longest bench channel with the largest catchment, and downchute with the largest catchment were determined for each mine site, and the flowrate was estimated for each using a conservative Rational Formula Method (NMDOT 2018) approach. The Rational Formula Method was used as a screening tool to determine if additional analysis was warranted. The individual CCP facilities at Chino and Tyrone and the associated conceptual surface water conveyance structures analyzed as part of this assessment are summarized in Table 1.

Table 1: Chino and Tyrone Closure Closeout Plan Facilities and Structures Analyzed

Facility	Benches	Downchutes	Top Channels
Chino			
Northwest Stockpile	--	--	--
North Stockpile[(a)]	--	--	--
Lee Hill Stockpile[(a)]	--	--	--
Northeast Stockpile[(a)]	--	--	--
West Stockpile	Yes[(b)]	Yes	Yes[(b)]
South Stockpile	Yes	Yes	--
STS2 Stockpile	Yes	--	--
Proposed 3A Stockpile[(a)]	Yes	--	--
Upper South Stockpile[(a)]	Yes	--	--
Planned Santa Rita Stockpile[(a)]	--	--	--
Lampbright Leach Stockpile (main, south, southwest)	Yes	Yes	--
Axi-Flo Lake	Yes	Yes	--
Southern end of Tailing Pond 6 East and 6 West	Yes	Yes	--
Tailing Pond 7	Yes	Yes	--

Facility	Benches	Downchutes	Top Channels
Tyrone			
1A Leach/1B Leach	Yes	Yes	Yes
2 Leach (Area 1)	Yes	Yes	Yes
2 Leach (Area 2)	Yes	Yes	Yes
2A Leach/2B Leach	Yes	Yes	No
2B Waste	Yes	Yes	Yes
3A Leach/3B Waste	Yes	Yes	Yes
5A Waste	Yes(b)	Yes	Yes
6A Leach(a)	--	--	--
6B Leach	Yes	Yes	--
6C Leach	Yes	Yes	Yes
6D Leach	Yes	Yes	--
8A Waste/8C Waste(a)	--	--	--
9A Waste	Yes	Yes	Yes
9AX Waste	Yes	--	--
CSG Waste	Yes	--	--
Gettysburg Waste(a)	--	--	--
San Salvador Pit/San Salvador Waste Backfill	Yes	Yes(b)	Yes
South Rim Pit/2 Leach/7C Waste	Yes	Yes	Yes(b)
Valencia In-Pit Leach(a)	--	--	--

a. Facility located entirely within the current defined Open Pit Surface Water Drainage Area (Chino) or Open Pit Surface Drainage Area (Tyrone).

b. Facility with worst-case structure.

“Yes” = structure type is present in the current CCP conceptual designs; “—” = structure type is not present in the CCP

For existing reclaimed facilities, the same conservative Rational Formula Method was initially used to estimate the flowrates through each structure. Unlike the CCP analysis, which looked at worst-case conveyance structure types across each mine site, individual existing reclaimed facilities were analyzed to identify the worst-case conveyance structure types at each facility at both mine sites. The existing reclaimed facilities at Chino and Tyrone and the associated surface water conveyance structures analyzed as part of this assessment are summarized in Table 2.

Table 2: Chino and Tyrone Existing Reclaimed Facilities and Structures Analyzed

Facility	Top Channels	Benches	Downchutes
Chino			
Lake One and Slag Pile	Yes	Yes	Yes
Tailing Pond 1	Yes	Yes	Yes
Tailing Pond 2	Yes	Yes	Yes
Pond 2 Repository	Yes	--	Yes
Tailing Pond B	Yes	Yes	Yes
Area North of Pond B	Yes	Yes	Yes
Tailing Pond C	Yes	Yes	Yes
Tailing Pond 4E	Yes	Yes	Yes
Pond 4E Repository	Yes	Yes	Yes
Tailing Pond 4W	Yes	Yes	Yes
Tailing Pond 6E	Yes	Yes	Yes
Tailing Pond 6W	Yes	Yes	Yes
Groundhog No. 5 Stockpile	Yes	--	--
Tyrone			
3 Tailing Impoundment	Yes	Yes	Yes
3X Tailing Impoundment	Yes	Yes	Yes
2 Tailing Impoundment	Yes	Yes	Yes
1X Tailing Impoundment	Yes	Yes	Yes
1 Tailing Impoundment	Yes	Yes	Yes
1A Tailing Impoundment	Yes	Yes	Yes
1 Tailing North Ponds Area	Yes	--	--
1 Tailing Southern Area	Yes	--	--
1 Leach Stockpile	Yes	--	Yes
USNR	Yes	--	--
1C Waste	--	--	Yes
7A Waste	Yes	Yes	Yes
7A Far West	--	--	Yes
Burro Mountain Tailing Impoundment	Yes	--	--

"Yes" = structure type is present at facility and considered in analyses; "—" = structure type is not present at facility

The conservative Rational Formula Method was used to evaluate whether conveyance channels had sufficient capacity/freeboard to carry the design storm with the additional projected rainfall estimated from Task 2 for the individual conveyance structures at each facility.

Select conveyance structures were further assessed using the Hydrologic Engineering Center – Hydrologic Modeling System (HEC-HMS) (USACE 1998) to evaluate the robustness of the Rational Formula Method analyses. Further details of the scope of the Task 3 precipitation analysis for closure surface water conveyances at the Chino and Tyrone mine sites are provided in Section 3.0, and the results of the assessment are provided in Section 4.0.

3.0 METHODOLOGY

The precipitation analysis WSP used was similar to analyses completed by Golder in 2018 (Golder 2018) to support a determination that the Chino CCP surface water facilities at the Chino Mine would meet the standards of the Supplemental Rules for Copper Mines. National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation estimates for the 100-year, 24-hour storm event were increased by 14% per the recommended representative concentration pathway (RCP) 4.5 monsoon precipitation described within the Task 2 report (AWA 2022) to provide a representation of hypothetical effects of climate change to the surface water conveyance assessments. The conservative increase of 14% as recommended in the AWA Task 2 study was used on the 100-year, 24-hour storm event as listed for each mine site in NOAA 14 Atlas. This led to 100-year, 24-hour storm depths of 4.48 inches for Chino and 4.29 inches for Tyrone that were applied in the precipitation analysis.

An initial high-level, conservative analysis of each CCP facility was conducted using the Rational Formula Method with the 14% increase to the NOAA Atlas 14 100-year storm event described previously. Following this initial screening analysis, a more detailed HEC-HMS analysis was performed on select conveyance structures to evaluate the robustness of the Rational Formula Method analyses. The results of the additional HEC-HMS analyses are presented in Section 5.0.

3.1 Precipitation Depths

Facilities included in the first pass are listed within Table 1 and Table 2 within Section 2.0. The stormwater conveyance structures at these facilities were originally sized using the representative NOAA Atlas 14 100-year storm event for each site. Based on the results of the AWA Task 2 climate change study (AWA 2022), total runoff from these facilities were estimated using a 14% modifier to the NOAA Atlas 14 100-year, 24-hour design storm for representation of potential climate change conditions. The AWA study results indicated that there was no projected change in the probable maximum precipitation (PMP) estimates for the RCP45 (present climate through 2100) and, as a result, any conveyance structures designed based on PMP estimates were excluded from these analyses.

The focus of this analysis is to observe the change in a structures capacity due to increased precipitation resulting from climate change. Structures designed to the PMP or ½ PMP were not analyzed, as no change to the 1-Day or 3-Day PMP is anticipated per the AWA Task 2 study climate change projections.

3.2 Rational Formula Method

The purpose of the Rational Formula Method evaluation is to develop a high-level conservative (screening) estimate of maximum flow rates for both planned CCP conveyance structures and conveyance structures constructed on existing reclaimed facilities at Chino and Tyrone. The Rational Formula Method is a widely accepted procedure for estimating peak rates of runoff from small watersheds for prefeasibility through feasibility level of analyses. The concept behind the Rational Formula Method is that if a rainfall of intensity *i* begins instantaneously and continues indefinitely, the rate of runoff will increase until the time of concentration *Tc*, when all of the watershed is contributing flow at the outlet. Due to this underlying basic premise, peak flows estimated using the Rational Formula Method result in a conservative estimate of the peak runoff from the watershed.

The product of rainfall intensity *i* and watershed area *A* is the inflow for the system, and the ratio of this rate to the rate of peak discharge *Q* (which occurs at time *Tc*) is termed the *runoff coefficient C*.

The standard form of the equation is:

$$Q = C \times i \times A \qquad \textit{Equation 1}$$

Where:
Q = the peak rate of runoff, in cubic feet per second (cfs)
C = a dimensionless runoff coefficient
i = the rainfall intensity, in inches/hour (in/hr)
A = the watershed area, in acres (ac)

This equation is in mixed units; therefore, a conversion factor to convert from acre-feet per hour (ac ft/hr) to cubic feet per second (cfs) of 1.008 is used. The Rational Formula Method has several assumptions implicit to the method, including the following:

- Peak flow occurs when all of the watershed is contributing runoff.
- The rainfall intensity is uniform over a duration of time equal to or greater than Tc.
- The frequency of the peak flow is equal to the frequency of the rainfall intensity.

3.2.1 Application of the Rational Formula Method

The following steps describe how to apply the Rational Formula Method for flow analysis:

- Measure each watershed area in acres.
- Obtain the applicable intensity–duration–frequency (IDF) table for the site.
- Compute the time of concentration (Tc) for the watershed.
- Determine design rainfall intensity (*i*) from the IDF table using the design event frequency and the watershed Tc.
- When Tc is computed as less than 10 minutes, a minimum rainfall duration of 10 minutes should be used.
- When Tc is computed as greater than 60 minutes, the Rational Formula Method should not be used.
- Estimate the runoff coefficient for the water shed.
- Calculate runoff Q = 1.008 x C i A

3.2.2 Evaluate Conceptual Downchute Channel Capacity

To calculate the downchute channel capacity, use the following:

Downchute channel flow = sum of bench channel flow + top area flow

3.2.3 Estimated Typical Closure Closeout Plan Bench Channel Tc

The following are used to estimate the typical CCP bench channel Tc:

- CCP interbench slope length = 190 feet.
- CCP interbench slope gradient = 33%.
- Assumed nearly bare and untilled (overland flow; conservative assumption representative of conditions prior to vegetation establishment). Alluvial fans in western mountain regions (shallow concentrated flow).
- From Figure 1, the estimated velocity is approximately 5.6 feet/second (ft/s).
- CCP Tc = 190 feet / 5.6 ft/s = 33.9 seconds.

Computed Tc is less than 10 minutes; therefore, the minimum allowable Tc is 10.0 minutes. Existing reclaimed facilities on average had an interbench slope length of roughly 126 feet. This led to an even shorter Tc. Due to this, the 10-minute Tc was used across both CCP and existing reclaimed facilities for all bench channels. While this did not affect the Tc, it did lead to a decrease in unit area for existing reclaimed structures and therefore runoff of each bench.

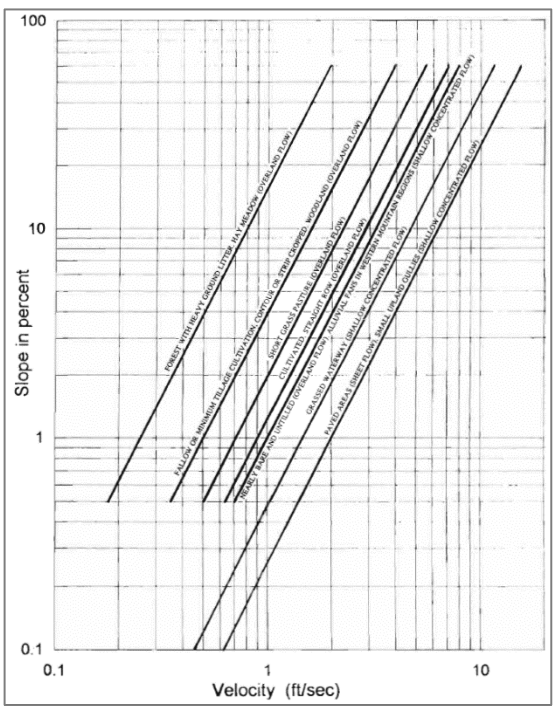

Figure 1: Flow Velocities for Overland and Shallow Concentrated Flows

Source: NMDOT 2018.

3.2.4 Estimated Typical Closure Closeout Plan Top Area Tc

The following calculation was used to estimate the typical CCP top area Tc:

- Assume top-surface slope length = 1,000 feet.
- Slope = 1%.
- Assume nearly bare and untilled (overland flow; conservative assumption representative of conditions prior to vegetation establishment). Alluvial fans in western mountain regions (shallow concentrated flow).
- From Figure 1, the estimated velocity is approximately 1.0 ft/s.
- Tc = 1,000 feet / 1.0 ft/s = 1,000 seconds = 16.7 min.

The 16.7-minute estimate that was used in previous hydraulic estimates at Chino was found to hold roughly true for a handful of facilities with calculated Tc's ranging between 10 to 20 minutes per top area.

3.2.5 Top Area Rainfall Intensity

- The following calculation was used to estimate the top area rainfall intensity: Tc = 16.7 minutes
- rainfall intensity interpolated from site-specific IDF curves
- rational "C" coefficient desert = 0.59 based on data extrapolated from IDF curves

3.2.6 Runoff Coefficient

Determination of runoff coefficients:

- Hydrologic soil groups (HSGs) are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.
- The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:
  - Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
  - Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
  - Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
  - Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high-water table, soils that have a clay pan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.
- If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Per the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey, Map Unit 46 = pits–dumps association, extremely steep, HSG = B.

Based upon previous characterization of the cover materials at Chino, HSG A and B are considered representative, with 30 to 40% vegetation cover in the reclaimed condition, based on field studies.

Summary:

- HSG = A and B
- 40% cover
- rational “C” coefficient desert = 0.60 based on data extracted from IDF curves

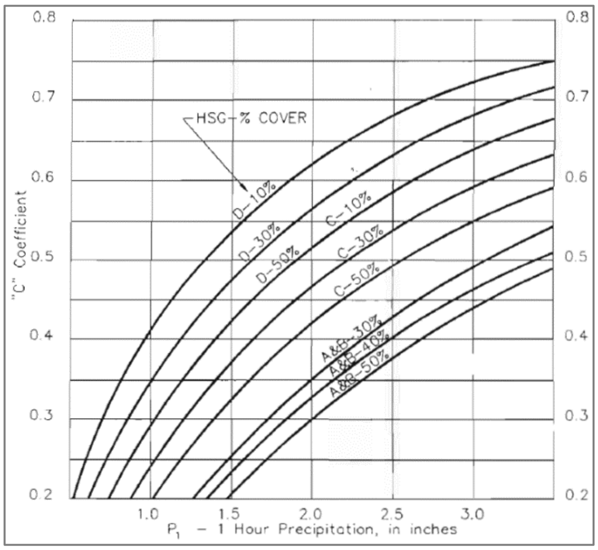

Figure 2: Rational "C" Coefficient Desert (Cactus, Grass, and Brush) as a Function of Rainfall Depth, Hydrologic Soil Group, and Percent of Vegetation Cover

Source: NMDOT 2018.

3.2.7 Intensity–Duration–Frequency Curves

An IDF table was collected from NOAA Atlas 14 for Chino (32.7922N, -108.0378W) and Tyrone (32.645N, -108.3748W). Per the Task 2 AWA climate change study (AWA 2022), a 14% multiplier was added to the 100-year design storm depths. This was then converted to an IDF table (Table 3). Both the present 100-year precipitation data and the 100-year adjusted climate change data were plotted, and the intensity for the typical top area Tc’s was derived using the trendlines presented in Figure 3 and Figure 4 in Section 4.1.

Table 3: Intensity–Duration–Frequency Curve Table

Return Period	Chino 100-Year (in/hr)	Tyrone 100-Year (in/hr)	Chino 100-Year + 14% (in/hr)	Tyrone 100-Year + 14% (in/hr)
5 min	8.53	8.27	9.73	9.43
10 min	6.48	6.30	7.39	7.18
15 min	5.36	5.20	6.11	5.93
30 min	8.53	3.50	9.73	3.99
1 hr	3.62	2.17	4.13	2.47
2 hr	2.24	1.28	2.55	1.46
3 hr	1.32	0.89	1.50	1.01
6 hr	0.91	0.50	1.04	0.57
12 hr	0.51	0.28	0.58	0.32
24 hr	0.29	0.16	0.33	0.18

Following the methodology used in prior channel flowrate estimates at Chino, the HSB A and B 40% cover graph was plotted and projected to have a maximum possible runoff coefficient of 0.6. This value was used for the total composite runoff coefficient for the 100-year, 24-hour storm events at both the Chino and Tyrone sites.

4.0 ASSESSMENT OF WORST-CASE STORMWATER CONVEYANCE STRUCTURES

4.1 Analysis of Chino Worst-Case Structures

Analysis of the Chino worst-case structures began with the creation of the IDF curves for both the present and climate change conditions. The trendline formula for these conditions was used to estimate the intensity of the storm at the Tc of both the top surfaces and side slopes.

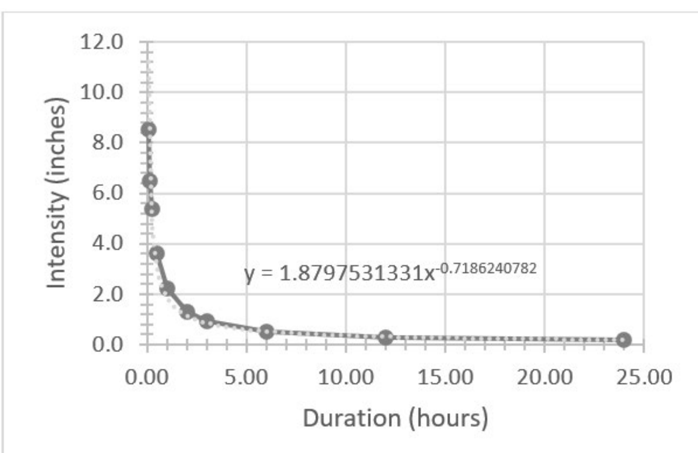

Figure 3: Chino 100-Year, 24-Hour Intensity–Duration–Frequency Curve

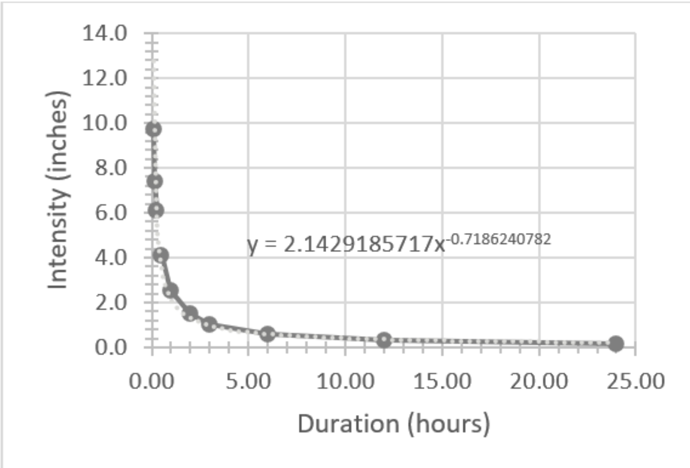

Figure 4: Chino 100-Year, 24-Hour Intensity–Duration–Frequency Curve with 14% Climate Change Modifier

The typical bench and typical top area peak runoff were then calculated as cfs/ft of bench channel and cfs/ac of top area, respectively. Additional times of concentration were calculated for select facilities that exceeded the average typical top surface area by a wide margin. The peak runoff per acre for the typical and facility-specific times of concentration are presented in Table 4.

