MOODY FLATS QUARRY

STORMWATER, EROSION CONTROL, AND DRAINAGE PLAN

SHASTA COUNTY, CALIFORNIA

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May 2010

1.0 Introduction

This Stormwater, Erosion Control, and Drainage Plan has been prepared for the Moody Flats Quarry Project (Project) proposed by 3M. The Project is located in western Shasta County (County) 1 mile west of Interstate 5, immediately north of the City of Shasta Lake, and 9 miles north of the City of Redding. 3M proposes to develop a hardrock quarry, aggregate processing facility, ancillary aggregate product facilities (e.g. ready-mix plant, asphalt batch plant, and recycled construction materials plant) and aggregate truck and railcar loadout facility within approximately 1,900-acres owned by 3M. Of the 1,900 acres, approximately 500 acres would be disturbed to develop the facilities listed above. Production and distribution goals include approximately 1.5 million tons of aggregate shipped via rail to regional markets annually, and 0.5 million tons of aggregate and finished products (e.g. ready-mix, asphalt) distributed to local markets via trucks. Maximum proposed annual aggregate sales for the Moody Flats Quarry would be 2 million tons per year. The operation is planned for 100 years and would generate about 200± million tons of aggregate material.

The Stormwater, Erosion Control, and Drainage Plan provided here presents a conceptual plan outlining site specific storm water runoff and sediment control analysis, erosion control mechanisms, and site drainage for the Moody Flats Quarry. The Plan, in Section 2.0, first provides existing site conditions relevant to the analysis and measures necessary to manage stormwater and control erosion. Section 3.0, Stormwater Management Evaluation, outlines the methodology used to calculate stormwater flows and provides the conclusions of that analysis. Erosion control requirements and mechanisms are provided in Section 4.0. The final section, 5.0 Drainage, outlines changes to existing site drainage as a result of mining operations.

At this time, all mine facilities, stormwater mechanisms, and erosion control measures are approximate and/or conceptual, pending environmental review of the Project and final approval by the County. It is anticipated that final acreages, volumes, flow rates and other parameters will be similar to those evaluated in this document, but may not be identical as development of the site may vary due to actual site conditions, final Conditional Use Permit mitigation measures and Conditions of Approval, engineering, and other considerations.

2.0 Site Conditions

Moody Flats Quarry is located in undeveloped open space land dominated by Montane Hardwood-Conifer and Montane Hardwood vegetative habitats. Moody Creek, Rancheria Creek, and Salt Creek transverse the center and eastern portions of the Project site. A Union Pacific Railroad line runs through the eastern portion of the property and Digger Bay Road cuts through the western portion of the property. The northwest corner of the property is within the mapped boundaries of the Whiskeytown-Shasta-Trinity National Recreation Area.

Elevations onsite range from approximately 900 feet above mean sea level (ft msl) to over 2000 ft msl. The precipitation for the Project site is based on rainfall data from the Shasta Dam and Mountaingate areas. Annual average rainfall is approximately 64 inches per year. The 25-year 24-hour storm event is approximately 9.03 inches. The 25-year six-hour storm event is approximately 4.6 inches. (Shasta County Development Standards, 1997, Chapter 2, Attachment Nos. 5 and 8).

The property is within four watersheds, Shasta Lake, Moody Creek, Rancheria Creek and Salt Creek. Salt Creek is a tributary of Churn Creek. Moody Creek and Rancheria Creek are tributaries of Stillwater Creek. Both Churn Creek and Stillwater Creek join the Sacramento River at Anderson approximately eight miles south of Redding.

Soils at the site are defined primarily as Auburn Loam (AnB and AnD) and Auburn Very Stony Clay Loam (AtE2), as defined by the NRCS soil survey maps. These soil types are classified as being part of Hydrologic Soil Group D on Attachment No. 2 in Chapter 2 of the Shasta County Development Standards (1997).

3.0 Stormwater Management Evaluation

3.1 Methodology

The evaluations presented below follow the *Shasta County Development Standards, Chapter 2, Section F - Drainage* (reprinted December 1997) and the California State Water Resources Control Board (SWRCB) *National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, Appendix D: Sediment Basin Sizing*[1]. For the Moody Flats stormwater site design, two basic methodologies were used to develop the conceptual plan. All of the curve numbers (CNs) for the various sub-catchments were calculated using the County of Shasta "Hydrology Analysis" worksheet. Run-off volumes and Time of Concentrations for the various sub-catchment areas were calculated using SCS TR-20 methodology and then checked using the County of Shasta "Hydrology Analysis" worksheet. It was determined that the TR-20 Methodology produced very similar results to the County of Shasta "Hydrology Analysis" worksheet. All of this data was then input into a HydroCAD model utilizing SCS TR-20 Methodology. The HydroCAD model was used for the detailed site-wide analysis because of the site complexity and the required routing of stormwater through the proposed basins. Attachment A includes the design assumptions, parameters, modeling results generated in HydroCAD.

Table 1, Stormwater Design Parameters, summarizes the parameters developed for each watershed at the site, including the weighted curve number (CN), runoff from the 25-year 24-hour storm (R-24), total runoff volume from the 25-year 24-hour storm (V-24), and the time of concentration (Tc).

[1] www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/draft/draftconst_att_d_sed_basin.pdf

For rock outcroppings and barren soil, Soil Group D is assumed to have a "CN" runoff curve number of 93. In areas of forest and grassland, Soil Group D is assumed to have a runoff curve number of 79, as shown on Attachment No. 2 in Chapter 2 of the Shasta County Development Standards (1997). Some developed areas of the site will also include roads, which are assumed to have a runoff curve number of 98. The Hydrologic Soil Groups and runoff curve numbers are used to calculate weighted runoff curve numbers, based on the acreages of different activities or disturbances that will occur as part of the Project. The weighted runoff curves are then used to estimate the fraction of rainfall from individual storm events that may runoff different areas of the site. During the Project, Watersheds 4 and 5 will have multiple land use cover types. Table 1 shows the acreage for each cover type for these two watersheds used to calculate the weighted CN.

TABLE 1
Stormwater Design Parameters

Watershed	Area (Acres)	Soil Type	Weighted CN	P-24	R-24	V-24	Tc
1. North Pit	263	D	93	9.03	8.25	181 ac-ft	N/A
2. South Pit (includes Primary Processing Area)	113	D	93	9.03	8.25	78 ac-ft	N/A
3. Overburden Stockpile Area	38	C/D	90	9.03	7.75	25 ac-ft	32.7 min
4. Northeast Load Out and Plant Area	59	D	89	9.03	7.7	38 ac-ft	15.6 min

Weighted CN Calculation:

Areas	CN	Description
18 ac	93	Plant Areas
5 ac	98	Roads
19 ac	79	Undeveloped
17 ac	93	Load-out Facility

Watershed	Area (Acres)	Soil Type	Weighted CN	P-24	R-24	V-24	Tc
5. Southeast Load Out Area and Access Ramp	27	D	86	9.03	7.25	17 ac-ft	26.2 min

Weighted CN Calculation:

Areas	CN	Description
13.5 ac	93	Load out Facility/Access Ramp
13.5 ac	79	Undeveloped

Notes:
CN = Curve Number
P-24 = Total rainfall from 25-yr 24-hr storm
R-24 = Inches of rainfall that will runoff
V-24 = Volume of runoff from a 25-yr 24-hr storm
Tc = Time of concentration

3.2 Stormwater Analysis and Conceptual Plan

Figure 1, Site Stormwater Plan Concept Map presents a process-flow diagram for Project storm water management. Figure 2, Stormwater Feasibility Map, shows the approximate layout of the storm water system features at the site. In addition, flow arrows indicate the direction of runoff to each of the main collection features. The exact location of detention features, drainage channels, diversions, and culverts will be determined after any mitigation measures and permit conditions have been identified. The feasibility map, however, demonstrates that there is adequate space within the Project layout for the storm water control system described above, and that adequate grades and flow directions can be maintained.

Storm water runoff in the North and South Pit watersheds will be retained within the pits' water storage sumps. As appropriate and necessary to facilitate mining, retained water within the storage sumps may be pumped out between storms or after the wet season. Runoff from the Overburden Fill Area will be collected in the Overburden Surge Basin. The Overburden Surge Basin size, as shown on Figure 1, is designed to reduce peak flows and provide initial settling of sediment particles. The basin dimensions are based on the SWRCB NPDES Sediment Basin Sizing criteria cited above, as are the other basins discussed below. Flows from the Overburden Surge Basin discharge to Rate Control Basin 1, along with the runoff from the Northeast Load Out and Plant Area watershed. Runoff from the Southeast Load Out Area and Access Ramp flow to Rate Control Basin 2.

Rate Control Basins 1 and 2 discharge to Water Quality Control Pond 1, which then discharges to Water Quality Control Pond 2. SWRCB NPDES Sediment Basin Sizing criteria indicate that only one Water Quality Control Pond is necessary, but a second pond has been included in the design to improve storm water quality prior to discharge. Water Quality Control Pond 2 discharges to the Vegetated Sheet Drain to provide an additional margin of safety in removing sediment and improving storm water quality. Flows through the Vegetated Sheet Drain eventually enter Moody Creek at the eastern edge of the Project site.

