Waterbury Filing No. 1 & 2
Operations and Maintenance Manual
Extended Detention Basin

County Job No. PUDSP-21-005

Extended detention basins have low to moderate maintenance requirements. Routine and non-routine maintenance is necessary to assure performance, enhance aesthetics, and protect structural integrity. Dry basins can result in nuisance complaints if not properly designed or maintained. Bio-degradable pesticides may be required to limit insect problems. Frequent debris removal and grass-mowing can reduce aesthetic complaints. If a shallow wetland or marshy area is included, mosquito breeding and nuisance odors could occur if the water becomes stagnant.

4 Way Ranch Metropolitan District No. 2
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done

1. Electronic Storage Extended Detention Basins Maintained by Electronic Storage.

There are 3 Extended Detention Basin on the Waterbury Filing No. 1 & 2 property that 4-Way joint Ventures owns and maintains. The following are details of this detention basin. Attached to this manual is a map showing the detention basin location.

Extended Detention Basin Pond 1– Extended Detention Basin with WQCV. This full spectrum detention basin will be built in 2022. The final drainage report for Waterbury Filing No. 1 & 2 covers the drainage calculations for this pond.

Extended Detention Basin Pond 2– Extended Detention Basin with WQCV. This full spectrum detention basin will be built in 2022. The final drainage report for Waterbury Filing No. 1 & 2 covers the drainage calculations for this pond.

Extended Detention Basin Pond 3– Extended Detention Basin with WQCV. This full spectrum detention basin will be built in 2022. The final drainage report for Waterbury Filing No. 1 & 2 covers the drainage calculations for this pond.

2. Access

The Extended Detention Basin Pond 1can be accessed from the Saybrook Road. There is a gravel access ramp on the east corner of the Extended Detention Basin.

Y - Satisfies criteria

N - Needs to be addressed

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EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT

GRADING AND EROSION CONTROL PLAN CHECKLIST

PUDSP-21-005

Site: Waterbury Filings 1& 2 **Location: Stapleton Rd. and Bandanero Dr.**

Revised: July 2019

		Applicant	PCD
1. GRADING AND EROSION CONTROL PLAN			
1	Vicinity map.	x	Y
2	Adjacent city/town/jurisdictional boundaries, subdivision names, and property parcel numbers labeled.	x	Y
3	North arrow and acceptable scale (1"=20' to 1"=100').	x	Y
4	Legend for all symbols used in the plan.	x	Y
5	Existing and proposed property lines. Proposed subdivision boundary for subdivision projects.	x	Y
6	All existing structures.	x	Y
7	All existing utilities.	x	Y
8	Construction site boundaries. ADDED TO LEGEND	x	N
9	Existing vegetation (notes are acceptable in cases where there is no notable vegetation, only grasses/weeds, or site has already been stripped).	x	Y
10	FEMA 100-yr floodplain.	x	Y
11	Existing and proposed water courses including springs, streams, wetlands, detention ponds, stormwater quality structures, roadside ditches, irrigation ditches and other water surfaces. Show maintenance of pre-existing vegetation within 50 feet of a receiving water.	x	Y
12	Existing and proposed contours 2 feet or less (except for hillside).	x	Y
13	Limits of disturbance delineating all anticipated areas of soil disturbance.	x	Y
14	Identify and protect areas outside of the construction site boundary with existing fencing, construction fencing or other methods as appropriate.	x	Y
15	Offsite grading clearly shown and called out.	x	Y
16	Areas of cut and fill identified.	x	Y
17	Conclusions from soils/geotechnical report and geologic hazards report incorporated in grading design (slopes, embankments, materials, mitigation, etc.)	x	Y
r	Proposed slopes steeper than 3:1 with top and toe of slope delineated. Erosion control blanketing or other protective covering required.	x	Y
s	Stormwater flow direction arrows.	x	Y
t	Location of any dedicated asphalt / concrete batch plants.	x	N/A
u	Areas used for staging, storage of building materials, soils (stockpiles) or wastes. The use of construction office trailers requires PCD permitting.	x	Y
v	All proposed temporary construction control measures, structural and non-structural. Temporary construction control measures shall be identified by phase of implementation to include" "initial," "interim," and "final" or shown on separate phased maps identifying each phase.	x	Y
w	Vehicle tracking provided at all construction entrances/exits. Construction fencing, barricades, and/or signage provided at access points not to be used for construction.	x	Y
x	Temporary sediment ponds provided for disturbed drainage areas greater than 1 acre. N/A: The disturbed areas are for roads, swales, and a detantion pond, none of which allow for the construction of temporaty sediment ponds. Some of the swales and roads also drain to the detention pond.	x	Y

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y	Dewatering operations to include locations of diversion, pump and discharge(s) as anticipated at time of design.	x	Y
z	All proposed temporary construction control measure details. Custom or other jurisdiction's details used must meet or exceed EPC standards.	x	Y
aa	Any offsite stormwater control measure proposed for use by the project and not under the direct control or ownership of the Owner or Operator.	x	Y
bb	Existing and proposed permanent storm water management facilities, including areas proposed for stormwater infiltration or subsurface detention.	x	Y
cc	Existing and proposed easements (permanent and construction) including required off site easements.	x	Y
dd	Retaining walls (not to be located in County ROW unless approved via license agreement). Design by P.E. and building permit from Regional Building Department required for walls greater than or equal to 4 feet in height, series of walls, or walls supporting a surcharge.	x	Y
ee	Plan certified by a Colorado Registered P.E., with EPC standard signature blocks for Engineer, Owner and EPC.	x	Y
ff	Engineer's Statement (for standalone GEC Plan): This Grading and Erosion Control Plan was prepared under my direction and supervision and is correct to the best of my knowledge and belief. Said Plan has been prepared according to the criteria established by the County for Grading and Erosion Control Plans. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this plan. _____ _____ Engineer of Record Signature Date	x	Y
gg	Engineer's Statement (for GEC Plan within Construction Drawing set): These detailed plans and specifications were prepared under my direction and supervision. Said plans and specifications have been prepared according to the criteria established by the County for detailed roadway, drainage, grading and erosion control plans and specifications, and said plans and specifications are in conformity with applicable master drainage plans and master transportation plans. Said plans and specifications meet the purposes for which the particular roadway and drainage facilities are designed and are correct to the best of my knowledge and belief. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparation of these detailed plans and specifications. _____ _____ Engineer of Record Signature Date	na	N/A
hh	Owner's Statement (for standalone GEC Plan): I, the owner/developer have read and will comply with the requirements of the Grading and Erosion Control Plan. _____ _____ Owner Signature Date	x	Y

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ii	Owner's Statement (for GEC Plan within Construction Drawing set): I, the owner/developer have read and will comply with the requirements of the grading and erosion control plan and all of the requirements specified in these detailed plans and specifications. _____ _____ Owner Signature Date	na	N/A
jj	El Paso County (standalone GEC Plan): County plan review is provided only for general conformance with County Design Criteria. The County is not responsible for the accuracy and adequacy of the design, dimensions, and/ or elevations which shall be confirmed at the job site. The County through the approval of this document assumes no responsibility for completeness and/ or accuracy of this document. Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual Volumes 1 and 2, and Engineering Criteria Manual, as amended. In accordance with ECM Section 1.12, these construction documents will be valid for construction for a period of 2 years from the date signed by the El Paso County Engineer. If construction has not started within those 2 years, the plans will need to be resubmitted for approval, including payment of review fees at the Planning and Community Development Director's discretion. _____ _____ County Engineer/ECM Administrator Date	x	Y
2. ADDITIONAL REPORTS/PERMITS/DOCUMENTS			
a	Soils report / geotechnical investigation as appropriate for grading/utilities/drainage/road construction.	x	
b	Use Agreement/easement between the Owner or Operator and other third party for use of all offsite grading or stormwater control measures, used by the owner or operator but not under their direct control or ownership.	x	
c	Floodplain Development Permit		
d	USACE 404/wetlands permit/mitigation plan	x	
e	FEMA CLOMR	na	
f	State Engineer's permit/Notice Of Intent to Construct	na	
g	Stormwater Management Plan (SWMP)	x	
h	Financial Assurance Estimate (FAE) (signed)	x	
i	Erosion and Stormwater Quality Control Permit (ESQCP) (signed)	x	
j	Pre-Development Site Grading Acknowledgement and Right of Access Form (signed)		
k	Conditions of Approval met?		

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3. STANDARD NOTES FOR EL PASO COUNTY GRADING AND EROSION CONTROL PLANS			
1	Stormwater discharges from construction sites shall not cause or threaten to cause pollution, contamination, or degradation of State Waters. All work and earth disturbance shall be done in a manner that minimizes pollution of any on-site or off-site waters, including wetlands.	x	Y
2	Notwithstanding anything depicted in these plans in words or graphic representation, all design and construction related to roads, storm drainage and erosion control shall conform to the standards and requirements of the most recent version of the relevant adopted El Paso County standards, including the Land Development Code, the Engineering Criteria Manual, the Drainage Criteria Manual, and the Drainage Criteria Manual Volume 2. Any deviations from regulations and standards must be requested, and approved, in writing.	x	Y
3	A separate Stormwater Management Plan (SMWP) for this project shall be completed and an Erosion and Stormwater Quality Control Permit (ESQCP) issued prior to commencing construction. Management of the SWMP during construction is the responsibility of the designated Qualified Stormwater Manager or Certified Erosion Control Inspector. The SWMP shall be located on site at all times during construction and shall be kept up to date with work progress and changes in the field.	x	Y
4	Once the ESQCP is approved and a “Notice to Proceed” has been issued, the contractor may install the initial stage erosion and sediment control measures as indicated on the approved GEC. A Preconstruction Meeting between the contractor, engineer, and El Paso County will be held prior to any construction. It is the responsibility of the applicant to coordinate the meeting time and place with County staff.	x	Y
5	Control measures must be installed prior to commencement of activities that could contribute pollutants to stormwater. control measures for all slopes, channels, ditches, and disturbed land areas shall be installed immediately upon completion of the disturbance.	x	Y
6	All temporary sediment and erosion control measures shall be maintained and remain in effective operating condition until permanent soil erosion control measures are implemented and final stabilization is established. All persons engaged in land disturbance activities shall assess the adequacy of control measures at the site and identify if changes to those control measures are needed to ensure the continued effective performance of the control measures. All changes to temporary sediment and erosion control measures must be incorporated into the Stormwater Management Plan.	x	Y
7	Temporary stabilization shall be implemented on disturbed areas and stockpiles where ground disturbing construction activity has permanently ceased or temporarily ceased for longer than 14 days.	x	Y
8	Final stabilization must be implemented at all applicable construction sites. Final stabilization is achieved when all ground disturbing activities are complete and all disturbed areas either have a uniform vegetative cover with individual plant density of 70 percent of pre-disturbance levels established or equivalent permanent alternative stabilization method is implemented. All temporary sediment and erosion control measures shall be removed upon final stabilization and before permit closure.	x	Y
9	All permanent stormwater management facilities shall be installed as designed in the approved plans. Any proposed changes that effect the design or function of permanent stormwater management structures must be approved by the ECM Administrator prior to implementation.	x	Y

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10	Earth disturbances shall be conducted in such a manner so as to effectively minimize accelerated soil erosion and resulting sedimentation. All disturbances shall be designed, constructed, and completed so that the exposed area of any disturbed land shall be limited to the shortest practical period of time. Pre-existing vegetation shall be protected and maintained within 50 horizontal feet of a waters of the state unless shown to be infeasible and specifically requested and approved.	x	Y
11	Compaction of soil must be prevented in areas designated for infiltration control measures or where final stabilization will be achieved by vegetative cover. Areas designated for infiltration control measures shall also be protected from sedimentation during construction until final stabilization is achieved. If compaction prevention is not feasible due to site constraints, all areas designated for infiltration and vegetation control measures must be loosened prior to installation of the control measure(s).	x	Y
12	Any temporary or permanent facility designed and constructed for the conveyance of stormwater around, through, or from the earth disturbance area shall be a stabilized conveyance designed to minimize erosion and the discharge of sediment off site.	x	Y
13	Concrete wash water shall be contained and disposed of in accordance with the SWMP. No wash water shall be discharged to or allowed to enter State Waters, including any surface or subsurface storm drainage system or facilities. Concrete washouts shall not be located in an area where shallow groundwater may be present, or within 50 feet of a surface water body, creek or stream.	x	Y
14	During dewatering operations of uncontaminated ground water may be discharged on site, but shall not leave the site in the form of surface runoff unless an approved State dewatering permit is in place.	x	Y
15	Erosion control blanketing or other protective covering shall be used on slopes steeper than 3:1.	x	Y
16	Contractor shall be responsible for the removal of all wastes from the construction site for disposal in accordance with local and State regulatory requirements. No construction debris, tree slash, building material wastes or unused building materials shall be buried, dumped, or discharged at the site.	x	Y
17	Waste materials shall not be temporarily placed or stored in the street, alley, or other public way, unless in accordance with an approved Traffic Control Plan. control measures may be required by El Paso County Engineering if deemed necessary, based on specific conditions and circumstances.	x	Y
18	Tracking of soils and construction debris off-site shall be minimized. Materials tracked off-site shall be cleaned up and properly disposed of immediately.	x	Y
19	The owner/developer shall be responsible for the removal of all construction debris, dirt, trash, rock, sediment, soil, and sand that may accumulate in roads, storm drains and other drainage conveyance systems and stormwater appurtenances as a result of site development.	x	Y
20	The quantity of materials stored on the project site shall be limited, as much as practical, to that quantity required to perform the work in an orderly sequence. All materials stored on-site shall be stored in a neat, orderly manner, in their original containers, with original manufacturer's labels.	x	Y
21	No chemical(s) having the potential to be released in stormwater are to be stored or used onsite unless permission for the use of such chemical(s) is granted in writing by the ECM Administrator. In granting approval for the use of such chemical(s), special conditions and monitoring may be required.	x	Y

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22	Bulk storage of allowed petroleum products or other allowed liquid chemicals in excess of 55 gallons shall require adequate secondary containment protection to contain all spills onsite and to prevent any spilled materials from entering State Waters, any surface or subsurface storm drainage system or other facilities.	x	Y
23	No person shall cause the impediment of stormwater flow in the curb and gutter or ditch except with approved sediment control measures.	x	Y
24	Owner/developer and their agents shall comply with the "Colorado Water Quality Control Act" (Title 25, Article 8, CRS), and the "Clean Water Act" (33 USC 1344), in addition to the requirements of the Land Development Code, DCM Volume II and the ECM Appendix I. All appropriate permits must be obtained by the contractor prior to construction (1041, NPDES, Floodplain, 404, fugitive dust, etc.). In the event of conflicts between these requirements and other laws, rules, or regulations of other Federal, State, local, or County agencies, the most restrictive laws, rules, or regulations shall apply.	x	Y
25	All construction traffic must enter/exit the site only at approved construction access points.	x	Y
26	Prior to construction the permittee shall verify the location of existing utilities.	x	Y
27	A water source shall be available on site during earthwork operations and shall be utilized as required to minimize dust from earthwork equipment and wind.	x	Y
28	The soils report for this site has been prepared by Entech Engineering and shall be considered a part of these plans.	x	Y
29	At least ten (10) days prior to the anticipated start of construction, for projects that will disturb one (1) acre or more, the owner or operator of construction activity shall submit a permit application for stormwater discharge to the Colorado Department of Public Health and Environment, Water Quality Division. The application contains certification of completion of a stormwater management plan (SWMP), of which this Grading and Erosion Control Plan may be a part. For information or application materials contact: Colorado Department of Public Health and Environment Water Quality Control Division WQCD – Permits 4300 Cherry Creek Drive South Denver, CO 80246-1530 Attn: Permits Unit	x	Y
4. Applicant Comments:			
a	Documents requiring design engineer's signature will be signed following County approval of the document (P = signature pending)		
b			

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5. Checklist Review Certifications:			
a	Engineer of Record: The Grading and Erosion Control Plan was prepared under my direction and supervision and is complete and correct to the best of my knowledge and belief. Said Plan has been prepared according to the criteria established by the County for Grading and Erosion Control Plans. Engineer of Record Signature — Date: 3/3/22		Y
b	Review Engineer: The Grading and Erosion Control Plan was reviewed and found to meet the checklist requirements except where otherwise noted or allowed by an approved deviation request. Review Engineer — Date		

WATERBURY FILING NO. 1 & 2

EL PASO COUNTY, CO

GRADING , EROSION AND SEDIMENT CONTROL

MARCH 2022

NOTE:

ALL EXISTING UNDERGROUND AND ABOVE GROUND UTILITY LOCATIONS, INVERTS AND SIZES ARE APPROXIMATE ONLY AND MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION. TIE IN POINTS SHALL BE POTHOLED AND LOCATIONS, INVERTS AND SIZES SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

STANDARD NOTES FOR EL PASO COUNTY GRADING AND EROSION CONTROL PLANS

1. STORMWATER DISCHARGES FROM CONSTRUCTION SITES SHALL NOT CAUSE OR THREATEN TO CAUSE POLLUTION, CONTAMINATION, OR DEGRADATION OF STATE WATERS. ALL WORK AND EARTH DISTURBANCE SHALL BE DONE IN A MANNER THAT MINIMIZES POLLUTION OF ANY ON-SITE OR OFF-SITE WATERS, INCLUDING WETLANDS.

2. NOTWITHSTANDING ANYTHING DEPICTED IN THESE PLANS IN WORDS OR GRAPHIC REPRESENTATION, ALL DESIGN AND CONSTRUCTION RELATED TO ROADS, STORM DRAINAGE AND EROSION CONTROL SHALL CONFORM TO THE STANDARDS AND REQUIREMENTS OF THE MOST RECENT VERSION OF THE RELEVANT ADOPTED EL PASO COUNTY STANDARDS, INCLUDING THE LAND DEVELOPMENT CODE, THE ENGINEERING CRITERIA MANUAL, THE DRAINAGE CRITERIA MANUAL, AND THE DRAINAGE CRITERIA MANUAL VOLUME 2. ANY DEVIATIONS FROM REGULATIONS AND STANDARDS MUST BE REQUESTED, AND APPROVED, IN WRITING.

3. A SEPARATE STORMWATER MANAGEMENT PLAN (SMWP) FOR THIS PROJECT SHALL BE COMPLETED AND AN EROSION AND STORMWATER QUALITY CONTROL PERMIT (ESQCP) ISSUED PRIOR TO COMMENCING CONSTRUCTION. MANAGEMENT OF THE SWMP DURING CONSTRUCTION IS THE RESPONSIBILITY OF THE DESIGNATED QUALIFIED STORMWATER MANAGER OR CERTIFIED EROSION CONTROL INSPECTOR. THE SWMP SHALL BE LOCATED ON SITE AT ALL TIMES DURING CONSTRUCTION AND SHALL BE KEPT UP TO DATE WITH WORK PROGRESS AND CHANGES IN THE FIELD.

4. ONCE THE ESQCP IS APPROVED AND A "NOTICE TO PROCEED" HAS BEEN ISSUED, THE CONTRACTOR MAY INSTALL THE INITIAL STAGE EROSION AND SEDIMENT CONTROL MEASURES AS INDICATED ON THE APPROVED GEC. A PRECONSTRUCTION MEETING BETWEEN THE CONTRACTOR, ENGINEER, AND EL PASO COUNTY WILL BE HELD PRIOR TO ANY CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE APPLICANT TO COORDINATE THE MEETING TIME AND PLACE WITH COUNTY STAFF.

5. CONTROL MEASURES MUST BE INSTALLED PRIOR TO COMMENCEMENT OF ACTIVITIES THAT COULD CONTRIBUTE POLLUTANTS TO STORMWATER. CONTROL MEASURES FOR ALL SLOPES, CHANNELS, DITCHES, AND DISTURBED LAND AREAS SHALL BE INSTALLED IMMEDIATELY UPON COMPLETION OF THE DISTURBANCE.

6. ALL TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES SHALL BE MAINTAINED AND REMAIN IN EFFECTIVE OPERATING CONDITION UNTIL PERMANENT SOIL EROSION CONTROL MEASURES ARE IMPLEMENTED AND FINAL STABILIZATION IS ESTABLISHED. ALL PERSONS ENGAGED IN LAND DISTURBANCE ACTIVITIES SHALL ASSESS THE ADEQUACY OF CONTROL MEASURES AT THE SITE AND IDENTIFY IF CHANGES TO THOSE CONTROL MEASURES ARE NEEDED TO ENSURE THE CONTINUED EFFECTIVE PERFORMANCE OF THE CONTROL MEASURES. ALL CHANGES TO TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES MUST BE INCORPORATED INTO THE STORMWATER MANAGEMENT PLAN.

7. TEMPORARY STABILIZATION SHALL BE IMPLEMENTED ON DISTURBED AREAS AND STOCKPILES WHERE GROUND DISTURBING CONSTRUCTION ACTIVITY HAS PERMANENTLY CEASED OR TEMPORARILY CEASED FOR LONGER THAN 14 DAYS.

8. FINAL STABILIZATION MUST BE IMPLEMENTED AT ALL APPLICABLE CONSTRUCTION SITES. FINAL STABILIZATION IS ACHIEVED WHEN ALL GROUND DISTURBING ACTIVITIES ARE COMPLETE AND ALL DISTURBED AREAS EITHER HAVE A UNIFORM VEGETATIVE COVER WITH INDIVIDUAL PLANT DENSITY OF 70 PERCENT OF PRE-DISTURBANCE LEVELS ESTABLISHED OR EQUIVALENT PERMANENT ALTERNATIVE STABILIZATION METHOD IS IMPLEMENTED. ALL TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES SHALL BE REMOVED UPON FINAL STABILIZATION AND BEFORE PERMIT CLOSURE.

9. ALL PERMANENT STORMWATER MANAGEMENT FACILITIES SHALL BE INSTALLED AS DESIGNED IN THE APPROVED PLANS. ANY PROPOSED CHANGES THAT AFFECT THE DESIGN OR FUNCTION OF PERMANENT STORMWATER MANAGEMENT STRUCTURES MUST BE APPROVED BY THE ECM ADMINISTRATOR PRIOR TO IMPLEMENTATION.

10. EARTH DISTURBANCES SHALL BE CONDUCTED IN SUCH A MANNER SO AS TO EFFECTIVELY MINIMIZE ACCELERATED SOIL EROSION AND RESULTING SEDIMENTATION. ALL DISTURBANCES SHALL BE DESIGNED, CONSTRUCTED, AND COMPLETED SO THAT THE EXPOSED AREA OF ANY DISTURBED LAND SHALL BE LIMITED TO THE SHORTEST PRACTICAL PERIOD OF TIME. PRE-EXISTING VEGETATION SHALL BE PROTECTED AND MAINTAINED WITHIN 50 HORIZONTAL FEET OF A WATERS OF THE STATE UNLESS SHOWN TO BE INFEASIBLE AND SPECIFICALLY REQUESTED AND APPROVED.

11. COMPACTION OF SOIL MUST BE PREVENTED IN AREAS DESIGNATED FOR INFILTRATION CONTROL MEASURES OR WHERE FINAL STABILIZATION WILL BE ACHIEVED BY VEGETATIVE COVER. AREAS DESIGNATED FOR INFILTRATION CONTROL MEASURES SHALL ALSO BE PROTECTED FROM SEDIMENTATION DURING CONSTRUCTION UNTIL FINAL STABILIZATION IS ACHIEVED. IF COMPACTION PREVENTION IS NOT FEASIBLE DUE TO SITE CONSTRAINTS, ALL AREAS DESIGNATED FOR INFILTRATION AND VEGETATION CONTROL MEASURES MUST BE LOOSENED PRIOR TO INSTALLATION OF THE CONTROL MEASURE(S).

12. ANY TEMPORARY OR PERMANENT FACILITY DESIGNED AND CONSTRUCTED FOR THE CONVEYANCE OF STORMWATER AROUND, THROUGH, OR FROM THE EARTH DISTURBANCE AREA SHALL BE A STABILIZED CONVEYANCE DESIGNED TO MINIMIZE EROSION AND THE DISCHARGE OF SEDIMENT OFF SITE.

13. CONCRETE WASH WATER SHALL BE CONTAINED AND DISPOSED OF IN ACCORDANCE WITH THE SWMP. NO WASH WATER SHALL BE DISCHARGED TO OR ALLOWED TO ENTER STATE WATERS, INCLUDING ANY SURFACE OR SUBSURFACE STORM DRAINAGE SYSTEM OR FACILITIES. CONCRETE WASHOUTS SHALL NOT BE LOCATED IN AN AREA WHERE SHALLOW GROUNDWATER MAY BE PRESENT, OR WITHIN 50 FEET OF A SURFACE WATER BODY, CREEK OR STREAM.

14. DURING DEWATERING OPERATIONS OF UNCONTAMINATED GROUND WATER MAY BE DISCHARGED ON SITE, BUT SHALL NOT LEAVE THE SITE IN THE FORM OF SURFACE RUNOFF UNLESS AN APPROVED STATE DEWATERING PERMIT IS IN PLACE.

15. EROSION CONTROL BLANKETING OR OTHER PROTECTIVE COVERING SHALL BE USED ON SLOPES STEEPER THAN 3:1.

16. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL WASTES FROM THE CONSTRUCTION SITE FOR DISPOSAL IN ACCORDANCE WITH LOCAL AND STATE REGULATORY REQUIREMENTS. NO CONSTRUCTION DEBRIS, TREE SLASH, BUILDING MATERIAL WASTES OR UNUSED BUILDING MATERIALS SHALL BE BURIED, DUMPED, OR DISCHARGED AT THE SITE.

17. WASTE MATERIALS SHALL NOT BE TEMPORARILY PLACED OR STORED IN THE STREET, ALLEY, OR OTHER PUBLIC WAY, UNLESS IN ACCORDANCE WITH AN APPROVED TRAFFIC CONTROL PLAN. CONTROL MEASURES MAY BE REQUIRED BY EL PASO COUNTY ENGINEERING IF DEEMED NECESSARY, BASED ON SPECIFIC CONDITIONS AND CIRCUMSTANCES.

18. TRACKING OF SOILS AND CONSTRUCTION DEBRIS OFF-SITE SHALL BE MINIMIZED. MATERIALS TRACKED OFF-SITE SHALL BE CLEANED UP AND PROPERLY DISPOSED OF IMMEDIATELY.

19. THE OWNER/DEVELOPER SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL CONSTRUCTION DEBRIS, DIRT, TRASH, ROCK, SEDIMENT, SOIL, AND SAND THAT MAY ACCUMULATE IN ROADS, STORM DRAINS AND OTHER DRAINAGE CONVEYANCE SYSTEMS AND STORMWATER APPURTENANCES AS A RESULT OF SITE DEVELOPMENT.

20. THE QUANTITY OF MATERIALS STORED ON THE PROJECT SITE SHALL BE LIMITED, AS MUCH AS PRACTICAL, TO THAT QUANTITY REQUIRED TO PERFORM THE WORK IN AN ORDERLY SEQUENCE. ALL MATERIALS STORED ON-SITE SHALL BE STORED IN A NEAT, ORDERLY MANNER, IN THEIR ORIGINAL CONTAINERS, WITH ORIGINAL MANUFACTURER'S LABELS.

21. NO CHEMICAL(S) HAVING THE POTENTIAL TO BE RELEASED IN STORMWATER ARE TO BE STORED OR USED ONSITE UNLESS PERMISSION FOR THE USE OF SUCH CHEMICAL(S) IS GRANTED IN WRITING BY THE ECM ADMINISTRATOR. IN GRANTING APPROVAL FOR THE USE OF SUCH CHEMICAL(S), SPECIAL CONDITIONS AND MONITORING MAY BE REQUIRED.

22. BULK STORAGE OF ALLOWED PETROLEUM PRODUCTS OR OTHER ALLOWED LIQUID CHEMICALS IN EXCESS OF 55 GALLONS SHALL REQUIRE ADEQUATE SECONDARY CONTAINMENT PROTECTION TO CONTAIN ALL SPILLS ONSITE AND TO PREVENT ANY SPILLED MATERIALS FROM ENTERING STATE WATERS, ANY SURFACE OR SUBSURFACE STORM DRAINAGE SYSTEM OR OTHER FACILITIES.

23. NO PERSON SHALL CAUSE THE IMPEDIMENT OF STORMWATER FLOW IN THE CURB AND GUTTER OR DITCH EXCEPT WITH APPROVED SEDIMENT CONTROL MEASURES.

24. OWNER/DEVELOPER AND THEIR AGENTS SHALL COMPLY WITH THE "COLORADO WATER QUALITY CONTROL ACT" (TITLE 25, ARTICLE 8, CRS), AND THE "CLEAN WATER ACT" (33 USC 1344), IN ADDITION TO THE REQUIREMENTS OF THE LAND DEVELOPMENT CODE, DCM VOLUME II AND THE ECM APPENDIX I. ALL APPROPRIATE PERMITS MUST BE OBTAINED BY THE CONTRACTOR PRIOR TO CONSTRUCTION (1041, NPDES, FLOODPLAIN, 404, FUGITIVE DUST, ETC.). IN THE EVENT OF CONFLICTS BETWEEN THESE REQUIREMENTS AND OTHER LAWS, RULES, OR REGULATIONS OF OTHER FEDERAL, STATE, LOCAL, OR COUNTY AGENCIES, THE MOST RESTRICTIVE LAWS, RULES, OR REGULATIONS SHALL APPLY.

25. ALL CONSTRUCTION TRAFFIC MUST ENTER/EXIT THE SITE ONLY AT APPROVED CONSTRUCTION ACCESS POINTS.

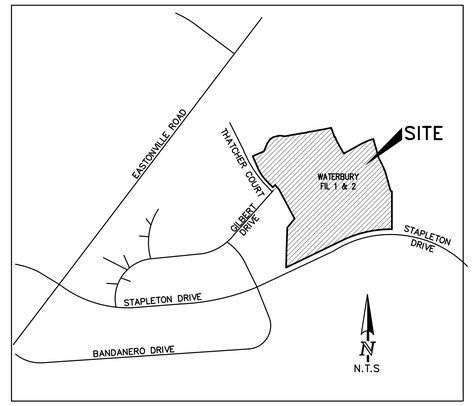
26. PRIOR TO CONSTRUCTION THE PERMITTEE SHALL VERIFY THE LOCATION OF EXISTING UTILITIES.

27. A WATER SOURCE SHALL BE AVAILABLE ON SITE DURING EARTHWORK OPERATIONS AND SHALL BE UTILIZED AS REQUIRED TO MINIMIZE DUST FROM EARTHWORK EQUIPMENT AND WIND.

28. THE SOILS REPORT FOR THIS SITE HAS BEEN PREPARED BY _____ AND SHALL BE CONSIDERED A PART OF THESE PLANS.

29. AT LEAST TEN (10) DAYS PRIOR TO THE ANTICIPATED START OF CONSTRUCTION, FOR PROJECTS THAT WILL DISTURB ONE (1) ACRE OR MORE, THE OWNER OR OPERATOR OF CONSTRUCTION ACTIVITY SHALL SUBMIT A PERMIT APPLICATION FOR STORMWATER DISCHARGE TO THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT, WATER QUALITY DIVISION. THE APPLICATION CONTAINS CERTIFICATION OF COMPLETION OF A STORMWATER MANAGEMENT PLAN (SWMP), OF WHICH THIS GRADING AND EROSION CONTROL PLAN MAY BE A PART. FOR INFORMATION OR APPLICATION MATERIALS CONTACT:

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
WATER QUALITY CONTROL DIVISION
WQCD - PERMITS
4300 CHERRY CREEK DRIVE SOUTH
DENVER, CO 80246-1530
ATTN: PERMITS UNIT



VICINITY MAP

GENERAL NOTES

1. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE EXISTENCE AND LOCATION OF ALL UNDERGROUND UTILITIES ALONG THE SITE. THE OMISSION FROM OR THE INCLUSION OF UTILITY LOCATIONS ON THE PLANS IS NOT TO BE CONSIDERED AS THE NON-EXISTENCE OF OR A DEFINITE LOCATION OF EXISTING UNDERGROUND UTILITIES.
2. THE CONTRACTOR WILL TAKE THE NECESSARY PRECAUTIONS TO PROTECT EXISTING UTILITIES, BUILDINGS, FENCES, AND ROADWAYS FROM DAMAGE DUE TO THIS OPERATION. ANY DAMAGE TO THE ABOVE WILL BE REPAIRED AT THE CONTRACTOR'S EXPENSE, AND ANY SERVICE DISRUPTION WILL BE SETTLED BY THE CONTRACTOR.
3. BULK GRADING SHALL BE COMPLETED TO A SUBGRADE TOLERANCE OF PLUS OR MINUS 0.2'.
4. CONTRACTOR TO OBTAIN COPIES OF THE SOILS REPORT FROM THE GEOTECHNICAL ENGINEER AND TO BE KEPT ONSITE DURING ALL EARTHWORK OPERATIONS.
5. MAXIMUM CUT/FILL SLOPES SHALL NOT EXCEED 3:1, UNLESS OTHERWISE NOTED.
6. ALL BOTOM OF WALL (BW) CALLOUTS ARE FOR THE BOTTOM OF WALL AT GRADE. THEY DO NOT REPRESENT THE BOTTOM OF THE CONSTRUCTED WALL OR FOOTING, WHICH IS NOT SPECIFIED ON THESE PLANS.

SOIL TYPES

ONSITE SOILS ARE HYDROLOGIC GROUPS "A" (COLUMBINE GRAVELLY SANDY LOAM) AND "B" (STAPLETON SANDY LOAM) (PER NRCS WEB SOIL SURVEY MAP)

AREA OF DISTURBANCE

ESTIMATED AREA OF DISTURBANCE = 68.70 ACRES

EARTHWORK VOLUMES

ESTIMATED CUT = 73,990 CY, ESTIMATED FILL = 287,149* CY, NET = 213,159 CY <FILL>
*20% COMPACTION ASSUMED FOR PLACEMENT OF FILL

SHEET INDEX

CONTACT INFORMATION:

OWNER:	4-WAY RANCH JOINT VENTURE P.O. BOX 50223 COLORADO SPRINGS, CO 80949 PETER MARTZ (719) 447-8773
CIVIL ENGINEER:	TERRA NOVA ENGINEERING, INC. 721 S. 23RD STREET COLORADO SPRINGS, COLORADO 80904 QUENTIN ARMIJO, P.E., (719) 635-6422
ENGINEERING DIVISION	EL PASO COUNTY DEVELOPMENT SERVICES 2880 INTERNATIONAL CIRCLE COLORADO SPRINGS, COLORADO 80910 JEFF RICE P.E. (719) 520-6300
METRO DISTRICT	4-WAY RANCH METRO DISTRICT P.O. BOX 50223 COLORADO SPRINGS, CO 80949
GAS DEPARTMENT	BLACK HILLS ENERGY 7060 ALEGRE ST. FOUNTAIN, CO 80817 GEORGE PETERSON (719) 393-6625
ELECTRIC DEPARTMENT	MOUNTAIN VIEW ELECTRIC ASSOCIATION 11140 E. WOODMEN ROAD FALCON, COLORADO 80831 DARYL EDWARDS (719) 495-2283
FIRE DEPARTMENT	STATION 3 / HEADQUARTERS 7030 OLD MERIDIAN ROAD PEYTON, COLORADO 80831 (719) 495-4050
TELEPHONE COMPANY	A.T.&T. LOCATORS (719) 635-3674 CENTURY LINK LOCATORS 811

BENCHMARKS

1. THE TOP OF A 1-1-/2' ALUMINUM SURVEYORS CAP STAMPED JR LTD PLS 31161, AT THE MOST EASTERLY CORNER OF LOT 36 AS PLATED IN 4-WAY RANCH FILING NO. 1 RECORDED UNDER RECEPTION NO. 206712416 RECORDS OF EL PASO COUNTY, COLORADO ELEV= 6931.92

2. THE TOP OF A 1-1-/2' ALUMINUM SURVEYORS CAP STAMPED JR LTD PLS 82820, ATTHE MOST NORTHERLY CORNER OF LOT 42 AS PLATED IN 4-WAY RANCH FILING NO. 1 RECORDED UNDER RECEPTION NO. 206712416 RECORDS OF EL PASO COUNTY, COLORADO ELEV= 6973.99

BASIS OF BEARING

THE NORTH LINE OF SECTION 28, TOWNSHIP 12 SOUTH, RANGE 64 WEST OF THE SIXTH PRINCIPAL MERIDIAN, EL PASO COUNTY, COLORADO BEINGMONUMNETED AT EACH END BY A 3-1/4" ALUMINUM SURVEYOR'S CAP STAMPED "PSINC LS 30087 AND ASSUMED TO BEAR S89°47'04"E A DISTANCE OF 5,285.07 FEET

ENGINEER'S STATEMENT

ENGINEER'S STATEMENT (FOR STANDALONE GEC PLAN):
THIS GRADING AND EROSION CONTROL PLAN WAS PREPARED UNDER MY DIRECTION AND SUPERVISION AND IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. SAID PLAN HAS BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE COUNTY FOR GRADING AND EROSION CONTROL PLANS. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARING THIS PLAN.

_____
QUENTIN ARMIJO, P.E. #37170 DATE
FOR AND ON BEHALF OF TERRA NOVA ENGINEERING, INC.

OWNER/DEVELOPER'S STATEMENT

I, THE OWNER/DEVELOPER HAVE READ AND WILL COMPLY WITH THE REQUIREMENTS OF THE GRADING AND EROSION CONTROL PLAN.

_____ _____
PETER MARTZ, OWNER DATE
4-WAY RANCH JOINT VENTURE
P.O. BOX 50223
COLORADO SPRINGS, CO 80949

EL PASO COUNTY APPROVAL

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/ OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/ OR ACCURACY OF THIS DOCUMENT. FILED IN ACCORDANCE WITH THE REQUIREMENTS OF THE EL PASO COUNTY LAND DEVELOPMENT CODE, DRAINAGE CRITERIA MANUAL VOLUMES 1 AND 2, AND ENGINEERING CRITERIA MANUAL, AS AMENDED.

IN ACCORDANCE WITH ECM SECTION 1.12, THESE CONSTRUCTION DOCUMENTS WILL BE VALID FOR CONSTRUCTION FOR A PERIOD OF 2 YEARS FROM THE DATE SIGNED BY THE EL PASO COUNTY ENGINEER. IF CONSTRUCTION HAS NOT STARTED WITHIN THOSE 2 YEARS, THE PLANS WILL NEED TO BE RESUBMITTED FOR APPROVAL, INCLUDING PAYMENT OF REVIEW FEES AT THE PLANNING AND COMMUNITY DEVELOPMENT DIRECTOR'S DISCRETION.

_____ _____
JENNIFER IRVINE, P.E. DATE
COUNTY ENGINEER/ECM ADMINISTRATOR

PUDSP-21-005

REVISIONS		
NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
4-WAY RANCH JOINT VENTURE
ATTN: PETER MARTZ
P.O. BOX 50223
COLORADO SPRINGS, CO 80949
719-491-315

Terra Nova Engineering, Inc.
Creative Civil Engineering Solutions
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
FAX: 719-635-6426
www.tnesinc.com

WATERBURY FILING NO. 1 & 2

GRADING , EROSION AND SEDIMENT CONTROL
COVER SHEET

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	
H-SCALE	AS SHOWN
V-SCALE	N/A
JOB NO.	1715.00
DATE ISSUED	3/3/22
SHEET NO.	1 OF 10

EROSION CONTROL LEGEND

KEY	TITLE	SYMBOL	IMPLEMENATION PHASE
SF	SILT FENCE	—— SF ——	INITIAL
CF	CONSTRUCTION FENCE	—— CF ——	INITIAL
SCL	SEDIMENT CONTROL LOGS	—— SCL ——	INITIAL
SP	STOCKPILE PROTECTION		INITIAL
VTC	VEHICLE TRACKING CONTROL		INITIAL
SSA	STABILIZED STAGING AREA		INITIAL
TSB	TEMPORARY SEDIMENT BASIN		INITIAL

GRADING LEGEND

- 10' EXISTING CONTOUR — 6810
- 2' EXISTING CONTOUR — 6802
- LIMITS OF DISTURBANCE/ CONSTRUCTION BOUNDARY SUBDIVISION BOUNDARY
- TRIBUTARY AREA TO TSB
- DIRECTION OF SURFACE FLOW
- EXISTING WETLANDS
- 100-Y FEMA FLOODPLAIN
- AREAS OF DE-WATERING

DEWATERING NOTE:

CONTRACTOR TO DISCHARGE GROUND WATER TO THE PROPOSED TEMPORARY SEDIMENT BASINS PER DETAIL ON SHEET 10

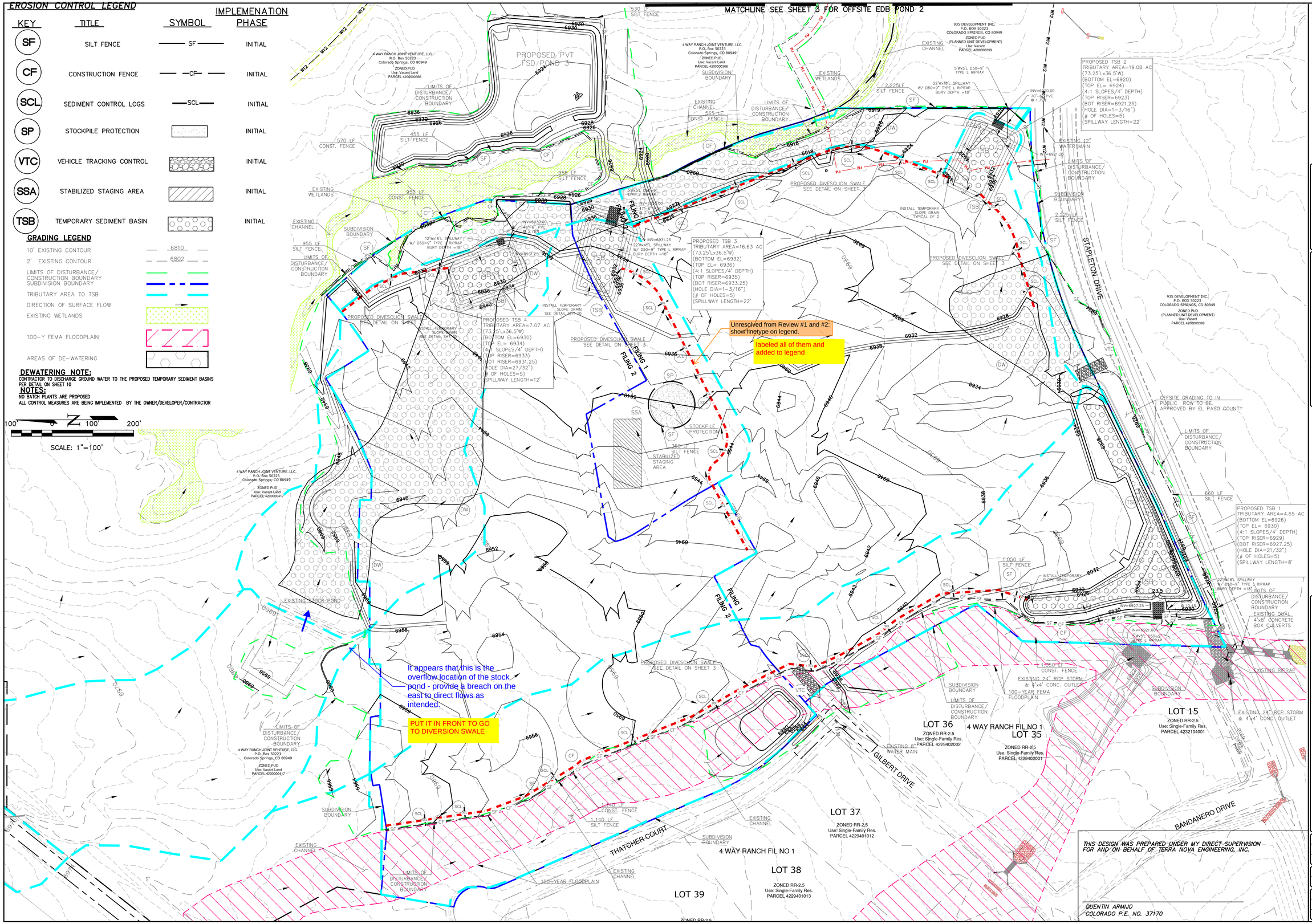
NOTES:

NO BATCH PLANTS ARE PROPOSED

ALL CONTROL MEASURES ARE BEING IMPLEMENTED BY THE OWNER/DEVELOPER/CONTRACTOR

100' 0 100' 200'

SCALE: 1"=100'



PREPARED FOR:
4-WAY RANCH JOINT VENTURE
ATTN: PETER MARTZ
P.O. BOX 50223
COLORADO SPRINGS, CO 80949
719-491-3150

REVISIONS

NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

Terra Nova Engineering, Inc.
Creative Civil Engineering Solutions
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
FAX: 719-635-6426
www.tneinc.com

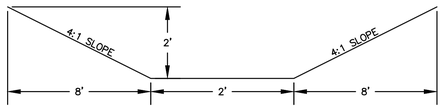
WATERBURY FILING NO. 1 & 2

GRADING AND EROSION CONTROL PLAN
INITIAL EROSION CONTROL PLAN 1

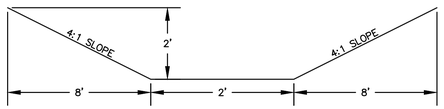
THIS DESIGN WAS PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF TERRA NOVA ENGINEERING, INC.

QUENTIN ARMIJO
COLORADO P.E. NO. 37170

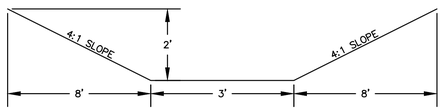
DESIGNED BY	DLF
DRAWN BY	QNA
CHECKED BY	QNA
H-SCALE	1" = 100'
V-SCALE	N/A
JOB NO.	1715.00
DATE ISSUED	3/3/28
SHEET NO.	2 OF 1(



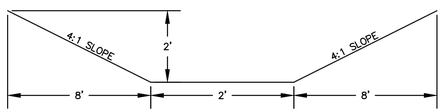
DIVERSION SWALE A–A



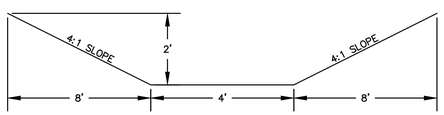
DIVERSION SWALE B–B



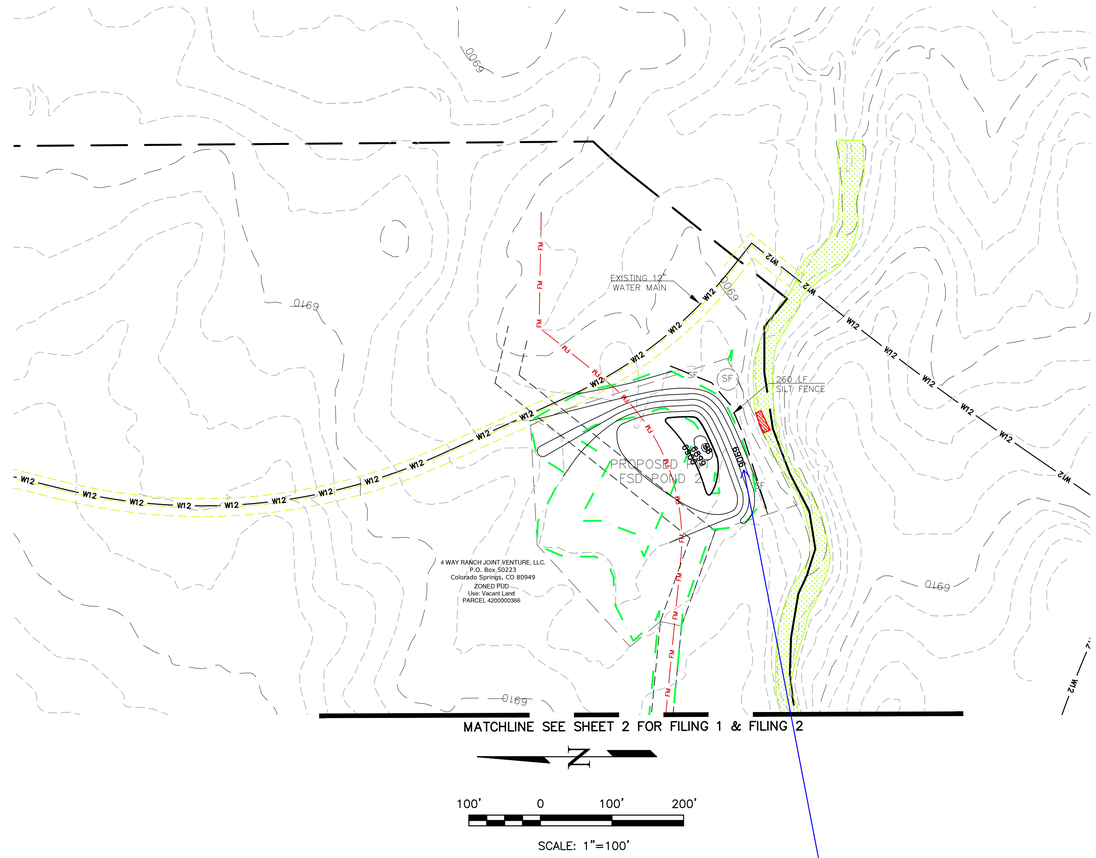
DIVERSION SWALE C–C



DIVERSION SWALE D–D



DIVERSION SWALE E–E



Is this a TSB initially?
Label if so.

no it does not have any flow from disturbed grading area to it.

NOTES:
NO BATCH PLANTS ARE PROPOSED
ALL CONTROL MEASURES ARE BEING IMPLEMENTED BY THE OWNER/DEVELOPER/CONTRACTOR

GRADING LEGEND

10' EXISTING CONTOUR	6810
2' EXISTING CONTOUR	6802
LIMITS OF DISTURBANCE/ CONSTRUCTION BOUNDARY	
SUBDIVISION BOUNDARY	
TRIBUTARY AREA TO TSB	
DIRECTION OF SURFACE FLOW	
EXISTING WETLANDS	
100–Y FEMA FLOODPLAIN	
AREAS OF DE–WATERING	

THIS DESIGN WAS PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF TERRA NOVA ENGINEERING, INC.

QUENTIN ARMIJO
COLORADO P.E. NO. 37170

REVISIONS		
NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
4–WAY RANCH JOINT VENTURE
ATTN: PETER MARTZ
P.O. BOX 50223
COLORADO SPRINGS, CO 80949
719–491–3150

Terra Nova Engineering, Inc.
Creative Civil Engineering Solutions
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719–635–6422
FAX: 719–635–6426
www.tnesinc.com

WATERBURY FILING NO. 1 & 2

GRADING EROSION CONTROL PLAN
INITIAL EROSION CONTROL 2

DESIGNED BY	DLF
DRAWN BY	QNA
CHECKED BY	QNA
H–SCALE	NA
V–SCALE	N/A
JOB NO.	1715.00
DATE ISSUED	3/3/22
SHEET NO.	3 OF 10

EROSION CONTROL LEGEND

KEY	TITLE	SYMBOL	IMPLEMENATION PHASE
SF	SILT FENCE	SF	INITIAL
CF	CONSTRUCTION FENCE	CF	INITIAL
CIP	CULVERT INLET PROTECTION		INTERIM
IP	INLET PROTECTION		INTERIM
SBB	STRAW BALE BARRIER		INTERIM
SP	STOCKPILE PROTECTION		INITIAL
VTC	VEHICLE TRACKING CONTROL		INITIAL
CWA	CONCRETE WASHOUT AREA		INTERIM
SSA	STABILIZED STAGING AREA		INITIAL
TSM	TEMPORARY SEEDING AND MULCHING		INTERIM

ADDED

Unresolved from Review #1 and #2:
Item H and M. If "limits of disturbance" and "construction boundary" are the same, change to "construction boundary/limits of disturbance" or otherwise show as separate linetypes for each on the legend and figure.

GRADING LEGEND

- 8' EXISTING CONTOUR — 6810
- 1' EXISTING CONTOUR — 6802
- 5' PROPED CONTOUR — 6810
- 1' PROPED CONTOUR — 6802
- LIMITS OF DISTURBANCE
- SUBDIVISION BOUNDARY
- CUT/FILL LINE — FILL / CUT
- DIRECTION OF SURFACE FLOW — 4.0%
- HIGH POINT — HPX
- LOW POINT — LPX
- A LOT — "A"
- B LOT — "B"
- WALK OUT LOT MODIFIED — "WO*"
- GARDEN LEVEL LOT MODIFIED — "G*"
- 100-Y FEMA FLOODPLAIN
- AREAS OF DE-WATERING

WETLANDS LEGEND

- EXISTING WETLANDS
- TEMPORARY WETLAND DISTURBANCE
- PERMANENT WETLAND DISTURBANCE

N

100' 0 100' 200'

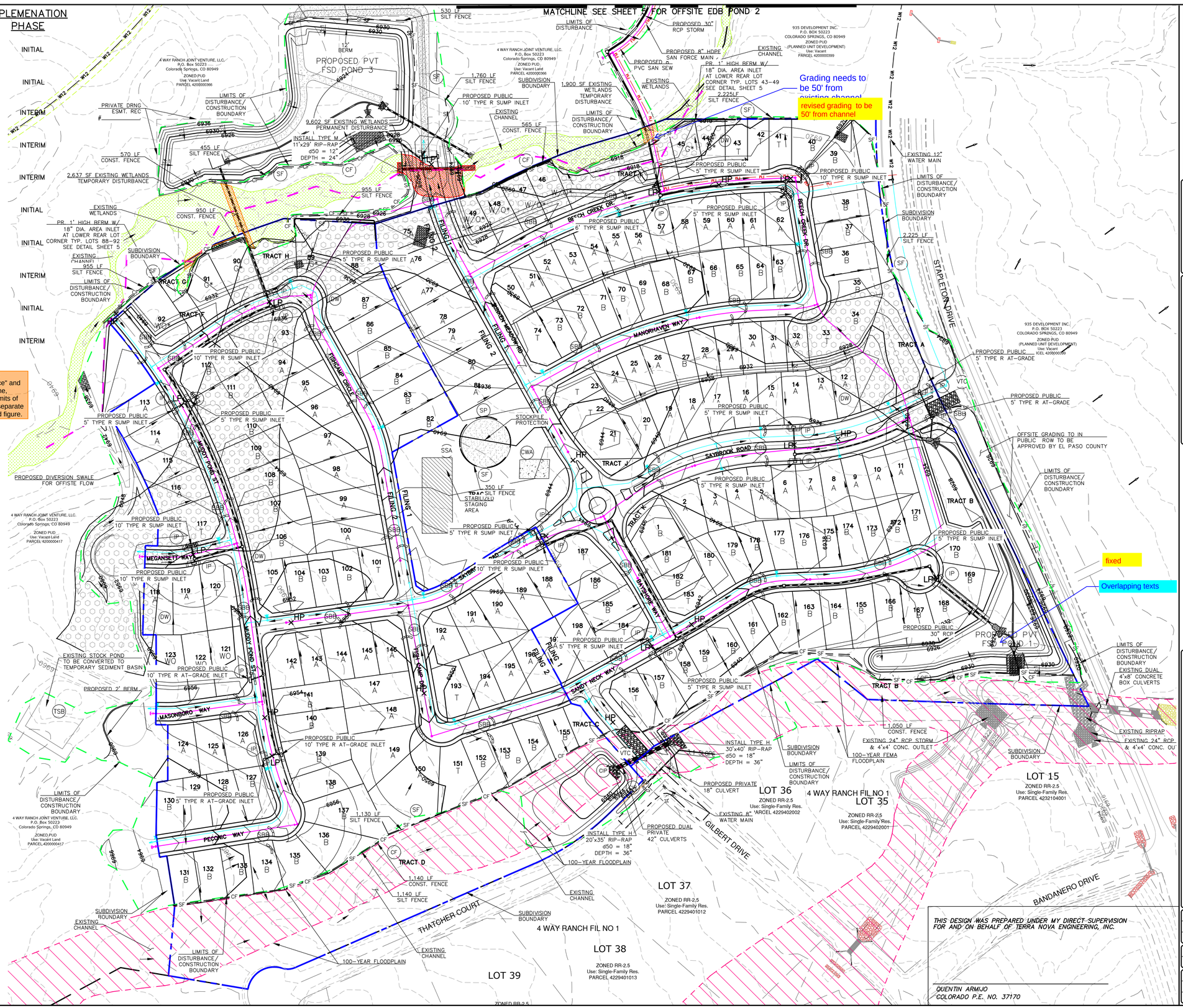
SCALE: 1"=100'

VEGETATION NOTE:

EXISTING VEGETATION CONSISTS OF NATIVE PRAIRIE GRASSES AND SHRUBS WITH FAIR TO GOOD COVERAGE OF 50% TO 70%

NOTES:

NO BATCH PLANTS ARE PROPOSED
ALL CONTROL MEASURES ARE BEING IMPLEMENTED BY THE OWNER/DEVELOPER/CONTRACTOR



REVISIONS		
NO.	DESCRIPTION	DATE

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PREPARED FOR:
4-WAY RANCH JOINT VENTURE
ATTN: PETER MARTZ
P.O. BOX 50223
COLORADO SPRINGS, CO 80949
719-491-3150

Terra Nova Engineering, Inc.
Creative Civil Engineering Solutions
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
FAX: 719-635-6426
www.tnesinc.com

WATERBURY FILING NO. 1 & 2

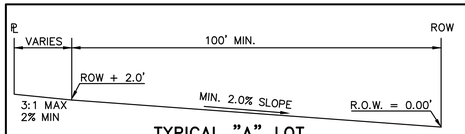
GRADING AND EROSION CONTROL PLAN
INTERIM EROSION CONTROL PLAN 1

THIS DESIGN WAS PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF TERRA NOVA ENGINEERING, INC.

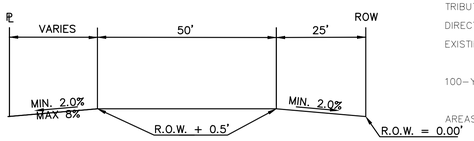
QUENTIN ARMIJO
COLORADO P.E. NO. 37170

DESIGNED BY	DLF
DRAWN BY	QNA
CHECKED BY	QNA
H-SCALE	1" = 100'
V-SCALE	N/A
JOB NO.	1715.00
DATE ISSUED	3/3/22
SHEET NO.	4 OF 10

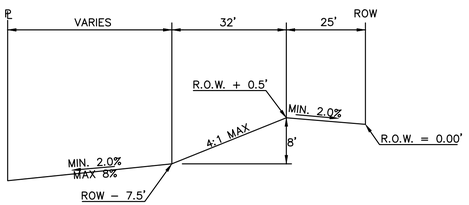
NOTES:
NO BATCH PLANTS ARE PROPOSED
ALL CONTROL MEASURES ARE BEING IMPLEMENTED BY THE OWNER/DEVELOPER/CONTRACTOR



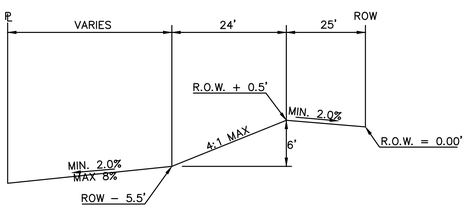
TYPICAL "A" LOT



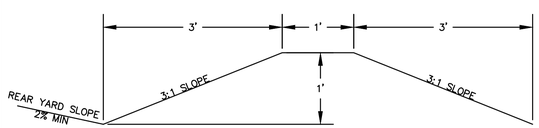
TYPICAL "B" LOT



TYPICAL "WALK-OUT" LOT



TYPICAL "GARDEN LEVEL" LOT



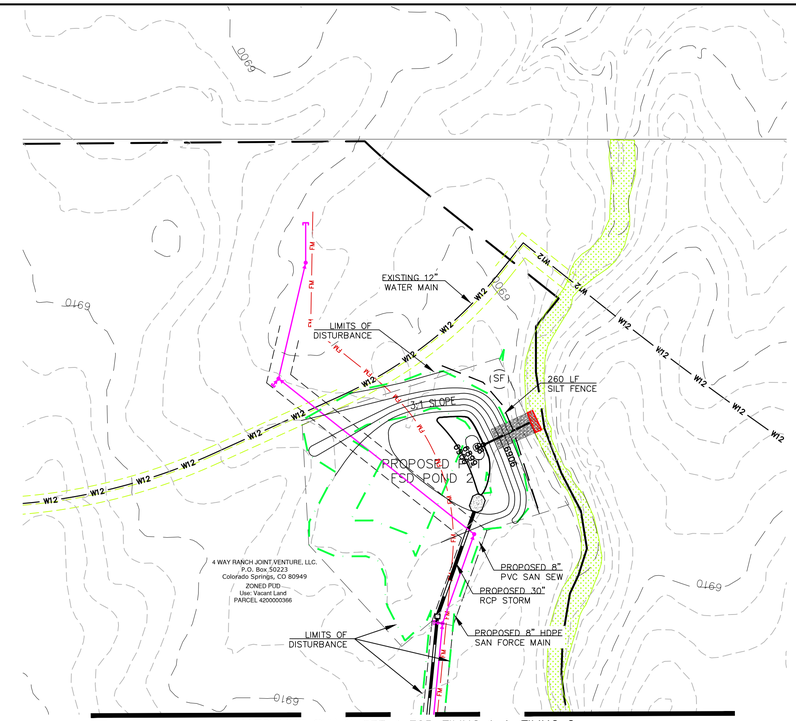
REAR YARD BERM LOTS 43–49 & 88–92

GRADING LEGEND

- 10' EXISTING CONTOUR — 6810
- 2' EXISTING CONTOUR — 6802
- LIMITS OF DISTURBANCE/ CONSTRUCTION BOUNDARY SUBDIVISION BOUNDARY
- TRIBUTARY AREA TO TSB
- DIRECTION OF SURFACE FLOW
- EXISTING WETLANDS
- 100-Y FEMA FLOODPLAIN
- AREAS OF DE-WATERING

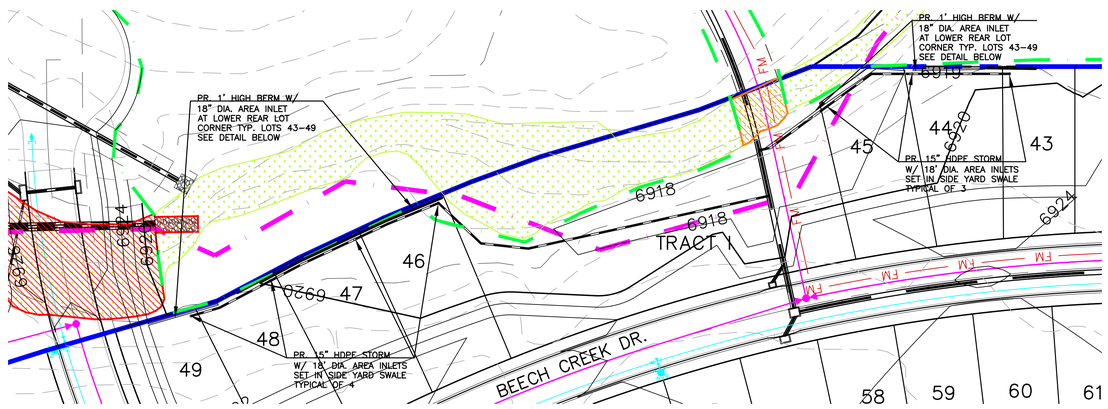
WETLANDS LEGEND

- EXISTING WETLANDS
- TEMPORARY WETLAND DISTURBANCE
- PERMANENT WETLAND DISTURBANCE



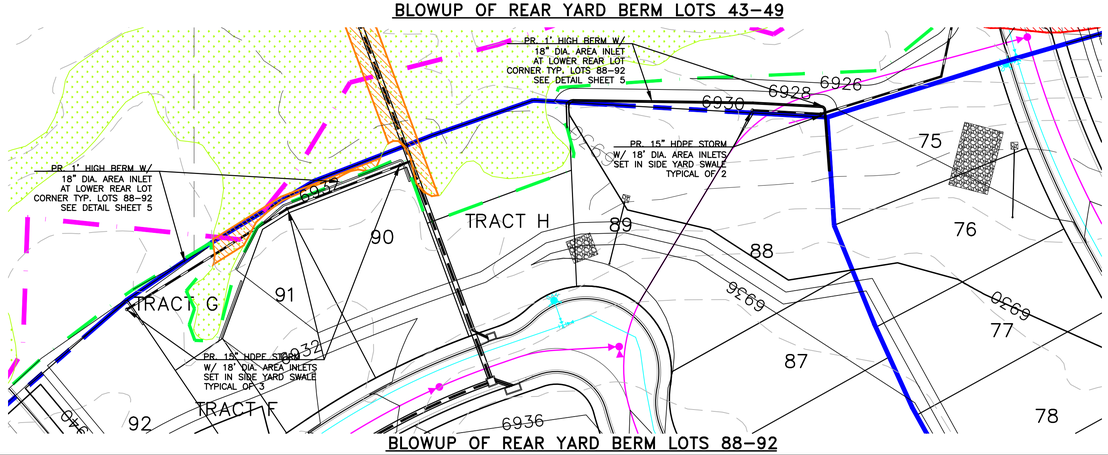
MATCHLINE SEE SHEET 4 FOR FILING 1 & FILING 2

100' 0 100' 200'
SCALE: 1"=100'



BLOWUP OF REAR YARD BERM LOTS 43–49

100' 0 100' 200'
SCALE: 1"=100'



BLOWUP OF REAR YARD BERM LOTS 88–92

100' 0 100' 200'
SCALE: 1"=100'

THIS DESIGN WAS PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF TERRA NOVA ENGINEERING, INC.