Table 4: Chino Intensity–Duration–Frequency Curve Table

Catchment ID	Time of Concentration (min)	Climate Change Conditions Unit Runoff	Present Conditions Unit Runoff
Typical bench	10	4.43 cfs/ft	3.89 cfs/ft
Typical top area	16.7	3.17 cfs/ac	2.78 cfs/ac
Pond 7 top area	160	0.63 cfs/ac	0.55 cfs/ac
Pond 6 East & 6 West	89.3	0.95 cfs/ac	0.83 cfs/ac

The estimated peak flows from analyzed catchment areas were then calculated by multiplying the actual facility lengths or areas by the above unit runoff rates. These flows were summed as needed based on the total catchment contributing to a given structure creating very conservative peak flowrates that assume the peak flows from each contributing area arrive at the structure simultaneously. The summary of these values is presented in Table 5 in Section 4.1.1.

4.1.1 Rational Method Assessment of Chino Closure Closeout Plan Conveyance Structures

The facilities were split into subbasins, and total bench channel lengths, as well as top areas, were used to calculate conservative flowrate estimates through the downchutes.

Table 5: Chino Subbasin Geometries and Rational Method Peak Flow Estimates for Closure Closeout Plan Facilities

Facility	Subbasin ID	Length of Bench Channels (ft)	Top Areas (ac)	Total Peak Flow in Downchute – Present Conditions (cfs)	Total Peak Flow in Downchute – Climate Change (cfs)
South Stockpile	South SP-1	50,885	55	1082	1,234
	South SP-2	39,788	29	809	923
West Stockpile	West SP-1	21,523	27	469	534
	West SP-2	9,543	20	231	264
	West SP-3	23,850	92	693	790
	West SP-4	29,257	10	564	643
Lampbright Leach Stockpile	Main Lampbright-1	31,900	25	654	746
	West Lampbright-2	25,138	10	486	555
	South Lampbright-1	25,536	27	543	620
	South Lampbright-2	46,227	15	887	1,011
Tailing Pond 6W	P6W-A	4,203	217	258	294
Tailing Pond 6E	P6E-A	3,938	243	275	313
Tailing Pond 7	P7-T	3,149	1,309	776	884
	P7-A	2,537	0	46	53
	P7-B	9,998	0	183	208
	P7-C	13,196	0	241	275
	P7-D	8,829	0	161	184
Axi-Flo Lake	Axi-Flo Lake	2,100	95	304	347

4.1.2 Rational Formula Method Assessment of Chino Worst-Case Existing Reclaimed Conveyance Structures

As detailed in Section 3.2, the Rational Formula Method assessment of the existing reclaimed conveyance structures only included the analysis of climate change flow estimates. Each facility's worst-case conveyance structures were determined via the Rational Formula Method conservative peak flow estimates. The peak flow estimates from the Rational Formula Method analysis of the existing reclaimed facilities at Chino are summarized in Table 6.

Table 6: Summary of Peak Flow Estimates through Worst-Case Structures at Existing Chino Reclaimed Facilities (Rational Formula Method)

Facility	Feature	Worst Case	Contributing Subbasin	Flow (cfs)
Tailing Pond 1	Top channels	Main top channel	P1-T	26
	Bench channels	East face, top southern bench	P1-A	13
	Downchutes	East face downchute	P1-A+P1-T	279
Tailing Pond 2	Top channels	Main Pond 2 top channel	P2-T	267
	Downchutes	East face downchute	P2-T + P2A	310
	Bench channels	East face lower bench	P2A	19
Pond 2 Repository	Top channels	Southern channel through repository (T-2,3)	P2W-TB	166
	Downchutes	Downchute into T-2,3	P2W-SDC	43.0
Tailing Pond 4 East	Top channels	Main top channel	P4E-T	377
	Downchutes	From top channel to NP6E	P4E-B + P4E-T	468
	Bench channels	East face bench	P4E-B	18
North of Tailing Pond 6 East	Top channels	From Pond 4 to downchute	P4E-B + P4E-T + NP6E-T	513
	Bench channels	East face bench	NP6E-A	24
	Downchutes	East face downchute	P4E-B + P4E-T + NP6E-T + NP6E-A	537
Tailing Pond 6 East	Top channels	Main top channel	P6E-TA	461
	Bench channels	East face lower bench	P6E-A	27
	Downchutes	Southern downchute	P6E-A + P6E-TA	522
	Access ramp channels[a]	Southern access ramp	P6E-AR2	21
Tailing Pond 6 West	Top channels	Main top channel	P6W-T + PC-P6W-A	444
	Bench channels	West face, second highest bench	P6W-B	35
	Downchutes	Northern downchute, west face	P6W + PC-P6W-A + P6W-B	525
	Access ramp channels[a]	Southern access ramp, west face	AR-2	29

Facility	Feature	Worst Case	Contributing Subbasin	Flow (cfs)
Tailing Pond 4 West	Downchutes	West face downchute	P4W-A + P4W-T + PC-TB + P4W-B	644
	Bench channels	West face bench between PC and P4W	P4W-B	26
	Top channels	Main top channel	P4W-T + PC-TB + P4W-B	593
Tailing Pond C	Top channels	Main top channel	PC-T	424
	Bench channels	South/west face, second highest bench	PC-A	29
	Downchutes	South face downchute	PC-A + PC-T	601
	Access ramp channels[(a)]	Southern access ramp	PC-AR	33
Tailing Pond B	Top channels	Southern main channel	PB-TB	171
	Bench channels	Northern lowest bench, west face	PB-B	15
	Downchutes	Southern downchute, west face	PB-TB + PB-B	246
	Access ramp channels[(a)]	West face, north of northern downchute	PB-AR	16
North of Tailing Pond B	Top channels	Main top channel	NPB-T	38
	Bench channels	West face, lower bench	NPB-A	16
	Downchutes	West face downchute	NPB-A	42
Groundhog	Diversion channel	West diversion channel	GH-A	23
Lake One and Slag Pile	Bench channels	East face lowest bench on slag pile	L1-B	19
	Top channels	Southeast main junction at culvert	L1-TC	694
	Downchutes	slag pile east face	L1-B + L1-TB	52

a. For the purpose of modelling, access ramps are assumed to behave similarly to benches.

4.2 Assessment of Tyrone Worst-Case Structures

Analysis of the Tyrone worst-case structures began with the creation of the IDF curves for both the present and climate change conditions. The trendline formula for these conditions was used to estimate the intensity of the storm at the Tc of both the top surfaces and side slopes.

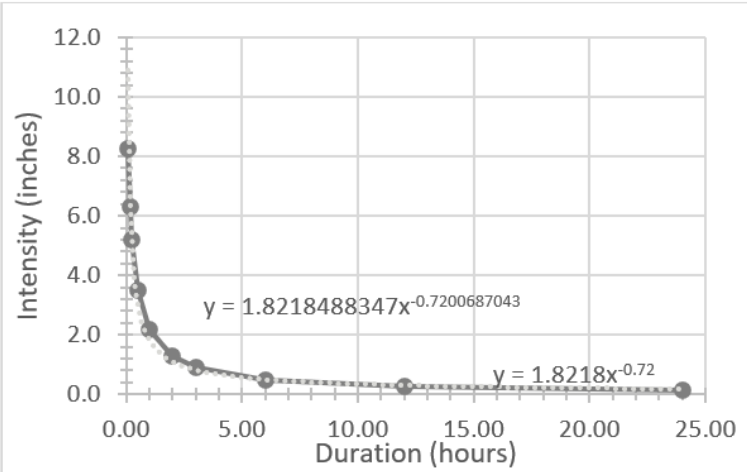

Figure 5: Tyrone 100-Year, 24-Hour Intensity–Duration–Frequency Curve

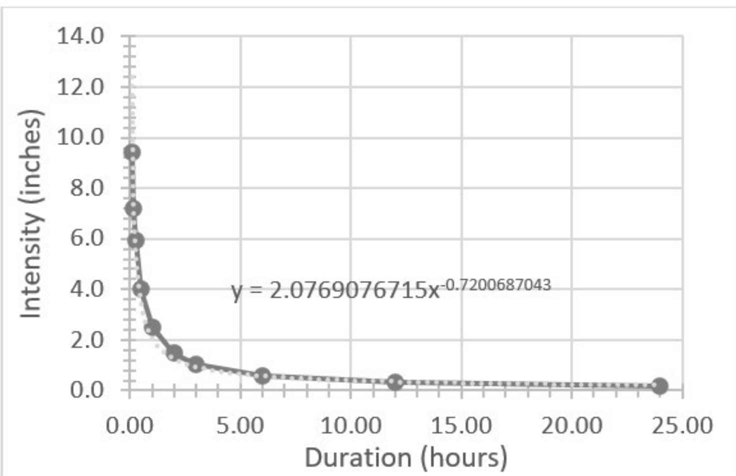

Figure 6: Tyrone 100-Year, 24-Hour Intensity–Duration–Frequency Curve with 14% Climate Change Modifier

Due to similar hydrologic soil composition between Chino and Tyrone, runoff coefficients from prior Chino work (Golder 2018) were used as an initial calculation of Tc at various facilities found the representative methodology to still be a valid approximation of Tc at facilities with similar top surface and sideslope construction.

The typical bench top and top area peak runoff was then calculated as cfs/ft of bench channel per calculations detailed in Section 2.0. The estimated peak runoff per acre for Tyrone is presented in Table 7.

Table 7: Tyrone Intensity–Duration–Frequency Curve Table

Catchment ID	Time of Concentration (minutes)	Present Conditions Unit Runoff	Climate Change Conditions Unit Runoff
Typical bench	10	3.78 cfs/ft	4.31 cfs/ft
Top area	16.7	2.70 cfs/ac	3.08 cfs/ac

The estimated peak unit runoff per foot of bench channel was used, as well as the runoff per acre to estimate the peak flow rates from top areas and bench channels. These estimated values were summed for each facility creating a very conservative peak flowrate that assumes the flow from top areas and bench channels are simultaneously transported through each facility's downchute. The summary of these values is presented in Table 8 in Section 4.2.1.

4.2.1 Rational Method Assessment of Tyrone Closure Closeout Plan Conveyance Structures

The Tyrone CCP facilities were split into subbasins, and total bench channel lengths, as well as top areas, were determined to calculate a conservative flow through the downchutes. The peak flow estimates from the Rational Formula Method analysis of the CCP facilities at Tyrone are summarized in Table 8.

Table 8: Tyrone Subbasin Geometries and Rational Method Peak Flow Estimates for Closure Closeout Plan Facilities

Facility	Subbasin ID	Length of Bench Channels (ft)	Top Areas (ac)	Total Peak Flow in Downchute Present (cfs)	Total Peak Flow in Downchute 2100 (cfs)
1A Leach/1B Leach	1A/1B-A	4,431	0	79	90
	1A/1B-B	24,095	0	428	488
	1A/1B-C	16,726	17	342	390
6A Leach	Savannah	0	9	23	27
6C Leach	6C-A	615	0	11	12
	6C-B	5,242	10	120	137
6B Leach/6D Leach	6B-A	2,509	7	64	73
2 Leach (Area 2)	6B-B	11,030	0	196	224
South Rim Pit/7B Waste/7C Waste	SRP-A	13,049	92	481	548
San Salvador Pit/San Salvador Waste Backfill	SSP-A	17,327	104	589	671
	SSP-T4	2,655	23	110	126
2 Leach (Area 1)	4C-A	10,995	0	195	223
	4C-B	9,614	3	179	204
	4C-C	3,296	17	104	119
9A Waste	9A-A	24,589	13	471	537

Facility	Subbasin ID	Length of Bench Channels (ft)	Top Areas (ac)	Total Peak Flow in Downchute Present (cfs)	Total Peak Flow in Downchute 2100 (cfs)
3A Leach/3B Waste	3A/B-A	10,666	0	190	216
	3A/B-B	9,866	0	175	200
	3A/B-C	20,034	0	356	406
	3A/B-D	15,503	39	380	434
5A Waste	5A-A	19,575	8	370	421
	5A-B	19,485	0	346	395
	5A-C	5,498	63	268	305
2A Leach/2B Leach	2A/2B-A	14,165	6	268	305
	2A/2B-B	8,427	0	150	171
	2A/2B-C	10,571	0	188	214
	2A/2B-D	15,503	0	276	314
2B Waste	2B-A	3,872	11	99	113
	2B-B	9,831	0	175	199

4.2.2 Rational Method Assessment of Tyrone Worst-Case Existing Reclaimed Conveyance Structures

As previously described, the Rational Formula Method assessment of the existing reclaimed conveyance structures only included the analysis of climate change flow estimates. Each facility’s worst-case features were determined via the rational method’s conservative peak flow estimate. The peak flow estimates from the Rational Formula Method analysis of the existing reclaimed facilities at Tyrone are summarized in Table 9.

Table 9: Summary of Peak Flow Estimates through Worst-Case Structures at Existing Tyrone Reclaimed Facilities (Rational Formula Method)

Facility	Feature	Worst Case	Contributing Subbasin	Flow (cfs)
1X Tailing Impoundment	Top channels	Main top collector channel	1X-T + 1A-A + 1-T	2449.7
	Bench channels	North face, west of downchute, 2nd highest bench	1X-A	21.4
	Downchutes	North face downchute	1X-A	132.3
1 Tailing Impoundment	Top channels	Main top collector channel	1-T + 1A-A	1007.1
	Bench channels	Bottom channel, east face	1-A	34.9
	Downchutes	East face downchute	1-C + 1A-B	211.8
1 Tailing North Ponds Area	Top channels	West outlet	N-A + 1X-A	306.2
1 Tailing Southern Area	Top channels	Easternmost channel	S-A	227.0
1A Tailing Impoundment	Top channels	Main top collector channel	1A-T	1037.2
	Downchutes	Top channel downchute	1A-T	1037.2
	Bench channels	Lowest bench east of downchute	1A-A	30.0
1C Waste	Downchutes	Representative downchute (longest)	Longest Downchute (LDC)	2.3
7A Far West	Downchutes	Downchute with top surface flow	LDC + Top Flow	15.0
Burro Mountain Tailing Impoundment	Channels	Main runoff V ditch	BM-D	121.0
7A Waste	Top channels	Eastern top channel	7A-T2	77.1
	Bench channels	West top bench channel (carries flow from 6C-B and 6C-T)	7A-B	71.8
	Downchute	Southwest face, downchute off-site	7A-B	66.5
1 Leach Stockpile	Downchutes	Representative downchute (longest)	LDC	6.0
	Downchutes with top flow	Representative downchute w/ top flow	LDC + N1-T	60.9
3X Tailing Impoundment	Downchutes	West face southern downchute	3X-B	137.2
	Bench channels	North face bottom bench	3X-A	33.1
	Top channels	North main top channel	3X-TA	385.4
2 Tailing Impoundment	Downchutes	Northwest face downchute	2-A	321.4
	Top channels	Main collector channel	2-T	831.8

Facility	Feature	Worst Case	Contributing Subbasin	Flow (cfs)
	Bench channels	Northwest face, bottom bench	2-A	48.2
3 Tailing Impoundment	Top channels	Third top channel from the south to east channel	3-T	235.7
	Downchutes	East face downchute, second from south	3-B	185.4
	Bench channels	East face second from bottom bench	3-C	21.6
	Downchutes	Longest ridge/valley structure	3-DC	8.0

4.3 Analysis Results

4.3.1 Chino Closure Closeout Plan Conveyance Structures

The worst-case CCP structures for Chino were analyzed and found to pass the freeboard criteria of 6 inches (0.5 feet) for present conditions and positive freeboard for climate change conditions. Table 10 provides a summary of the results of the Rational Formula Method assessment of the Chino CCP conveyance structures.

Table 10: Summary of Freeboard Estimates for Present and Climate Change Conditions at Chino Facilities (Rational Formula Method)

Structure	Facility	Length (ft) / Area (ac)	Estimated Flow – Present Conditions (cfs)	Estimated Freeboard – Present Conditions (ft)	Estimated Flow – Climate Change Conditions (cfs)	Estimated Freeboard – Climate Change Conditions (ft)
Longest bench	Tailing Pond 7	2,886 ft	53	0.6 (desert pav.) 0.5 (riprap)	60	0.5 (desert pav.) 0.4 (riprap)
Downchute with the largest catchment	South Stockpile	293.8 ac	1,082	0.7-1.7 (ACB)[(a)] 0.2-1.3 (riprap)[(a)]	1,234	0.6–1.6 (ACB)[(a)] 0.1–1.2 (riprap)[(a)]
Longest top channel	West Stockpile	14.4 ac	56	0.5 (desert pav.) 0.4 (riprap)	64	0.4 (desert pav.) 0.3 (riprap)

a. Channel dimensions not available. Assumed values were used.

4.3.2 Chino Existing Conveyance Structures

Table 11 provides a summary of the results of the Rational Formula Method assessment of the conveyance structures at the existing reclaimed facilities at Chino. The capacity of existing structures was evaluated, and the structures with adequate capacity to convey the modified flow are indicated with a check mark, while other facilities are labeled with the word “capacity” if they did not pass the Rational Formula Method screening analysis.

Table 11: Summary of Rational Formula Method Analysis Results for Chino Existing Structures

Facility	Top Channels	Benches	Downchutes	Access Ramp/Haul Road Channels
Lake One and Slag Pile	✓	✓	✓	--
Tailing Pond 1	Capacity	✓	✓	--
Tailing Pond 2	Capacity	✓	✓	--
Pond 2 Repository	Capacity	--	✓	--
Tailing Pond B	✓	✓	✓	✓
Area North of Pond B	✓	✓	✓	✓
Tailing Pond C	Capacity	✓	✓	✓
Tailing Pond 4E	Capacity	✓	✓	--
Pond 4E Repository	Capacity	✓	✓	--
Tailing Pond 4W	✓	✓	✓	
Tailing Pond 6E	✓	✓	✓	✓
Tailing Pond 6W	✓	✓	✓	✓
Groundhog No. 5 Stockpile	Capacity	--	--	--

Note: “Capacity” indicates the structure requires further/more accurate evaluation for capacity.

✓ = indicates that the structure has sufficient capacity; -- = indicates that a structure type is not present

As a further evaluation of the robustness of the Rational Formula Method, various channels were selected for further detailed evaluation with HEC-HMS. These included the downchute at Tailing Pond 6 West, the downchute at Tailing Pond 4 West, the downchute at Tailing Pond C, and the top surface channels at Tailing Pond 4 East. The results of these analyses are presented in Section 5.0.

4.3.3 Tyrone Closure Closeout Plan Conveyance Structures

The worst-case CCP structures for Tyrone were analyzed and found to pass the freeboard criteria of 6 inches (0.5 feet) for present conditions and positive freeboard for climate change conditions. Table 12 provides a summary of the results of the Rational Formula Method assessment of the Tyrone CCP conveyance structures.

Table 12: Summary of Freeboard Estimates for Present and Climate Change Conditions at Tyrone Facilities (Rational Formula Method)

Structure	Facility	Length(ft) / Area (ac)	Estimated Flow – Present Conditions (cfs)	Estimated Freeboard – Present Conditions (ft)	Estimated Flow – Climate Change Conditions (cfs)	Estimated Freeboard – Climate Change Conditions (ft)
Longest bench channel	5A Waste	2,707 ft	49	0.6 (desert pav.) 0.5 (riprap)	56	0.5 (desert pav.) 0.4 (riprap)
Downchute with the largest catchment	San Salvador Pit/San Salvador Waste Backfill	185.2 ac	589	1.1 (ACB) 0.8 (riprap)	671	1.0 (ACB) 0.7 (riprap)
Longest top channel	South Rim Pit/7B Waste/7C Waste	153.5 ac	58	0.9 (desert pav.) 0.8 (riprap)	66	0.8 (desert pav.) 0.7 (riprap)

a. Channel dimensions not available. Assumed values were used.