The storm water control system also acts to attenuate flood flows. Current peak discharge for a 25-year 24-hour storm from the site is estimated to be approximately 633 cubic feet per second (cfs). The surge basin and rate control basins reduce the peak flow to approximately 358 cfs. Therefore, the proposed development of the property will not result in the potential for increased flooding downstream of the property, it will reduce flooding.

4.0 Erosion Control

Erosion control for the project will be accomplished through a combination of permanent and temporary facilities. Permanent facilities include the stormwater runoff control and management facilities described in Section 3.0 above. These permanent facilities include surge ponds, rate control basins, ditches, settling (water quality control) ponds, and a

vegetated sheet drain. In addition, appropriate slopes, terraces, ditches, and downdrains will be utilized as described in Section 5.0, Grading and Drainage below. This section addresses temporary erosion control measures that will be used on active disturbed areas of the Project.

After Project approval, but prior to any construction activities, a Notice of Intent to prepare a Stormwater Pollution Prevention Plan (SWPPP) will be submitted to the SWRCB , and a copy of the SWPPP will be provided to the Central Valley Regional Water Quality Control Board (Redding Office) and County. A copy of the SWPPP will also be maintained at the Project site. The SWPPP will include an erosion control plan prepared following the guidelines presented in the Shasta County Development Standards, Chapter 4 (1997), and the County of Shasta Erosion and Sediment Control Standards Design Manual. The SWPPP and erosion control plan will generally follow California Department of Transportation (CalTrans) guidance documents, such as "The Construction Site Best Management Practices (BMPs) Manual" and the "Stormwater Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual". These documents incorporate the requirements of the SWRCB NPDES General Permit, Waste Discharge Requirements for Discharges of Stormwater Runoff Associated with Construction Activity" (Order No.99-08-DWQ, NPDES No. CAS000002).

The SWPPP and erosion control plan will define best management practices (BMPs) to prevent erosion and the discharge of sediment to surface waters. BMPs will be specified for soil stabilization, sediment control, vehicle track out, and transport of soil by wind (e.g. dust control and wind erosion BMPs). Typical soil stabilization BMPs include preservation of existing vegetation, mulch, hydroseeding, soil binders, geotextiles, lining of drainage ditches and velocity control structures at drain outlets. Typical sediment control BMPs include silt fences, fiber rolls, straw bale barriers, drain inlet protection, and the settling basins and vegetated sheet drain described in Section 3.0 for the stormwater runoff control and management facilities. Vehicle track out and dust-related BMPs include paved or stabilized roadway surfaces, tire washes, use of grates at vehicle entrances or exits, soil stabilizers, and water spray. The final plan may incorporate these or additional BMPs as appropriate on a Project and location-specific basis.

The performance of the BMPs will be monitored as required under the General Stormwater NPDES permit. Monitoring reports will be provided to RWQCB and the County. If the monitoring indicates that corrective actions are needed, appropriate measures will be taken as required in the permit, SWPPP and erosion control plan.

5.0 Drainage

This section presents a description of the general grading and drainage practices that will be used at the Project site. Existing site drainage and anticipated reclaimed site drainage figures have been provided in the Reclamation Plan. Final grading and drainage plans will be prepared and provided to the County after Project approval and all applicable

mitigation measures and/or conditions of approval have been identified, but prior to any excavation work.

In general terms, grading at the site will be performed in a manner that will avoid creation of unstable slopes and filled areas. The objective is to control erosion and sedimentation, and prevent damage to off-site property, streams, other water courses, and aquatic habitat during the active mining phase of the project and after the site has been reclaimed. Drainage features will be provided to effectively move stormwater runoff away from disturbed areas and into the stormwater runoff control and management facilities. The stormwater runoff control and management facilities are described in detail in 3.0.

Grading and drainage plans for the Project will be prepared in accordance with Chapter 4 of the Shasta County Development Standards (1997). Cut slopes in unconsolidated material will not be steeper than 2:1 (horizontal:vertical). Cut slopes in bedrock will not be steeper than those recommended in the geotechnical engineering report for the project. Fill areas, including waste rock and overburden storage areas, will not have slopes steeper than those recommended in the geotechnical engineering report, but will generally be no steeper than 2:1 (H:V). Prior to receiving fill, the ground surface will be prepared by removing vegetation, unstable or non-conforming soils, and top soil. The ground surface will be scarified to allow the fill to bond with the underlying soils.

Cut and filled slopes will be provided with adequate drainage facilities to efficiently move stormwater runoff away from the slopes. Terraces at least six feet wide will be established on all vertical slopes greater than 30 feet. For cut or fill slopes greater than 60 feet and up to 120 feet in vertical height, a single 12-foot wide terrace will be installed mid-slope. If there are any cut or fill slopes greater than 120 feet in height, terrace widths and spacing will be designed by a civil engineer after Project approval but before cut or fill activities occur. The area beyond the base of any fill slopes will be sloped away from the fill to allow sheet flow to occur, or an appropriate drainage ditch will be installed.

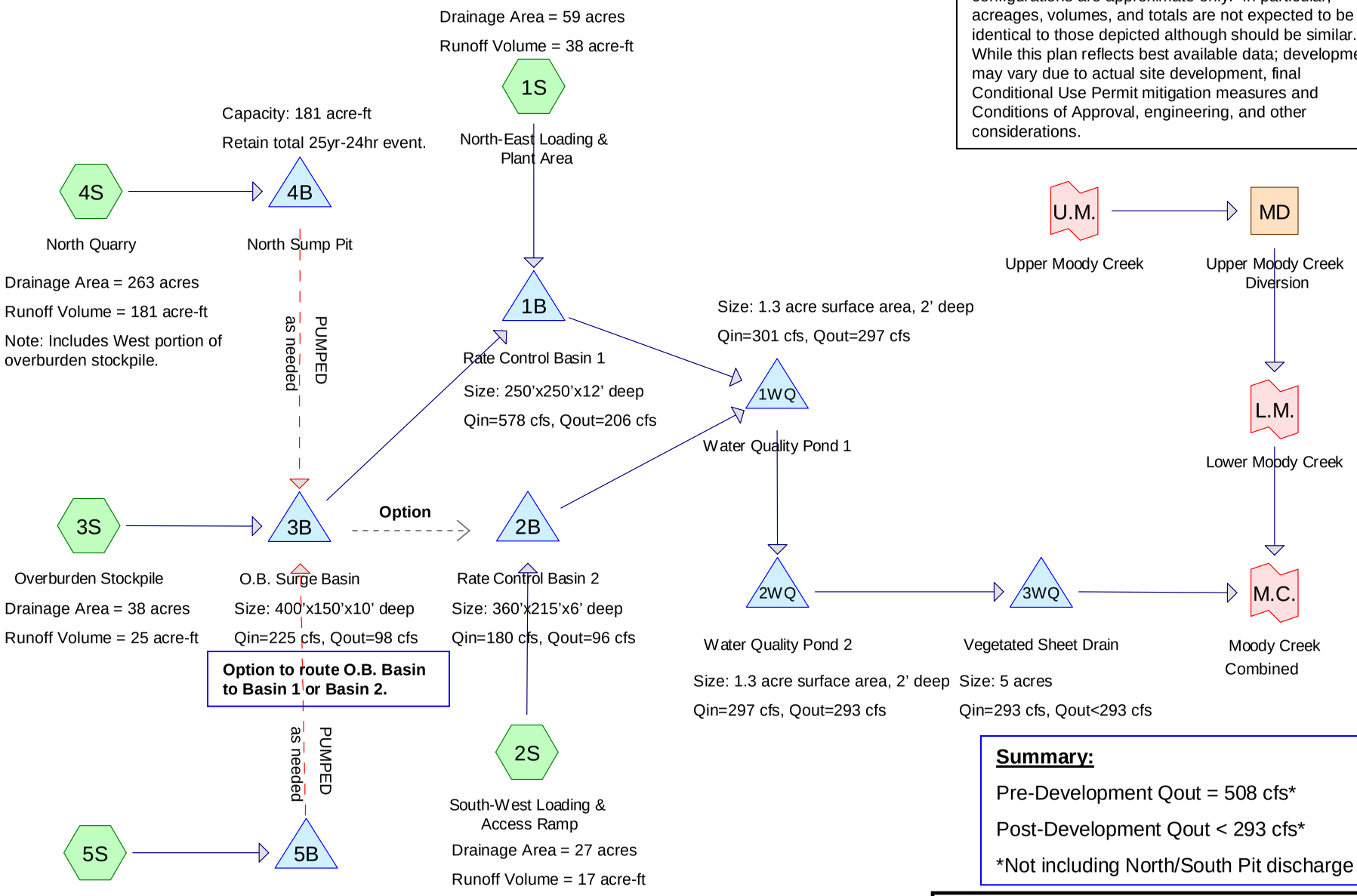
Terraces will be designed and constructed to efficiently direct stormwater off the slopes without causing erosion or sedimentation. Swales or ditches on the terraces will have a gradient of five percent or greater, and will be constructed of rock or suitable paving material to protect the underlying cut or fill material. Downdrains will be provided for each horizontal area of 13,500 square feet. The swales, ditches, slope aprons, and downdrains will channel water to the stormwater runoff control and management facilities described in Section 3.0.

Notwithstanding other regulatory or permit requirements, the above applies to grading activities outside of the North and South pits. The North and South pits will be graded to drain internally and will not discharge stormwater, except as described in Section 3.2. Benches, swales, and other drainage features will be constructed in accordance with the geotechnical engineers report and the Reclamation Plan.