QUENTIN ARMIJO
COLORADO P.E. NO. 37170

REVISIONS		
NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

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4-WAY RANCH JOINT VENTURE
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Terra Nova Engineering, Inc. "Creative Civil Engineering Solutions"
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COLORADO SPRINGS, CO 80904
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WATERBURY FILING NO. 1 & 2

GRADING EROSION & STORMWATER CONTROL PLAN
INTERIM EROSION CONTROL PLAN 2

DESIGNED BY	DLF
DRAWN BY	QNA
CHECKED BY	QNA
H-SCALE	NA
V-SCALE	N/A
JOB NO.	1715.00
DATE ISSUED	3/3/22
SHEET NO.	5 OF 10

EROSION CONTROL LEGEND

KEY	TITLE	SYMBOL	IMPLEMENATION PHASE
SF	SILT FENCE	SF	INITIAL
CF	CONSTRUCTION FENCE	CF	INITIAL
CIP	CULVERT INLET PROTECTION		INTERIM
IP	INLET PROTECTION		INTERIM
SBB	STRAW BALE BARRIER		INTERIM
SP	STOCKPILE PROTECTION		INITIAL
VTC	VEHICLE TRACKING CONTROL		INITIAL
CWA	CONCRETE WASHOUT AREA		INTERIM
SSA	STABILIZED STAGING AREA		INITIAL
TSM	TEMPORARY SEEDING AND MULCHING		FINAL
PSM	PERMANENT SEEDING AND MULCHING		ADDED

Unresolved comment from Review #1 and #2: Item H and M. If "limits of disturbance" and "construction boundary" are the same, change to "construction boundary/limits of disturbance' or otherwise show as separate linetypes for each on the legend and figure.

GRADING LEGEND

8' EXISTING CONTOUR	6808
1' EXISTING CONTOUR	6802
5' PROPED CONTOUR	6810
1' PROPED CONTOUR	6802
LIMITS OF DISTURBANCE	
SUBDIVISION BOUNDARY	
CUT/FILL LINE	FILL / CUT
DIRECTION OF SURFACE FLOW	4.0%
HIGH POINT	HPX
LOW POINT	LPX
A LOT	"A"
B LOT	"B"
WALK OUT LOT MODIFIED	"WO*"
GARDEN LEVEL LOT MODIFIED	"G*"
100-Y FEMA FLOODPLAIN	
AREAS OF DE-WATERING	

WETLANDS LEGEND

EXISTING WETLANDS	
TEMPORARY WETLAND DISTURBANCE	
PERMANENT WETLAND DISTURBANCE	

N

100' 0 100' 200'

SCALE: 1"=100'

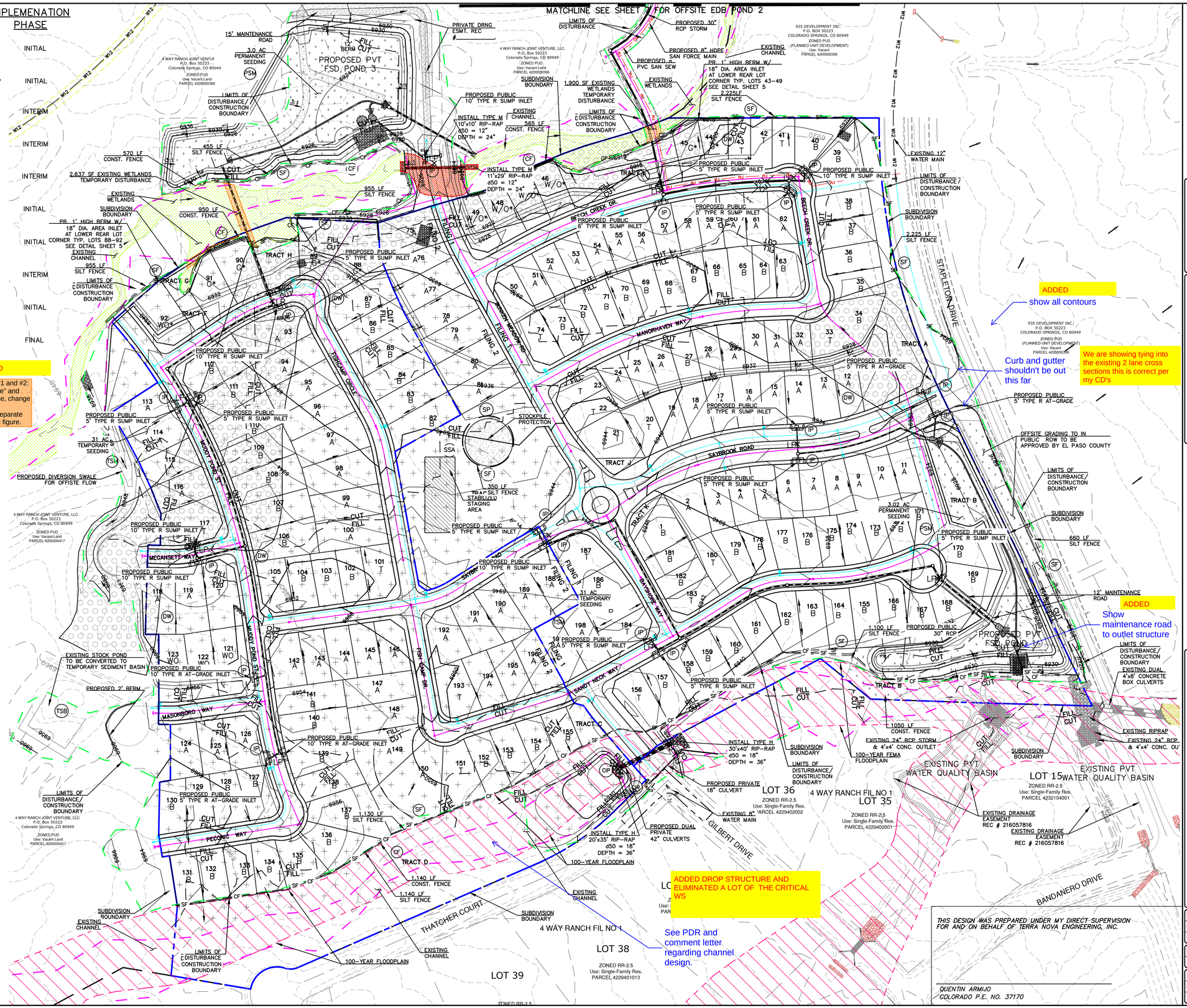
VEGETATION NOTE:

EXISTING VEGETATION CONSISTS OF NATIVE PRAIRIE GRASSES AND SHRUBS WITH FAIR TO GOOD COVERAGE OF 50% TO 70%

NOTES:

NO BATCH PLANTS ARE PROPOSED

ALL CONTROL MEASURES ARE BEING IMPLEMENTED BY THE OWNER/DEVELOPER/CONTRACTOR



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QUENTIN ARMIJO
COLORADO P.E. NO. 37170

REVISIONS		
NO.	DESCRIPTION	DATE

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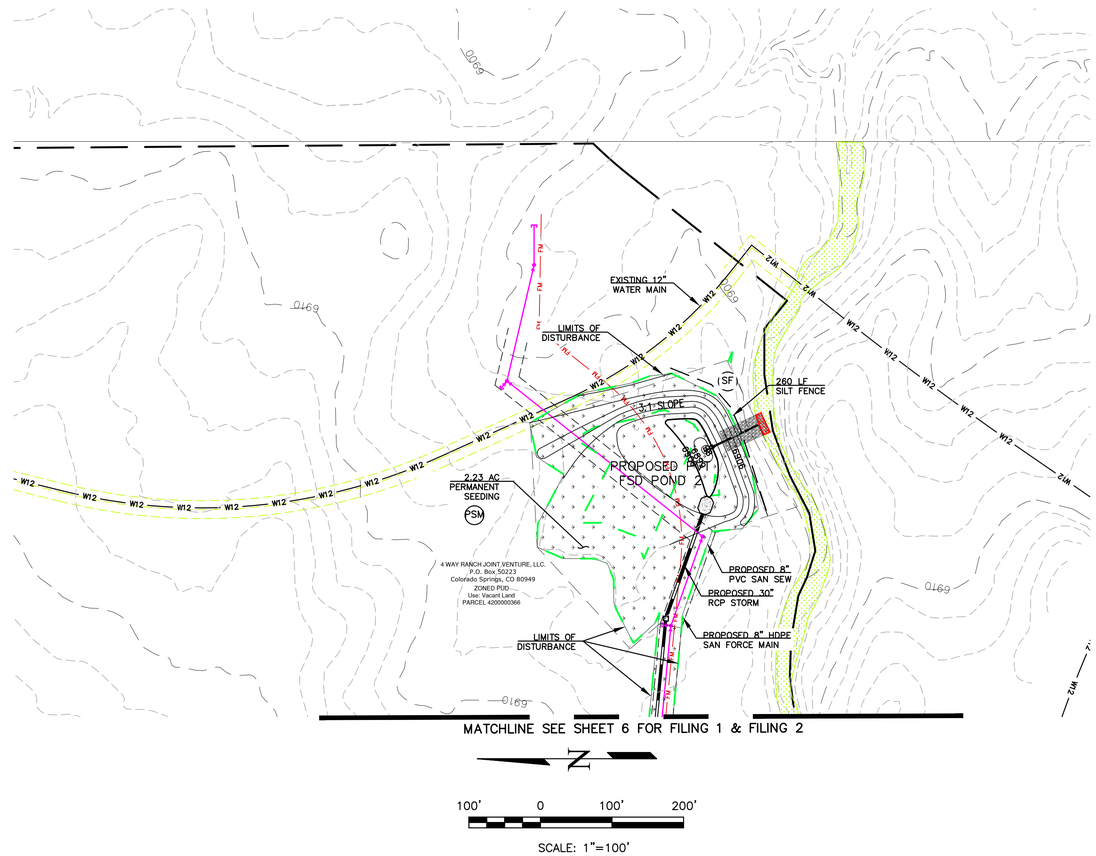
WATERBURY FILING NO. 1 & 2

GRADING AND EROSION CONTROL PLAN
FINAL EROSION CONTROL PLAN 1

DESIGNED BY	DLF
DRAWN BY	QNA
CHECKED BY	QNA
H-SCALE	1" = 100'
V-SCALE	N/A
JOB NO.	1715.00
DATE ISSUED	3/3/22
SHEET NO.	6 OF 10



NOTES:

1. ALL CONTROL MEASURES ARE BEING IMPLEMENTED BY THE OWNER/DEVELOPER/CONTRACTOR

GRADING LEGEND

8' EXISTING CONTOUR	6802
1' EXISTING CONTOUR	6802
5' PROPED CONTOUR	6810
1' PROPED CONTOUR	6802
LIMITS OF DISTURBANCE	
SUBDIVISION BOUNDARY	
CUT/FILL LINE	FILL CUT
DIRECTION OF SURFACE FLOW	4.0%
HIGH POINT	HP
LOW POINT	LP
A LOT	"A"
B LOT	"B"
WALK OUT LOT MODIFIED	"WO*"
GARDEN LEVEL LOT MODIFIED	"G*"
100-Y FEMA FLOODPLAIN	
AREAS OF DE-WATERING	

WETLANDS LEGEND

EXISTING WETLANDS	
TEMPORARY WETLAND DISTURBANCE	
PERMANENT WETLAND DISTURBANCE	

ADDED

Unresolved from Review #1 and #2:
Item H and M. If "limits of disturbance" and "construction boundary" are the same, change to "construction boundary/limits of disturbance" or otherwise show as separate linetypes for each on the legend and figure.

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WATERBURY FILING NO. 1

GRADING EROSION & CONTROL PLAN
FINAL EROSION CONTROL PLAN 2

DESIGNED BY	DLF
DRAWN BY	QNA
CHECKED BY	QNA
H-SCALE	NA
V-SCALE	N/A
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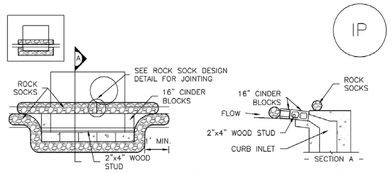


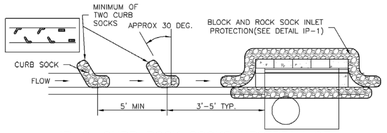
IP–1. BLOCK AND ROCK SOCK SUMP OR ON GRADE INLET PROTECTION

BLOCK AND CURB SOCK INLET PROTECTION INSTALLATION NOTES

1. SEE ROCK SOCK DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.

2. CONCRETE "CINDER" BLOCKS SHALL BE LAID ON THEIR SIDES AROUND THE INLET IN A SINGLE ROW, ABUTTING ONE ANOTHER WITH THE OPEN END FACING AWAY FROM THE CURB.

3. GRAVEL BAGS SHALL BE PLACED AROUND CONCRETE BLOCKS, CLOSELY ABUTTING ONE ANOTHER AND JOINTED TOGETHER IN ACCORDANCE WITH ROCK SOCK DESIGN DETAIL.



IP–2. CURB ROCK SOCKS UPSTREAM OF INLET PROTECTION

CURB ROCK SOCK INLET PROTECTION INSTALLATION NOTES

1. SEE ROCK SOCK DESIGN DETAIL INSTALLATION REQUIREMENTS.

2. PLACEMENT OF THE SOCK SHALL BE APPROXIMATELY 30 DEGREES FROM PERPENDICULAR IN THE OPPOSITE DIRECTION OF FLOW.

3. SOCKS ARE TO BE FLUSH WITH THE CURB AND SPACED A MINIMUM OF 5 FEET APART.

4. AT LEAST TWO CURB SOCKS IN SERIES ARE REQUIRED UPSTREAM OF ON–GRADE INLETS.

GENERAL INLET PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
–LOCATION OF INLET PROTECTION.
–TYPE OF INLET PROTECTION (IP.1, IP.2, IP.3, IP.4, IP.5, IP.6)

2. INLET PROTECTION SHALL BE INSTALLED PROMPTLY AFTER INLET CONSTRUCTION OR PAVING IS COMPLETE (TYPICALLY WITHIN 48 HOURS). IF A RAINFALL/RUNOFF EVENT IS FORECAST, INSTALL INLET PROTECTION PRIOR TO ONSET OF EVENT.

3. MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

INLET PROTECTION MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF INLET PROTECTION SHALL BE REMOVED AS NECESSARY TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN STORAGE VOLUME REACHES 50% OF CAPACITY, A DEPTH OF 6" WHEN SILT FENCE IS USED, OR ¼ OF THE HEIGHT OF STRAW BALES.

5. INLET PROTECTION IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS PERMANENTLY STABILIZED, UNLESS THE LOCAL JURISDICTION APPROVES EARLIER REMOVAL OF INLET PROTECTION IN STREETS.

6. WHEN INLET PROTECTION AT AREA INLETS IS REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOP SOIL, SEEDED AND MULCHED, OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

NOTE: THE DETAILS INCLUDED WITH THIS FACT SHEET SHOW COMMONLY USED, CONVENTIONAL METHODS OF INLET PROTECTION IN THE DENVER METROPOLITAN AREA. THERE ARE MANY PROPRIETARY INLET PROTECTION METHODS ON THE MARKET. UDFCD NEITHER ENDORSES NOR DISCOURAGES USE OF PROPRIETARY INLET PROTECTION; HOWEVER, IN THE EVENT PROPRIETARY METHODS ARE USED, THE APPROPRIATE DETAIL FROM THE MANUFACTURER MUST BE INCLUDED IN THE SWMP AND THE BMP MUST BE INSTALLED AND MAINTAINED AS SHOWN IN THE MANUFACTURER'S DETAILS.

NOTE: SOME MUNICIPALITIES DISCOURAGE OR PROHIBIT THE USE OF STRAW BALES FOR INLET PROTECTION. CHECK WITH LOCAL JURISDICTIONS TO DETERMINE IF STRAW BALE INLET PROTECTION IS ACCEPTABLE.

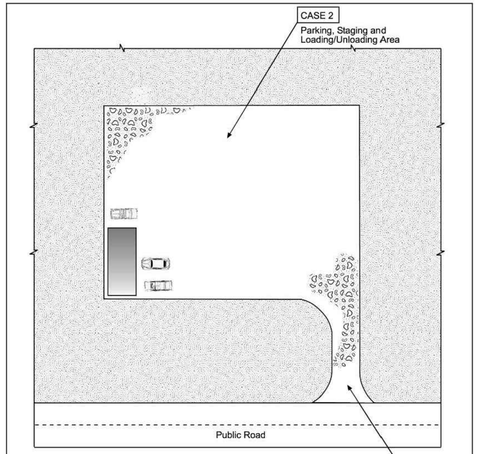


Table VT-1

	Case 1	Case 2
Gravel Thickness	9"	3"
Filter Fabric	YES	NO

City of Colorado Springs Storm Water Quality

Figure VT-1
Vehicle Tracking
Application Examples

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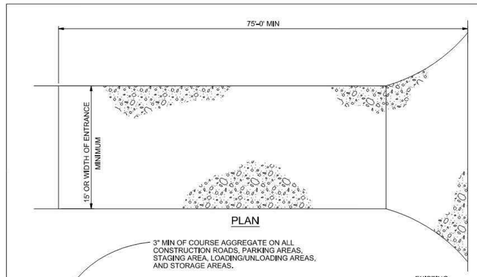
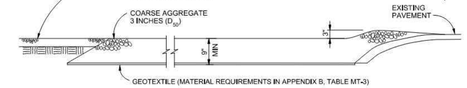


PLAN



SECTION

VEHICLE TRACKING
NTS

VEHICLE TRACKING NOTES

INSTALLATION REQUIREMENTS

1. ALL ENTRANCES TO THE CONSTRUCTION SITE ARE TO BE STABILIZED PRIOR TO CONSTRUCTION BEGINNING.

2. CONSTRUCTION ENTRANCES ARE TO BE BUILT WITH AN APRON TO ALLOW FOR TURNING TRAFFIC, BUT SHOULD NOT BE BUILT OVER EXISTING PAVEMENT EXCEPT FOR A SLIGHT OVERLAP.

3. AREAS TO BE STABILIZED ARE TO BE PROPERLY GRADED AND COMPACTED PRIOR TO LAYING DOWN GEOTEXTILE AND STONE.

4. CONSTRUCTION ROADS, PARKING AREAS, LOADING/UNLOADING ZONES, STORAGE AREAS, AND STAGING AREAS ARE TO BE STABILIZED.

5. CONSTRUCTION ROADS ARE TO BE BUILT TO CONFORM TO SITE GRADES, BUT SHOULD NOT HAVE SIDE SLOPES OR ROAD GRADES THAT ARE EXCESSIVELY STEEP.

MAINTENANCE REQUIREMENTS

1. REGULAR INSPECTIONS ARE TO BE MADE OF ALL STABILIZED AREAS, ESPECIALLY AFTER STORM EVENTS.

2. STONES ARE TO BE REAPPLIED PERIODICALLY AND WHEN REPAIR IS NECESSARY.

3. SEDIMENT TRACKED ONTO PAVED ROADS IS TO BE REMOVED DAILY BY SHOVELING OR SWEEPING. SEDIMENT IS NOT TO BE WASHED DOWN STORM SEWER DRAINS.

4. STORM SEWER INLET PROTECTION IS TO BE IN PLACE, INSPECTED, AND CLEANED IF NECESSARY.

5. OTHER ASSOCIATED SEDIMENT CONTROL MEASURES ARE TO BE INSPECTED TO ENSURE GOOD WORKING CONDITION.

City of Colorado Springs Stormwater Quality

Figure VT-2
Vehicle Tracking
Application Examples

Table 14-10. Recommended Seed Mix for Transition Areas[1]

Common Name (Variety)	Scientific Name	Growth Season	Growth Form	Seeds/Lb	Lbs PLS/Acre Drilled	Lbs PLS/Acre Broadcast or Hydroseeded
Sheep fescue (Durar)	*Festuca ovina*	Cool	Bunch	680,000	1.3	2.6
Western wheatgrass (Arriba)	*Pascopyrum smithii*	Cool	Sod	110,000	7.9	15.8
Alkali sacaton	*Spolobolus airoides*	Warm	Bunch	1,758,000	0.5	1.0
Slender wheatgrass	*Elymus trachycaulus*	Cool	Bunch	159,000	5.5	11.0
Canadian bluegrass (Ruebens)[1]	*Poa compressa*	Cool	Sod	2,500,000	0.3	0.6
Switchgrass (Pathfinder)	*Panicum virgatum*	Warm	Sod/ Bunch	389,000	1.3	2.6
Annual rye	*Lolium multiflorum*	Cool	Cover crop	227,000	10.0	20.0
				TOTAL	**26.8**	**53.6**
Wildflowers						
Blanket flower	*Faillardia aristata*	---	---	132,000	0.25	0.50
Prairie coneflower	*Ratibida columnaris*	---	---	1,230,000	0.20	0.40
Purple prairie clover	*Petalostemum purpurea*	---	---	210,000	0.20	0.40
Gayfeather	*Liatris punctata*	---	---	138,000	0.06	0.12
Flax	*Linum lewisii*	---	---	293,000	0.20	0.40
Penstemon	*Penstemon strictus*	---	---	592,000	0.20	0.40
Yarrow	*Achillea millefolium*	---	---	2,770,000	0.03	0.06
				TOTAL	**1.14**	**2.28**

[1]For side slopes or between wet and dry areas.
[2]Substitute 1.7 lbs PLS/acre of inland saltgrass (*Distichlis spicata)* in salty soils.

SEED MIX FOR POND BOTTOMS

THE CITY OF COLORADO SPRINGS ENGINEERING DEPARTMENT GENERAL SPECIFICATIONS SHOULD BE USED AS A RESOURCE WHEN DEVELOPING TECHNICAL SPECIFICATIONS FOR RE–VEGETATION. GENERAL GUIDELINES AND RECOMMENDATIONS FOR RE–VEGETATION INCLUDE:

1. SEED MIXTURES SHOULD BE SOWN AT THE PROPER TIME OF YEAR FOR THE MIXTURE. GENERALLY, THERE ARE TWO OPTIMAL SEEDING PERIODS DURING THE YEAR. THE FIRST PERIOD IS IN THE SPRING, MARCH TO MAY. THE SECOND PERIOD IS IN LATE SUMMER TO EARLY FALL, AUGUST TO SEPTEMBER.

2. SEED SHOULD BE DRILL–SEEDED, WHENEVER POSSIBLE.

3. BROADCAST SEEDING OR HYDRO–SEEDING MAY BE SUBSTITUTED ON SLOPES STEEPER THAN 3:1 OR ON OTHER AREAS NOT PRACTICAL TO DRILL SEED.

4. SEEDING RATES SHOULD BE DOUBLED FOR BROADCAST SEEDING OR INCREASED BY 50% IF USING A BRILLION DRILL OR HYDRO–SEEDING.

5. BROADCAST SEED SHOULD BE LIGHTLY HAND–RAKED INTO THE SOIL.

6. SEED DEPTH SHOULD BE ¼ TO ½ INCH FOR MOST MIXTURES.

7. SEEDED AREAS SHOULD BE MULCHED, AND THE MULCH SHOULD BE ADEQUATELY SECURED.

8. IF HYDRO–SEEDING IS CONDUCTED, MULCHING SHOULD BE CONDUCTED AS A SEPARATE, SECOND OPERATION.

9. CONTAINERIZED NURSERY STOCK SHOULD BE KEPT IN A LIVE AND HEALTHY CONDITION PRIOR TO INSTALLATION.

10. CONTAINERIZED TREES AND SHRUBS SHOULD BE INSTALLED ACCORDING TO THE PLANTING DETAILS PROVIDE IN THE COLORADO SPRINGS LANDSCAPE CODE AND POLICY MANUAL, UNIT FOUR, APPENDICES FOR TREE AND SHRUB PLANTING DETAILS.

11. LIVE STAKES, POLES AND WILLOW BUNDLES SHOULD BE INSTALLED WHEN DORMANT (LATE WINTER AND EARLY SPRING).

12. IF BEAVER ARE KNOWN TO BE IN THE AREA, BEAVER PROTECTION SHOULD BE PROVIDED FOR TREES AND SHRUBS.

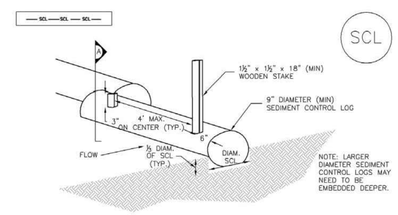
ALLOWABLE PLANT VARIETIES

(SEE DRAINAGE CRITERIA MANUAL, VOLUME 1, CHAPTER 14, TABLE 14–5)

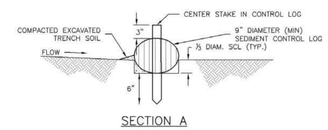
SPECIES

WESTERN WHEATGRASS (PASCOPYRUM SMITHII)
SWITCHGRASS (PANICUM VIRGATUM)
SLENDER WHEATGRASS (ELYMUS TRACHYCAULUS SSP. TRACHYCAULUS
PUBESCENT WHEATGRASS (TRIGIA INTERMEDIA SSP. TRICHOPHORUM)
INDIAN GRASS (ACHNATHERUM HYMENOIDES)
BIG BLUESTEM (POA AMPLA)
BLUE GRAMA (BOUTELOUA GRACILIS)
SWITCHGRASS (PANICUM VIRGATUM)
SIDE–OATS GRAMA (BOUTELOUA CURTIPENDULA)
NEEDLE AND THREAD (HESPEROSTIPA COMATA SSP. COMATA)

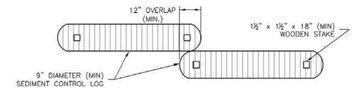
***SEED MIX SHOULD BE APPROVED BY THE COUNTY**



SEDIMENT CONTROL LOG



SECTION A



SEDIMENT CONTROL LOG JOINTS

SCL–1. SEDIMENT CONTROL LOG

SEDIMENT CONTROL LOG INSTALLATION NOTES

1. SEE PLAN VIEW FOR LOCATION AND LENGTH OF SEDIMENT CONTROL LOGS.

2. SEDIMENT CONTROL LOGS THAT ACT AS A PERIMETER CONTROL SHALL BE INSTALLED PRIOR TO ANY UPGRADIENT LAND–DISTURBING ACTIVITIES.

3. SEDIMENT CONTROL LOGS SHALL CONSIST OF STRAW, COMPOST, EXCELSIOR OR COCONUT FIBER, AND SHALL BE FREE OF ANY NOXIOUS WEED SEEDS OR DEFECTS INCLUDING RIPS, HOLES AND OBVIOUS WEAR.

4. SEDIMENT CONTROL LOGS MAY BE USED AS SMALL CHECK DAMS IN DITCHES AND SWALES; HOWEVER, THEY SHOULD NOT BE USED IN PERENNIAL STREAMS OR HIGH VELOCITY DRAINAGE WAYS.

5. IT IS RECOMMENDED THAT SEDIMENT CONTROL LOGS BE TRENCHED INTO THE GROUND TO A DEPTH OF APPROXIMATELY ⅓ OF THE DIAMETER OF THE LOG. IF TRENCHING TO THIS DEPTH IS NOT FEASIBLE AND/OR DESIRABLE (SHORT TERM INSTALLATION WITH DESIRE NOT TO DAMAGE LANDSCAPE) A LESSER TRENCHING DEPTH MAY BE ACCEPTABLE WITH MORE ROBUST STAKING

6. THE UPHILL SIDE OF THE SEDIMENT CONTROL LOG SHALL BE BACKFILLED WITH SOIL THAT IS FREE OF ROCKS AND DEBRIS. THE SOIL SHALL BE TIGHTLY COMPACTED INTO THE SHAPE OF A RIGHT TRIANGLE USING A SHOVEL OR WEIGHTED LAWN ROLLER.

7. FOLLOW MANUFACTURERS' GUIDANCE FOR STAKING. IF MANUFACTURERS' INSTRUCTIONS DO NOT SPECIFY SPACING, STAKES SHALL BE PLACED ON 4' CENTERS AND EMBEDDED A MINIMUM OF 6" INTO THE GROUND. 3" OF THE STAKE SHALL PROTRUDE FROM THE TOP OF THE LOG. STAKES THAT ARE BROKEN PRIOR TO INSTALLATION SHALL BE REPLACED.

SEDIMENT CONTROL LOG MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF SEDIMENT CONTROL LOG SHALL BE REMOVED AS NEEDED TO MAINTAIN FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY ½ OF THE HEIGHT OF THE SEDIMENT CONTROL LOG.

5. SEDIMENT CONTROL LOG SHALL BE REMOVED AT THE END OF CONSTRUCTION. IF DISTURBED AREAS EXIST AFTER REMOVAL, THEY SHALL BE COVERED WITH TOP SOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAILS ADAPTED FROM TOWN OF PARKER, COLORADO, JEFFERSON COUNTY, COLORADO, DOUGLAS COUNTY, COLORADO, AND CITY OF AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

NO.	REVISIONS DESCRIPTION	DATE

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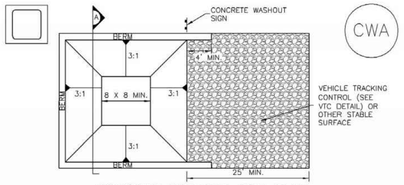
WATERBURY FILING NO. 1 & 2

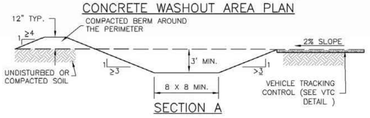
GRADING EROSION & STORMWATER CONTROL PLAN
EROSION CONTROL DETAILS

DESIGNED BY DLF
DRAWN BY QNA
CHECKED BY QNA
H–SCALE NA
V–SCALE N/A
JOB NO. 1715.00
DATE ISSUED 3/3/22
SHEET NO. 8 OF 10

Concrete Washout Area (CWA) MM-1



CONCRETE WASHOUT AREA PLAN



SECTION A

CWA–1. CONCRETE WASHOUT AREA

CWA INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –CWA INSTALLATION LOCATION.

2. DO NOT LOCATE AN UNLINED CWA WITHIN 400' OF ANY NATURAL DRAINAGE PATHWAY OR WATERBODY. DO NOT LOCATE WITHIN 1,000' OF ANY WELLS OR DRINKING WATER SOURCES. IF SITE CONSTRAINTS MAKE THIS INFEASIBLE, OR IF HIGHLY PERMEABLE SOILS EXIST ON SITE, THE CWA MUST BE INSTALLED WITH AN IMPERMEABLE LINER (16 MIL MIN. THICKNESS) OR SURFACE STORAGE ALTERNATIVES USING PREFABRICATED CONCRETE WASHOUT DEVICES OR A LINED ABOVE GROUND STORAGE ARE SHOULD BE USED.

3. THE CWA SHALL BE INSTALLED PRIOR TO CONCRETE PLACEMENT ON SITE.

4. CWA SHALL INCLUDE A FLAT SUBSURFACE PIT THAT IS AT LEAST 8' BY 8' SLOPES LEADING OUT OF THE SUBSURFACE PIT SHALL BE 3:1 OR FLATTER. THE PIT SHALL BE AT LEAST 3' DEEP.

5. BERM SURROUNDING SIDES AND BACK OF THE CWA SHALL HAVE MINIMUM HEIGHT OF 1'.

6. VEHICLE TRACKING PAD SHALL BE SLOPED 2% TOWARDS THE CWA.

7. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE CWA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CWA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.

8. USE EXCAVATED MATERIAL FOR PERIMETER BERM CONSTRUCTION.

MM-1 Concrete Washout Area (CWA)

CWA MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. THE CWA SHALL BE REPAIRED, CLEANED, OR ENLARGED AS NECESSARY TO MAINTAIN CAPACITY FOR CONCRETE WASTE, CONCRETE MATERIALS, ACCUMULATED IN PIT, SHALL BE REMOVED ONCE THE MATERIALS HAVE REACHED A DEPTH OF 2'.

5. CONCRETE WASHOUT WATER, WASTED PIECES OF CONCRETE AND ALL OTHER DEBRIS IN THE SUBSURFACE PIT SHALL BE TRANSPORTED FROM THE JOB SITE IN A WATER–TIGHT CONTAINER AND DISPOSED OF PROPERLY.

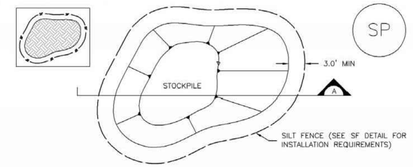
6. THE CWA SHALL REMAIN IN PLACE UNTIL ALL CONCRETE FOR THE PROJECT IS PLACED.

7. WHEN THE CWA IS REMOVED, COVER THE DISTURBED AREA WITH TOP SOIL, SEED AND MULCH OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

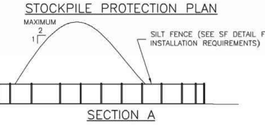
(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND THE CITY OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD).

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Stockpile Management (SP) MM-2



STOCKPILE PROTECTION PLAN



SECTION A

SP–1. STOCKPILE PROTECTION

STOCKPILE PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION OF STOCKPILES.
   –TYPE OF STOCKPILE PROTECTION.

2. INSTALL PERIMETER CONTROLS IN ACCORDANCE WITH THEIR RESPECTIVE DESIGN DETAILS. SILT FENCE IS SHOWN IN THE STOCKPILE PROTECTION DETAILS; HOWEVER, OTHER TYPES OF PERIMETER CONTROLS INCLUDING SEDIMENT CONTROL LOGS OR ROCK SOCKS MAY BE SUITABLE IN SOME CIRCUMSTANCES. CONSIDERATIONS FOR DETERMINING THE APPROPRIATE TYPE OF PERIMETER CONTROL FOR A STOCKPILE INCLUDE WHETHER THE STOCKPILE IS LOCATED ON A PERVIOUS OR IMPERVIOUS SURFACE, THE RELATIVE HEIGHTS OF THE PERIMETER CONTROL AND STOCKPILE, THE ABILITY OF THE PERIMETER CONTROL TO CONTAIN THE STOCKPILE WITHOUT FAILING IN THE EVENT THAT MATERIAL FROM THE STOCKPILE SHIFTS OR SLUMPS AGAINST THE PERIMETER, AND OTHER FACTORS.

3. STABILIZE THE STOCKPILE SURFACE WITH SURFACE ROUGHENING, TEMPORARY SEEDING AND MULCHING, EROSION CONTROL BLANKETS, OR SOIL BINDERS. SOILS STOCKPILED FOR AN EXTENDED PERIOD (TYPICALLY FOR MORE THAN 60 DAYS) SHOULD BE SEEDED AND MULCHED WITH A TEMPORARY GRASS COVER ONCE THE STOCKPILE IS PLACED (TYPICALLY WITHIN 14 DAYS). USE OF MULCH ONLY OR A SOIL BINDER IS ACCEPTABLE IF THE STOCKPILE WILL BE IN PLACE FOR A MORE LIMITED TIME PERIOD (TYPICALLY 30–60 DAYS).

4. FOR TEMPORARY STOCKPILES ON THE INTERIOR PORTION OF A CONSTRUCTION SITE, WHERE OTHER DOWNGRADIENT CONTROLS, INCLUDING PERIMETER CONTROL, ARE IN PLACE, STOCKPILE PERIMETER CONTROLS MAY NOT BE REQUIRED.

MM-2 Stockpile Management (SM)

STOCKPILE PROTECTION MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

STOCKPILE PROTECTION MAINTENANCE NOTES

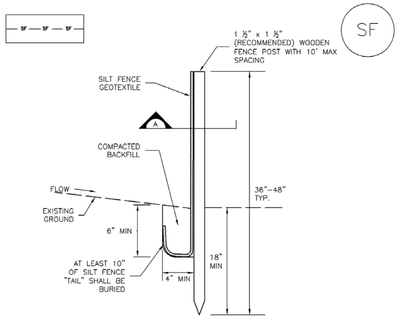
4. IF PERIMETER PROTECTION MUST BE MOVED TO ACCESS SOIL STOCKPILE, REPLACE PERIMETER CONTROLS BY THE END OF THE WORKDAY.

5. STOCKPILE PERIMETER CONTROLS CAN BE REMOVED ONCE ALL THE MATERIAL FROM THE STOCKPILE HAS BEEN USED.

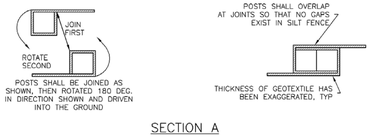
(DETAILS ADAPTED FROM PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Silt Fence (SF) SC-1



SILT FENCE



SECTION A

SF–1. SILT FENCE

SC-1 Silt Fence (SF)

SILT FENCE INSTALLATION NOTES

1. SILT FENCE MUST BE PLACED AWAY FROM THE TOE OF THE SLOPE TO ALLOW FOR WATER PONDING. SILT FENCE AT THE TOE OF A SLOPE SHOULD BE INSTALLED IN A FLAT LOCATION AT LEAST SEVERAL FEET (2–5 FT) FROM THE TOE OF THE SLOPE TO ALLOW ROOM FOR PONDING AND DEPOSITION.

2. A UNIFORM 6" X 4" ANCHOR TRENCH SHALL BE EXCAVATED USING TRENCHER OR SILT FENCE INSTALLATION DEVICE. NO ROAD GRADERS, BACKHOES, OR SIMILAR EQUIPMENT SHALL BE USED.

3. COMPACT ANCHOR TRENCH BY HAND WITH A "JUMPING JACK" OR BY WHEEL ROLLING. COMPACTION SHALL BE SUCH THAT SILT FENCE RESISTS BEING PULLED OUT OF ANCHOR TRENCH BY HAND.

4. SILT FENCE SHALL BE PULLED TIGHT AS IT IS ANCHORED TO THE STAKES. THERE SHOULD BE NO NOTICEABLE SAG BETWEEN STAKES AFTER IT HAS BEEN ANCHORED TO THE STAKES.

5. SILT FENCE FABRIC SHALL BE ANCHORED TO THE STAKES USING 1" HEAVY DUTY STAPLES OR NAILS WITH 1" HEADS. STAPLES AND NAILS SHOULD BE PLACED 3" ALONG THE FABRIC DOWN THE STAKE.

6. AT THE END OF A RUN OF SILT FENCE ALONG A CONTOUR, THE SILT FENCE SHOULD BE TURNED PERPENDICULAR TO THE CONTOUR TO CREATE A "J–HOOK." THE "J–HOOK" EXTENDING PERPENDICULAR TO THE CONTOUR SHOULD BE OF SUFFICIENT LENGTH TO KEEP RUNOFF FROM FLOWING AROUND THE END OF THE SILT FENCE (TYPICALLY 10' – 20').

7. SILT FENCE SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

SILT FENCE MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF THE SILT FENCE SHALL BE REMOVED AS NEEDED TO MAINTAIN THE FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY 6".

5. REPAIR OR REPLACE SILT FENCE WHEN THERE ARE SIGNS OF WEAR, SUCH AS SAGGING, TEARING, OR COLLAPSE.

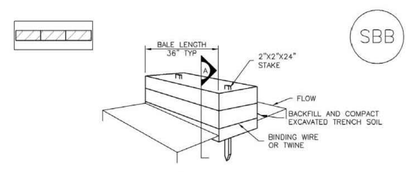
6. SILT FENCE IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION, OR IS REPLACED BY AN EQUIVALENT PERIMETER SEDIMENT CONTROL BMP.

7. WHEN SILT FENCE IS REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

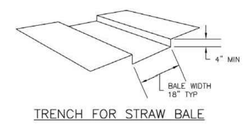
(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF AURORA, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

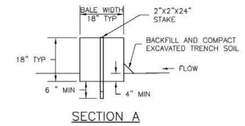
SC-3 Straw Bale Barrier (SBB)



STRAW BALE



TRENCH FOR STRAW BALE



SECTION A

SBB–1. STRAW BALE

Straw Bale Barrier (SBB) SC-3

STRAW BALE INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION(S) OF STRAW BALES.

2. STRAW BALES SHALL CONSIST OF CERTIFIED WEED FREE STRAW OR HAY. LOCAL JURISDICTIONS MAY REQUIRE PROOF THAT BALES ARE WEED FREE.

3. STRAW BALES SHALL CONSIST OF APPROXIMATELY 5 CUBIC FEET OF STRAW OR HAY AND WEIGH NOT LESS THAN 35 POUNDS.

4. WHEN STRAW BALES ARE USED IN SERIES AS A BARRIER, THE END OF EACH BALE SHALL BE TIGHTLY ABUTTING ONE ANOTHER.

5. STRAW BALE DIMENSIONS SHALL BE APPROXIMATELY 36"X18"X18".

6. A UNIFORM ANCHOR TRENCH SHALL BE EXCAVATED TO A DEPTH OF 4". STRAW BALES SHALL BE PLACED SO THAT BINDING TWINE IS ENCOMPASSING THE VERTICAL SIDES OF THE BALE(S). ALL EXCAVATED SOIL SHALL BE PLACED ON THE UPHILL SIDE OF THE STRAW BALE(S) AND COMPACTED.

7. TWO (2) WOODEN STAKES SHALL BE USED TO HOLD EACH BALE IN PLACE. WOODEN STAKES SHALL BE 2"X2"X24". WOODEN STAKES SHALL BE DRIVEN 6" INTO THE GROUND.

STRAW BALE MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. STRAW BALES SHALL BE REPLACED IF THEY BECOME HEAVILY SOILED, ROTTEN, OR DAMAGED BEYOND REPAIR.

5. SEDIMENT ACCUMULATED UPSTREAM OF STRAW BALE BARRIER SHALL BE REMOVED AS NEEDED TO MAINTAIN FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY ½ OF THE HEIGHT OF THE STRAW BALE BARRIER.

6. STRAW BALES ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

7. WHEN STRAW BALES ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAILS ADAPTED FROM TOWN OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

REVISIONS		
NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
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COLORADO SPRINGS, CO 80949
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Creative Civil Engineering Solutions
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
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WATERBURY FILING NO. 1 & 2

GRADING AND EROSION CONTROL PLAN
EROSION CONTROL DETAILS

DESIGNED BY DLF
DRAWN BY QNA
CHECKED BY QNA
H–SCALE NA
V–SCALE N/A
JOB NO. 1715.00
DATE ISSUED 3/3/22
SHEET NO. 9 OF 10

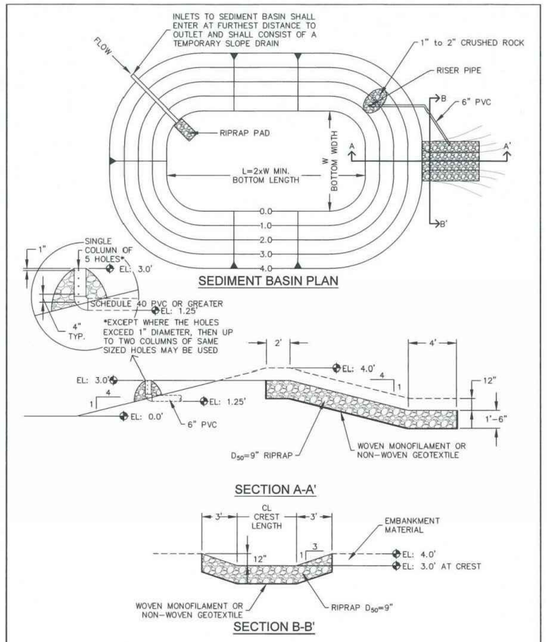


TABLE SB-1, SIZING INFORMATION FOR STANDARD SEDIMENT BASIN

UPSTREAM DRAINAGE AREA (ROUNDED TO NEAREST ACRE), (AC)	BASIN BOTTOM WIDTH (W), (FT)	SPILLWAY CREST LENGTH (CL), (FT)	HOLE DIAMETER (HD), (IN)
1	12½"	2	9/32
2	21	3	13/16
3	28	5	1/2
4	33½	6	9/16
5	38½	8	23/32
6	43	9	23/32
7	47¼	11	25/32
8	51	12	27/32
9	55	13	7/8
10	58¾	15	15/16
11	61	16	31/32
12	64	18	1"
13	67½	19	1 1/16
14	70½	21	1 1/8
15	73¼	22	1 3/16

INSTALLATION NOTES

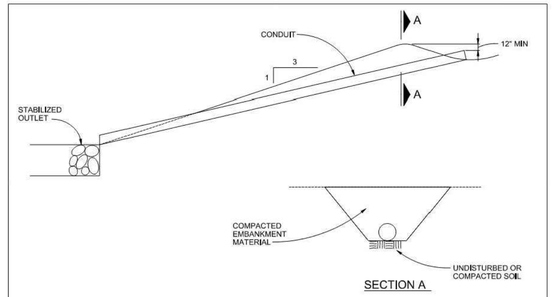
1. FOR STANDARD BASIN, BOTTOM DIMENSION MAY BE MODIFIED AS LONG AS BOTTOM AREA IS NOT REDUCED.
2. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL FREE OF DEBRIS, ORGANIC MATERIAL, AND ROCKS OR CONCRETE GREATER THAN 3 INCHES, AND SHALL HAVE A MINIMUM OF 15 PERCENT BY WEIGHT PASSING THE No. 200 SIEVE.
3. EMBANKMENT MATERIAL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D-698.
4. PIPE SCHEDULE 40 OR GREATER SHALL BE USED.
5. THE DETAILS SHOWN ON THESE SHEETS PERTAIN TO STANDARD SEDIMENT BASIN(S) FOR DRAINAGE AREAS LESS THAN 15 ACRES. SEE CONSTRUCTION DRAWINGS FOR EMBANKMENT, STORAGE VOLUME, SPILLWAY, OUTLET, AND OUTLET PROTECTION DETAILS FOR ANY SEDIMENT BASIN(S) THAT HAVE BEEN INDIVIDUALLY DESIGNED FOR DRAINAGE AREAS LARGER THAN 15 ACRES. DESIGN CALCULATIONS MUST BE APPROVED PRIOR TO IMPLEMENTATION.

MAINTENANCE NOTES

1. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN CONTROL MEASURES IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
2. SEDIMENT ACCUMULATED IN BASIN SHALL BE REMOVED AS NEEDED TO MAINTAIN CONTROL MEASURE EFFECTIVENESS, TYPICALLY WHEN SEDIMENT DEPTH REACHES ONE FOOT (I.E. TWO FEET BELOW SPILLWAY CREST).
3. SEDIMENT BASINS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS PERMANENTLY STABILIZED.
4. PERMANENTLY STABILIZE AREA AFTER SEDIMENT BASIN REMOVAL.

TSB

STORMWATER ENTERPRISE | TEMPORARY SEDIMENT BASIN | APPROVED: SWMT MANAGER | ISSUED: 10/7/19 | REVISED: 8/19/2020 | DRAWING NO. 900-TSB-2



SLOPE DRAIN
NTS

SLOPE DRAIN NOTES

INSTALLATION REQUIREMENTS

1. THE SLOPE DRAIN IS TO BE DESIGNED TO CONVEY THE PEAK RUNOFF FOR THE 2-YEAR STORM.

2. PIPE MATERIAL MAY INCLUDE CORRUGATED METAL, OR RIGID OR FLEXIBLE PLASTIC.

3. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL WITH A MINIMUM OF 15% PASSING A #200 SIEVE. EXCAVATED SOIL CAN BE USED IF IT MEETS THIS REQUIREMENT.

4. EMBANKMENT IS TO BE COMPACTED TO AT LEAST 90% OF MAXIMUM DENSITY AND WITHIN 2% OF OPTIMUM MOISTURE CONTENT ACCORDING TO ASTM D 698.

5. SLOPE DRAIN SECTIONS ARE TO BE SECURELY FASTENED TOGETHER AND HAVE WATERTIGHT FITTINGS.

6. THE OUTLET IS TO BE STABILIZED AND, UNLESS THE DRAIN DISCHARGES DIRECTLY TO A SEDIMENT BASIN, A TEMPORARY SURFACE IS TO BE PROVIDED TO CONVEY FLOWS DOWN STREAM.

7. IMMEDIATELY STABILIZE ALL AREAS DISTURBED BY INSTALLATION OR REMOVAL OF THE PIPE SLOPE DRAIN.

MAINTENANCE REQUIREMENTS

1. INLET AND OUTLET POINTS ARE TO BE CHECKED REGULARLY, AND AFTER HEAVY STORMS FOR CLOGGING AND OVERCHARGING. ANY BREAKS IN THE PIPE ARE TO BE PROMPTLY REPAIRED, AND CLOGS REMOVED AS NEEDED.

2. WATER IS NOT TO BYPASS OR UNDERCUT THE INLET OR PIPE. IF THESE PROBLEMS DO EXIST, THE HEADWALL NEEDS TO BE REINFORCED WITH COMPACT EARTH OR SANDBAGS.

3. THE OUTLET POINT IS TO BE FREE OF EROSION, AND, IF NECESSARY, ADDITIONAL OUTLET PROTECTION SHOULD BE INSTALLED.

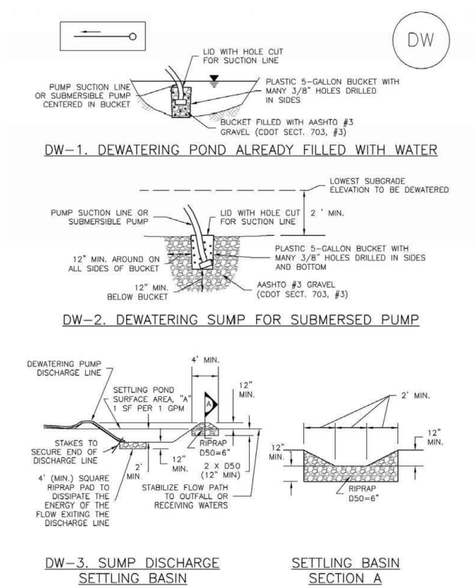
4. CONSTRUCTION TRAFFIC IS NOT TO CROSS THE SLOPE DRAIN AND MATERIALS ARE NOT TO BE PLACED ON IT.

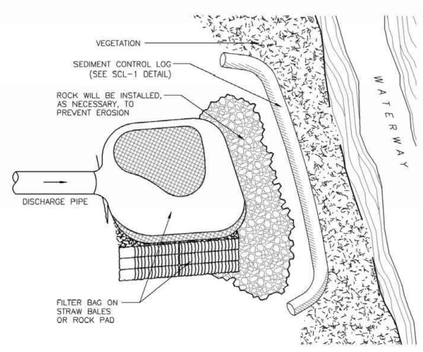
5. THE SLOPE DRAIN IS TO REMAIN IN PLACE UNTIL THE SLOPE HAS BEEN COMPLETELY STABILIZED OR UP TO 30 DAYS AFTER PERMANENT SLOPE STABILIZATION.

City of Colorado Springs
Stormwater Quality

Figure SD-1
Slope Drain
Construction Detail and Maintenance Requirements

3-39





DEWATERING INSTALLATION NOTES

1. SEE PLAN VIEW FOR;
   -LOCATION OF DEWATERING EQUIPMENT.
   -TYPE OF DEWATERING OPERATION (DW-1 TO DW-4).

2. THE OWNER OR CONTRACTOR SHALL OBTAIN A CONSTRUCTION DISCHARGE (DEWATERING) PERMIT FROM THE STATE PRIOR TO ANY DEWATERING OPERATIONS DISCHARGING FROM THE SITE. ALL DEWATERING SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE PERMIT.

3. THE OWNER OR OPERATOR SHALL PROVIDE, OPERATE, AND MAINTAIN DEWATERING SYSTEMS OF SUFFICIENT SIZE AND CAPACITY TO PERMIT EXCAVATION AND SUBSEQUENT CONSTRUCTION IN DRY CONDITIONS AND TO LOWER AND MAINTAIN THE GROUNDWATER LEVEL A MINIMUM OF 2-FEET BELOW THE LOWEST POINT OF EXCAVATION AND CONTINUOUSLY MAINTAIN EXCAVATIONS FREE OF WATER UNTIL BACK-FILLED TO FINAL GRADE.

DEWATERING INSTALLATION NOTES

4. DEWATERING OPERATIONS SHALL USE ONE OR MORE OF THE DEWATERING SUMPS SHOWN ABOVE, WELL POINTS, OR OTHER MEANS APPROVED BY THE LOCAL JURISDICTION TO REDUCE THE PUMPING OF SEDIMENT, AND SHALL PROVIDE A TEMPORARY SEDIMENT BASIN OR FILTRATION BMP TO REDUCE SEDIMENT TO ALLOWABLE LEVELS PRIOR TO RELEASE OFF SITE OR TO A RECEIVING WATER. A SEDIMENT BASIN MAY BE USED IN LIEU OF SUMP DISCHARGE SETTLING BASIN SHOWN ABOVE IF A 4-FOOT-SQUARE RIPRAP PAD IS PLACED AT THE DISCHARGE POINT AND THE DISCHARGE END OF THE LINE IS STAKED IN PLACE TO PREVENT MOVEMENT OF THE LINE.

DEWATERING MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. DEWATERING BMPs ARE REQUIRED IN ADDITION TO ALL OTHER PERMIT REQUIREMENTS.

5. TEMPORARY SETTLING BASINS SHALL BE REMOVED WHEN NO LONGER NEEDED FOR DEWATERING OPERATIONS. ANY DISTURBED AREA SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO, NOT AVAILABLE IN AUTOCAD)

REVISIONS

NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
4-WAY RANCH JOINT VENTURE
ATTN: PETER MARTZ
P.O. BOX 50223
COLORADO SPRINGS, CO 80949
719-491-3150

Terra Nova Engineering, Inc.
Creative Civil Engineering Solutions
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
FAX: 719-635-6426
www.tnesinc.com

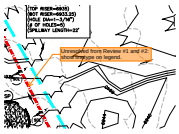
WATERBURY FILING NO. 1 & 2

GRADING AND EROSION CONTROL PLAN
EROSION CONTROL DETAILS

DESIGNED BY DLF
DRAWN BY QNA
CHECKED BY QNA
H-SCALE NA
V-SCALE N/A
JOB NO. 1715.00
DATE ISSUED 3/3/22
SHEET NO. 10 OF 10

ENG-PUDSP21005-R3-GEC.pdf Markup Summary

2 (3)



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Page Index: 2
Date: 4/7/2022 12:13:57 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: [1] SHT 2 EC INITIAL

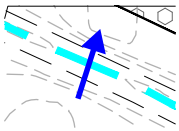
Unresolved from Review #1 and #2:
show linetype on legend.

ADDED TO LEGEND

Subject: Callout
Page Index: 2
Date: 4/22/2022 9:13:16 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] SHT 2 EC INITIAL

It appears that this is the overflow location of the stock pond - provide a breach on the east to direct flows as intended.

ADDED BUT ON THE SOUTH END AS THIS WHERE THE FLOW WILL GET INTO THE DIVERSION SWALE E-E



Subject: Arrow
Page Index: 2
Date: 4/22/2022 9:03:27 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] SHT 2 EC INITIAL

ADDED

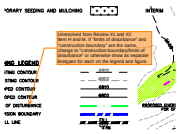
3 (1)

Subject: Callout
Page Index: 3
Date: 4/22/2022 12:43:23 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] SHT 3 INITIAL

Is this a TSB initially? Label if so.

NO IT IS NOT A TSB

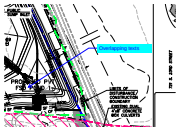
4 (3)



Subject: SW - Comment
Page Index: 4
Date: 4/7/2022 12:13:38 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: [1] SHT 4 EC INTERIM

Unresolved from Review #1 and #2:
Item H and M. If "limits of disturbance" and "construction boundary" are the same, change to "construction boundary/limits of disturbance" or otherwise show as separate linetypes for each on the legend and figure.

ADDED TO LEGEND



Subject: Callout
Page Index: 4
Date: 4/18/2022 3:00:09 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] SHT 4 EC INTERIM

Overlapping texts

FIXED

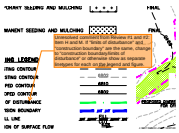
Subject: Callout
Page Index: 4
Date: 4/18/2022 3:01:58 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] SHT 4 EC INTERIM

Grading needs to be 50' from existing channel.

revised grading to be 50' from east channel in the early grading plans

---

6 (5)



Subject: SW - Comment
Page Index: 6
Date: 4/7/2022 12:17:49 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: [1] SHT 6 FINAL

Unresolved comment from Review #1 and #2: Item H and M. If "limits of disturbance" and "construction boundary" are the same, change to "construction boundary/limits of disturbance" or otherwise show as separate linetypes for each on the legend and figure.

ADDED TO LEGEND

Subject: Callout
Page Index: 6
Date: 4/18/2022 3:04:27 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] SHT 6 FINAL

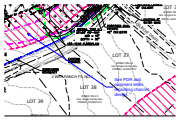
show all contours

ADDED

Subject: Callout
Page Index: 6
Date: 4/18/2022 3:05:07 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] SHT 6 FINAL

Curb and gutter shouldn't be out this far

We are shown tying into the existing 2 lane cross sections this is correct per my CD's



Subject: Callout
Page Index: 6
Date: 4/22/2022 12:54:13 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] SHT 6 FINAL

See PDR and comment letter regarding channel design.

??????????

Subject: Callout
Page Index: 6
Date: 4/22/2022 12:55:13 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] SHT 6 FINAL

Show maintenance road to outlet structure

ADDED length to road

7 (1)

Subject: SW - Comment
Page Index: 7
Date: 4/7/2022 12:18:48 PM
Author: EPC Stormwater - Glenn Reese
Color: ■
Layer:
Space:
Page Label: [1] SHT 7 FINAL

Unresolved from Review #1 and #2:
Item H and M. If "limits of disturbance" and "construction boundary" are the same, change to "construction boundary/limits of disturbance" or otherwise show as separate linetypes for each on the legend and figure.

ADDED TO LEGEND

One of these forms is needed for each PBMP so that the specific ponding acreage and Lat/Long for each pond can be inputted/tracked.

El Paso County MS4 Post Construction Detention / Water Quality Facility Documentation Form done

This document **must be completed and submitted** with required attachments to the County for projects requiring a detention and/or a water quality facility. A separate completed form must be submitted for each facility.

Project name: Waterbury Filing No. 1 & 2

Owner name: 4-Way Ranch Joint Ventures

Location Address:

Stapleton Drive and Bandernero Drive intersection Falcon, CO

Latitude and Longitude:

Lat: 38.970595, Long: -104.568777

Assessor's Parcel #: 4200000417 Section: 28 Township: 12 Range: 64

Expected Completion date: Fall 2021

Project acreage: 61.93 Design Ponding Acres: 3.19 Design Storm: 100-Y

Design Engineer Email Address: quentin.armijo@tnesinc.com

To ensure compliance with C.R.S. 37-92-602(8), the completed Stormwater Detention and Infiltration Design Data Sheet **must be attached**. The form can be found here: https://maperture.digitaldataservices.com/gvh/?viewer=cswdif# (click on Download SDI Design Data Sheet)

List all permanent water quality control measure(s) (EDBs, rain gardens, etc):

EDB POND 1, EDB POND 2 & EDB POND 3

For all projects for which the constrained redevelopment sites standard is applied, provide an explanation of why it is not practicable to meet the full design standards. NA

Attach Operations and Maintenance (O&M) Plan describing the operation and maintenance procedures that ensure the long-term observation, maintenance, and operation of control measure(s), including routine inspection frequencies and maintenance activities. If multiple, different water quality control measures are used at the same location, a separate O & M Plan must be provided for each facility.

Attach Private Detention Basin / Stormwater Quality Best Management Practice Maintenance Agreement and Easement addressing maintenance of BMPs that shall be binding on all subsequent owners of the permanent BMPs.

Attachments:

Stormwater Detention and Infiltration Design Data Sheet
O & M Plan
Maintenance and Access Agreement

Review Engineer

EPC Project File No.