4.3.4 Tyrone Existing Conveyance Structures

The capacity of existing Tyrone structures was evaluated using the Rational Formula Method analysis. Table 13 provides a summary of the results of the Rational Formula Method assessment of the conveyance structures at the existing reclaimed facilities at Tyrone.

Table 13: Summary of Rational Formula Method Analysis Results for Tyrone Existing Structures

Facility	Top Channels	Downchutes	Benches
3 Tailing Impoundment	✓	✓	✓
3X Tailing Impoundment	✓	✓	✓
2 Tailing Impoundment	✓	✓	✓
1X Tailing Impoundment	✓	✓	✓
1/1X Tailing Impoundment	--	Capacity	--
1 Tailing Impoundment	✓	✓	✓
1A Tailing Impoundment	✓	✓	✓
1 Tailing North Ponds Area	✓	--	--
1 Tailing Southern Area	Capacity	--	--
1 Leach Stockpile	✓	✓	--

Facility	Top Channels	Downchutes	Benches
USNR	✓	--	--
1C Waste	--	✓	--
7A Waste	✓	✓	✓
7A Far West	--	✓	--
Burro Mountain Tailing Impoundment	Capacity	--	--

Note: "Capacity" indicates the structure requires further/more accurate evaluation for capacity.

✓ = indicates that the structure has sufficient capacity; -- = indicates that a structure type is not present

As previously described, as a further evaluation of the robustness of the Rational Formula Method, various channels were selected for further detailed evaluation with HEC-HMS. For Tyrone, these included the downchute at 7A Waste, both the downchute and bench channel at the 1A Tailing Impoundment, the bench channel at the 1 Tailing Impoundment, the downchute between the 1 and 1X Tailing Impoundments, the downchute at the 2 Tailing Impoundment, and the top surface channels at the Burro Mountain Tailing Impoundment. The results of these analyses are presented in Section 5.0.

5.0 HEC-HMS SECOND-PASS ANALYSIS

As previously described in Section 3.0, HEC-HMS modeling was performed on select channels to evaluate the robustness of the Rational Formula Method analyses.

5.1 Facilities and Parameters

The facilities and conveyance structures modeled within HEC-HMS are listed below:

- Chino:
  - Tailing Pond C Spillway 3
  - Tailing Pond 4 West Spillway 10
  - Tailing Pond 6 West Spillway 5
  - Tailing Pond 4 East Main Top Surface Channel
- Tyrone:
  - 1/1X Tailing Impoundment T-1 Downchute
  - 1 Tailing Impoundment Bench Channel 1-WE-6
  - 1A Tailing Impoundment 1A Downchute
  - 1A Tailing Impoundment Bench Channel 1A-NW3
  - 2 Tailing Impoundment Northwest Downchute
  - Burro Mountain Tailing Impoundment V-Ditch 4
  - 7A Waste 7A-B Downchute discharging to HDPE culverts

The Tc for each subbasin contributing to each structure was calculated individually according to NCRS TR-55 methodology (NRCS 1986). In HEC-HMS, loss and transform methods were set to use the NCRS curve number of 80, consistent with previous HEC-HMS efforts at Chino and Tyrone. The same total precipitation depths used in the Rational Formula Method (see Section 3.1) were applied in the HEC-HMS analyses. These depths were used to create hyetographs according to AWA's East General 24-hour 10th percentile accumulated rainfall distribution[6]. This distribution was found to generate the highest peak flows from among the four distributions provided by AWA.

The 100-year 24-hour storm event was modelled, consistent with the CCP design criteria of a 100-year, 24-hour storm event, and previous analysis performed at CCP facilities at Chino.

5.2 Basin Models

Basin models were created using GIS referenced shapefiles from As-Built AutoCAD drawing files of the facilities using the New Mexico NAD87 West coordinate system. Individual bench channels were analyzed separately as "_Bench Eval" subbasins, where necessary. The individual basin models developed for this analysis are presented in Figure 7 through Figure 11.

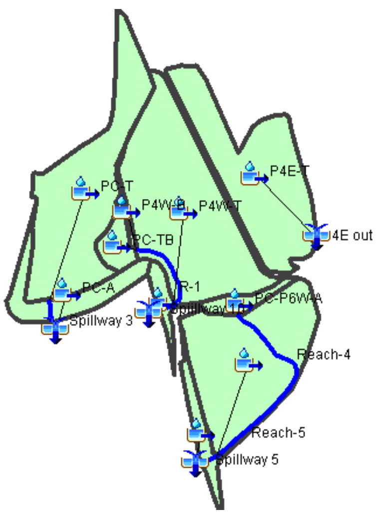

Figure 7: Chino Tailing Ponds C, 4W, 4E, and 6W Facilities

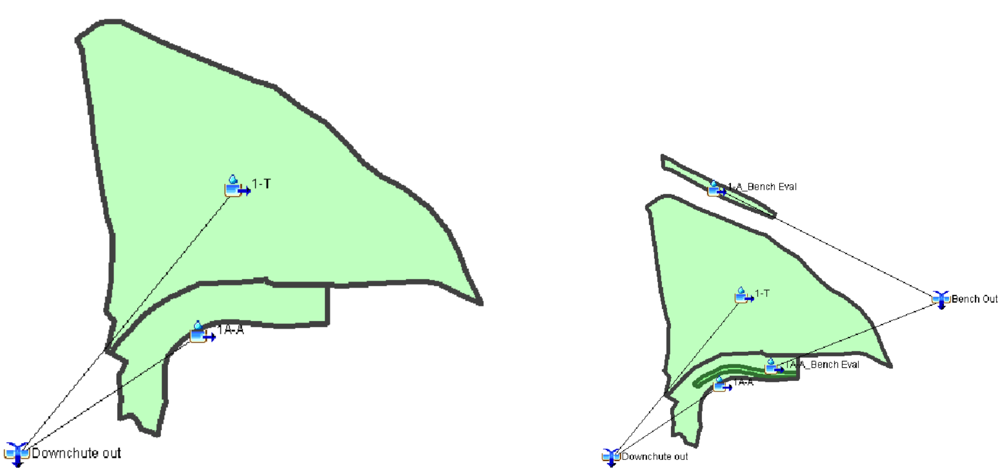

Figure 8: Tyrone 1 and 1A Tailing Impoundment Facilities

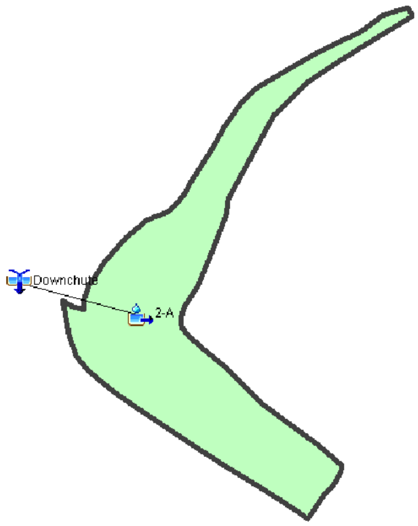

Figure 9: Tyrone 2 Tailing Impoundment Downchute Subbasin

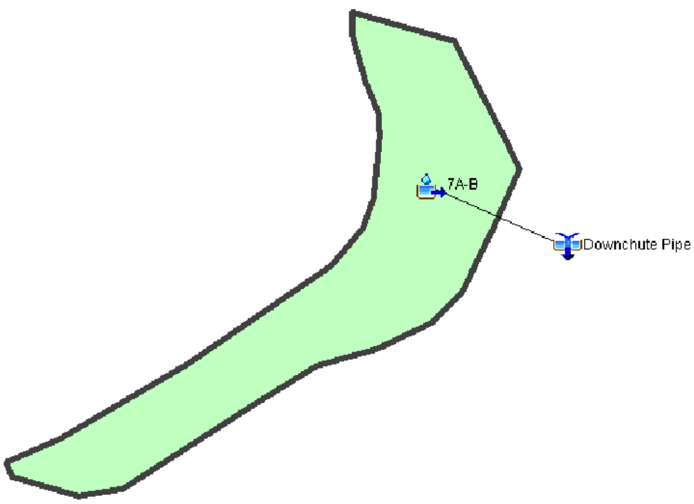

Figure 10: Tyrone 7A Waste Downchute Subbasin

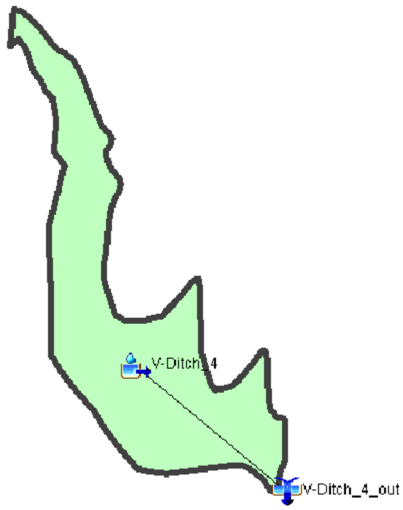

Figure 11: Burrow Mountain Tailing Impoundment Subbasin

5.3 Rational Formula Method and HEC-HMS Results Comparison

Flow estimates from the HEC-HMS model proved to be significantly lower than the conservative outputs from the Rational Formula Method. This is to be expected, as the 10-minute and 16.7-minute Tc's used across the facilities proved to be significantly shorter (more conservative) than the actual Tc's estimated in HEC-HMS, which, when measured for each basin for the SCS Unit Hydrograph transform method, were estimated to be up to 57 minutes long.

In addition to this, the conservative Rational Formula Method assumption that all bench channels contained an equal drainage area per foot of channel led to an inflation of side slope areas. This drainage area was calculated based on representative maximum distances between benches. The HEC-HMS model, by way of using the correct sideslope areas as an input, did not include this highly conservative assumption. Another conservative method used by the Rational Formula Method was to simply add peak flowrates from all subbasins to determine subsequent downstream peak flow rates. For example, this estimation would simply add the total peak flowrate from a top surface to the peak flowrate from the side slopes to determine the flow through a downchute. HEC-HMS does not make this assumption; the model properly staggers these peak flows, greatly decreasing the total flowrates for individual conveyance structures.

The significantly lower flow estimates from the HEC-HMS are expected, as the first pass Rational Formula Method was intentionally meant to provide conservative flow estimates, which would be followed by more precise HEC-HMS modeling as needed. Table 14 provides a comparison of the estimated flows between the Rational Formula Method and the HEC-HMS. As shown, the HEC-HMS flow estimates are reduced by as much as 97.58%.

Table 14: Comparison Between HEC-HMS and Rational Formula Method Flow Estimates

Site	Facility	Structure	HEC-HMS (cfs)	Rational Formula Method (cfs)	% Reduction
Tyrone	1/1X Tailing Impoundment	Downchute	139	1007	-86.24%
	1 Tailing Impoundment	Bench	6	35	-82.00%
	1A Tailing Impoundment	Downchute	25	1037	-97.58%
		Bench	3	30	-90.00%
	2 Tailing Impoundment	Downchute	36	321	-88.72%
	7A Waste	Downchute	8	66	-87.27%
	Burro Mountain Tailing Impoundment	V Ditch	13	93	-89.26%
Chino	Tailing Pond C	Downchute	83	600	-86.25%
	Tailing Pond 4W	Downchute	99	525	-81.24%
	Tailing Pond 6W	Downchute	82	644	-87.27%
	Tailing Pond 4 East	Top Channel	58	513	-88.69%

To better understand this large reduction in flow estimates, these facilities were analyzed a third time with a modified Rational Formula Method approach. This time the average top surface and sideslope Tc's were adjusted to be specific to these facilities. The Tc increased from 16.7 to 37.9 minutes for top surfaces, and from 10 to 13.3 minutes for sideslopes. The Tc's for bench channels were calculated and averaged to a single 29.8-minute Tc. In addition to these new Tc's, the runoff coefficients were recalculated according to intensities extracted from the climate change IDF curves. The new bench runoff coefficients for Chino and Tyrone were slightly decreased, from 0.6 for top surfaces to 0.56 and 0.57, respectively. Top surface runoff coefficients saw the biggest change, decreasing from 0.59 to 0.47 and 0.46 for Chino and Tyrone respectively. A comparison of the estimated flow rates associated with the original Rational Formula Method, modified Rational Formula Method, and HEC-HMS for the structures that were analyzed by all three methods is provided in Table 15.

Table 15: Peak Flow Estimates for All Estimation Methods

Facility	Structure	Original Rational Formula Method (cfs)	Modified Rational Formula Method (cfs)	Reduction from Original Rational Formula Method (%)	HEC-HMS (cfs)	Reduction from Modified Rational Formula Method (%)
Tailing Pond 6 West	Spillway 5	525	279[a]	-46.86%	82[a]	-70.61%
Tailing Pond 4 West	Spillway 10	644	314[a]	-51.24%	99[a]	-68.47%
Tailing Pond 4 East	Top Channel T-4E,2	513	225	-56.14%	58[a]	-74.22%
Tailing Pond C	Spillway 3	600	337[a]	-43.83%	83[a]	-75.37%
1 Tailings Impoundment	Bench 1-WE-6	35	28[a]	-20.00%	3[a]	-89.29%
1A Tailing Impoundment	1A Downchute	1,037	443	-57.28%	25[a]	-94.36%
	Bench 1A-NW3	30	24[a]	-20.00%	6[a]	-75.00%
1X/1 Tailing Impoundments	Downchute	1,007	488[a]	-51.54%	139[a]	-71.52%
7A Waste	Downchute to Downdrain Pipe	66	54	-18.18%	8[a]	-85.19%
Burro Mountain Tailing Impoundment	V Ditch 4	121	93	-23.14%	13[a]	-86.02%

a. Estimated flowrate is conveyed with adequate freeboard capacity.

6.0 CONCLUSIONS

The depth of the 100-year, 24-hour storm event obtained from the MetPortal REPS precipitation tool was found to be 17% less than NOAA Atlas 14 design storm depths for Tyrone and 20% less than the design depth for Chino. For the sake of proving the robustness of the planned and as-built conveyance structures, the NOAA Atlas 14 precipitation values were used as the basis for this analysis, as they were the most conservative.

The results of the Task 3 precipitation analysis for the Chino and Tyrone conveyance structures (presented in Section 4.3 and Section 5.3) show the success of the facilities in conveying stormwater adequately under both current conditions and climate change conditions for facilities facing closure, as well as those that have already been reclaimed. The first sweep Rational Formula Method analyses, although overtly conservative with many assumptions, showed that all CCP facilities have adequate capacity to convey stormwater under both current conditions and climate change conditions, and the majority of the existing conveyance structures at reclaimed facilities would provide adequate capacity under both current conditions and climate change conditions.

Critical structures (downchutes and bench channels) that did not provide adequate capacity on the original Rational Formula Method screening analyses were reanalyzed using more accurate Tc’s. This led to a decrease in estimated flowrates ranging from 18.2% to 57.28% for the original failed structures (Table 15). Results of the modified Rational Formula Method analyses indicated that all structures analyzed provide adequate capacity with the exception of the main top surface channel at Tailing Pond 4 East, which exceeded its channel capacity by an estimated 0.1 foot.

Results of the further analysis with more accurate HEC-HMS modeling indicates that all facilities provide adequate capacity with estimated flowrate reductions ranging from 70.6% to 94.36% of the modified Rational Formula Method estimates (Table 15).

Based on these results, the design of the structures considered in this study appear to be robust in relation to the predicted impacts of climate change on local precipitation.

7.0 CLOSING

The intent of this study was to assess the adequacy of stormwater conveyance under projected climate change conditions for both planned closure structures documented in the most current CCPs for the Chino and Tyrone mines and conveyance structures constructed at existing reclaimed facilities at both sites. Results of the conveyance structure assessment indicate that all proposed CCP structures and all critical structures constructed on reclaimed lands at both Chino and Tyrone are designed (CCP) and built (existing reclaimed) to provide adequate capacity under projected climate change conditions. With increased specificity and accurate hydraulic modeling, critical facility structures are shown to provide adequate capacity (Table 16 and Table 17).

Table 16: Summary of Conveyance Structure Analysis Results for Chino Existing Structures

Chino Facility	Top Channels	Benches	Downchutes
Lake One and Slag Pile	✓	✓	✓
Tailing Pond 1	▢	✓	✓
Tailing Pond 2	▢	✓	✓
Pond 2 Repository	▢	--	✓
Tailing Pond B	✓	✓	✓
Area North of Pond B	✓	✓	✓
Tailing Pond C	▢	✓	▢
Tailing Pond 4E	△	✓	✓
Pond 4E Repository	▢	✓	✓
Tailing Pond 4W	▢	✓	▢
Tailing Pond 6E	✓	✓	✓
Tailing Pond 6W	✓	✓	▢
Groundhog No. 5 Stockpile	▢	--	--

✓ = indicates that the structure provides capacity based on original Rational Formula Method analyses;

▢ = indicates that the structure provides capacity based on modified Rational Formula Method analyses;

△ = indicates that the structure provides capacity based on HEC-HMS modeling

-- = indicates that a structure type is not present

Note: Capacity/stability indicates a failure of the listed criteria and associated (estimated exceedance of criteria) based on original Rational Formula Method analyses.

Table 17: Summary of Conveyance Structure Analysis Results for Tyrone Existing Structures

Tyrone Facility	Top Channels	Benches	Downchutes
3 Tailing Impoundment	✓	✓	✓
3X Tailing Impoundment	✓	✓	✓
2 Tailing Impoundment	✓	✓	✓
1X Tailing Impoundment	✓	✓	✓
1/1X Tailing Impoundments	--	--	▢
1 Tailing Impoundment	✓	✓	✓
1A Tailing Impoundment	✓	✓	✓
1 Tailing North Ponds Area	✓	--	--
1 Tailing Southern Area	▢	--	--
1 Leach Stockpile	✓	--	✓
USNR	✓	--	--
1C Waste	--	--	✓
7A Waste	✓	✓	△
7A Far West	--	--	✓
Burro Mountain Tailing Impoundment	△	--	--

✓ = indicates that the structure provides capacity based on original Rational Formula Method analyses;

▢ = indicates that the structure provides capacity based on modified Rational Formula Method analyses;

△ = indicates that the structure provides capacity based on HEC-HMS modeling;

-- = indicates that a structure type is not present

The conservative Rational Formula Method is shown to produce estimated flowrates over five times those estimated with the more detailed HEC-HMS (actual range 5.3 to 41.5 times the HEC-HMS estimates shown in Table 14). The fact that NOAA Atlas 14 precipitation depths (i.e., larger than those from the REPS tool) were used for this analysis adds confidence to the conclusions and demonstrates the robustness of the current and planned conveyance structures. That said, WSP's understanding is that precipitation depths derived from the REPS tool represent the most up-to-date and accurate analysis of the regional climate and have been accepted for use by the State Engineer's office. As such, for future design and modeling work, it is recommended to use precipitation values from the REPS tool.

Signature Page

WSP USA Inc.