FIGURES

Date: 6/16/10

Disclaimer: All mine and stormwater facilities and configurations are approximate only. In particular, acreages, volumes, and totals are not expected to be identical to those depicted although should be similar. While this plan reflects best available data; development may vary due to actual site development, final Conditional Use Permit mitigation measures and Conditions of Approval, engineering, and other considerations.



Summary:

Pre-Development Qout = 508 cfs*

Post-Development Qout < 293 cfs*

*Not including North/South Pit discharge

Note: All values based on peak flows from 25 yr – 24 hr event of 9.03".

Site Stormwater Plan Concept Map Moody Flats

NORTH PIT

4B
NORTH SUMP PIT

OVERBURDEN STOCKPILE

UPPER MOODY CREEK

DRAINAGE DIVERSION CHANNEL

DRAINAGE CHANNEL

3B
O.B. SURGE

DRAINAGE CHANNEL

ALTERNATE ROUTE, O.B. SURGE CAN FLOW TO 1B OR 2B

PLANT AREA

1B
RATE CTRL. BASIN 1

2B
RATE CTRL. BASIN 2

LOAD-OUT DRAINAGE CHANNEL

LOAD-OUT PAD

120' WIDE RAIL LOAD-OUT

50' WIDE RAIL SURGE POND PAD 2

UP R.O.W.

UP MAINLINE

UP R.O.W.

2WQ
WATER QUALITY PONDS

1WQ

3WQ
VEGETATED SHEET DRAIN

ACCESS RAMP

DRAINAGE CHANNEL

SOUTH PIT

5B
SOUTH SUMP PIT

PRIMARY PROCESSING PLANT

ACCESS ROAD

ACCESS BRIDGE

ACCESS ROAD

NORTH FORK CREEK

HARPER CREEK

PROPERTY LINE

MOODY CREEK

OUTFALL TO MOODY CREEK

DISCLAIMER:

ALL MINE AND STORMWATER FACILITIES AND CONFIGURATIONS ARE APPROXIMATE ONLY. WHILE THIS PLAN REFLECTS BEST AVAILABLE DATA; DEVELOPMENT MAY VARY DUE TO ACTUAL SITE DEVELOPMENT, FINAL CONDITIONAL USE PERMIT MITIGATION MEASURES AND CONDITIONS OF APPROVAL, ENGINEERING, AND OTHER CONSIDERATIONS.

LEGEND

- DRAINAGE FLOW DIRECTION
- EXISTING CULVERT
- PROPOSED CULVERT
- EXISTING WATERCOURSE

ACCESS CODES			DESIGN REFERENCE	NEXT ASSEMBLY	
1		5-3-2010	ORIGINAL ISSUE		TCC
REV	PROJECT ID	DATE	DESCRIPTION		DRWN CHKD

CONSULTANT NAME/LOGO

FACILITIES ENGINEERING

SCALE 1"=300'

REGISTRATION STAMP

I.S. CERTIFICATION

DRWN T. CRAWFORD	DATE 5-3-2010	MFG	DATE
CHKD	DATE	APPVD	DATE

3M CENTER ST. PAUL, MN 55144

TITLE

STORMWATER FEASIBILITY
MOODY FLATS

BLDG. NO.

SIZE	DRAWING NUMBER	SHEET	REV
F	1		

ATTACHMENT A

Summary for Subcatchment 1PRE: Pre-Development - North-East Loading & Plant Area

Analysis to be considered preliminary.

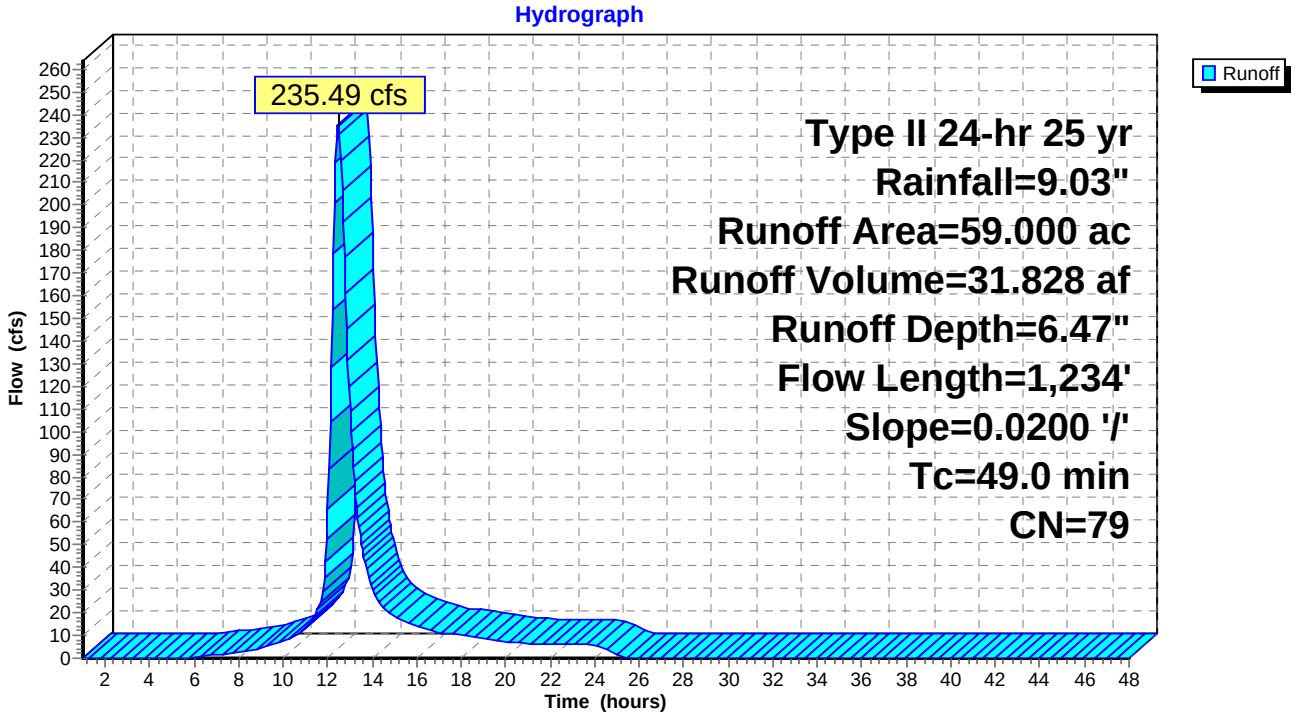
Runoff = 235.49 cfs @ 12.47 hrs, Volume= 31.828 af, Depth= 6.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 yr Rainfall=9.03"

	Area (ac)	CN	Description
*	42.000	79	Plant Area
*	17.000	79	N-E Load-out Area
	59.000	79	Weighted Average
	59.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.7	150	0.0200	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
18.3	1,084	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
49.0	1,234	Total			

Subcatchment 1PRE: Pre-Development - North-East Loading & Plant Area



Summary for Subcatchment 1S: North-East Loading & Plant Area

Worst case Land Use scenario assumed.

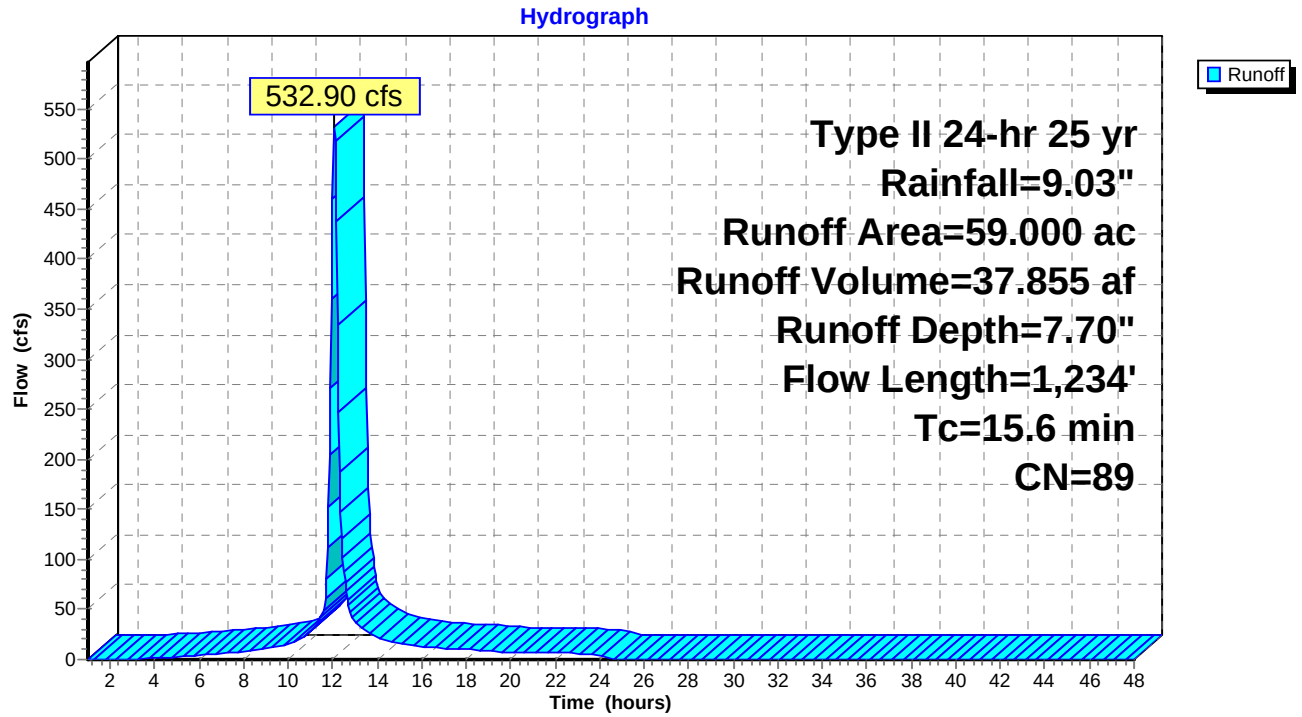
Runoff = 532.90 cfs @ 12.07 hrs, Volume= 37.855 af, Depth= 7.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 yr Rainfall=9.03"