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: **Waterbury Filing No. 1 & 2 EDB Pond 1 D8 8**

Facility Location & Jurisdiction: **Stapleton Dr. & Bandernero Dr Intersection**

User Input: Watershed Characteristics

Watershed Slope =	0.012	ft/ft
Watershed Length =	1935	ft
Watershed Area =	21.12	acres
Watershed Imperviousness =	55.5%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent

Location for 1-hr Rainfall Depths (use dropdown):

User Input

WQCV Treatment Method = Extended Detention

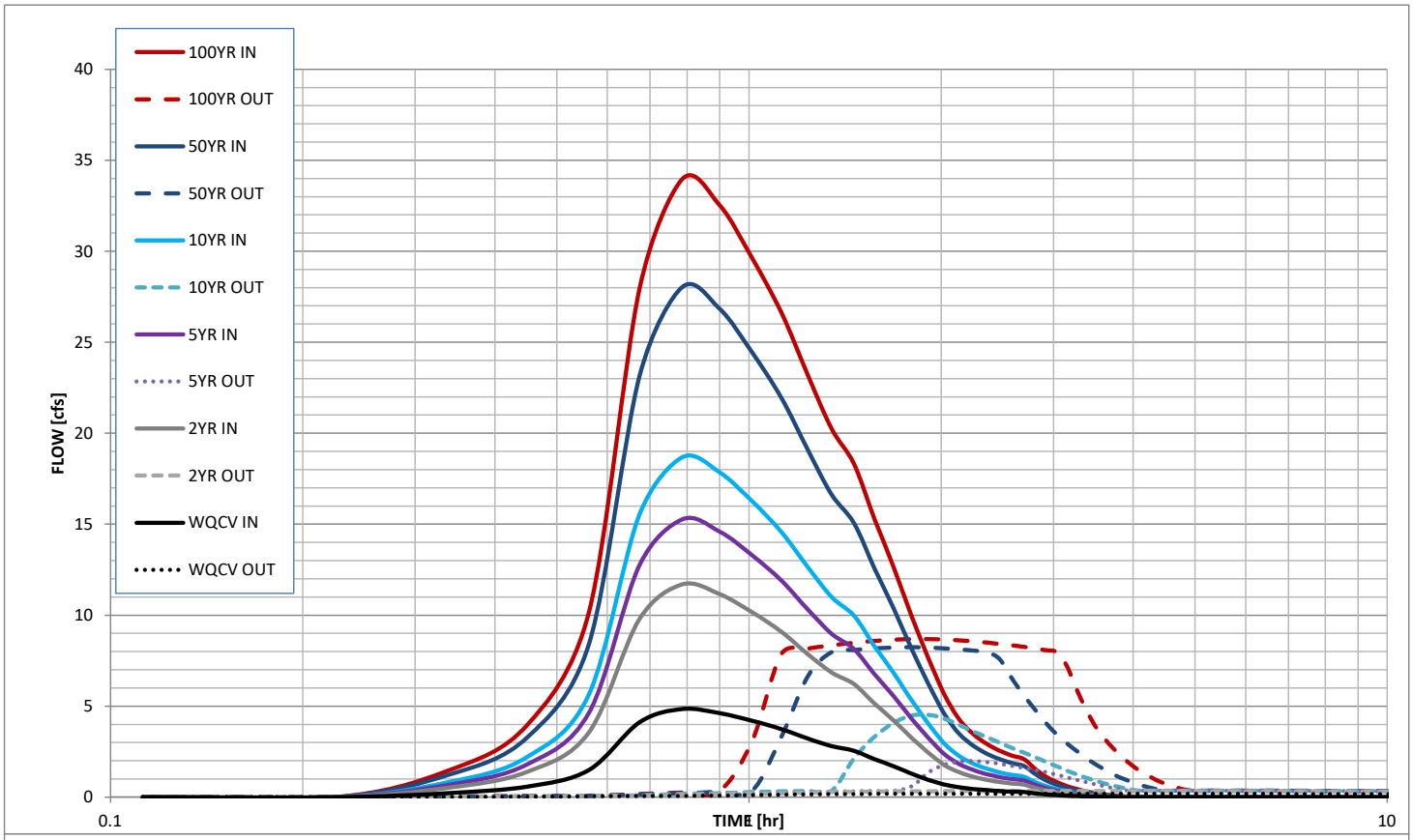
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	100	0.00	0.00
0.25	3,176	0.25	0.04
0.50	6,253	0.50	0.06
0.75	8,372	0.75	0.07
1.00	10,492	1.00	0.09
1.25	12,612	1.25	0.14
1.50	14,732	1.50	0.17
1.75	16,852	1.75	0.19
2.00	18,972	2.00	0.21
2.25	21,092	2.25	0.27
2.50	23,212	2.50	0.30
2.75	25,435	2.75	0.33
3.00	27,658	3.00	0.36
3.25	29,881	3.25	3.70
3.50	32,105	3.50	7.91
3.75	34,328	3.75	8.21
4.00	36,551	4.00	8.50
4.25	38,744	4.25	8.78
4.50	40,997	4.50	9.06
4.75	43,176	4.75	20.80
5.00	45,355	5.00	42.67
5.25	47,534	5.25	71.79
5.50	49,712	5.50	107.27
5.75	51,891	5.75	148.67
6.00	54,070	6.00	195.73
6.25	56,249	6.25	248.30
6.50	58,428	6.50	306.29

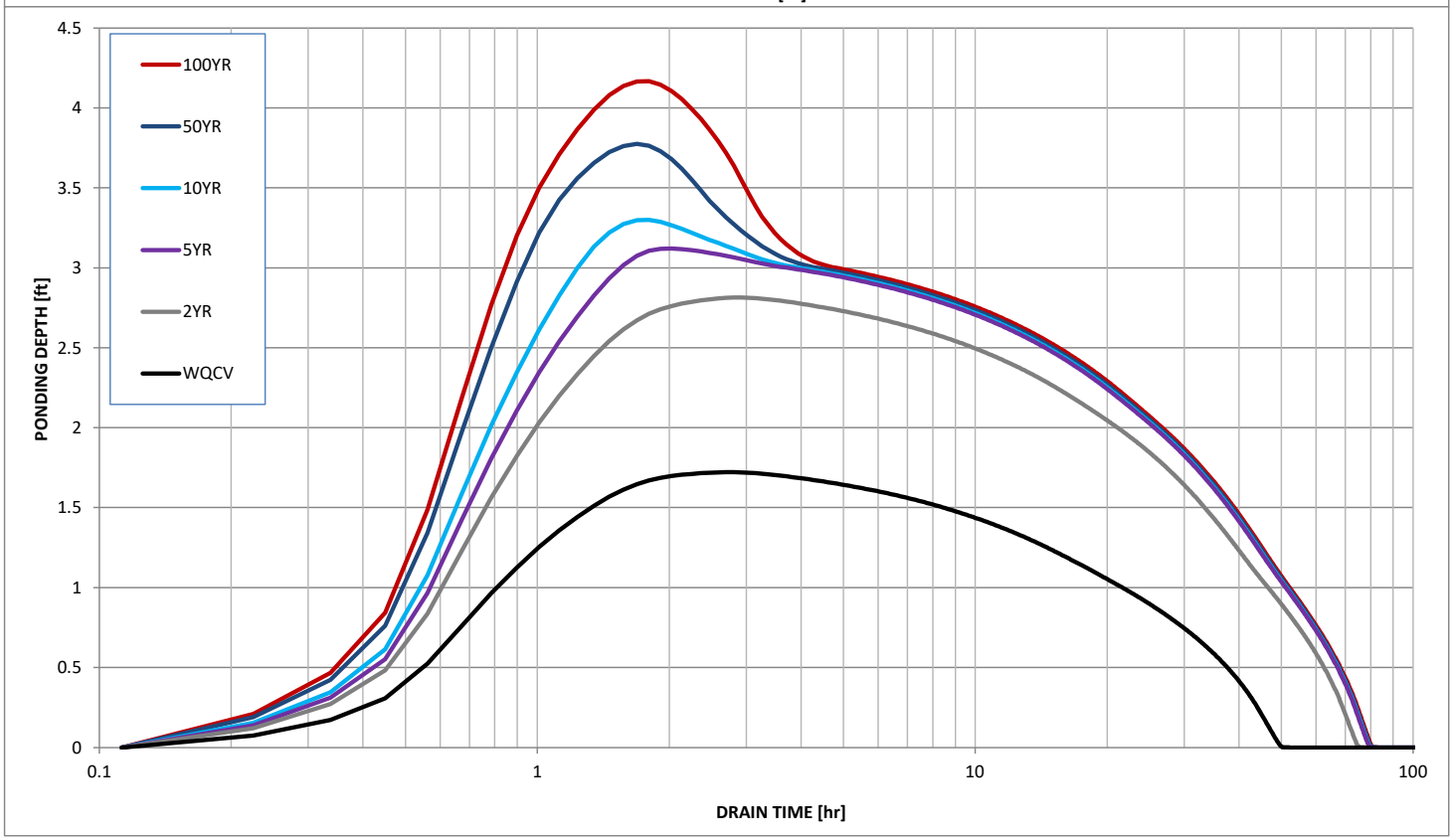
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	1.19	1.50	1.75	2.25	2.52	in
Calculated Runoff Volume =	0.391	0.953	1.250	1.532	2.312	2.808	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	0.391	0.953	1.249	1.531	2.311	2.807	acre-ft
Time to Drain 97% of Inflow Volume =	43.4	64.2	**66.8**	65.4	61.5	59.3	hours
Time to Drain 99% of Inflow Volume =	46.2	69.0	72.7	72.1	70.6	**69.9**	hours
Maximum Ponding Depth =	1.72	2.81	3.12	3.30	3.77	4.17	ft
Maximum Ponded Area =	0.38	0.60	0.66	0.69	0.79	**0.87**	acres
Maximum Volume Stored =	0.355	0.887	1.079	1.199	1.553	1.881	acre-ft

Stormwater Detention and Infiltration Design Data Sheet





Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: **Waterbury Filing No. 1 & 2 EDB Pond 2 DP 18**

Facility Location & Jurisdiction: **Stapleton Dr. & Bandernero Dr Intersection**

User Input: Watershed Characteristics

Watershed Slope =	0.014	ft/ft
Watershed Length =	1425	ft
Watershed Area =	21.93	acres
Watershed Imperviousness =	27.2%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent

Location for 1-hr Rainfall Depths (use dropdown):

User Input

WQCV Treatment Method = Extended Detention

User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	100	0.00	0.00
0.25	942	0.25	0.02
0.50	1,784	0.50	0.03
0.75	2,626	0.75	0.04
1.00	3,468	1.00	0.04
1.25	5,034	1.25	0.07
1.50	6,600	1.50	0.09
1.75	8,166	1.75	0.10
2.00	9,732	2.00	0.11
2.25	11,297	2.25	0.14
2.50	12,863	2.50	0.16
2.75	14,429	2.75	0.17
3.00	15,995	3.00	0.18
3.25	19,602	3.25	3.05
3.50	23,209	3.50	10.28
3.75	26,815	3.75	10.76
4.00	30,422	4.00	11.17
4.25	34,029	4.25	11.57
4.50	37,636	4.50	11.96
4.75	41,243	4.75	12.33
5.00	44,850	5.00	12.70
5.25	48,650	5.25	20.77
5.50	52,450	5.50	35.88
5.75	56,251	5.75	56.20
6.00	60,051	6.00	81.25
6.25	63,851	6.25	110.80
6.50	67,652	6.50	144.75
6.75	71,452	6.75	183.06
7.00	75,252	7.00	225.73

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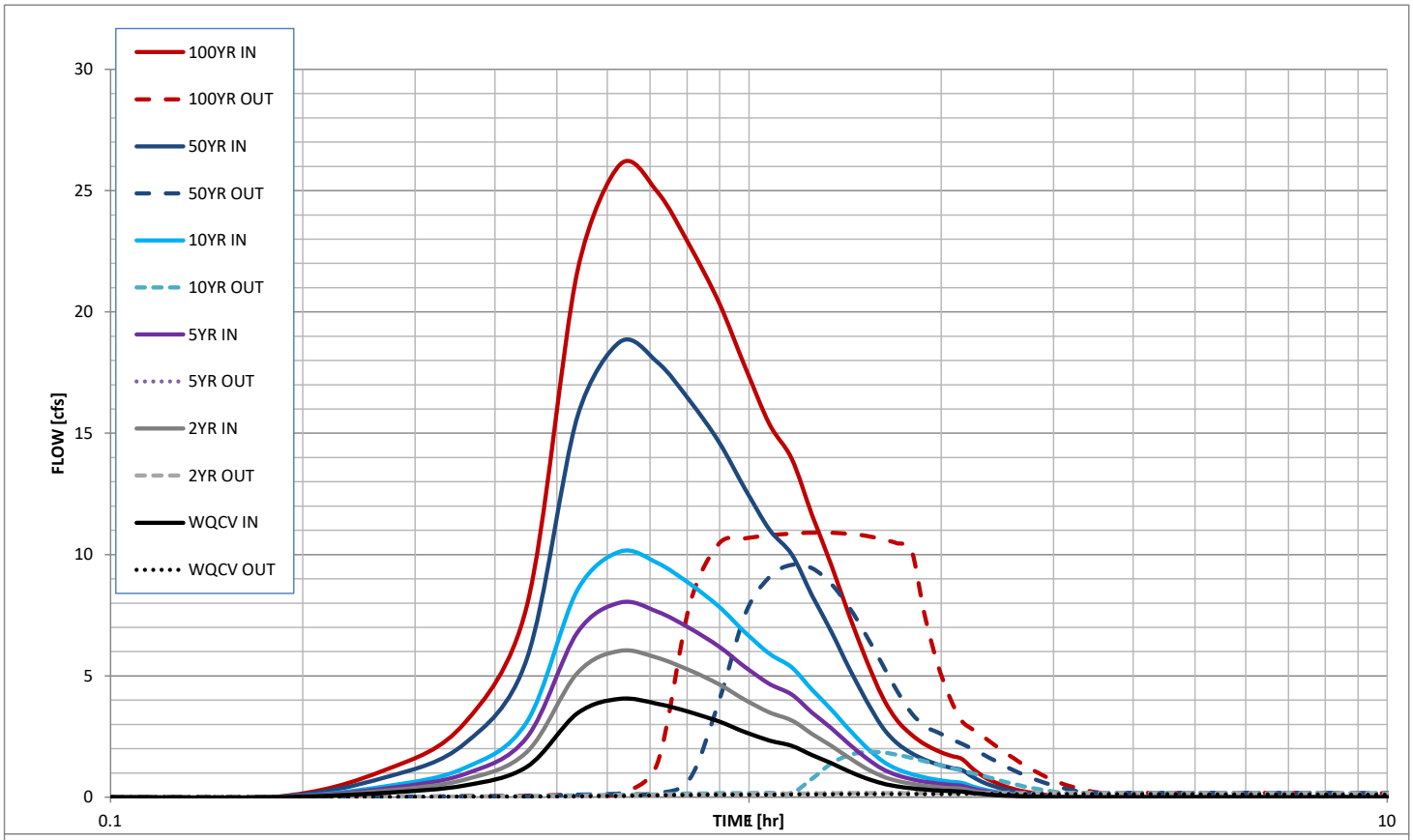
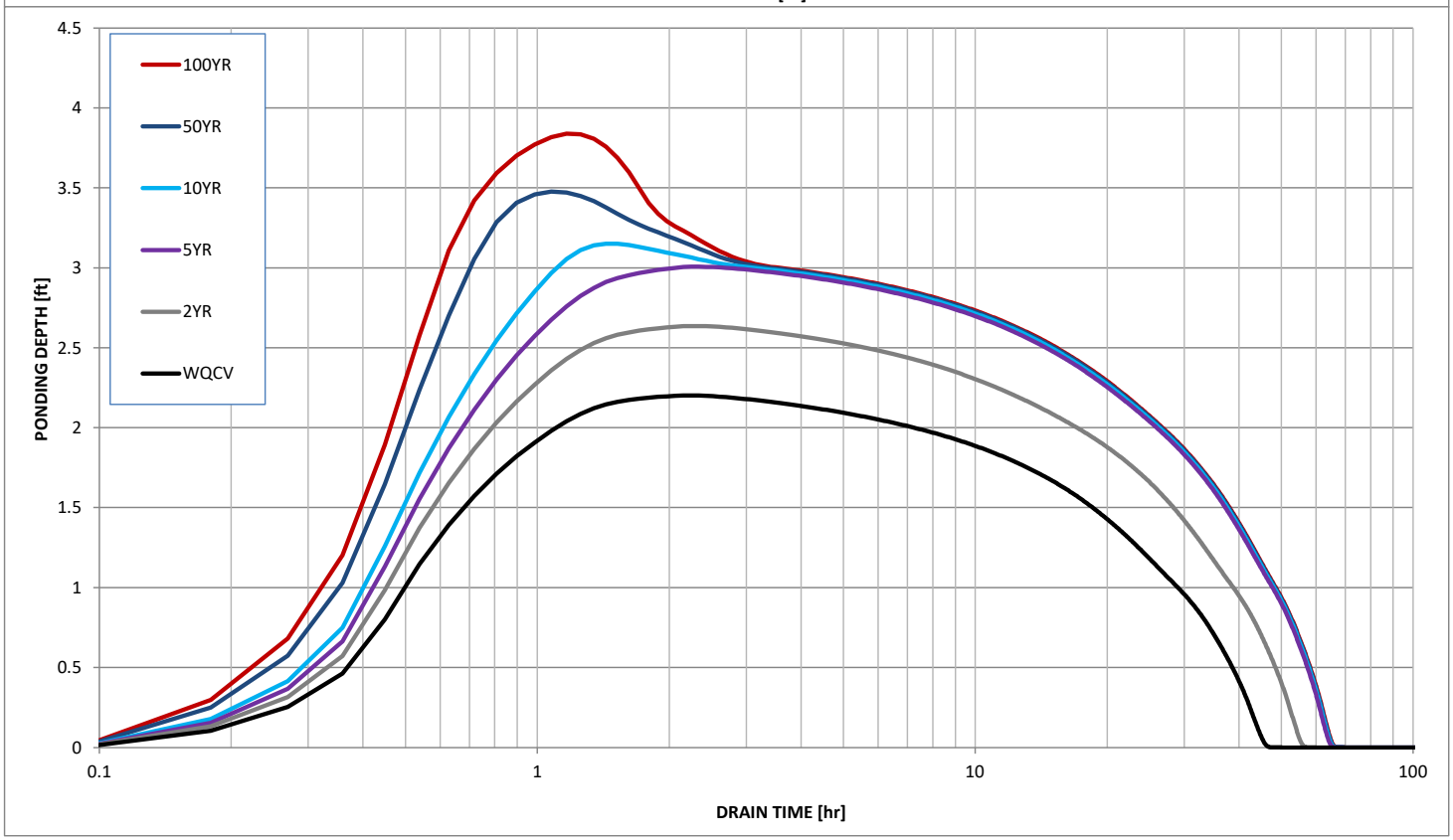
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	1.19	1.50	1.75	2.25	2.52	in
Calculated Runoff Volume =	0.261	0.389	0.519	0.657	1.228	1.712	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	0.260	0.389	0.519	0.657	1.227	1.711	acre-ft
Time to Drain 97% of Inflow Volume =	40.0	48.2	**55.6**	54.6	49.6	45.9	hours
Time to Drain 99% of Inflow Volume =	42.6	51.7	60.0	59.6	57.5	**55.8**	hours
Maximum Ponding Depth =	2.20	2.64	3.01	3.15	3.48	3.84	ft
Maximum Ponded Area =	0.25	0.31	0.37	0.41	0.52	**0.64**	acres
Maximum Volume Stored =	0.239	0.362	0.488	0.544	0.699	0.908	acre-ft

Stormwater Detention and Infiltration Design Data Sheet





Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: **Waterbury Filing No. 1 & 2 EDB Pond 3 DP 29**

Facility Location & Jurisdiction: **Stapleton Dr. & Bandernero Dr Intersection**

User Input: Watershed Characteristics

Watershed Slope =	0.022	ft/ft
Watershed Length =	2265	ft
Watershed Area =	84.64	acres
Watershed Imperviousness =	49.3%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent

Location for 1-hr Rainfall Depths (use dropdown):

User Input

WQCV Treatment Method = Extended Detention

User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	100	0.00	0.00
0.25	2,785	0.25	0.10
0.50	5,470	0.50	0.14
0.75	8,155	0.75	0.18
1.00	10,840	1.00	0.20
1.25	13,525	1.25	0.23
1.50	16,210	1.50	0.25
1.75	18,895	1.75	0.37
2.00	21,580	2.00	0.43
2.25	26,334	2.25	0.48
2.50	31,088	2.50	0.53
2.75	35,842	2.75	0.57
3.00	40,596	3.00	0.60
3.25	45,530	3.25	0.73
3.50	50,105	3.50	0.81
3.75	54,895	3.75	0.87
4.00	59,613	4.00	0.93
4.25	62,301	4.25	0.98
4.50	64,989	4.50	1.03
4.75	67,677	4.75	4.39
5.00	70,365	5.00	14.71
5.25	73,504	5.25	28.91
5.50	75,742	5.50	46.13
5.75	78,430	5.75	60.71
6.00	81,118	6.00	62.35
6.25	82,113	6.25	74.47
6.50	83,503	6.50	111.77
6.75	84,696	6.75	163.81
7.00	85,888	7.00	227.74
7.25	87,081	7.25	302.17
7.50	88,274	7.50	386.27
7.75	89,466	7.75	479.48
8.00	90,659	8.00	581.41

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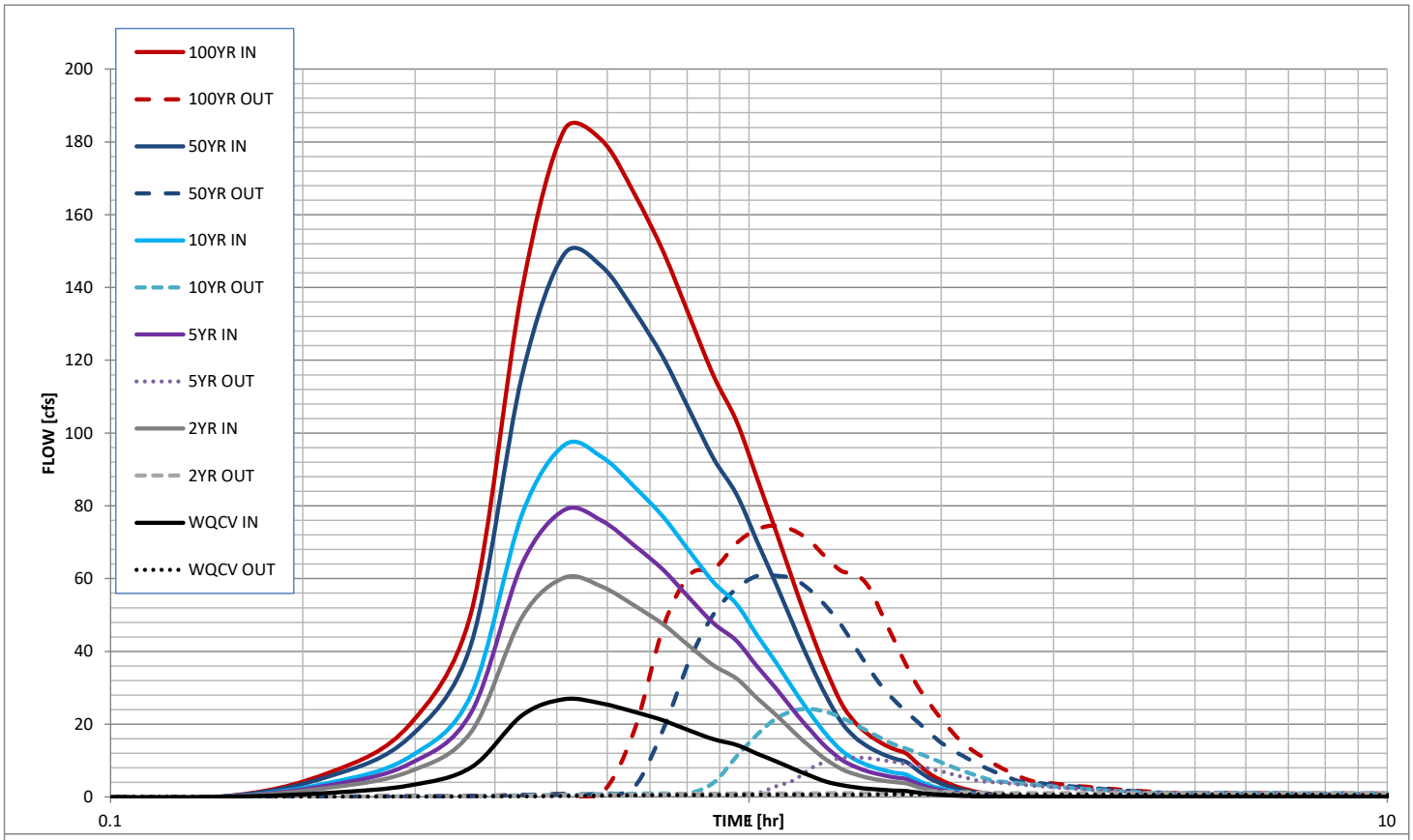
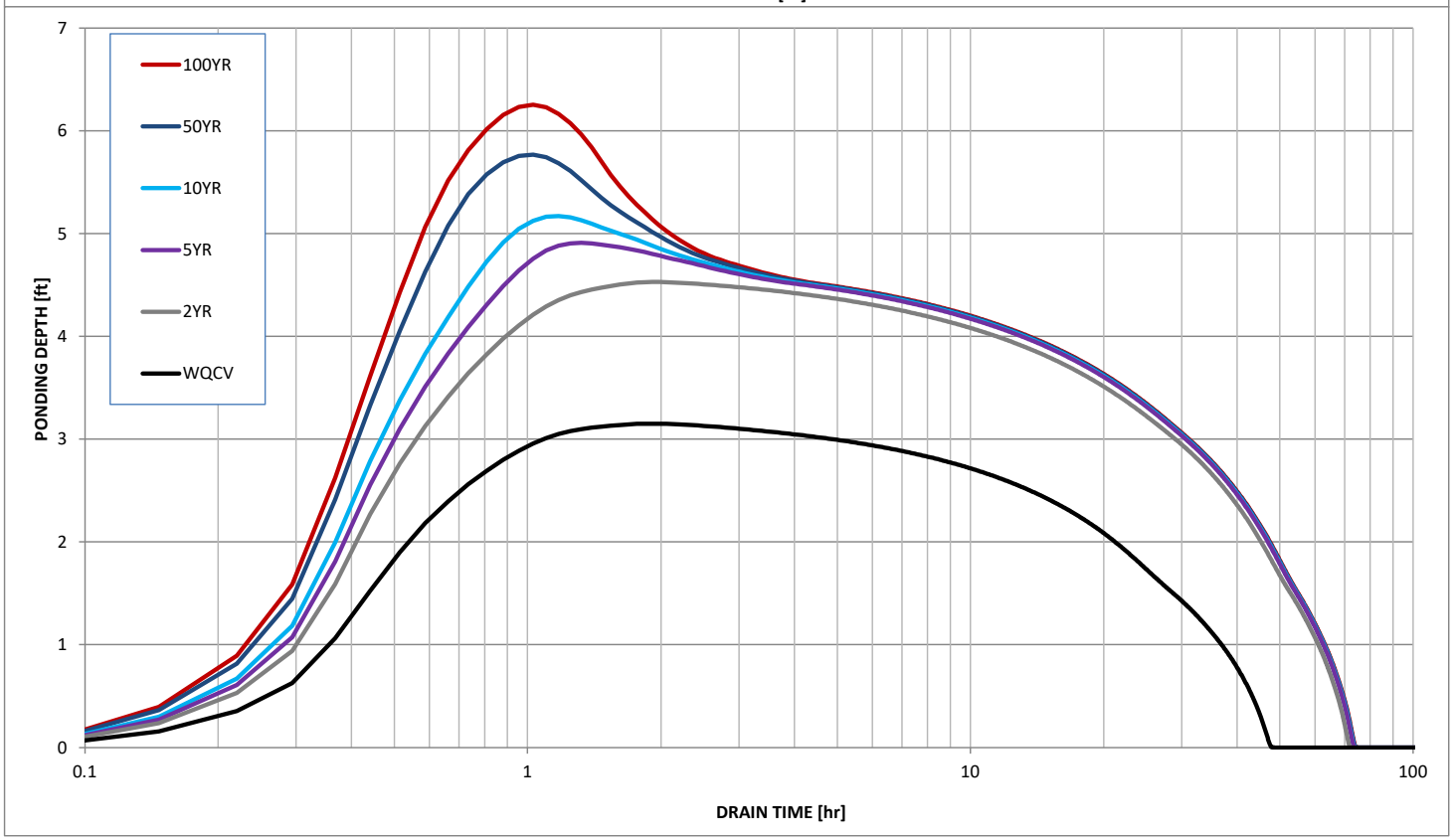
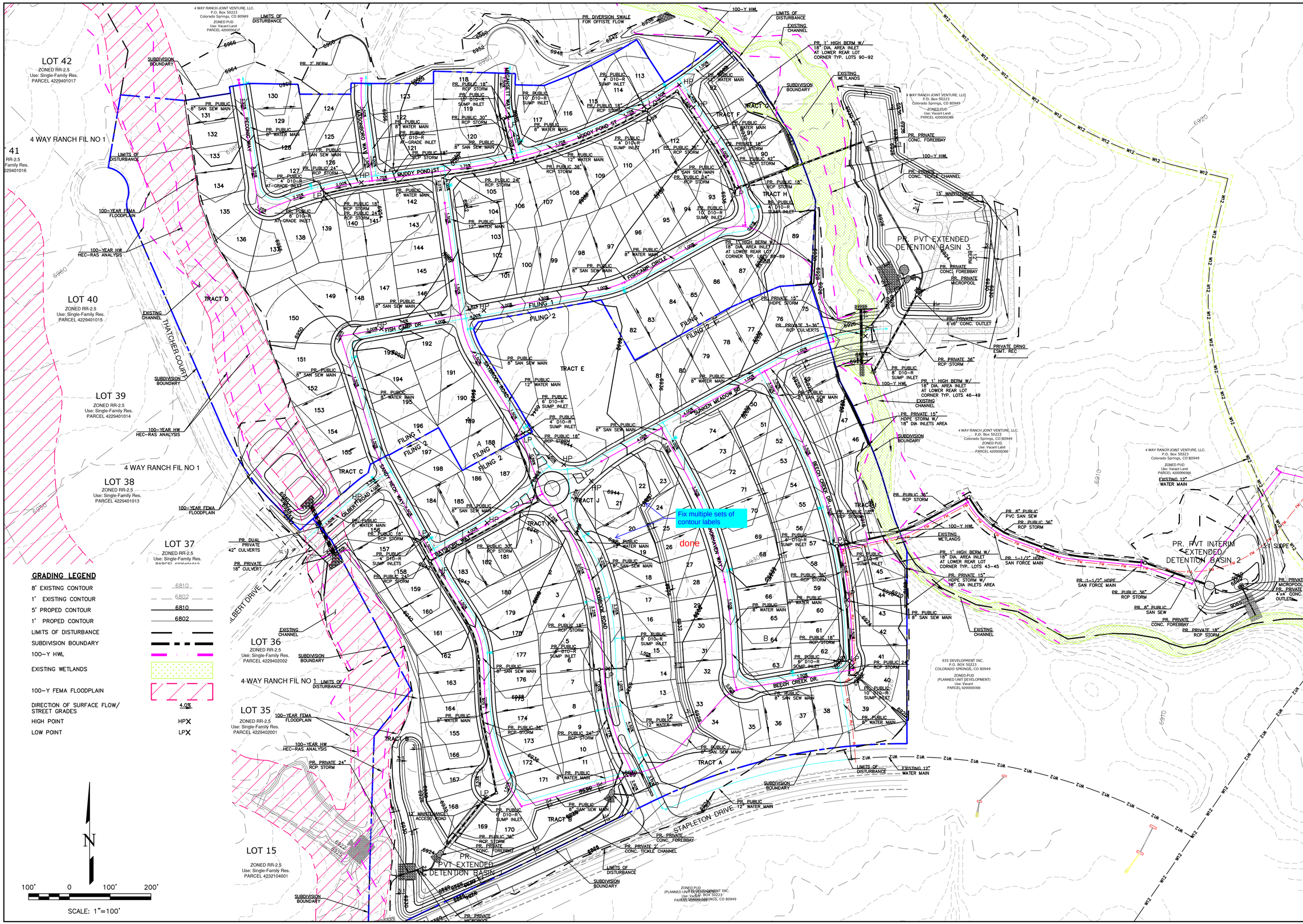
Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	1.19	1.50	1.75	2.25	2.52	in
Calculated Runoff Volume =	1.441	3.266	4.295	5.293	8.263	10.226	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	1.441	3.265	4.295	5.291	8.258	10.218	acre-ft
Time to Drain 97% of Inflow Volume =	42.4	62.8	**62.5**	60.9	56.4	53.8	hours
Time to Drain 99% of Inflow Volume =	45.0	67.4	68.2	67.6	65.8	**64.6**	hours
Maximum Ponding Depth =	3.15	4.53	4.91	5.17	5.77	6.25	ft
Maximum Ponded Area =	1.00	1.50	1.59	1.66	1.80	**1.89**	acres
Maximum Volume Stored =	1.350	3.111	3.701	4.123	5.152	6.062	acre-ft

Stormwater Detention and Infiltration Design Data Sheet







NO.	REVISIONS DESCRIPTION	DATE

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COLORADO SPRINGS, CO 80949
719-491-3150

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FAX: 719-635-6426
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WATERBURY FILING NO. 1 & 2

GRADING AND UTILITIES PLAN

DESIGNED BY DLF
DRAWN BY QNA
CHECKED BY QNA
H-SCALE 1" = 100'
V-SCALE N/A
JOB NO. 1715.00
DATE ISSUED 3/3/22
SHEET NO. 1 OF 1

ENG-PUDSP21005-R3-PDR.pdf Markup Summary

1 (1)

See comment letter also

Subject: Text Box
Page Index: 1
Date: 4/22/2022 12:19:19 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 1

See comment letter also

NOTED

5 (5)

be

Subject: Text Box
Page Index: 5
Date: 4/18/2022 4:13:41 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 5

be

ADDED

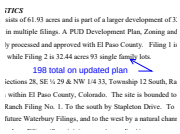
Haegler

the Hagler

Subject: Text Box
Page Index: 5
Date: 4/18/2022 4:16:21 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 5

Haegler

FIXED



Subject: Callout
Page Index: 5
Date: 4/21/2022 6:06:06 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 5

198 total on updated plan

updated

---

es 93 sir

Subject:
Page Index: 5
Date: 4/21/2022 6:06:37 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 5

93

updated

---

th 108 si

Subject:
Page Index: 5
Date: 4/21/2022 6:08:26 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 5

108

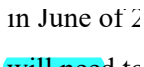
updated

6 (1)

Subject: Line
Page Index: 6
Date: 4/18/2022 4:17:33 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 6

FIXED

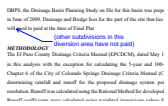
7 (3)



Subject:
Page Index: 7
Date: 4/22/2022 9:08:56 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 7

will nee

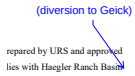
revised



Subject: Callout
Page Index: 7
Date: 4/22/2022 9:09:55 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 7

(other subdivisions in this diversion area have not

revised



Subject: Callout
Page Index: 7
Date: 4/22/2022 9:10:45 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 7

(diversion to Geick)

FIXED

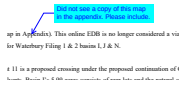
14 (1)

Subject: Callout
Page Index: 14
Date: 4/20/2022 4:29:00 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 14

Calculations for forebay missing in appendix

added at end of FSD & WQ calcs

16 (1)



Subject: Callout
Page Index: 16
Date: 4/20/2022 4:40:36 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 16

Did not see a copy of this map in the appendix. Please include.

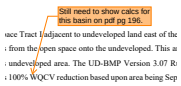
ADDED AT END OF MAPS

18 (3)

Subject: SW - Highlight
Page Index: 18
Date: 4/7/2022 2:30:37 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: 18

The UD-BMP Version 3.07 Runoff Reduction was used to show that this area has 100% WQCV

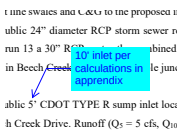
ADDED TO SPREADSHEET W/ M2



Subject: SW - Textbox with Arrow
Page Index: 18
Date: 4/7/2022 2:31:09 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: 18

Still need to show calcs for this basin on pdf pg 196.

ADDED TO SPREADSHEET W/ M2

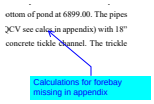


Subject: Callout
Page Index: 18
Date: 4/20/2022 4:43:51 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 18

10' inlet per calculations in apprendix

REVISED TO 10'

19 (1)

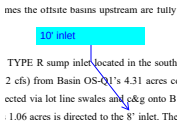


Subject: Callout
Page Index: 19
Date: 4/20/2022 4:49:31 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 19

Calculations for forebay missing in appendix

added at end of FSD & WQ calcs

20 (1)

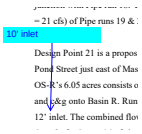


Subject: Callout
Page Index: 20
Date: 4/20/2022 4:50:26 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 20

10' inlet

REVISED

21 (1)

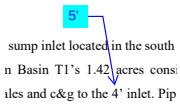


Subject: Callout
Page Index: 21
Date: 4/20/2022 4:57:13 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 21

10' inlet

REVISED

22 (1)

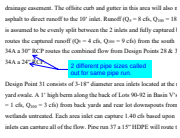


Subject: Callout
Page Index: 22
Date: 4/20/2022 5:01:26 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 22

5'

REVISED

23 (1)



Subject: Callout
Page Index: 23
Date: 4/21/2022 7:10:19 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 23

2 different pipe sizes called out for same pipe run.

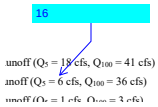
REVISED TO 30"

24 (2)

Subject: Callout
Page Index: 24
Date: 4/21/2022 7:11:39 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 24

Forebay calcs missing in appendix

added at end of FSD & WQ calcs

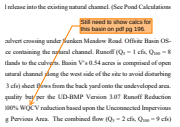


Subject: Callout
Page Index: 24
Date: 4/21/2022 7:41:29 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 24

16

REVISED TO 16

25 (2)



Subject: SW - Textbox with Arrow
Page Index: 25
Date: 4/7/2022 2:31:32 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: 25

Still need to show calcs for this basin on pdf pg 196.

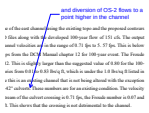
ADDED TO SPREADSHEET W/ M2 & P

Subject: SW - Highlight
Page Index: 25
Date: 4/7/2022 2:31:37 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: 25

UD-BMP Version 3.07 Runoff Reduction spreadsheet shows that this area has 100% WQCV

ADDED TO SPREADSHEET W/ M2 & P

26 (4)



Subject: Callout
Page Index: 26
Date: 4/22/2022 9:27:59 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 26

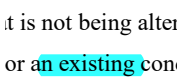
and diversion of OS-2 flows to a point higher in the channel

ADDED

Subject: Callout
Page Index: 26
Date: 4/22/2022 9:30:05 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 26

Areas above 0.9 (and V>5) need to be identified and if necessary, stabilized.

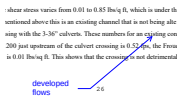
ADDED



Subject:
Page Index: 26
Date: 4/22/2022 9:30:37 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 26

n existing

REVISED to developed

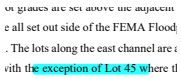


Subject: Callout
Page Index: 26
Date: 4/22/2022 9:31:18 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 26

developed flows

REVISED to developed

27 (3)



Subject:
Page Index: 27
Date: 4/22/2022 9:32:00 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 27

e exception of Lot 45 w

REVISED LOT AND SENTENCE

Subject: Callout
Page Index: 27
Date: 4/22/2022 9:32:44 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 27

This lot needs to be adjusted to be out of the calculated floodplain

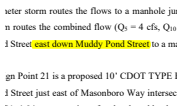
REVISED LOT AND SENTENCE

Subject:
Page Index: 27
Date: 4/22/2022 9:33:06 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 27

PS

REVISED

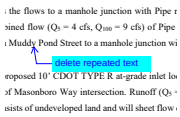
28 (2)



Subject: Highlight
Page Index: 28
Date: 4/21/2022 7:47:54 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 28

east down Muddy Pond Street

REMOVED DUPLICATE



Subject: Callout
Page Index: 28
Date: 4/21/2022 7:48:07 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 28

delete repeated text

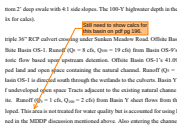
REMOVED DUPLICATE

30 (3)

Subject: SW - Highlight
Page Index: 30
Date: 4/7/2022 2:32:18 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: 30

This area is not treated for water quality but is accounted for using Runoff
Reduction as mentioned in the MDDP

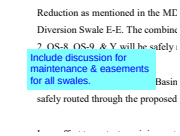
ADDED TO SPREADSHEET W/ M2, P, & V



Subject: SW - Textbox with Arrow
Page Index: 30
Date: 4/7/2022 2:32:34 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: 30

Still need to show calcs for this basin on pdf pg 196.

ADDED TO SPREADSHEET W/ M2, P, & V

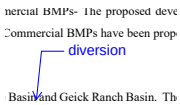


Subject: Text Box
Page Index: 30
Date: 4/21/2022 8:13:14 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 30

Include discussion for maintenance & easements for all swales.

ADDED DISCUSSION IN TEXT AND EDITED O&M MANUAL TO LIST SWALE

31 (3)



Subject: Callout
Page Index: 31
Date: 4/22/2022 9:34:18 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 31

diversion

added

Subject:
Page Index: 31
Date: 4/22/2022 9:34:36 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 31

At the time of the Final
Drainage Report Basin fee calculations will be done for the portion in the Haegler Ranch Basin.

revised to say no fees

Subject: Callout
Page Index: 31
Date: 4/22/2022 9:35:42 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 31

See comment on page 7

revised to say no fees

54 (1)

Missing Basin OS-9 as shown on basin map. Please include

Subject: Text Box
Page Index: 54
Date: 4/19/2022 12:11:09 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 54

Missing Basin OS-9 as shown on basin map. Please include

took of Basin OS-9 off from map as it does not come onto the graded property or is routed through early grading TSBs also not discussed in text

55 (1)

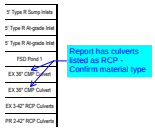
Design Points EX10 , 9 and 13 are shown on drainage map but are missing from table. Please include.

Subject: Text Box
Page Index: 55
Date: 4/19/2022 12:10:42 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 55

Design Points EX10 , 9 and 13 are shown on drainage map but are missing from table. Please include.

took of Design Points EX9 & EX13 off from map as it does not come onto the graded property or is routed through early grading TSBs also not discussed in text

62 (1)

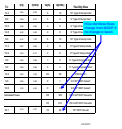


Subject: Callout
Page Index: 62
Date: 4/19/2022 1:31:49 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 62

Report has culverts listed as RCP - Confirm material type

CHANGED TO RCP
IN SPREADSHEET

74 (1)

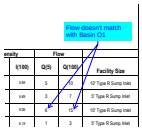


Subject: Callout
Page Index: 74
Date: 4/20/2022 2:45:51 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 74

HOw did these flows change from MDDP if no change to basin.

EASY I SCREWED UP AND ENTGERED WRONG INFO NOW CORRECT

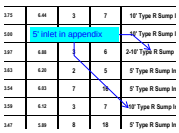
76 (3)



Subject: Callout
Page Index: 76
Date: 4/20/2022 2:46:41 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 76

Flow doesn't match with Basin O1

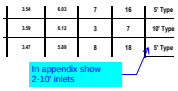
CORRECTED HAD WRONG Tc BOTH O1 & O2



Subject: Callout
Page Index: 76
Date: 4/20/2022 2:50:29 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 76

5' inlet in appendix

CORRECTED

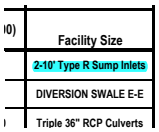


Subject: Callout
Page Index: 76
Date: 4/20/2022 2:50:57 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 76

In appendix show 2-10' inlets

CORRECTED

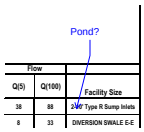
77 (4)



Subject:
Page Index: 77
Date: 4/22/2022 12:21:45 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 77

2-10' Type R Sump Inlets

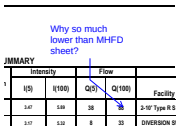
CORRECTED



Subject: Callout
Page Index: 77
Date: 4/22/2022 12:22:03 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 77

Pond?

CORRECTED



Subject: Callout
Page Index: 77
Date: 4/22/2022 12:22:27 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 77

Why so much lower than MHFD sheet?

THIS IS INTERIM STAGE WHEN NO UPSTREAM DEVELOPMENT MHFD IS FOR FULL BUILD OUT

Subject:
Page Index: 77
Date: 4/22/2022 12:22:46 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 77

5.20

CORRECTED

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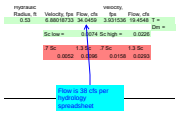
84 (1)



Subject: Callout
Page Index: 84
Date: 4/20/2022 7:54:53 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 84

Flow is 38 cfs per hydrology spreadsheet

UPDATED SPREADSHEET AND TEXT IN REPORT TO 0.94'

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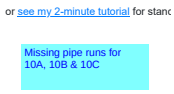
104 (1)



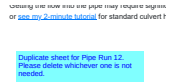
Subject: Text Box
Page Index: 104
Date: 4/20/2022 2:00:53 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 104

Missing pipe runs for 10A, 10B & 10C

ADDED

---

106 (1)



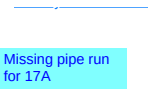
Subject: Text Box
Page Index: 106
Date: 4/20/2022 8:14:52 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 106

Duplicate sheet for Pipe Run 12. Please delete whichever one is not needed.

CORRECTED 11 WAS MISLABELED AS 12

---

111 (1)

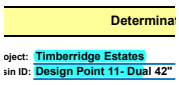


Subject: Text Box
Page Index: 111
Date: 4/20/2022 2:01:23 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: 111

Missing pipe run for 17A

ADDED

137 (1)

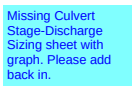


Subject:
Page Index: 137
Date: 4/22/2022 11:04:28 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 137

Timberridge Estates
Design Point 11- Du

CORRECTED

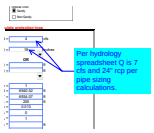
139 (3)



Subject: Text Box
Page Index: 139
Date: 4/20/2022 9:18:02 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 139

Missing Culvert Stage-Discharge Sizing sheet with graph. Please add back in.

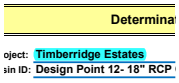
ADDED



Subject: Callout
Page Index: 139
Date: 4/20/2022 9:19:18 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 139

Per hydrology spreadsheet Q is 7 cfs and 24" rcp per pipe sizing calculations.

I HAVE 4 CFS ON MY HYDROLOGY SHEETS AND 18" RCP

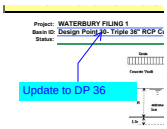


Subject:
Page Index: 139
Date: 4/22/2022 11:04:14 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 139

Timberridge Estates

FIXED

140 (1)

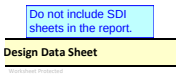


Subject: Callout
Page Index: 140
Date: 4/20/2022 9:20:22 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 140

Update to DP 36

it is DP 30
Pipe run 36

167 (1)

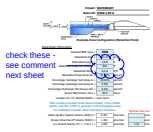


Subject: Text Box
Page Index: 167
Date: 4/22/2022 11:08:06 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 167

Do not include SDI sheets in the report.

REMOVED

169 (1)

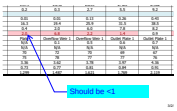


Subject: Cloud+
Page Index: 169
Date: 4/22/2022 11:13:13 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 169

check these - see comment next sheet

edited to get closet to DP values

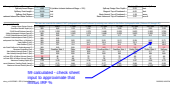
171 (2)



Subject: Callout
Page Index: 171
Date: 4/20/2022 9:38:05 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 171

Should be <1

revised

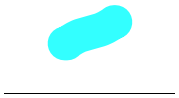


Subject: Callout
Page Index: 171
Date: 4/22/2022 11:34:41 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 171

59 calculated - check sheet input to approximate that minus IRF %

edited lengths to get closet to DP values

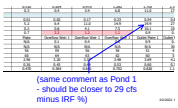
175 (1)



Subject:
Page Index: 175
Date: 4/22/2022 11:15:09 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 175

revised lengths & removed from appendix

179 (1)



Subject: Callout
Page Index: 179
Date: 4/22/2022 11:35:02 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 179

(same comment as Pond 1 - should be closer to 29 cfs minus IRF %)

edited lengths to get closet to DP values

182 (1)

Subject: Callout
Page Index: 182
Date: 4/22/2022 11:25:44 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 182

Delete duplicate sheets or relabel if this is different

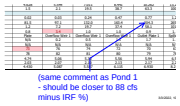
removed duplicate

188 (1)

Subject:
Page Index: 188
Date: 4/22/2022 11:27:12 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 188

removed

192 (1)

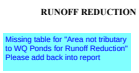


Subject: Callout
Page Index: 192
Date: 4/22/2022 11:34:25 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 192

(same comment as Pond 1 - should be closer to 88 cfs minus IRF %)

revised lengths to get closer match

195 (1)



Subject: Text Box
Page Index: 195
Date: 4/20/2022 9:41:14 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 195

Missing table for "Area not tributary to WQ Ponds for Runoff Reduction" Please add back into report

ADDED

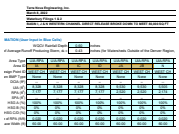
196 (2)

Subject: Contractor
Page Index: 196
Date: 4/7/2022 2:33:29 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: 196

added subbasins to proposed map and explanation in text

Unresolved comment from Review #2: These sub-basins of I and J are not delineated on any of the drainage maps. Show on one of the maps, or created a new map.

V3 Update: it is still unclear which UIA/RPA region on the map (on pdf pg 277) corresponds with which Area ID on this spreadsheet . There is also RR in Basin P, V, and Y which should be shown on this spreadsheet too...



Subject: SW - Rectangle
Page Index: 196
Date: 4/7/2022 12:57:31 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: 196

added subbasins to proposed map and explanation in text

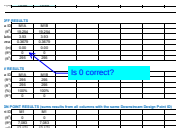
197 (2)

Subject: Contractor
Page Index: 197
Date: 4/7/2022 2:34:03 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: 197

No longer have sub-basins

Unresolved comment from Review #2: These sub-basins of M are not delineated on any of the drainage maps. Show on one of the maps, or created a new map.

V3 Update: it is still unclear which UIA/RPA region on the map (on pdf pg 277) corresponds with which Area ID on this spreadsheet . There is also RR in Basin P, V, and Y which should be shown on this spreadsheet too...

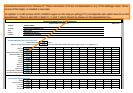


Subject: Callout
Page Index: 197
Date: 4/20/2022 9:42:38 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: 197

Is 0 correct?

YES

198 (2)

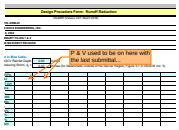


Subject: Contractor
Page Index: 198
Date: 4/7/2022 2:34:21 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: 198

No longer have sub-basins

Unresolved comment from Review #2: These sub-basins of M are not delineated on any of the drainage maps. Show on one of the maps, or created a new map.

V3 Update: it is still unclear which UIA/RPA region on the map (on pdf pg 277) corresponds with which Area ID on this spreadsheet . There is also RR in Basin P, V, and Y which should be shown on this spreadsheet too...



Subject: SW - Textbox with Arrow
Page Index: 198
Date: 4/7/2022 4:54:00 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: 198

P & V used to be on here with the last submittal...

ADDED

201 (1)

6964.11	R
6964.11	F
0.018200	A

Subject:
Page Index: 201
Date: 4/22/2022 11:39:02 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 201

6964.11

202 (3)

6962.32	R
6962.32	F
0.016174	A

Subject:
Page Index: 202
Date: 4/22/2022 11:39:30 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 202

ONLY 4 X-SECTIONS HAVE CRITICAL FLOW NOW. WE ARE STABELIZING 1500 TO 1400 W/ DROP STRUCTURE. STA 200 HAS ESTABLISEHD CATTAILS AND A VELOCITY OF 1.99 FPS, SHEAR OF 1.03 & A FROUD OF 1.03 LB/SQ FT ALL ALLOWABLE. NO NEED TO DISTURB ESTABLISHED CHANNEL WITH SIGNIFICANT VEGETATION. SECTION 100 IS THE LAST STATION WHICH IS ALWAY CRITICAL DUE TO NO DOWNSTREAM TO RUN CALCS IN HECRAS

6959.60	R
6959.60	F
0.016348	A

Subject:
Page Index: 202
Date: 4/22/2022 11:39:44 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 202

6959.60

6955.67	R
6955.58	F
0.010768	A

Subject:
Page Index: 202
Date: 4/22/2022 11:39:53 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 202

6955.58

ONLY 4 X-SECTIONS HAVE CRITICAL FLOW NOW. WE ARE STABELIZING 1500 TO 1400 W/ DROP STRUCTURE. STA 200 HAS ESTABLISEHD CATTAILS AND A VELOCITY OF 1.99 FPS, SHEAR OF 1.03 & A FROUD OF 1.03 LB/SQ FT ALL ALLOWABLE. NO NEED TO DISTURB ESTABLISHED CHANNEL WITH SIGNIFICANT VEGETATION. SECTION 100 IS THE LAST STATION WHICH IS ALWAY CRITICAL DUE TO NO DOWNSTREAM TO RUN CALCS IN HECRAS

203 (3)

6954.37	R
6954.37	F
0.015744	A

Subject:
Page Index: 203
Date: 4/22/2022 11:40:10 A
Author: dsdrice
Color:
Layer:
Space:
Page Label: 203

6951.49	R
6951.49	F
0.014715	A

Subject:
Page Index: 203
Date: 4/22/2022 11:40:14 A
Author: dsdrice
Color:
Layer:
Space:
Page Label: 203

6949.19	R
6949.19	F
0.013784	A

Subject:
Page Index: 203
Date: 4/22/2022 11:40:21 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 203

6949.19

204 (2)

6944.86	R
6944.86	F
0.016056	A

Subject:
Page Index: 204
Date: 4/22/2022 11:41:18 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 204

6944.86

6946.56	R
6946.56	F
0.015089	A

Subject:
Page Index: 204
Date: 4/22/2022 11:41:24 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 204

6946.56

---

205 (2)

6942.09	R
6939.49	F
0.000053	A

Subject:
Page Index: 205
Date: 4/22/2022 11:41:55 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 205

6939.49

ONLY 4 X-SECTIONS HAVE CRITICAL FLOW NOW. WE ARE STABELIZING 1500 TO 1400 W/ DROP STRUCTURE. STA 200 HAS ESTABLISEHD CATTAILS AND A VELOCITY OF 1.99 FPS, SHEAR OF 1.03 & A FROUD OF 1.03 LB/SQ FT ALL ALLOWABLE. NO NEED TO DISTURB ESTABLISHED CHANNEL WITH SIGNIFICANT VEGETATION. SECTION 100 IS THE LAST STATION WHICH IS ALWAY CRITICAL DUE TO NO DOWNSTREAM TO RUN CALCS IN HECRAS

6942.09	R
6942.09	F
0.016728	A

Subject:
Page Index: 205
Date: 4/22/2022 11:42:07
Author: dsdrice
Color:
Layer:
Space:
Page Label: 205

206 (3)

6934.68	R
6934.68	F
0.020420	A

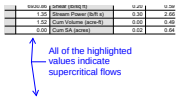
Subject:
Page Index: 206
Date: 4/22/2022 11:43:41 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 206

6934.68

6931.98	R
6931.98	F
0.014832	A

Subject:
Page Index: 206
Date: 4/22/2022 11:43:47 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 206

6931.98



Subject: Callout
Page Index: 206
Date: 4/22/2022 11:51:01 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 206

All of the highlighted values indicate supercritical flows

207 (3)

6929.52	R
6929.52	F
0.015820	A

Subject:
Page Index: 207
Date: 4/22/2022 11:44:09 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 207

6929.52

6926.98	R
6926.98	F
0.014589	A

Subject:
Page Index: 207
Date: 4/22/2022 11:44:13 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 207

6926.98

ONLY 4 X-SECTIONS HAVE CRITICAL FLOW NOW. WE ARE STABELIZING 1500 TO 1400 W/ DROP STRUCTURE. STA 200 HAS ESTABLISEHD CATTAILS AND A VELOCITY OF 1.99 FPS, SHEAR OF 1.0 3LB/SQ FT & A FROUD OF 0.31 ALL ALLOWABLE. NO NEED TO DISTURB ESTABLISHED CHANNEL WITH SIGNIFICANT VEGETATION. SECTION 100 IS THE LAST STATION WHICH IS ALWAY CRITICAL DUE TO NO DOWNSTREAM TO RUN CALCS IN HECRAS

6924.27	R
6924.27	F
0.013593	A

Subject:
Page Index: 207
Date: 4/22/2022 11:44:19
Author: dsdrice
Color:
Layer:
Space:
Page Label: 207

208 (1)

6921.37	R
6921.37	F
0.014171	A

Subject:
Page Index: 208
Date: 4/22/2022 11:49:32 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 208

209 (6)

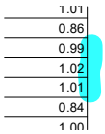
1.02
0.81

Subject:
Page Index: 209
Date: 4/22/2022 11:52:20 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 209

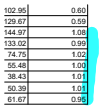
ALL FROUDE #S ARE LESS THAN .9 EXCEPT AT DROP STRUCTURE STA 14+20 AND STA 1+00 WHERE HECRAS ALWAYS HAS CRITICAL FLOW AT LAST STATION DUE TO NO DOWNSTREAM SECTION TO RUN THE CALCS

0.81
1.02
0.99
1.01
0.86
0.99

Subject:
Page Index: 209
Date: 4/22/2022 11:52:17 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 209

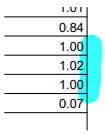


Subject:
Page Index: 209
Date: 4/22/2022 11:52:13 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 209

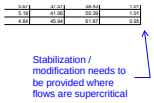


Subject:
Page Index: 209
Date: 4/22/2022 11:52:24 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 209

ALL FROUDE #S ARE LESS THAN .9 EXCEPT AT DROP STRUCTURE STA 14+20 AND STA 1+00 WHERE HECRAS ALWAYS HAS CRITICAL FLOW AT LAST STATION DUE TO NO DOWNSTREAM SECTION TO RUN THE CALCS



Subject:
Page Index: 209
Date: 4/22/2022 11:52:09 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 209



Subject: Callout
Page Index: 209
Date: 4/22/2022 11:53:34 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 209

Stabilization / modification needs to be provided where flows are supercritical

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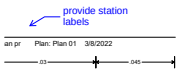
226 (1)



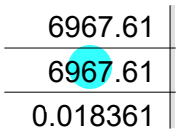
Subject: Callout
Page Index: 226
Date: 4/22/2022 11:54:49 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 226

provide station labels

ADDED

---

235 (2)



Subject:
Page Index: 235
Date: 4/22/2022 11:55:30 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 235

NO LONGER CRITICAL

6964.11	F
6964.11	F
0.018200	A

Subject:
Page Index: 235
Date: 4/22/2022 11:55:37 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 235

NO LONGER CRITICAL

243 (8)

0.99
0.92
1.00
0.93

Subject:
Page Index: 243
Date: 4/22/2022 11:57:02 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 243

NO LONGER CRITICAL

0.93
0.71
1.01
1.02
0.62
1.01

Subject:
Page Index: 243
Date: 4/22/2022 11:56:59 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 243

ALL FROUDE #S ARE LESS THAN .9 EXCEPT AT DROP STRUCTURE STA 14+20 AND STA 1+00 WHERE HECRAS ALWAYS HAS CRITICAL FLOW AT LAST STATION DUE TO NO DOWNSTREAM SECTION TO RUN THE CALCS

0.62
1.01
0.69

Subject:
Page Index: 243
Date: 4/22/2022 11:56:57 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 243

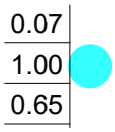
0.69
1.02
1.01
0.89

Subject:
Page Index: 243
Date: 4/22/2022 11:56:38 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 243

ALL FROUDE #S ARE LESS THAN .9 EXCEPT AT DROP STRUCTURE STA 14+20 AND STA 1+00 WHERE HECRAS ALWAYS HAS CRITICAL FLOW AT LAST STATION DUE TO NO DOWNSTREAM SECTION TO RUN THE CALCS

0.96
0.26

Subject:
Page Index: 243
Date: 4/22/2022 11:56:33 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 243



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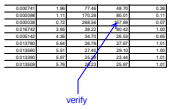
Page Index: 243
Date: 4/22/2022 11:56:29 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 243

ALL FROUDE #S ARE LESS THAN .9 EXCEPT AT DROP STRUCTURE STA 14+20 AND STA 1+00 WHERE HECRAS ALWAYS HAS CRITICAL FLOW AT LAST STATION DUE TO NO DOWNSTREAM SECTION TO RUN THE CALCS

Subject:
Page Index: 243
Date: 4/22/2022 11:56:27 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 243

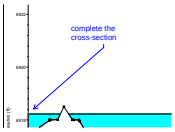


Subject: Callout
Page Index: 243
Date: 4/22/2022 11:59:19 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 243

verify

REVISED

263 (1)

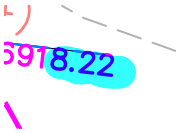


Subject: Callout
Page Index: 263
Date: 4/22/2022 12:01:39 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: 263

complete the cross-section

REVISED

270 (12)

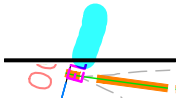


Subject:
Page Index: 270
Date: 4/21/2022 6:09:35 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] Layout1

REVISED

Subject:
Page Index: 270
Date: 4/21/2022 6:09:39 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] Layout1

REVISED



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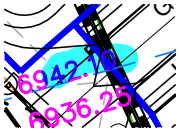
Page Index: 270
Date: 4/21/2022 6:10:49 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] Layout1

FIXED

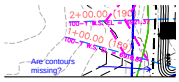
Subject:
Page Index: 270
Date: 4/21/2022 6:10:59 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] Layout1

FIXED



Subject:
Page Index: 270
Date: 4/21/2022 6:11:46 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] Layout1

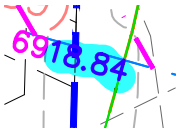
FIXED



Subject: Callout
Page Index: 270
Date: 4/21/2022 6:13:31 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] Layout1

Are contours missing?

ADDED



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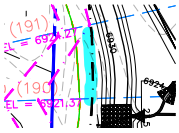
Page Index: 270
Date: 4/21/2022 6:14:24 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] Layout1

FIXED



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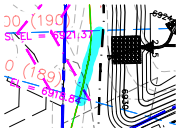
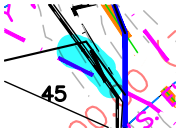
Page Index: 270
Date: 4/21/2022 6:14:40 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] Layout1

ALL CONTOURS ARE THERE



Subject:
Page Index: 270
Date: 4/21/2022 6:15:04 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] Layout1

ALL CONTOURS ARE THERE



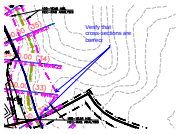
Subject:
Page Index: 270
Date: 4/21/2022 6:17:17 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] Layout1

ADJUSTED LOT LINE

Subject: Callout
Page Index: 270
Date: 4/21/2022 6:17:32 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] Layout1

Adjust lot to be out of floodplain

ADJUSTED



Subject: Callout
Page Index: 270
Date: 4/22/2022 12:00:30 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] Layout1

Verify that cross-sections are correct

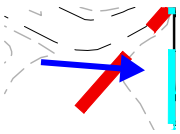
REVISED

273 (3)

Subject: SW - Textbox with Arrow
Page Index: 273
Date: 4/7/2022 1:56:52 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: [1] EX 2

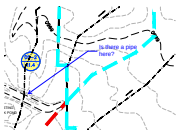
This linetype is not labeled or shown in the Legend.

REMOVED



Subject: Arrow
Page Index: 273
Date: 4/22/2022 9:22:38 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] EX 2

MOVED TO FRONT OF SPILLWAY AND LABELED ON PLAN



Subject: Callout
Page Index: 273
Date: 4/22/2022 9:25:06 AM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] EX 2

Is there a pipe here?

no there is not, just a spillway

---

274 (1)

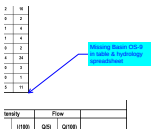
Subject: Callout
Page Index: 274
Date: 4/20/2022 9:50:36 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] EGP 1

Show spillway location

MOVED TO FRONT OF SPILLWAY AND LABELED ON PLAN

---

275 (2)



Subject: Callout
Page Index: 275
Date: 4/20/2022 10:24:48 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] EGP 2

Missing Basin OS-9 in table & hydrology spreadsheet

took of Basin OS-9 off from map as it does not come onto the graded property or is routed through early grading TSBs also not discussed in text

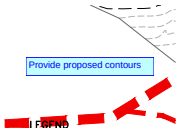
Subject: Text Box
Page Index: 275
Date: 4/20/2022 10:25:20 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] EGP 2

Missing Design Points EX10, 9 & 13

added DP EX 10 took DP- 9 & 13 off from map as it does not come onto the graded property or is routed through early grading TSBs also not discussed in text

---

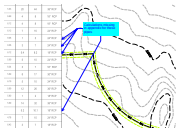
276 (9)



Subject: Text Box
Page Index: 276
Date: 4/20/2022 9:52:49 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] PROP 1

Provide proposed contours

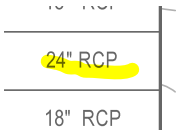
don't have them this is a future phase



Subject: Callout
Page Index: 276
Date: 4/20/2022 1:57:02 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] PROP 1

Calculations missing in appendix for these pipes

ADDED



Subject: Highlight
Page Index: 276
Date: 4/20/2022 1:58:13 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] PROP 1

REVISED

Subject: Highlight
Page Index: 276
Date: 4/20/2022 1:58:19 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] PROP 1

REVISED

Subject: Highlight
Page Index: 276
Date: 4/20/2022 1:58:25 PM
Author: CDurham
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Layer:
Space:
Page Label: [1] PROP 1

REVISED

Subject: Highlight
Page Index: 276
Date: 4/20/2022 1:58:41 PM
Author: CDurham
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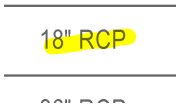
Layer:
Space:
Page Label: [1] PROP 1

REVISED



Subject: Highlight
Page Index: 276
Date: 4/20/2022 1:58:46 PM
Author: CDurham
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Page Label: [1] PROP 1

REVISED

Subject: Highlight
Page Index: 276
Date: 4/20/2022 1:58:58 PM
Author: CDurham
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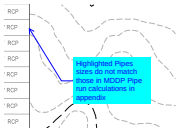
Space:
Page Label: [1] PROP 1

REVISED



Subject: Callout
Page Index: 276
Date: 4/20/2022 1:59:32 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] PROP 1

Highlighted Pipes sizes do not match those in MDDP Pipe run calculations in appendix

REVISED

CHANGED LOT GRADING SO ONLY LAST 20' OF THE LOT (NO BUILD ZONE IN SETBACK) DRAINS UNTREATED RUNOFF. ALSO ADDED TO O&M MANUAL AND TO GEC. PER JEFF RICE "Regarding the RPAs, we are working on a policy but are currently allowing for a plat note, so no additional easement is needed at this time. This is the plat note: No lots shall have any impervious improvements constructed within the rear setback (i.e. patios, hardscape, recreational facilities, etc.)"

Note that all RPA areas will need to be within a no build/drainage easement and discussed in the maintenance agreement and O&M manual. Also make sure to show the limits of the RPA's on GEC Plans (not just FDR) so our SW inspectors and the QSM know that these areas are to remain pervious and vegetated post-construction.
Update the O&M Manual accordingly and provide a Maintenance Agreement.

Subject: SW - Textbox with Arrow
Page Index: 277
Date: 4/7/2022 5:07:16 PM

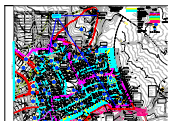
ADDED MAPS PER YOUR REQUEST

Page Label: [1] PROP 2

Still unresolved:
It is still unclear which areas throughout the site are to be excluded from WQ treatment. For example, it appears that these three areas are to be graded but are not tributary to a pond or a runoff reduction area. Clarify which exclusion(s) apply to each area. It is really helpful to have a WQ-specific map such as the example provided below. It has different colors for each tributary area to each pond and for the different exclusions (Exclusion D for utilities, Exclusion G for land disturbance to undeveloped land that will remain undeveloped, and up to 20% not to exceed 1ac of the site can be excluded from WQ treatment.

Subject: Image
Page Index: 277
Date: 4/7/2022 5:07:13 PM
Author: EPC Stormwater - Glenn Reese
Color:
Layer:
Space:
Page Label: [1] PROP 2

ADDED MAPS PER YOUR REQUEST

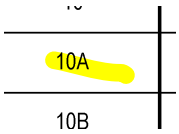


Subject: Callout
Page Index: 277
Date: 4/20/2022 9:55:49 AM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] PROP 2

Consider moving overflow spillways north (less drop to channels)

LEVAING AS IS

278 (17)



Subject: Highlight
Page Index: 278
Date: 4/20/2022 2:20:53 PM
Author: CDurham
Color:
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Space:
Page Label: [1] PROP 1

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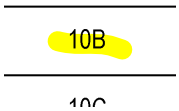

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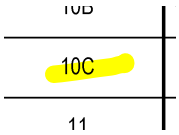
Page Label: [1] PROP 1

FIXED



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Date: 4/20/2022 2:20:59 PM
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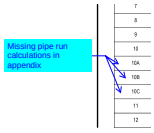
Space:
Page Label: [1] PROP 1

FIXED



Subject: Callout
Page Index: 278
Date: 4/20/2022 2:21:36 PM
Author: CDurham
Color:
Layer:
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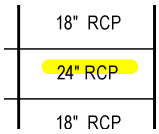
Page Label: [1] PROP 1

Missing pipe run calculations in appendix

ADDED



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Author: CDurham
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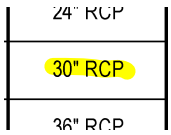
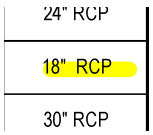
FIXED



Subject: Highlight
Page Index: 278
Date: 4/20/2022 2:22:04 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] PROP 1

FIXED



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Date: 4/20/2022 2:22:10 PM
Author: CDurham
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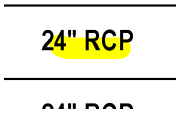
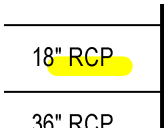
Space:
Page Label: [1] PROP 1

FIXED



Subject: Highlight
Page Index: 278
Date: 4/20/2022 2:22:18 PM
Author: CDurham
Color:
Layer:
Space:
Page Label: [1] PROP 1

FIXED



Subject: Highlight
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Date: 4/20/2022 2:22:29 PM
Author: CDurham
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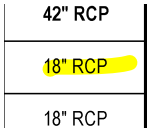
FIXED



Subject: Highlight
Page Index: 278
Date: 4/20/2022 2:22:35 PM
Author: CDurham
Color:
Layer:
Space:
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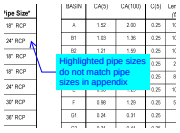
FIXED



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Highlighted pipe sizes do not match pipe sizes in appendix

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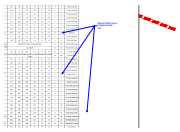

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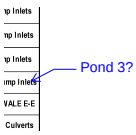
Adjust MHFD input to approximate this

ADJUSTED



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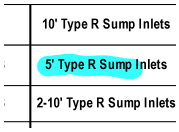
Pond 3?

REVISED



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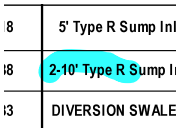

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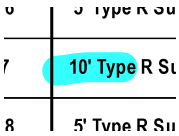

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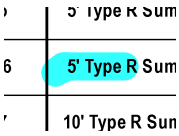

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FIXED

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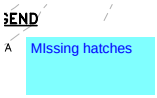
279 (8)



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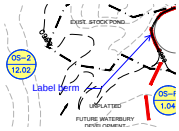
MIssing hatches

added



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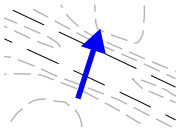
Label berm

added



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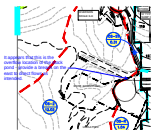

Subject: Callout
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Page Label: [1] PROP 2

It appears that this is the overflow location of the stock pond - provide a breach on the east to direct flows as intended.