Christian Olson
Associate Water Resources Engineer

Brendan O'Brian
Senior Lead Consultant

CO/BO/af

https://wsponline.sharepoint.com/:w:/r/sites/GLOBAL-FMINMOPSClimateChang/Project%20Files/6%20Deliverable/001-RPT-Closure_SW_Conv_Precip_Analysis_T3/Rev0/31404677.015-001-RPT-0-Closure_SW_Conv_Precip_Analysis_T3_16JUN23.docx

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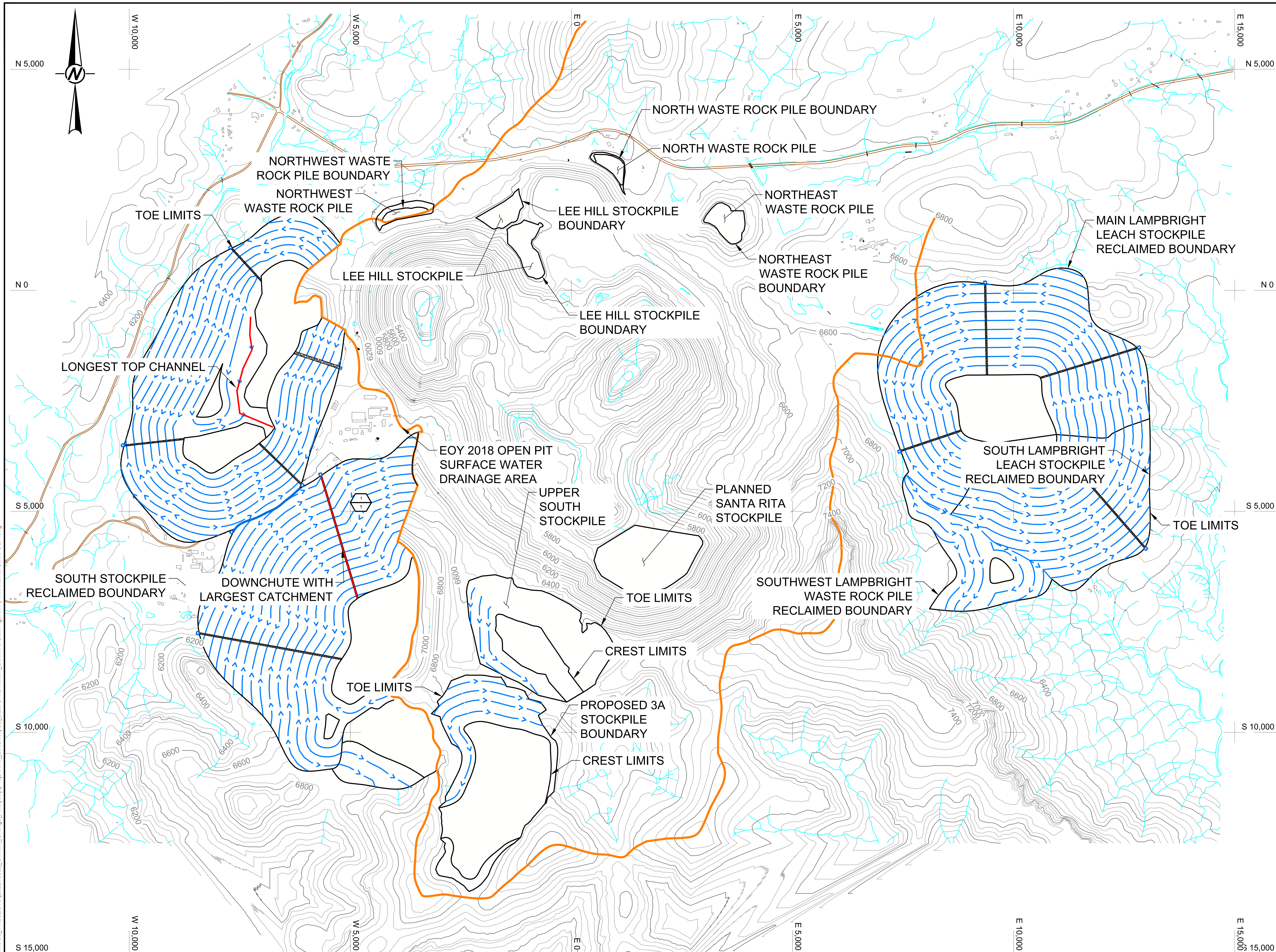
APPENDIX A

Site Maps – Figures 1 through 13



LEGEND

(red line)	WORST-CASE STRUCTURE
6250	EXISTING CONTOURS
6250	REGRADED CONTOURS
(blue dash-dot line)	CHANNEL
(hatched line)	DOWN CHUTE CHANNEL
(orange line)	OPEN PIT SURFACE WATER DRAINAGE AREA

NOT FOR CONSTRUCTION

DRAFT

0 1200 2400

SCALE FEET

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PHOENIX ARIZONA
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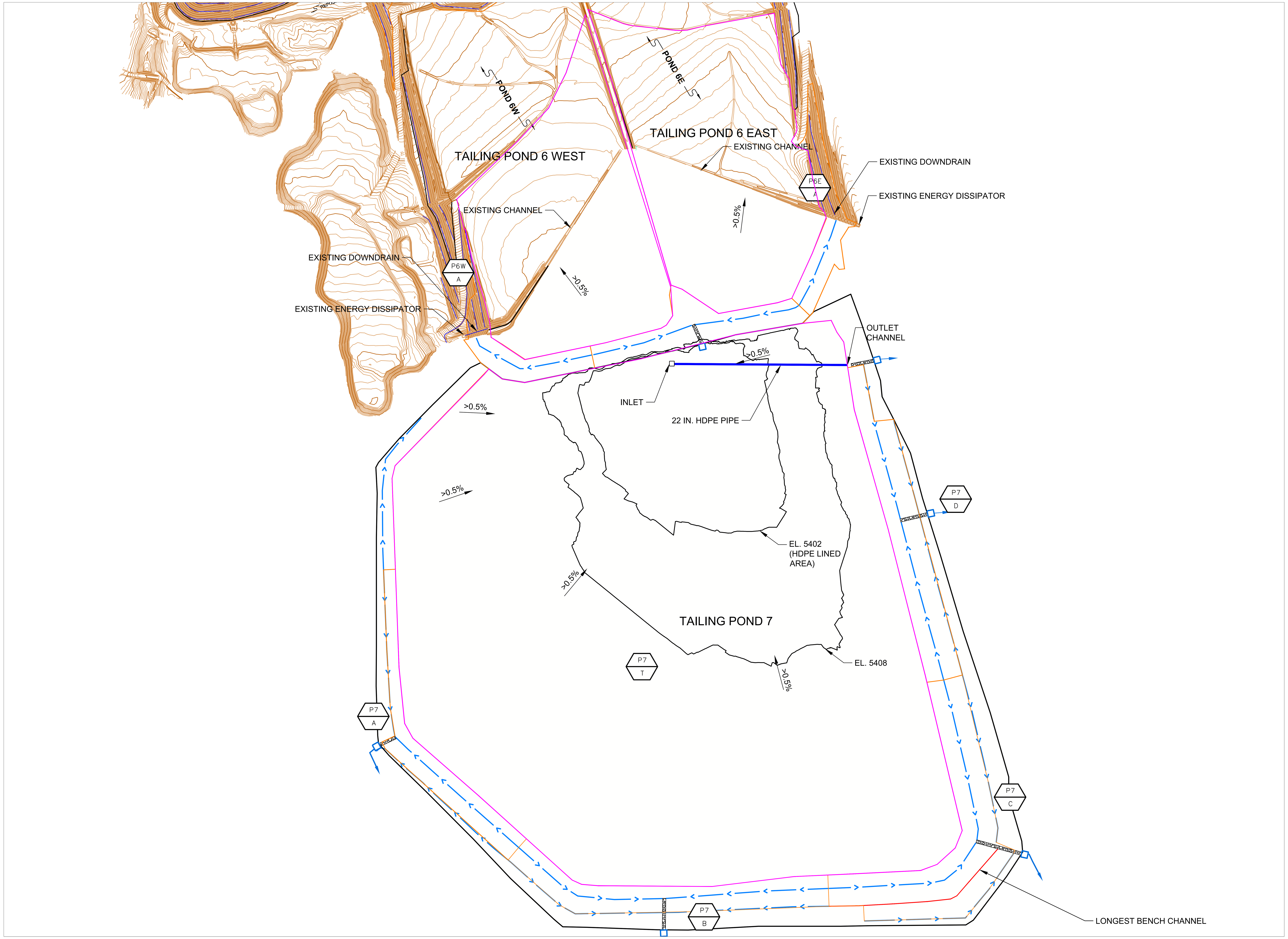
- FMI NEW MEXICO OPERATIONS

TITLE
CHINO NORTH CCP STRUCTURES

PROJECT No.	CONTROL	Rev.	FIGURE
31404677.015		----	01

01 of 13



LEGEND

(red line)	WORST-CASE STRUCTURE
6250 5790	REGRADED CONTOURS
(blue line)	CHANNEL
(orange line)	SUBBASIN DELINEATION
(magenta line)	FLAT TOP AREA

NOT FOR CONSTRUCTION

DRAFT

N

0 800 1600

1" = 800' FEET

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TITLE
CHINO SOUTH CCP STRUCTURES

PROJECT No.	CONTROL	Rev.	02 of 013	FIGURE
31404677.015		A		02

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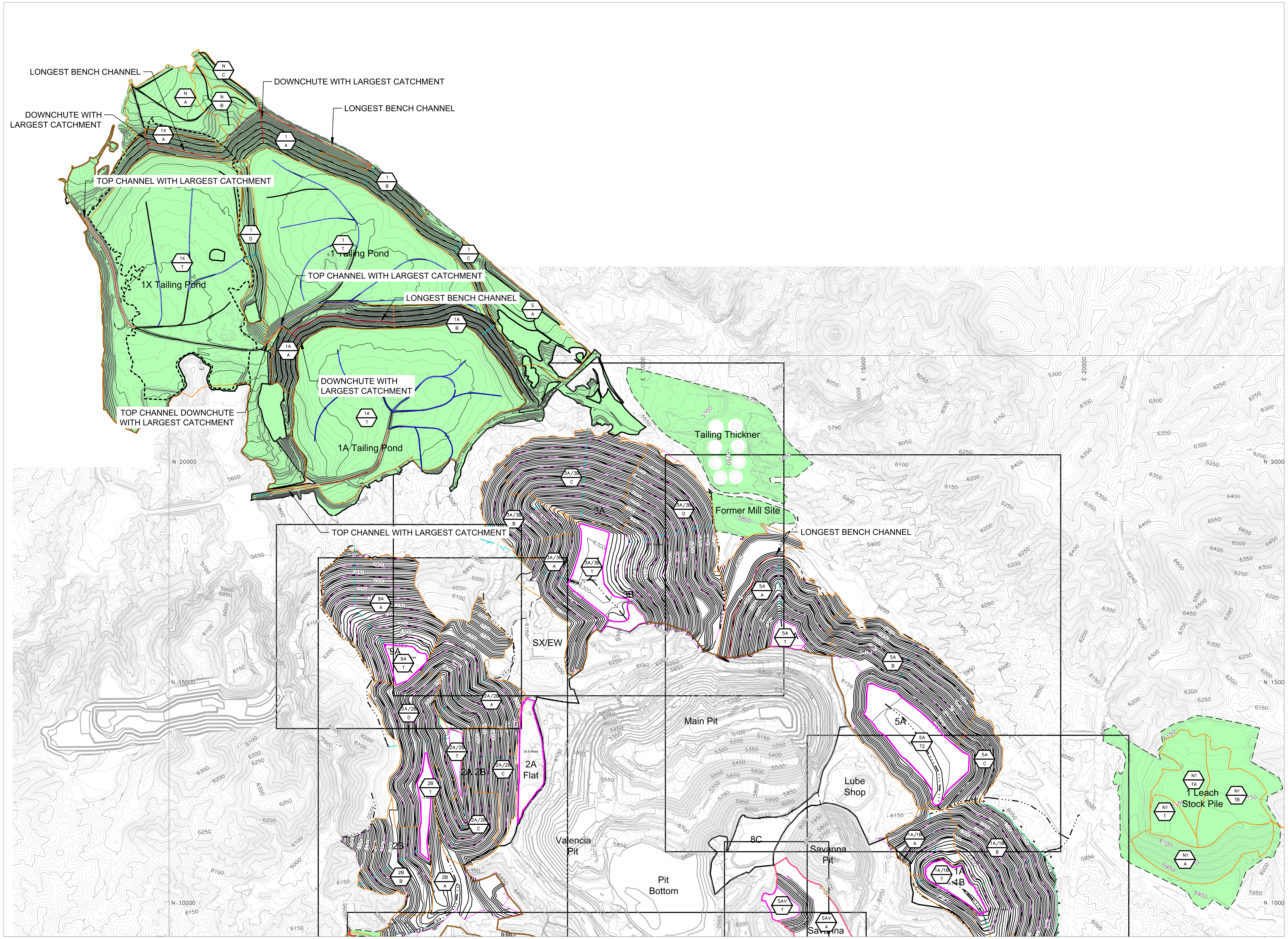

LEGEND

- 'WORST-CASE STRUCTURE
- EXISTING CONTOURS
- REGRADED CONTOURS
- RECLAMATION AREA
- CCP INTERIOR FLAT AREA
- CHANNEL
- DOWN CHUTE CHANNEL
- SUBBASIN DELINEATION
- RECLAIMED AREAS (2014)
- DRAINAGE CHANNEL

NOT FOR CONSTRUCTION

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0 700 1400
1" = 700' FEET

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- FMI NEW MEXICO OPERATIONS

TITLE
TYRONE NORTH AREA OVERVIEW
-CCP AND EXISTING RECLAIMED AREAS

PROJECT No. 31404677.015 | CONTROL | Rev. ---- | 03 of 013 | FIGURE 03

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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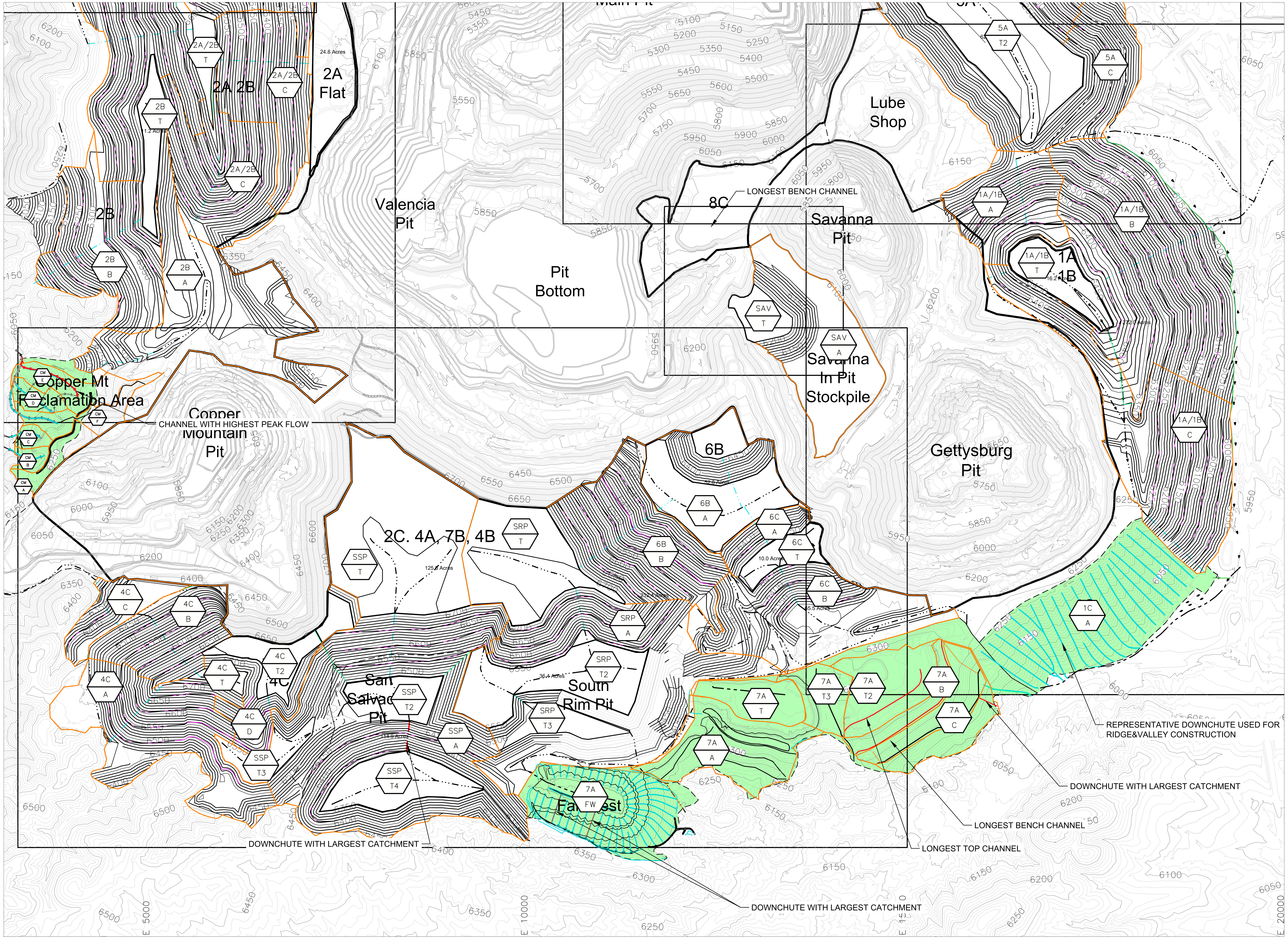

LEGEND

- 'WORST-CASE STRUCTURE
- 6250 EXISTING CONTOURS
- 6250 REGRADED CONTOURS
- RECLAMATION AREA
- CCP INTERIOR FLAT AREA
- CHANNEL
- DOWN CHUTE CHANNEL
- SUBBASIN DELINEATION
- RECLAIMED AREAS (2014)
- DRAINAGE CHANNEL

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0 700 1400
1" = 700' FEET

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- FMI NEW MEXICO OPERATIONS

TITLE
TYRONE SOUTH AREA OVERVIEW - CCP AND EXISTING RECLAIMED AREAS

PROJECT No.	CONTROL	Rev.		FIGURE
31404677.015		----	04 of 012	04

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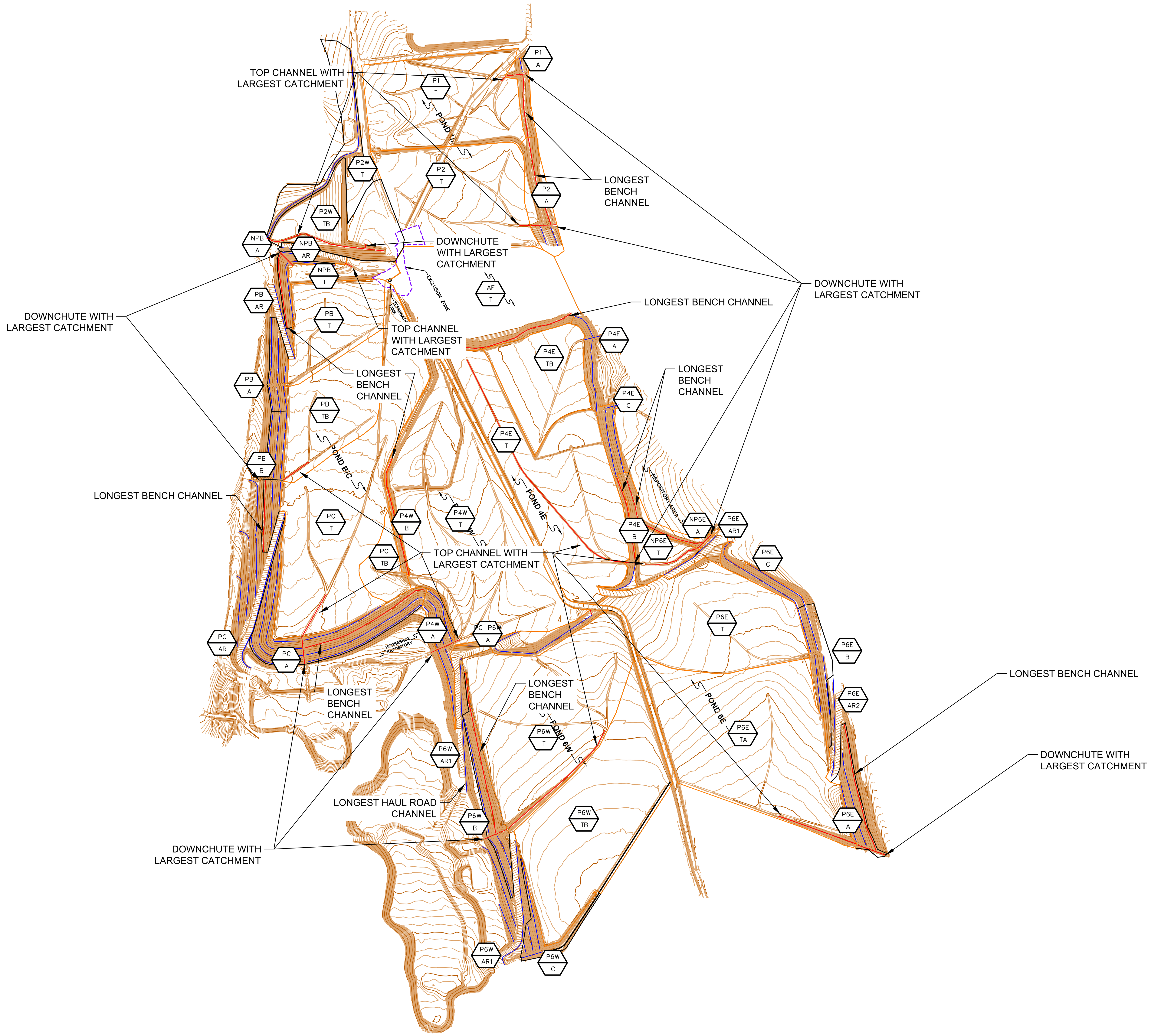