	Area (ac)	CN	Description
*	18.000	93	Aggregate Processing, Concrete, and Asphalt Plants
*	5.000	98	Roads
*	19.000	79	Un-touched Existing Vegetation
*	17.000	93	Load-out
	59.000	89	Weighted Average
	54.000		91.53% Pervious Area
	5.000		8.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	150	0.0100	0.33		**Sheet Flow, Initial Sheet Flow** Fallow n= 0.050 P2= 3.00"
7.9	1,084	0.0200	2.28		**Shallow Concentrated Flow, To Basin** Unpaved Kv= 16.1 fps
15.6	1,234	Total			

Subcatchment 1S: North-East Loading & Plant Area



Summary for Subcatchment 2PRE: Pre-Development - South-West Loading & Access Ramp

Analysis to be considered preliminary.

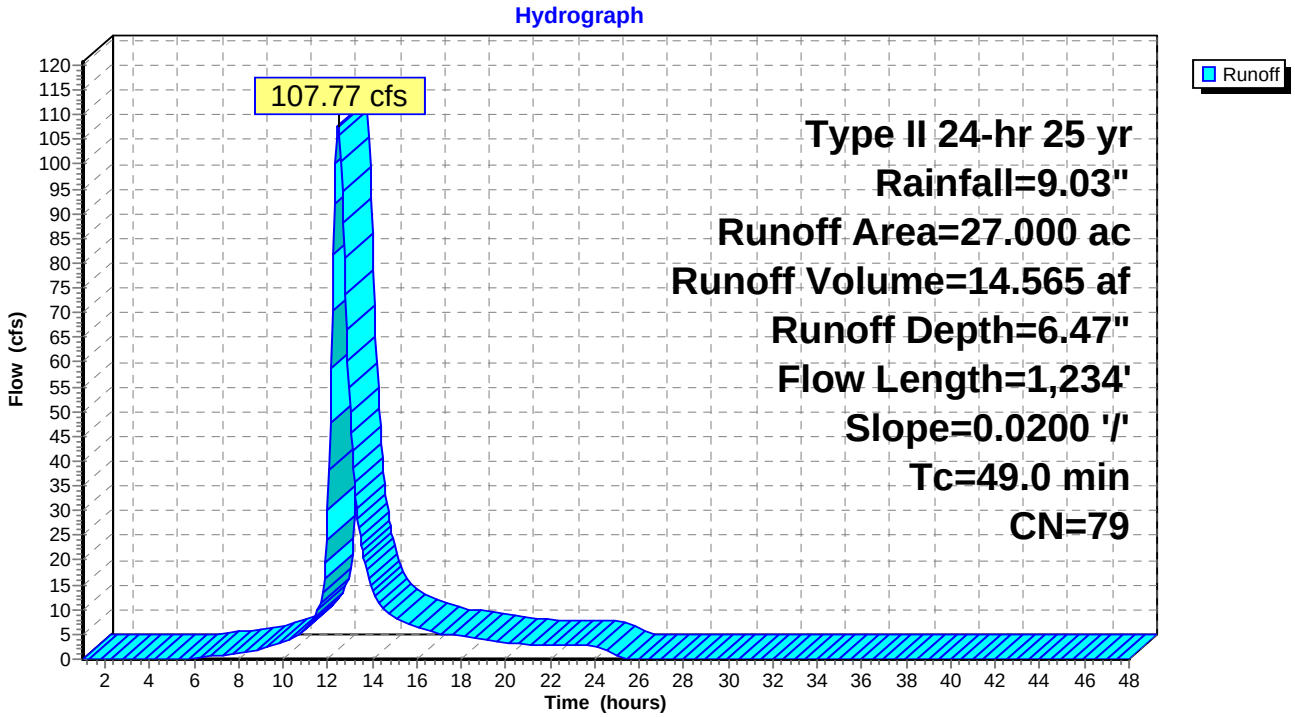
Runoff = 107.77 cfs @ 12.47 hrs, Volume= 14.565 af, Depth= 6.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 yr Rainfall=9.03"

	Area (ac)	CN	Description
*	27.000	79	S-W Loadout and Access Ramp
	27.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.7	150	0.0200	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
18.3	1,084	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
49.0	1,234	Total			

Subcatchment 2PRE: Pre-Development - South-West Loading & Access Ramp



Summary for Subcatchment 2S: South-West Loading & Access Ramp

Worst case Land Use scenario assumed.

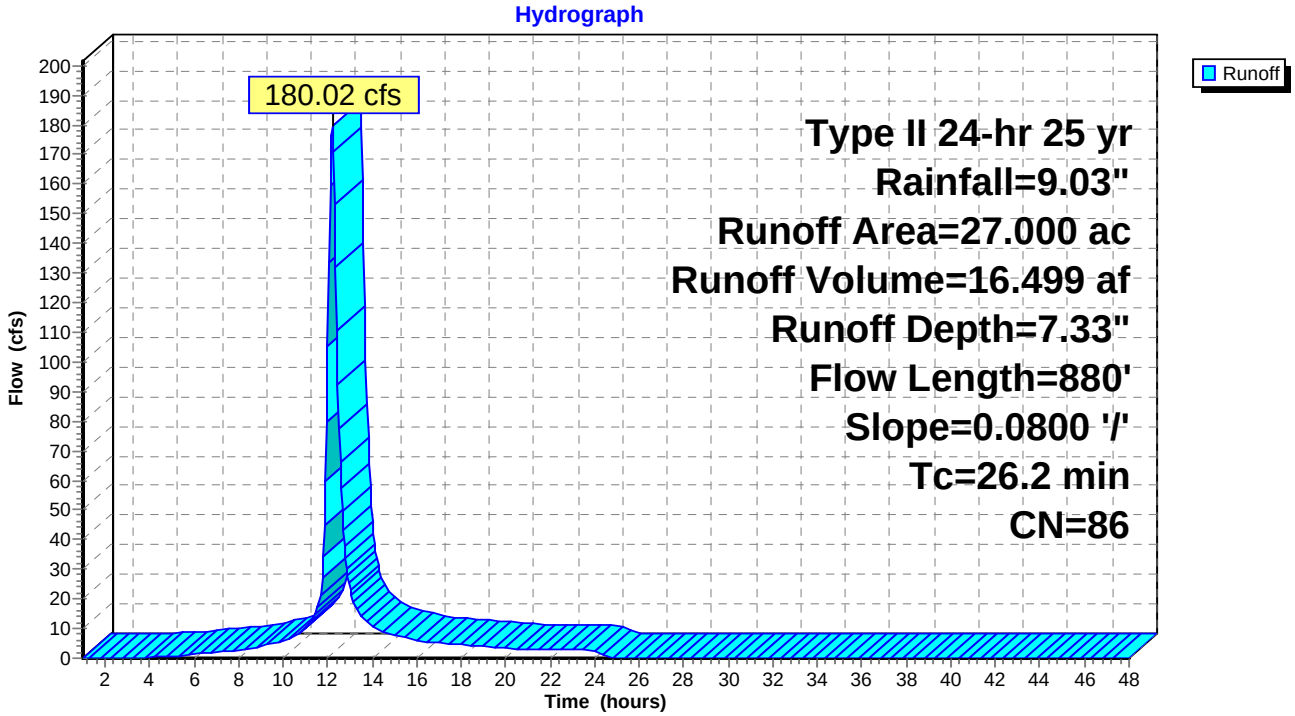
Runoff = 180.02 cfs @ 12.19 hrs, Volume= 16.499 af, Depth= 7.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 yr Rainfall=9.03"

	Area (ac)	CN	Description
*	13.500	79	Un-Touched Vegetation
*	13.500	93	Loadout/Access Ramp
	27.000	86	Weighted Average
	27.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.6	150	0.0800	0.14		**Sheet Flow, Initial Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.00"
8.6	730	0.0800	1.41		**Shallow Concentrated Flow, To Basin** Woodland Kv= 5.0 fps
26.2	880	Total			

Subcatchment 2S: South-West Loading & Access Ramp



Summary for Subcatchment 3PRE: Pre-Development - Overburden Stockpile

Analysis to be considered preliminary.