MOVED TO WHERE BLUE ARROW IS SO IT CAN GET IN DIVERSION SWALE E-E

Subject:
Page Index: 279
Date: 4/22/2022 12:15:27 PM
Author: dsdrice
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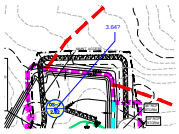
Page Label: [1] PROP 2

6

REVISED



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Date: 4/22/2022 12:25:53 PM
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Color:
Layer:
Space:
Page Label: [1] PROP 2

3.642

it is 2.82 fixed spreadsheet and text in report

Subject: Callout
Page Index: 279
Date: 4/22/2022 12:27:25 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] PROP 2

These flows should be per calculations. Label MHFD flows separately if you want to add them as well.

revised and added ud-detention numbers also

Subject: Callout
Page Index: 279
Date: 4/22/2022 12:27:44 PM
Author: dsdrice
Color:
Layer:
Space:
Page Label: [1] PROP 2

These flows should be per calculations. Label MHFD flows separately if you want to add them as well.

revised and added ud-detention numbers also

MASTER DEVELOPMENT DRAINAGE PLAN AND PRELIMINARY DRAINAGE REPORT FOR WATERBURY FILINGS NO. 1 & 2 EL PASO COUNTY, COLORADO

PCD FILE NO:
PUDSP-21-005

MARCH 2022

Prepared For:

Prepared for:
4-WAY RANCH JOINT VENTURE
P.O. BOX 50223
COLORADO SPRINGS, CO 80949
Contact: Peter Martz

Prepared By:

TERRA NOVA ENGINEERING, INC.
721 S. 23rd ST.
Colorado Springs, CO 80904

Job No. 1715.00

See comment letter also

MASTER DEVELOPMENT DRAINAGE PLAN AND PRELIMINARY DRAINAGE REPORT FOR WATERBURY FILINGS NO. 1 & 2 EL PASO COUNTY, COLORADO

TABLE OF CONTENTS

REQUIRED MAPS AND DRAWINGS

MASTER DEVELOPMENT DRAINAGE PLAN AND PRELIMINARY DRAINAGE REPORT FOR WATERBURY FILINGS NO. 1 & 2 EL PASO COUNTY, COLORADO

DESIGN ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

_____ _____

Quentin Armijo, P.E. 37170 Date
On behalf of Terra Nova Engineering, Inc.

OWNER/DEVELOPER'S STATEMENT:

I, the owner/developer have read and will comply with all of the requirements specified in this drainage report and plan.

_____ _____

Authorized Signature Date

_____

Printed Name, Title

_____

Business Name

_____

Address

EL PASO COUNTY:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

_____ _____

Jennifer Irvine, P.E. Date
County Engineer / ECM Administrator
Conditions:

MASTER DEVELOPMENT DRAINAGE PLAN AND PRELIMINARY DRAINAGE REPORT FOR WATERBURY FILINGS NO. 1 & 2 EL PASO COUNTY, COLORADO

INTRODUCTION

PURPOSE

The purpose of this Master Development Drainage Plan is to identify and analyze the proposed drainage patterns, determine proposed runoff quantities, size drainage structures for conveyance of developed runoff based upon the overall development of single-family homes along with all the supporting infrastructure, while following the guidelines of the 4-step process.

This site was previously submitted as Waterbury Phase 1 Preliminary Plan with 3 separate filings by Classic Consulting Engineers & Surveyors, LLC. The Final Drainage Report for Filing 1 along with the construction drawings were approved in September of 2016 by EL Paso County Development Services and the Final Drainage Report for Filing 2 along with the construction drawings were submitted for review in September of 2017 and comments given back in September of 2017. Filing 3 had been preliminary designed but nothing submitted to EL Paso County. Since this time the owner has revised the lot layout and removed the alleys shown in Filings 1 & 2. All the public roadways have remained the same with the exception of the ROW for Saybrook Road from Stapleton to Bayshore Way, where the it changed from 65' to 89'. With these changes El Paso County Development Services has requested that we submit a new Preliminary Plan and the associated MDDP for these revisions. The site will now be developed in 2 Filings, Filing 1 & Filing 2. A Final Drainage Report will be submitted with the Final Plat and Construction drawings. With the Preliminary Plan submittal an Early Grading Permit is also being submitted. The overall proposed drainage patterns do not differ much and follow the previous studies closely.

DBPS

The Waterbury site lies within the Geick Ranch and the Haegler Drainage Basins, storm runoff drains southerly via 2 existing natural waterways, one bordering the site on the west (Haegler Drainage Basin) and one on the east (Geick Ranch Drainage Basin). The "Haegler Drainage Basin Planning Study" was prepared by URS and approved in June of 2009. Drexel Barrel & Co prepared the "Geick Ranch Drainage Basin Planning Study" submitted for approval February 2008 but it has yet to be

FIXED

Haegler

approved by El Paso County, and therefore there are no drainage fees in this basin. In the Hagler DBPS it is noted that "a portion of the Haegler Ranch as delineated by the County map was found to be part of the Geick Ranch Drainage Basin at Judge Orr Road, due to a the lack of a roadway culvert at the crossing. This is excluded from the Haegler Ranch DBPS and is included as part of the Geick Ranch DBPS, per the County." These 2 channels eventually drain to Black Squirrel Creek and ultimately the Arkansas River.

ADDED

PROJECT CHARACTERISTICS

Waterbury Filings 1 & 2 consists of 61.93 acres and is part of a larger development of 322.0 acres to be developed over time and in multiple filings. A PUD Development Plan, Zoning and Conceptual plans have all been previously processed and approved with El Paso County. Filing 1 is 29.44 acres with 108 single family units, while Filing 2 is 32.44 acres 93 single family lots.

updated 198 total on updated plan

The site is in the SW 1/4 of Sections 28, SE ¼ 29 & NW 1/4 33, Township 12 South, Range 64 West of the 6th Principal Meridian within El Paso County, Colorado. The site is bounded to the west by natural channel and 4-Way Ranch Filing No. 1. To the south by Stapleton Drive. To the north by unplatted land consisting of future Waterbury Filings, and to the west by a natural channel unplatted land consisting of future Waterbury Filings (See vicinity map, Appendix A).

The site consists of 100% Columbine Gravelly (19) per the USDA, NRCS web soil survey. The hydrologic soil group "A" was used to represent the soil types and determine the onsite basin overland flow. (See map in appendix)

The study area consists of undeveloped land that has existing vegetation consisting of established native grasses. A ridge running north to south splits the site with the west 1/3 draining southwest with average slopes of 0% to 3% and the remaining 2/3 drains southwest with average slopes of 0% to 3%. There are no existing on-site improvements.

The site has been analyzed in several approved studies including the following "Revision to the MDDP for Meridian Ranch, EL Paso County, Colorado", approved October 2005, and prepared by PBS&J. "Final Drainage Report for 4-Way Ranch Phase 1" by JR Engineering Dated March 2006.

The "Geick Ranch Drainage Basin Planning Study" dated February 2008, and prepared by Drexel Barrel & Co. The "Preliminary/Final Drainage Report for Meridian Ranch filing No. 3" by Tech Contractors, November 2011. The "Master Development Drainage Plan, 4-Way Ranch – Phase 1" by Advanced Design Professionals, Inc. dated January 2012. The "Preliminary Drainage Report for Waterbury (Phase 1 Preliminary Plan) dated June 2013 by Classic Consulting analyzes this area in more detail and then Classic followed up with the "Final Drainage Report for Waterbury Filing No. 1" dated September 2016 which studied a portion of the area now being developed. Kiowa Engineering also prepared a 2004 LOMR (04-08-0012).

As-built field survey data is the basis for the design of the drainage basins.

FLOODPLAIN STATEMENT

A portion of this site along the western edge is within a designated F.E.M.A. floodplain, as determined by Flood Insurance Rate Map No. 08041C0552G December 7, 2018 (see appendix). The floodplain is shown on the proposed Drainage Map in the appendix along with the FEMA Firmette. Lots from Filings 1 & 2 abut the channel with rear lots lines, but are set to be outside of the floodplain. As mentioned in the previously approved "Final Drainage Report for Waterbury Filing 1" dated September 2016 prepared by Classic Consulting Engineering & Surveying the floodplain was determined by Kiowa Engineering in a 2004 LOMR (04-08-0012) using a HEC-RAS analysis modeling developed flows along the channel from the 3-42" culverts under Eastonville Road south to the existing stock pond (Design Point 13) south of Stapleton Drive with proposed and existing improvements such as the proposed 42" dual culverts located at the Gilbert Road crossing and existing dual 4' x 8' box culverts at Stapleton Drive (see appendix for HEC-RAS model). At the time of Final Platting the Base Floodplain Elevations are required to be shown on the Final Plat.

HYDROLOGIC ANALYSIS FOR MDDP

MAJOR DRAINAGE BASIN

The Waterbury Filing 1 & 2 site lies within the Geick Ranch and Haegler Drainage Basin, storm runoff drains southerly to Black Squirrel Creek via a public piped system and then into Fountain Creek. "Geick Ranch Drainage Basin Planning Study" dated February 2008, and ~~pre~~prepared by Drexel Barrel & Co. has been drafted but not yet approved by El Paso County. The Haegler Ranch

FIXED

(diversion to Geick)

FIXED

DBPS, the Drainage Basin Planning Study on file for this basin was prepared by URS and approved in June of 2009. Drainage and Bridge fees for the part of the site that lies with Haegler Ranch Basin will need to paid at the time of Final Plat

revised

(other subdivisions in this diversion area have not paid)

METHODOLOGY

The El Paso County Drainage Criteria Manual (EPCDCM), dated May 1994 was the resource used in this analysis with the exception for calculating the 5-year and 100-year design storm events. Chapter 6 of the City of Colorado Springs Drainage Criteria Manual (CSDCM) was referenced in determining rainfall and runoff for the proposed drainage system per the EPC DCM1 Update resolution. Runoff was calculated using the Rational Method for developed conditions (see appendix). Runoff coefficients were calculated using weighted impervious values for each specific basin base upon Table 6.6 of the CSDCM. Table 6.5 was used for calculating intensity (see appendix).

EXISTING MAJOR SUBBASIN DESCRIPTION (FOR MDDP)

In the existing condition runoff from Filing 2 sheet flows south onto Filing 1 and from here the runoff is directed southwest and southeast overland to the existing channels on the west and east side of the site. Below is a description of the existing condition's Design Points, Basins and site runoff.

There are 4 offsite basins that drain existing runoff onto the site from the north under Eastonville Road through culverts. There is also unplatted open space just north of the proposed Waterbury Filing No. 1 & 2.

At Design Point 10A 3-42" RCP that routes runoff from a temporary sediment pond south onto the property (Basin OS-5). The "Preliminary/Final Drainage Report for Meridian Ranch Filing No. 3" and shows flows of Q_5 = 28 cfs, Q_{100} = 153 cfs while the Meridian Ranch MDDP shows a 100-year flow of 185 cfs. This larger flow of 185 cfs is used in the HEC-RAS model for downstream channel analysis and culvert design. As mentioned above in the Floodplain Statement section the natural channel along the west side of the site is a recognized FEMA floodplain. This channel in the Haegler Creek Basin drains south to Stapleton Drive where dual 4' high x 8' wide concrete box culverts route the water south in its natural path.

Design Point EX1 consist of onsite Basin EXA's 9.62 acres and offsite Basin OS-5's 6.74 acres, which both consist of undeveloped open space prairie and the FEMA flood channel and the runoff from Design Point EX10A mentioned above travel in the channel south to the southern boundary of our site. The combined flow from these upstream basins and our onsite basins that contribute to the flow is Q_5 = 38 cfs, Q_{100} = 219 cfs. This report does not analyze the flow coming from the adjacent Subdivision as the culverts were previously sized and installed in the approved Classic Consulting "Final Drainage Report for Waterbury Filing No. 1" dated September 2016.

Design Point EX2 is a point at the southern boundary of Filing 1 where runoff (Q_5 = 1 cfs, Q_{100} = 9 cfs) from Basin EXB's 4.09 acres of undeveloped prairie flow into Stapleton Road.

Design Point EX3 consists of a shallow swale that leave the site at the south east boundary. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin OS-4's 0.29 acres is directed south onto Basin EXC. The runoff (Q_5 = 7 cfs, Q_{100} = 45 cfs) form Basin EXC's 24.80 acres is combined with the Basin's OS-4. The combined runoff (Q_5 = 7 cfs, Q_{100} = 45 cfs) is directed offsite and shortly later in the existing channel in the Geick Ranch Basin.

Design Point EX4 is a point at the easthern boundary of Filing 1 where runoff (Q_5 = 0 cfs, Q_{100} = 2 cfs) from Basin OS-3's 1.11 acres of undeveloped prairie flows south onto Basin EXD's 15.87 acres (Q_5 = 5 cfs, Q_{100} = 31 cfs). The combined flow (Q_5 = 5 cfs, Q_{100} = 33 cfs) travels south and drains into the existing channel along the eastern boundary.

At Design Point EX10 a 36" CMP culvert (corresponds to DP10 in the MDDP) that drains from north to south under Eastonville Road (Basin OS-8) onto the undeveloped open space north (Basin OS-2) of the proposed Filing 2 layout. The Meridian Ranch MDDP states the runoff is Q_5 = 5 cfs, Q_{100} = 11 cfs.

Design Point EX5 consists of a swale that leave the site at the south east boundary. Runoff (Q_5 = 3 cfs, Q_{100} = 22 cfs) from Basin OS-2's 11.40 acres and Design Point EX10 is directed south onto Basin EXE. The runoff (Q_5 = 2 cfs, Q_{100} = 14 cfs) from Basin EXE's 5.83 acres is combined with Basin's OS-2 & Design Point EX10. The combined runoff (Q_5 = 10 cfs, Q_{100} = 44 cfs) of the 3 basins is

directed offsite and into the existing channel in the Geick Ranch Basin.

At Design Point EX9 (Basin OS-9) is another 36" DONE culvert (corresponds to DP9 in the MDDP) that routes the runoff (Q_5 = 8 cfs, Q_{100} = 19 cfs) under Eastonville Road and onto the open space in Basin OS-1. The runoff (Q_5 = 13 cfs, Q_{100} = 85 cfs) from Basin OS-1's 45.02 acres is routed south via the existing channel located in the Geick Ranch Basin. An analysis found that this drainage channel is a jurisdictional waters of the U.S. with associated jurisdictional wetland habitat. Basin EXF's 1.62 acres is a small area consisting of open space prairies located at the north east corner of the site. Runoff Q_5 = 1 cfs, Q_{100} = 4 cfs) from Basin EXF is directed onto Basin OS-1 along the eastern boundary at Design Point EX6.

Design Point EX7 is a point in the channel that corresponds to the proposed Design Point 30. The combined flow of Basin OS-1, Design Points EX5, EX6, & EX9 at DP EX7 is Q_5 = 31 cfs, Q_{100} = 151 cfs).

EARLY GRADING PERMIT SUBBASIN DESCRIPTION

The developer/owner is applying for an Early Grading Permit with the PUD and Final Plat submittal. Per El Paso County Standards, the site must be analyzed for this step in the process. All the flow will be treated via temporary BMP's. These BMP's include silt fence for areas along the site boundary that cannot be routed to a Temporary Sediment Basin (TSB). The larger open areas being graded will be routed via natural and temporary diversion swales to a TSB. All the diversion swales are trapezoidal swales 2' deep, 2'-4' bottom width with 4:1 side slopes (see appendix for calcs) and will have Sediment Control Logs to help control sediment runoff. The velocities in these swales are less than the 7 fps and therefore will be stable. All TSBs will allow sediment to settle out and runoff will be routed via 6" PVC pipe wrapped in rock or in the bigger storm via the riprap armored weir. Below is a description of the site for the Initial Grading Phase.

Basin PRE-A's 4.61 acres consists of small open space prairie along the western boundary that cannot be routed to a Temporary Sediment Basin, and the existing channel floodplain. Runoff (Q_5 = 1 cfs, Q_{100} = 10 cfs) will sheet flow to Silt Fence BMPs prior to draining into the channel.

Design Point PRE1 is Temporary Sediment Basin 1 (TSB1) located at the southwestern corner of the site and will become a permanent Full Spectrum Detention Basin (FSD 1) when construction starts. Offsite Basin OS-4's 0.56 acres will sheet flow (Q_5 = 0 cfs, Q_{100} = 1 cfs) onto Basin PRE-B. Runoff (Q_5 = 4 cfs, Q_{100} = 24 cfs) from Basin PRE-B's 12.35 acres will combine with the upstream offsite Basin OS-4. The combined flow (Q_5 = 4 cfs, Q_{100} = 25 cfs) will be routed overland and via temporary diversion swale A-A to TSB where the water will be treated prior to leaving the site. The swale is a 2' wide bottom 2' deep swale with 4:1 side slopes. The 100-Y highwater depth in the swale is 1.00' (See Appendix for calcs).

Design Point PRE2 is Temporary Sediment Basin 2 (TSB2) located at the southeastern corner of the site. Runoff (Q_5 = 6 cfs, Q_{100} = 38 cfs) from Basin PRE-C's 19.08 acres will be routed overland and via 2 temporary diversion swales B-B to the TSB where the water will be treated prior to leaving the site. it is assumed that the flow is split between the 2 swales. The flows of Q_5 = 3 cfs, Q_{100} = 19 cfs are used in the swale calculations. The swales are a 2' wide bottom, 2' deep swale with 4:1 side slopes. The 100-Y highwater depth in the swale is 0.89' (See Appendix for calcs).

Design Point PRE3 is Temporary Sediment Basin 3 (TSB3) located on the eastern boundary of the site. Offsite Basin OS-3's 1.11 acres will sheet flow (Q_5 = 0 cfs, Q_{100} = 3 cfs) onto Basin PRE-D. Runoff (Q_5 = 5 cfs, Q_{100} = 30 cfs) from Basin PRE-D's 15.52 acres will combine with the upstream offsite Basin OS-3. The combined flow (Q_5 = 5 cfs, Q_{100} = 33 cfs) will be routed overland and via temporary Diversion Swale C-C that is located along the Boundary between Filing 1 & 2, to the TSB where the water will be treated prior to leaving the site. The swale is a 3' wide bottom, 2' deep swale with 4:1 side slopes. The 100-Y highwater depth in the swale is 1.04' (See Appendix for calcs).

Design Point PRE4 is Temporary Sediment Basin 4 (TSB4) located on the eastern boundary of the site just north of TSB3. Offsite Basin OS-1's 0.75 acres will sheet flow (Q_5 = 0 cfs, Q_{100} = 2 cfs) onto Basin PRE-E. Runoff (Q_5 = 2 cfs, Q_{100} = 16 cfs) from Basin PRE-E's 6.33 acres will combine with the upstream offsite Basin OS-1. The combined flow (Q_5 = 3 cfs, Q_{100} = 18 cfs) will be routed overland and via temporary Diversion Swale D-D to the TSB where the water will be treated prior to leaving the site. The swale is a 2' wide bottom 2' deep swale with 4:1 side slopes. The 100-Y highwater depth in the swale is 0.86' (See Appendix for calcs).

Design Point PRE5 is downstream of an existing stock pond located just north of Filing 2 boundary in a future Waterbury Phase. Offsite Basin OS-8's 2.56 acres flow (Q_5 = 5 cfs, Q_{100} = 11 cfs) under Eastonville Road via a 36" CMP culvert onto Basin OS-2. Offsite Basin OS-2's 11.15 acres flow (Q_5 = 8 cfs, Q_{100} = 19 cfs) into the existing stock pond. The combined flow (Q_5 = 9 cfs, Q_{100} = 35 cfs) of the 2 basins will be routed overland in a proposed Diversion Swale E-E north of the Filing 2 Boundary to the existing channel that runs along the eastern boundary, while keeping it off of the proposed development. The swale is a 4' wide bottom 2' deep swale with 4:1 side slopes. The 100-Y highwater depth in the swale is 0.99' (See Appendix for calcs).

Design Point PRE6 is a point located at the southern boundary of the site in Stapleton Drive. Basin PRE-F's 0.62 acres consists of small open space prairie that cannot be routed to a Temporary Sediment Basin. Runoff (Q_5 = 0 cfs, Q_{100} = 2 cfs) will sheet flow to Silt Fence BMPs prior to draining offsite in its historic path.

Design Point PRE7 is a point located at the eastern boundary of the site in the existing channel in the Geick Ranch Basin. Basin PRE-G's 2.00 acres consists of small open space prairie next to the channel and wetlands in Filing 1 that cannot be routed to a Temporary Sediment Basin. Runoff (Q_5 = 1 cfs, Q_{100} = 4 cfs) will sheet flow to Silt Fence BMPs prior to draining offsite in it' historic path. Basin PRE-H's 1.33 acres consists of small open space prairie next to the channel and wetlands in Filing 2 that cannot be routed to a Temporary Sediment Basin. Runoff (Q_5 = 1 cfs, Q_{100} = 4 cfs) will sheet flow to Silt Fence BMPs prior to draining offsite in its historic path. Along with these 2 Basins, runoff discharged from PRE2, PRE3, PRE4, & PRE5 for a combined runoff of Q_5 = 25 cfs, Q_{100} = 147 cfs that is routed to the existing channel.

PROPOSED MAJOR SUBBASIN DESCRIPTION (FOR MDDP)

The overall site will be developed in several Filings with each filing requiring its own final drainage report. The Proposed Major Basin Descriptions below is for Waterbury Filings 1 & 2 development and the preliminary layout of the future filings to the north tributary to the storm drain system and detention ponds in Filings 1 & 2. This future area is shown as fully developed to analyze the ultimate

storm drain capacity and pond volumes. In the section below labeled Hydrologic Analysis for Filing 1 FDR the interim condition will be discussed and how runoff is captured and routed safely to the proposed private EDB for Filings 1 & 2 construction. See the Proposed MDDP Drainage Map in the appendix for a visual representation of the below Basin descriptions.

Design Point 1 is a proposed public 10' CDOT TYPE R sump inlet located in the west flowline of Saybrook drive just north of the roundabout. Basin A's 3.39 acres consists of roadway and single-family development. Runoff (Q_5 = 5 cfs, Q_{100} = 12 cfs) sheet flows into street sections and then is routed south via c&g where the inlet captures all the flow.

Design Point 2 is a proposed public 5' CDOT TYPE R sump inlet located in the west flowline of Saybrook drive opposite of DP 1. Basin C's 0.86 acres is comprised of roadway and single-family development. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) drains overland to the street and then to the inlet where it is fully captured. Pipe run 1 an 18" RCP routes the flow to a junction at DP 1. Pipe Run 2 a public 24" RCP routes the combined flow (Q_5 = 7 cfs, Q_{100} = 15 cfs) of DP 1 & 2 down Saybrook Road and then down Bayshore Drive over to manhole junction in Sandy Neck Way.

Design Point 3 is a proposed public 5' CDOT TYPE R sump inlet located in the east flowline of Sandy Neck Way. Basin B1's 2.30 acres consists of roadway and single-family development. Runoff (Q_5 = 4 cfs, Q_{100} = 8 cfs) is directed south to Design Point 3. The 5' CDOT TYPE R sump inlet captures the entire flow. Pipe run 3 an 18" public RCP storm sewer routes the flow west to a manhole junction with Pipe run 4.

Design Point 4 is a proposed public 5' CDOT TYPE R sump inlet located in the west flowline of Sandy Neck Way opposite of DP 3. Basin B2's 2.69 acres consists of roadway and single-family development. Runoff (Q_5 = 4 cfs, Q_{100} = 9 cfs) is routed to Design Point 4. The 5' CDOT TYPE R sump inlet captures the entire flow. Pipe run 4 an 18" public RCP storm sewer routes the flow west to a manhole junction with Pipe run 3. Pipe run 5 a 24" RCP routes the combined (Q_5 = 8 cfs, Q_{100} = 17 cfs) flow of Pipe runs 3 & 4 south down Sandy Neck Way to the manhole junction with Pipe run 2. Pipe run 6 a public 30" RCP then routes the combined (Q_5 = 15 cfs, Q_{100} = 32 cfs) flow of Pipe runs 2 & 5 south down Sandy Neck Way to a junction at Design Point 5.

Design Point 5 is a proposed public 10' CDOT TYPE R sump inlet located in the flowline of Sandy Neck Way cul-de-sac. Runoff (Q_5 = 4 cfs, Q_{100} = 9 cfs) from Basin F's 2.18 acres consisting of single-family development is directed to the east flow line of Sandy Neck Way and then south to the cul-de-sac bulb low point. Runoff (Q_5 = 2 cfs, Q_{100} = 5 cfs) from Basin H's 1.13 acres consisting of single-family development is directed to the west flow line of Sandy Neck Way and then south to the cul-de-sac bulb low point. The combined flow (Q_5 = 6 cfs, Q_{100} = 14 cfs) at DP 5 is captured in the 10' CDOT TYPE R sump inlet and then is routed to the pond along with the flow from Pipe Run 6 via a proposed 36" public RCP storm sewer (Pipe run 7, Q_5 = 20 cfs, Q_{100} = 44 cfs) to Design Point 8. If this inlet were blocked, runoff would overtop the curb and flow down the storm drain tract and into the proposed FSD Pond 1 (Design Point 8).

Design Point 6 is a proposed public 5' CDOT TYPE R sump inlet located in the west flowline of Saybrook Road. Runoff (Q_5 = 4 cfs, Q_{100} = 8 cfs) from Basin D's 2.11 acres consisting of single-family development is directed to the low point in Saybrook Road where the entire flow is captured. It is then routed via a proposed 18" public RCP storm sewer (Pipe run 8) to a manhole junction with Pipe run 9.

Design Point 7 is a proposed public 5' CDOT TYPE R sump inlet located opposite of DP 6 in Saybrook Road. Runoff (Q_5 = 4 cfs, Q_{100} = 8 cfs) from Basin E's 2.18 acres consisting of roadway and single-family lots is directed via side lot line swales and C&G to the proposed inlet. The 5' inlet captures all of the flow and Pipe run 9 a public 18" diameter RCP storm sewer routes the flow to a manhole junction at with Pipe run 8. The combined flows (Q_5 = 7 cfs, Q_{100} = 15 cfs) of Pipe runs 8 & 9 are routed south down Saybrook Road in Pipe run 10 a public 24' diameter RCP to the proposed FSD Pond 1 Design (Design Point 8).

Design Point 7A is a proposed public 5' CDOT TYPE R at-grade inlet located in the east flowline of Saybrook Road at the south boundary. Runoff (Q_5 = 1 cfs, Q_{100} = 3 cfs) from Basin G1's 0.53 acres consisting of single-family development is directed to the at-grade inlet. The entire flow is captured. It is then routed via a proposed 15" public RCP storm sewer (Pipe run 10A) to a Design Point 7B.

Design Point 7B is a proposed public 5' CDOT TYPE R at-grade inlet located opposite of DP 7A in Saybrook Road. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from Basin G2's 0.69 acres consisting of roadway and single-family lots is directed via side lot line swales and C&G to the proposed inlet. The 5' inlet captures all of the flow and Pipe run 10B a public 18" diameter RCP storm sewer routes the combined flows (Q_5 = 7 cfs, Q_{100} = 15 cfs) of Pipe runs 10A & Design Point 7B are routed west to the proposed FSD Pond 1 Design (Design Point 8).

Design Point 8 is a proposed private Full Spectrum Detention Basin called FSD Pond 1. Design Points 1-7B are routed to the pond and treated for Water Quality and Detention along with Basin K's 3.06 acres consisting mainly of the EDB area and rear yards. Runoff (Q_5 = 3 cfs, Q_{100} = 11 cfs) sheet flows into the EDB. The basins tributary to Design Point 8 are Basins A, B1, B2, C, D, E, F, G1, G2, H & K with a total area of 21.12 acres. The 100-year effective impervious area of 55.5% was calculated using UD-BMP Version 3.07 IRF spreadsheet. This information was entered into the UD-Detention_v4.03 spreadsheet and the calculation yielded a required a WQCV of 0.391 ac-ft, a EURV of 1.002 ac-ft and a 100-year total required volume of 2.154 ac-ft. The top of pond is set at 6930.00, with a bottom of pond at 6923.50. The pipes and swales to the pond discharge into 2 concrete forebays (3% WQCV see calcs in appendix) with 18" high walls and a 3" notch to release minor flows into 2' wide concrete tickle channel. The trickle channel directs runoff to the proposed concrete micro-pool at the surcharge elevation of 6923.83. The bottom of the micro-pool is set at 6921.00 and the top set at 6923.50. A proposed 4' x 4' grate set at 6926.90 on top of a concrete outlet box, an outlet plate on the front to meet the 3-orifice requirement and an 18" outlet pipe with a restrictor plate set 7.5" above the invert will route all runoff from the pond. The metal plate will have 1 column containing 3 rows of 1-15/16" diameter orifice holes spaced 14.0" apart starting at 6923.50. The WQCV release is 0.20 cfs with a ponding elevation of 6925.28 and takes 40 hours to release. The EURV release is 0.5 cfs, with an elevation of 6926.99 and takes 74 hours to release. The 100-year detention release is 8.2 cfs, with an elevation of 6927.86 and takes 76 hours to release. A 30' long riprap emergency spillway set at 6928.00 will allow the 100-year developed peak in flow (Q_{100}= 38.5 cfs) with a depth of 0.55' (top of water = 6928.55) to be routed west into the natural channel. 1.00' freeboard is provided (see appendix for all pond calcs). The spillway and downhill slope will be armored with d50= VH 24" riprap. Pipe Run 10C a private 24" RCP will route the pond release into the existing natural channel. (See Pond Calculations in appendix).

added at end of FSD & WQ calcs

Calculations for forebay missing in appendix

Design Point 9 is an existing 36" RCP culvert under Eastonville Road where Offsite Basin OS-9 discharges onto offsite Basin OS-2. Runoff (Q_5 = 8 cfs, Q_{100} = 19 cfs) from Basin OS-9's 11.80 acres consists of historic flow based upon upstream detention. Further breakdown of this flow will be discussed with analysis of Design Point 29 and the discussion for Tributary flow to the FSD Pond 3.

Design Point 10 is an existing 36" RCP culvert under Eastonville Road south of the existing High School Pond where Offsite Basin OS-8 discharges onto a future Waterbury Filing. Runoff (Q_5 = 5 cfs, Q_{100} = 11 cfs) from Basin OS-10's 2.56 acres consists of historic flow based upon upstream detention. In the ultimate buildout this flow will be piped west to the existing natural channel along the westside of Waterbury and to Offsite Basin OS-5. Until the future filings are built this flow will follow its natural channel south to the existing channel located along the eastern boundary of Filings 1 & 2. This will be discussed again in the Preliminary Drainage Report section below.

Design Point 10A is where existing 3-42" RCP culverts from the temporary Meridian Ranch Pond cross under Eastonville Road per the "Preliminary/Final Drainage Report for Meridian Ranch Filing No. 3" and shows flows of Q_5 = 28 cfs, Q_{100} = 153 cfs while the Meridian Ranch MDDP shows a 100-year flow of 185 cfs. The pipes discharge onto Offsite Basin OS-5. Offsite Basin OS-5's 5.64 acres consists of future Waterbury rear lots, open space and the natural channel. Runoff (Q_5 = 10 cfs, Q_{100} = 23 cfs) from OS-5 sheet flows to the channel. The flow is then routed south to Design Point 11.

Design Point 13 in this report corresponds to Design Point 13 in Classic Consulting's previously approved "Final Drainage Report for Waterbury Filing 1" dated September 2016. Design Point 13 is an existing Stormwater Quality Pond 3 (SWQ Pond 3) that was an existing stock pond south of Stapleton Drive that has been converted to an EDB and treat 40.4 acres of 4-Way Ranch Filing No. 1 from their Basins OS-5, OS-6, D, E, N 40% of L, 50% of O, Q & basins I, J & N of Waterbury Filing No. 1. The EDB was designed using a 4' x 4' outlet set at 6907.50 with an orifice plate with 1 column of 8-1/8" diameter holes spaced 4" apart. The forebay top is set at 6915.00 with the bottom at 6914.75. The required volume was calculated to be 0.66 ac-ft and the design volume shown is 1.20 ac-ft. The release out of the pond was calculated to be Q_5 = 69 cfs, Q_{100} = 396 cfs (See Classic Consulting

Did not see a copy of this map in the appendix. Please include.

ADDED AT END OF MAPS

Drainage Map in Appendix). This online EDB is no longer considered a viable solution to treating for WQCV for Waterbury Filing 1 & 2 basins I, J & N.

Design Point 11 is a proposed crossing under the proposed continuation of Gilbert Drive with dual 42" RCP culverts. Basin I's 5.99 acres consists of rear lots and the natural channel. Runoff (Q_5 = 6 cfs, Q_{100} = 20 cfs) sheet flows to the channel and is directed south to Design Points 11. As mentioned above Kiowas Engineering did a HEC-RAS analysis modeling developed flows along the channel. Tera Nova Engineering has done a new HEC-RAS analysis modeling developed flows. This information can be found under the Hydraulic analysis section below. The combined flow of Design Point 10A along with Basins OS-5 and I is Q_5 = 36 cfs, Q_{100} = 213 cfs. This flow is routed south under Gilbert drive and onto Basin J. Basin I's runoff as mentioned above was intended to be treated downstream in the existing EDB at Design Point 13. This online EDB is no longer considered a viable solution to treating for WQCV due to new regulations. Therefore, the UD-BMP Version 3.07 Runoff Reduction was used to show that this area can be treated using Runoff Reduction. The results show that we have a 100% WQCV reduction for Basin I. The Preliminary Plan/PUD also places impervious restrictions on the rear yards of lots in this Basin area.

Design Point 12 is a proposed 18" RCP culvert under Gilbert Drive that routes the runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from offsite Basin OS-6's 1.06 acres that is comprised of the eastern half of Thatcher Court located in 4-Way Ranch Filing 1 to the existing natural channel.

Basin J's 1.99 acres is comprised of rear lots and the existing channel along the west boundary. Runoff (Q_5 = 4 cfs, Q_{100} = 8 cfs) sheet flows into the channel and then is routed south to Design Point 13, an on-line existing stock pond that was converted to an EDB to provide water quality for part of 4-Way Ranch Filing No. 1 and Waterbury Basins I, J & N. As mentioned above this online EDB is no longer considered a viable solution to treating for WQCV. Therefore, the UD-BMP Version 3.07 Runoff Reduction was used to show that this area can be treated using Runoff Reduction. The results show that we have a 100% WQCV reduction for Basin J. The Preliminary Plan/PUD also places impervious restrictions on the rear yards of lots in this Basin area.

Basin N's 0.22 acres is comprised of the proposed extension of Gilbert Road form 4-Way Ranch into

Waterbury. Runoff (Q_5 = 1 cfs, Q_{100} = 1 cfs) sheet flows into the channel and then is routed south to Design Point 13, an on-line existing stock pond that is being converted to an EDB to provide water quality for part of 4-Way Ranch Filing No. 1 and Waterbury Basins I, J & N. Once again, this online EDB is no longer considered a viable solution to treating for WQCV. Therefore, the UD-BMP Version 3.07 Runoff Reduction was used to show that this area can be treated using Runoff Reduction. The results show that we have a 100% WQCV reduction for Basin N. The Preliminary Plan/PUD also places impervious restrictions on this Basin area.

In the previously approved "Final Drainage Report for Waterbury Filing No. 1" by Classic Consulting it was stated that there were 3 Stormwater Quality Ponds that needed to be provided for the adjacent 4-Way Ranch per conditions set forth by the Board of County Commissioners at approval of the Waterbury PUD Development Plan. Because there have been no changes to the tributary areas to these 3 Ponds and they have already been designed and constructed. The original approved calculations and results can be found in the appendix of the original report by Classic Consulting along with the Basin Exhibit Map.

Basin M1's 1.41 acres is comprised of the rear yards & open space tract along Stapleton Drive along. Runoff (Q_5 = 2 cfs, Q_{100} = 6 cfs) sheet flows over the back yard and open space tract onto Stapleton Drive and then is routed east via curb & gutter to an existing storm drain system from here it is routed to the eastern channel located in the Geick Ranch Basin. The area consists roof area and pervious rear yards that sheet flow over pervious area. The UD-BMP Version 3.07 Runoff Reduction was used to show that this area has 100% WQCV reduction based upon the Unconnected Impervious Area being routed over the Receiving Pervious Area. The Preliminary Plan/PUD also places impervious restrictions on this Basin area.

Basin M2's 0.45 acres is comprised of the rear yards adjacent to undeveloped land east of the site. Runoff (Q_5 = 1 cfs, Q_{100} = 2 cfs) sheet flows from the back yard onto the undeveloped. This area is not treated for water quality but is pervious area. The UD-BMP Version 3.07 Runoff Reduction was used to show that this area has 100% WQCV reduction based upon the Unconnected Impervious Area being routed over the Receiving Pervious Area. The Preliminary Plan/PUD also places impervious restrictions on this Basin area.

ADDED TO SPREADSHEET W/ M2

Still need to show calcs for this basin on pdf pg 196.

Basin P's 0.70 acres is comprised of open space Tract I adjacent to undeveloped land east of the site. Runoff (Q_5 = 0 cfs, Q_{100} = 2 cfs) sheet flows from the open space onto the undeveloped. This area is not treated for water quality but is pervious undeveloped area. The UD-BMP Version 3.07 Runoff Reduction was used to show that this area has 100% WQCV reduction based upon area being Separate Pervious Area.

Design Point 14 is a low point in the knuckle of Beech Creek Drive with a proposed public 10' CDOT TYPE R sump inlet. Runoff (Q_5 = 5 cfs, Q_{100} = 11 cfs) from Basin L1's 3.27 acres consisting of roadway and single-family lots is directed via side lot line swales and C&G to the proposed inlet. The 10' inlet captures all of the flow and Pipe run 11 a public 24" diameter RCP storm sewer routes the flow to a manhole junction with Pipe run 12.

Design Point 15 is a proposed public 5' CDOT TYPE R sump inlet opposite of DP 14 in Beech Creek Drive Runoff (Q_5 = 3 cfs, Q_{100} = 7 cfs) from Basin L2's 2.00 acres consisting of roadway and single-family lots is directed via side lot line swales and C&G to the proposed inlet. The 5' inlet captures all of the flow and Pipe run 12 a public 24" diameter RCP storm sewer routes the flow to a manhole junction with Pipe run 11. Pipe run 13 a 30" R[illegible] bined flow (Q_5 = 8 cfs, Q_{100} = 18 cfs) of Pipe Runs 11 & 12 north in Beech ~~Creek~~ [illegible]le junction with Pipe run 14.

10' inlet per calculations in apprendix

REVISED TO 10'

Design Point 16 is a proposed public 5' CDOT TYPE R sump inlet located in the proposed western half of the private street of Beech Creek Drive. Runoff (Q_5 = 5 cfs, Q_{100} = 10 cfs) from Basin O1's 2.82 acres consisting of roadway and single-family lots is directed via side lot line swales and C&G to the proposed inlet. The 5' inlet captures all of the flow and Pipe run 14 a public 30" diameter RCP storm sewer routes the flow to a manhole junction with Pipe run 13. Pipe run 15 a 30" RCP routes the combined flow (Q_5 = 12 cfs, Q_{100} = 27 cfs) of Pipe Runs 13 & 14 west to a manhole junction with Pipe run 16.

Design Point 17 is a proposed public 5' CDOT TYPE R sump inlet located opposite of DP 16 in Beech Creek Drive. Runoff (Q_5 = 1 cfs, Q_{100} = 2 cfs) from Basin O2's 0.71 acres consisting of roadway, parking, roof and landscape area sheet flows to the east flowline of Beech Creek Drive and

to the proposed inlet. After all the flow is captured by the inlet Pipe run 16 routes the runoff to a junction with Pipe run 15. Pipe run 17 routes the combined flows (Q_5 = 14 cfs, Q_{100} = 32 cfs) of Pipe runs 15, 16, 39 & 40 and is routed west offsite via a private 36" diameter RCP to Design Point 18 a proposed private temporary EDB to be in place until future final design of a pond accommodates the new Waterbury development tributary to this pond. This is the FSD Pond 2.

Design Point 33 consists of 4-18" diameter area inlets located at the rear lot line in the downhill side yard swale. A 1' high berm along the back of Lots 46-49 in Basin O3's 0.45 acres will keep runoff (Q_5 = 1 cfs, Q_{100} = 2 cfs) from back yards and rear lot downspouts from sheet flowing into the existing wetlands untreated. Each area inlet can capture 1.40 cfs based upon a head of 0.25'. Therefore the 4 inlets can capture all of the flow. Pipe run 39 a 15" HDPE will route the captured flow to pipe run 17.

Design Point 34 consists of 3-18" diameter area inlets located at the rear lot line in the downhill side yard swale. A 1' high berm along the back of Lots 43-45 in Basin O4's 0.38 acres will keep runoff (Q_5 = 1 cfs, Q_{100} = 2 cfs) from back yards and rear lot downspouts from sheet flowing into the existing wetlands untreated. Each area inlet can capture 1.40 cfs based upon a head of 0.25'. Therefore the 3 inlets can capture all of the flow. Pipe run 40 a 15" HDPE will route the captured flow to pipe run 17.

Design Point 18 is a proposed temporary private Full Spectrum Detention Basin called FSD Pond 2. This pond will be replaced and resized when future filings to the east are final designed. There are no set time frames at this time to when the final design of the permanent pond will happen. Design Points 14-17 are routed to the pond and treated for Water Quality and Detention along with the Basin OS-4's 10.90 acres consisting of the EDB area and undeveloped upstream tributary area. Runoff (Q_5 = 2 cfs, Q_{100} = 16 cfs) from Basin OS-4 sheet flows into the EDB. The basins tributary to Design Point 18 are L1, L2, O1, O2 and OS-4 with a total area of 20.31 acres. The 100-year effective impervious area of 27.2% was calculated using UD-BMP Version 3.07 IRF spreadsheet. This information was entered into the UD-Detention_v4.03 spreadsheet and the calculation yielded a required a WQCV of 0.241 ac-ft, a EURV of 0.297 ac-ft and a 100-year detention total required volume of 1.041 ac-ft. The top of pond is set at 6906.00, with a bottom of pond at 6899.00. The pipes and swales to the pond discharge into a concrete forebay (3% WQCV see calcs in appendix) with 18" high walls and a 3" notch to release minor flows into 2' wide concrete tickle channel. The trickle

added at end of FSD & WQ calcs

Calculations for forebay missing in appendix

channel directs runoff to the proposed concrete micro-pool at the surcharge elevation of 6899.33. The bottom of the micro-pool is set at 6896.50 and the top set at 6899.00. A proposed 4' x 4' grate set at 6902.13 on top of a concrete outlet box, an outlet plate on the front to meet the 3-orifice requirement and an 18" outlet pipe with a restrictor plate set 11" above the invert will route all runoff from the pond. The metal plate will have 1 column containing 3 rows of 1-5/16" diameter orifice holes spaced 12.5" apart starting at 6899.00. The WQCV release is 0.10 cfs with a ponding elevation of 6901.21 and takes 40 hours to release. The EURV release is 0.2 cfs, with an elevation of 6902.13 and takes 61 hours to release. The 100-year detention release is 10.1 cfs, with an elevation of 6902.69 and takes 60 hours to release. A 20' long riprap emergency spillway set at 6904.00 will allow the 100-year developed peak in flow (Q_{100}= 11.0 cfs) with a depth of 0.46' (top of water = 6904.46) to be routed west into the natural channel. 1.00' freeboard is provided (see appendix). The spillway and downhill slope will be armored with d50= VH 24" riprap. Pipe Run 17A a private 18" RCP will route the pond release into the existing natural channel. (See Pond Calculations in appendix). When future filings are developed this temporary Pond 2 will be replaced with a permanent Pond as shown in the "Conceptual Drainage Report for Waterbury PUD Plan" prepared by Classic Consulting and dated November 2012.

For Design Points 19-25 this MDDP assumes the offsite basins upstream are fully developed with future Waterbury Filings.

REVISED

10' inlet

Design Point 19 is a proposed 10' CDOT TYPE R sump inlet located in the south curb of Muddy Pond Street. Runoff (Q_5 = 6 cfs, Q_{100} = 12 cfs) from Basin OS-Q1's 4.31 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin Q1. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from Basin Q1's 1.06 acres is directed to the 8' inlet. The combined flow (Q_5 = 7 cfs, Q_{100} = 15 cfs) is fully captured in the inlet and Pipe run 18 a 24" RCP diameter storm routes the flows to a manhole junction with Pipe run 19.

Design Point 20 is a proposed 5' CDOT TYPE R sump inlet located opposite of DP 19. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from Basin OS-Q2's 0.96 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin Q2. Runoff (Q_5 = 2 cfs, Q_{100} = 5 cfs) from Basin Q2's 1.10 acres is directed to the 4' inlet. The combined flow (Q_5 = 3 cfs, Q_{100} = 8 cfs) is fully

REVISED

captured in the inlet and Pipe run 19 an 18" RCP diameter storm routes the flows to a manhole junction with Pipe run 18. Pipe Run 20 a 24" RCP storm routes the combined flow (Q_5 = 10 cfs, Q_{100} = 21 cfs) of Pipe runs 19 & 20 east down Muddy Pond Street to a manhole junction with Pipe run 21.

REVISED

10' inlet

Design Point 21 is a proposed 10' CDOT TYPE R at-grade inlet located in the north curb of Muddy Pond Street just east of Masonboro Way intersection. Runoff (Q_5 = 11 cfs, Q_{100} = 24 cfs) from Basin OS-R's 6.05 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin R. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from Basin R's 1.02 acres is directed to the 12' inlet. The combined flow (Q_5 = 12 cfs, Q_{100} = 28 cfs) is routed to the inlet at Design Point 21 and Q_5 = 8 cfs, Q_{100} = 14 cfs is captured by the at-grad inlet. The bypass flow (Q_5 = 4 cfs, Q_{100} = 14 cfs) at DP 21 travels in the north flow line of Muddy Pond Street to Design Point 22. Pipe run 21 an 18" RCP diameter storm routes the captured flow to a manhole junction with Pipe run 20. Pipe run 22 routes the combined flow (Q_5 = 13 cfs, Q_{100} = 34 cfs) of Pipe runs 20 & 21 east down Muddy Pond Street to a manhole junction with Pipe run 25. The bypass flow (Q_5 = 4 cfs, Q_{100} = 14 cfs) at DP 21 travels in the north flow line of Muddy Pond Street to Design Point 22.

Design Point 22 is a proposed 10' CDOT TYPE R sump inlet located in the west curb of Megansett Wat. Runoff (Q_5 = 8 cfs, Q_{100} = 18 cfs) from Basin OS-S1's 5.59 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin S1. Runoff (Q_5 = 3 cfs, Q_{100} = 7 cfs) from Basin S1's 1.55 acres is directed to the 10' inlet. The combined flow (Q_5 = 15 cfs, Q_{100} = 32 cfs) of Basins OS-S1, S1 & the bypass flow from DP 21 is routed to the low point.

Design Point 23 is a proposed 10' CDOT TYPE R sump inlet located opposite of DP 22. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin OS-S2's 0.17 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin S2. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin S2's 0.13 acres is directed to the 10' inlet. The combined flow at DP 23 is Q_5 = 1 cfs, Q_{100} = 1 cfs. It is presumed that the combined flow (Q_5 = 15 cfs, Q_{100} = 33 cfs) at DP 22 & 23 is evenly split between the 2-10' CDOT TYPE R sump inlets. Pipe run 23 a 24" RCP diameter storm routes the flow (Q_5 = 8 cfs, Q_{100} = 17cfs) from the inlet at DP 22 to a manhole junction with Pipe run 24. Pipe Run 24 a 24" RCP storm routes the flow (Q_5 = 8 cfs, Q_{100} = 17 cfs) to the manhole junction with Pipe run 23. Pipe Run 25 a 30" RCP routes the combined flow (Q_5 = 15 cfs, Q_{100} = 33 cfs) of Pipe runs 23

& 24 south to a manhole junction with Pipe run 22 in Muddy Pond Street. Pipe run 26 a 36" RCP then routes the combined flow (Q_5 = 31 cfs, Q_{100} = 62 cfs) of Pipe runs 22 & 25 east in Muddy Pond to a manhole junction with Pipe runs 27 & 28.

5' REVISED

Design Point 24 is a proposed 5' CDOT TYPE R sump inlet located in the south curb of Muddy Pond Street. Runoff (Q_5 = 3 cfs, Q_{100} = 6 cfs) from Basin T1's 1.42 acres consists of single-family development and will be directed via lot line swales and c&g to the 4' inlet. Pipe run 27 an 18" RCP diameter storm routes the fully captured flow from the inlet to a manhole junction with Pipe runs 26 & 28.

Design Point 25 is a proposed 5' CDOT TYPE R sump inlet located opposite of DP 24. Runoff (Q_5 = 1 cfs, Q_{100} = 3 cfs) from Basin OS-T2's 0.76 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin T2. Runoff (Q_5 = 2 cfs, Q_{100} = 5 cfs) from Basin T2's 1.23 acres is directed to the 5' inlet. The combined flow at DP 25 is Q_5 = 3 cfs, Q_{100} = 7 cfs. Pipe run 28 an 18" RCP diameter storm routes the fully captured flow from the inlet to a manhole junction with Pipe runs 26 & 27. Pipe run 29 a 36" RCP then routes the combined flow (Q_5 = 35 cfs, Q_{100} = 72 cfs) of Pipe runs 26, 27 & 28 east in Muddy Pond Street and then south down Fish Camp Circle to a manhole junction with Pipe run 30.

Design Point 26 is a proposed 10' CDOT TYPE R sump inlet located in the west curb of Fish Camp Circle near the Knuckle. Runoff (Q_5 = 7 cfs, Q_{100} = 16 cfs) from Basin U1's 4.38 acres consists of single-family development and will be directed via lot line swales and c&g to the 10' inlet. Pipe run 30 a 24" RCP diameter storm routes the fully captured flow from the inlet to a manhole junction with Pipe run 29. Pipe run 31 a 42" RCP transports the combined flow (Q_5 = 41 cfs, Q_{100} = 84 cfs) of Pipe runs 29 & 30.

Design Point 27 is a proposed 5' CDOT TYPE R sump inlet located opposite of DP 26. Runoff (Q_5 = 3 cfs, Q_{100} = 7 cfs) from Basin U2's 1.89 acres consists of future single-family development and will be directed via lot line swales to the 5' inlet. Pipe run 32 an 18" RCP diameter storm routes the fully captured flow from the inlet to a manhole junction with Pipe runs 31.

Design Point 28 are 2 proposed 10' CDOT TYPE R sump inlets located in the north and south curb of Sunken Meadow Road. These inlets are offsite in a future phase and will be built within a proposed drainage easement. The offsite curb and gutter in this area will also need to be built along with some asphalt to direct runoff to the 10' inlet. Runoff (Q_5 = 8 cfs, Q_{100} = 18 cfs) from Basin W's 5.20 acres is assumed to be evenly split between the 2 inlets and fully captured by them. Pipe run 34 a 24" RCP routes the captured runoff (Q_5 = 4 cfs, Q_{100} = 9 cfs) from the south inlet to the north inlet. Pipe run 34A a 30" RCP routes the combined flow from Design Points 28 & 32, described below via Pipe run 34A a 24" RCP.

2 different pipe sizes called out for same pipe run.

REVISED TO 30"

Design Point 31 consists of 3-18" diameter area inlets located at the rear lot line in the downhill side yard swale. A 1' high berm along the back of Lots 90-92 in Basin V's 0.54 acres will keep runoff (Q_5 = 1 cfs, Q_{100} = 3 cfs) from back yards and rear lot downspouts from sheet flowing into the existing wetlands untreated. Each area inlet can capture 1.40 cfs based upon a head of 0.25'. Therefore the 3 inlets can capture all of the flow. Pipe run 37 a 15" HDPE will route the captured flow to pipe run 33. Pipe run 33 a 42" RCP then routes the combined flow (Q_5 = 44 cfs, Q_{100} = 91 cfs) of Pipe runs 31, 32 & 37 east through a Drainage Tract to FSD Pond 3.

Design Point 32 consists of 2-18" diameter area inlets located at the rear lot line in the downhill side yard swale. A 1' high berm along the back of Lots 88-89 in Basin X's 0.43 acres will keep runoff (Q_5 = 1 cfs, Q_{100} = 2 cfs) from back yards and rear lot downspouts from sheet flowing into the existing wetlands untreated. Each area inlet can capture 1.40 cfs based upon a head of 0.25'. Therefore the 2 inlets can capture all of the flow. Pipe run 38 a 15" HDPE will route the fully captured flow to Design point 28. Pipe run 34 a 30" RCP will route the combined flow (Q_5 = 9 cfs, Q_{100} = 20 cfs) of Design Point 28 and Pipe run 32 to FSD Pond 3.

The following Basin are for future Waterbury Filings to the north and east that will be tributary to FSD Pond 3. All the basin descriptions are the same, they are comprised of future single-family development and will be directed via lot line swales and c&g to future storm drain systems the future drain systems will be routed to FSD Pond 3. The exact routes and design have not been finalized at this time but will be with a future Final Drainage Report at the time of development. Below is the summary of the flow and acreage.

16

REVISED TO 16

Basin OS-1: 11.81 acres, Runoff (Q_5 = 18 cfs, Q_{100} = 41 cfs)

Basin OS-2: 11.53 acres Runoff (Q_5 = 6 cfs, Q_{100} = 36 cfs)

Basin OS-3A: 0.79 acres Runoff (Q_5 = 1 cfs, Q_{100} = 3 cfs)

Basin OS-3B: 5.66 acres Runoff (Q_5 = 9 cfs, Q_{100} = 20 cfs)

As mentioned above Design Point 9 is an existing 36" CMP culvert under Eastonville Road where Offsite Basin OS-9 discharges onto Offsite Basin OS-2. Runoff (Q_5 = 8 cfs, Q_{100} = 19 cfs) from Basin OS-9's 11.80 acres consists of historic flow based upon upstream detention. Runoff will be directed through the future Waterbury filings and into FSD Pond 3.

Design Point 29 is a proposed private Full Spectrum Detention Basin called FSD Pond 3. Design Points 19-28 and Offsite Basins OS-1, OS-2, OS-3A, OS-3B, & OS-9 along with Basin OS-7's 2.82 acres consisting of the EDB area. Runoff (Q_5 = 1 cfs, Q_{100} = 9 cfs) sheet flows into the EDB with a total area of 82.02 acres routed to the pond and treated for Water Quality and Detention. The 100-year effective impervious area of 49.3% was calculated using UD-BMP Version 3.07 IRF spreadsheet. This information was entered into the UD-Detention_v4.03 spreadsheet and the calculation yielded a required a WQCV of 1.396 ac-ft, a EURV of 3.245 ac-ft and a 100-year total required detention volume of 7.405 ac-ft. The top of pond is set at 6930.00, with a bottom of pond at 6922.00. The pipes and swales to the pond discharge into a concrete forebay (3% WQCV see calcs in appendix) with 18" high walls and a 3" notch to release minor flows into 2' wide concrete tickle channel. The trickle channel directs runoff to the proposed concrete micro-pool at the surcharge elevation of 6922.33. The bottom of the micro-pool is set at 6899.50 and the top set at 6922.00. A proposed 6' x 6' grate set at 6926.59 on top of a concrete outlet box, an outlet plate on the front to meet the 3-orifice requirement and a 36" outlet pipe with a restrictor plate set 26.10" above the invert will route all runoff from the pond. The metal plate will have 1 column containing 3 rows of 2.62" x 2.62" orifice holes spaced 19.4" apart starting at 6922.00. The WQCV release is 0.70 cfs with a ponding elevation of 6925.03 and takes 40 hours to release. The EURV release is 1.2 cfs, with an elevation of 6926.85 and takes 78 hours to release. The 100-year detention release is 58.1 cfs, with an elevation of 6927.94and takes 79 hours to release. A 75' long riprap emergency spillway set at 6928.20 will allow the 100-year developed peak in flow (Q_{100}= 204.3 cfs) with a depth of 0.91' (top

added at end of FSD & WQ calcs

Forebay calcs
missing in appendix

of water = 6928.88) to be routed west into the natural channel. 0.89' freeboard is provided (see appendix). The spillway and downhill slope will be armored with d50= VH 24" riprap. Pipe Run 35 a private 36" RCP will route the pond release into the existing natural channel. (See Pond Calculations in appendix).

ADDED TO SPREADSHEET W/ M2 & P

Still need to show calcs for this basin on pdf pg 196.

Design Point 30 is a triple 36" RCP culvert crossing under Sunken Meadow Road. Offsite Basin OS-10's 3.41 acres consists of open space containing the natural channel. Runoff (Q_5 = 1 cfs, Q_{100} = 8 cfs) is directed south through the wetlands to the culverts. Basin V's 0.54 acres is comprised of open space tracts adjacent to the existing natural channel along the west side of the site to avoid disturbing wetlands. Runoff (Q_5 = 1 cfs, Q_{100} = 3 cfs) sheet flows from the back yard onto the undeveloped area. This area is not treated for water quality but per the UD-BMP Version 3.07 Runoff Reduction spreadsheet shows that this area has 100% WQCV reduction based upon the Unconnected Impervious Area being routed over the Receiving Pervious Area. The combined flow (Q_5 = 2 cfs, Q_{100} = 9 cfs) at DP 30 does not warrant the triple 36" RCP culverts alone but in case of failure in the Pond 3 outlet runoff from the emergency spillway (Q_{100} = 204 cfs) will be safely routed through the triple 36" RCP culverts (See appendix).

HYDRAULIC ANALYSIS

MAJOR DRAINAGEWAYS

As mentioned above there are 2 major drainage ways on the east and west side of the site. In the previously approved "Final Drainage Report for Waterbury Filing 1" dated September 2016 prepared by Classic Consulting Engineering & Surveying the floodplain along the west side of the site was determined by Kiowa Engineering in a 2004 LOMR (04-08-0012) using a HEC-RAS analysis modeling developed flows along the channel from the 3-42" culverts under Eastonville Road south to the existing stock pond (Design Point 13) south of Stapleton Drive with proposed and existing improvements such as the proposed 42" dual culverts located at the Gilbert Road crossing and existing dual 4' x 8' box culverts at Stapleton Drive. Terra Nova engineering has done a new HEC-RAS study for the floodplain to establish base flood elevations (see appendix for HEC-RAS model). These channels will be contained in proposed Tracts dedicated to drainage that will allow the 4-Way Ranch Metro District to provide maintenance.

Areas above 0.9 (and V>5) need to be identified and if necessary, stabilized.

and diversion of OS-2 flows to a point higher in the channel

A HEC-RAS analysis was done of the east channel using the existing topo and the proposed contours sampled from these AutoCAD files along with the developed 100-year flow of 151 cfs. The output information shows that the channel velocities are in the range of 0.71 fps to 5. 57 fps. This is below the suggested velocities of 7 fps from the DCM Manual chapter 12 for 100-year event. The Froude numbers vary from 0.07 to 1.02. This is slightly larger than the suggested value of 0.80 for the 100-year event. The shear stress varies from 0.01 to 0.83 lbs/q ft, which is under the 1.0 lbs/sq ft listed in the DCM. As mentioned above this is an existing channel that is not being altered with the exception of the road crossing with the 2-42" culverts. These numbers are for an existing condition. The velocity at Cross-section 1200 just upstream of the culvert crossing is 0.71 fps, the Froude number is 0.07 and the shear stress is 0.01 lbs/sq ft. This shows that the crossing is not detrimental to the channel.

As part of the revised Preliminary Plan submittal for the site revisions an analysis of the eastern channel by ECO Systems found that this drainage channel is a jurisdictional water of the U.S. with associated jurisdictional wetland habitat. Therefore, to comply with Section 404 of the Clean Water Act, we must meet the 404(b)(1) project review criteria, which include impact avoidance and minimization. The option the client plan to take is to minimize Project-wide impacts to 0.5-acre or less such that the pre-approved Nationwide Permits (NWP) may be used. No channel grading or redesign is proposed for the channels; with the exception of the Sunken Meadow Crossing where 3-36" culverts are being placed. The rest of the channel is to remain natural.

A HEC-RAS analysis was done of the east channel using the existing topo and the proposed contours sampled from these AutoCAD files along with the developed 100-year flow of 213 cfs. The output information shows that the channel velocities are in the range of 0.52 fps to 5.97 fps. This is below the suggested velocities of 7 fps from the DCM Manual chapter 12 for 100-year event. The Froude numbers vary from 0.05 to 1.02. This is slightly larger than the suggested value of 0.80 for the 100-year event. The shear stress varies from 0.01 to 0.85 lbs/q ft, which is under the 1.0 lbs/sq ft listed in the DCM. As mentioned above this is an existing channel that is not being altered with the exception of the road crossing with the 3-36" culverts. These numbers for an existing condition. The velocity at Cross-section 1200 just upstream of the culvert crossing is 0.52 fps, the Froude number is 0.05 and the shear stress is 0.01 lbs/sq ft. This shows that the crossing is not detrimental to the channel.

REVISED to developed

developed flows

The 100-year high water elevations and limits for the east and west channels were checked against the adjacent proposed lots and the finished grade. All lot grades are set above the adjacent 100-year highwater elevation. The lots along the west channel are all set out side of the FEMA Floodplain and the calculated 100-year high water elevations and limits. The lots along the east channel are all placed outside the calculated 100-year high water elevations with the exception of Lot 45 where the corner of the lot is bisected by the 100-year high water limits but the building setback is set out side of this line.

This lot needs to be adjusted to be out of the calculated floodplain

REVISED LOT AND SENTENCE

HYDROLOGIC ANALYSIS FOR FILING 1 & 2 PDR

REVISED

PROPSOED BASIN DESCRIPTION (FOR PDR)

The development of the overall Waterbury site will occur in several platting phases. With the design of Waterbury Filings 1 & 2 the site will have an interim condition where the area to the north will be unplatted natural open space with drainage patterns differing from the future full build out analysis in the MDDP section until such time that it is developed. Below is a description of the Design Points and the overall proposed drainage characteristics for the development of only Waterbury Filing 1 & 2. Design Points 1-18 do not have any changes to them from the description above in the MDDP section therefore these basins will not be described below. The following is a description of the Design Points 19-30 altered by the interim state of undeveloped land upstream. In all cases the design flow is less than the ultimate build-out and therefore the inlets and pipes can capture and route the flow safely

Design Point 19 is a proposed 10' CDOT TYPE R sump inlet located in the south curb of Muddy Pond Street. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin OS-Q1's 0.33 acres consists of undeveloped land and will sheet flow onto Basin Q1. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from Basin Q1's 1.06 acres is directed to the 8' inlet. The combined flow (Q_5 = 2 cfs, Q_{100} = 5 cfs) is captured in the inlet and Pipe run 18 a 24" RCP diameter storm routes the flows to a manhole junction with Pipe run 19.

Design Point 20 is a proposed 5' CDOT TYPE R sump inlet located opposite of DP 19. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin OS-Q2's 0.22 acres consists of undeveloped land and will sheet flow onto Basin Q2. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from Basin Q2's 0.96 acres is directed to the 4' inlet. The combined flow (Q_5 = 2 cfs, Q_{100} = 5 cfs) is fully captured in the inlet and Pipe run 19 an 18" RCP

diameter storm routes the flows to a manhole junction with Pipe run 18. Pipe Run 20 a 24" RCP storm routes the combined flow (Q_5 = 4 cfs, Q_{100} = 9 cfs) of Pipe runs 19 & 20 east down Muddy Pond Street east down Muddy Pond Street to a manhole junction with Pipe run 21.

delete repeated text REMOVED DUPLICATE

Design Point 21 is a proposed 10' CDOT TYPE R at-grade inlet located in the north curb of Muddy Pond Street just east of Masonboro Way intersection. Runoff (Q_5 = 0 cfs, Q_{100} = 2 cfs) from Basin OS-R's 1.04 acres consists of undeveloped land and will sheet flow onto Basin R. Runoff (Q_5 = 2 cfs, Q_{100} = 4 cfs) from Basin R's 1.02 acres is directed to the 10' inlet. The combined flow (Q_5 = 2 cfs, Q_{100} = 6 cfs) is routed to the inlet and the flow is fully captured. Pipe run 21 an 18" RCP diameter storm routes the captured flow to a manhole junction with Pipe run 20. Pipe run 22 routes the combined flow (Q_5 = 6 cfs, Q_{100} = 15 cfs) of Pipe runs 20 & 21 east down Muddy Pond Street to a manhole junction with Pipe run 25. The bypass flow (Q_5 = 0 cfs, Q_{100} = 1 cfs) at DP 21 travels in the north flow line of Muddy Pond Street to Design Point 22.

Design Point 22 is a proposed 10' CDOT TYPE R sump inlet located in the west curb of Megansett Way. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin OS-S1's 0.31 acres consists of undeveloped land and will sheet flow onto Basin S1. Runoff (Q_5 = 3 cfs, Q_{100} = 7 cfs) from Basin S1's 1.55 acres is directed to the 10' inlet. The combined flow (Q_5 = 3 cfs, Q_{100} = 7 cfs) of Basins OS-S1 & S1 is routed via Pipe run 23 to a junction with Pipe run 24.

Design Point 23 is a proposed 10' CDOT TYPE R sump inlet located opposite of DP 22. Runoff (Q_5 = 0 cfs, Q_{100} = 0 cfs) from Basin OS-S2's 0.13 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin S2. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin S2's 0.13 acres is directed to the 10' inlet. The combined flow at DP 23 is Q_5 = 0 cfs, Q_{100} = 1 cfs. Pipe run 24 a 24" RCP diameter storm routes the flow (Q_5 = 0 cfs, Q_{100} = 1 cfs) from the inlet at DP 22 to a manhole junction with Pipe run 23. Pipe Run 25 a 30" RCP routes the combined flow (Q_5 = 3 cfs, Q_{100} = 7 cfs) of Pipe runs 23 & 24 south to a manhole junction with Pipe run 22 in Muddy Pond Street. Pipe run 26 a 36" RCP then routes the combined flow (Q_5 = 8 cfs, Q_{100} = 22 cfs) of Pipe runs 22 & 25 east in Muddy Pond to a manhole junction with Pipe runs 27 & 28.