LEGEND

WORST-CASE STRUCTURE

REGRADED CONTOURS

CHANNEL

SUBBASIN DELINEATION

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0 1000 2000

1" = 1000' FEET

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TITLE
CHINO TAILINGS PONDS AS-BUILTS

PROJECT No.	CONTROL	Rev.	005 of 013	FIGURE
31404677.015		----		05

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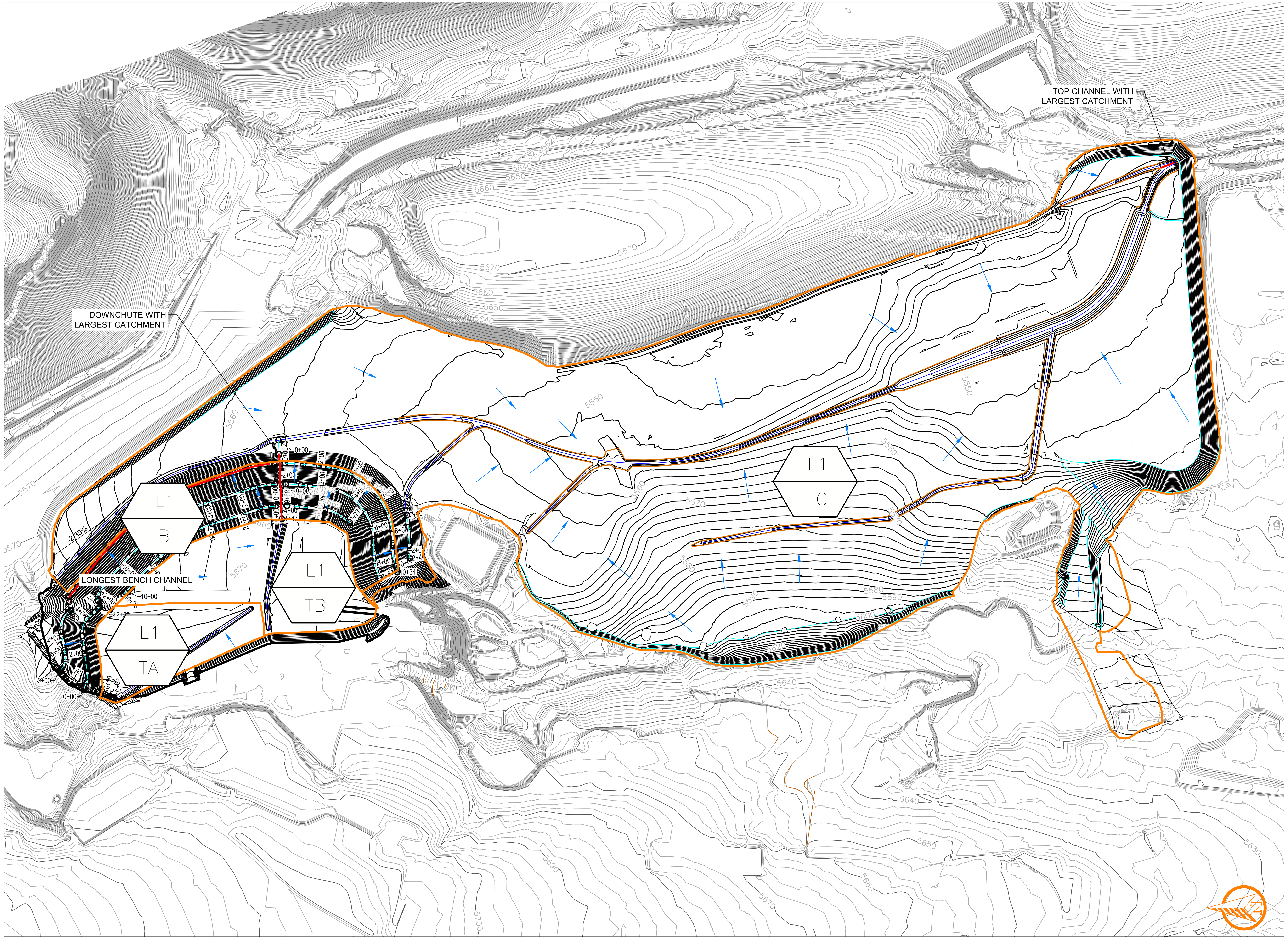

LEGEND

(red line)	WORST-CASE STRUCTURE
6250	EXISTING CONTOURS
6250	REGRADED CONTOURS
(blue line)	CHANNEL
	DOWNCHUTE/BENCH CHANNEL
(orange line)	SUBBASIN DELINEATION

0 300 600
1" = 300' FEET

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TITLE
CHINO LAKE ONE AND SLAG PILE AS-BUILTS

PROJECT No.	CONTROL	Rev.		FIGURE
31404677.015		----	06 of 13	06

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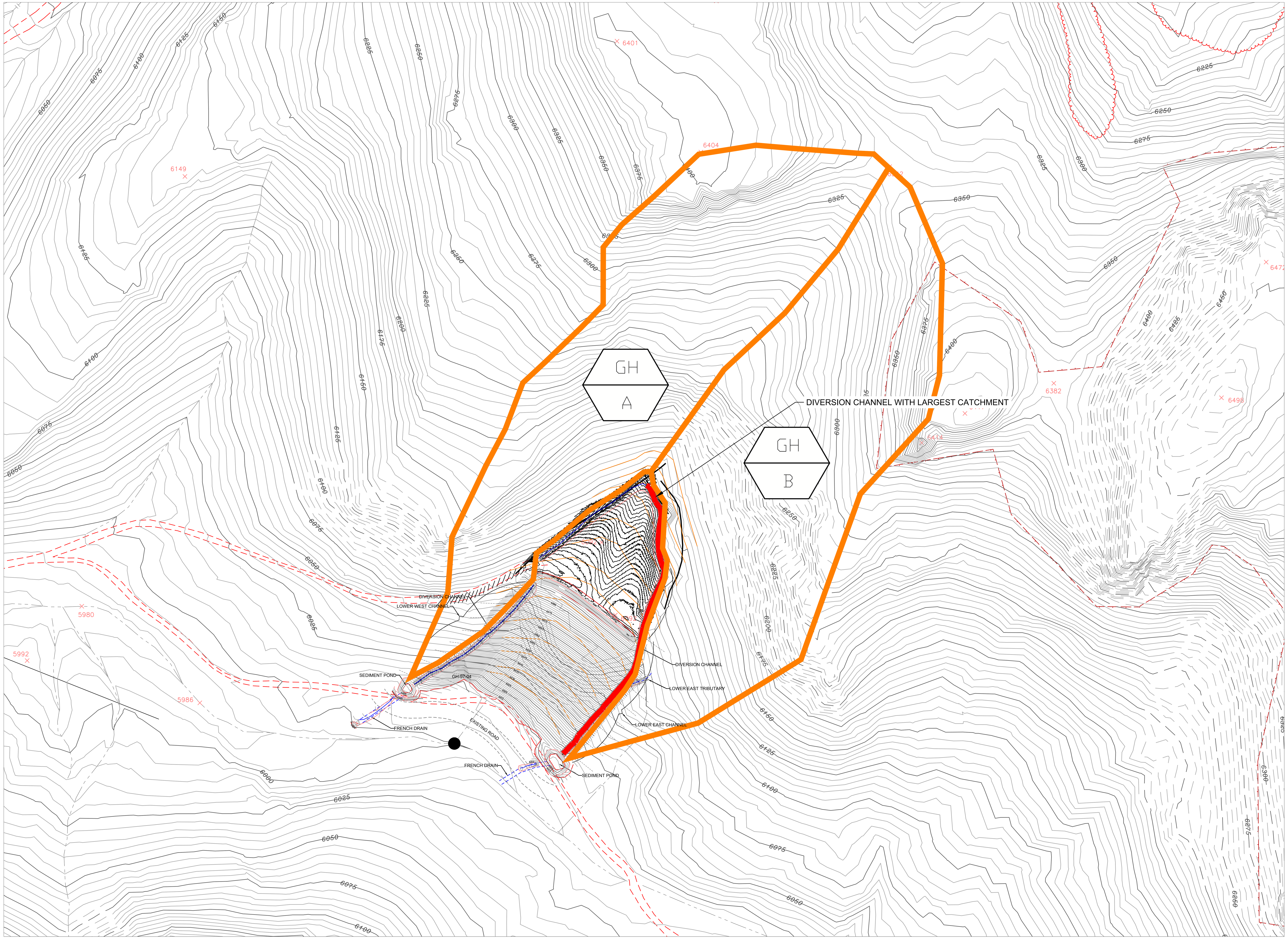

WORST CASE STRUCTURE
6250 EXISTING CONTOURS
6250 REGRADED CONTOURS
CHANNEL
SUBBASIN DELINEATION

0 1000 2000
1" = 1000' FEET

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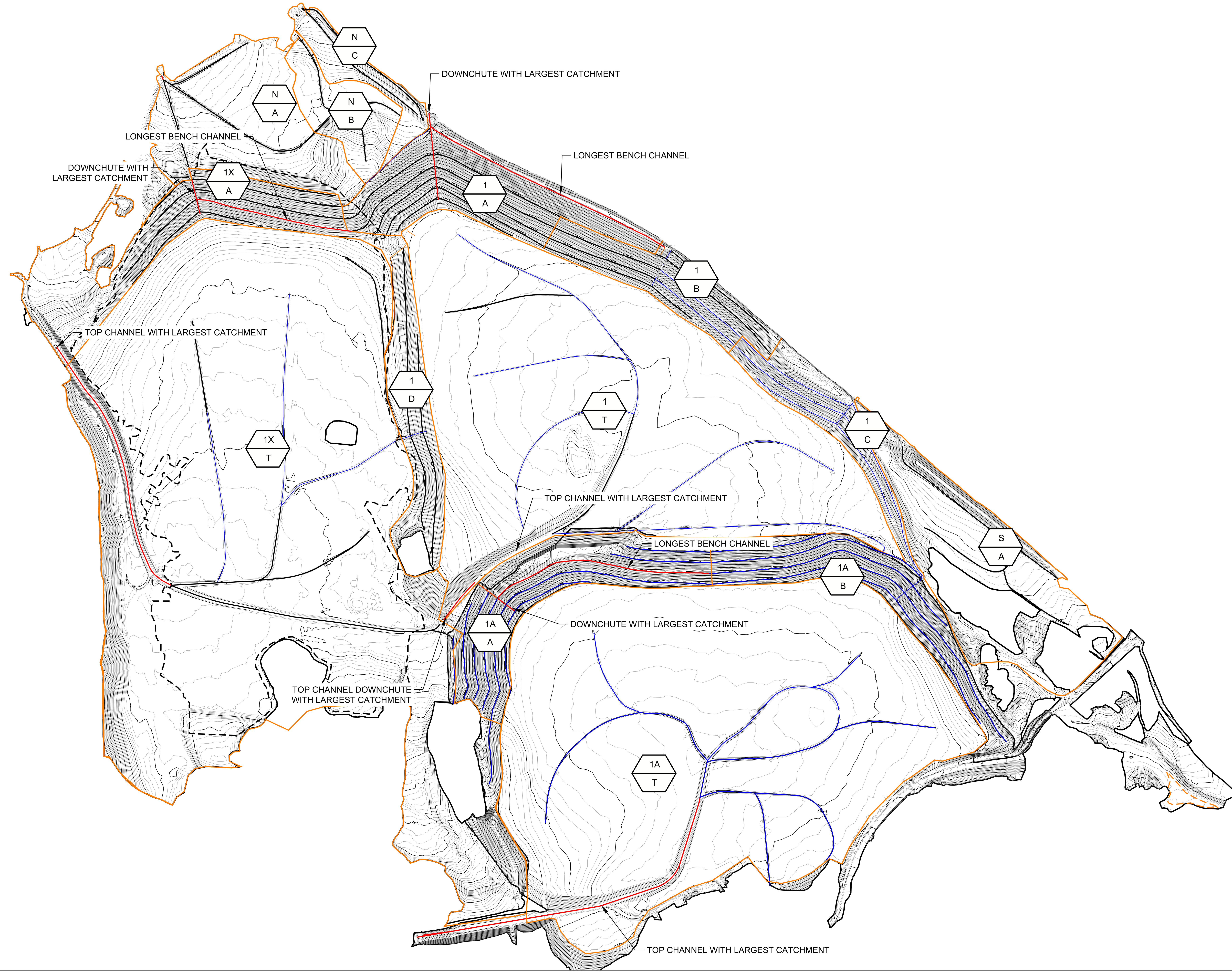
TITLE
CHINO GROUNDHOG MINE AS-BUILTS

PROJECT No. 31404677.015 | CONTROL | Rev. ---- | 007 of 0013 | FIGURE 07



LEGEND

- WORST-CASE STRUCTURE
- 6250 EXISTING CONTOURS
- 6250 REGRADED CONTOURS
- CHANNEL
- DOWN CHUTE CHANNEL
- SUBBASIN DELINEATION

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0 700 1400

1" = 700' FEET

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- FMI NEW MEXICO OPERATIONS

TITLE
TYRONE 1, 1A, AND 1X TAILING IMPOUNDMENTS AS-BUILT

PROJECT No.	CONTROL	Rev.		FIGURE
31404677.015		----	008 of 013	08

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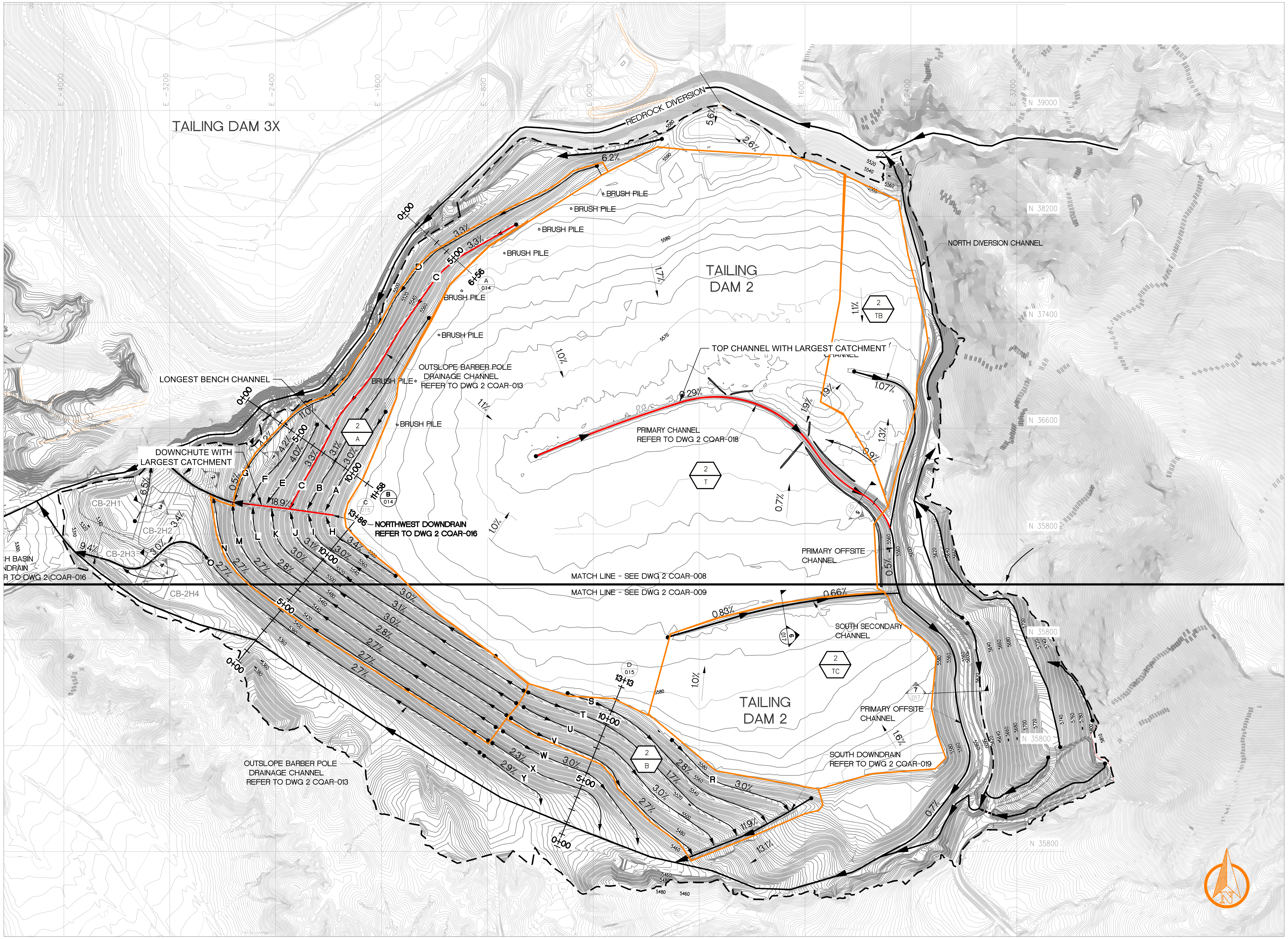

LEGEND

(red line)	WORST CASE STRUCTURE
6250	EXISTING CONTOURS
6250	REGRADED CONTOURS
(black line)	CHANNEL
(orange line)	SUBBASIN DELINEATION