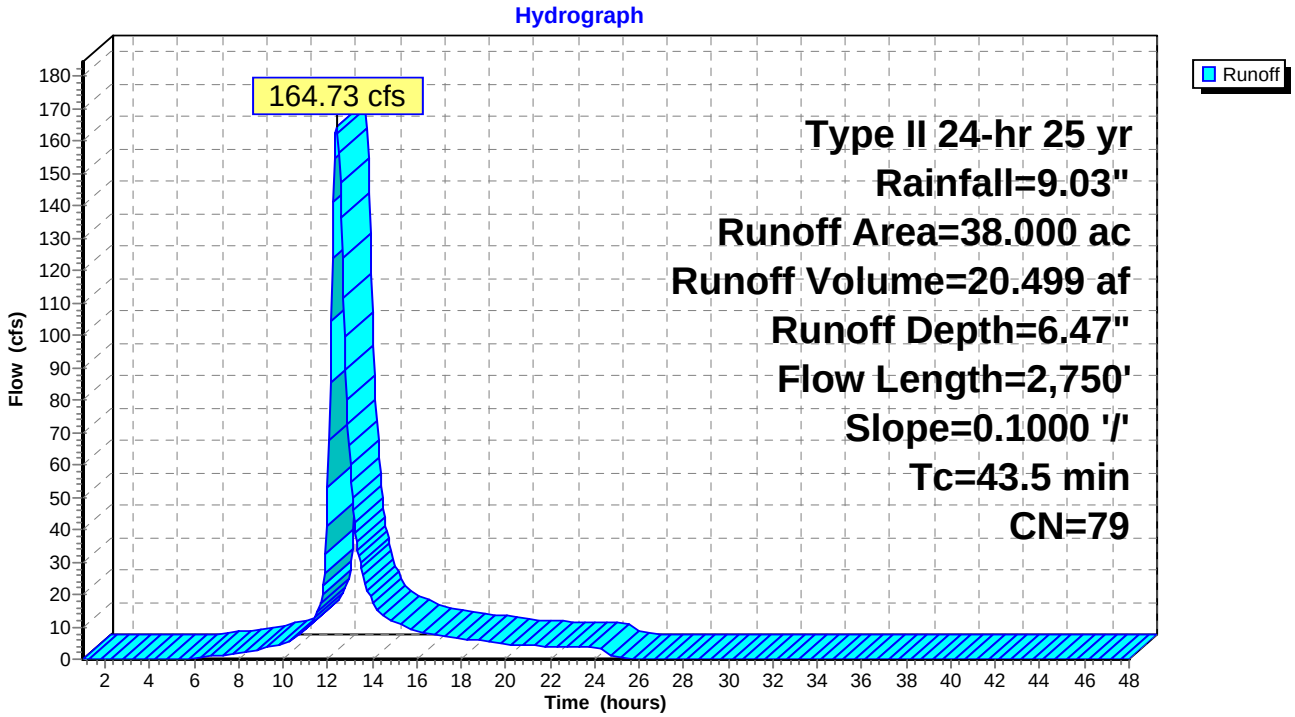
Runoff = 164.73 cfs @ 12.40 hrs, Volume= 20.499 af, Depth= 6.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 yr Rainfall=9.03"

	Area (ac)	CN	Description
*	38.000	79	
	38.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.1	150	0.1000	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.00"
27.4	2,600	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
43.5	2,750	Total			

Subcatchment 3PRE: Pre-Development - Overburden Stockpile



Summary for Subcatchment 3S: Overburden Stockpile

Worst case Land Use scenario assumed.

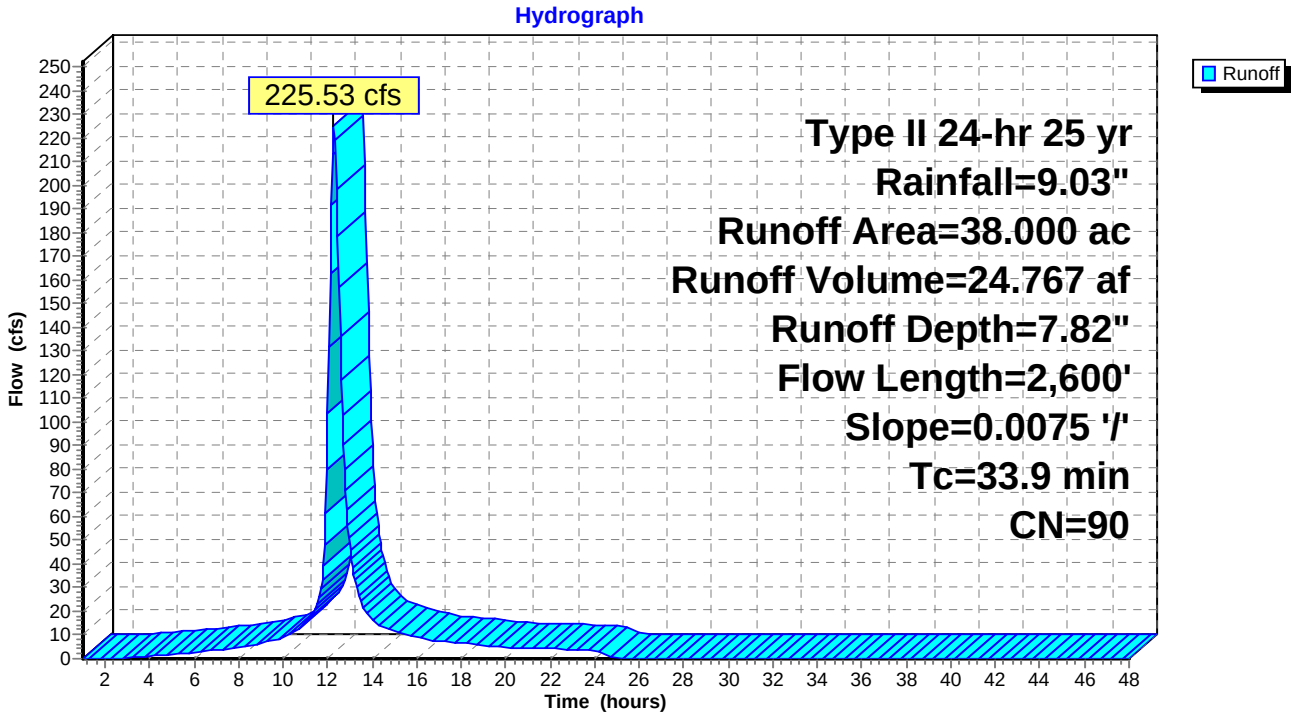
Runoff = 225.53 cfs @ 12.27 hrs, Volume= 24.767 af, Depth= 7.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 yr Rainfall=9.03"

	Area (ac)	CN	Description
*	38.000	90	Assumed mix of types B and D soils, worst case scenario of no initial vegetation.
	38.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Flow from Top of Pile**
5.0					**Direct Entry, Flow from 3rd Bench**
5.0					**Direct Entry, Flow from 2nd Bench**
5.0					**Direct Entry, Flow from 1st Bench**
13.9	2,600	0.0075	3.12	62.48	**Channel Flow, Overburden Containment Channel** Area= 20.0 sf Perim= 20.9' r= 0.96' n= 0.040 Mountain streams
33.9	2,600	Total			

Subcatchment 3S: Overburden Stockpile



Summary for Pond 1B: Rate Control Basin 1

Outlet Structures sized for Preliminary modeling purposes. Basin sized to assess site feasibility.
Assumes no additional water added from Quarry Pumping. Includes routing from O.B. Surge Basin.

Inflow Area = 97.000 ac, 5.15% Impervious, Inflow Depth = 7.74" for 25 yr event
Inflow = 578.95 cfs @ 12.07 hrs, Volume= 62.602 af
Outflow = 206.09 cfs @ 12.41 hrs, Volume= 62.540 af, Atten= 64%, Lag= 20.1 min
Primary = 193.56 cfs @ 12.41 hrs, Volume= 62.355 af
Secondary = 12.52 cfs @ 12.41 hrs, Volume= 0.185 af

Routing by Stor-Ind method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 112.23' @ 12.41 hrs Surf.Area= 1.376 ac Storage= 14.480 af

Plug-Flow detention time= 54.2 min calculated for 62.473 af (100% of inflow)
Center-of-Mass det. time= 53.5 min (863.6 - 810.1)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	17.020 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