Design Point 24 is a proposed 5' CDOT TYPE R sump inlet located in the south curb of Muddy Pond

Street. Runoff (Q_5 = 3 cfs, Q_{100} = 6 cfs) from Basin T1's 1.42 acres consists of single-family development and will be directed via lot line swales and c&g to the 5' inlet. Pipe run 27 an 18" RCP diameter storm routes the flow from the inlet to a manhole junction with Pipe runs 26 & 28.

Design Point 25 is a proposed 5' CDOT TYPE R sump inlet located opposite of DP 24. Runoff (Q_5 = 0 cfs, Q_{100} = 1 cfs) from Basin OS-T2's 0.30 acres consists of future single-family development and will be directed via lot line swales and c&g onto Basin T2. Runoff (Q_5 = 2 cfs, Q_{100} = 5 cfs) from Basin T2's 1.23 acres is directed to the 4' inlet. The combined flow at DP 25 is Q_5 = 2 cfs, Q_{100} = 5 cfs. Pipe run 28 an 18" RCP diameter storm routes the flow from the inlet to a manhole junction with Pipe runs 27 & 28. Pipe run 29 a 36" RCP then routes the combined flow (Q_5 = 13 cfs, Q_{100} = 32 cfs) of Pipe runs 26, 27 & 28 east in Muddy Pond Street and then south down Fish Camp Circle to a manhole junction with Pipe run 30.

Design Point 26 is a proposed 10' CDOT TYPE R sump inlet located in the west curb of Fish Camp Circle near the Knuckle. Runoff (Q_5 = 7 cfs, Q_{100} = 16 cfs) from Basin U1's 4.38 acres consists of single-family development and will be directed via lot line swales and c&g to the 10' inlet. Pipe run 30 a 24" RCP diameter storm routes the flow from the inlet to a manhole junction with Pipe run 29. Pipe run 31 a 42" RCP transports the combined flow (Q_5 = 19 cfs, Q_{100} = 47 cfs) of Pipe runs 29 & 30.

Design Point 27 is a proposed 5' CDOT TYPE R sump inlet located opposite of DP 26. Runoff (Q_5 = 3 cfs, Q_{100} = 7 cfs) from Basin U2's 1.89 acres consists of future single-family development and will be directed via lot line swales to the 6' inlet. Pipe run 32 an 18" RCP diameter storm routes the flow from the inlet to a manhole junction with Pipe runs 31. Pipe run 33 a 42" RCP then routes the combined flow (Q_5 = 23 cfs, Q_{100} = 55 cfs) of Pipe runs 31 & 32 east through a Drainage Tract to FSD Pond 3.

Design Point E-E is a proposed 4' wide swale, 2' deep with 4:1 side slopes. Offsite Basin OS-8's 2.56 acres flow (Q_5 = 5 cfs, Q_{100} = 11 cfs) under Eastonville Road via a 36" CMP culvert onto Basin OS-2. Offsite Basin OS-2's 12.02 undeveloped acres flow (Q_5 = 3 cfs, Q_{100} = 23 cfs) south into the existing stock pond. The combined flow (Q_5 = 8 cfs, Q_{100} = 33 cfs) of the 2 basins will be routed

overland in a proposed Diversion Swale E-E north of the Filing 2 Boundary to the existing channel that runs along the eastern boundary, while keeping it from entering the proposed development. The swale is a 4' wide bottom 2' deep swale with 4:1 side slopes. The 100-Y highwater depth in the swale is 0.99' (See Appendix for calcs).

ADDED TO SPREADSHEET W/ M2, P, & V

Still need to show calcs for this basin on pdf pg 196.

Design Point 30 is a triple 36" RCP culvert crossing under Sunken Meadow Road. Offsite Basin OS-9 discharges onto Offsite Basin OS-1. Runoff (Q_5 = 8 cfs, Q_{100} = 19 cfs) from Basin OS-9's 11.80 acres consists of historic flow based upon upstream detention. Offsite Basin OS-1's 41.09 acres consists of undeveloped land and open space containing the natural channel. Runoff (Q_5 = 11 cfs, Q_{100} = 73 cfs) from Basin OS-1 is directed south through the wetlands to the culverts. Basin Y's 0.35 acres is comprised of undeveloped open space Tracts adjacent to the existing natural channel along the east side of the site. Runoff (Q_5 = 1 cfs, Q_{100} = 2 cfs) from Basin Y sheet flows from the back yard onto the undeveloped. This area is not treated for water quality but is accounted for using Runoff Reduction as mentioned in the MDDP discussion mentioned above. Also entering the channel is the Diversion Swale E-E. The combined flow (Q_5 = 36 cfs, Q_{100} = 120 cfs) at DP 30 of Basins OS-1, Os-2, OS-8, OS-9, & Y will be safely routed through the triple 36" RCP culverts (See appendix).

Include discussion for maintenance & easements for all swales.

Basin description shows that in the interim condition all runoff can be safely routed through the proposed storms drain system.

In an effort to protect receiving water and as part of the "four step process to minimize adverse impacts of urbanization" this site was analyzed in the following manner:

1. Reduce Runoff- The proposed impervious areas on the site are surrounded by landscaping and green space areas. Additionally, the new improvements and impervious areas on the site will be routed to a proposed private Extended Detention Basin. These items will reduce the volume of runoff using ponding and infiltration.
2. Stabilize Drainageways- There are 2 existing drainageways onsite. The westerly channel has been studied in HEC-RAS model and based upon calculations velocities are within the range for stabilized flow. The easterly channel has wetlands that allow the channel to stay stabilized.
3. Provide Water Quality Capture Volume (WQCV)- The 6 Extended Detention Basin have been sized and designed to sufficiently capture the required WQCV and slowly release it though

the three-hole outlet, thereby allowing solids and contaminants to settle out.

4. Consider Need for Industrial and Commercial BMPs- The proposed development is single family site; therefore, no Industrial and Commercial BMPs have been proposed.

diversion added

DRAINAGE FEES

This site lies within the Haegler Ranch Drainage Basin and Geick Ranch Basin. There is no approved Drainage Basin Planning study on file done with fees for Geick Ranch Basin. At the time of the Final Drainage Report Basin fee calculations will be done for the portion in the Haegler Ranch Basin.

See comment on page 7

revised to say no fees

SUMMARY

Site runoff and storm drain and appurtenances associated with the development of the Waterbury Filing No. 1 & 2 site will not adversely affect the surrounding and downstream developments. Runoff will be routed to the existing and proposed detention basins and reduce the runoff to be at or below historic rates mentioned above in the report via Full Spectrum Detention while slowly treating the water quality capture volume and in turn helping to stabilize the downstream channel banks. Terra Nova Engineering requests that this report satisfy the submittal requirements for the drainage analysis for Waterbury. This report and findings are in general conformance with all previously approved reports for this site.

PREPARED BY:
TERRA NOVA ENGINEERING, INC.

Quentin N. Armijo, P.E.
Vice President
Jobs/1717.00/drainage/1715.00 MMDP-FDR 1-2

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NRCS Soils Map for El Paso County

"Revision to the MDDP for Meridian Ranch, EL Paso County, Colorado", approved October 2005, and prepared by PBS&J

"Final Drainage Report for 4-Way Ranch Phase 1" approved March 2006 prepared by JR Engineering

The "Geick Ranch Drainage Basin Planning Study" approved February 2008, preprepared by Drexel Barrel & Co

"Preliminary/Final Drainage Report for Meridian Ranch filing No. 3" approved November 2011 prepared by Tech Contractors

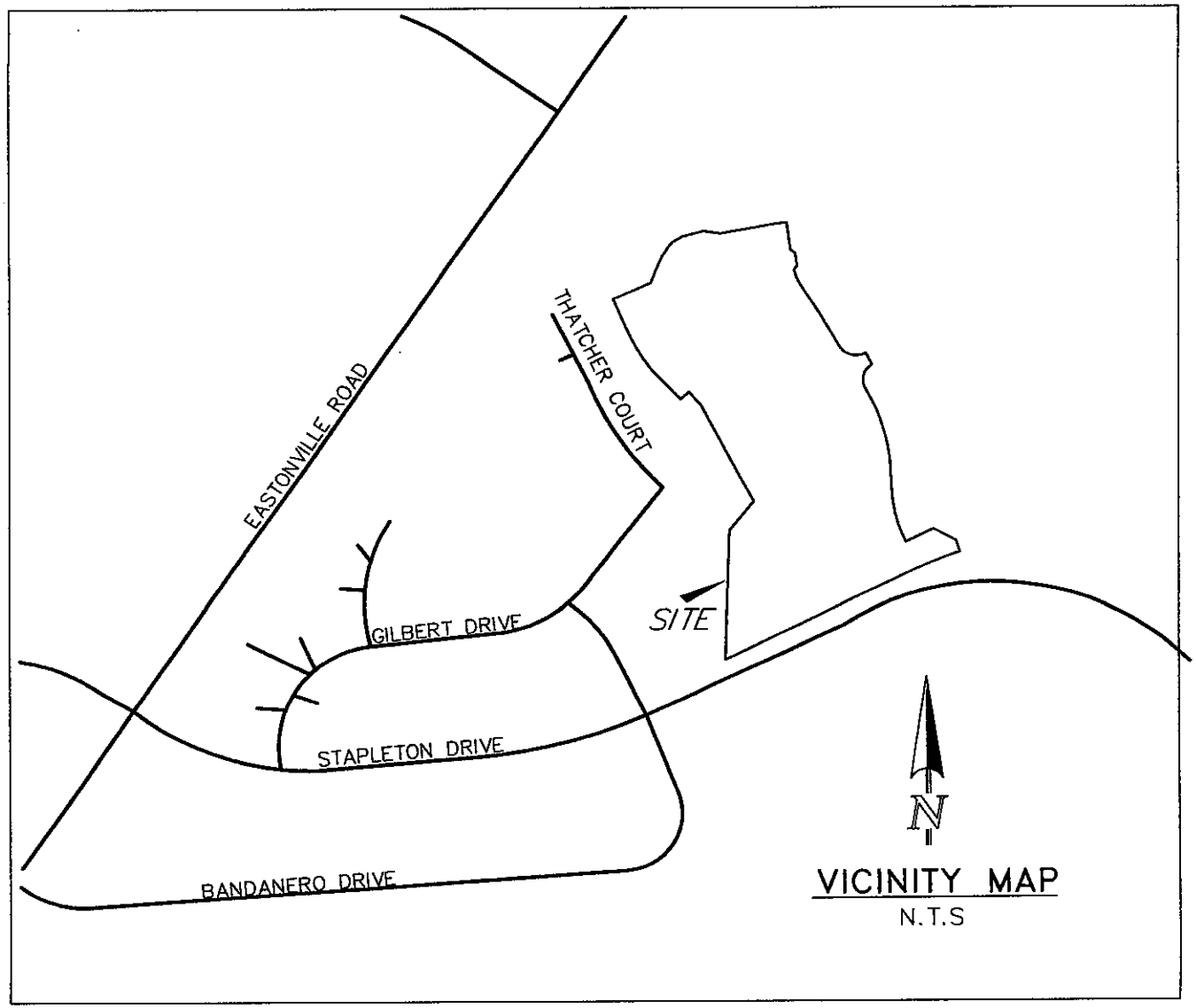
"Master Development Drainage Plan, 4-Way Ranch – Phase 1" approved January 2012 prepared by Advanced Design Professionals, Inc.

"Preliminary Drainage Report for Waterbury (Phase 1 Preliminary Plan) approved June 2013 prepared by Classic Consulting

"Final Drainage Report for Waterbury Filing No. 1" approved September 2016 prepared by Classic Consulting

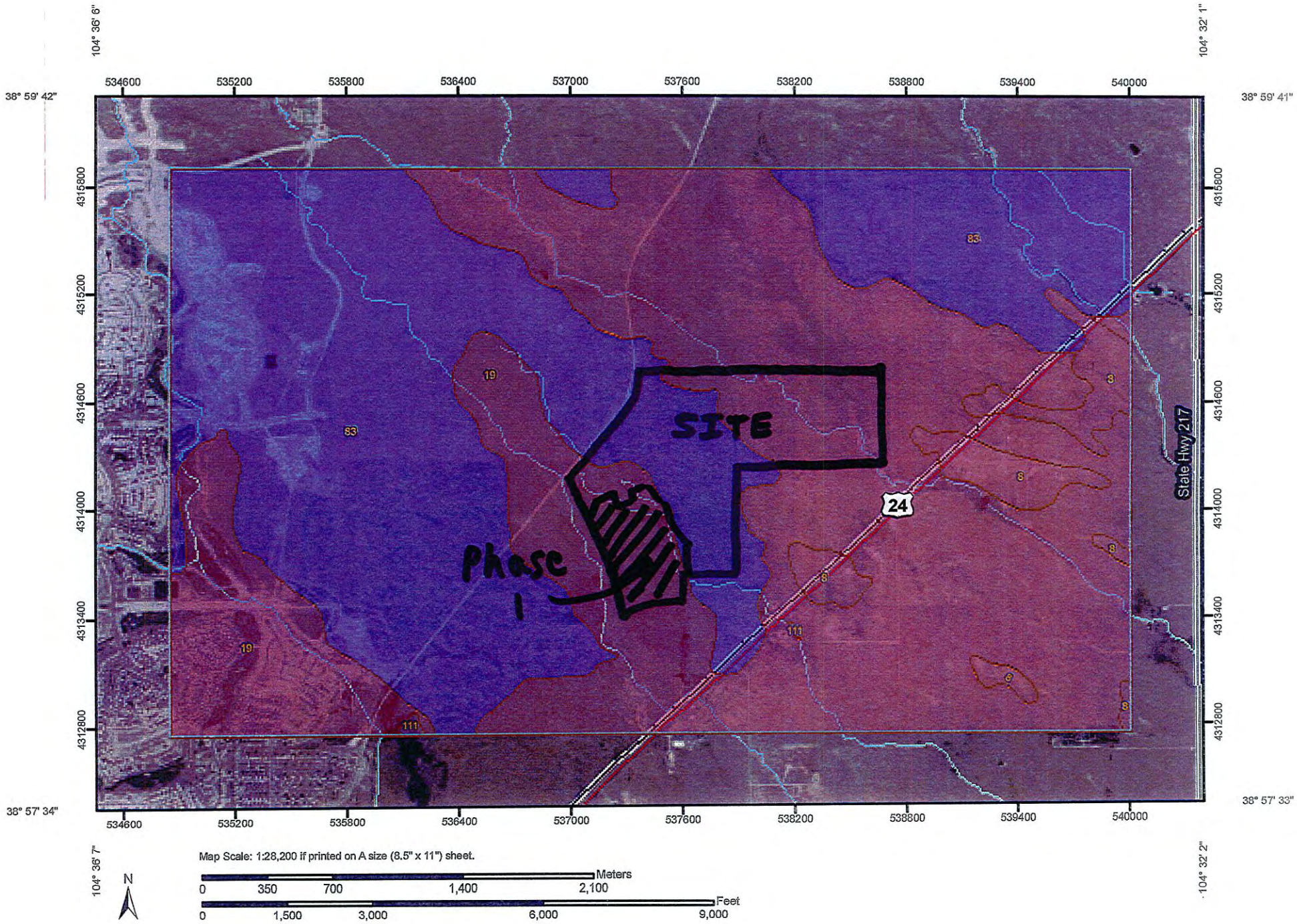
APPENDIX

VICINTY MAP



VICINITY MAP
N.T.S

NRCS SOILS MAP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104° 32' 1"
38° 59' 42"
38° 59' 41"
38° 57' 34"
38° 57' 33"
534600
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4312800
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24
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111
8
104° 36' 7"
104° 32' 2"
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Map Scale: 1:28,200 if printed on A size (8.5" x 11") sheet.
Meters
0
350
700
1,400
2,100
Feet
0
1,500
3,000
6,000
9,000

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Political Features

Cities

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:28,200 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 8, Apr 6, 2011

Date(s) aerial images were photographed: 7/29/2005; 8/17/2005; 7/2/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — El Paso County Area, Colorado (CO625)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
8	Blakeland loamy sand, 1 to 9 percent slopes	A	155.7	3.9%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	2,095.1	52.1%
83	Stapleton sandy loam, 3 to 8 percent slopes	B	1,768.2	44.0%
111	Water		3.8	0.1%
Totals for Area of Interest			**4,022.9**	**100.0%**

Description

Hydrologic soil groups 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 claypan 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.

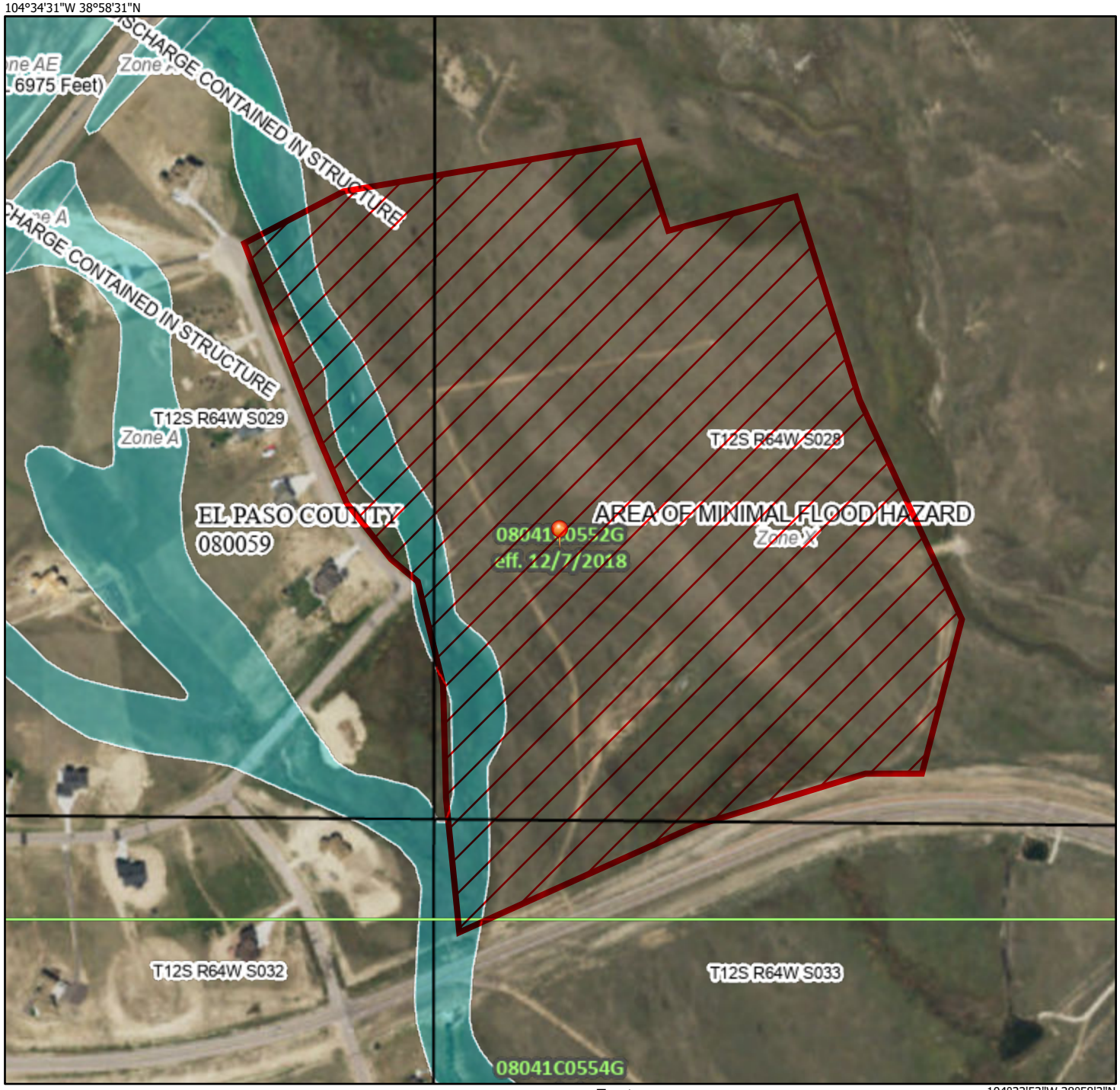
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

FEMA FIRM MAP

National Flood Hazard Layer FIRMette

FEMA

104°34'31"W 38°58'31"N



104°33'53"W 38°58'3"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/27/2021 at 4:44 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Federal Emergency Management Agency

Washington, D.C. 20472

FEB 19 2004

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Chuck Brown
Chairman, El Paso County
Board of Commissioners
27 East Vermijo Avenue
Colorado Springs, CO 80903-2208

IN REPLY REFER TO:
Case No.: 04-08-0012P
Community Name: El Paso County, CO
Community No.: 080059
Effective Date of This Revision: **MAR 19 2004**

Dear Mr. Brown:

The Flood Insurance Rate Map for your community has been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel(s) revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Federal Insurance and Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Denver, Colorado, at (303) 235-4830, or the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

Kevin C. Long

Kevin C. Long, CFM, Project Engineer
Hazard Identification Section
Mitigation Division
Emergency Preparedness
and Response Directorate

For: Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness
and Response Directorate

List of Enclosures:
- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map

cc: Mr. Kevin Stilson, P.E., CFM
Floodplain Administrator
Pikes Peak Regional Building Department

Mr. Richard N. Wray, P.E.
Principal
Kiowa Engineering Corporation

 | Issue Date: FEB 19 2004 | Effective Date: MAR 19 2004 | Case No.: 04-08-0012P | LOMR-APP

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas)	NO PROJECT	HYDROLOGIC ANALYSIS HYDRAULIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 080059		
IDENTIFIER	Fourway Ranch Letter of Map Revision	APPROXIMATE LATITUDE & LONGITUDE: 39.974, -104.566 SOURCE: USGS QUADRANGLE DATUM: NAD 83	
FLOODING SOURCE(S) & REVISED REACH(ES)	**Haegler Ranch Tributary 1** – from approximately 1,200 feet upstream of the Cadillac and Lake City Railroad to just upstream of Eastonville Road **Haegler Ranch Tributary 1A** – from the confluence with Haegler Ranch Tributary 1 to just upstream of Eastonville Road **Haegler Ranch Tributary 2** – from the confluence with Haegler Ranch Tributary 1 to just upstream of Eastonville Road **Geick Ranch Tributary 1** – from approximately 600 feet upstream to approximately 4,000 feet upstream of the Cadillac and Lake City Railroad **Geick Ranch Tributary 2** – from approximately 600 feet upstream to approximately 2,600 feet upstream of the Cadillac and Lake City Railroad		

SUMMARY OF REVISIONS

Effective Flooding: Zone A
Revised Flooding: Zone A
Increases: YES
Decreases: YES

* BFEs – Base Flood Elevations

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 08041C0575 F Date: March 17, 1997	NO REVISION TO THE FLOOD INSURANCE STUDY REPORT

* FIRM – Flood Insurance Rate Map; ** FBFM – Flood Boundary and Floodway Map; *** FHBM – Flood Hazard Boundary Map

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

102061 D.A04080012 102IC

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance discharges computed in the submitted hydrologic model. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

102061 D.A04080012 102IC

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Mr. Steve L. Olsen
Director, Federal Insurance and Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267
(303) 235-4830

STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panel and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

102061 D.A04080012 102IC

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

This revision will become effective 30 days from the date of this letter. Any requests to review or alter this determination should be made within 30 days and must be based on scientific or technical data.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate 102061 D.A04080012 102IC

HYDROLOGIC CALCULATIONS

EXISTING CONDITIONS

JOB NAME: *WATERBURY MDDP*
JOB NUMBER: *1715.00*
DATE: *03/07/22*
CALCULATED BY: *QNA*

MDDP DRAINAGE REPORT ~ EXISTING BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS / DEVELOPED AREA			NONIMPERVIOUS / UNDEVELOPED AREA			WEIGHTED		**WEIGHTED CA**	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	**CA(5)**	**CA(100)**
EXA	9.62	0.00	0.45	0.59	9.62	0.09	0.36	0.09	0.36	**0.87**	**3.46**
EXB	4.09	0.00	0.45	0.59	4.09	0.09	0.36	0.09	0.36	**0.37**	**1.47**
EXC	24.80	0.00	0.45	0.59	24.80	0.09	0.36	0.09	0.36	**2.23**	**8.93**
EXD	15.87	0.00	0.45	0.59	15.87	0.09	0.36	0.09	0.36	**1.43**	**5.71**
EXE	5.83	0.00	0.45	0.59	5.83	0.09	0.36	0.09	0.36	**0.52**	**2.10**
EXF	1.62	0.00	0.45	0.59	1.62	0.09	0.36	0.09	0.36	**0.15**	**0.58**
OS-1	45.02	0.00	0.45	0.59	45.02	0.09	0.36	0.09	0.36	**4.05**	**16.21**
OS-2	11.40	0.00	0.45	0.59	11.40	0.09	0.36	0.09	0.36	**1.03**	**4.11**
OS-3	1.11	0.00	0.45	0.59	1.11	0.09	0.36	0.09	0.36	**0.10**	**0.40**
OS-4	0.29	0.00	0.45	0.59	0.29	0.09	0.36	0.09	0.36	**0.03**	**0.11**
OS-5	6.74	0.00	0.45	0.59	6.74	0.09	0.36	0.09	0.36	**0.61**	**2.43**
OS-8	2.56	FLOW TAKEN FROM MERIDAIN RANCH MDDP									
OS-9	11.80	FLOW TAKEN FROM MERIDAIN RANCH MDDP									
OS-10A	12.80	FLOW TAKEN FROM MERIDAIN RANCH MDDP									

JOB NAME: *WATERBURY MDDP*
JOB NUMBER: *1715.00*
DATE: *03/07/22*
CALC'D BY: *QNA*

MDDP ~ EXISTING BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	STREET / CHANNEL FLOW Slope (%)	STREET / CHANNEL FLOW Velocity (fps)	STREET / CHANNEL FLOW Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	TOTAL FLOWS Q(100) (cfs)
EXA	0.87	3.46	0.25	100	3	11.1	1193	1.7%	4.5	4.4	15.4	3.43	5.81	3	20
EXB	0.37	1.47	0.25	100	2	12.6	623	2.2%	5.2	2.0	14.6	3.51	5.96	1	9
EXC	2.23	8.93	0.25	100	2.5	11.7	2420	1.7%	4.6	8.9	20.6	3.01	5.01	7	45
EXD	1.43	5.71	0.25	100	2	12.6	1615	2.6%	5.6	4.8	17.4	3.25	5.47	5	31
EXE	0.52	2.10	0.25	100	8	8.0	1063	2.1%	5.0	3.5	11.5	3.86	6.66	2	14
EXF	0.15	0.58	0.25	100	6	8.8	400	2.5%	5.5	1.2	10.0	4.06	7.07	1	4
OS-1	4.05	16.21	0.25	100	6	8.8	3219	2.3%	5.3	10.1	18.9	3.13	5.24	13	85
OS-2	1.03	4.11	0.25	100	2	12.6	1203	1.0%	3.5	5.7	18.4	3.17	5.32	3	22
OS-3	0.10	0.40	0.25	100	2	12.6	330	2.6%	5.6	1.0	13.6	3.61	6.17	0	2
OS-4	0.03	0.11	0.25	100	2	12.6	230	2.6%	5.7	0.7	13.3	3.64	6.23	0	1
OS-5	0.61	2.43	0.25	80	5	7.8	1000	2.5%	5.5	3.0	10.8	3.96	6.85	2	17
OS-8	FLOW TAKEN FROM MERIDAIN RANCH MDDP													5	11
OS-9	FLOW TAKEN FROM MERIDAIN RANCH MDDP													8	19

JOB NAME: *WATERBURY MDDP*
JOB NUMBER: *1715.00*
DATE: *03/07/22*
CALCULATED BY: *QNA*

MDDP ~ EXISTING SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Facility Size
						I(5)	I(100)	Q(5)	Q(100)	
EX1	EXA, OS-5, & DP-EX10A	18.92	1.47	5.89	15.4	3.43	5.81	33	219	3-42" CULVERTS
EX2	EXB	4.09	0.37	1.47	14.6	3.51	5.96	1	9	STAPLETON ROAD
EX3	EXC & OS-4	25.10	2.26	9.03	20.6	3.01	5.01	7	45	EAST BOUNDARY
EX4	EXD & OS-3	16.98	1.53	6.11	17.4	3.25	5.47	5	33	EAST BOUNDARY
EX5	EXE, OS-2 & OS-8	17.23	1.55	6.20	18.4	3.17	5.32	10	44	EAST BOUNDARY
EX6	EXF	1.62	0.15	0.58	13.8	3.59	6.12	1	4	EAST BOUNDARY
EX7	EXE, EXF, OS-1, OS-2, OS-8 & OS-9	78.24	5.75	23.00	18.9	3.13	5.24	31	151	DP 30 PROP CONDITION
EX9	OS-9	11.80						8	19	DP 30 PROP CONDITION
EX10	OS-8	2.56						5	11	DP 30 PROP CONDITION
EX10A	MERIDIAN POND E RELEASE	Meridaian Ranch Filing 3 FDR Calculated Flows						28	185	EX 3-42" RCP Culverts

EARLY GRADING CONDITIONS

JOB NAME: *WATERBURY MDDP*
JOB NUMBER: *1715.00*
DATE: *03/03/22*
CALCULATED BY: *QNA*

MDDP DRAINAGE REPORT ~ EARLY GRADING BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS / DEVELOPED AREA			NONIMPERVIOUS / UNDEVELOPED AREA			WEIGHTED		**WEIGHTED CA**	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	**CA(5)**	**CA(100)**
PRE-A	4.61	0.00	0.45	0.59	4.61	0.09	0.36	0.09	0.36	**0.41**	**1.66**
PRE-B	12.35	0.00	0.45	0.59	12.35	0.09	0.36	0.09	0.36	**1.11**	**4.45**
PRE-C	19.08	0.00	0.45	0.59	19.08	0.09	0.36	0.09	0.36	**1.72**	**6.87**
PRE-D	15.52	0.00	0.45	0.59	15.52	0.09	0.36	0.09	0.36	**1.40**	**5.59**
PRE-E	6.33	0.00	0.45	0.59	6.33	0.09	0.36	0.09	0.36	**0.57**	**2.28**
PRE-F	0.62	0.00	0.45	0.59	0.62	0.09	0.36	0.09	0.36	**0.06**	**0.22**
PRE-G	2.00	0.00	0.45	0.59	2.00	0.09	0.36	0.09	0.36	**0.18**	**0.72**
PRE-H	1.33	0.00	0.45	0.59	1.33	0.09	0.36	0.09	0.36	**0.12**	**0.48**
OS-1	0.75	0.00	0.45	0.59	0.75	0.09	0.36	0.09	0.36	**0.07**	**0.27**
OS-2	11.15	0.00	0.45	0.59	11.15	0.09	0.36	0.09	0.36	**1.00**	**4.01**
OS-3	1.11	0.00	0.45	0.59	1.11	0.09	0.36	0.09	0.36	**0.10**	**0.40**
OS-4	0.56	0.00	0.45	0.59	0.56	0.09	0.36	0.09	0.36	**0.05**	**0.20**
OS-8	2.56	FLOW TAKEN FROM MERIDAIN RANCH MDDP									

JOB NAME:	*WATERBURY MDDP*
JOB NUMBER:	*1715.00*
DATE:	*03/03/22*
CALC'D BY:	*QNA*

MDDP ~ EARLY GRADING BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	STREET / CHANNEL FLOW Slope (%)	STREET / CHANNEL FLOW Velocity (fps)	STREET / CHANNEL FLOW Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	TOTAL FLOWS Q(100) (cfs)
PRE-A	0.41	1.66	0.25	100	2.5	11.7	909	1.4%	4.2	3.6	15.4	3.43	5.82	1	10
PRE-B	1.11	4.45	0.25	100	2.5	11.7	1612	1.3%	4.0	6.7	18.5	3.16	5.31	4	24
PRE-C	1.72	6.87	0.25	100	2.5	11.7	1308	1.3%	4.0	5.5	17.2	3.27	5.50	6	38
PRE-D	1.40	5.59	0.25	100	2	12.6	1297	1.6%	4.5	4.9	17.5	3.24	5.46	5	30
PRE-E	0.57	2.28	0.25	100	8	8.0	752	2.1%	5.1	2.5	10.5	4.00	6.94	2	16
PRE-F	0.06	0.22	0.25	64	2	8.7					8.7	4.26	7.47	0	2
PRE-G	0.18	0.72	0.25	161	5	13.9					13.9	3.58	6.12	1	4
PRE-H	0.12	0.48	0.25	67	2	9.1					9.1	4.21	7.36	1	4
OS-1	0.07	0.27	0.25	85	2	11.0	75	1.3%	4.0	0.3	11.4	3.88	6.70	0	2
OS-2	1.00	4.01	0.25	76	2	10.1	1427	2.1%	5.1	4.7	14.8	3.49	5.94	4	24
OS-3	0.10	0.40	0.25	100	9	7.7	329	2.5%	5.5	1.0	8.7	4.27	7.49	0	3
OS-4	0.05	0.20	0.25	100	2	12.6	127	2.4%	5.4	0.4	13.0	3.68	6.30	0	1
OS-8	FLOW TAKEN FROM MERIDAIN RANCH MDDP													5	11

Missing Basin OS-9 as shown on basin map. Please include

took of Basin OS-9 off from map as it does not come onto the graded property or is routed through early grading TSBs. also not discussed in text

JOB NAME:	*WATERBURY MDDP*
JOB NUMBER:	*1715.00*
DATE:	*03/03/22*
CALCULATED BY:	*QNA*

MDDP ~ EARLY GRADING SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Facility Size
						I(5)	I(100)	Q(5)	Q(100)	
PRE1	PRE-B & OS-4	4.65	1.16	4.65	18.5	3.16	5.31	4	25	TSB 1
PRE2	PRE-C	19.08	1.72	6.87	17.2	3.27	5.50	6	38	TSB 2
PRE3	PRE-D & OS-3	16.63	1.50	5.99	17.5	3.24	5.46	5	33	TSB 3
PRE4	PRE-E & OS-1	7.07	0.64	2.55	10.5	4.00	6.94	3	18	TSB 4
PRE5	OS-8 & OS-2	13.71	1.00	4.01	14.8	3.49	5.94	9	35	EASTERN CHANNEL
PRE6	PRE-F	0.62	0.06	0.22	8.7	4.26	7.47	0	2	STAPLETON ROAD
PRE7	PRE-G, PRE-H & DPS PRE2-PRE5	59.82	5.15	20.61	17.5	3.24	5.46	25	147	EX GEICK RANCH CHANNEL

Design Points EX10 , 9 and 13 are shown on drainage map but are missing from table. Please include.

took of Design Points EX9 & EX13 off from map as it does not come onto the graded property or is routed through early grading TSBs. also not discussed in text

MDDP CALCULATIONS

JOB NAME: *WATERBURY MDDP*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALCULATED BY: *QNA*

MDDP DRAINAGE REPORT ~ PROPOSED BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS / DEVELOPED AREA			NONIMPERVIOUS / UNDEVELOPED AREA			WEIGHTED		**WEIGHTED CA**	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	**CA(5)**	**CA(100)**
A	3.39	3.39	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.52**	**2.00**
B1	2.30	2.30	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.03**	**1.36**
B2	2.69	2.69	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.21**	**1.59**
C	0.86	0.86	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.39**	**0.51**
D	2.11	2.11	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.95**	**1.24**
E	2.18	2.18	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.98**	**1.29**
F	2.18	2.18	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.98**	**1.29**
G1	0.53	0.53	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.24**	**0.31**
G2	0.69	0.69	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.31**	**0.41**
H	1.13	1.13	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.51**	**0.67**
I	5.99	2.46	0.45	0.59	3.53	0.09	0.36	0.24	0.45	**1.43**	**2.72**
J	1.99	1.99	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.90**	**1.17**
K	3.06	1.14	0.45	0.59	1.92	0.09	0.36	0.22	0.45	**0.69**	**1.37**
L1	3.27	3.27	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.47**	**1.93**
L2	2.00	2.00	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.90**	**1.18**
M1	1.41	1.41	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.63**	**0.83**
M2	0.45	0.45	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.20**	**0.26**
N	0.22	0.22	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.10**	**0.13**
O1	2.82	2.82	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.27**	**1.66**
O2	0.71	0.71	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.32**	**0.42**
O3	0.45	0.45	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.20**	**0.27**
O4	0.38	0.38	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.17**	**0.23**
P	0.70	0.00	0.45	0.59	0.70	0.09	0.36	0.09	0.36	**0.06**	**0.25**
Q1	1.06	1.06	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.48**	**0.62**
Q2	0.96	0.96	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.43**	**0.56**
R	1.02	1.02	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.46**	**0.60**
S1	1.55	1.55	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.70**	**0.91**
S2	0.13	0.13	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.06**	**0.08**
T1	1.42	1.42	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.64**	**0.84**

JOB NAME: *WATERBURY MDDP*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALCULATED BY: *QNA*

MDDP DRAINAGE REPORT ~ PROPOSED BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS / DEVELOPED AREA			NONIMPERVIOUS / UNDEVELOPED AREA			WEIGHTED		**WEIGHTED CA**	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	**CA(5)**	**CA(100)**
T2	1.23	1.23	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.55**	**0.73**
U1	4.38	4.38	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.97**	**2.58**
U2	1.89	1.89	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.85**	**1.11**
V	0.54	0.54	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.24**	**0.32**
W	5.20	5.20	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**2.34**	**3.07**
X	0.43	0.43	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.19**	**0.25**
Y	0.35	0.35	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.16**	**0.21**
OS-1	11.81	11.81	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**5.31**	**6.97**
OS-2	11.53	11.53	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**5.19**	**6.80**
0S-3A	0.79	0.79	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.35**	**0.47**
0S-3B	5.66	5.66	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**2.55**	**3.34**
OS-4	10.90	0.00	0.45	0.59	10.90	0.09	0.36	0.09	0.36	**0.98**	**3.92**
OS-5	5.64	0.00	0.45	0.59	5.64	0.09	0.36	0.09	0.36	**0.51**	**2.03**
OS-6	1.06	1.06	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.48**	**0.63**
OS-7	2.82	0.00	0.45	0.59	2.82	0.09	0.36	0.09	0.36	**0.25**	**1.01**
OS-8	2.56	FLOW TAKEN FROM MERIDAIN RANCH MDDP									
OS-9	11.80	FLOW TAKEN FROM MERIDAIN RANCH MDDP									
OS-10	3.41	0.00	0.45	0.59	3.41	0.09	0.36	0.09	0.36	**0.31**	**1.23**
OS-Q1	4.31	4.31	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.94**	**2.54**
OS-Q2	0.94	0.94	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.42**	**0.55**
OS-R	6.05	6.05	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**2.72**	**3.57**
OS-S1	5.59	5.59	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**2.51**	**3.30**
OS-S2	0.17	0.17	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.08**	**0.10**
OS-T2	0.76	0.76	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.34**	**0.45**

JOB NAME: *WATERBURY MDDP*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALC'D BY: *QNA*

MDDP ~ PROPOSED BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	STREET / CHANNEL FLOW Slope (%)	STREET / CHANNEL FLOW Velocity (fps)	STREET / CHANNEL FLOW Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	TOTAL FLOWS Q(100) (cfs)
A	1.52	2.00	0.25	100	2	12.6	420	1.5%	4.3	1.6	14.3	3.54	6.03	5	12
B1	1.03	1.36	0.25	100	2	12.6	400	1.5%	4.3	1.6	14.2	3.55	6.05	4	8
B2	1.21	1.59	0.25	100	2	12.6	550	1.5%	4.3	2.1	14.8	3.49	5.93	4	9
C	0.39	0.51	0.25	20	0.5	5.3	500	2.0%	4.9	1.7	6.9	4.58	8.14	2	4
D	0.95	1.24	0.25	80	2	10.5	300	2.5%	5.5	0.9	11.4	3.87	6.69	4	8
E	0.98	1.29	0.25	100	2	12.6	400	2.5%	5.5	1.2	13.8	3.59	6.12	4	8
F	0.98	1.29	0.25	50	2	7.1	620	1.5%	4.3	2.4	9.5	4.14	7.22	4	9
G1	0.24	0.31	0.25								5.0	5.00	9.06	1	3
G2	0.31	0.41	0.25								5.0	5.00	9.06	2	4
H	0.51	0.67	0.25	50	2	7.1	525	1.5%	4.3	2.0	9.2	4.19	7.33	2	5
I	1.43	2.72	0.25	80	4	8.4	250	2.0%	4.9	0.8	9.2	4.18	7.32	6	14
J	0.90	1.17	0.25	90	6	8.1	850	2.0%	4.9	2.9	10.9	3.94	6.81	4	8
K	0.69	1.37	0.25	100	18	6.1	80	1.0%	3.5	0.4	6.5	4.67	8.33	3	11
L1	1.47	1.93	0.25	100	2	12.6	860	1.4%	4.1	3.5	16.1	3.36	5.69	5	11
L2	0.90	1.18	0.25	55	1.1	9.4	860	1.4%	4.1	3.5	12.8	3.70	6.34	3	7
M1	0.63	0.83	0.25	70	1.5	10.3	200	2.0%	4.9	0.7	11.0	3.92	6.79	2	6
M2	0.20	0.26	0.25	65	3	7.7	0	0.0%	0.0	0.0	7.7	4.43	7.83	1	2
N	0.10	0.13	0.25								5.0	5.00	9.06	1	1
O1	1.27	1.66	0.25	100	2.5	11.7	460	1.5%	4.3	1.8	13.5	3.62	6.19	5	10
O2	0.32	0.42	0.25	100	2	12.6	850	2.0%	4.9	2.9	15.5	3.42	5.80	1	2
O3	0.20	0.27	0.25								5.0	5.00	9.06	1	2
O4	0.17	0.23	0.25								5.0	5.00	9.06	1	2

JOB NAME: *WATERBURY MDDP*
JOB NUMBER: *1715.00*
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MDDP ~ PROPOSED BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	STREET / CHANNEL FLOW Slope (%)	STREET / CHANNEL FLOW Velocity (fps)	STREET / CHANNEL FLOW Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	TOTAL FLOWS Q(100) (cfs)
P	0.06	0.25	0.25								5.0	5.00	9.06	0	2
Q1	0.48	0.62	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	2	4
Q2	0.43	0.56	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	2	4
R	0.46	0.60	0.25	100	4	10.1	700	2.0%	4.9	2.4	12.4	3.75	6.44	2	4
S1	0.70	0.91	0.25	100	6	8.8	175	2.0%	4.9	0.6	9.4	4.16	7.26	3	7
S2	0.06	0.08	0.25								5.0	5.00	9.06	0	1
T1	0.64	0.84	0.25	55	1.1	9.4	390	2.0%	4.9	1.3	10.7	3.97	6.88	3	6
T2	0.55	0.73	0.25	100	2	12.6	245	2.0%	5.0	0.8	13.5	3.63	6.20	2	5
U1	1.97	2.58	0.25	100	2	12.6	520	2.3%	5.3	1.6	14.3	3.54	6.03	7	16
U2	0.85	1.11	0.25	100	2	12.6	385	2.3%	5.4	1.2	13.8	3.59	6.12	3	7
V	0.24	0.32	0.25								5.0	5.00	9.06	1	3
W	2.34	3.07	0.25	100	2	12.6	630	1.6%	4.4	2.4	15.0	3.47	5.89	8	18
X	0.19	0.25	0.25								5.0	5.00	9.06	1	2
Y	0.16	0.21	0.25								5.0	5.00	9.06	1	2
OS-1	5.31	6.97	0.25	100	2	12.6	690	2.0%	5.0	2.3	15.0	3.47	5.90	18	41
OS-2	5.19	6.80	0.25	100	2	12.6	1700	1.8%	4.6	6.1	18.7	3.14	5.27	16	36
0S-3A	0.35	0.47	0.25	55	1.1	9.4	480	1.3%	3.9	2.0	11.4	3.87	6.68	1	3
0S-3B	2.55	3.34	0.25	100	2	12.6	480	1.3%	3.9	2.0	14.7	3.50	5.95	9	20
OS-4	0.98	3.92	0.25	800	26	30.5					30.5	2.46	4.01	2	16
OS-5	0.51	2.03	0.25	80	5	7.8	1000	2.5%	5.5	3.0	10.8	3.96	6.85	2	14
OS-6	0.48	0.63	0.25	30	0.6	6.9	900	1.8%	4.7	3.2	10.1	4.05	7.04	2	4
OS-7	0.25	1.01									5.0	5.00	9.06	1	9
OS-8	FLOW TAKEN FROM MERIDAIN RANCH MDDP													5	11
OS-9	FLOW TAKEN FROM MERIDAIN RANCH MDDP													8	19
OS-10	0.31	1.23	0.25	100	2	12.6	300	2.7%	5.7	0.9	13.5	3.62	6.19	1	8

JOB NAME:	*WATERBURY MDDP*
JOB NUMBER:	*1715.00*
DATE:	*03/08/22*
CALC'D BY:	*QNA*

MDDP ~ PROPOSED BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	CA(100)	OVERLAND C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)
OS-Q1	1.94	2.54	0.25	200	5	16.6	1500	1.5%	4.3	5.8	22.4	2.88	4.78	**6**	**12**
OS-Q2	0.42	0.55	0.25	50	1	8.9	900	1.5%	4.3	3.5	12.4	3.75	6.43	**2**	**4**
OS-R	2.72	3.57	0.25	50	1	8.9	850	2.7%	5.8	2.5	11.4	3.87	6.69	**11**	**24**
OS-S1	2.51	3.30	0.25	100	2	12.6	920	1.2%	3.8	4.0	16.7	3.32	5.60	**8**	**18**
OS-S2	0.08	0.10	0.25	100	2	12.6					12.6	3.72	6.39	**0**	**1**
OS-T2	0.34	0.45	0.25	100	2	12.6					12.6	3.72	6.39	**1**	**3**

JOB NAME:	*WATERBURY MDDP*
JOB NUMBER:	*1715.00*
DATE:	*03/08/22*
CALCULATED BY:	*QNA*

MDDP ~ PROPOSED SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Facility Size
						I(5)	I(100)	Q(5)	Q(100)	
1	A	3.39	1.52	2.00	14.3	3.54	6.03	5	12	10' Type R Sump Inlet
2	C	0.86	0.39	0.51	6.9	4.58	8.14	2	4	5' Type R Sump Inlet
3	B1	2.30	1.03	1.36	14.2	3.55	6.05	4	8	5' Type R Sump Inlet
4	B2	2.69	1.21	1.59	14.8	3.49	5.93	4	9	5' Type R Sump Inlet
5	F & H	3.31	1.49	1.95	9.5	4.14	7.22	6	14	10' Type R Sump Inlet
6	D	2.11	0.95	1.24	11.4	3.87	6.69	4	8	5' Type R Sump Inlets
7	E	2.18	0.98	1.29	13.8	3.59	6.12	4	8	5' Type R Sump Inlets
7A	G1	0.53	0.24	0.31	5.0	5.00	9.06	1	3	5' Type R At-
7B	G2	0.69	0.31	0.41	5.0	5.00	9.06	2	4	5' Type R At-grade Inlet
8	DESIGN POINTS 1-7 & K	16.84	7.58	9.94	14.8	3.49	5.93	26	59	FSD Pond 1
9	OS-9	11.80						8	19	EX 36" CMP Culvert
10	OS-8	2.56						5	11	EX 36" CMP Culvert
10A	MERIDIAN POND E RELEASE	Meridaian Ranch Filing 3 FDR Calculated Flows						28	185	EX 3-42" RCP Culverts
11	OS-5, I, DP10A (MERIDIAN POND E RELEASE)	Sum of Basins						36	213	PR 2-42" RCP Culverts
12	OS-6	1.06	0.48	0.63	10.1	4.05	7.04	2	4	18"' RCP Culvert
13	TOTAL OFFISITE EX. STOCK POND INFLOW	Per "Final Drainage Report for Waterbury Filing No. 1" dated September 2016, by Classic Consulting						69	396	EX STOCK POND

CHANGED TO RCP IN SPREADSHEET

Report has listed as RC Confirm ma

JOB NAME: *WATERBURY MDDP*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALCULATED BY: *QNA*

MDDP ~ PROPOSED SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Facility Size
						I(5)	I(100)	Q(5)	Q(100)	
14	L1	3.27	1.47	1.93	16.1	3.36	5.69	5	11	10' Type R Sump Inlet
15	L2	2.00	0.90	1.18	12.8	3.70	6.34	3	7	5' Type R Sump Inlet
16	O1	2.82	1.27	1.66	13.5	3.62	6.19	5	10	10' Type R Sump Inlet
17	O2	0.71	0.32	0.42	15.5	3.42	5.80	1	2	5' Type R Sump Inlet
18	DESIGN POINTS 14-17 & BASIN 0S-4	19.71	4.94	5.20	16.1	3.36	5.69	17	30	Interim FSD Pond 2
19	Q1 & OS-Q1	5.37	2.41	3.17	22.4	2.88	4.78	7	15	10' Type R Sump Inlet
20	Q2 & OS-Q2	1.89	0.85	1.12	12.4	3.75	6.43	3	7	5' Type R Sump Inlet
21	R & OS-R	7.06	3.18	4.17	11.4	3.87	6.69	12	28	10' Type R At-grade Inlet
22	S1 & OS-S1 & DP 21 FLOW BY	8.34	4.42	5.64	16.7	3.32	5.60	15	32	10' Type R Sump Inlet
23	S2 & OS-S2	0.31	0.14	0.18	12.6	3.72	6.39	1	1	10' Type R Sump Inlet
22 & 23 SPLIT	S1, OS-S1, S2, OS-S2, & DP 21 FLOW BY	8.65	4.56	5.82	16.7	3.32	5.60	8	16	2-10' Type R Sump Inlets
24	T1	1.42	0.64	0.84	10.7	3.97	6.88	3	6	5' Type R Sump Inlets
25	T2 & OS-T2	1.99	0.90	1.18	13.5	3.63	6.20	3	7	5' Type R Sump Inlets
26	U1	4.38	1.97	2.58	14.3	3.54	6.03	7	16	10' Type R Sump Inlets
27	U2	1.89	0.85	1.11	13.8	3.59	6.12	3	7	5' Type R Sump Inlets
28	W	5.20	2.34	3.07	15.0	3.47	5.89	8	18	2-10' Type R Sump Inlets
29	DPS 19-28, 31-32, OFFSITE BASINS OS-1, 2, 3A, 3B, 7, & 9	82.02	35.91	47.46	22.4	2.88	4.78	112	246	FSD POND

JOB NAME: *WATERBURY MDDP*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALCULATED BY: *QNA*

MDDP ~ PROPOSED SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Facility Size
						I(5)	I(100)	Q(5)	Q(100)	
30	Y & OS-10	3.76	0.46	1.43	13.5	3.62	6.19	2	9	Triple 36" RCP Culverts
30	FSD POND 3 EMERGCNEY SPILLWAY RELEASE	MHFD DETENTION 100Y PEAK INFLOW							204	Triple 36" RCP Culverts
31	V	0.54	0.24	0.32	5.0	5.00	9.06	1	3	18" DIA INLETS
32	X	0.43	0.19	0.25	5.0	5.00	9.06	1	2	18" DIA INLETS
33	O-3	0.45	0.20	0.27	5.0	5.00	9.06	1	2	18" DIA INLETS
34	O-4	0.38	0.17	0.23	5.0	5.00	9.06	1	2	18" DIA INLETS

JOB NAME: *WATERBURY MDDP*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALCULATED BY: *QNA*

* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

MDDP ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
1	DP 2	0.39	0.51	6.9	4.58	8.14	2	4	18" RCP
2	DP 1 & 2	1.91	2.51	14.3	3.54	6.03	7	15	24" RCP
3	DP 3	1.03	1.36	14.2	3.55	6.05	4	8	18" RCP
4	DP-4	1.21	1.59	14.8	3.49	5.93	4	9	18" RCP
5	DP 3 & 4	2.25	2.94	14.8	3.49	5.93	8	17	24" RCP
6	DP 1-4	4.16	5.45	14.8	3.49	5.93	15	32	30" RCP
7	DP-1-5	5.65	7.41	14.8	3.49	5.93	20	44	36" RCP
8	DP-6	0.95	1.24	11.4	3.87	6.69	4	8	18" RCP
9	DP-7	0.98	1.29	13.8	3.59	6.12	4	8	18" RCP
10	DP-6 & 7	1.97	2.58	13.8	3.59	6.12	7	16	24" RCP
10A	DP-7A	0.24	0.31	5.0	5.00	9.06	1	3	24" RCP
10B	DP-7A & 7B	0.55	0.72	5.0	5.00	9.06	3	7	24" RCP
10C	POND 1 RELEASE	2.95	3.87	13.8	3.59	6.12	0.4	8.2	18" RCP
11	DP-14	1.47	1.93	16.1	3.36	5.69	5	11	24" RCP
12	DP-15	0.90	1.18	12.8	3.70	6.34	3	7	18" RCP
13	DP 14 & 15	2.37	3.11	16.1	3.36	5.69	8	18	30" RCP
14	DP 16	1.27	1.66	13.5	3.62	6.19	5	10	24" RCP
15	DP 14, 15 & 16	3.64	4.77	16.1	3.36	5.69	12	27	36" RCP
16	DP 17	0.32	0.42	15.5	3.42	5.80	1	2	18" RCP

JOB NAME: *WATERBURY MDDP*
JOB NUMBER: *1715.00*
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CALCULATED BY: *QNA*

* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

MDDP ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
17	DP 14, 15, 16, 17, 33, & 34	4.34	5.69	16.1	3.36	5.69	15	32	36" RCP
17A	POND 2 RELEASE								18" RCP
18	DP 19	2.41	3.17	22.4	2.88	4.78	7	15	24" RCP
19	DP 20	0.85	1.12	12.4	3.75	6.43	3	7	18" RCP
20	DP 18 & 19	3.27	4.28	22.4	2.88	4.78	9	20	24" RCP
21	DP 21 PICK UP						8	14	18" RCP
22	DP 19, 20 & 21	6.04	7.21	22.4	2.88	4.78	17	34	30" RCP
23	DP 22	2.28	2.91	16.7	3.32	5.60	8	16	24" RCP
24	DP 23	2.28	2.91	16.7	3.32	5.60	8	16	24" RCP
25	DP 22 & 23	4.56	5.82	16.7	3.32	5.60	15	33	30" RCP
26	DP 19 -23	10.60	13.03	22.4	2.88	4.78	31	62	36" RCP
27	DP 24	0.64	0.84	10.7	3.97	6.88	3	6	18" RCP
28	DP 25	0.90	1.18	13.5	3.63	6.20	3	7	18" RCP
29	DP 19-25	12.13	15.05	22.4	2.88	4.78	35	72	36" RCP
30	DP 26	1.97	2.58	14.3	3.54	6.03	7	16	24" RCP
31	DP 19-26	14.10	17.63	22.4	2.89	4.79	41	84	42" RCP
32	DP 27	0.85	1.11	13.8	3.59	6.12	3	7	18" RCP
33	DP 19-27, & 31	15.19	19.06	22.4	2.88	4.78	44	91	42" RCP
34	DP 28 SPLIT	1.17	1.53	15.0	3.47	5.89	4	9	18" RCP

JOB NAME: *WATERBURY MDDP*
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* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

MDDP ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
34A	29 & 32	2.53	3.32	15.0	3.47	5.89	9	20	18" RCP
35	Pond 3 Release	MHFD UD-DETENTION POND RELEASE					1.2	58.1	36" RCP
36	DP 30	FSD POND 3 EMERGCNEY SPILLWAY RELEASE						204.3	TRIPLE 36" RCP
37	DP 31	0.24	0.32	5.00	5.00	9.06	1.2	3	15" HDPE
38	DP 32	0.19	0.25	5.00	5.00	9.06	1.2	2	15" HDPE
39	DP 33	0.20	0.27	5.00	5.00	9.06	1.2	2	15" HDPE
40	DP 34	0.17	0.23	5.00	5.00	9.06	1.2	2	15" HDPE

PDR CALCULATIONS

JOB NAME: *WATERBURY FDR*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALCULATED BY: *QNA*

PELIMNARY DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS / DEVELOPED AREA			NONIMPERVIOUS / UNDEVELOPED AREA			WEIGHTED		**WEIGHTED CA**	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	**CA(5)**	**CA(100)**
A	3.39	3.39	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.52**	**2.00**
B1	2.30	2.30	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.03**	**1.36**
B2	2.69	2.69	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.21**	**1.59**
C	0.86	0.86	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.39**	**0.51**
D	2.11	2.11	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.95**	**1.24**
E	2.18	2.18	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.98**	**1.29**
F	2.18	2.18	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.98**	**1.29**
G1	0.53	0.53	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.24**	**0.31**
G2	0.69	0.69	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.31**	**0.41**
H	1.13	1.13	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.51**	**0.67**
I	5.99	2.46	0.45	0.59	3.53	0.09	0.36	0.24	0.45	**1.43**	**2.72**
J	1.99	1.99	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.90**	**1.17**
K	3.06	1.14	0.45	0.59	1.92	0.09	0.36	0.22	0.45	**0.69**	**1.37**
L1	3.04	3.04	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.37**	**1.79**
L2	2.00	2.00	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.90**	**1.18**
M1	1.64	1.64	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.74**	**0.97**
M2	0.45	0.45	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.20**	**0.26**
N	0.22	0.22	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.10**	**0.13**
O1	2.82	2.82	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.27**	**1.66**
O2	0.71	0.71	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.32**	**0.42**
O3	0.45	0.45	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.20**	**0.27**
O4	0.38	0.38	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.17**	**0.23**
P	0.70	0.00	0.45	0.59	0.70	0.09	0.36	0.09	0.36	**0.06**	**0.25**
Q1	1.06	1.06	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.48**	**0.62**
Q2	0.96	0.96	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.43**	**0.56**
R	1.02	1.02	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.46**	**0.60**
S1	1.55	1.55	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.70**	**0.91**
S2	0.13	0.13	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.06**	**0.08**
T1	1.42	1.42	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.64**	**0.84**

JOB NAME: *WATERBURY FDR*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALCULATED BY: *QNA*

PELIMNARY DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS / DEVELOPED AREA			NONIMPERVIOUS / UNDEVELOPED AREA			WEIGHTED		**WEIGHTED CA**	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	**CA(5)**	**CA(100)**
T2	1.23	1.23	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.55**	**0.73**
U1	4.38	4.38	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**1.97**	**2.58**
U2	1.89	1.89	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.85**	**1.11**
V	0.54	0.54	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.24**	**0.32**
W	5.20	5.20	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**2.34**	**3.07**
X	0.43	0.43	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.19**	**0.25**
Y	0.35	0.35	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.16**	**0.21**
OS-1*	**41.09**	**0.00**	**0.45**	**0.59**	**41.09**	**0.09**	**0.36**	**0.09**	**0.36**	**3.70**	**14.79**
OS-2*	**12.02**	**0.00**	**0.45**	**0.59**	**12.02**	**0.09**	**0.36**	**0.09**	**0.36**	**1.08**	**4.33**
OS-4	10.90	0.00	0.45	0.59	10.90	0.09	0.36	0.09	0.36	**0.98**	**3.92**
OS-5	5.64	0.00	0.45	0.59	5.64	0.09	0.36	0.09	0.36	**0.51**	**2.03**
OS-6	1.06	1.06	0.45	0.59	0.00	0.09	0.36	0.45	0.59	**0.48**	**0.63**
OS-7*	**3.64**	**0.00**	**0.45**	**0.59**	**3.64**	**0.09**	**0.36**	**0.09**	**0.36**	**0.33**	**1.31**
OS-8	2.56	FLOW TAKEN FROM MERIDAIN RANCH MDDP									
OS-9	11.80	FLOW TAKEN FROM MERIDAIN RANCH MDDP									
OS-Q1*	**0.33**	**0.00**	**0.45**	**0.59**	**0.33**	**0.09**	**0.36**	**0.09**	**0.36**	**0.03**	**0.12**
OS-Q2*	**0.22**	**0.00**	**0.45**	**0.59**	**0.22**	**0.09**	**0.36**	**0.09**	**0.36**	**0.02**	**0.08**
OS-R*	**1.04**	**0.00**	**0.45**	**0.59**	**1.04**	**0.09**	**0.36**	**0.09**	**0.36**	**0.09**	**0.38**
OS-S1*	**0.31**	**0.00**	**0.45**	**0.59**	**0.31**	**0.09**	**0.36**	**0.09**	**0.36**	**0.03**	**0.11**
OS-S2*	**0.13**	**0.00**	**0.45**	**0.59**	**0.13**	**0.09**	**0.36**	**0.09**	**0.36**	**0.01**	**0.05**
OS-T2*	**0.30**	**0.00**	**0.45**	**0.59**	**0.30**	**0.09**	**0.36**	**0.09**	**0.36**	**0.03**	**0.11**

BASIN* = BASIN AREA REVISED FROM MDDP IN PRELIMINARY CONDITION DUE TO UNDEVELOPED UPSTREAM

JOB NAME: *WATERBURY FDR*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALC'D BY: *QNA*

PELIMINARY DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	CA(100)	OVERLAND C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)
A	1.52	2.00	0.25	100	2	12.6	420	1.5%	4.3	1.6	14.3	3.54	6.03	5	12
B1	1.03	1.36	0.25	100	2	12.6	400	1.5%	4.3	1.6	14.2	3.55	6.05	4	8
B2	1.21	1.59	0.25	100	2	12.6	550	1.5%	4.3	2.1	14.8	3.49	5.93	4	9
C	0.39	0.51	0.25	20	0.5	5.3	500	2.0%	4.9	1.7	6.9	4.58	8.14	2	4
D	0.95	1.24	0.25	80	2	10.5	300	2.5%	5.5	0.9	11.4	3.87	6.69	4	8
E	0.98	1.29	0.25	100	2	12.6	400	2.5%	5.5	1.2	13.8	3.59	6.12	4	8
F	0.98	1.29	0.25	50	2	7.1	620	1.5%	4.3	2.4	9.5	4.14	7.22	4	9
G1	0.24	0.31	0.25								5.0	5.00	9.06	1	3
G2	0.31	0.41	0.25								5.0	5.00	9.06	2	4
H	0.51	0.67	0.25	50	2	7.1	525	1.5%	4.3	2.0	9.2	4.19	7.33	2	5
I	1.43	2.72	0.25	80	4	8.4	250	2.0%	4.9	0.8	9.2	4.18	7.32	6	20
J	0.90	1.17	0.25	90	6	8.1	850	2.0%	4.9	2.9	10.9	3.94	6.81	4	8
K	0.69	1.37	0.25	100	18	6.1	80	1.0%	3.5	0.4	6.5	4.67	8.33	3	11
L1	1.37	1.79	0.25	100	2	12.6	860	1.4%	4.1	3.5	16.1	3.36	5.69	5	10
L2	0.90	1.18	0.25	55	1.1	9.4	860	1.4%	4.1	3.5	12.8	3.70	6.34	3	7
M1	0.74	0.97	0.25	70	1.5	10.3	200	2.0%	4.9	0.7	11.0	3.92	6.79	3	7
M2	0.20	0.26	0.25	65	3	7.7	0	0.0%	0.0	0.0	7.7	4.43	7.83	1	2
N	0.10	0.13	0.25								5.0	5.00	9.06	1	1
O1	1.27	1.66	0.25	100	3	11.1	460	1.5%	4.3	1.8	12.8	3.70	6.34	5	11
O2	0.32	0.42	0.25	100	2	12.6	850	2.0%	4.9	2.9	15.5	3.42	5.80	1	2
O3	0.20	0.27	0.25								5.0	5.00	9.06	1	2
O4	0.17	0.23	0.25								5.0	5.00	9.06	1	2
P	0.06	0.25	0.25								5.0	5.00	9.06	0	2
Q1	0.48	0.62	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	2	4

JOB NAME: *WATERBURY FDR*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALC'D BY: *QNA*

PELIMINARY DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	CA(100)	OVERLAND C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)
Q2	0.43	0.56	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	2	4
R	0.46	0.60	0.25	100	4	10.1	700	2.0%	4.9	2.4	12.4	3.75	6.44	2	4
S1	0.70	0.91	0.25	100	6	8.8	175	2.0%	4.9	0.6	9.4	4.16	7.26	3	7
S2	0.06	0.08	0.25								5.0	5.00	9.06	0	1
T1	0.64	0.84	0.25	55	1.1	9.4	390	2.0%	4.9	1.3	10.7	3.97	6.88	3	6
T2	0.55	0.73	0.25	100	2	12.6	245	2.0%	5.0	0.8	13.5	3.63	6.20	2	5
U1	1.97	2.58	0.25	100	2	12.6	520	2.3%	5.3	1.6	14.3	3.54	6.03	7	16
U2	0.85	1.11	0.25	100	2	12.6	385	2.3%	5.4	1.2	13.8	3.59	6.12	3	7
V	0.24	0.32	0.25	100	2	12.6	630	1.6%	4.4	2.4	15.0	3.47	5.89	1	2
W	2.34	3.07	0.25	100	2	12.6	630	1.6%	4.4	2.4	15.0	3.47	5.89	8	18
X	0.19	0.25	0.25	95	6	8.4					8.4	4.31	7.58	1	2
Y	0.16	0.21	0.25	95	6	8.4					8.4	4.31	7.58	1	2
OS-1*	**3.70**	**14.79**	**0.25**	**100**	**2**	**12.6**	**2700**	**2.3%**	**5.3**	**8.5**	**21.1**	**2.97**	**4.94**	**11**	**73**
OS-2*	**1.08**	**4.33**	**0.25**	**100**	**2**	**12.6**	**1203**	**1.0%**	**3.5**	**5.7**	**18.4**	**3.17**	**5.32**	**3**	**23**
OS-4	0.98	3.92	0.25	800	26	30.5					30.5	2.46	4.01	2	16
OS-5	0.51	2.03	0.25	600	18	27.1					27.1	2.62	4.30	1	9
OS-6	0.48	0.63	0.25	30	0.6	6.9	900	1.8%	4.7	3.2	10.1	4.05	7.04	2	4
OS-7*	**0.33**	**1.31**	**0.25**								**5.0**	**5.00**	**9.06**	**2**	**12**
OS-8	FLOW TAKEN FROM MERIDAIN RANCH MDDP													5	11
OS-9	FLOW TAKEN FROM MERIDAIN RANCH MDDP													8	19
OS-Q1*	**0.03**	**0.12**	**0.25**	**100**	**2**	**12.6**	**135**	**1.5%**	**4.3**	**0.5**	**13.2**	**3.66**	**6.27**	**0**	**1**
OS-Q2*	**0.02**	**0.08**	**0.25**	**50**	**1**	**8.9**	**135**	**1.5%**	**4.3**	**0.5**	**9.5**	**4.14**	**7.24**	**0**	**1**
OS-R*	**0.09**	**0.38**	**0.25**	**100**	**2**	**12.6**	**50**	**2.7%**	**5.8**	**0.1**	**12.8**	**3.70**	**6.35**	**0**	**2**
OS-S1*	**0.03**	**0.11**	**0.25**								**5.0**	**5.00**	**9.06**	**0**	**1**

JOB NAME:	*WATERBURY FDR*
JOB NUMBER:	*1715.00*
DATE:	*03/08/22*
CALC'D BY:	*QNA*

PELIMINARY DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	CA(100)	C(5)	OVERLAND Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)
OS-S2*	**0.01**	**0.05**	**0.25**								**5.0**	**5.00**	**9.06**	**0**	**0**
OS-T2*	**0.03**	**0.11**	**0.25**								**5.0**	**5.00**	**9.06**	**0**	**1**

BASIN* = BASIN AREA REVISED FROM MDDP IN PRELIMINARY CONDITION DUE TO UNDEVELOPED UPSTREAM

JOB NAME: *WATERBURY FDR*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALCULATED BY: *QNA*

PELIMINARY DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Facility Size
						I(5)	I(100)	Q(5)	Q(100)	
1	A	3.39	1.52	2.00	14.3	3.54	6.03	5	12	10' Type R Sump Inlet
2	C	0.86	0.39	0.51	6.9	4.58	8.14	2	4	5' Type R Sump Inlet
3	B1	2.30	1.03	1.36	14.2	3.55	6.05	4	8	5' Type R Su
4	B2	2.69	1.21	1.59	14.8	3.49	5.93	4	9	5' Type R Su
5	F & H	3.31	1.49	1.95	9.5	4.14	7.22	6	14	10'
6	D	2.11	0.95	1.24	11.4	3.87	6.69	4	8	5' T
7	E	2.18	0.98	1.29	13.8	3.59	6.12	4	8	5' T
7A	G1	0.53	0.24	0.31	5.0	5.00	9.06	1	3	5' Type R At-grade Inlet
7B	G2	0.69	0.31	0.41	5.0	5.00	9.06	2	4	5' Type R At-grade Inlet
8	DESIGN POINTS 1-7 & K	16.84	7.58	9.94	14.8	3.49	5.93	26	59	FSD Pond 1
9	OS-9	0.31	0.03	0.11	5.0	5.00	9.06	0	1	EX 36" CMP Culvert
10	OS-8	1.04	0.09	0.38	12.8	3.70	6.35	0	2	EX 36" CMP Culvert
10A	MERIDIAN POND E RELEASE	Meridaian Ranch Filing 3 FDR Calculated Flows						28	185	EX 3-42" RCP Culverts
11	OS-5, I, OS-& MERIDIAN POND E RELEASE	Sum of Basins						35	214	PR 2-42" RCP Culverts
12	OS-6	0.33	5.19	6.80	18.7	3.14	5.27	16	36	18"' RCP Culvert

HOw did these
change from M
no change to b

EASY I SCREWED U
AND ENTERED WRO
INFO NOW CORREC

JOB NAME:	*WATERBURY FDR*
JOB NUMBER:	*1715.00*
DATE:	*03/08/22*
CALCULATED BY:	*QNA*

PELIMINARY DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Facility Size
						I(5)	I(100)	Q(5)	Q(100)	
13	TOTAL OFFISITE EX. STOCK POND INFLOW	Per "Final Drainage Report for Waterbury Filing No. 1" dated September 2016, by Classic Consulting						69	396	EX STOCK POND

JOB NAME: *WATERBURY FDR*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALCULATED BY: *QNA*

CORRECTED HAD WRONG Tc BOTH O1 & O2

w doesn't match n Basin O1

PELIMINARY DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Facility Size
14	L1	3.04	1.37	1.79	16.1	3.36	5.69	5	10	10' Type R Sump Inlet
15	L2	2.00	0.90	1.18	16.1	3.36	5.69	3	7	5' Type R Sump Inlet
16	O1	2.82	1.27	1.66	5.0	5.00	9.06	6	15	10' Type R Sump Inlet
17	O2	0.71	0.32	0.42	13.5	3.62	6.19	1	3	5' Type R Sump Inlet
18	DESIGN POINTS 14-17 & BASIN 0S-4	19.48	3.86	5.06	16.1	3.36	5.69	13	29	Interim FSD Pond 2
19*	**Q1 & OS-Q1**	**1.39**	**0.51**	**0.74**	**13.2**	**3.66**	**6.27**	**2**	**5**	**10' Type R Sump Inlet**
20*	**Q2 & OS-Q2**	**1.18**	**0.45**	**0.65**	**9.5**	**4.14**	**7.24**	**2**	**5**	**5' Type R Sump Inlet**
21*	**R & OS-R**	**2.06**	**0.55**	**0.98**	**12.4**	**3.75**	**6.44**	**2**	**6**	**10' Type R At-grade Inlet**
22*	**S1 & OS-S1**	**1.86**	**0.72**	**1.02**	**12.4**	**3.75**	**6.44**	**3**	**7**	**10' Type R Sump Inlet**
23*	**S2 & OS-S2**	**0.27**	**0.07**	**0.13**	**5.0**	**5.00**				**10' Type R Sump Inlet**
24*	**T1**	**1.42**	**0.64**	**0.84**	**10.7**			**3**	**6**	**2-10' Type R Sump Inlets**
25*	**T2 & OS-T2**	**1.54**	**0.58**	**0.84**	**13.5**	**3.63**	**6.20**	**2**	**5**	**5' Type R Sump Inlets**
26*	**U1**	**4.38**	**1.97**	**2.58**	**14.3**	**3.54**	**6.03**	**7**	**16**	**5' Type R Sump Inlets**
27*	**U2**	**1.89**	**0.85**	**1.11**	**13.8**	**3.59**	**6.12**	**3**	**7**	**10' Type R Sump Inlets**
28	**W**	**2.34**	**2.34**	**3.07**	**15.0**	**3.47**	**5.89**	**8**	**18**	**5' Type R Sump Inlets**

5' inlet in appendix

CORRECTED

CORRECTED

In appendix show 2-10' inlets

JOB NAME: *WATERBURY FDR*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALCULATED BY: *QNA*

THIS IS INTERIM STAGE WHEN NO UPSTREAM DEVELOPMENT MHFD IS FOR FULL BUILD OUT

Why so much lower than MHFD sheet?