NOT FOR CONSTRUCTION

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0 400 800

1" = 400' FEET

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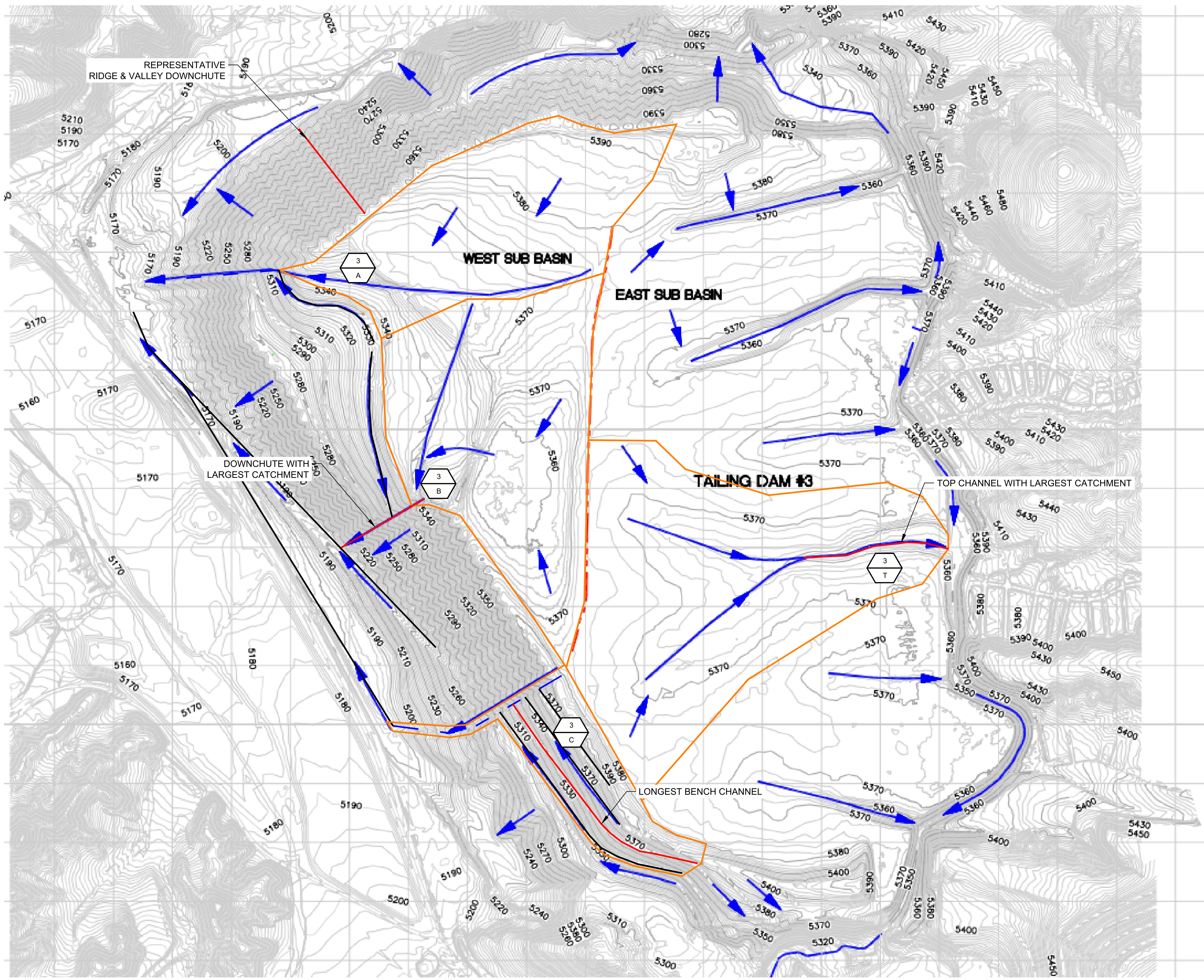
TASK 3 PRECIPITATION ANALYSIS
- FMI NEW MEXICO OPERATIONS

TITLE

TYRONE 2 TAILING IMPOUNDMENT AS-BUILT

PROJECT No.	CONTROL	Rev.	009 of 013	FIGURE
31404677.015		----		09



LEGEND

(red line)	WORST-CASE STRUCTURE
6250	EXISTING CONTOURS
6250	REGRADED CONTOURS
(black line)	CHANNEL
(dash-dot line)	DOWN CHUTE CHANNEL
(orange line)	SUBBASIN DELINEATION

NOT FOR CONSTRUCTION

DRAFT

0 700 1400

1" = 700' FEET

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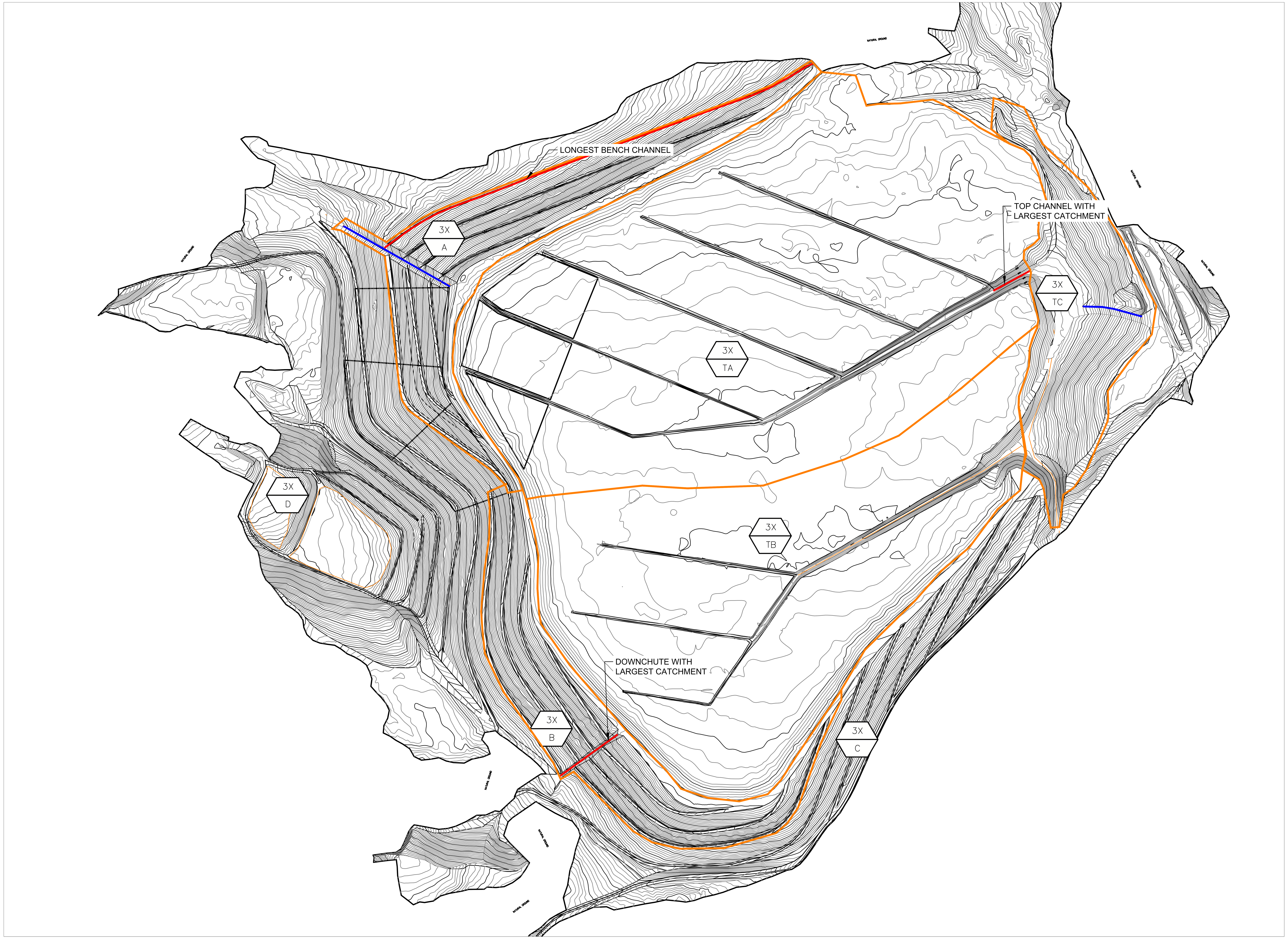
TITLE
TYRONE 3 TAILING IMPOUNDMENT AS-BUILT

PROJECT No.	CONTROL	Rev.		FIGURE
31404677.015		----	010 of 013	10



LEGEND

- 'WORST-CASE STRUCTURE
- 6250 EXISTING CONTOURS
- 6250 REGRADED CONTOURS
- CHANNEL
- DOWN CHUTE CHANNEL
- SUBBASIN DELINEATION

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0 300 600
1" = 300' FEET

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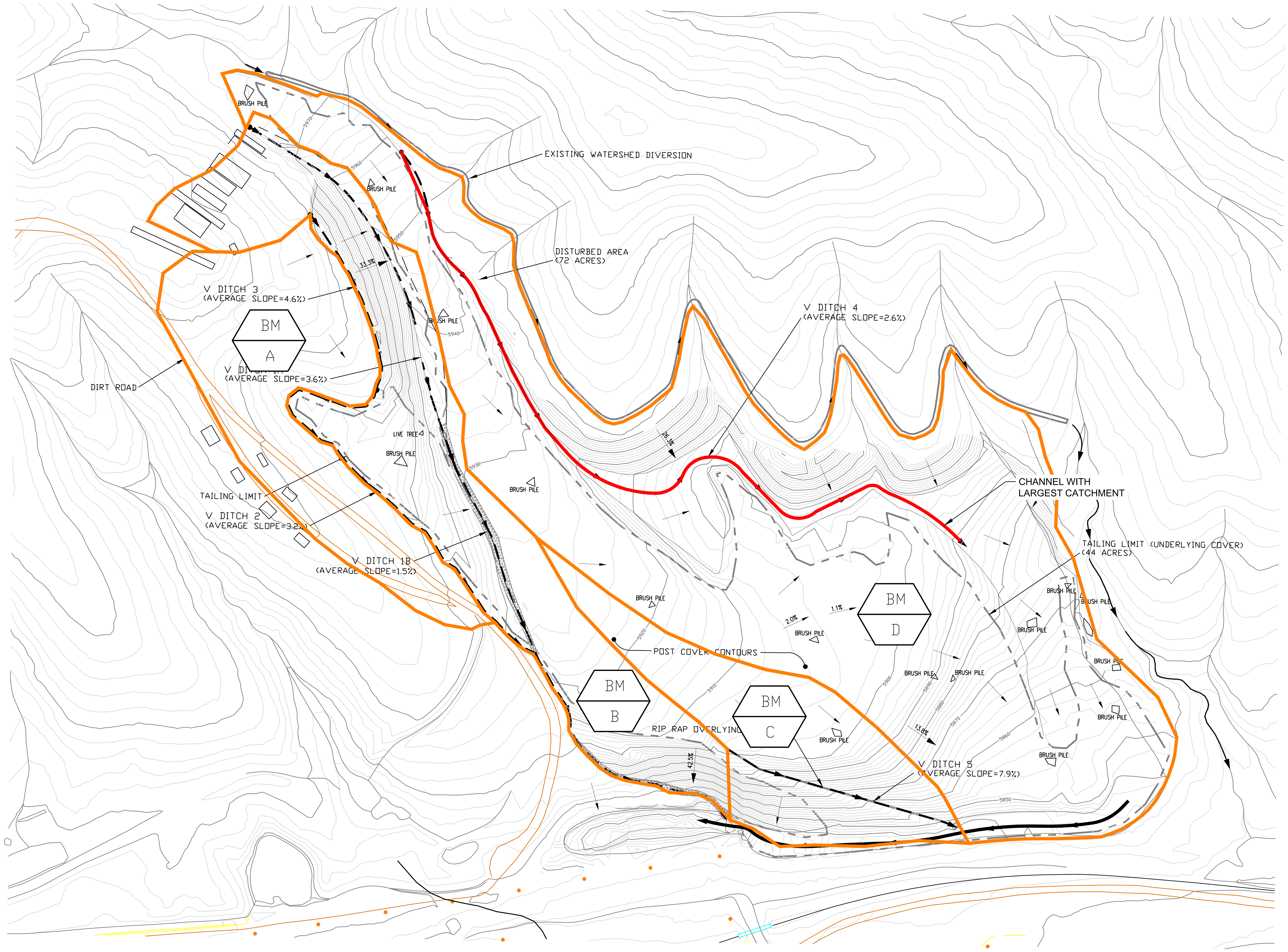
TITLE
TYRONE 3X TAILING IMPOUNDMENT AS-BUILT

PROJECT No. 31404677.015 | CONTROL | Rev. ---- | 011 of 013 | FIGURE 11



LEGEND

	WORST-CASE STRUCTURE
6250	EXISTING CONTOURS
6250	REGRADED CONTOURS
	CHANNEL
	SUBBASIN DELINEATION

NOT FOR CONSTRUCTION

DRAFT

0 200 400

1" = 200' FEET

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TITLE
TYRONE BURRO MOUNTAIN TAILING IMPOUNDMENT AS-BUILT

PROJECT No.	CONTROL	Rev.	012 of 013	FIGURE
31404677.015		----		12

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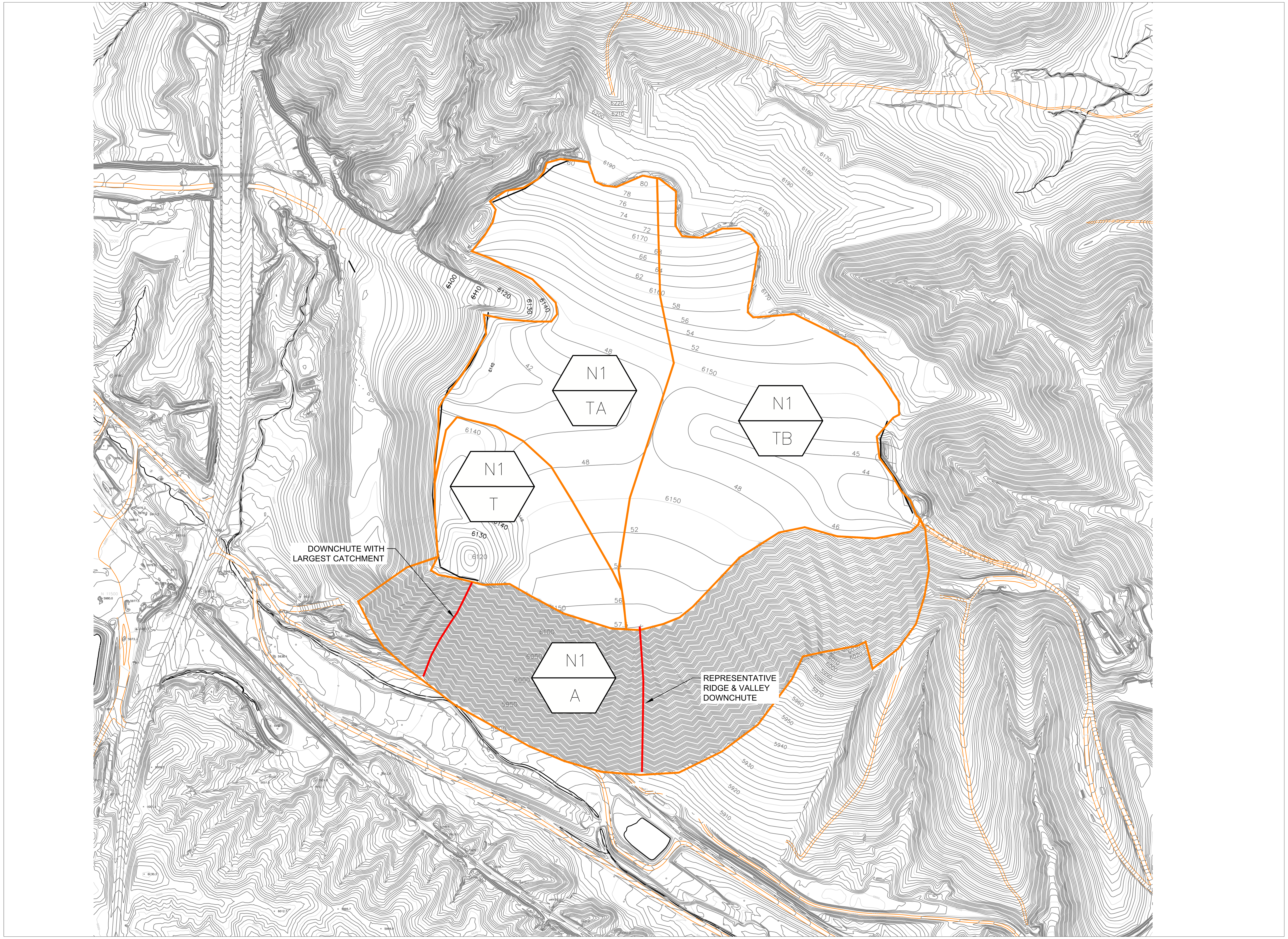

LEGEND

- WORST-CASE STRUCTURE
- 6250 EXISTING CONTOURS
- 6250 REGRADED CONTOURS
- CHANNEL
- SUBBASIN DELINEATION

NOT FOR CONSTRUCTION

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0 700 1400

1" = 700' FEET

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TITLE
TYRONE 1 LEACH STOCKPILE AS-BUILT

PROJECT No.	CONTROL	Rev.	013 of 013	FIGURE
31404677.015		----		13

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APPENDIX B

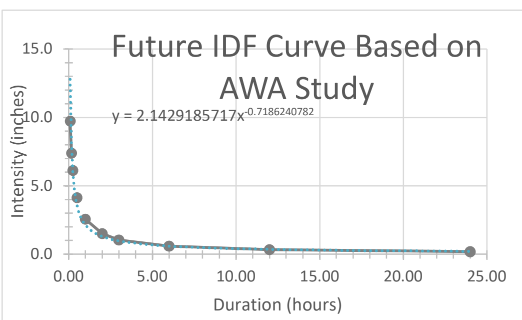
Summary Calculation Sheets and Results Tables

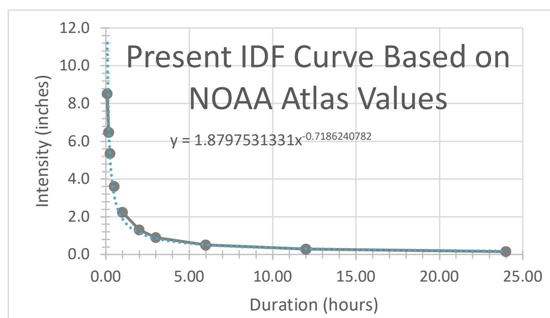
Chino IDF Calculation

Depth-Duration (inches) from NOAA Atlas 14 for Lattitude 32.7922, Longitude -108.0378 W										
Return Period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr	500-yr	1000-yr	100-yr*1.14
5-min	0.293	0.387	0.46	0.557	0.632	0.711	0.792	0.899	0.986	0.81054
10-min	0.446	0.589	0.7	0.847	0.962	1.08	1.21	1.37	1.5	1.2312
15-min	0.552	0.73	0.868	1.05	1.19	1.34	1.49	1.7	1.86	1.5276
30-min	0.744	0.984	1.17	1.42	1.61	1.81	2.01	2.29	2.51	2.0634
1-hr	0.92	1.22	1.45	1.75	1.99	2.24	2.49	2.83	3.1	2.5536
2-hr	1.05	1.39	1.66	2.03	2.32	2.63	2.95	3.39	3.75	2.9982
3-hr	1.13	1.46	1.74	2.11	2.42	2.73	3.07	3.53	3.9	3.1122
6-hr	1.32	1.69	1.98	2.39	2.71	3.05	3.4	3.88	4.27	3.477
12-hr	1.56	1.97	2.3	2.75	3.09	3.46	3.83	4.32	4.72	3.9444
24-hr	1.88	2.33	2.69	3.18	3.55	3.93	4.32	4.84	5.24	4.4802