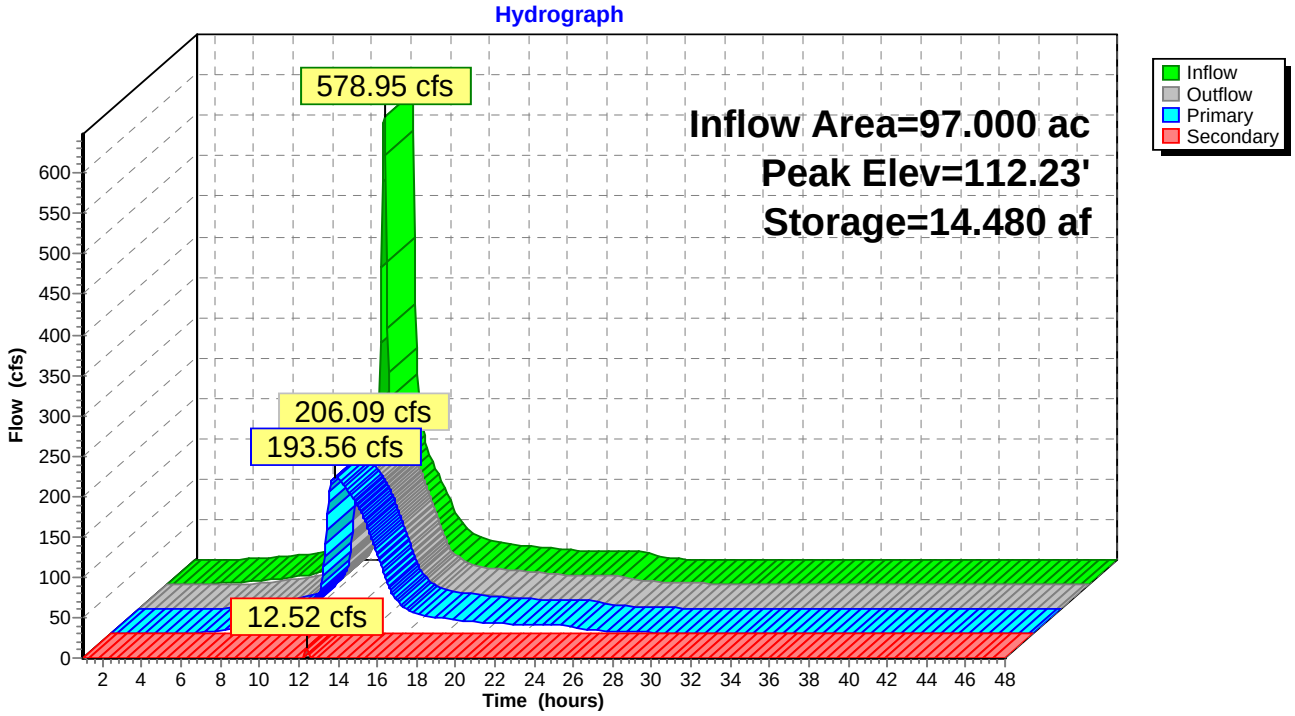
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	1.000	0.000	0.000
112.00	1.360	14.160	14.160
114.00	1.500	2.860	17.020

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**48.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	112.00'	**40.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=193.53 cfs @ 12.41 hrs HW=112.23' (Free Discharge)
↑└**1=Orifice/Grate** (Orifice Controls 193.53 cfs @ 15.40 fps)

Secondary OutFlow Max=11.82 cfs @ 12.41 hrs HW=112.23' (Free Discharge)
↑└**2=Broad-Crested Rectangular Weir** (Weir Controls 11.82 cfs @ 1.29 fps)

Pond 1B: Rate Control Basin 1



Summary for Pond 1WQ: Water Quality Pond 1

Water Quality Basin sized according to RWQCB recommendation.

Equation used: A=(1.2xQ)/Vs

Where: Q = 300 cfs
Vs = 0.0062 for 0.05 mm particle

Inflow Area = 124.000 ac, 4.03% Impervious, Inflow Depth > 7.64" for 25 yr event
Inflow = 301.79 cfs @ 12.41 hrs, Volume= 78.990 af
Outflow = 296.42 cfs @ 12.49 hrs, Volume= 76.384 af, Atten= 2%, Lag= 4.6 min
Primary = 296.42 cfs @ 12.49 hrs, Volume= 76.384 af

Routing by Stor-Ind method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 78.72' @ 12.49 hrs Surf.Area= 1.392 ac Storage= 4.943 af

Plug-Flow detention time= 48.0 min calculated for 76.384 af (97% of inflow)
Center-of-Mass det. time= 21.8 min (886.8 - 864.9)

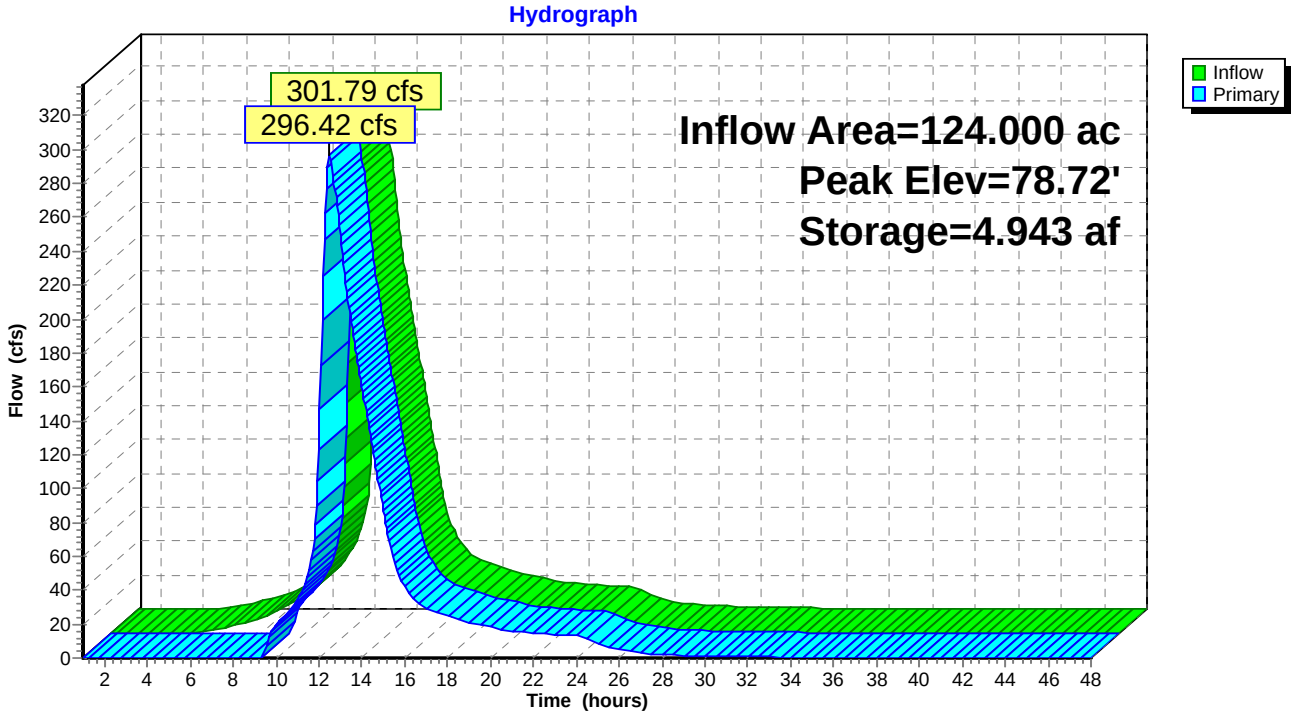
Volume	Invert	Avail.Storage	Storage Description
#1	75.00'	5.335 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
75.00	1.250	0.000	0.000
76.00	1.310	1.280	1.280
77.00	1.330	1.320	2.600
78.00	1.370	1.350	3.950
79.00	1.400	1.385	5.335

Device	Routing	Invert	Outlet Devices
#1	Primary	77.00'	**50.0' long x 50.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=296.14 cfs @ 12.49 hrs HW=78.72' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 296.14 cfs @ 3.45 fps)

Pond 1WQ: Water Quality Pond 1



Summary for Pond 2B: Rate Control Basin 2

Outlet Structures sized for Preliminary modeling purposes. Basin sized to assess site feasibility.

Inflow Area = 27.000 ac, 0.00% Impervious, Inflow Depth = 7.33" for 25 yr event
Inflow = 180.02 cfs @ 12.19 hrs, Volume= 16.499 af
Outflow = 95.89 cfs @ 12.44 hrs, Volume= 16.450 af, Atten= 47%, Lag= 15.2 min
Primary = 95.89 cfs @ 12.44 hrs, Volume= 16.450 af
Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 104.51' @ 12.44 hrs Surf.Area= 1.118 ac Storage= 4.768 af

Plug-Flow detention time= 71.4 min calculated for 16.433 af (100% of inflow)
Center-of-Mass det. time= 70.6 min (869.9 - 799.3)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	6.464 af	**Custom Stage Data (Prismatic)** Listed below (Recalc) x 1.05

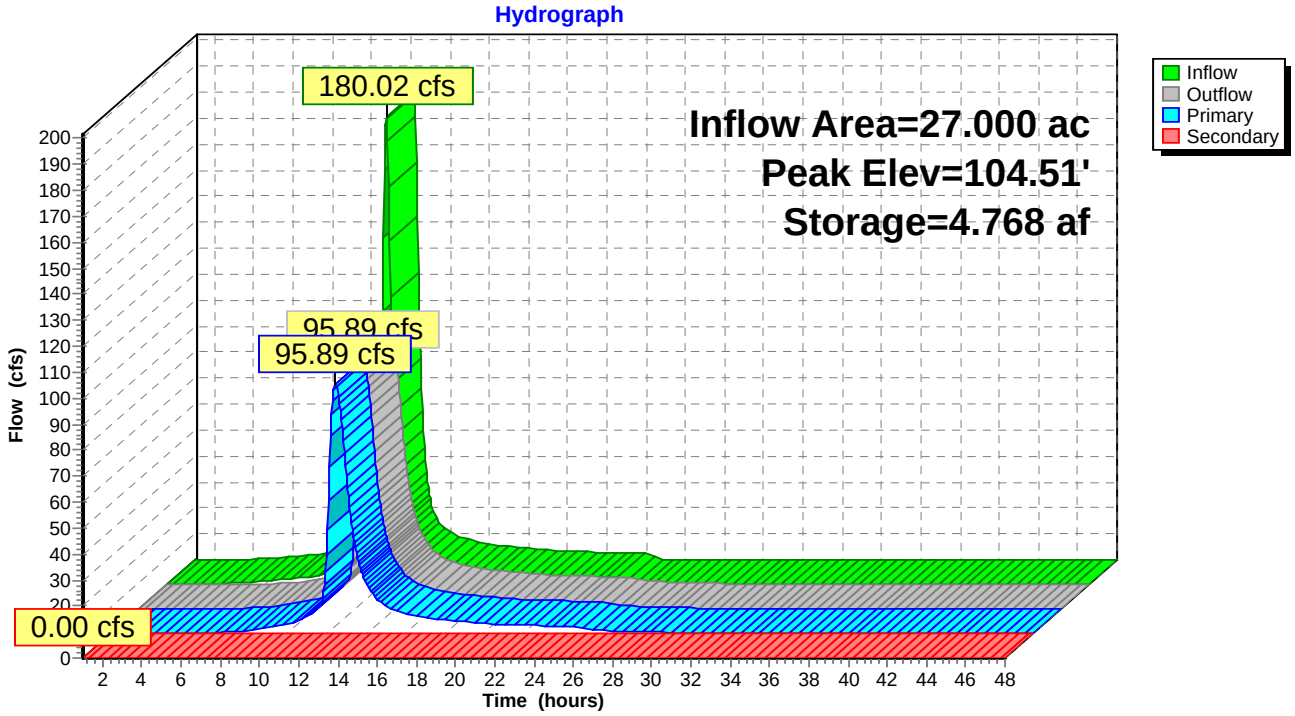
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.950	0.000	0.000
102.00	1.000	1.950	1.950
104.00	1.050	2.050	4.000
106.00	1.106	2.156	6.156