CORRECTED Pond?

PELIMINARY DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Facility Size
29*	DESIGN POINTS 19-28 & OS-7	5.20	11.02	15.02	15.0	3.47	5.89	38	88	2-10' Type R Sump Inlets
E-E*	OS-2 & OS-8	14.58	2.66	6.20	18.4	3.17	5.32	8	33	DIVERSION SWALE E-E
30*	Y, OS-1, OS-2, OS-8 & OS-9	67.82	9.32	20.34	21.1	2.97	4.94	36	120	Triple 36" RCP Culverts
31	V	0.54	0.24	0.32	5.0	5.00	9.06	1	3	18" DIA INLETS
32	X	0.43	0.19	0.25	5.0	5.00	9.06	1	2	18" DIA INLETS
33	O-3	0.45	0.20	0.27	5.0	5.00	9.06	1	2	18" DIA INLETS
34	O-4	0.38	0.17	0.23	5.0	5.00	9.06	1	2	18" DIA INLETS

CORRECTED

DESIGN POINT* = DESIGN POINT REVISED FROM MDDP IN PRELIMINARY CONDITION DUE TO UNDEVELOPED UPSTREAM

JOB NAME: *WATERBURY FDR*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALCULATED BY: *QNA*

* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

PELIMINARY DRAINAGE REPORT ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
1	DP 2	0.39	0.51	6.9	4.58	8.14	2	4	18" RCP
2	DP 1 & 2	1.91	2.51	14.3	3.54	6.03	7	15	24" RCP
3	DP 3	1.03	1.36	14.2	3.55	6.05	4	8	18" RCP
4	DP-4	1.21	1.59	14.8	3.49	5.93	4	9	18" RCP
5	DP 3 & 4	2.25	2.94	14.8	3.49	5.93	8	17	24" RCP
6	DP 1-4	4.16	5.45	14.8	3.49	5.93	15	32	30" RCP
7	DP-1-5	5.65	7.41	14.8	3.49	5.93	20	44	36" RCP
8	DP-6	0.95	1.24	11.4	3.87	6.69	4	8	18" RCP
9	DP-7	0.98	1.29	13.8	3.59	6.12	4	8	18" RCP
10	DP-6 & 7	1.93	2.53	13.8	3.59	6.12	7	15	24" RCP
10A	DP-7A						1.2	2.8	24" RCP
10B	DP-7A & 7B						1.2	2.8	24" RCP
10C	Pond 1 Release						1.2	2.8	18" RCP
11	DP-14	1.37	1.79	16.1	3.36	5.69	5	10	24" RCP

JOB NAME: *WATERBURY FDR*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALCULATED BY: *QNA*

* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

PELIMINARY DRAINAGE REPORT ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
12	DP-15	0.90	1.18	16.1	3.36	5.69	3	7	18" RCP
13	DP 14 & 15	2.27	2.98	16.1	3.36	5.69	8	17	30" RCP
14	DP 16	1.27	1.66	5.0	5.00	9.06	6	15	24" RCP
15	DP 14, 15 & 16	3.54	4.64	16.1	3.36	5.69	12	26	36" RCP
16	DP 17	0.32	0.42	13.5	3.62	6.19	1	3	18" RCP
17	DP 14, 15, 16, & 17	3.86	5.06	16.1	3.36	5.69	13	29	36" RCP
17A	Pond 2 Release						1.1	2.4	18" RCP
18*	**DP 19**	**0.51**	**0.74**	**13.2**	**3.66**	**6.27**	**2**	**5**	**24" RCP**
19*	**DP 20**	**0.45**	**0.65**	**9.5**	**4.14**	**7.24**	**2**	**5**	**18" RCP**
20*	**DP 19 & 20**	**0.96**	**1.39**	**13.2**	**3.66**	**6.27**	**4**	**9**	**24" RCP**
21*	**DP 21 PICK UP**						**2**	**6**	**18" RCP**
22*	**DP 19, 20 & 21**	**1.50**	**2.35**	**13.2**	**3.66**	**6.27**	**6**	**15**	**24" RCP**
23*	**DP 22**	**0.72**	**1.02**	**12.4**	**3.75**	**6.44**	**3**	**7**	**24" RCP**
24*	**DP 23**	**0.07**	**0.13**	**5.0**	**5.00**	**9.06**	**0**	**1**	**24" RCP**

JOB NAME: *WATERBURY FDR*
JOB NUMBER: *1715.00*
DATE: *03/08/22*
CALCULATED BY: *QNA*

* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE.
REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

PELIMINARY DRAINAGE REPORT ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
25*	**DP 22 & 23**	**0.80**	**1.15**	**12.4**	**3.75**	**6.44**	**3**	**7**	**30" RCP**
26*	**DP 19 -23**	**2.30**	**3.50**	**13.2**	**3.66**	**6.27**	**8**	**22**	**36" RCP**
27*	**DP 24**	**0.64**	**0.84**	**10.7**	**3.97**	**6.88**	**3**	**6**	**18" RCP**
28*	**DP 25**	**0.58**	**0.84**	**13.5**	**3.63**	**6.20**	**2**	**5**	**18" RCP**
29*	**DP 19-25**	**3.52**	**5.17**	**13.5**	**3.63**	**6.20**	**13**	**32**	**36" RCP**
30*	**DP 26**	**1.97**	**2.58**	**14.3**	**3.54**	**6.03**	**7**	**16**	**24" RCP**
31*	**DP 19-26**	**5.49**	**7.75**	**14.3**	**3.54**	**6.03**	**19**	**47**	**42" RCP**
32*	**DP 27**	**0.85**	**1.11**	**13.8**	**3.59**	**6.12**	**3**	**7**	**18" RCP**
33*	**DP 19-27 & 31**	**6.58**	**9.18**	**14.3**	**3.54**	**6.03**	**23**	**55**	**42" RCP**
34	DP 28	2.34	3.07	21.1	2.97	4.94	7	15	18" RCP
34A	29 & 32	2.43	4.02	14.3	3.54	6.03	9	24	18" RCP
35	Pond 3 Release	MHFD UD-DETENTION POND RELEASE					1	58	36" RCP
36*	DP 30	SUM OF BASINS					36	120	TRIPLE 36" RCP
37	DP 31	0.24	0.32	5.00	5.00	9.06	1	3	15" HDPE
38	DP 32	0.19	0.25	5.00	5.00	9.06	1	2	15" HDPE
39	DP 33	0.20	0.27	5.00	5.00	9.06	1	2	15" HDPE
40	DP 34	0.17	0.23	5.00	5.00	9.06	1	2	15" HDPE

PIPE RUN* = PIPE RUN REVISED FROM MDDP IN PRELIMINARY CONDITION DUE TO UNDEVELOPED UPSTREAM

HYDRAULIC CALCULATIONS

PRELIMINARY GRADING SWALES

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project:	**WATERBURY 1&2 MDP/PDR**	Location:	DP-PRE1 DIVERSIONS SWALE A-A
By:	QNA	Date:	3/1/2022
Chk By:		Date:	

version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

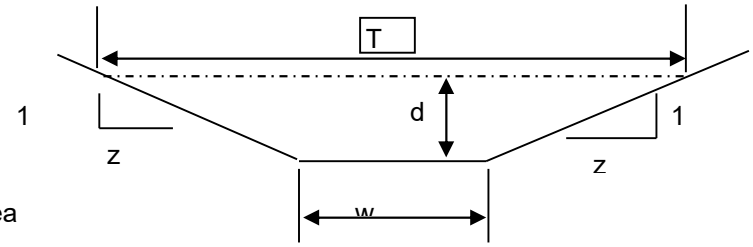
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

	INPUT
z (sideslope)=	4
z (sideslope)=	4
b (btm width, ft)=	2
d (depth, ft)=	1
S (slope, ft/ft)	0.02
n_{low} =	0.02
n_{high} =	0.035

Clear Data Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N Velocity, fps	Low N Flow, cfs	High N Velocity, fps	High N Flow, cfs		
1	6.00	10.25	0.59	7.35452611	44.1272	4.202586	25.2155	T =	10
								Dm =	0.600
				Sc low =	0.0071	Sc high =	0.0218		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0050	0.0093	0.0153	0.0284		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project:	**WATERBURY 1&2 MDP/PDR**	Location:	DP-PRE2 DIVERSIONS SWALE B-B
By:	QNA	Date:	3/1/2022
Chk By:		Date:	

version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

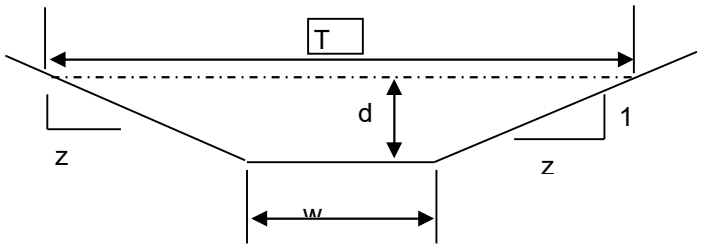
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

INPUT	
z (sideslope)=	4
z (sideslope)=	4
b (btm width, ft)=	2
d (depth, ft)=	0.89
S (slope, ft/ft)	0.02
n_{low} =	0.02
n_{high} =	0.035

Clear Data Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N Velocity, fps	Low N Flow, cfs	High N Velocity, fps	High N Flow, cfs		
0.89	4.95	9.34	0.53	6.88018733	34.0459	3.931536	19.4548	T =	9.12
								Dm =	0.543
				Sc low =	0.0074	Sc high =	0.0226		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0052	0.0096	0.0158	0.0293		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

Flow is 38 cfs per hydrology spreadsheet

UPDATED SPREADSHEET AND TEXT IN REPORT TO 0.94' TO GET 38 CFS

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project:	**WATERBURY 1&2 MDP/PDR**	Location:	DP-PRE3 DIVERSIONS SWALE C-C
By:	QNA	Date:	3/1/2022
Chk By:		Date:	

version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

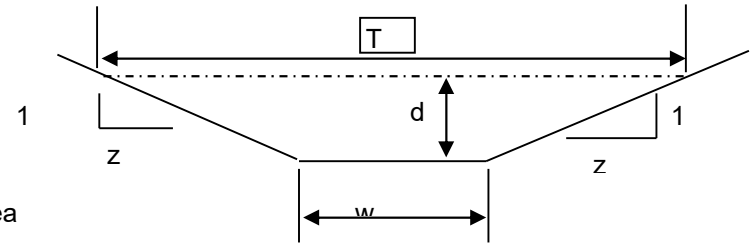
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

	INPUT
z (sideslope)=	4
z (sideslope)=	4
b (btm width, ft)=	3
d (depth, ft)=	1.04
S (slope, ft/ft)	0.02
n_{low} =	0.02
n_{high} =	0.035

Clear Data Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N Velocity, fps	Low N Flow, cfs	High N Velocity, fps	High N Flow, cfs		
1.04	7.45	11.58	0.64	7.82986896	58.3043	4.474211	33.3168	T =	11.32
								Dm =	0.658
				Sc low =	0.0069	Sc high =	0.0211		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0048	0.0090	0.0148	0.0275		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project:	**WATERBURY 1&2 MDP/PDR**	Location:	DP-PRE4 DIVERSIONS SWALE D-D
By:	QNA	Date:	3/1/2022
Chk By:		Date:	

version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

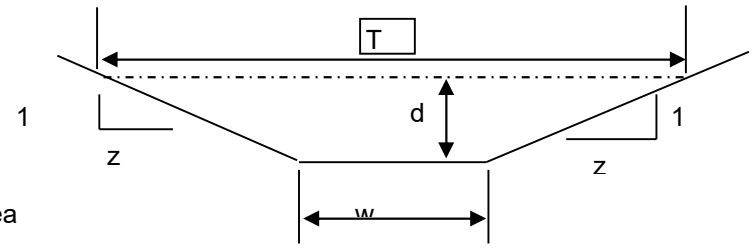
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

	INPUT
z (sideslope)=	4
z (sideslope)=	4
b (btm width, ft)=	2
d (depth, ft)=	0.86
S (slope, ft/ft)	0.02
n_{low} =	0.02
n_{high} =	0.035

Clear Data Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N Velocity, fps	Low N Flow, cfs	High N Velocity, fps	High N Flow, cfs		
0.86	4.68	9.09	0.51	6.74726399	31.5664	3.855579	18.0379	T =	8.88
								Dm =	0.527
				Sc low =	0.0074	Sc high =	0.0228		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0052	0.0097	0.0160	0.0296		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project:	**WATERBURY 1&2 MDP/PDR**	Location:	DP-PRE5 DIVERSIONS SWALE E-E
By:	QNA	Date:	3/1/2022
Chk By:		Date:	

version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

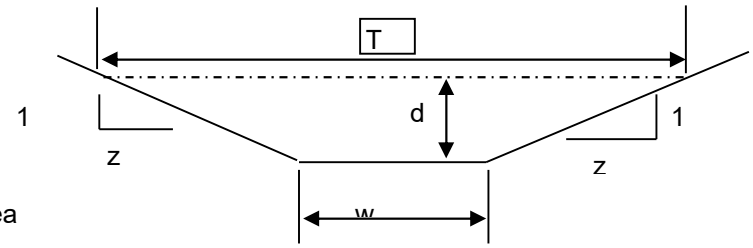
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

	INPUT
z (sideslope)=	4
z (sideslope)=	4
b (btm width, ft)=	4
d (depth, ft)=	0.99
S (slope, ft/ft)	0.02
n_{low} =	0.02
n_{high} =	0.035

Clear Data Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N Velocity, fps	Low N Flow, cfs	High N Velocity, fps	High N Flow, cfs		
0.99	7.88	12.16	0.65	7.86716151	61.9964	4.495521	35.4265	T =	11.92
								Dm =	0.661
				Sc low =	0.0069	Sc high =	0.0210		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0048	0.0089	0.0147	0.0273		

s_c = critical slope ft / ft

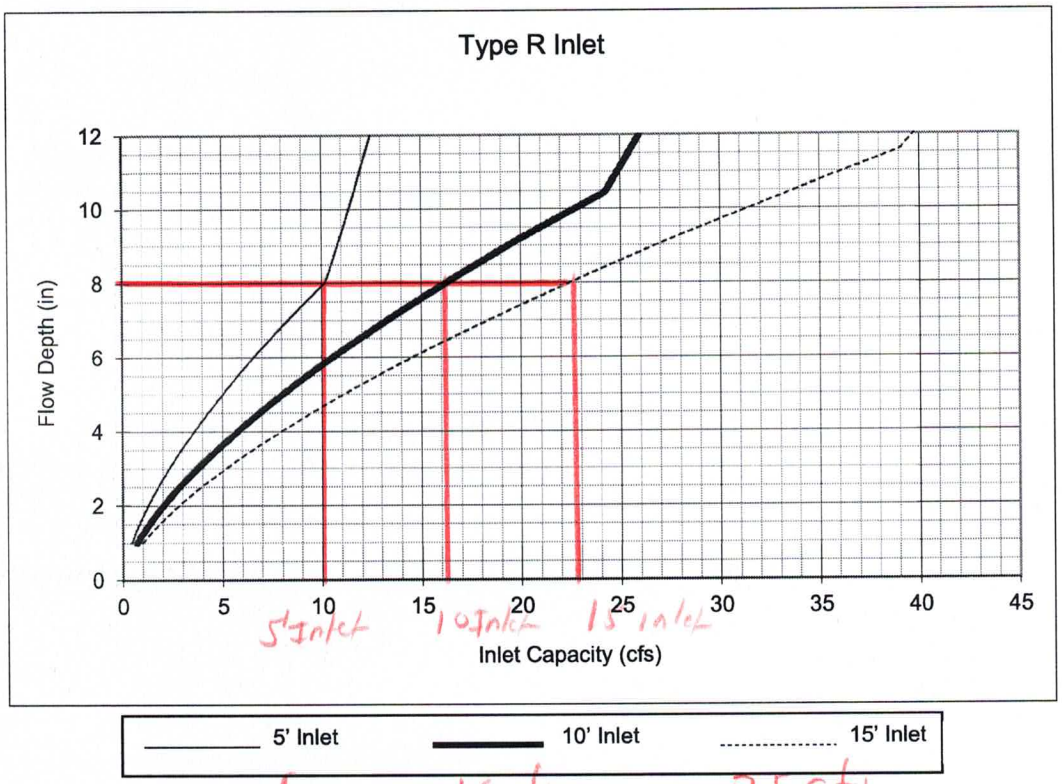
T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

MDDP
INLET CALCULATIONS

Figure 8-11. Inlet Capacity Chart Sump Conditions , Curb Opening (Type R) Inlet



10 cfs 16 cfs 25 cfs

DP1: Q_{100} = 12 cfs → 10' Inlet
DP2: Q_{100} = 4 cfs → 5' Inlet
DP3: Q_{100} = 8 cfs → 5' Inlet
DP4: Q_{100} = 9 cfs → 5' Inlet
DP5: Q_{100} = 14 cfs → 10' Inlet
DP6: Q_{100} = 8 cfs → 5' Inlet
DP7: Q_{100} = 8 cfs → 5' Inlet
DP14: Q_{100} = 10 cfs → 10' Inlet
DP15 Q_{100} = 7 cfs → 5' Inlet
DP16 Q_{100} = 10 cfs → 10' Inlet

DP17 Q_{100} = 2 cfs → 5' Inlet
DP19 Q_{100} = 15 cfs → 10' Inlet
DP20 Q_{100} = 7 cfs → 5' Inlet
DP22 Q_{100} = 16 cfs → 10' Inlet
DP23 Q_{100} = 16 cfs → 10' Inlet
DP24 Q_{100} = 6 cfs → 5' Inlet
DP25 Q_{100} = 7 cfs → 5' Inlet
DP26 Q_{100} = 16 cfs → 10' Inlet
DP27 Q_{100} = 7 cfs → 5' Inlet

Notes:

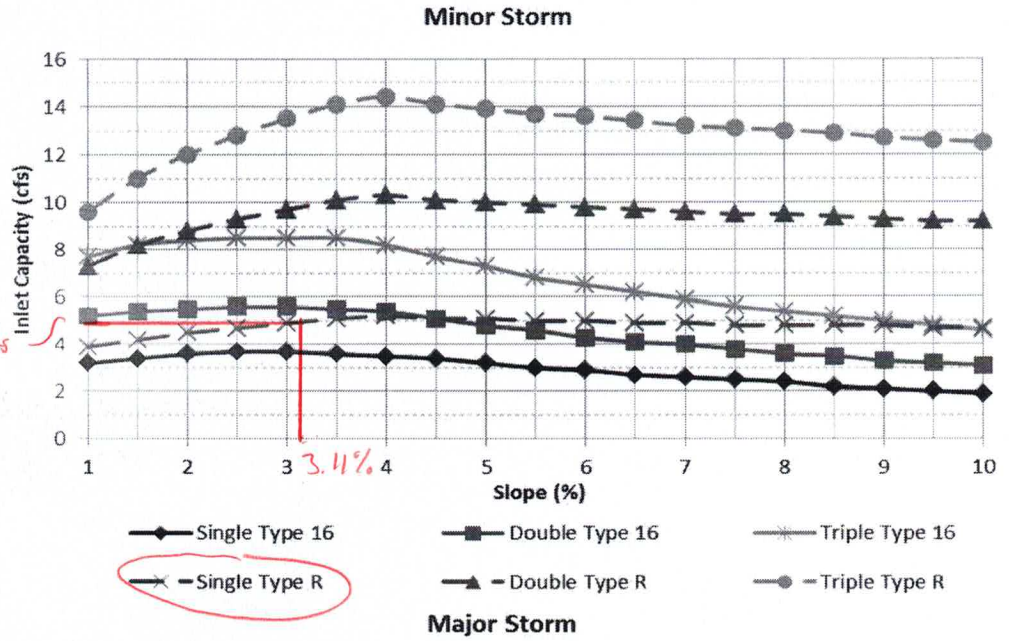
1. The standard inlet parameters must apply to use this chart.

DP 7A 5' At-Grade Inlet
Q_5 = 1 cfs, Q_{100} = 3 cfs
Sagbrook Slope = 3.11%

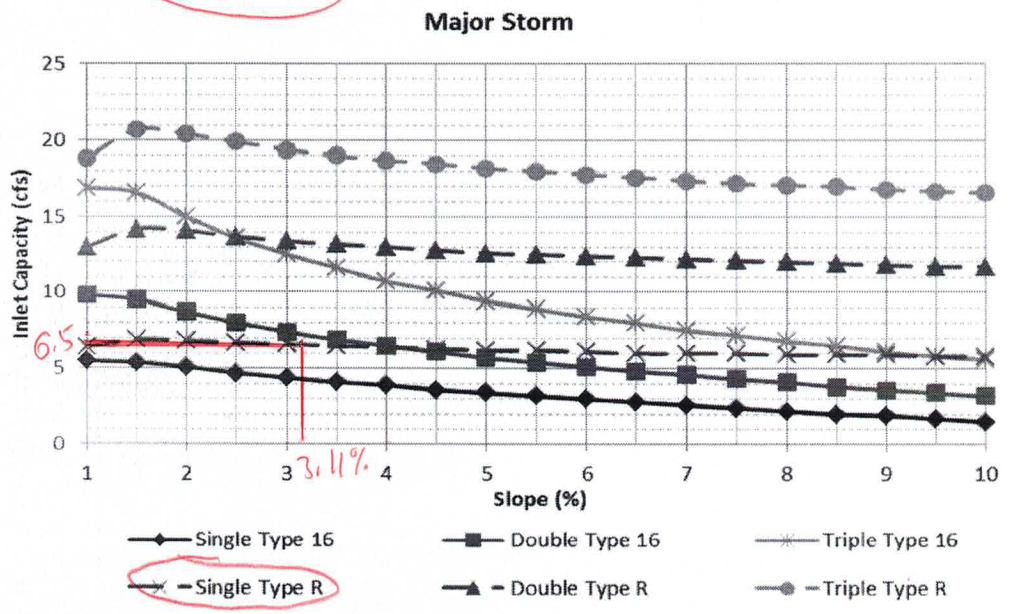
Figure 8-7. Inlet Capacity Chart Continuous Grade Conditions, Residential (Local)
(Attached and Detached Sidewalk)

Street Section Data: Street Width Flowline to Flowline = 34'
Type of Curb and Gutter: D-10-R = 8" vertical
Type 16 = 6" vertical

5 cfs ≥ 1
ok
Full Capture



6.5 ≥ 3
ok
Full Capture



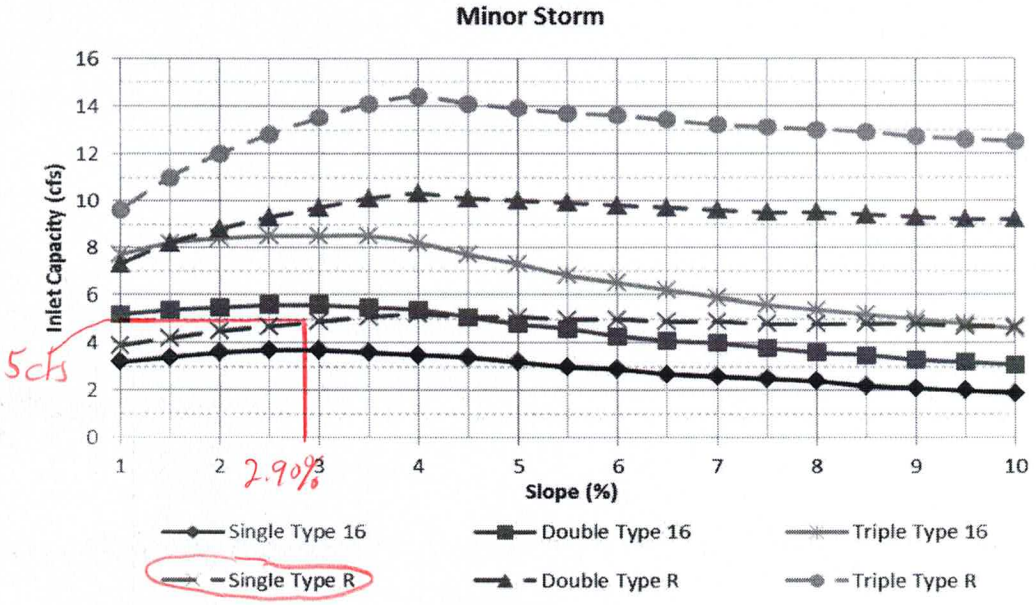
The standard street section parameters as defined in Chapter 7 must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets. The maximum spread width is limited by the curb height based on no curb overtopping during a minor storm and flow being contained within the public right-of-way during the major storm. Calculations were done using UD-Inlet 3.00.xls, Mar., 2011 with the default clogging factors.

DP 7B 5' At-Grade Inlet
$Q_5 = 2$ cfs, $Q_{100} = 4$ cfs
Daylight Slope = 2.90%

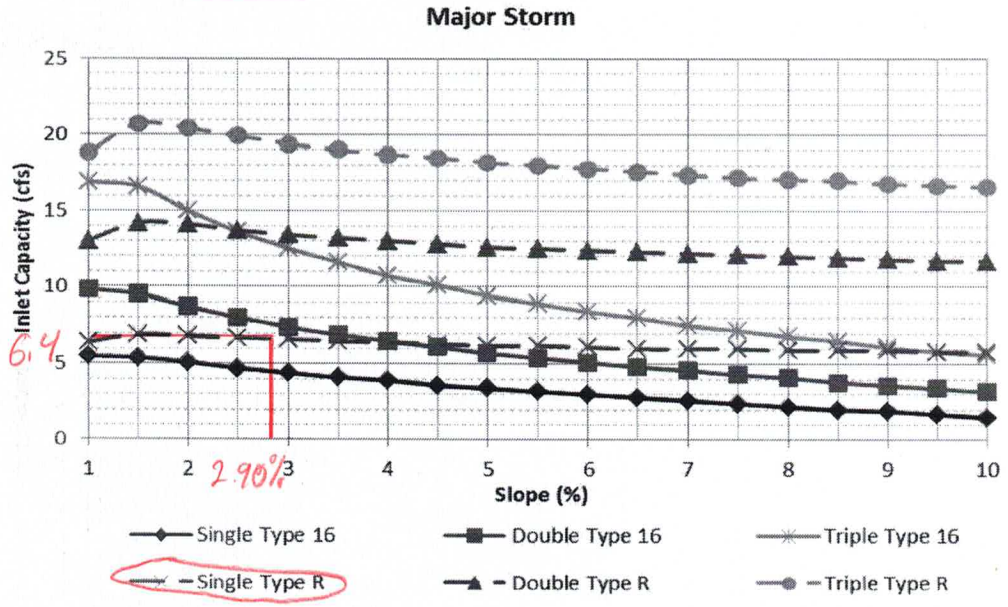
Figure 8-7. Inlet Capacity Chart Continuous Grade Conditions, Residential (Local)
(Attached and Detached Sidewalk)

Street Section Data: Street Width Flowline to Flowline = 34'
Type of Curb and Gutter: D-10-R = 8" vertical
Type 16 = 6" vertical

5<2
OK
Full Capture



6.4<4
OK
Full Capture



The standard street section parameters as defined in Chapter 7 must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets. The maximum spread width is limited by the curb height based on no curb overtopping during a minor storm and flow being contained within the public right-of-way during the major storm. Calculations were done using UD-Inlet 3.00.xls, Mar., 2011 with the default clogging factors.

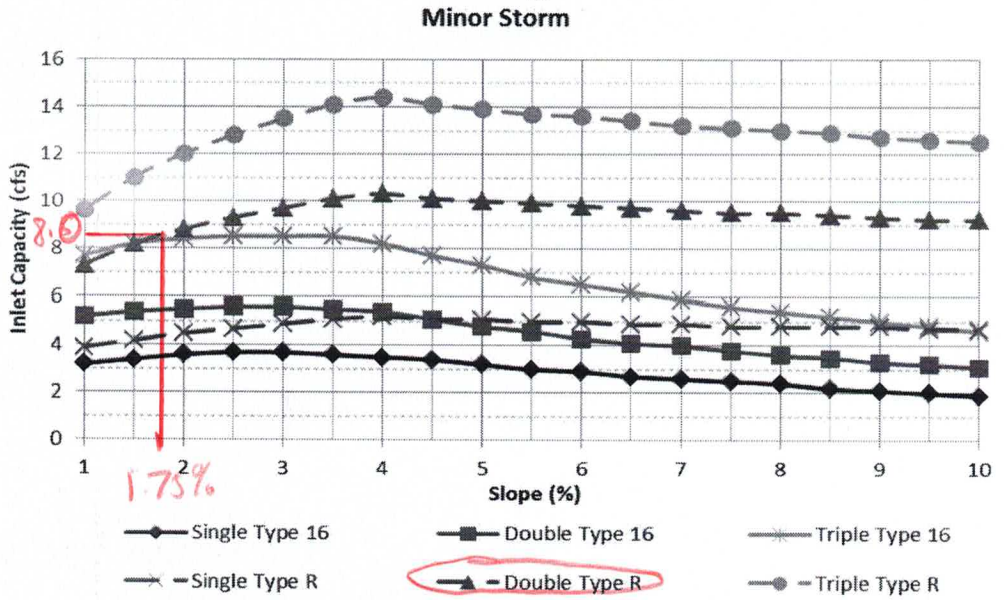
DP-21 10' TYPE R - At Grade
$Q_5 = 12$, $Q_{100} = 28$
Muddy Pond Slope = 1.75%

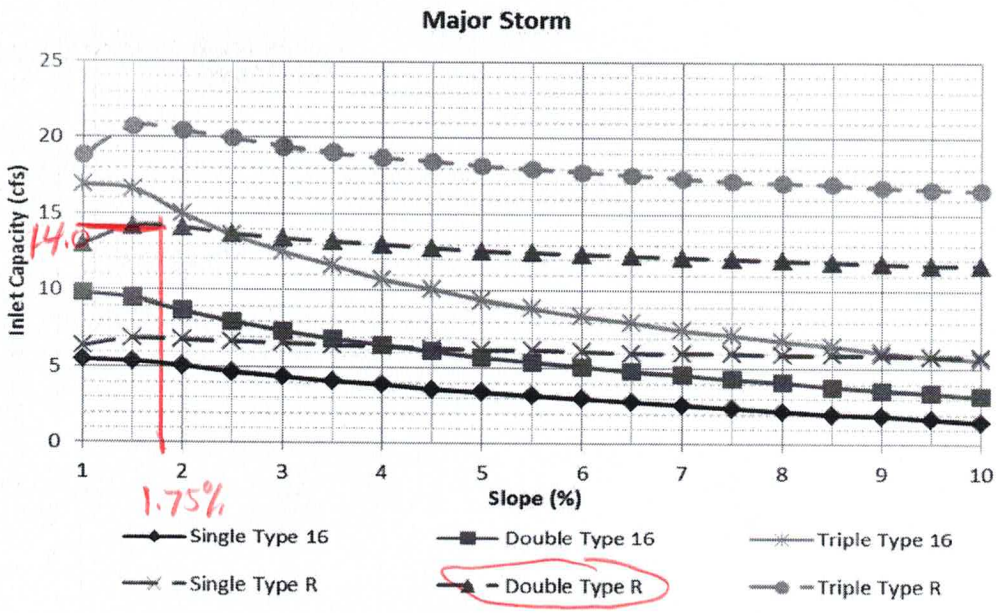
Figure 8-7. Inlet Capacity Chart Continuous Grade Conditions, Residential (Local)
(Attached and Detached Sidewalk)

Street Section Data: Street Width Flowline to Flowline = 34'
Type of Curb and Gutter: D-10-R = 8" vertical
Type 16 = 6" vertical

Captured:
$Q_5 = 8.0$ cfs
$Q_{100} = 14.0$ cfs

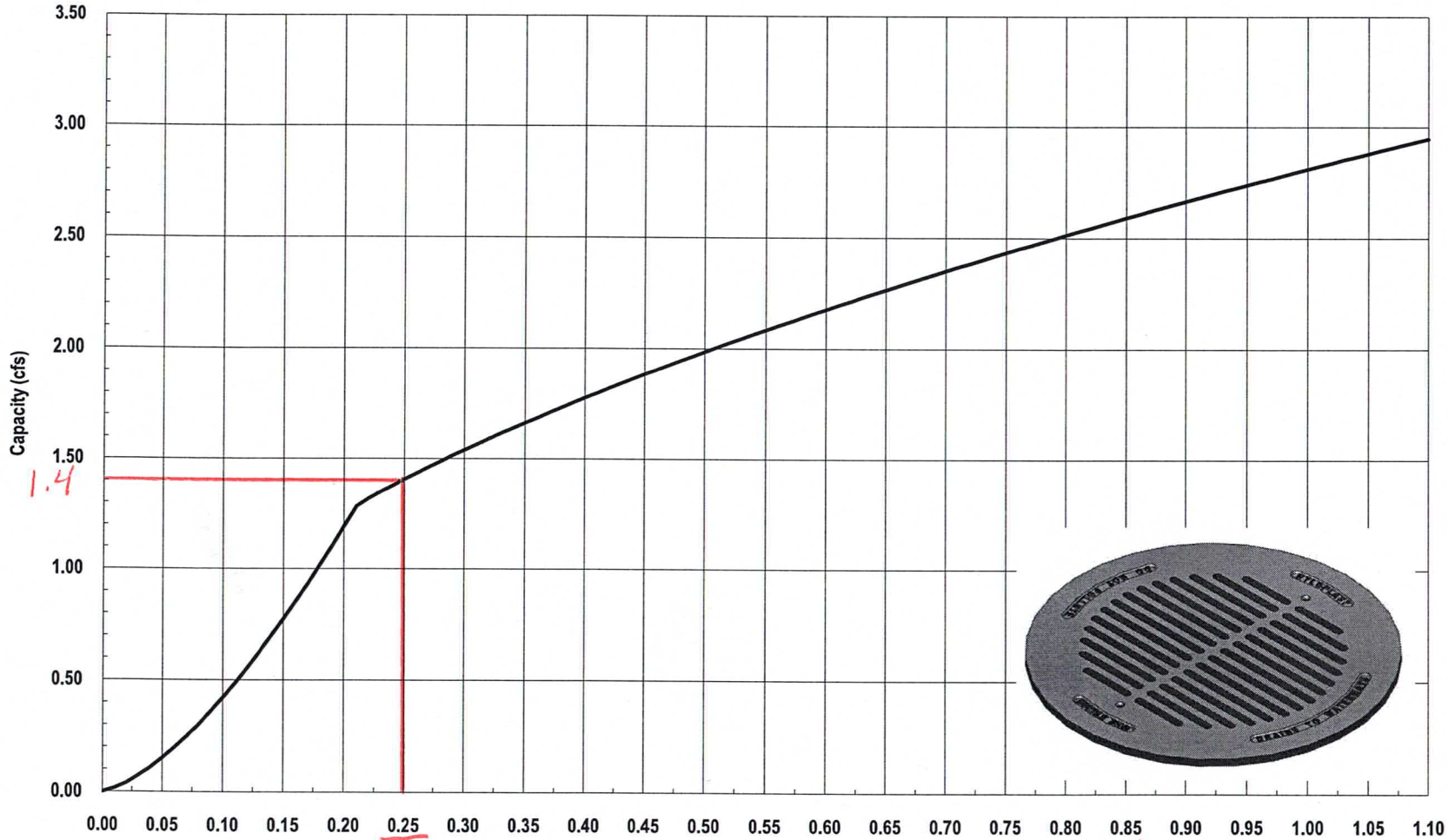
By Pass:
$Q_5 = 4.0$ cfs
Q_{100} 14.00 cfs





The standard street section parameters as defined in Chapter 7 must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets. The maximum spread width is limited by the curb height based on no curb overtopping during a minor storm and flow being contained within the public right-of-way during the major storm. Calculations were done using UD-Inlet 3.00.xls, Mar., 2011 with the default clogging factors.

Nyloplast 18" Drop In Grate Inlet Capacity Chart



DP 33 Q_{100} = 2 cfs 4 inlets Capacity = 4 x 1.4 = 5.6 cfs
DP 34 Q_{100} = 2 cfs 3 inlets Capacity = 3 x 1.4 = 4.2 cfs
DP 31 Q_{100} = 2 cfs 2 inlets Capacity = 2 x 1.4 = 2.8 cfs
DP 32 Q_{100} = 3 cfs 3 inlets Capacity = 3 x 1.4 = 4.2 cfs

Nyloplast
3130 Verona Avenue • Buford, GA 30518
(866) 888-8479 / (770) 932-2443 • Fax: (770) 932-2490

MDDP
PIPE CALCULATIONS

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Check out our spreadsheet version of this calculator Download Spreadsheet Open Google Sheets version View All Spreadsheets

Pipe run 1

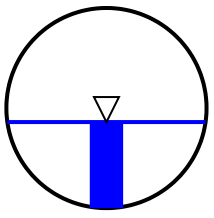
18" RCP @ 1.00%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	43	%

Results

Flow, Q	4.0349	cfs
Velocity, v	5.5533	ft/sec
Velocity head, h_v	0.4793	ft H2O
Flow area	0.7266	ft^2
Wetted perimeter	2.1455	ft
Hydraulic radius	0.3387	ft
Top width, T	1.4852	ft
Froude number, F	1.40	
Shear stress (tractive force), tau	0.2114	psf



Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 2

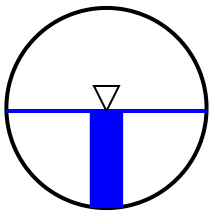
30" RCP" @ 0.60%

Inputs

Pipe diameter, d_0	30	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	.6	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	48.5	%

Results

Flow, Q (See notes)	15.0788	cfs
Velocity, v	6.3878	ft/sec
Velocity head, h_v	0.6342	ft H2O
Flow area	2.3607	ft^2
Wetted perimeter	3.8519	ft
Hydraulic radius	0.6128	ft
Top width, T	2.4988	ft
Froude number, F	1.16	
Average shear stress (tractive force), tau	0.2296	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Check out our spreadsheet version of this calculator Download Spreadsheet Open Google Sheets version View All Spreadsheets

Pipe run 3

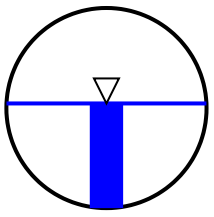
18" RCP @ 2.00%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	.013	
Pressure slope (possibly ? equal to pipe slope), S_0	2	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	52.3	%

Results

Flow, Q	8.0101	cfs
Velocity, v	8.5644	ft/sec
Velocity head, h_v	1.1400	ft H2O
Flow area	0.9353	ft^2
Wetted perimeter	2.4252	ft
Hydraulic radius	0.3857	ft
Top width, T	1.4984	ft
Froude number, F	1.91	
Shear stress (tractive force), tau	0.4815	psf



Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 4

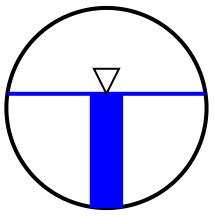
18" RCP" @ 1.90%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.9	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	57.1	%

Results

Flow, Q (See notes)	9.0044	cfs
Velocity, v	8.6352	ft/sec
Velocity head, h_v	1.1589	ft H2O
Flow area	1.0428	ft^2
Wetted perimeter	2.5699	ft
Hydraulic radius	0.4058	ft
Top width, T	1.4848	ft
Froude number, F	1.82	
Average shear stress (tractive force), tau	0.4813	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Check out our spreadsheet version of this calculator Download Spreadsheet Open Google Sheets version View All Spreadsheets

Pipe run 5

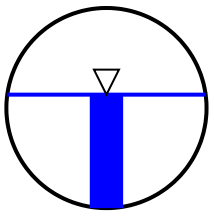
24" RCP @ 1.5%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.5	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	56.7	%

Results

Flow, Q	17.0392	cfs
Velocity, v	9.2708	ft/sec
Velocity head, h_v	1.3358	ft H2O
Flow area	1.8380	ft^2
Wetted perimeter	3.4104	ft
Hydraulic radius	0.5389	ft
Top width, T	1.9819	ft
Froude number, F	1.70	
Shear stress (tractive force), tau	0.5047	psf



Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 6

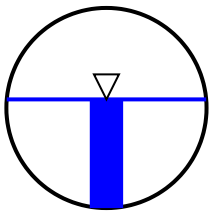
36" RCP" @ 0.70%

Inputs

Pipe diameter, d_0	36	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	.7	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	54.3	%

Results

Flow, Q (See notes)	32.0084	cfs
Velocity, v	8.1640	ft/sec
Velocity head, h_v	1.0359	ft H2O
Flow area	3.9209	ft^2
Wetted perimeter	4.9707	ft
Hydraulic radius	0.7888	ft
Top width, T	2.9889	ft
Froude number, F	1.26	
Average shear stress (tractive force), tau	0.3447	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Check out our spreadsheet version of this calculator Download Spreadsheet Open Google Sheets version View All Spreadsheets

Pipe run 7

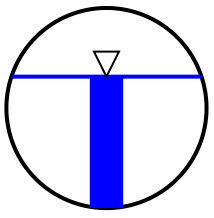
36" RCP @ 0.74%

Inputs

Pipe diameter, d_0	36	in
Manning roughness, n	.013	
Pressure slope (possibly ? equal to pipe slope), S_0	.74	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	65.7	%

Results

Flow, Q	44.0607	cfs
Velocity, v	8.9490	ft/sec
Velocity head, h_v	1.2446	ft H2O
Flow area	4.9238	ft^2
Wetted perimeter	5.6705	ft
Hydraulic radius	0.8683	ft
Top width, T	2.8482	ft
Froude number, F	1.20	
Shear stress (tractive force), tau	0.4011	psf



Manning Formula Uniform Pipe Flow at Given Slope and Depth

Check out our spreadsheet version of this calculator Download Spreadsheet Open Google Sheets version View All Spreadsheets

Pipe run 8

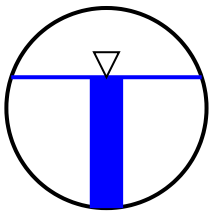
18" RCP @ 1.00%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	65.4	%

Results

Flow, Q	8.0145	cfs
Velocity, v	6.5452	ft/sec
Velocity head, h_v	0.6658	ft H2O
Flow area	1.2245	ft^2
Wetted perimeter	2.8258	ft
Hydraulic radius	0.4333	ft
Top width, T	1.4271	ft
Froude number, F	1.25	
Shear stress (tractive force), tau	0.2705	psf



Manning Formula Uniform Pipe Flow at Given Slope and Depth

Check out our spreadsheet version of this calculator Download Spreadsheet Open Google Sheets version View All Spreadsheets

Pipe run 9

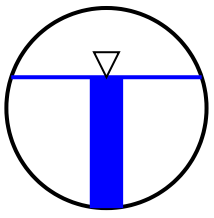
18" RCP @ 1.00%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	65.4	%

Results

Flow, Q	8.0145	cfs
Velocity, v	6.5452	ft/sec
Velocity head, h_v	0.6658	ft H2O
Flow area	1.2245	ft^2
Wetted perimeter	2.8258	ft
Hydraulic radius	0.4333	ft
Top width, T	1.4271	ft
Froude number, F	1.25	
Shear stress (tractive force), tau	0.2705	psf



Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 10

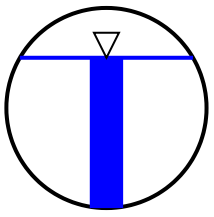
24" RCP" @ 0.60%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	.6	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	75.1	%

Results

Flow, Q (See notes)	16.0022	cfs
Velocity, v	6.3230	ft/sec
Velocity head, h_v	0.6214	ft H2O
Flow area	2.5309	ft^2
Wetted perimeter	4.1934	ft
Hydraulic radius	0.6035	ft
Top width, T	1.7297	ft
Froude number, F	0.92	
Average shear stress (tractive force), tau	0.2261	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Missing pipe runs for 10A, 10B & 10C

ADDED

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Check out our spreadsheet version of this calculator Download Spreadsheet Open Google Sheets version View All Spreadsheets

Pipe run 10A

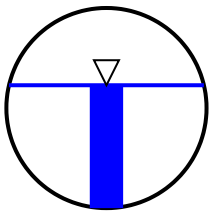
18' RCP @ 1%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	61.4	%

Results

Flow, Q	7.3079	cfs
Velocity, v	6.4228	ft/sec
Velocity head, h_v	0.6411	ft H2O
Flow area	1.1378	ft^2
Wetted perimeter	2.7012	ft
Hydraulic radius	0.4212	ft
Top width, T	1.4605	ft
Froude number, F	1.28	
Shear stress (tractive force), tau	0.2630	psf



Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe run 11

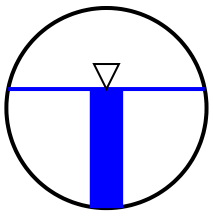
24" RCP @ 1.00%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	59.5	%

Results

Flow, Q	15.0032	cfs
Velocity, v	7.7001	ft/sec
Velocity head, h_v	0.9215	ft H2O
Flow area	1.9485	ft^2
Wetted perimeter	3.5239	ft
Hydraulic radius	0.5529	ft
Top width, T	1.9635	ft
Froude number, F	1.36	
Shear stress (tractive force), tau	0.3452	psf



Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe Run 12

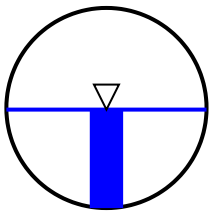
24" RCP 1.00%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	49.2	%

Results

Flow, Q (See notes)	11.0036	cfs
Velocity, v	7.1510	ft/sec
Velocity head, h_v	0.7947	ft H2O
Flow area	1.5388	ft^2
Wetted perimeter	3.1096	ft
Hydraulic radius	0.4949	ft
Top width, T	1.9997	ft
Froude number, F	1.44	
Average shear stress (tractive force), tau	0.3089	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 12

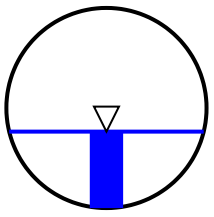
24" RCP" @ 1.00%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	38.2	%

Results

Flow, Q (See notes)	7.0037	cfs
Velocity, v	6.3486	ft/sec
Velocity head, h_v	0.6264	ft H2O
Flow area	1.1032	ft^2
Wetted perimeter	2.6651	ft
Hydraulic radius	0.4139	ft
Top width, T	1.9435	ft
Froude number, F	1.49	
Average shear stress (tractive force), tau	0.2584	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Duplicate sheet for Pipe Run 12. Please delete whichever one is not needed.

REMOVED

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe Run 13

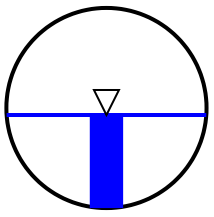
30" RCP 1.00%

Inputs

Pipe diameter, d_0	30	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	46.5	%

Results

Flow, Q (See notes)	18.0963	cfs
Velocity, v	8.0942	ft/sec
Velocity head, h_v	1.0182	ft H2O
Flow area	2.2358	ft^2
Wetted perimeter	3.7518	ft
Hydraulic radius	0.5959	ft
Top width, T	2.4938	ft
Froude number, F	1.51	
Average shear stress (tractive force), tau	0.3720	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 14

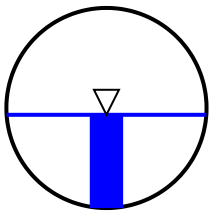
24" RCP" @ 1.00%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	46.6	%

Results

Flow, Q (See notes)	10.0183	cfs
Velocity, v	6.9821	ft/sec
Velocity head, h_v	0.7576	ft H2O
Flow area	1.4349	ft^2
Wetted perimeter	3.0055	ft
Hydraulic radius	0.4774	ft
Top width, T	1.9954	ft
Froude number, F	1.45	
Average shear stress (tractive force), tau	0.2981	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe Run 15

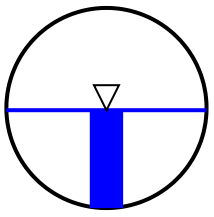
36" RCP 1.00%

Inputs

Pipe diameter, d_0	36	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	48.9	%

Results

Flow, Q (See notes)	32.1044	cfs
Velocity, v	9.3457	ft/sec
Velocity head, h_v	1.3575	ft H2O
Flow area	3.4353	ft^2
Wetted perimeter	4.6463	ft
Hydraulic radius	0.7393	ft
Top width, T	2.9992	ft
Froude number, F	1.54	
Average shear stress (tractive force), tau	0.4616	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe run 16

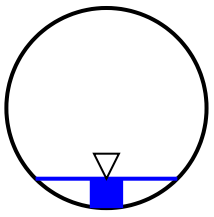
18" RCP @ 17.80%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	.013	
Pressure slope (possibly ? equal to pipe slope), S_0	17.8	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	14.7	%

Results

Flow, Q	2.0660	cfs
Velocity, v	12.7995	ft/sec
Velocity head, h_v	2.5462	ft H2O
Flow area	0.1614	ft^2
Wetted perimeter	1.1804	ft
Hydraulic radius	0.1367	ft
Top width, T	1.0623	ft
Froude number, F	5.83	
Shear stress (tractive force), tau	1.5195	psf



Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe Run 17

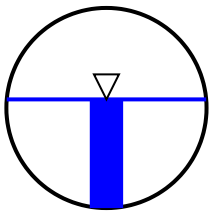
36" RCP 0.70%

Inputs

Pipe diameter, d_0	36	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	.7	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	54.3	%

Results

Flow, Q (See notes)	32.0084	cfs
Velocity, v	8.1640	ft/sec
Velocity head, h_v	1.0359	ft H2O
Flow area	3.9209	ft^2
Wetted perimeter	4.9707	ft
Hydraulic radius	0.7888	ft
Top width, T	2.9889	ft
Froude number, F	1.26	
Average shear stress (tractive force), tau	0.3447	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Missing pipe run for 17A

ADDED

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe run 18

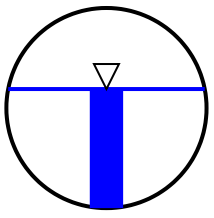
24" RCP @ 1.00%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	59.5	%

Results

Flow, Q	15.0032	cfs
Velocity, v	7.7001	ft/sec
Velocity head, h_v	0.9215	ft H2O
Flow area	1.9485	ft^2
Wetted perimeter	3.5239	ft
Hydraulic radius	0.5529	ft
Top width, T	1.9635	ft
Froude number, F	1.36	
Shear stress (tractive force), tau	0.3452	psf



Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 19

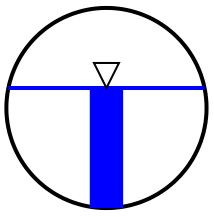
18" RCP" @ 1.00%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.0	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	60	%

Results

Flow, Q (See notes)	7.0566	cfs
Velocity, v	6.3743	ft/sec
Velocity head, h_v	0.6315	ft H2O
Flow area	1.1071	ft^2
Wetted perimeter	2.6582	ft
Hydraulic radius	0.4165	ft
Top width, T	1.4697	ft
Froude number, F	1.29	
Average shear stress (tractive force), tau	0.2600	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 20

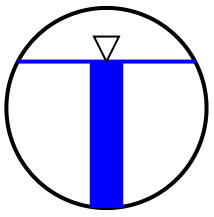
24" RCP" @ 1.00%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.0	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	73.2	%

Results

Flow, Q (See notes)	20.0390	cfs
Velocity, v	8.1319	ft/sec
Velocity head, h_v	1.0277	ft H2O
Flow area	2.4644	ft^2
Wetted perimeter	4.1066	ft
Hydraulic radius	0.6001	ft
Top width, T	1.7717	ft
Froude number, F	1.22	
Average shear stress (tractive force), tau	0.3746	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 21

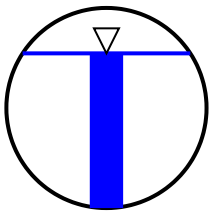
18" RCP" @ 2.00%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	2	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	77.3	%

Results

Flow, Q (See notes)	14.0127	cfs
Velocity, v	9.5603	ft/sec
Velocity head, h_v	1.4205	ft H2O
Flow area	1.4658	ft^2
Wetted perimeter	3.2225	ft
Hydraulic radius	0.4548	ft
Top width, T	1.2567	ft
Froude number, F	1.56	
Average shear stress (tractive force), tau	0.5679	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 22

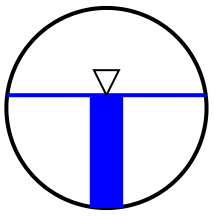
30" RCP @ 1.85%

Inputs

Pipe diameter, d_0	30	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.85	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	56.4	%

Results

Flow, Q (See notes)	34.0208	cfs
Velocity, v	11.9238	ft/sec
Velocity head, h_v	2.2097	ft H2O
Flow area	2.8533	ft^2
Wetted perimeter	4.2478	ft
Hydraulic radius	0.6717	ft
Top width, T	2.4794	ft
Froude number, F	1.96	
Average shear stress (tractive force), tau	0.7758	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 23

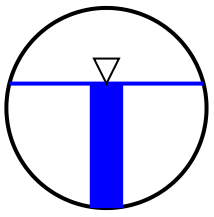
24" RCP" @ 1.00%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.0	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	62.2	%

Results

Flow, Q (See notes)	16.0460	cfs
Velocity, v	7.8127	ft/sec
Velocity head, h_v	0.9486	ft H2O
Flow area	2.0539	ft^2
Wetted perimeter	3.6345	ft
Hydraulic radius	0.5651	ft
Top width, T	1.9395	ft
Froude number, F	1.34	
Average shear stress (tractive force), tau	0.3528	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 24

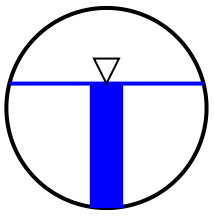
24" RCP" @ 1.00%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.0	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	62.2	%

Results

Flow, Q (See notes)	16.0460	cfs
Velocity, v	7.8127	ft/sec
Velocity head, h_v	0.9486	ft H2O
Flow area	2.0539	ft^2
Wetted perimeter	3.6345	ft
Hydraulic radius	0.5651	ft
Top width, T	1.9395	ft
Froude number, F	1.34	
Average shear stress (tractive force), tau	0.3528	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 25

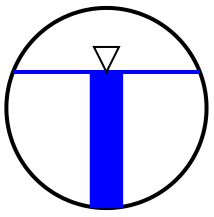
30" RCP" @ 1.00%

Inputs

Pipe diameter, d_0	30	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.0	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	68	%

Results

Flow, Q (See notes)	33.0363	cfs
Velocity, v	9.2943	ft/sec
Velocity head, h_v	1.3426	ft H2O
Flow area	3.5546	ft^2
Wetted perimeter	4.8476	ft
Hydraulic radius	0.7332	ft
Top width, T	2.3324	ft
Froude number, F	1.33	
Average shear stress (tractive force), tau	0.4578	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 26

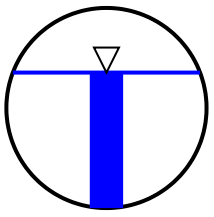
36" RCP" @ 1.36%

Inputs

Pipe diameter, d_0	36	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.35	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	67.7	%

Results

Flow, Q (See notes)	62.0431	cfs
Velocity, v	12.1815	ft/sec
Velocity head, h_v	2.3062	ft H2O
Flow area	5.0934	ft^2
Wetted perimeter	5.7979	ft
Hydraulic radius	0.8785	ft
Top width, T	2.8057	ft
Froude number, F	1.59	
Average shear stress (tractive force), tau	0.7404	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

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Pipe run 27

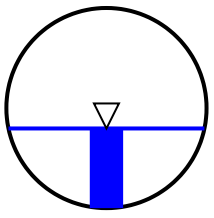
18" RCP @ 3.00%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	3.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	39.8	%

Results

Flow, Q	6.0746	cfs
Velocity, v	9.2649	ft/sec
Velocity head, h_v	1.3341	ft H2O
Flow area	0.6557	ft^2
Wetted perimeter	2.0480	ft
Hydraulic radius	0.3201	ft
Top width, T	1.4684	ft
Froude number, F	2.45	
Shear stress (tractive force), tau	0.5996	psf



Manning Formula Uniform Pipe Flow at Given Slope and Depth

Check out our spreadsheet version of this calculator Download Spreadsheet Open Google Sheets version View All Spreadsheets

Pipe run 28

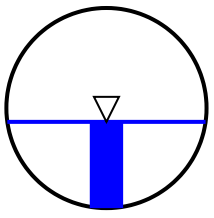
18" RCP @ 3.00%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	3.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	43.1	%

Results

Flow, Q	7.0177	cfs
Velocity, v	9.6292	ft/sec
Velocity head, h_v	1.4411	ft H2O
Flow area	0.7288	ft^2
Wetted perimeter	2.1485	ft
Hydraulic radius	0.3392	ft
Top width, T	1.4856	ft
Froude number, F	2.42	
Shear stress (tractive force), tau	0.6353	psf



Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 29

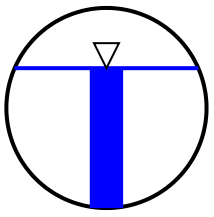
36" RCP" @ 1.67%

Inputs

Pipe diameter, d_0	36	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.67	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	69.9	%

Results

Flow, Q (See notes)	72.0225	cfs
Velocity, v	13.6493	ft/sec
Velocity head, h_v	2.8955	ft H2O
Flow area	5.2769	ft^2
Wetted perimeter	5.9403	ft
Hydraulic radius	0.8883	ft
Top width, T	2.7521	ft
Froude number, F	1.74	
Average shear stress (tractive force), tau	0.9261	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 30

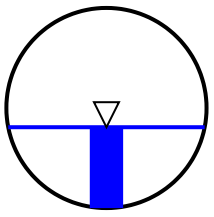
24" RCP" @ 4.26%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	4.26	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	40.4	%

Results

Flow, Q (See notes)	16.0217	cfs
Velocity, v	13.4735	ft/sec
Velocity head, h_v	2.8214	ft H2O
Flow area	1.1892	ft^2
Wetted perimeter	2.7552	ft
Hydraulic radius	0.4316	ft
Top width, T	1.9628	ft
Froude number, F	3.05	
Average shear stress (tractive force), tau	1.1479	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 31

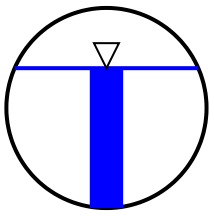
42" RCP" @ 1.00%

Inputs

Pipe diameter, d_0	42	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	69.9	%

Results

Flow, Q (See notes)	84.0687	cfs
Velocity, v	11.7053	ft/sec
Velocity head, h_v	2.1294	ft H2O
Flow area	7.1824	ft^2
Wetted perimeter	6.9304	ft
Hydraulic radius	1.0363	ft
Top width, T	3.2108	ft
Froude number, F	1.38	
Average shear stress (tractive force), tau	0.6470	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 32

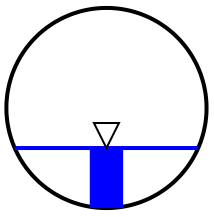
18" RCP" @ 11.70%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	11.70	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	30	%

Results

Flow, Q (See notes)	7.0356	cfs
Velocity, v	15.7797	ft/sec
Velocity head, h_v	3.8699	ft H2O
Flow area	0.4459	ft^2
Wetted perimeter	1.7389	ft
Hydraulic radius	0.2564	ft
Top width, T	1.3748	ft
Froude number, F	4.90	
Average shear stress (tractive force), tau	1.8729	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 33

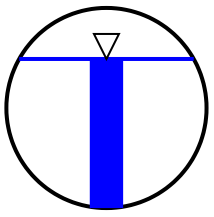
42" RCP" @ 1.00%

Inputs

Pipe diameter, d_0	42	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	74.5	%