1	2	3	4	5	6	7				
NOAA Intesity-Duration (in/hr)								NOAA*1.14	IDF curve derived	
Return Period	t (hr)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	100-yr *1.14	future	current
5-min	0.08	3.52	4.64	5.52	6.68	7.58	8.53	9.73	12.78	11.21
10-min	0.17	2.68	3.53	4.20	5.08	5.77	6.48	7.39	7.77	6.81
13.3 min	0.22								6.33	5.55
15-min	0.25	2.21	2.92	3.47	4.20	4.76	5.36	6.11	5.80	5.09
16.67-min	0.28								5.38	4.72
29.8	0.50								3.54	3.11
30-min	0.50	1.49	1.97	2.34	2.84	3.22	3.62	4.13	3.53	3.09
37.9 min	0.63								2.98	2.62
1-hr	1.00	0.92	1.22	1.45	1.75	1.99	2.24	2.55	2.14	1.88
2-hr	2.00	0.53	0.70	0.83	1.02	1.16	1.32	1.50	1.30	1.14
3-hr	3.00	0.38	0.49	0.58	0.70	0.81	0.91	1.04	0.97	0.85
6-hr	6.00	0.22	0.28	0.33	0.40	0.45	0.51	0.58	0.59	0.52
12-hr	12.00	0.13	0.16	0.19	0.23	0.26	0.29	0.33	0.36	0.32
24-hr	24.00	0.08	0.10	0.11	0.13	0.15	0.16	0.19	0.22	0.19

Minimum 10-min Intensity-Duration Value Used for Benched Slopes (Modified Rational Method)
Interpolated Intensity-Duration For Top Surfaces (Modified Rational Method)
Interpolated Intensity-Duration For Top Surfaces (Standard Rational Method)
Minimum 10-min Intensity-Duration Value Used for Benched Slopes (Standard Rational Method)





Tyrone IDF Calculation

Depth-Duration (inches) from NOAA Atlas 14 for Latitude: 32.645, Longitude: -108.3748										
Return Period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr	500-yr	1000-yr	100-yr*1.14
5-min	0.288	0.38	0.449	0.542	0.614	0.689	0.765	0.867	0.949	0.78546
10-min	0.439	0.578	0.684	0.825	0.935	1.05	1.17	1.32	1.44	1.197
15-min	0.543	0.716	0.848	1.02	1.16	1.3	1.44	1.64	1.79	1.482
30-min	0.732	0.965	1.14	1.38	1.56	1.75	1.95	2.2	2.41	1.995
1-hr	0.906	1.19	1.41	1.71	1.93	2.17	2.41	2.73	2.98	2.4738
2-hr	1.03	1.35	1.61	1.97	2.26	2.56	2.88	3.32	3.68	2.9184
3-hr	1.09	1.41	1.68	2.05	2.35	2.66	3	3.46	3.84	3.0324
6-hr	1.26	1.62	1.91	2.31	2.64	2.98	3.35	3.85	4.27	3.3972
12-hr	1.46	1.86	2.17	2.61	2.95	3.32	3.69	4.21	4.63	3.7848
24-hr	1.79	2.22	2.56	3.02	3.39	3.76	4.14	4.66	5.06	4.2864

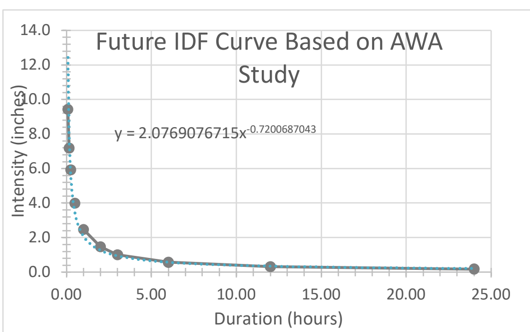
1	2	3	4	5	6	7			
NOAA Intesity-Duration (in/hr)							NOAA*1.14	IDF curve derived	
Return Period	t (hr)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	100-yr*1.14	future	current
5-min	0.08	3.46	4.56	5.39	6.50	7.37	8.27	9.43	12.43	10.90
10-min	0.17	2.63	3.47	4.10	4.95	5.61	6.30	7.18	7.55	6.62
13.3 min	0.22								6.15	5.39
15-min	0.25	2.17	2.86	3.39	4.08	4.64	5.20	5.93	5.64	4.94
16.67-min	0.28								5.22	4.58
29.8-min	0.50								3.44	3.02
30-min	0.50	1.46	1.93	2.28	2.76	3.12	3.50	3.99	3.42	3.00
37.9 min	0.63								2.89	2.54
1-hr	1.00	0.91	1.19	1.41	1.71	1.93	2.17	2.47	2.08	1.82
2-hr	2.00	0.52	0.68	0.81	0.99	1.13	1.28	1.46	1.26	1.11
3-hr	3.00	0.36	0.47	0.56	0.68	0.78	0.89	1.01	0.94	0.83
6-hr	6.00	0.21	0.27	0.32	0.39	0.44	0.50	0.57	0.57	0.50
12-hr	12.00	0.12	0.16	0.18	0.22	0.25	0.28	0.32	0.35	0.30
24-hr	24.00	0.07	0.09	0.11	0.13	0.14	0.16	0.18	0.21	0.18

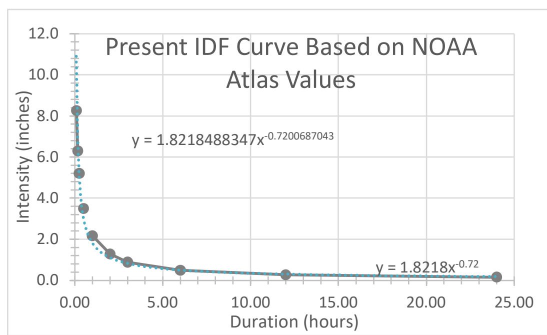
Minimum 10-min Intensity-Duration Value Used for Benched Slopes (Modified Rational Method)

Interpolated Intensity-Duration For Top Surfaces (Modified Rational Method)

Interpolated Intensity-Duration For Top Surfaces (Standard Rational Method)

Minimum 10-min Intensity-Duration Value Used for Benched Slopes (Standard Rational Method)





CHINO RATIONAL METHOD

Goal: Calculate Conservative Estimate of Unit Flow
Method: Rational Method
Design Storm: 100 year - 24 hour

Step 1 - Determine the unit area of a typical bench.

Dimension	Value	Units
Interbench vertical height	36	ft
interbench slope angle	3	H:1V
interbench slope length	108	ft
bench width	20	ft
area per ft of bench	128	sq ft

Step 2 - Determine Composite C, for the stockpliles.
5 YR (for TOC calcs) and the 100 YR (design) storm events.

			Modified Rational Method	Standard Rational Method
Catchment ID	**Area (ac)**	**C_5**[1]	**C_{100}**[1]	**C_{100}**[1]
Bench	0.0003	0.28		
Slope	0.0029	0.40		
Total/Composite	0.0029	0.43	0.52	0.60
Top Area	1.0000		0.47	0.59

1. Coefficients assumed Undeveloped, Pasture/Range. From Applied Hydrology, (Chow et al., 1988).
2. Standard Rational runoff coeffients utilized from a previous analysis of Chino (Step 3, below), however slope area has been adjusted for the area per ft of bench.
3. Coeffients based on HSB A&B 40% cover

Step 3 - Determine Time of Concentration, (t_c) for the standard rational method
Overland Flow
Maximum overland flow length for rural areas = 500 ft
Minimum tc for non-urban areas = 10 min

Catchment ID	**Length (ft)**	**Slope (ft/ft)**	**T_i (min)**
Typical	189.87	0.33	5.2

1. Tc and distances from previous analysis was estimated with a TR55 method on representative facilities and found to be valid. Tc Unchanged from past analysis.
2. 2.2.1.4.2 Time of Concentration by the Kirpich Formula

Catchment ID	**Length (ft)**	**Conveyance Factor**	**Slope (ft/ft)**	**T_t (min)**	**T_C (min)**
Typical	1	10	0.05	0.01	**5.2**

3. Tc from previous analysis was estimated with a TR55 method on representative facilities and found to be valid. Tc Unchanged from past analysis of Chino CCP Structures
4. Channelized Flow - Using a conveyance factor for "nearly bare ground" for conservatism

Step 4 - Determine the rainfall intensity for the design storm.

The intensity was then assumed constant for all watersheds.

Standard Rational Method		
Condition	**Future/AWA Adjusted**	**Present/Unadjusted**
100-yr, 10-min Intensity (in/hr)	7.3872	6.48
100-yr, 16.67-min Intensity (in/hr)	5.379174436	4.72

Modifed Rational Method		
Condition	**Future/AWA Adjusted**	**Present/Unadjusted**
100-yr, 29.8-min Intensity (in/hr)	3.54	3.11
100-yr, 37.9-min Intensity (in/hr)	2.98	2.62

Step 5 - Calculate the peak flow rate.
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		Standard Rational Method			
		Future/AWA Adjusted		**Present/Unadjusted**	
	Catchment ID	**Peak Unit Runoff (cfs/ft)**	**Peak Unit Runoff (cfs/ac)**	**Peak Unit Runoff (cfs/ft)**	**Peak Unit Runoff (cfs/ac)**
Bench	Typical	0.013	4.43	0.01	3.89
Top	Top Area		3.17		2.78

		Modified Rational Method			
		Future/AWA Adjusted		**Present/Unadjusted**	
	Catchment ID	**Peak Unit Runoff (cfs/ft)**	**Peak Unit Runoff (cfs/ac)**	**Peak Unit Runoff (cfs/ft)**	**Peak Unit Runoff (cfs/ac)**
Bench	Typical	0.005	1.86	0.005	1.63
Top	Top Area		1.39		1.22

1. Bench Channel lengths to be multiplied by peak runoff per foot
2. Top Surfaces to be multiplied by peak runoff per acre

TYRONE RATIONAL METHOD

Goal: Calculate Conservative Estimate of Unit Flow
Method: Rational Method
Design Storm: 100 year - 24 hour

Step 1 - Determine the unit area of a typical bench.

Dimension	Value	Units
Interbench vertical height	30	ft
interbench slope angle	~3	H:1V
interbench slope length	112	ft
bench width	14	ft
area per ft of bench	126	sq ft

Step 2 - Determine Composite C, for the stockpliles.
5 YR (for TOC calcs) and the 100 YR (design) storm events.

			Modified Rational Method	Standard Rational Method
Catchment ID	Area (ac)	C_5[1]	C_{100}[1]	C_{100}[2]
Bench	0.0003	0.28		
Slope	0.0027	0.40		
Total/Composite	0.0029	0.41	0.57	0.60
Top Area	1.0000		0.46	0.59

1. Coefficients assumed Undeveloped, Pasture/Range. From Applied Hydrology, (Chow et al., 1988).
2. Standard Rational runoff coeffients utilized from a previous analysis of Chino (Step 3, below), however slope area has been adjusted for the area per ft of bench.
3. Coeffients based on HSB A&B 40% cover

Step 3 - Determine Time of Concentration, (t_c) for the standard rational method
Overland Flow
Maximum overland flow length for rural areas = 500 ft
Minimum tc for non-urban areas = 10 min

Catchment ID	Length (ft)	Slope (ft/ft)	T_i (min)
Typical	189.87	0.33	5.4

1. Tc and distances from previous analysis was estimated with a TR55 method on representative facilities and found to be valid. Tc Unchanged from past analysis.
2. 2.2.1.4.2 Time of Concentration by the Kirpich Formula

Catchment ID	Length (ft)	Conveyance Factor	Slope (ft/ft)	T_t (min)	T_C (min)
Typical	1	10	0.05	0.01	5.4

3. Tc from previous analysis was estimated with a TR55 method on representative facilities and found to be valid. Tc Unchanged from past analysis of Chino CCP Structures
4. Channelized Flow - Using a conveyance factor for "nearly bare ground" for conservatism

Step 4 - Determine the rainfall intensity for the design storm.
The minimum time of concentration for non-urban areas is 10 minutes, as such 10 minutes was used to calculate intensity.
The intensity was then assumed constant for all watersheds.

Standard Rational Method		
Condition	Future	Current
100-yr, 10-min Intensity (in/hr)	0.00	0.00
100-yr, 16.67-min Intensity (in/hr)	0.00	0.00

Modified Rational Method		
Condition	Future	Current
100-yr, 29.8-min Intensity (in/hr)	3.44	3.02
100-yr, 37.9-min Intensity (in/hr)	2.89	2.54

Step 5 - Calculate the unit peak flow rate.

		Standard Rational Method			
		Future/AWA Adjusted		Present/Unadjusted	
	Catchment ID	Peak Unit Runoff (cfs/ft)	Peak Unit Runoff (cfs/ac)	Peak Unit Runoff (cfs/ft)	Peak Unit Runoff (cfs/ac)
Bench	Typical	0.012	4.31	0.01	3.78
Top	Top Area		3.08		2.70

		Modified Rational Method			
		Future/AWA Adjusted		Present/Unadjusted	
	Catchment ID	Peak Unit Runoff (cfs/ft)	Peak Unit Runoff (cfs/ac)	Peak Unit Runoff (cfs/ft)	Peak Unit Runoff (cfs/ac)
Bench	Typical	0.006	1.96	0.005	1.72
Top	Top Area		1.32		1.15

1. Bench Channel lengths to be multiplied by peak runoff per foot
2. Top Surfaces to be multiplied by peak runoff per acre

Current and Future conditions Comparison								
Chino								
Subbasin ID	Length of terrace channels (ft)	Top Areas (ft^2)	Top Areas (ac)	Peak Flow from terraces (cfs)	Peak Flow from Tops (cfs)	Total Peak Flow in Downchute (cfs)	Total Peak Flow in Downchute AWA (cfs)	delta (cfs)
South SP-1	50,885	2,374,565	55	1,061	173	1082	1,234	151
South SP-2	39,788	1,280,449	29	829	93	809	923	113
West SP-1	21,523	1,173,358	27	449	85	469	534	66
West SP-2	9,543	887,788	20	199	65	231	264	32
West SP-3	23,850	4,018,710	92	497	293	693	790	97
West SP-4	29,257	454,768	10	610	33	564	643	79
Main Lampbright-1	31,900	1,110,444	25	665	81	654	746	92
West Lampbright-2	25,138	419,314	10	524	31	486	555	68
South Lampbright-1	25,536	1,196,736	27	532	87	543	620	76
South Lampbright-2	46,227	653,932	15	964	48	887	1,011	124
P6W-A	4,203	9,458,540	217	88	206	258	294	36
P6E-A	3,938	10,589,624	243	82	231	275	313	38
P7-T	3,149	57,012,844	1,309	66	819	776	884	109
P7-A	2,537	0	0	53	0	46	53	6
P7-B	9,998	0	0	208	0	183	208	26
P7-C	13,196	0	0	275	0	241	275	34
P7-D	8,829	0	0	184	0	161	184	23
Axiflow Lake	2,100	4,155,758	95	44	303	304	347	42
Tyrone								
1A/1B-A	4,431	0	0	90	0	79	90	11
1A/1B-B	24,095	0	0	488	0	428	488	60
1A/1B-C	16,726	719,008	17	339	51	342	390	48
Savannah	0	374,909	9	0	27	23	27	3
6C-A	615	0	0	12	0	11	12	2
6C-B	5,242	436,305	10	106	31	120	137	17
6B-A	2,509	317,922	7	51	22	64	73	9
6B-B	11,030	0	0	224	0	196	224	27
SRP-A	13,049	4,012,563	92	264	284	481	548	67
SSP-A	17,327	4,519,465	104	351	320	589	671	82
SSP-T4	2,655	1,014,392	23	54	72	110	126	15
4C-A	10,995	0	0	223	0	195	223	27
4C-B	9,614	136,209	3	195	10	179	204	25
4C-C	3,296	732,052	17	67	52	104	119	15
9A-A	24,589	550,031	13	498	39	471	537	66
3A/B-A	10,666	0	0	216	0	190	216	27
3A/B-B	9,866	0	0	200	0	175	200	25
3A/B-C	20,034	0	0	406	0	356	406	50
3A/B-D	15,503	1,688,954	39	314	119	380	434	53
5A-A	19,575	347,317	8	397	25	370	421	52
5A-B	19,485	0	0	395	0	346	395	48
5A-C	5,498	2,737,995	63	111	194	268	305	37
2A/2B-A	14,165	257,023	6	287	18	268	305	37
2A/2B-B	8,427	0	0	171	0	150	171	21
2A/2B-C	10,571	0	0	214	0	188	214	26
2A/2B-D	15,503	0	0	314	0	276	314	39
2B-A	3,872	487,743	11	78	35	99	113	14
2B-B	9,831	0	0	199	0	175	199	24

CCP Climate Change Results

Reach Designation	Q100 (cfs)	Design Channel Lining	Present Conditions Available Freeboard (ft)	Climate Change Available Freeboard (ft)
Chino				
Longest Bench Channel	60	Desert Pavement	0.5	0.6
Longest Bench Channel	60	Riprap	0.4	0.5
Downchute With Largest Catchment	1,234	ACB	0.6	0.7
Downchute With Largest Catchment	1,234	Riprap	0.2	0.3
Longest Top Channel	64	Desert Pavement	1.3	1.4
Longest Top Channel	64	Riprap	1.2	1.3
Tyrone				
Longest Bench Channel	56	Desert Pavement	0.5	0.6
Longest Bench Channel	56	Riprap	0.4	0.5
Downchute With Largest Catchment	671	ACB	1.0	1.1
Downchute With Largest Catchment	671	Riprap	0.7	0.8
Longest Top Channel	66	Desert Pavement	0.8	0.9
Longest Top Channel	66	Riprap	0.7	0.8