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**48.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	105.00'	**20.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=95.81 cfs @ 12.44 hrs HW=104.51' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 95.81 cfs @ 7.62 fps)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=100.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2B: Rate Control Basin 2



Summary for Pond 2WQ: Water Quality Pond 2

Water Quality Basin sized according to RWQCB recommendation.

Equation used: A=(1.2xQ)/Vs

Where: Q = 300 cfs
Vs = 0.0062 for 0.05 mm particle

Inflow Area = 124.000 ac, 4.03% Impervious, Inflow Depth > 7.39" for 25 yr event
Inflow = 296.42 cfs @ 12.49 hrs, Volume= 76.384 af
Outflow = 292.50 cfs @ 12.57 hrs, Volume= 73.778 af, Atten= 1%, Lag= 4.7 min
Primary = 292.50 cfs @ 12.57 hrs, Volume= 73.778 af

Routing by Stor-Ind method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 78.70' @ 12.57 hrs Surf.Area= 1.391 ac Storage= 4.922 af

Plug-Flow detention time= 44.0 min calculated for 73.700 af (96% of inflow)
Center-of-Mass det. time= 18.0 min (904.8 - 886.8)

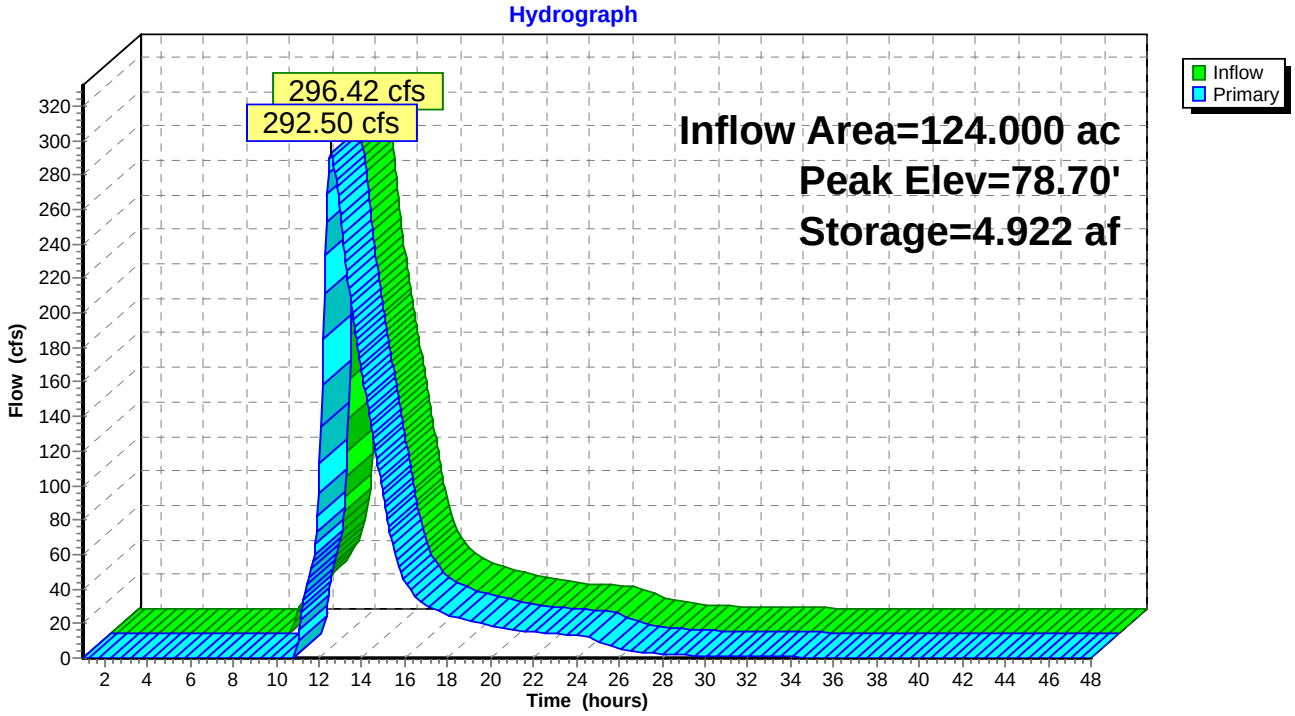
Volume	Invert	Avail.Storage	Storage Description
#1	75.00'	5.335 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
75.00	1.250	0.000	0.000
76.00	1.310	1.280	1.280
77.00	1.330	1.320	2.600
78.00	1.370	1.350	3.950
79.00	1.400	1.385	5.335

Device	Routing	Invert	Outlet Devices
#1	Primary	77.00'	**50.0' long x 50.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=292.07 cfs @ 12.57 hrs HW=78.70' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 292.07 cfs @ 3.43 fps)

Pond 2WQ: Water Quality Pond 2



Summary for Pond 3B: O.B. Surge Basin

Outlet Structures sized for Preliminary modeling purposes. Basin sized to assess site feasibility. Assumes no additional water added from Quarry Pumping.

Inflow Area = 38.000 ac, 0.00% Impervious, Inflow Depth = 7.82" for 25 yr event
Inflow = 225.53 cfs @ 12.27 hrs, Volume= 24.767 af
Outflow = 97.64 cfs @ 12.67 hrs, Volume= 24.747 af, Atten= 57%, Lag= 23.9 min
Primary = 94.18 cfs @ 12.67 hrs, Volume= 24.707 af
Secondary = 3.46 cfs @ 12.67 hrs, Volume= 0.040 af

Routing by Stor-Ind method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 109.16' @ 12.67 hrs Surf.Area= 0.894 ac Storage= 7.331 af

Plug-Flow detention time= 59.5 min calculated for 24.720 af (100% of inflow)
Center-of-Mass det. time= 60.0 min (854.8 - 794.8)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	8.092 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

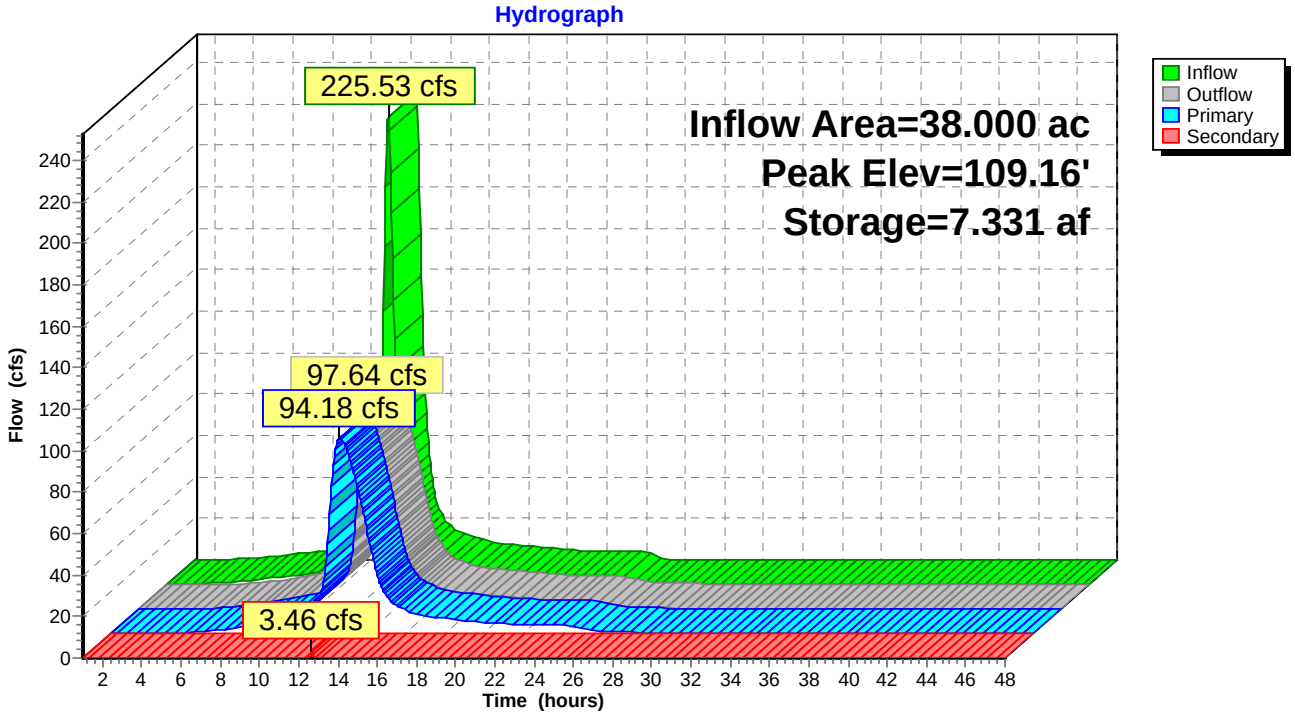
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
100.00	0.710	0.000	0.000
102.00	0.750	1.460	1.460
104.00	0.787	1.537	2.997
106.00	0.829	1.616	4.613
108.00	0.869	1.698	6.311
110.00	0.912	1.781	8.092