Results

Flow, Q (See notes)	91.0199	cfs
Velocity, v	11.8412	ft/sec
Velocity head, h_v	2.1792	ft H2O
Flow area	7.6871	ft^2
Wetted perimeter	7.2900	ft
Hydraulic radius	1.0544	ft
Top width, T	3.0510	ft
Froude number, F	1.32	
Average shear stress (tractive force), tau	0.6583	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 34

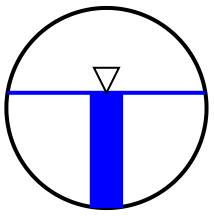
24" RCP" @ 0.40%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.4	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	57.6	%

Results

Flow, Q (See notes)	9.0211	cfs
Velocity, v	4.8149	ft/sec
Velocity head, h_v	0.3603	ft H2O
Flow area	1.8736	ft^2
Wetted perimeter	3.4467	ft
Hydraulic radius	0.5436	ft
Top width, T	1.9767	ft
Froude number, F	0.87	
Average shear stress (tractive force), tau	0.1357	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 34A

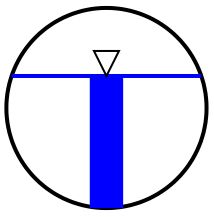
30" RCP" @ 0.40%

Inputs

Pipe diameter, d_0	30	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	0.4	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	66	%

Results

Flow, Q (See notes)	20.0495	cfs
Velocity, v	5.8336	ft/sec
Velocity head, h_v	0.5289	ft H2O
Flow area	3.4371	ft^2
Wetted perimeter	4.7413	ft
Hydraulic radius	0.7249	ft
Top width, T	2.3685	ft
Froude number, F	0.85	
Average shear stress (tractive force), tau	0.1810	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 35

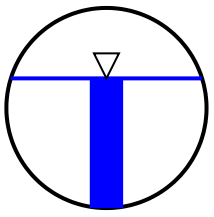
36" RCP @ 1.34%

Inputs

Pipe diameter, d_0	36	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.34	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	64.8	%

Results

Flow, Q (See notes)	58.1391	cfs
Velocity, v	11.9963	ft/sec
Velocity head, h_v	2.2366	ft H2O
Flow area	4.8466	ft^2
Wetted perimeter	5.6138	ft
Hydraulic radius	0.8633	ft
Top width, T	2.8655	ft
Froude number, F	1.63	
Average shear stress (tractive force), tau	0.7222	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 37

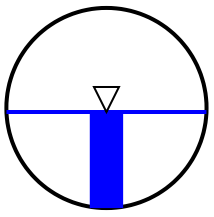
15" HDPE @ 1%

Inputs

Pipe diameter, d_0	15	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	48	%

Results

Flow, Q (See notes)	3.0116	cfs
Velocity, v	5.1715	ft/sec
Velocity head, h_v	0.4157	ft H2O
Flow area	0.5824	ft^2
Wetted perimeter	1.9135	ft
Hydraulic radius	0.3043	ft
Top width, T	1.2490	ft
Froude number, F	1.34	
Average shear stress (tractive force), tau	0.1900	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 38

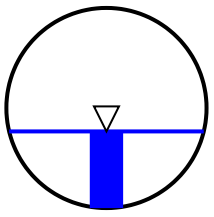
15" HDPE @ 1%

Inputs

Pipe diameter, d_0	15	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	38.3	%

Results

Flow, Q (See notes)	2.0096	cfs
Velocity, v	4.6470	ft/sec
Velocity head, h_v	0.3356	ft H2O
Flow area	0.4325	ft^2
Wetted perimeter	1.6682	ft
Hydraulic radius	0.2592	ft
Top width, T	1.2153	ft
Froude number, F	1.37	
Average shear stress (tractive force), tau	0.1618	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 39

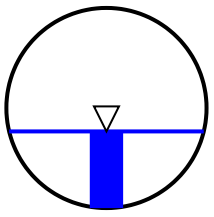
15" HDPE @ 1%

Inputs

Pipe diameter, d_0	15	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	38.3	%

Results

Flow, Q (See notes)	2.0096	cfs
Velocity, v	4.6470	ft/sec
Velocity head, h_v	0.3356	ft H2O
Flow area	0.4325	ft^2
Wetted perimeter	1.6682	ft
Hydraulic radius	0.2592	ft
Top width, T	1.2153	ft
Froude number, F	1.37	
Average shear stress (tractive force), tau	0.1618	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 40

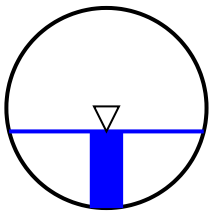
15" HDPE @ 1%

Inputs

Pipe diameter, d_0	15	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	38.3	%

Results

Flow, Q (See notes)	2.0096	cfs
Velocity, v	4.6470	ft/sec
Velocity head, h_v	0.3356	ft H2O
Flow area	0.4325	ft^2
Wetted perimeter	1.6682	ft
Hydraulic radius	0.2592	ft
Top width, T	1.2153	ft
Froude number, F	1.37	
Average shear stress (tractive force), tau	0.1618	psf

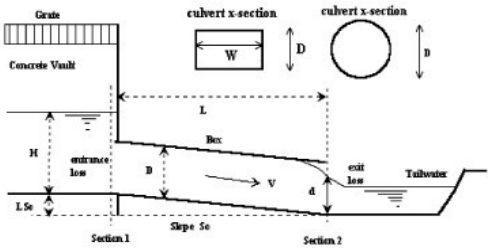


Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: WATERBURY FILING 1
Basin ID: Design Point 11- Dual 42" RCP Culverts
Status:



Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	42	inches
	Inlet Edge Type (choose from pull-down list)		Grooved End Projection	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	Height (Rise) =		ft.
	Barrel Width (Span) in Feet	Width (Span) =		ft.
	Inlet Edge Type (choose from pull-down list)		Square Edge w/ 90-15 Deg. Headwall	
	Number of Barrels	No =	2	
	Inlet Elevation at Culvert Invert	Inlet Elev =	6935.82	ft. elev.
	Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)	Outlet Elev =	6934.18	ft. elev.
	Culvert Length in Feet	L =	128	ft.
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.75
Sum of All Loss Coefficients	K_s =	1.95
Orifice Inlet Condition Coefficient	C_d =	0.95
Minimum Energy Condition Coefficient	KE_{low} =	-0.0310

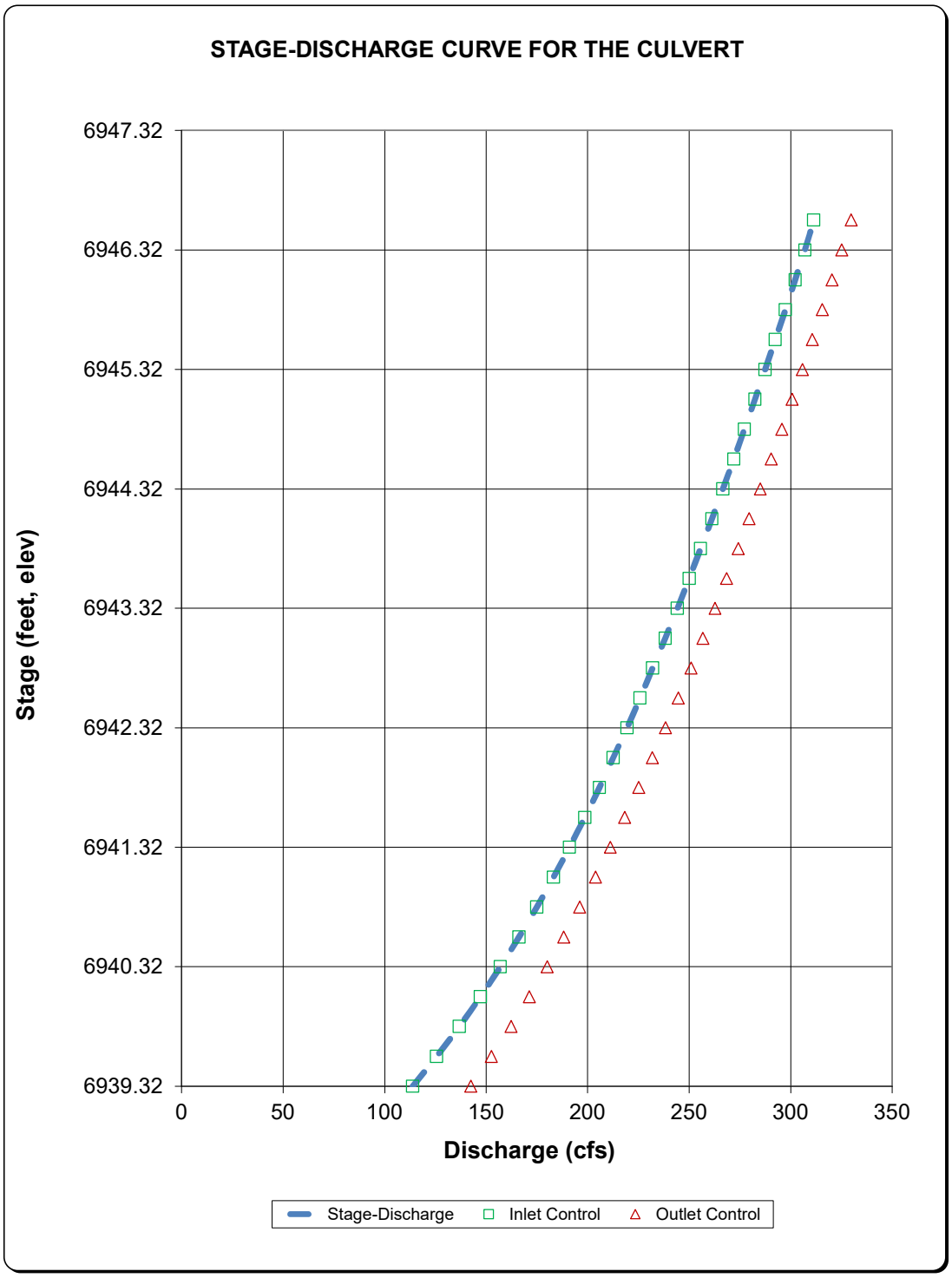
Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
6939.32		113.80	142.47	**113.80**	Regression Eqn.	INLET
6939.57		125.60	152.60	**125.60**	Regression Eqn.	INLET
6939.82		136.80	162.28	**136.80**	Regression Eqn.	INLET
6940.07		147.20	171.28	**147.20**	Regression Eqn.	INLET
6940.32		157.00	180.05	**157.00**	Regression Eqn.	INLET
6940.57		166.20	188.25	**166.20**	Regression Eqn.	INLET
6940.82		175.00	196.11	**175.00**	Regression Eqn.	INLET
6941.07		183.20	203.85	**183.20**	Regression Eqn.	INLET
6941.32		191.00	211.14	**191.00**	Regression Eqn.	INLET
6941.57		198.60	218.20	**198.60**	Regression Eqn.	INLET
6941.82		205.80	225.15	**205.80**	Regression Eqn.	INLET
6942.07		212.60	231.86	**212.60**	Regression Eqn.	INLET
6942.32		219.40	238.36	**219.40**	Regression Eqn.	INLET
6942.57		225.80	244.62	**225.80**	Regression Eqn.	INLET
6942.82		232.00	250.88	**232.00**	Regression Eqn.	INLET
6943.07		238.20	256.81	**238.20**	Regression Eqn.	INLET
6943.32		244.20	262.73	**244.20**	Regression Eqn.	INLET
6943.57		250.00	268.42	**250.00**	Regression Eqn.	INLET
6943.82		255.60	274.12	**255.60**	Regression Eqn.	INLET
6944.07		261.20	279.58	**261.20**	Regression Eqn.	INLET
6944.32		266.60	285.05	**266.60**	Regression Eqn.	INLET
6944.57		272.00	290.40	**272.00**	Regression Eqn.	INLET
6944.82		277.20	295.64	**277.20**	Regression Eqn.	INLET
6945.07		282.40	300.76	**282.40**	Regression Eqn.	INLET
6945.32		287.40	305.77	**287.40**	Regression Eqn.	INLET
6945.57		292.40	310.67	**292.40**	Regression Eqn.	INLET
6945.82		297.40	315.57	**297.40**	Regression Eqn.	INLET
6946.07		302.20	320.35	**302.20**	Regression Eqn.	INLET
6946.32		307.00	325.13	**307.00**	Regression Eqn.	INLET
6946.57		311.40	329.80	**311.40**	Orifice Eqn.	INLET

Processing Time: 27.79 Seconds

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

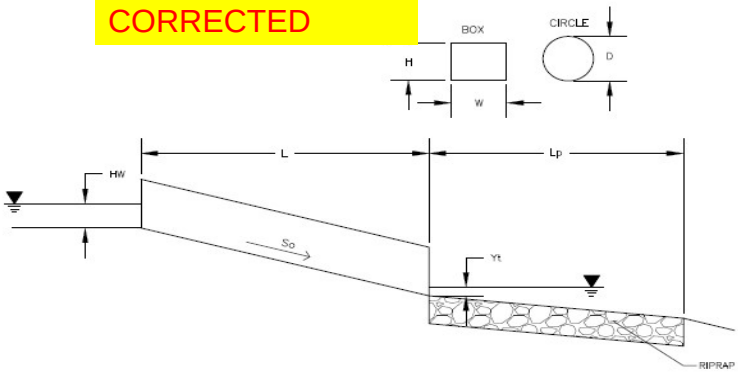
Project: WATERBURY FILING 1
Basin ID: Design Point 11- Dual 42" RCP Culverts



Determination of Culvert Headwater and Outlet Protection

Project: Timberridge Estates
Basin ID: Design Point 11- Dual 42" RCP Culverts

CORRECTED



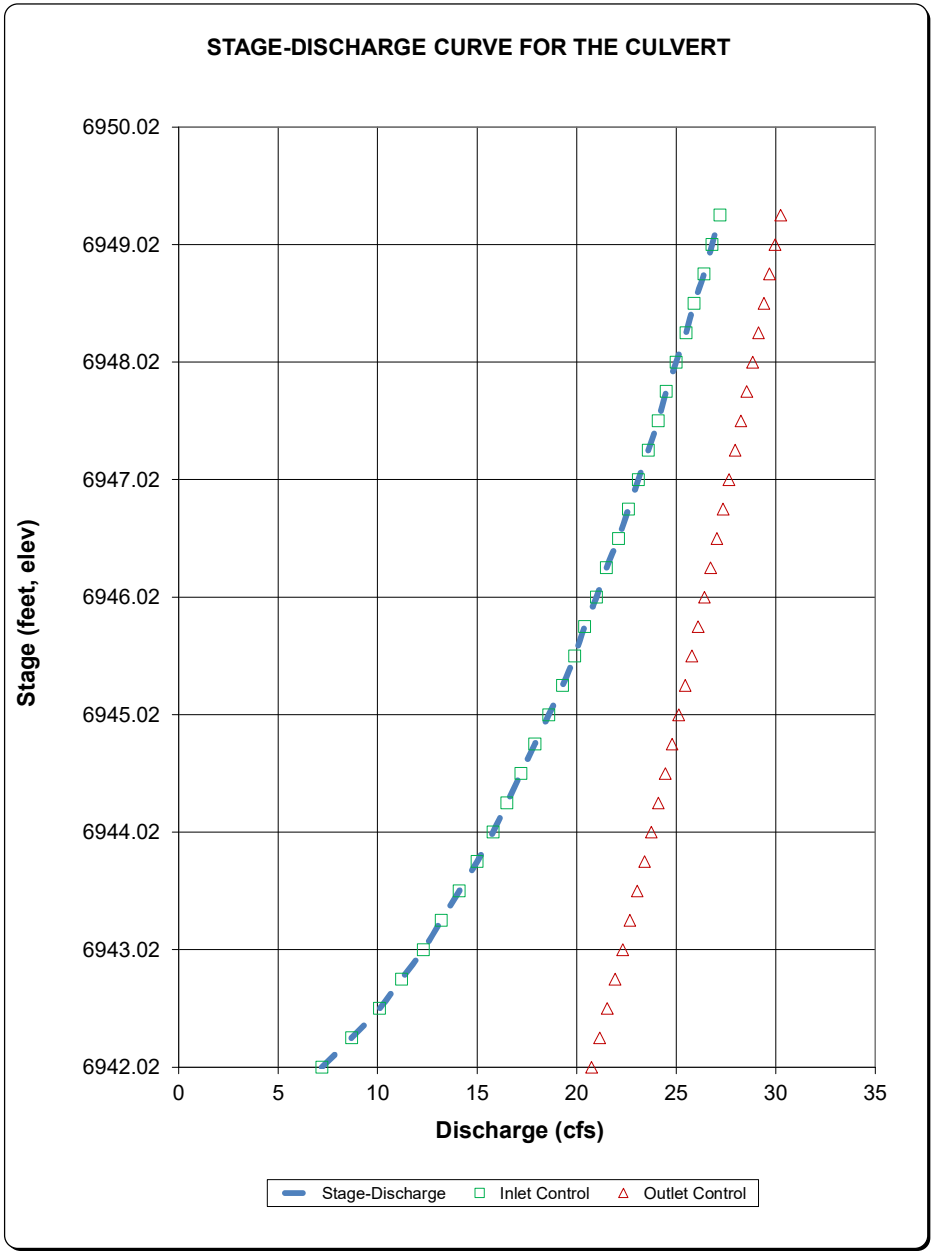
Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Design Information (Input):

	Design Discharge	Q =	213	cfs
Circular Culvert:				
	Barrel Diameter in Inches	D =	24	inches
	Inlet Edge Type (Choose from pull-down list)	Grooved End Projection		
Box Culvert:		**OR**		
	Barrel Height (Rise) in Feet	Height (Rise) =		ft
	Barrel Width (Span) in Feet	Width (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	No =	2	
	Inlet Elevation	Elev IN =	6935.82	ft
	Outlet Elevation **OR** Slope	Elev OUT =	6934.18	ft
	Culvert Length	L =	128	ft
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	k_b =	0	
	Exit Loss Coefficient	k_x =	1	
	Tailwater Surface Elevation	Elev Y_t =		ft
	Max Allowable Channel Velocity	V =	5	ft/s

Required Protection (Output):

Tailwater Surface Height	Y_t =	0.80	ft
Flow Area at Max Channel Velocity	A_t =	21.28	ft^2
Culvert Cross Sectional Area Available	A =	3.14	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	1.58	
Sum of All Losses Coefficients	k_s =	2.78	ft
Culvert Normal Depth	Y_n =	0.56	ft
Culvert Critical Depth	Y_c =	2.00	ft
Tailwater Depth for Design	d =	2.00	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	-	ft
Expansion Factor	1/(2*tan(Θ)) =	1.85	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	18.81	$ft^{0.5}/s$
Froude Number	Fr =	-	**Pressure flow!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.40	
Inlet Control Headwater	HW_I =	40.47	ft
Outlet Control Headwater	HW_O =	49.90	
Design Headwater Elevation	**HW =**	**6,985.72**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**24.95**	**HW/D > 1.5!**
Minimum Theoretical Riprap Size	d_{50} =	31	in
Nominal Riprap Size	d_{50} =	-	in
UDFCD Riprap Type	**Type =**	**Very Big**	
Length of Protection	**L_p =**	**27**	**ft**
Width of Protection	**T =**	**17**	**ft**


STAGE-DISCHARGE CURVE FOR THE CULVERT
Stage (feet, elev)
6950.02
6949.02
6948.02
6947.02
6946.02
6945.02
6944.02
6943.02
6942.02
0
5
10
15
20
25
30
35
Discharge (cfs)
Stage-Discharge
Inlet Control
Outlet Control

Determination of Culvert Headwater and Outlet Protection

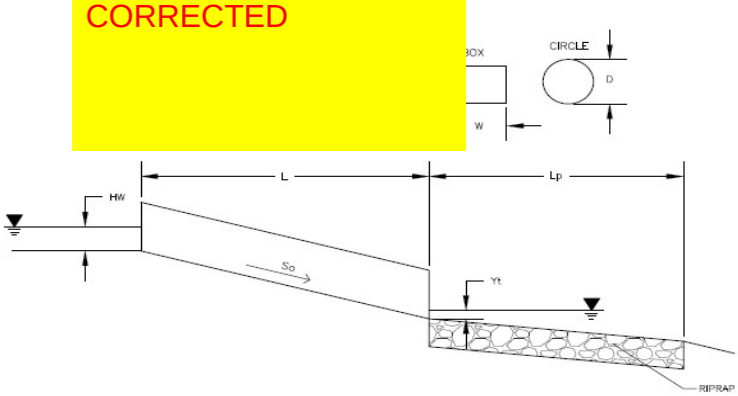
Project: Timberridge Estates

Basin ID: Design Point 12- 18" RCP Culvert

CORRECTED

ADDED

Missing Culvert Stage-Discharge Sizing sheet with graph. Please add back in.



Soil Type:

Choose One:
- (●) Sandy
- ( ) Non-Sandy

Supercritical Flow! Using Da to calculate protection type.

Design Information (Input):

	Design Discharge	Q =	4	cfs
Circular Culvert:				
	Barrel Diameter in Inches	D =	18	inches
	Inlet Edge Type (Choose from pull-down list)		Grooved End Projection	
Box Culvert:			**OR**	
	Barrel Height (Rise) in Feet	Height (Rise) =		ft
	Barrel Width (Span) in Feet	Width (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	No =	1	
	Inlet Elevation	Elev IN =	6940.52	ft
	Outlet Elevation **OR** Slope	Elev OUT =	6934.07	ft
	Culvert Length	L =	200	ft
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	k_b =	0	
	Exit Loss Coefficient	k_x =	1	
	Tailwater Surface Elevation	Elev Y_t =		ft
	Max Allowable Channel Velocity	V =	5	ft/s

Per hydrology spreadsheet Q is 7 cfs and 24" rcp per pipe sizing calculations.

I HAVE 4 CFS ON MY HYDROLOGY SHEETS AND 18" RCP

Required Protection (Output):

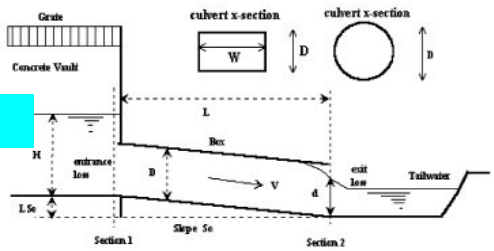
Tailwater Surface Height	Y_t =	0.60	ft
Flow Area at Max Channel Velocity	A_t =	0.88	ft^2
Culvert Cross Sectional Area Available	A =	1.77	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	3.62	
Sum of All Losses Coefficients	k_s =	4.82	ft
Culvert Normal Depth	Y_n =	0.49	ft
Culvert Critical Depth	Y_c =	0.80	ft
Tailwater Depth for Design	d =	1.15	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	1.00	ft
Expansion Factor	1/(2*tan(Θ)) =	6.70	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	1.60	$ft^{0.5}/s$
Froude Number	Fr =	2.57	**Supercritical!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.60	
Inlet Control Headwater	HW_I =	1.13	ft
Outlet Control Headwater	HW_O =	-4.83	
Design Headwater Elevation	**HW =**	**6,941.65**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**0.76**	
Minimum Theoretical Riprap Size	d_{50} =	2	in
Nominal Riprap Size	d_{50} =	6	in
UDFCD Riprap Type	**Type =**	**VL**	
Length of Protection	**L_p =**	**5**	**ft**
Width of Protection	**T =**	**3**	**ft**

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: WATERBURY FILING 1
Basin ID: Design Point 30- Triple 36" RCP Culverts
Status:

it is DP 30
Pipe run 36

Update to DP 36



Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	36	inches
	Inlet Edge Type (choose from pull-down list)		Grooved End Projection	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	Height (Rise) =		ft.
	Barrel Width (Span) in Feet	Width (Span) =		ft.
	Inlet Edge Type (choose from pull-down list)		Square Edge w/ 90-15 Deg. Headwall	
	Number of Barrels	No =	3	
	Inlet Elevation at Culvert Invert	Inlet Elev =	6920	ft. elev.
	Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)	Outlet Elev =	6919	ft. elev.
	Culvert Length in Feet	L =	130	ft.
	Manning's Roughness	n =	0.013	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.93
Sum of All Loss Coefficients	K_s =	2.13
Orifice Inlet Condition Coefficient	C_d =	0.95
Minimum Energy Condition Coefficient	KE_{low} =	-0.0132

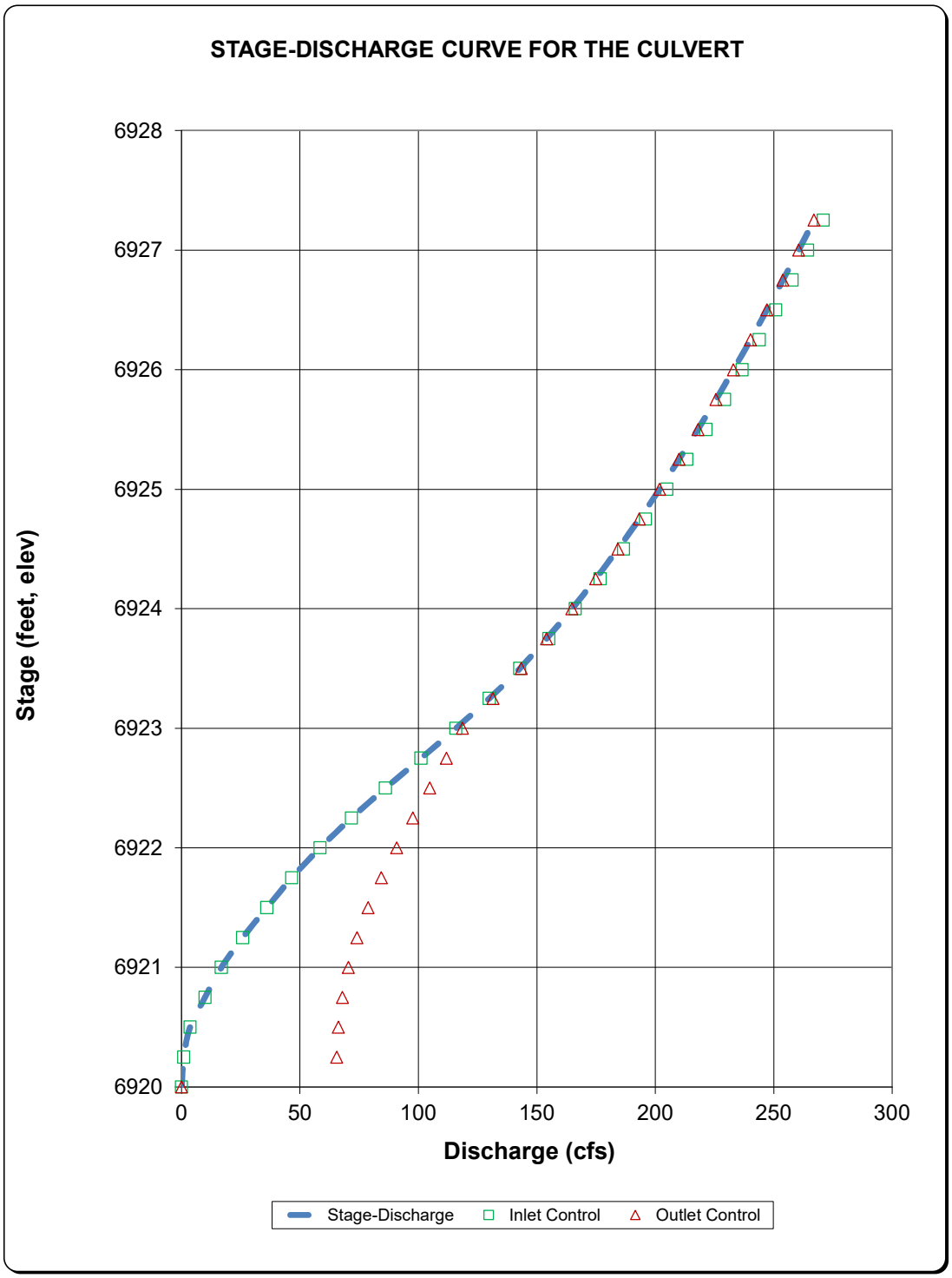
Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
6920.00		0.00	0.00	**0.00**	No Flow (WS < inlet)	N/A
6920.25		0.90	65.46	**0.90**	Min. Energy. Eqn.	INLET
6920.50		3.60	66.25	**3.60**	Min. Energy. Eqn.	INLET
6920.75		9.90	67.92	**9.90**	Min. Energy. Eqn.	INLET
6921.00		16.80	70.46	**16.80**	Min. Energy. Eqn.	INLET
6921.25		25.80	74.06	**25.80**	Min. Energy. Eqn.	INLET
6921.50		36.00	78.71	**36.00**	Min. Energy. Eqn.	INLET
6921.75		46.50	84.33	**46.50**	Regression Eqn.	INLET
6922.00		58.50	90.82	**58.50**	Regression Eqn.	INLET
6922.25		71.70	97.66	**71.70**	Regression Eqn.	INLET
6922.50		86.10	104.77	**86.10**	Regression Eqn.	INLET
6922.75		101.10	111.79	**101.10**	Regression Eqn.	INLET
6923.00		115.80	118.55	**115.80**	Regression Eqn.	INLET
6923.25		129.90	131.45	**129.90**	Regression Eqn.	INLET
6923.50		142.80	143.38	**142.80**	Regression Eqn.	INLET
6923.75		155.10	154.08	**154.08**	Regression Eqn.	OUTLET
6924.00		166.20	164.79	**164.79**	Regression Eqn.	OUTLET
6924.25		176.70	174.79	**174.79**	Regression Eqn.	OUTLET
6924.50		186.60	184.18	**184.18**	Regression Eqn.	OUTLET
6924.75		195.90	193.22	**193.22**	Regression Eqn.	OUTLET
6925.00		204.90	201.82	**201.82**	Regression Eqn.	OUTLET
6925.25		213.30	209.98	**209.98**	Regression Eqn.	OUTLET
6925.50		221.40	217.97	**217.97**	Regression Eqn.	OUTLET
6925.75		229.20	225.60	**225.60**	Regression Eqn.	OUTLET
6926.00		236.70	232.97	**232.97**	Regression Eqn.	OUTLET
6926.25		243.90	240.17	**240.17**	Regression Eqn.	OUTLET
6926.50		250.80	247.10	**247.10**	Regression Eqn.	OUTLET
6926.75		257.70	253.85	**253.85**	Regression Eqn.	OUTLET
6927.00		264.30	260.52	**260.52**	Regression Eqn.	OUTLET
6927.25		270.90	266.93	**266.93**	Regression Eqn.	OUTLET

Processing Time: 00.91 Seconds

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

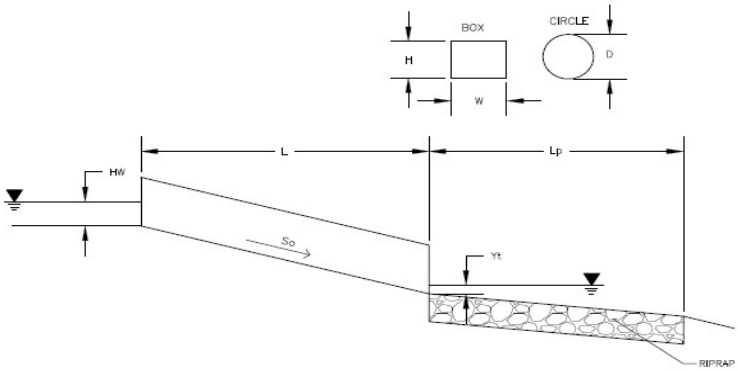
Project: WATERBURY FILING 1
Basin ID: Design Point 30- Triple 36" RCP Culverts



FIXED

Determination of Culvert Headwater and Outlet Protection

Project: Timberridge Estates
Basin ID: Design Point 30- Triple 36" RCP Culverts



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Design Information (Input):

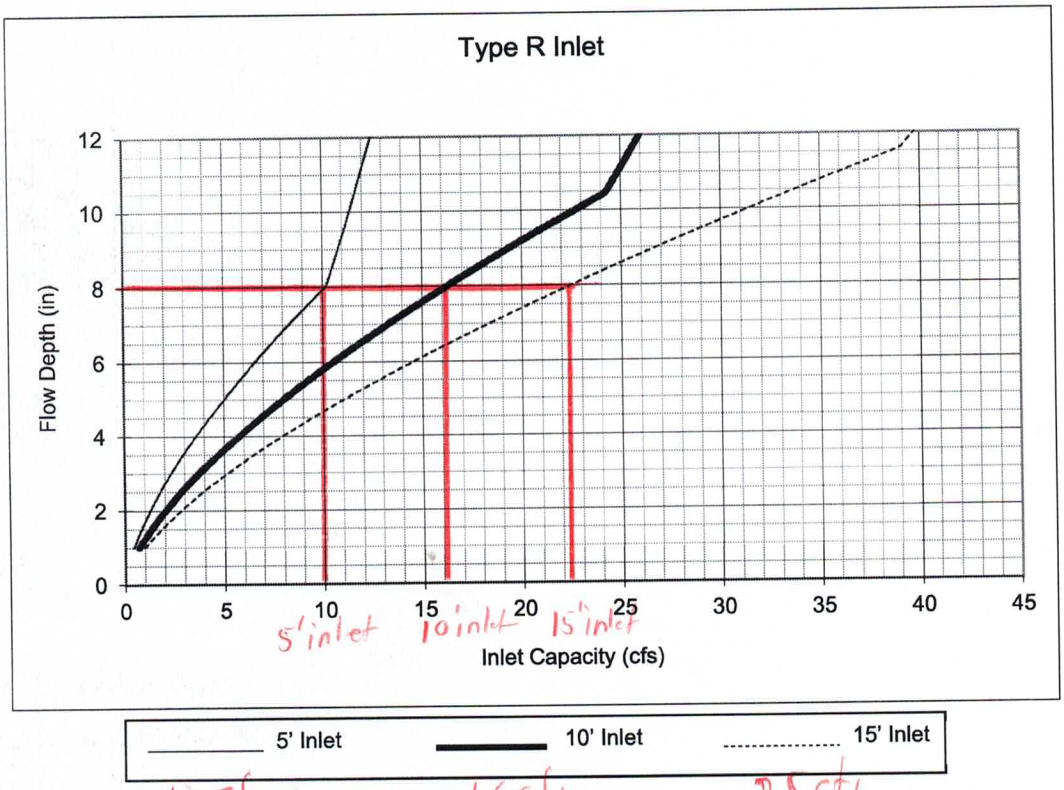
Design Discharge	Q =	204.31	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	36	inches
Inlet Edge Type (Choose from pull-down list)	Grooved End Projection		
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =		ft
Barrel Width (Span) in Feet	Width (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	No =	3	
Inlet Elevation	Elev IN =	6920	ft
Outlet Elevation **OR** Slope	Elev OUT =	6919	ft
Culvert Length	L =	133.5	ft
Manning's Roughness	n =	0.013	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =	6920	ft
Max Allowable Channel Velocity	V =	5	ft/s

Required Protection (Output):

Tailwater Surface Height	Y_t =	1.00	ft
Flow Area at Max Channel Velocity	A_t =	13.62	ft^2
Culvert Cross Sectional Area Available	A =	7.07	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	0.96	
Sum of All Losses Coefficients	k_s =	2.16	ft
Culvert Normal Depth	Y_n =	2.11	ft
Culvert Critical Depth	Y_c =	2.63	ft
Tailwater Depth for Design	d =	2.82	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	-	ft
Expansion Factor	1/(2*tan(Θ)) =	2.32	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	4.37	$ft^{0.5}/s$
Froude Number	Fr =	-	**Pressure flow!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.33	
Inlet Control Headwater	HW_I =	4.99	ft
Outlet Control Headwater	HW_O =	4.93	
Design Headwater Elevation	**HW =**	**6,924.99**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.66**	**HW/D > 1.5!**
Minimum Theoretical Riprap Size	d_{50} =	14	in
Nominal Riprap Size	d_{50} =	18	in
UDFCD Riprap Type	**Type =**	**H**	
Length of Protection	**L_p =**	**25**	**ft**
Width of Protection	**T =**	**14**	**ft**

PDR
INLET CALCULATIONS

Figure 8-11. Inlet Capacity Chart Sump Conditions , Curb Opening (Type R) Inlet



10 cfs 16 cfs 25 cfs

DP19 Q_{100} = 5 cfs < 10 cfs → 10' Inlet ok
DP20 Q_{100} = 5 cfs < 10 cfs → 5' Inlet ok
~~DP21 Q_{100} = 6 cfs < 10 cfs~~
DP 22 Q_{100} = 7 cfs < 10 cfs → 10' Inlet ok
DP 23 Q_{100} = 1 cfs < 10 cfs → 10' Inlet ok
DP 24 Q_{100} = 6 cfs < 10 cfs → 5' Inlet ok
DP 25 Q_{100} = 5 cfs < 10 cfs → 10' Inlet ok
DP 26 Q_{100} = 16 cfs ≤ 16 cfs → 10' Inlet ok
DP 27 Q_{100} = 7 cfs < 10 cfs → 5' Inlet ok
DP28 Q_{100} = 18 cfs/2 = 9 cfs → 2-10' Inlets

Notes:

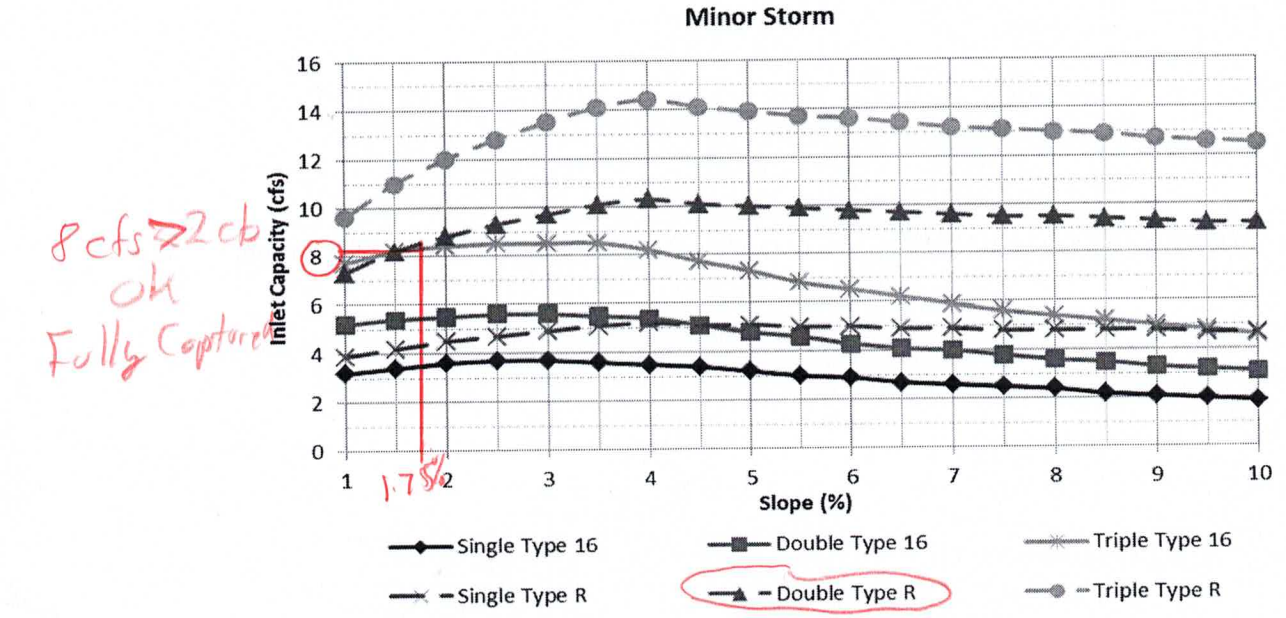
1. The standard inlet parameters must apply to use this chart.

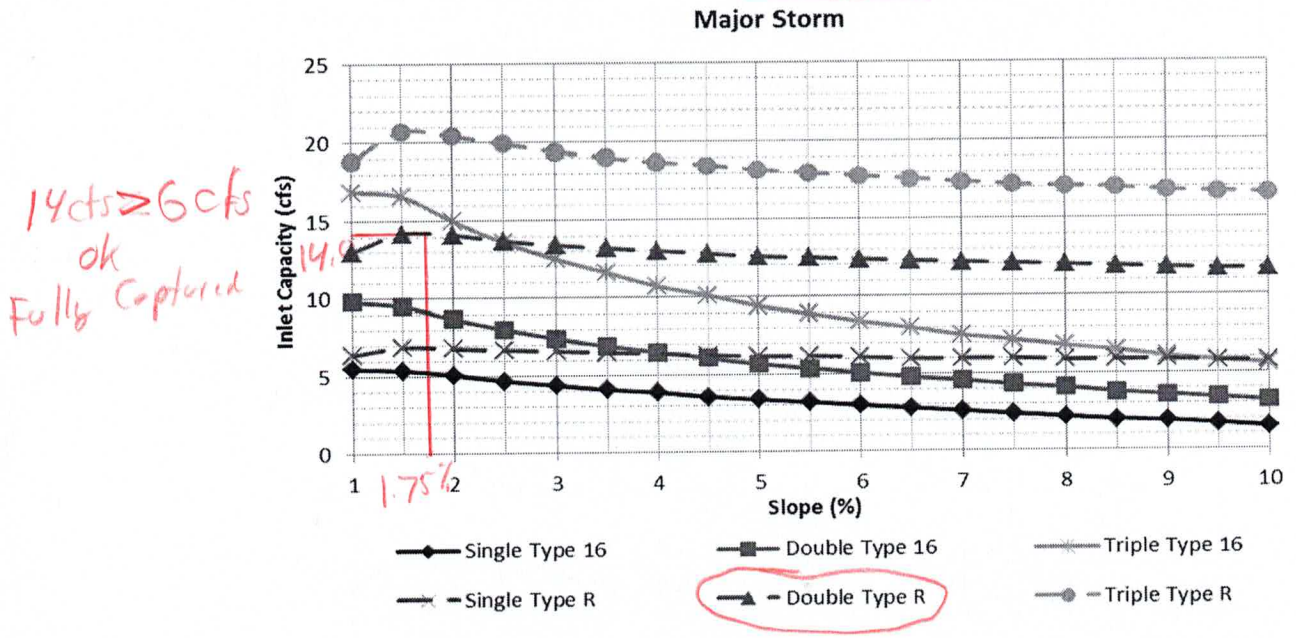
PDR

DP21 10' Type R At-Grade
Q5 = 2 cfs Q100 = 6 cfs
Muddy Pond Slope = 1.75%

Figure 8-7. Inlet Capacity Chart Continuous Grade Conditions, Residential (Local)
(Attached and Detached Sidewalk)

Street Section Data: Street Width Flowline to Flowline = 34'
Type of Curb and Gutter: D-10-R = 8" vertical
Type 16 = 6" vertical





The standard street section parameters as defined in Chapter 7 must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets. The maximum spread width is limited by the curb height based on no curb overtopping during a minor storm and flow being contained within the public right-of-way during the major storm. Calculations were done using UD-Inlet 3.00.xls, Mar., 2011 with the default clogging factors.

PDR
PIPE CALCULATIONS

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project:	**WATERBURY 1&2 MDP/PDR**	Location:	DP-PRE5 DIVERSIONS SWALE E-E PDR
By:	QNA	Date:	3/1/2022
Chk By:		Date:	

version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

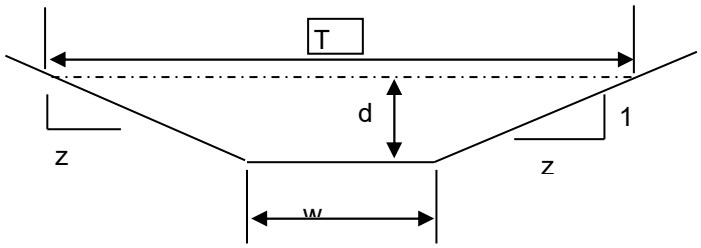
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

	INPUT
z (sideslope)=	4
z (sideslope)=	4
b (btm width, ft)=	4
d (depth, ft)=	0.99
S (slope, ft/ft)	0.02
n_{low} =	0.02
n_{high} =	0.035

Clear Data Entry Cells

Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Low N Velocity, fps	Low N Flow, cfs	High N Velocity, fps	High N Flow, cfs		
0.99	7.88	12.16	0.65	7.86716151	61.9964	4.495521	35.4265	T =	11.92
								Dm =	0.661
				Sc low =	0.0069	Sc high =	0.0210		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0048	0.0089	0.0147	0.0273		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 18 PDR

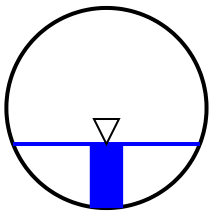
24" RCP @ 1.0%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	32	%

Results

Flow, Q (See notes)	5.0161	cfs
Velocity, v	5.7880	ft/sec
Velocity head, h_v	0.5207	ft H2O
Flow area	0.8667	ft^2
Wetted perimeter	2.4050	ft
Hydraulic radius	0.3603	ft
Top width, T	1.8659	ft
Froude number, F	1.50	
Average shear stress (tractive force), tau	0.2250	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 19 PDR

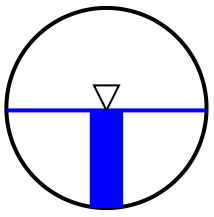
18" RCP @ 1.0%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	48.8	%

Results

Flow, Q (See notes)	5.0384	cfs
Velocity, v	5.8822	ft/sec
Velocity head, h_v	0.5378	ft H2O
Flow area	0.8566	ft^2
Wetted perimeter	2.3202	ft
Hydraulic radius	0.3692	ft
Top width, T	1.4996	ft
Froude number, F	1.37	
Average shear stress (tractive force), tau	0.2305	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 20 PDR

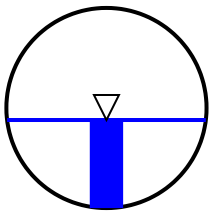
24" RCP @ 1.0%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	44	%

Results

Flow, Q (See notes)	9.0539	cfs
Velocity, v	6.8006	ft/sec
Velocity head, h_v	0.7188	ft H2O
Flow area	1.3314	ft^2
Wetted perimeter	2.9010	ft
Hydraulic radius	0.4589	ft
Top width, T	1.9855	ft
Froude number, F	1.46	
Average shear stress (tractive force), tau	0.2865	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 21 PDR

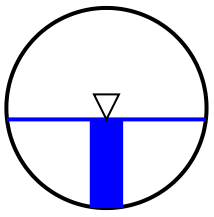
18" RCP @ 2.0%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	2.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	44.3	%

Results

Flow, Q (See notes)	6.0176	cfs
Velocity, v	7.9643	ft/sec
Velocity head, h_v	0.9858	ft H2O
Flow area	0.7556	ft^2
Wetted perimeter	2.1848	ft
Hydraulic radius	0.3458	ft
Top width, T	1.4902	ft
Froude number, F	1.97	
Average shear stress (tractive force), tau	0.4318	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 22 PDR

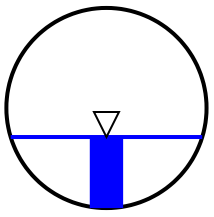
30" RCP @ 1.85%

Inputs

Pipe diameter, d_0	30	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.85	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	35.5	%

Results

Flow, Q (See notes)	15.0647	cfs
Velocity, v	9.6511	ft/sec
Velocity head, h_v	1.4476	ft H2O
Flow area	1.5610	ft^2
Wetted perimeter	3.1914	ft
Hydraulic radius	0.4891	ft
Top width, T	2.3925	ft
Froude number, F	2.11	
Average shear stress (tractive force), tau	0.5649	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 23 PDR

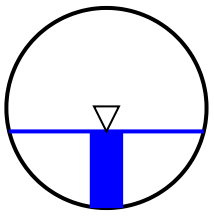
24" RCP @ 1.00%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	38.3	%

Results

Flow, Q (See notes)	7.0376	cfs
Velocity, v	6.3570	ft/sec
Velocity head, h_v	0.6281	ft H2O
Flow area	1.1071	ft^2
Wetted perimeter	2.6692	ft
Hydraulic radius	0.4148	ft
Top width, T	1.9445	ft
Froude number, F	1.49	
Average shear stress (tractive force), tau	0.2589	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 24 PDR

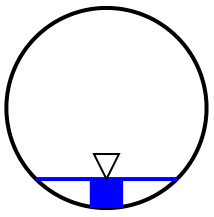
24" RCP @ 1.00%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	14.5	%

Results

Flow, Q (See notes)	1.0252	cfs
Velocity, v	3.6443	ft/sec
Velocity head, h_v	0.2064	ft H2O
Flow area	0.2813	ft^2
Wetted perimeter	1.5626	ft
Hydraulic radius	0.1800	ft
Top width, T	1.4084	ft
Froude number, F	1.44	
Average shear stress (tractive force), tau	0.1124	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 25 PDR

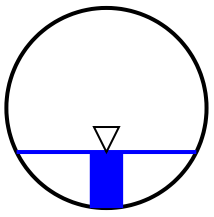
30" RCP @ 1.00%

Inputs

Pipe diameter, d_0	30	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	28	%

Results

Flow, Q (See notes)	7.0227	cfs
Velocity, v	6.2419	ft/sec
Velocity head, h_v	0.6055	ft H2O
Flow area	1.1251	ft^2
Wetted perimeter	2.7880	ft
Hydraulic radius	0.4036	ft
Top width, T	2.2450	ft
Froude number, F	1.55	
Average shear stress (tractive force), tau	0.2519	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 26 PDR

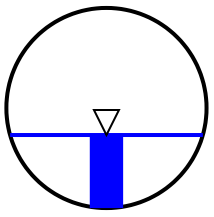
36" RCP @ 1.00%

Inputs

Pipe diameter, d_0	36	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.35	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	36.5	%

Results

Flow, Q (See notes)	22.0448	cfs
Velocity, v	9.4445	ft/sec
Velocity head, h_v	1.3863	ft H2O
Flow area	2.3342	ft^2
Wetted perimeter	3.8922	ft
Hydraulic radius	0.5997	ft
Top width, T	2.8886	ft
Froude number, F	1.85	
Average shear stress (tractive force), tau	0.5054	psf



Notes:

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Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 27 PDR

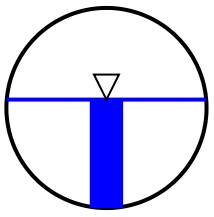
18" RCP @ 1.00%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	54.2	%

Results

Flow, Q (See notes)	6.0071	cfs
Velocity, v	6.1426	ft/sec
Velocity head, h_v	0.5864	ft H2O
Flow area	0.9780	ft^2
Wetted perimeter	2.4823	ft
Hydraulic radius	0.3940	ft
Top width, T	1.4947	ft
Froude number, F	1.34	
Average shear stress (tractive force), tau	0.2460	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 28 PDR

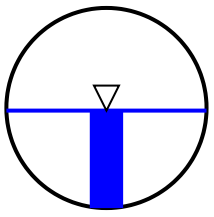
18" RCP @ 1.00%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	48.7	%

Results

Flow, Q (See notes)	5.0207	cfs
Velocity, v	5.8770	ft/sec
Velocity head, h_v	0.5368	ft H2O
Flow area	0.8543	ft^2
Wetted perimeter	2.3172	ft
Hydraulic radius	0.3687	ft
Top width, T	1.4995	ft
Froude number, F	1.37	
Average shear stress (tractive force), tau	0.2302	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 29 PDR

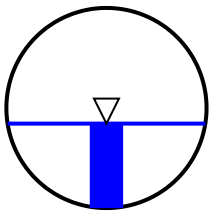
36" RCP @ 1.00%

Inputs

Pipe diameter, d_0	36	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.67	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	42.2	%

Results

Flow, Q (See notes)	32.0090	cfs
Velocity, v	11.2904	ft/sec
Velocity head, h_v	1.9812	ft H2O
Flow area	2.8352	ft^2
Wetted perimeter	4.2424	ft
Hydraulic radius	0.6683	ft
Top width, T	2.9632	ft
Froude number, F	2.04	
Average shear stress (tractive force), tau	0.6967	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 30 PDR

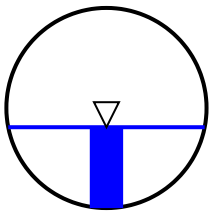
24" RCP @ 4.26%

Inputs

Pipe diameter, d_0	24	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	4.26	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	40.4	%

Results

Flow, Q (See notes)	16.0217	cfs
Velocity, v	13.4735	ft/sec
Velocity head, h_v	2.8214	ft H2O
Flow area	1.1892	ft^2
Wetted perimeter	2.7552	ft
Hydraulic radius	0.4316	ft
Top width, T	1.9628	ft
Froude number, F	3.05	
Average shear stress (tractive force), tau	1.1479	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 31 PDR

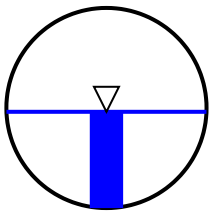
42" RCP @ 1.00%

Inputs

Pipe diameter, d_0	42	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	48.1	%

Results

Flow, Q (See notes)	47.0731	cfs
Velocity, v	10.2831	ft/sec
Velocity head, h_v	1.6434	ft H2O
Flow area	4.5779	ft^2
Wetted perimeter	5.3647	ft
Hydraulic radius	0.8533	ft
Top width, T	3.4974	ft
Froude number, F	1.58	
Average shear stress (tractive force), tau	0.5327	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 32 PDR

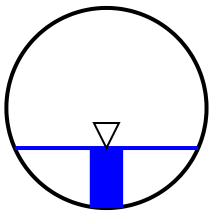
18" RCP @ 11.70%

Inputs

Pipe diameter, d_0	18	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	11.7	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	30	%

Results

Flow, Q (See notes)	7.0356	cfs
Velocity, v	15.7797	ft/sec
Velocity head, h_v	3.8699	ft H2O
Flow area	0.4459	ft^2
Wetted perimeter	1.7389	ft
Hydraulic radius	0.2564	ft
Top width, T	1.3748	ft
Froude number, F	4.90	
Average shear stress (tractive force), tau	1.8729	psf



Notes:

This is the flow and depth *inside* the pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or see my 2-minute tutorial for standard culvert headwater calculations using HY-8.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe run 33 PDR

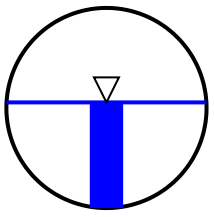
42" RCP @ 1.00%

Inputs

Pipe diameter, d_0	42	in
Manning roughness, n	0.013	
Pressure slope (possibly ? equal to pipe slope), S_0	1.00	% rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	52.8	%

Results

Flow, Q (See notes)	55.1123	cfs
Velocity, v	10.6947	ft/sec
Velocity head, h_v	1.7776	ft H2O
Flow area	5.1534	ft^2
Wetted perimeter	5.6938	ft
Hydraulic radius	0.9051	ft
Top width, T	3.4945	ft
Froude number, F	1.55	
Average shear stress (tractive force), tau	0.5650	psf



Notes:

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MDDP
FULL SPECTRUM DETENTION & WATER QUALITY CALCULATIONS

POND TRIBUTARY AREA

POND 1 TRIB AREA (DP 8)	**21.12** AC	BASINS A, B1, B2, C, D ,E, F, H, G1, G2, & K	DCIA	5.03
			UIA	6.92
			RPA	1.24
			SPA	7.94
			Total	**21.12**
POND 2 TRIB AREA (DP 18)	**20.31** AC	BASINS L1, L2, O1, O2, O-3, O-4 & OS-4	DCIA	2.34
			UIA	3.23
			RPA	0.19
			SPA	14.55
			Total	**20.31**
POND 3 TRIB AREA (DP 29)	**82.02** AC	BASINS Q1, Q2, R, S1, S2, T1, T2, U1, U2, V, W, X, OS-1, OS-2, OS-3A, 0S-3B, OS-Q1, OS-Q2, OS-4, OS-S1, OS-S2, OS-T2, OS-7, & OS-9	DCIA	19.50
			UIA	22.09
			RPA	8.68
			SPA	31.74
			Total	**82.02**

Worksheet Protected

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.43	inches
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer:	**QNA**
Company:	**Terra Nova Engineering**
Date:	**March 2, 2022**
Project:	**WATERBURY FILING 1 POND 1**
Location:	**POND 1 Design Point 8 Full Spectrum Detention**

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	**DP 8 FSD**													
Receiving Pervious Area Soil Type	Loamy Sand													
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	21.12													
Directly Connected Impervious Area (DCIA, acres)	5.03													
Unconnected Impervious Area (UIA, acres)	6.92													
Receiving Pervious Area (RPA, acres)	1.24													
Separate Pervious Area (SPA, acres)	7.94													
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C													

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	21.124													
Directly Connected Impervious Area (DCIA, %)	23.8%													
Unconnected Impervious Area (UIA, %)	32.7%													
Receiving Pervious Area (RPA, %)	5.9%													
Separate Pervious Area (SPA, %)	37.6%													
A_R (RPA / UIA)	0.179													
I_a Check	0.850													
f / I for WQCV Event:	4.5													
f / I for 5-Year Event:	0.5													
f / I for 100-Year Event:	0.4													
f / I for Optional User Defined Storm CUHP:														
IRF for WQCV Event:	0.83													
IRF for 5-Year Event:	0.96													
IRF for 100-Year Event:	0.97													
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I_{total}	56.6%													
Effective Imperviousness for WQCV Event:	51.0%													
Effective Imperviousness for 5-Year Event:	55.1%													
Effective Imperviousness for 100-Year Event:	55.5%													
Effective Imperviousness for Optional User Defined Storm CUHP:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	7.2%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	1.8%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	**56.6%**
Total Site Effective Imperviousness for WQCV Event:	**51.0%**
Total Site Effective Imperviousness for 5-Year Event:	**55.1%**
Total Site Effective Imperviousness for 100-Year Event:	**55.5%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

removed

Do not include SDI sheets in the report.