Channel Analysis - Rational Method

Facility	Structure	Worst Case Structure Description	Peak Flow	Design Channel Lining	Available Freeboard (ft)
Tailing Pond 1	Top Channels	Main Top Channel (post-confluence of T-1,1&2)	263	Riprap	-0.2
	Bench Channels	East face, Top Southern Bench (OS-12-B)	13	Riprap	1.1
	Downchutes	East Face Downchute (Spillway 15)	279	ACB	1.1
Tailing Pond 2	Top channels	Main pond 2 top channel (post-confluence of T-2,1&2)	267	Riprap	-0.3
	Downchutes	East Face Downchute (Spillway 16)	310	ACB	3.2
	Bench Channels	East face lower bench (OS-12-C)	19	Riprap	1.0
Tailing Pond 2 Repository	Top Channels	Southern Channel through Repository (T-2,3)	166	Riprap	-0.4
	Downchutes	Dounchute into T-2,3	43	ACB	3.8
Axiflow Lake	Bench Channels	Bench to pit bottom	27	Riprap	0.9
Tailing Pond 4 East	Top Channels	Main Top Channel (T-4E,2)	513	Riprap	-1.3
	Downchutes	From Top Channel to NP6E (Spillway 11)	468	ACB	1.0
	Bench Channels	East Face Bench (OS-4E-F)	18	Riprap	1.0
North of Pond 6 (Tailing Pond 4E Repository)	Top Channels	From Pond 4 to Downchute (T-4E,4)	513	Riprap	-0.5
	Bench Channels	East face bench (OS-4E-G)	24	Riprap	0.9
	Downchutes	East Face Downchute (Spillway 12)	537	ACB	1.0
Tailing Pond 6 East	Top Channels	Main Top Channel (post confluence of T-6E,2 & TS-6E,3)	461	Riprap	13.3
	Bench Channels	East Face Lower Bench (OS-6E-H)	27	Riprap	0.5
	Downchutes	Southern Downchute (Spillway 8)	522	ACB	1.0
Tailing Pond 6 West	Top Channels	Main Top Channel (post-confluence of T-6W,1 & TS-6W,2)	444	Riprap	13.3
	Bench Channels	West Face, Second Highest Bench (OS-6W-C)	34	Riprap	0.4
	Downchutes	Northern Downchute, West Face (Spillway 5)	525	ACB	1.1
Tailing Pond 4 West	Downchutes	West Face Downchute (Spillway 10)	644	ACB	1.0
	Bench Channels	East Face Bench between PC and P4W (OS-4W-A)	25	Riprap	0.9
	Top Channels	Main Top Channel (Post-confluence of T-4W, 1-4)	593	Riprap	1.1
Tailing Pond C	Top Channels	Main Top Channel (T-C,1)	424	Riprap	-1.0
	Bench Channels	South/West Face, Second Highest Bench (OS-BC-Y)	28	Riprap	0.8
	Downchutes	South Face Downchute (Spillway 3)	600	ACB	1.0
Tailing Pond B	Top Channels	Southern Main Channel (T-B,2)	171	Riprap	0.2
	Bench Channels	Northern Lowest Bench, West Face (OS-BC-G)	15	Riprap	1.1
	Downchutes	Southern Downchute, West Face (Spillway 2)	246	ACB	1.4
North of Tailing Pond B	Top Channels	Main Top Channel post-confluence (T-B North 1 &2)	38	Riprap	2.2
	Bench Channels	West Face, Lower Bench (OS-BC-D)	24	Riprap	0.9
	Downchutes	West Face Downchute (Spillway 1B)	42	ACB	1.8
Groundhog Mine	Diversion Channel	West Diversion Channel	23	Riprap	-0.04
Lake One and Slag Pile	Bench Channels	East face lowest bench on slag pile (O9)	19	Riprap	1.5
	Top Channels	Southeast main junction at culvert (P1 & S5)	694	Riprap	3.0
	Downchutes	slag pile east face (D2)	52	ACB	1.8
1X Tailing Impoundment	Top Channels	Main Top Collector Channel (T1X-Main-A)	2,450	Riprap	2.0
	Bench Channels	North Face, West of Downchute (1X-E-2)	21	Riprap	1.4
	Downchutes	North Face Downchute (1X Downdrain)	132	Riprap	1.6
1 Tailing Impoundment	Top Channels	Main Top Collector Channel (T1-Main-A)	1,007	Riprap	2.0
	Bench Channels	Bottom Channel, East Face (1-WE-6)	35	Riprap	1.2
	Downchutes	East Face Downchute (1B-NW-Downdrain)	212	Riprap	1.4
1 Tailing North Ponds	Top Channels	West Outlet (NX-1)	306	Riprap	0.8
1 Tailing Southern Area	Top Channels	Easternmost Channel (12P-C13)	227	Riprap	-0.3
1A Tailing Impoundment	Top Channels	Main Top Collector Channel (T1A-MAIN-B2)	1,037	Riprap	21.8
	Downchutes	Northwest Downchute (1A Downchute)	151	Riprap	3.6
	Bench Channels	Lowest Bench East of Western Downchute (1A-NW3)	30	Riprap	1.3
1X/1 Tailing Impoundments	Downchutes	Downchute Between both Top Surfaces	1007	Riprap	-0.2
1C Waste	Downchutes	Representative Downchute (longest)	2	Riprap	0.9
7A Far West	Downchutes	Downchute With Top Surface Flow	15	Riprap	1.8
Burro Mountain Tailing Impoundment	Channels	Main Runoff V Ditch (V Ditch 4)	121	Desert Pavement	-1.9
USNR	Channels	Northernmost Drainage Channel (Drainage 1)	35	Riprap	0.6
7A Waste	Top Channels	Western top Channel (7A-ET1)	77	Leach Cap	0.6
	Bench Channels	West Bench Channel (7A EW1)	72	Desert Pavement	1.0
	Downchute	Southwest Face, 2 x 24" HDPE culverts at end of channel	66	Plastic	NA
1 Leach Stockpile	Downchutes	Representative Downchute (longest)	6	Riprap	0.9
	Downchutes with Top Flow	Representative Downchute w/ Top Flow	61	Riprap	0.67
3X Tailing Impoundment	Downchutes	West Face Southern Downchute (South Downdrain)	137	Riprap	2.18
	Bench Channels	North Face Bottom Bench (4)	33	Riprap	0.27
	Top Channels	North Main Top Channel (9)	385	Riprap	12.37
2 Tailing Impoundment	Downchutes	Northwest Face Downchute (Northwest Downdrain)	321	Riprap	1.83
	Top Channels	Main Top Collector Channel (Primary Channel)	832	Desert Pavement	9.21
	Bench Channels	Northwest Face, Bottom Bench (C)	48	Riprap	1.21
3 Tailing Impoundment	Top Channels	Third Top Channel from the South	236	Desert Pavement	0.50
	Downchutes	East Face Downchute, Second from South	185	Riprap	8.89
	Bench Channels	East Face Second from Bottom Bench	22	Riprap	0.25
	Downchutes	Longest Ridge/Valley Structure	8	Riprap	2.82
Tailing Pond 6 West	Downchutes	Northern Downchute, West Face (Spillway 5)	82	ACB	1.70
Tailing Pond 4 West	Downchutes	West Face Downchute (Spillway 10)	99	ACB	1.66
Tailing Pond C	Downchutes	South Face Downchute (Spillway 3)	83	ACB	1.70
1X/1 Tailing Impoundments	Downchutes	Downchute Between both Top Surfaces	139	Riprap	1.26
1 Tailing Impoundment	Bench Channels	Bottom Channel, East Face (1-WE-6)	6	Riprap	1.70
1A Tailing Impoundment	Downchutes	Northwest Downchute (1A Downchute)	25	Riprap	3.85
	Bench Channels	Lowest Bench East of Western Downchute (1A-NW3)	3	Riprap	1.82
2 Tailing Impoundment	Downchutes	Northwest Face Downchute (Northwest Downdrain)	36	Riprap	2.67
7A Waste	Downchute	Southwest Face, 2 x 24" HDPE culverts at end of channel	8	Plastic	NA
Tailing Pond 4 East	Top Channels	Main Top Channel (T-4E,2)	58	Riprap	1.03
Burro Mountain Impoundment	Channels	Main Runoff V Ditch (V Ditch 4)	13	Grass-lined	0.67

Structure Re-Analyzed in HEC-HMS; HEC-HMS Result

Channel Analysis - Modified Rational Method

Facility	Structure	Worst Case Structure Description	Peak Flow (cfs)	Design Channel Lining	Available Freeboard (ft)
Tailing Pond 1	Top Channels	Main Top Channel (post-confluence of T-1,1&2)	115	Riprap	0.6
	Bench Channels	East face, Top Southern Bench (OS-12-B)	6	Riprap	1.4
	Downchutes	East Face Downchute (Spillway 15)	122	ACB	1.5
Tailing Pond 2	Top channels	Main pond 2 top channel (post-confluence of T-2,1&2)	117	Riprap	0.5
	Downchutes	East Face Downchute (Spillway 16)	310	ACB	3.2
	Bench Channels	East face lower bench (OS-12-C)	8	Riprap	1.3
Tailing Pond 2 Repository	Top Channels	Southern Channel through Repository (T-2,3)	72	Riprap	0.4
	Downchutes	Dounchute into T-2,3	19	ACB	3.9
Axiflow Lake	Bench Channels	Bench to pit bottom	11	Riprap	1.2
Tailing Pond 4 East	Top Channels	Main Top Channel (T-4E,2)	225	Riprap	-0.1
	Downchutes	From Top Channel to NP6E (Spillway 11)	205	ACB	1.4
	Bench Channels	East Face Bench (OS-4E-F)	8	Riprap	1.3
Tailing Pond 4E Repository	Top Channels	From Pond 4 to Downchute (T-4E,4)	225	Riprap	0.8
	Bench Channels	East face bench (OS-4E-G)	10	Riprap	1.2
	Downchutes	East Face Downchute (Spillway 12)	235	ACB	1.4
Tailing Pond 6 East	Top Channels	Main Top Channel (post confluence of T-6E,2 & TS-6E,3)	202	Riprap	14.3
	Bench Channels	East Face Lower Bench (OS-6E-H)	11	Riprap	1.0
	Downchutes	Southern Downchute (Spillway 8)	227	ACB	1.4
Tailing Pond 6 West	Top Channels	Main Top Channel (post-confluence of T-6W,1 & TS-6W,2)	194	Riprap	14.3
	Bench Channels	West Face, Second Highest Bench (OS-6W-C)	14	Riprap	0.9
	Downchutes	Northern Downchute, West Face (Spillway 5)	228	ACB	1.4
Tailing Pond 4 West	Downchutes	West Face Downchute (Spillway 10)	280	ACB	1.4
	Bench Channels	East Face Bench between PC and P4W (OS-4W-A)	11	Riprap	1.2
	Top Channels	Main Top Channel (Post-confluence of T-4W, 1-4)	259	Riprap	2.2
Tailing Pond C	Top Channels	Main Top Channel (T-C,1)	186	Riprap	0.1
	Bench Channels	South/West Face, Second Highest Bench (OS-BC-Y)	12	Riprap	1.2
	Downchutes	South Face Downchute (Spillway 3)	260	ACB	1.4
Tailing Pond B	Top Channels	Southern Main Channel (T-B,2)	75	Riprap	0.9
	Bench Channels	Northern Lowest Bench, West Face (OS-BC-G)	6	Riprap	1.3
	Downchutes	Southern Downchute, West Face (Spillway 2)	106	ACB	1.6
North of Tailing Pond B	Top Channels	Main Top Channel post-confluence (T-B North 1 &2)	17	Riprap	2.5
	Bench Channels	West Face, Lower Bench (OS-BC-D)	10	Riprap	1.2
	Downchutes	West Face Downchute (Spillway 1B)	18	ACB	1.9
Groundhog Miine	Diversion Channel	West Diversion Channel	10	Riprap	0.11
Lake One and Slag Pile	Bench Channels	East face lowest bench on slag pile (O9)	8	Riprap	1.7
	Top Channels	Southeast main junction at culvert (P1 & S5) Lake One	304	Riprap	4.2
	Downchutes	Slag pile east face (D2)	23	ACB	1.9
1X Tailing Impoundment	Top Channels	Main Top Collector Channel (T1X-Main-A)	1,062	Riprap	4.9
	Bench Channels	North Face, West of Downchute (1X-E-2)	10	Riprap	1.3
	Downchutes	North Face Downchute (1X Downdrain)	60	Riprap	1.7
1 Tailing Impoundment	Top Channels	Main Top Collector Channel (T1-Main-A)	434	Riprap	4.3
	Bench Channels	Bottom Channel, East Face (1-WE-6)	16	Riprap	2.5
	Downchutes	East Face Downchute (1B-NW-Downdrain)	96	Riprap	1.6
1 Tailing North Ponds	Top Channels	West Outlet (NX-1)	134	Riprap	1.3
1 Tailing Southern Area	Top Channels	Easternmost Channel (12P-C13)	97	Riprap	0.5
1A Tailing Impoundment	Top Channels	Main Top Collector Channel (T1A-MAIN-B2)	443	Riprap	9.2
	Downchutes	Northwest Downchute (1A Downchute)	443	Riprap	3.2
	Bench Channels	Lowest Bench East of Western Downchute (1A-NW3)	14	Riprap	3.1
1X/1 Tailing Impoundments	Downchutes	Downchute Between both Top Surfaces (1X-J Downdrain)	434	Riprap	0.6
1C Waste	Downchutes	Representative Downchute (longest)	2	Riprap	0.9
7A Far West	Downchutes	Downchute With Top Surface Flow (#9)	9	Riprap	1.9
Burro Mountain Tailing Impoundment	Channels	Main Runoff V Ditch (V Ditch 4)	93	Desert Pavement	-0.8
USNR	Channels	Northernmost Drainage Channel (Drainage 1)	15	Riprap	0.8
7A Waste	Top Channels	Western top Channel (7A-ET1)	33	Leach Cap	0.7
	Bench Channels	West Bench Channel (7A EW1)	33	Desert Pavement	1.7
	Downchute	Southwest Face, 2 x 24" HDPE culverts at end of channel	30	Plastic	NA
1 Leach Stockpile	Downchutes	Representative Downchute (longest)	6	Riprap	0.9
	Downchutes with Top Flow	Representative Downchute w/ Top Flow	29	Riprap	0.79
3X Tailing Impoundment	Downchutes	West Face Southern Downchute (South Downdrain)	62	Riprap	2.48
	Bench Channels	North Face Bottom Bench (4)	15	Riprap	0.11
	Top Channels	North Main Top Channel (9)	164	Riprap	13.70
2 Tailing Impoundment	Downchutes	Northwest Face Downchute (Northwest Downdrain)	146	Riprap	2.26
	Top Channels	Main Top Collector Channel (Primary Channel)	355	Desert Pavement	10.93
	Bench Channels	Northwest Face, Bottom Bench (C)	22	Riprap	1.51
3 Tailing Impoundment	Top Channels	Third Top Channel from the South	101	Desert Pavement	1.09
	Downchutes	East Face Downchute, Second from South	80	Riprap	9.31
	Bench Channels	East Face Second from Bottom Bench	10	Riprap	0.62
	Downchutes	Longest Ridge/Valley Structure	8	Riprap	2.82
Tailing Pond 6 West	Downchutes	Northern Downchute, West Face (Spillway 5)	82	ACB	1.70
Tailing Pond 4 West	Downchutes	West Face Downchute (Spillway 10)	99	ACB	1.66
Tailing Pond C	Downchutes	South Face Downchute (Spillway 3)	83	ACB	1.70
1X/1 Tailing Impoundments	Downchutes	Downchute Between both Top Surfaces	139	Riprap	1.26
1 Tailing Impoundment	Bench Channels	Bottom Channel, East Face (1-WE-6)	6	Riprap	1.70
1A Tailing Impoundment	Downchutes	Northwest Downchute (1A Downchute)	25	Riprap	3.85
	Bench Channels	Lowest Bench East of Western Downchute (1A-NW3)	3	Riprap	1.82
2 Tailing Impoundment	Downchutes	Northwest Face Downchute (Northwest Downdrain)	36	Riprap	2.67
7A Waste	Pipes/Culverts	Southwest Face, 2 x 24" HDPE culverts	8	Plastic	NA
Tailing Pond 4 East	Top Channels	Main Top Channel (T-4E,2)	58	Riprap	1.03
Burro Mountain Tailing Impoundment	Channels	Main Runoff V Ditch (V Ditch 4)	13	Riprap	0.90

Structure Re-Analyzed in HEC-HMS; HEC-HMS RESULT

HEC-HMS Summary Tables

Global Summary Results for Run "Tyrone 10 East Burro Mtn"

Proje... HMS Analysis　Simulation R... Tyrone 10 East Burro ...

Start of R... 01Jan2023, 00...　Basin Mod... Burro Moun...
End of R... 02Jan2023, 12...　Meteorologic Mo... Tyrone 10 e...
Compute Ti... 01Jun2023, 16:0...　Control Specificati... Contr...

Show Eleme... All Elements　Volume Un... (•) IN ( ) ACRE-...　Sorti... Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
BM-A	0.0190	6.3	02Jan2023, 00:15	2.28
BM-B	0.0286	9.5	02Jan2023, 00:15	2.28
V-Ditch-1D	0.0190	6.3	02Jan2023, 00:16	2.28
BM-D	0.0819	26.5	02Jan2023, 00:16	2.28
Toe-2	0.0819	26.4	02Jan2023, 00:19	2.28
BM-C	0.0150	4.9	02Jan2023, 00:16	2.28
BM-C&D	0.0969	31.3	02Jan2023, 00:18	2.28
BM-A&B	0.0476	15.8	02Jan2023, 00:15	2.28
Out	0.1445	46.9	02Jan2023, 00:16	2.28
V-Ditch_Eval	0.0406	13.3	02Jan2023, 00:16	2.28
V-Ditch_out	0.0406	13.3	02Jan2023, 00:16	2.28

Figure 1: Burro Mountain Results

Global Summary Results for Run "Chino 10 East"

Proje... HMS Analysis　Simulation R... Chino 10 E...

Start of R... 01Jan2023, 00...　Basin Mod... Chi...
End of R... 02Jan2023, 12...　Meteorologic Mo... Chino 10 e...
Compute Ti... 30May2023, 11:58...　Control Specificati... Contr...

Show Eleme... All Eleme...　Volume Un... (•) IN ( ) ACRE-...　Sorti... Hydrolo...

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
PC-T	0.2081	65.1	02Jan2023, 00:09	2.88
Spillway 3	0.2081	65.1	02Jan2023, 00:10	2.88
PC-A	0.0558	20.0	02Jan2023, 00:00	2.88
P4W-T	0.2570	84.7	02Jan2023, 00:05	2.88
PC-TB	0.0224	8.0	02Jan2023, 00:00	2.88
P4W-B	0.0052	1.8	02Jan2023, 00:03	2.88
R-1	0.0276	9.7	02Jan2023, 00:08	2.88
R-2	0.0276	9.7	02Jan2023, 00:08	2.88
Spillway 10	0.2846	94.4	02Jan2023, 00:06	2.88
P4W-A	0.0159	5.7	02Jan2023, 00:00	2.88
S-10	0.3005	98.5	02Jan2023, 00:03	2.88
S-3	0.2639	82.5	02Jan2023, 00:02	2.88
PC-P6W-A	0.0191	6.9	02Jan2023, 00:00	2.88
Reach-4	0.0191	6.9	02Jan2023, 00:06	2.88
P6W-T	0.2008	66.8	02Jan2023, 00:05	2.88
Reach-5	0.0191	6.9	02Jan2023, 00:18	2.88
Spillway 5	0.2199	73.5	02Jan2023, 00:05	2.88
P6W-B	0.0250	8.8	02Jan2023, 00:01	2.88
S-5	0.2449	82.0	02Jan2023, 00:04	2.88
P4E-T	0.1856	57.7	02Jan2023, 00:08	2.44
4E out	0.1856	57.7	02Jan2023, 00:08	2.44

Figure 2: South Chino Ponds Results

Global Summary Results for Run "Tyrone 10 East 1-1A"

Proje... HMS Analysis Simulation R... Tyrone 10 East 1...

Start of R... 01Jan2023, 00... Basin Mod... Tyro...
End of R... 02Jan2023, 12... Meteorologic Mo... Tyrone 10 e...
Compute Ti... DATA CHANGED, RECOMP... Control Specificati... Contr...

Show Eleme... All Eleme... Volume Un... IN ACRE-... Sorti... Hydrolo...

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
1-A_Bench Eval	0.0202	6.3	02Jan2023, 00:18	2.28
1A-A_Bench Eval	0.0098	3.0	02Jan2023, 00:20	2.28
1-T	0.4343	118.8	02Jan2023, 00:28	2.28
1A-A	0.0764	25.1	02Jan2023, 00:15	2.28
Downchute out	0.5107	138.6	02Jan2023, 00:19	2.28
Bench Out	0.0300	9.3	02Jan2023, 00:19	2.28

Figure 3: Tyrone Tailings Ponds Results

Global Summary Results for Run "Tyrone 10 East Dam 2"

Proje... HMS Analysis Simulation R... Tyrone 10 East Da...

Start of R... 01Jan2023, 00... Basin Mod... Tyrone Da...
End of R... 02Jan2023, 12... Meteorologic Mo... Tyrone 10 e...
Compute Ti... DATA CHANGED, RECOMP... Control Specificati... Contr...

Show Eleme... All Eleme... Volume Un... IN ACRE-... Sorti... Hydrolo...

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
2-A	0.1085	36.2	02Jan2023, 00:15	2.28
Downchute	0.1085	36.2	02Jan2023, 00:15	2.28

Figure 4: Tyrone Tailings Dam 2 Results

Global Summary Results for Run "Tyrone 10 East 7A"

Proje... HMS Analysis Simulation R... Tyrone 10 East...

Start of R... 01Jan2023, 00... Basin Mod... Tyrone ...
End of R... 02Jan2023, 12... Meteorologic Mo... Tyrone 10 e...
Compute Ti... DATA CHANGED, RECOMP... Control Specificati... Contr...

Show Eleme... All Eleme... Volume Un... IN ACRE-... Sorti... Hydrolo...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Downchute Pipe	0.0253	8.4	02Jan2023, 00:15	2.28

Figure 5: Tyrone 7A

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