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	109.00'	**20.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=94.13 cfs @ 12.67 hrs HW=109.15' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 94.13 cfs @ 13.32 fps)

Secondary OutFlow Max=3.09 cfs @ 12.67 hrs HW=109.15' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 3.09 cfs @ 1.04 fps)

Pond 3B: O.B. Surge Basin



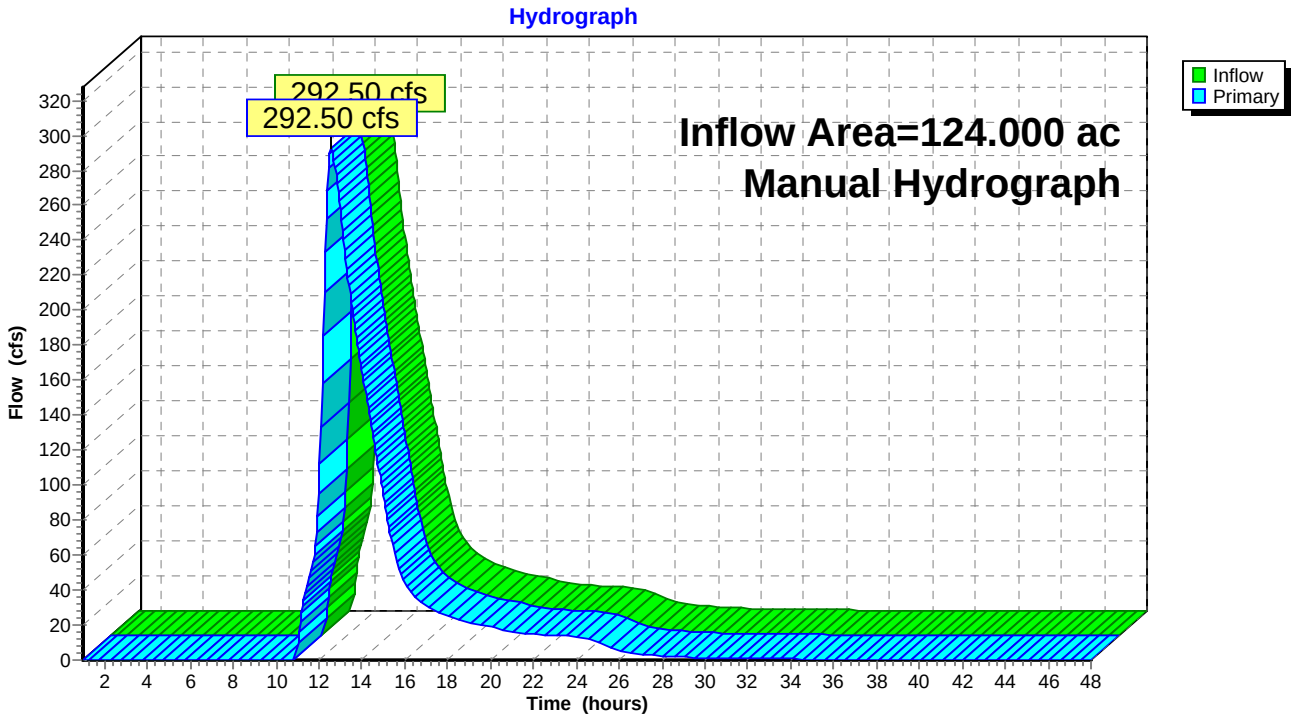
Summary for Link OUT: Output Flow Data to Sheet Drain

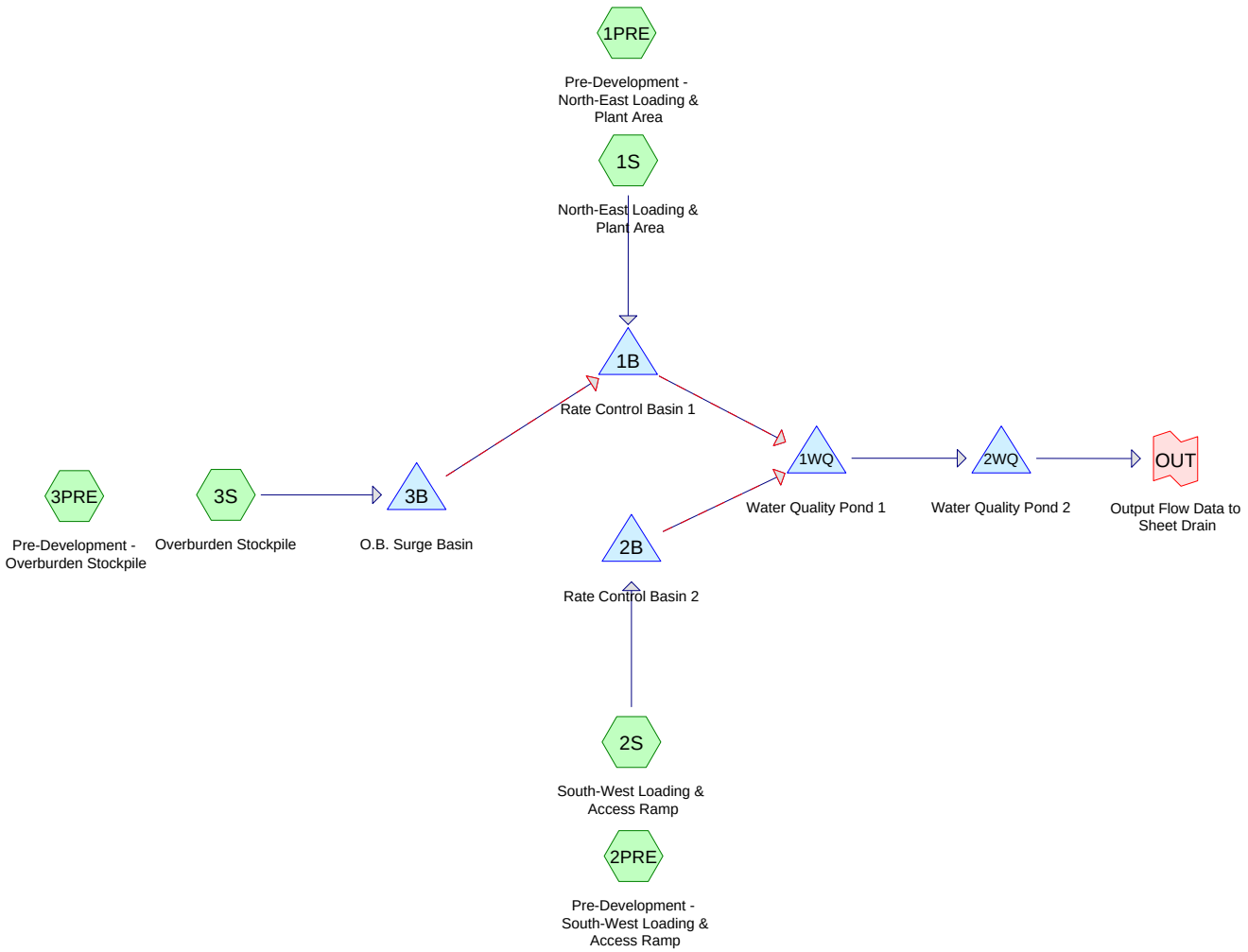
Inflow Area = 124.000 ac, 4.03% Impervious, Inflow Depth > 7.14" for 25 yr event
Inflow = 292.50 cfs @ 12.57 hrs, Volume= 73.778 af
Primary = 292.50 cfs @ 12.57 hrs, Volume= 73.778 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs

Constant Inflow= 0.00 cfs

Link OUT: Output Flow Data to Sheet Drain





Subcat Reach Pond Link

Drainage Diagram for Moody Flats Stormwater Plan, Revised 6/16/10

Prepared by 3M Facilities Engineering, Printed 6/16/2010

Project Notes

Disclaimer: All mine and stormwater facilities and configurations are approximate only. In particular, acreages, volumes, and totals are not expected to be identical to those depicted although should be similar. While this plan reflects the best available data; development may vary due to actual site development, final Conditional Use Permit mitigation measures and Conditions of Approval, engineering, and other considerations.