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: **Waterbury Filing No. 1 & 2 EDB Pond 1 D8 8**

Facility Location & Jurisdiction: **Stapleton Dr. & Bandernero Dr Intersection**

User Input: Watershed Characteristics

Watershed Slope =	0.012	ft/ft
Watershed Length =	1935	ft
Watershed Area =	21.12	acres
Watershed Imperviousness =	55.5%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent

Location for 1-hr Rainfall Depths (use dropdown):

User Input

WQCV Treatment Method = Extended Detention

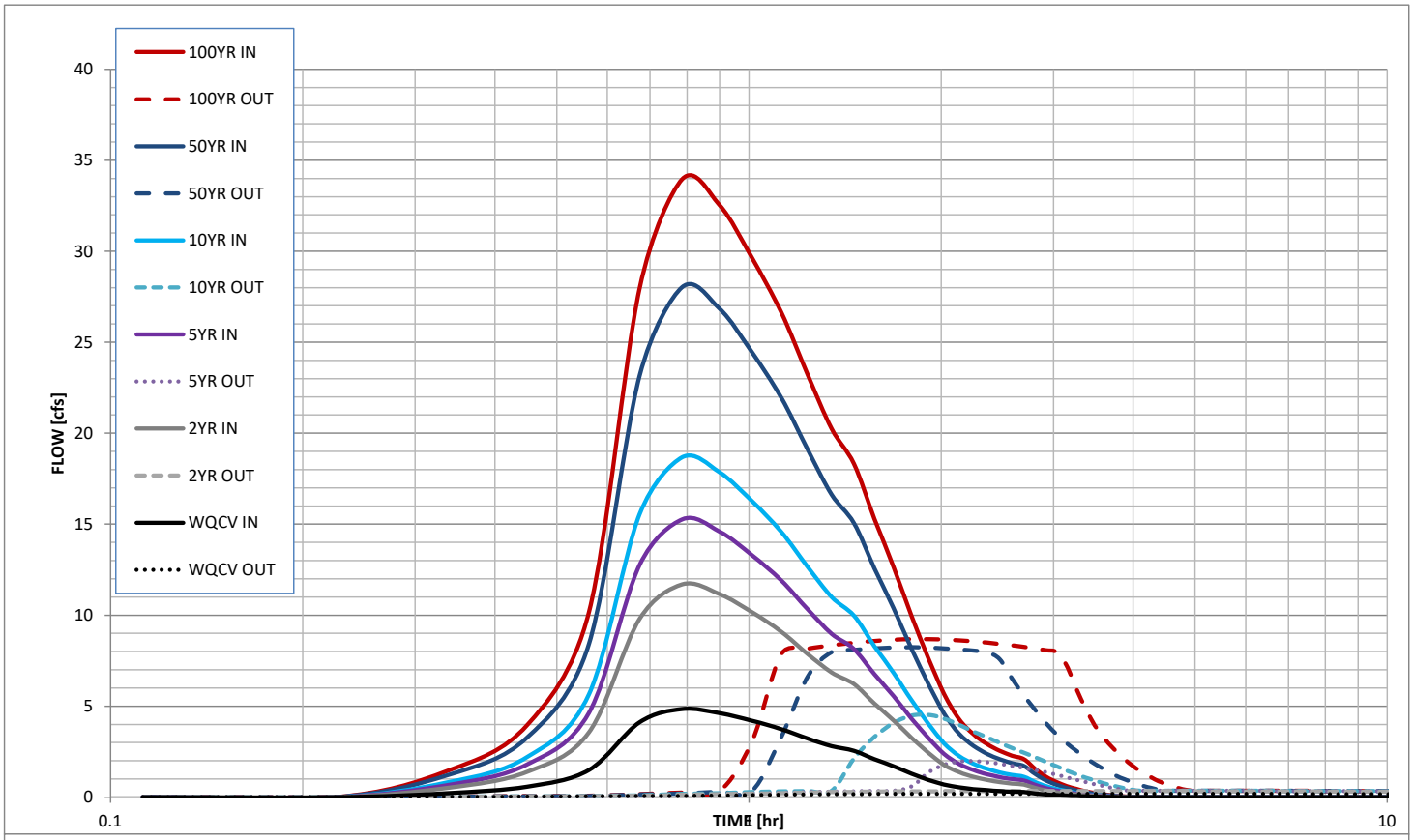
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	100	0.00	0.00
0.25	3,176	0.25	0.04
0.50	6,253	0.50	0.06
0.75	8,372	0.75	0.07
1.00	10,492	1.00	0.09
1.25	12,612	1.25	0.14
1.50	14,732	1.50	0.17
1.75	16,852	1.75	0.19
2.00	18,972	2.00	0.21
2.25	21,092	2.25	0.27
2.50	23,212	2.50	0.30
2.75	25,435	2.75	0.33
3.00	27,658	3.00	0.36
3.25	29,881	3.25	3.70
3.50	32,105	3.50	7.91
3.75	34,328	3.75	8.21
4.00	36,551	4.00	8.50
4.25	38,744	4.25	8.78
4.50	40,997	4.50	9.06
4.75	43,176	4.75	20.80
5.00	45,355	5.00	42.67
5.25	47,534	5.25	71.79
5.50	49,712	5.50	107.27
5.75	51,891	5.75	148.67
6.00	54,070	6.00	195.73
6.25	56,249	6.25	248.30
6.50	58,428	6.50	306.29

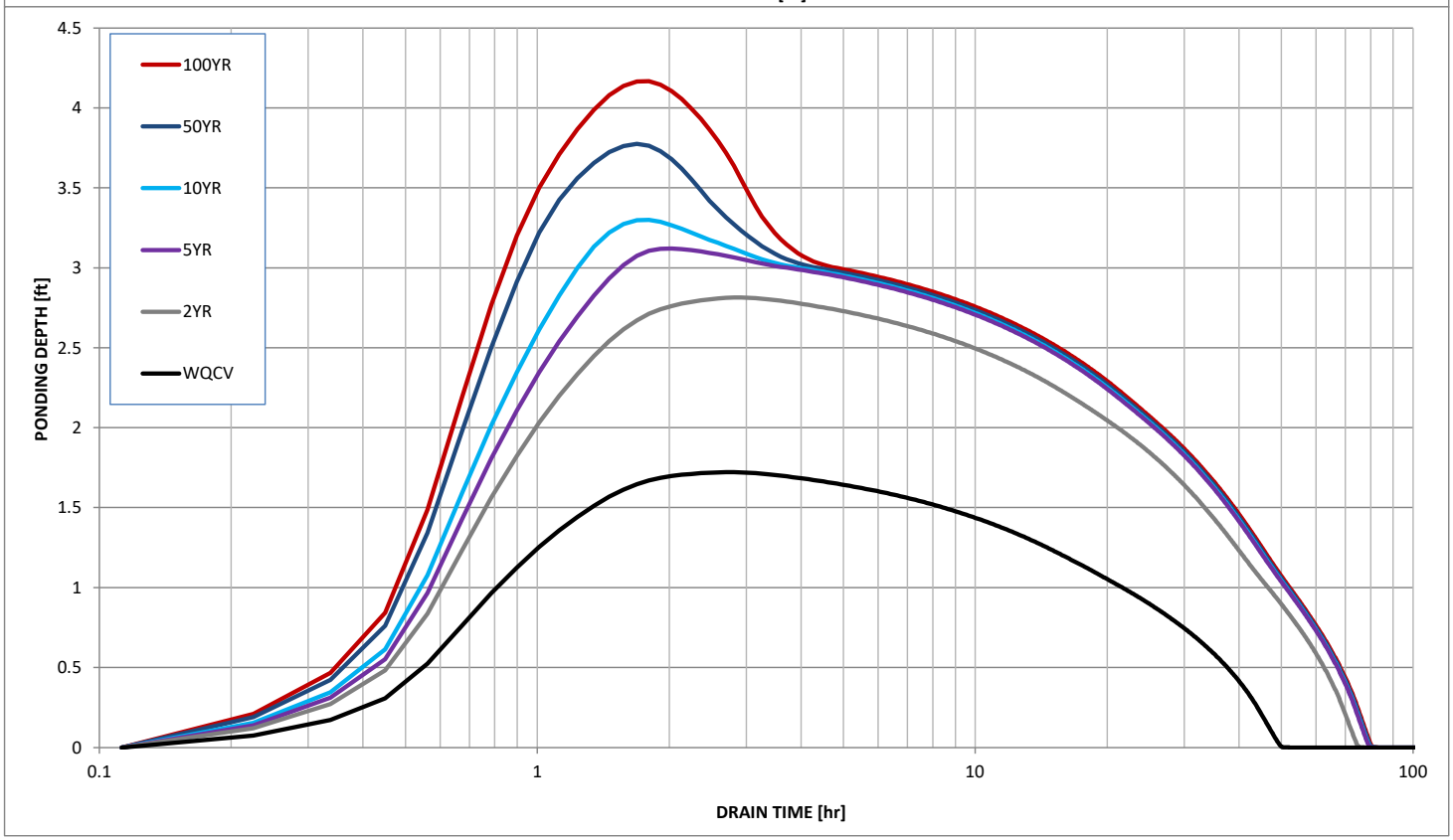
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	1.19	1.50	1.75	2.25	2.52	in
Calculated Runoff Volume =	0.391	0.953	1.250	1.532	2.312	2.808	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	0.391	0.953	1.249	1.531	2.311	2.807	acre-ft
Time to Drain 97% of Inflow Volume =	43.4	64.2	**66.8**	65.4	61.5	59.3	hours
Time to Drain 99% of Inflow Volume =	46.2	69.0	72.7	72.1	70.6	**69.9**	hours
Maximum Ponding Depth =	1.72	2.81	3.12	3.30	3.77	4.17	ft
Maximum Ponded Area =	0.38	0.60	0.66	0.69	0.79	**0.87**	acres
Maximum Volume Stored =	0.355	0.887	1.079	1.199	1.553	1.881	acre-ft

Stormwater Detention and Infiltration Design Data Sheet



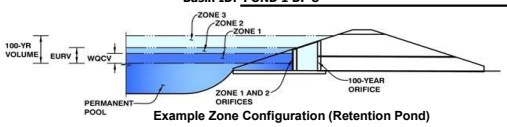


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: **WATERBURY**

Basin ID: **POND 1 DP 8**



Example Zone Configuration (Retention Pond)

check these - see comment next sheet

REVISED

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	21.12	acres
Watershed Length =	1,935	ft
Watershed Length to Centroid =	800	ft
Watershed Slope =	0.012	ft/ft
Watershed Imperviousness =	55.[illegible]%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
[illegible]ydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
[illegible]on for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

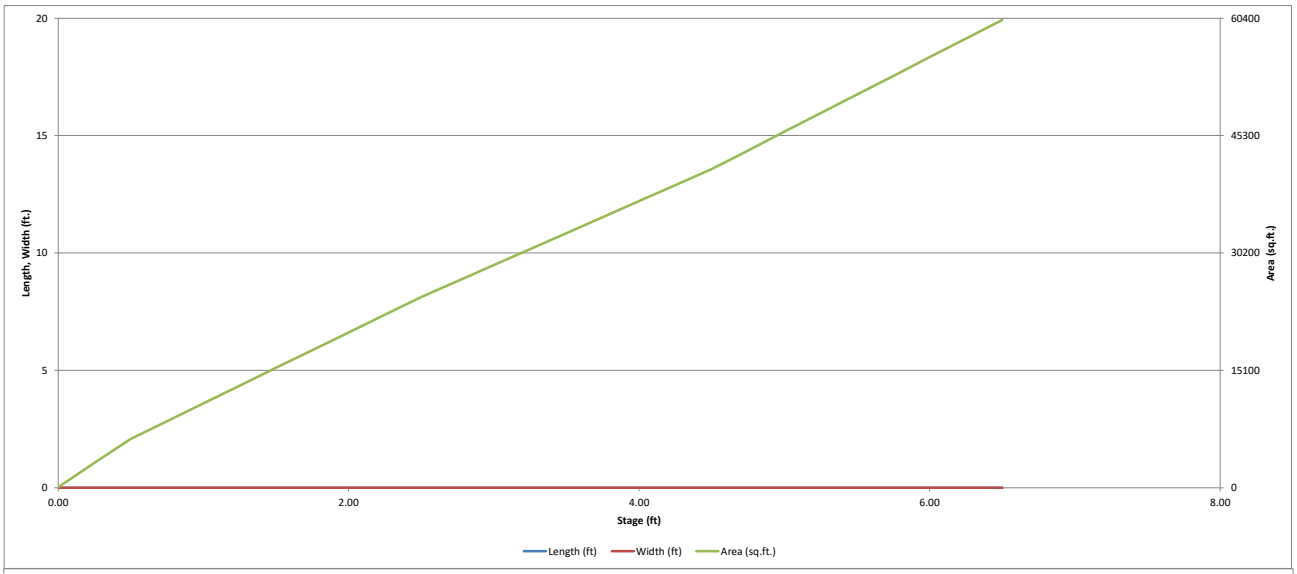
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.391	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.392	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.043	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.379	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.648	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.039	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.423	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.902	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3 in.) =	3.700	acre-feet	3.00	inches
Approximate 2-yr Detention Volume =	0.900	acre-feet		
Approximate 5-yr Detention Volume =	1.181	acre-feet		
Approximate 10-yr Detention Volume =	1.434	acre-feet		
Approximate 25-yr Detention Volume =	1.743	acre-feet		
Approximate 50-yr Detention Volume =	1.935	acre-feet		
Approximate 100-yr Detention Volume =	2.154	acre-feet		

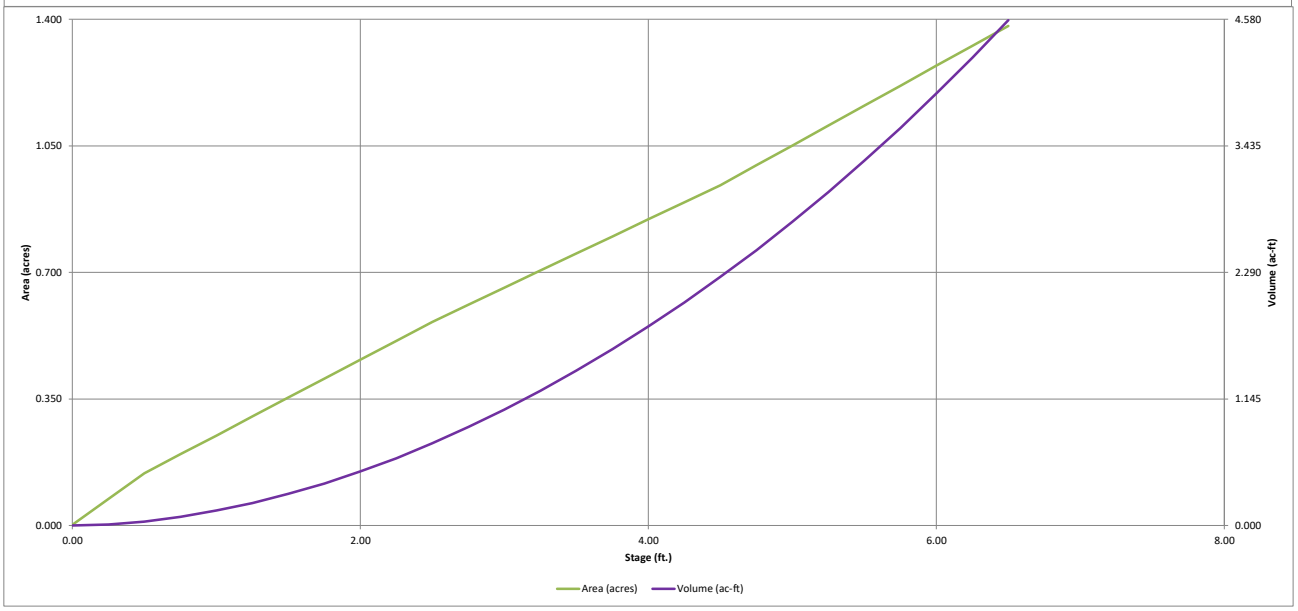
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.391	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.002	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.762	acre-feet
Total Detention Basin Volume =	2.154	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	100	0.002		
6923.75	--	0.25	--	--	--	3,201	0.073	412	0.009
6924.00	--	0.50	--	--	--	6,302	0.145	1,600	0.037
6924.25	--	0.75	--	--	--	8,582	0.197	3,461	0.079
6924.50	--	1.00	--	--	--	10,862	0.249	5,891	0.135
6924.75	--	1.25	--	--	--	13,142	0.302	8,892	0.204
6925.00	--	1.50	--	--	--	15,422	0.354	12,462	0.286
6925.25	--	1.75	--	--	--	17,702	0.406	16,603	0.381
6925.50	--	2.00	--	--	--	19,981	0.459	21,313	0.489
6925.75	--	2.25	--	--	--	22,262	0.511	26,593	0.611
6926.00	--	2.50	--	--	--	24,542	0.563	32,444	0.745
6926.25	--	2.75	--	--	--	26,599	0.611	38,837	0.892
6926.50	--	3.00	--	--	--	28,655	0.658	45,743	1.050
6926.75	--	3.25	--	--	--	30,713	0.705	53,164	1.220
6927.00	--	3.50	--	--	--	32,770	0.752	61,100	1.403
6927.25	--	3.75	--	--	--	34,826	0.799	69,549	1.597
6927.50	--	4.00	--	--	--	36,883	0.847	78,513	1.802
6927.75	--	4.25	--	--	--	38,940	0.894	87,991	2.020
6928.00	--	4.50	--	--	--	40,997	0.941	97,983	2.249
6928.25	--	4.75	--	--	--	43,397	0.996	108,532	2.492
6928.50	--	5.00	--	--	--	45,797	1.051	119,681	2.748
6928.75	--	5.25	--	--	--	48,198	1.106	131,431	3.017
6929.00	--	5.50	--	--	--	50,598	1.162	143,780	3.301
6929.25	--	5.75	--	--	--	52,988	1.216	156,728	3.598
6929.50	--	6.00	--	--	--	55,398	1.272	170,277	3.909
6929.75	--	6.25	--	--	--	57,798	1.327	184,426	4.234
6930.00	--	6.50	--	--	--	60,198	1.382	199,176	4.572


Length, Width (ft.)
Area (sq.ft.)
Stage (ft)
20
15
10
5
0
60400
45300
30200
15100
0
0.00
2.00
4.00
6.00
8.00
Length (ft)
Width (ft)
Area (sq.ft.)

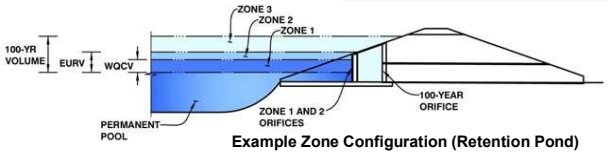

Area (acres)
Volume (ac-ft)
Stage (ft.)
1.400
1.050
0.700
0.350
0.000
4.580
3.435
2.290
1.145
0.000
0.00
2.00
4.00
6.00
8.00
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **WATERBURY**

Basin ID: **POND 1 DP 8**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.78	0.391	Orifice Plate
Zone 2 (EURV)	3.49	1.002	Orifice Plate
Zone 3 (100-year)	4.40	0.762	Weir&Pipe (Restrict)
Total (all zones)		2.154	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	2.111E-02	ft^2
Depth at top of Zone using Orifice Plate =	3.49	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	14.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	3.04	sq. inches (diameter = 1-15/16 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.16	2.33					
Orifice Area (sq. inches)	3.04	3.04	3.04					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.49	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.49	N/A	feet
Overflow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	13.35	N/A	
Overflow Grate Open Area w/o Debris =	11.20	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.60	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.10	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	7.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.84	N/A	ft^2
Outlet Orifice Centroid =	0.37	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.19	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	30.00	feet
Spillway End Slopes =	3.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.55	feet
Stage at Top of Freeboard =	6.05	feet
Basin Area at Top of Freeboard =	1.28	acres
Basin Volume at Top of Freeboard =	3.97	acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	0.391	1.392	1.043	1.379	1.648	2.039	2.423	2.902	3.700
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.043	1.379	1.648	2.039	2.423	2.902	3.700
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.3	2.7	5.5	9.2	15.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.01	0.13	0.26	0.43	0.71
Peak Inflow Q (cfs) =	N/A	N/A	12.3	16.3	19.4	25.9	31.5	38.5	49.3
Peak Outflow Q (cfs) =	0.2	0.5	0.4	0.4	2.0	6.0	7.8	8.2	18.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.0	6.8	2.2	1.4	0.9	1.2
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.1	0.5	0.6	0.7	0.7
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	69	62	70	72	70	69	67	64
Time to Drain 99% of Inflow Volume (hours) =	**40**	74	66	75	78	77	77	76	75
Maximum Ponding Depth (ft) =	1.78	3.49	2.89	3.36	3.62	3.78	3.97	4.36	4.72
Area at Maximum Ponding Depth (acres) =	0.41	0.75	0.64	0.73	0.77	0.81	0.84	0.91	0.99
Maximum Volume Stored (acre-ft) =	0.393	1.395	0.973	1.299	1.487	1.621	1.769	2.119	2.452

59 calculated - check sheet input to approximate that minus IRF %

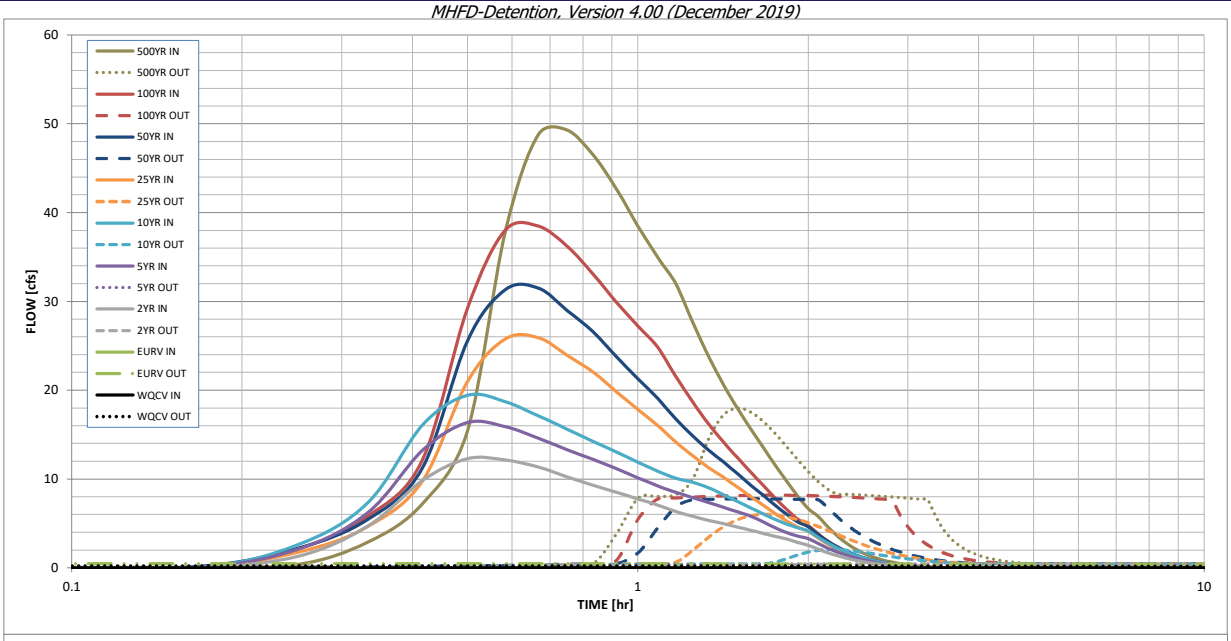
REVISED

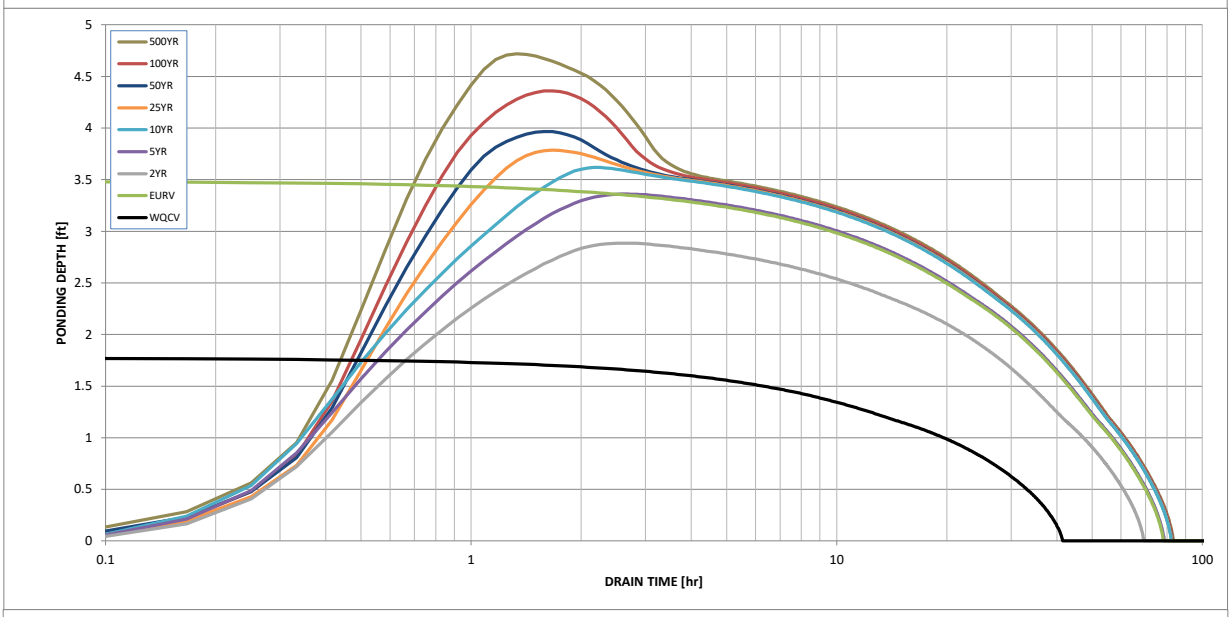
Should be <1

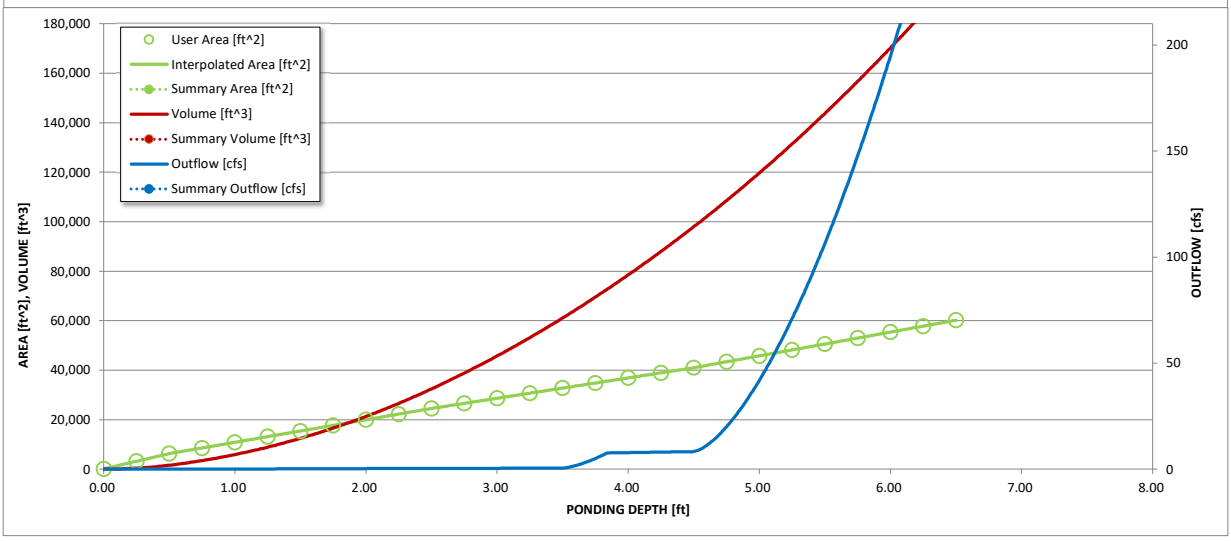
REVISED

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.01	0.36
	0:15:00	0.00	0.00	1.27	2.06	2.56	1.72	2.17	2.11	2.87
	0:20:00	0.00	0.00	4.67	6.18	7.30	4.63	5.43	5.79	7.21
	0:25:00	0.00	0.00	9.82	13.21	16.06	9.78	11.24	12.16	15.44
	0:30:00	0.00	0.00	12.29	16.34	19.43	20.97	25.56	29.23	37.82
	0:35:00	0.00	0.00	12.13	15.88	18.70	25.76	31.32	38.03	48.76
	0:40:00	0.00	0.00	11.34	14.60	17.12	25.93	31.51	38.48	49.29
	0:45:00	0.00	0.00	10.23	13.28	15.61	23.94	28.99	36.20	46.51
	0:50:00	0.00	0.00	9.29	12.21	14.23	22.06	26.58	33.10	42.66
	0:55:00	0.00	0.00	8.49	11.16	13.04	19.82	23.78	29.92	38.50
	1:00:00	0.00	0.00	7.75	10.14	11.91	17.83	21.29	27.24	35.01
	1:05:00	0.00	0.00	7.08	9.22	10.89	16.05	19.09	24.86	31.99
	1:10:00	0.00	0.00	6.34	8.50	10.10	14.17	16.76	21.56	27.63
	1:15:00	0.00	0.00	5.78	7.91	9.62	12.61	14.85	18.67	23.84
	1:20:00	0.00	0.00	5.35	7.34	9.02	11.29	13.26	16.20	20.62
	1:25:00	0.00	0.00	4.95	6.80	8.23	10.19	11.92	14.15	17.94
	1:30:00	0.00	0.00	4.59	6.30	7.47	9.07	10.58	12.38	15.62
	1:35:00	0.00	0.00	4.23	5.81	6.75	8.01	9.31	10.76	13.52
	1:40:00	0.00	0.00	3.87	5.15	6.07	7.03	8.12	9.24	11.55
	1:45:00	0.00	0.00	3.52	4.50	5.44	6.10	7.02	7.83	9.71
	1:50:00	0.00	0.00	3.24	3.95	4.91	5.27	6.01	6.55	8.06
	1:55:00	0.00	0.00	2.84	3.57	4.51	4.56	5.16	5.47	6.65
	2:00:00	0.00	0.00	2.53	3.29	4.14	4.10	4.62	4.77	5.78
	2:05:00	0.00	0.00	2.08	2.73	3.44	3.33	3.75	3.81	4.61
	2:10:00	0.00	0.00	1.68	2.21	2.78	2.65	2.98	2.99	3.59
	2:15:00	0.00	0.00	1.36	1.77	2.25	2.11	2.36	2.33	2.79
	2:20:00	0.00	0.00	1.09	1.42	1.80	1.68	1.88	1.82	2.17
	2:25:00	0.00	0.00	0.87	1.14	1.44	1.33	1.49	1.41	1.67
	2:30:00	0.00	0.00	0.69	0.90	1.13	1.04	1.17	1.09	1.28
	2:35:00	0.00	0.00	0.54	0.70	0.88	0.81	0.90	0.84	0.99
	2:40:00	0.00	0.00	0.43	0.54	0.68	0.62	0.69	0.65	0.77
	2:45:00	0.00	0.00	0.33	0.42	0.52	0.48	0.54	0.51	0.60
	2:50:00	0.00	0.00	0.26	0.32	0.41	0.38	0.42	0.40	0.47
	2:55:00	0.00	0.00	0.19	0.24	0.31	0.28	0.32	0.30	0.35
	3:00:00	0.00	0.00	0.13	0.17	0.22	0.21	0.23	0.22	0.25
	3:05:00	0.00	0.00	0.09	0.12	0.15	0.14	0.16	0.15	0.17
	3:10:00	0.00	0.00	0.05	0.07	0.09	0.09	0.10	0.09	0.11
	3:15:00	0.00	0.00	0.03	0.04	0.05	0.05	0.05	0.05	0.06
	3:20:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.02
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Worksheet Protected

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.43	inches
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer:	**QNA**
Company:	**Terra Nova Engineering**
Date:	**March 2, 2022**
Project:	**WATERBURY FILING 1 POND 2**
Location:	**POND 2 Design Point 18 Full Spectrum Detention**

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	**DP 18 FSD**													
Receiving Pervious Area Soil Type	Loamy Sand													
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	20.31													
Directly Connected Impervious Area (DCIA, acres)	2.34													
Unconnected Impervious Area (UIA, acres)	3.23													
Receiving Pervious Area (RPA, acres)	0.19													
Separate Pervious Area (SPA, acres)	14.55													
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C													

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	20.312													
Directly Connected Impervious Area (DCIA, %)	11.5%													
Unconnected Impervious Area (UIA, %)	15.9%													
Receiving Pervious Area (RPA, %)	0.9%													
Separate Pervious Area (SPA, %)	71.6%													
A_R (RPA / UIA)	0.058													
I_a Check	0.940													
f / I for WQCV Event:	4.5													
f / I for 5-Year Event:	0.5													
f / I for 100-Year Event:	0.4													
f / I for Optional User Defined Storm CUHP:														
IRF for WQCV Event:	0.93													
IRF for 5-Year Event:	0.98													
IRF for 100-Year Event:	0.99													
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I_{total}	27.4%													
Effective Imperviousness for WQCV Event:	26.4%													
Effective Imperviousness for 5-Year Event:	27.2%													
Effective Imperviousness for 100-Year Event:	27.2%													
Effective Imperviousness for Optional User Defined Storm CUHP:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	2.6%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	0.8%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	**27.4%**
Total Site Effective Imperviousness for WQCV Event:	**26.4%**
Total Site Effective Imperviousness for 5-Year Event:	**27.2%**
Total Site Effective Imperviousness for 100-Year Event:	**27.2%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

REMOVED

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: **Waterbury Filing No. 1 & 2 EDB Pond 2 DP 18**

Facility Location & Jurisdiction: **Stapleton Dr. & Bandernero Dr Intersection**

User Input: Watershed Characteristics

Watershed Slope =	0.014	ft/ft
Watershed Length =	1425	ft
Watershed Area =	21.93	acres
Watershed Imperviousness =	27.2%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent

Location for 1-hr Rainfall Depths (use dropdown):

User Input

WQCV Treatment Method = Extended Detention

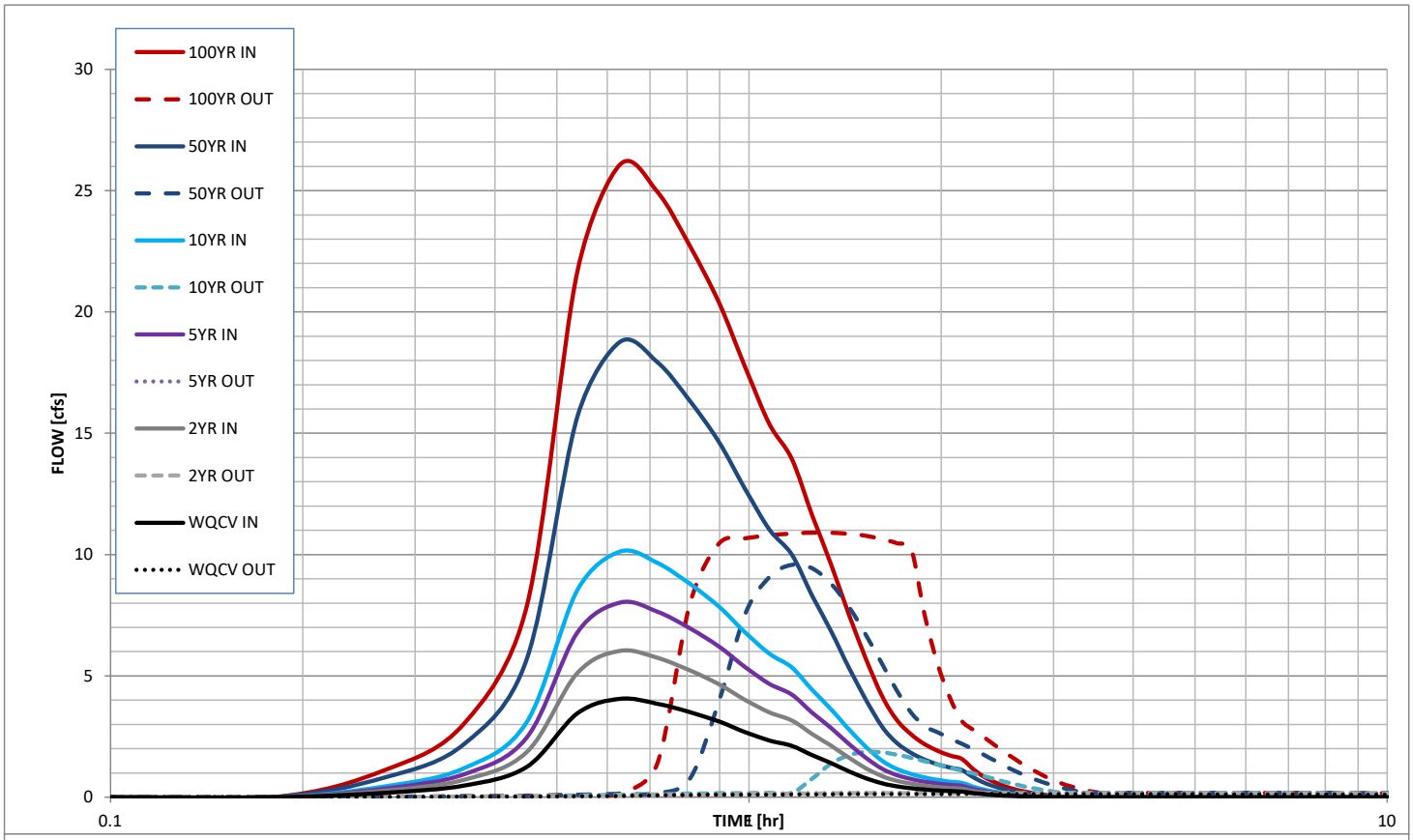
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	100	0.00	0.00
0.25	942	0.25	0.02
0.50	1,784	0.50	0.03
0.75	2,626	0.75	0.04
1.00	3,468	1.00	0.04
1.25	5,034	1.25	0.07
1.50	6,600	1.50	0.09
1.75	8,166	1.75	0.10
2.00	9,732	2.00	0.11
2.25	11,297	2.25	0.14
2.50	12,863	2.50	0.16
2.75	14,429	2.75	0.17
3.00	15,995	3.00	0.18
3.25	19,602	3.25	3.05
3.50	23,209	3.50	10.28
3.75	26,815	3.75	10.76
4.00	30,422	4.00	11.17
4.25	34,029	4.25	11.57
4.50	37,636	4.50	11.96
4.75	41,243	4.75	12.33
5.00	44,850	5.00	12.70
5.25	48,650	5.25	20.77
5.50	52,450	5.50	35.88
5.75	56,251	5.75	56.20
6.00	60,051	6.00	81.25
6.25	63,851	6.25	110.80
6.50	67,652	6.50	144.75
6.75	71,452	6.75	183.06
7.00	75,252	7.00	225.73

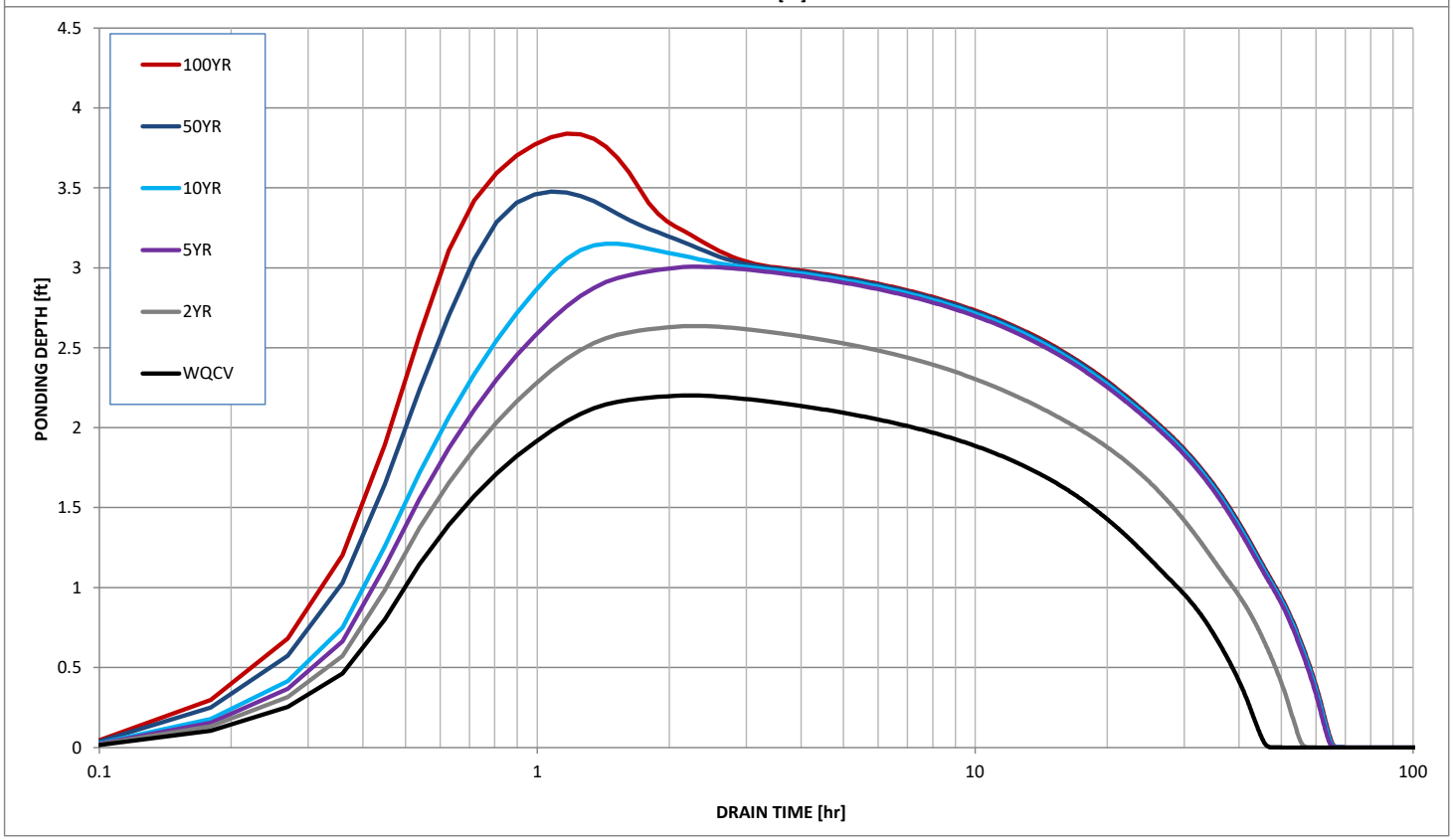
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	1.19	1.50	1.75	2.25	2.52	in
Calculated Runoff Volume =	0.261	0.389	0.519	0.657	1.228	1.712	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	0.260	0.389	0.519	0.657	1.227	1.711	acre-ft
Time to Drain 97% of Inflow Volume =	40.0	48.2	**55.6**	54.6	49.6	45.9	hours
Time to Drain 99% of Inflow Volume =	42.6	51.7	60.0	59.6	57.5	**55.8**	hours
Maximum Ponding Depth =	2.20	2.64	3.01	3.15	3.48	3.84	ft
Maximum Ponded Area =	0.25	0.31	0.37	0.41	0.52	**0.64**	acres
Maximum Volume Stored =	0.239	0.362	0.488	0.544	0.699	0.908	acre-ft

Stormwater Detention and Infiltration Design Data Sheet



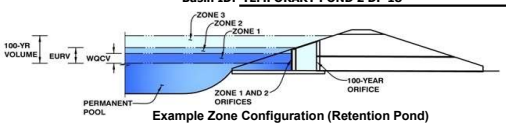


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: **WATERBURY**

Basin ID: **TEMPORARY POND 2 DP 18**



Example Zone Configuration (Retention Pond)

REVISED

Watershed Information

Selected BMP Type =	**EDB**	
rshed Area =	20.31	acres
hed Length =	1,425	ft
to Centroid =	650	ft
Watershed Slope =	0.014	ft/ft
Watershed Imperviousness =	27.24%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

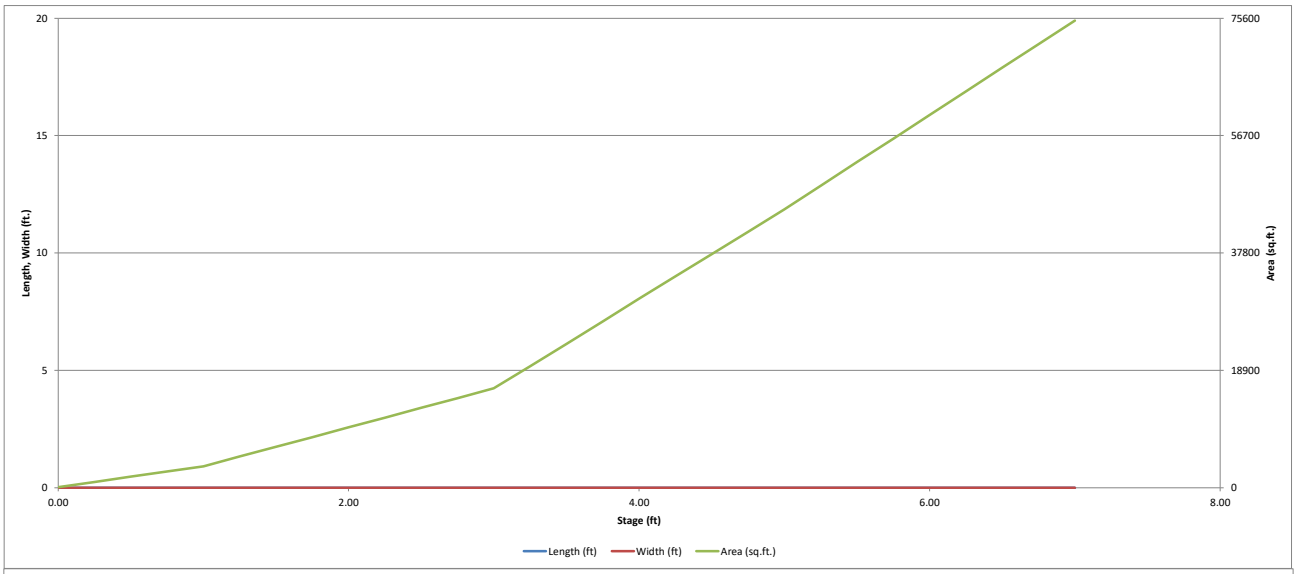
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.241	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.538	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.367	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.510	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.634	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.970	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.282	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.703	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3 in.) =	2.391	acre-feet	3.00	inches
Approximate 2-yr Detention Volume =	0.337	acre-feet		
Approximate 5-yr Detention Volume =	0.451	acre-feet		
Approximate 10-yr Detention Volume =	0.566	acre-feet		
Approximate 25-yr Detention Volume =	0.719	acre-feet		
Approximate 50-yr Detention Volume =	0.838	acre-feet		
Approximate 100-yr Detention Volume =	1.041	acre-feet		

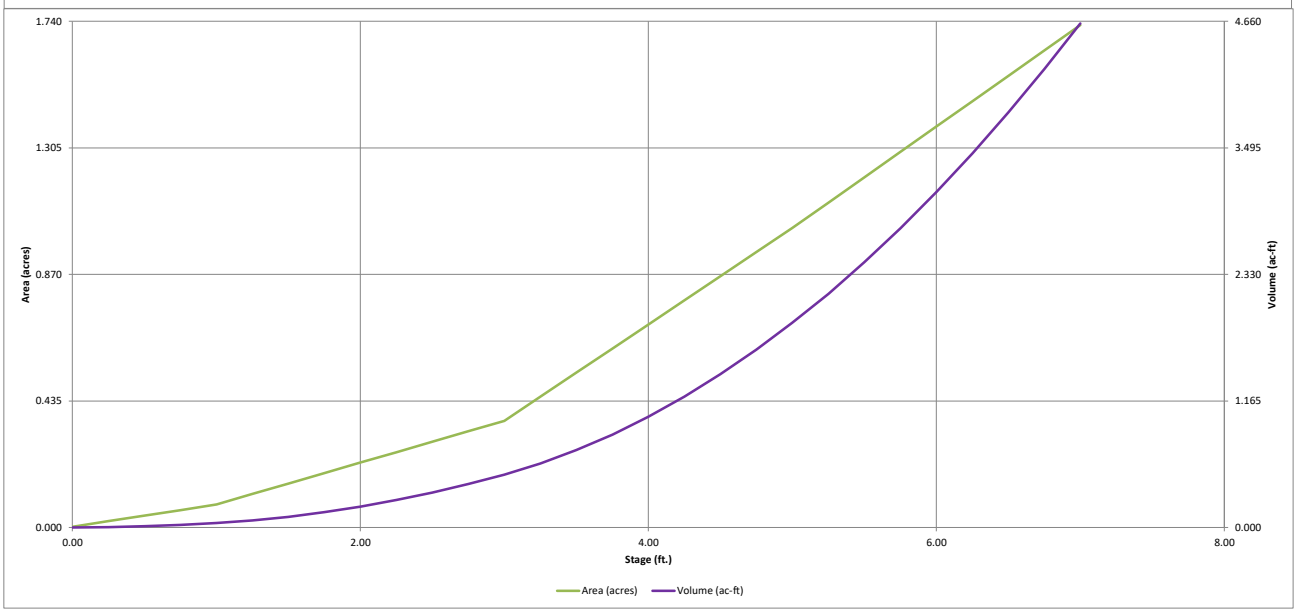
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.241	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.297	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.503	acre-feet
Total Detention Basin Volume =	1.041	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	100	0.002		
6899.25	--	0.25	--	--	--	942	0.022	130	0.003
6899.50	--	0.50	--	--	--	1,784	0.041	471	0.011
6899.75	--	0.75	--	--	--	2,626	0.060	1,022	0.023
6900.00	--	1.00	--	--	--	3,468	0.080	1,784	0.041
6900.25	--	1.25	--	--	--	5,034	0.116	2,847	0.065
6900.50	--	1.50	--	--	--	6,600	0.152	4,301	0.099
6900.75	--	1.75	--	--	--	8,166	0.187	6,147	0.141
6901.00	--	2.00	--	--	--	9,732	0.223	8,384	0.192
6901.25	--	2.25	--	--	--	11,297	0.259	11,013	0.253
6901.50	--	2.50	--	--	--	12,863	0.295	14,033	0.322
6901.75	--	2.75	--	--	--	14,429	0.331	17,444	0.400
6902.00	--	3.00	--	--	--	15,995	0.367	21,247	0.488
6902.25	--	3.25	--	--	--	19,602	0.450	25,697	0.590
6902.50	--	3.50	--	--	--	23,209	0.533	31,048	0.713
6902.75	--	3.75	--	--	--	26,815	0.616	37,301	0.856
6903.00	--	4.00	--	--	--	30,422	0.698	44,456	1.021
6903.25	--	4.25	--	--	--	34,029	0.781	52,512	1.206
6903.50	--	4.50	--	--	--	37,636	0.864	61,470	1.411
6903.75	--	4.75	--	--	--	41,243	0.947	71,330	1.638
6904.00	--	5.00	--	--	--	44,850	1.030	82,092	1.885
6904.25	--	5.25	--	--	--	48,650	1.117	93,779	2.153
6904.50	--	5.50	--	--	--	52,450	1.204	106,417	2.443
6904.75	--	5.75	--	--	--	56,251	1.291	120,004	2.755
6905.00	--	6.00	--	--	--	60,051	1.379	134,542	3.089
6905.25	--	6.25	--	--	--	63,851	1.466	150,030	3.444
6905.50	--	6.50	--	--	--	67,652	1.553	166,468	3.822
6905.75	--	6.75	--	--	--	71,452	1.640	183,856	4.221
6906.00	--	7.00	--	--	--	75,252	1.728	202,194	4.642


20
15
10
5
0
Length, Width (ft.)
75600
56700
37800
18900
0
Area (sq.ft.)
0.00
2.00
4.00
6.00
8.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

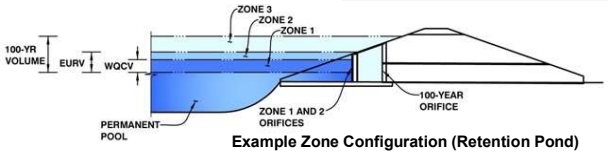

1.740
1.305
0.870
0.435
0.000
Area (acres)
4.660
3.495
2.330
1.165
0.000
Volume (ac-ft)
0.00
2.00
4.00
6.00
8.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **WATERBURY**

Basin ID: **TEMPORARY POND 2 DP 18**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.21	0.241	Orifice Plate
Zone 2 (EURV)	3.13	0.297	Orifice Plate
Zone 3 (100-year)	4.03	0.503	Weir&Pipe (Restrict)
Total (all zones)		1.041	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	9.306E-03	ft^2
Depth at top of Zone using Orifice Plate =	3.13	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	12.50	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.34	sq. inches (diameter = 1-5/16 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.04	2.09					
Orifice Area (sq. inches)	1.34	1.34	1.34					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.13	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.13	N/A	feet
Overflow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	9.90	N/A	
Overflow Grate Open Area w/o Debris =	11.20	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.60	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	11.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.13	N/A	ft^2
Outlet Orifice Centroid =	0.52	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.79	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.46	feet
Spillway Crest Length =	20.00	feet	Stage at Top of Freeboard =	6.46	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	1.54	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.76	acre-ft

Calculated Parameters for Spillway

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

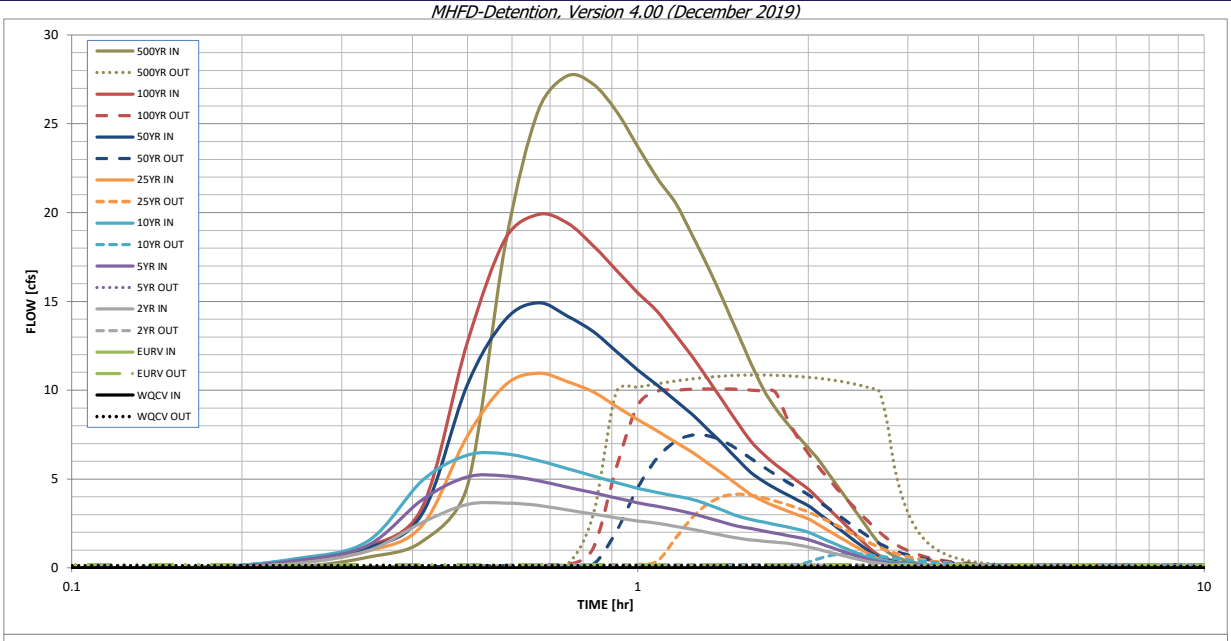
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	0.241	0.538	0.367	0.510	0.634	0.970	1.282	1.703	2.391
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.367	0.510	0.634	0.970	1.282	1.703	2.391
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.3	0.4	3.4	6.8	11.0	17.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.17	0.33	0.54	0.88
Peak Inflow Q (cfs) =	N/A	N/A	3.6	5.2	6.4	11.0	14.9	19.9	27.7
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.2	0.8	4.1	7.5	10.1	10.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	2.2	1.2	1.1	0.9	0.6
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.1	0.4	0.6	0.9	0.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	56	47	56	59	56	54	51	47
Time to Drain 99% of Inflow Volume (hours) =	**40**	61	51	60	64	63	62	60	58
Maximum Ponding Depth (ft) =	2.21	3.13	2.54	2.96	3.20	3.37	3.48	3.69	4.24
Area at Maximum Ponding Depth (acres) =	0.25	0.41	0.30	0.36	0.43	0.49	0.53	0.60	0.78
Maximum Volume Stored (acre-ft) =	0.243	0.538	0.334	0.470	0.564	0.641	0.702	0.820	1.198

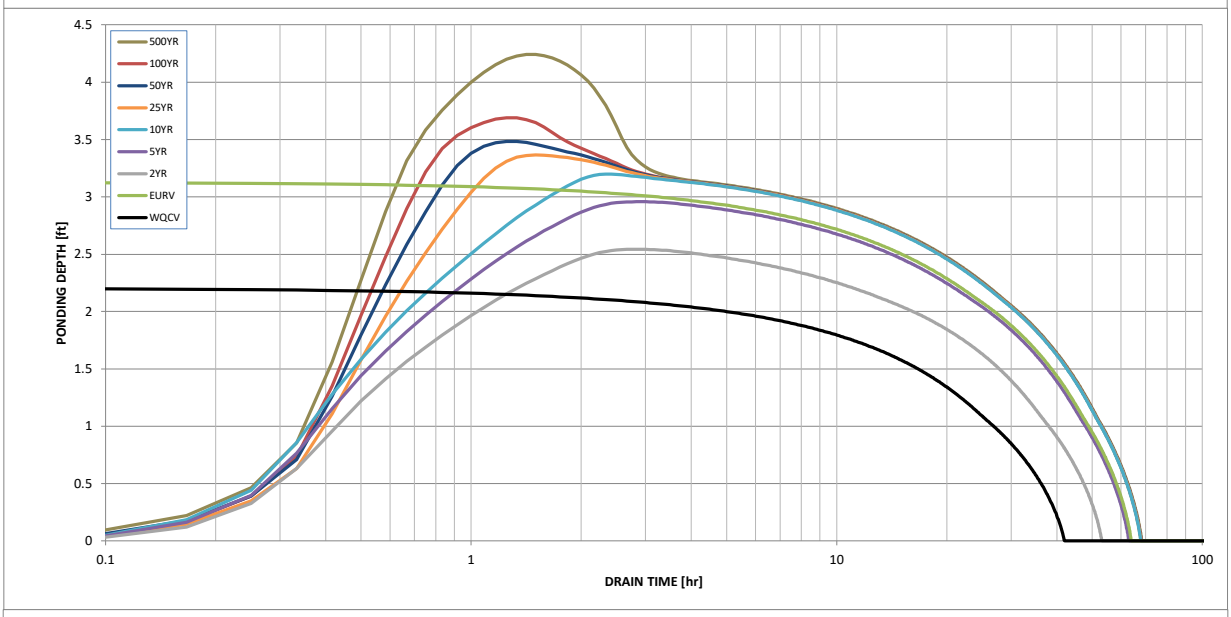
REVISED

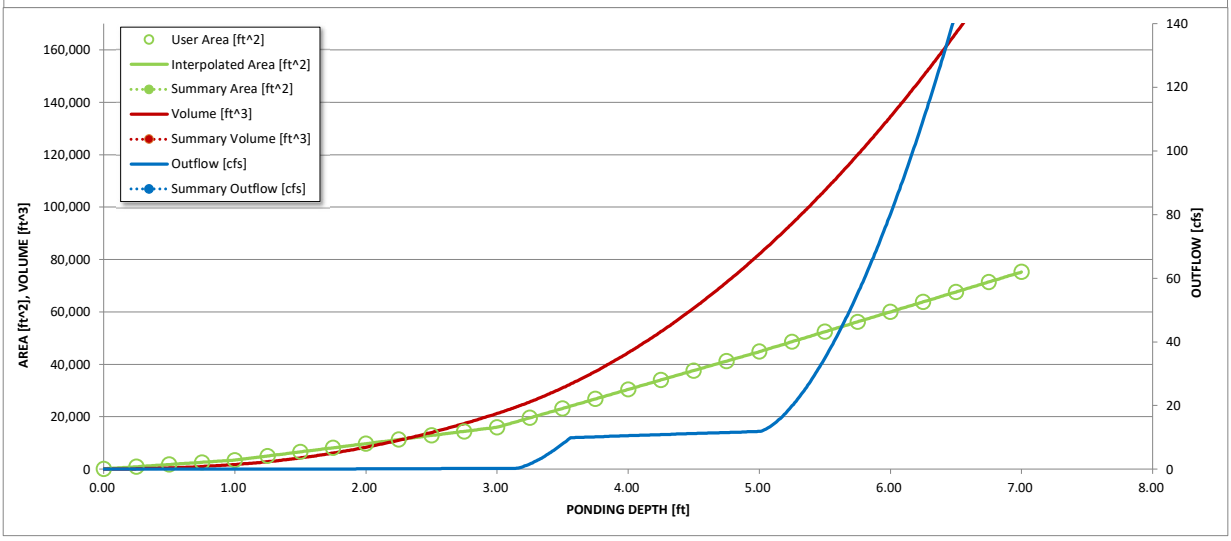
(same comment as Pond 1 - should be closer to 29 cfs minus IRF %)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.07
	0:15:00	0.00	0.00	0.26	0.42	0.52	0.35	0.45	0.43	0.59
	0:20:00	0.00	0.00	0.96	1.26	1.50	0.95	1.12	1.19	1.49
	0:25:00	0.00	0.00	2.56	3.85	4.92	2.41	3.06	3.43	4.64
	0:30:00	0.00	0.00	3.57	5.12	6.34	7.43	10.32	12.72	18.18
	0:35:00	0.00	0.00	3.65	5.17	6.41	10.29	13.96	18.52	25.73
	0:40:00	0.00	0.00	3.52	4.90	6.04	10.96	14.92	19.90	27.70
	0:45:00	0.00	0.00	3.26	4.54	5.59	10.49	14.19	19.43	27.24
	0:50:00	0.00	0.00	3.03	4.23	5.18	9.91	13.31	18.15	25.71
	0:55:00	0.00	0.00	2.82	3.93	4.80	9.09	12.18	16.76	23.71
	1:00:00	0.00	0.00	2.64	3.67	4.48	8.34	11.14	15.49	21.92
	1:05:00	0.00	0.00	2.50	3.46	4.25	7.70	10.27	14.42	20.52
	1:10:00	0.00	0.00	2.34	3.27	4.04	7.07	9.40	13.10	18.66
	1:15:00	0.00	0.00	2.16	3.04	3.85	6.48	8.61	11.86	16.89
	1:20:00	0.00	0.00	1.99	2.80	3.55	5.87	7.76	10.57	15.02
	1:25:00	0.00	0.00	1.82	2.56	3.23	5.27	6.93	9.34	13.24
	1:30:00	0.00	0.00	1.68	2.35	2.92	4.67	6.11	8.17	11.54
	1:35:00	0.00	0.00	1.58	2.21	2.72	4.13	5.38	7.13	10.06
	1:40:00	0.00	0.00	1.51	2.08	2.57	3.75	4.87	6.39	9.00
	1:45:00	0.00	0.00	1.45	1.95	2.44	3.47	4.48	5.83	8.16
	1:50:00	0.00	0.00	1.39	1.83	2.31	3.22	4.13	5.33	7.43
	1:55:00	0.00	0.00	1.29	1.72	2.17	2.98	3.81	4.87	6.75
	2:00:00	0.00	0.00	1.18	1.59	2.01	2.76	3.50	4.43	6.11
	2:05:00	0.00	0.00	1.04	1.40	1.77	2.43	3.09	3.89	5.36
	2:10:00	0.00	0.00	0.90	1.22	1.52	2.11	2.67	3.37	4.63
	2:15:00	0.00	0.00	0.77	1.04	1.29	1.81	2.28	2.87	3.93
	2:20:00	0.00	0.00	0.65	0.87	1.08	1.51	1.89	2.38	3.25
	2:25:00	0.00	0.00	0.53	0.71	0.88	1.23	1.53	1.91	2.59
	2:30:00	0.00	0.00	0.42	0.56	0.70	0.96	1.18	1.46	1.96
	2:35:00	0.00	0.00	0.33	0.43	0.55	0.72	0.86	1.03	1.37
	2:40:00	0.00	0.00	0.27	0.35	0.45	0.52	0.61	0.71	0.94
	2:45:00	0.00	0.00	0.22	0.30	0.38	0.39	0.46	0.51	0.68
	2:50:00	0.00	0.00	0.19	0.25	0.32	0.31	0.36	0.39	0.51
	2:55:00	0.00	0.00	0.16	0.21	0.27	0.25	0.29	0.30	0.39
	3:00:00	0.00	0.00	0.13	0.17	0.22	0.20	0.23	0.23	0.29
	3:05:00	0.00	0.00	0.11	0.14	0.18	0.17	0.19	0.18	0.22
	3:10:00	0.00	0.00	0.09	0.12	0.15	0.14	0.15	0.14	0.17
	3:15:00	0.00	0.00	0.08	0.10	0.12	0.11	0.12	0.11	0.13
	3:20:00	0.00	0.00	0.06	0.08	0.10	0.09	0.10	0.09	0.11
	3:25:00	0.00	0.00	0.05	0.06	0.08	0.07	0.08	0.07	0.09
	3:30:00	0.00	0.00	0.04	0.05	0.06	0.06	0.06	0.06	0.07
	3:35:00	0.00	0.00	0.03	0.04	0.05	0.04	0.05	0.04	0.05
	3:40:00	0.00	0.00	0.02	0.03	0.03	0.03	0.04	0.03	0.04
	3:45:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	3:50:00	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.01	0.02
	3:55:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

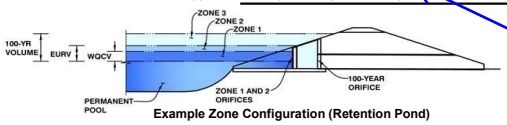
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: **WATERBURY**

Basin ID: **TEMPORARY POND 2 DP 18**

Delete duplicate sheets or relabel if this is different



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	21.93	acres
Watershed Length =	1,425	ft
Watershed Length to Centroid =	650	ft
Watershed Slope =	0.014	ft/ft
Watershed Imperviousness =	30.02%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.243	acre-feet	0.243	acre-feet
Excess Urban Runoff Volume (EURV) =	0.507	acre-feet	0.507	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.337	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.474	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.597	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.949	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.281	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.730	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3 in.) =	2.464	acre-feet	3.00	inches
Approximate 2-yr Detention Volume =	0.414	acre-feet		
Approximate 5-yr Detention Volume =	0.552	acre-feet		
Approximate 10-yr Detention Volume =	0.690	acre-feet		
Approximate 25-yr Detention Volume =	0.872	acre-feet		
Approximate 50-yr Detention Volume =	1.008	acre-feet		
Approximate 100-yr Detention Volume =	1.227	acre-feet		

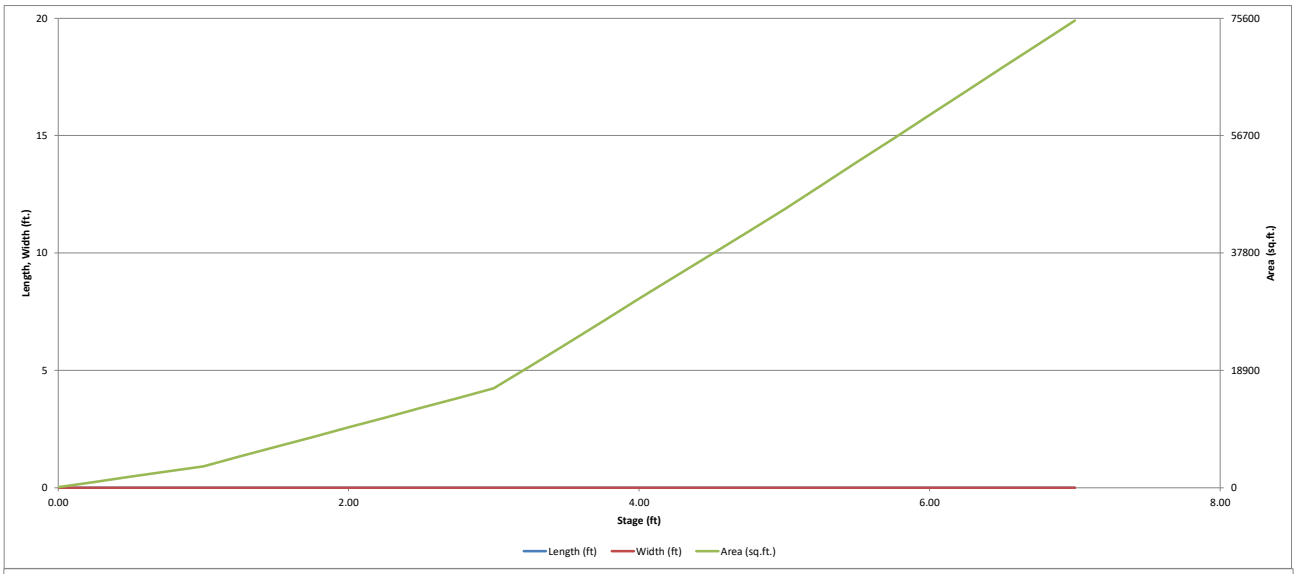
Define Zones and Basin Geometry

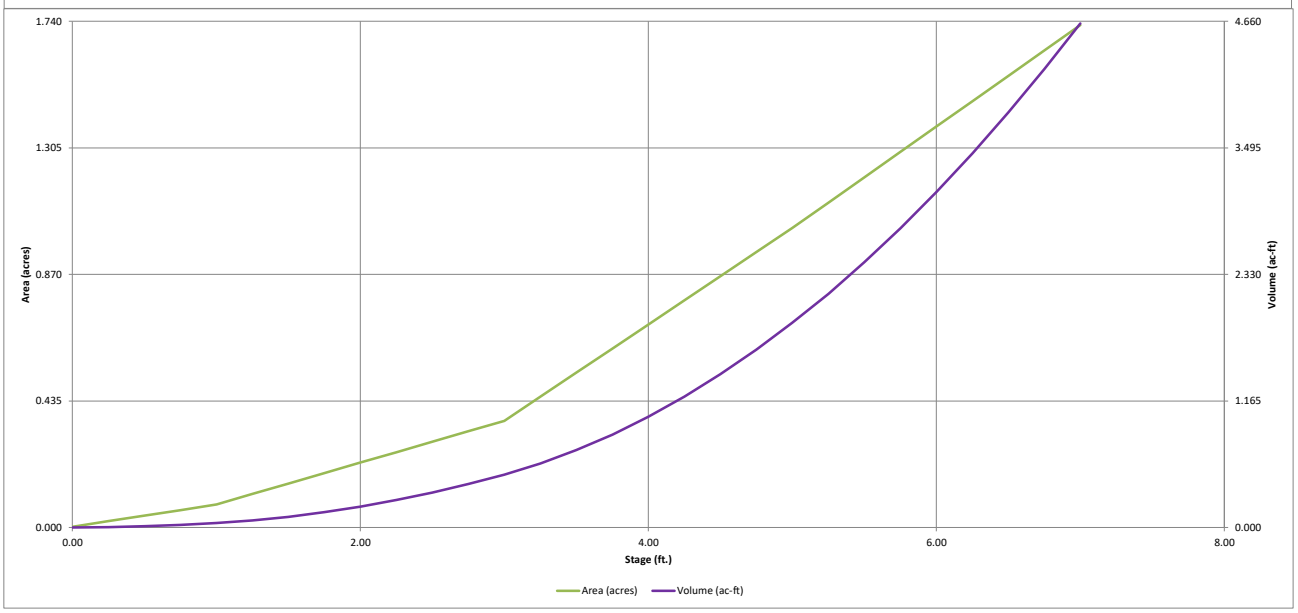
Zone 1 Volume (WQCV) =	0.243	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.264	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.720	acre-feet
Total Detention Basin Volume =	1.227	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = [illegible]

removed

Stage - Storage Description	Stage (ft)	Optional [illegible]				Optional [illegible]ride (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--					[illegible]0	0.002		
6899.25	--					[illegible]2	0.022	130	0.003
6899.50	--	0.50	--	--	--	1,784	0.041	471	0.011
6899.75	--	0.75	--	--	--	2,626	0.060	1,022	0.023
6900.00	--	1.00	--	--	--	3,468	0.080	1,784	0.041
6900.25	--	1.25	--	--	--	5,034	0.116	2,847	0.065
6900.50	--	1.50	--	--	--	6,600	0.152	4,301	0.099
6900.75	--	1.75	--	--	--	8,166	0.187	6,147	0.141
6901.00	--	2.00	--	--	--	9,732	0.223	8,384	0.192
6901.25	--	2.25	--	--	--	11,297	0.259	11,013	0.253
6901.50	--	2.50	--	--	--	12,863	0.295	14,033	0.322
6901.75	--	2.75	--	--	--	14,429	0.331	17,444	0.400
6902.00	--	3.00	--	--	--	15,995	0.367	21,247	0.488
6902.25	--	3.25	--	--	--	19,602	0.450	25,697	0.590
6902.50	--	3.50	--	--	--	23,209	0.533	31,048	0.713
6902.75	--	3.75	--	--	--	26,815	0.616	37,301	0.856
6903.00	--	4.00	--	--	--	30,422	0.698	44,456	1.021
6903.25	--	4.25	--	--	--	34,029	0.781	52,512	1.206
6903.50	--	4.50	--	--	--	37,636	0.864	61,470	1.411
6903.75	--	4.75	--	--	--	41,243	0.947	71,330	1.638
6904.00	--	5.00	--	--	--	44,850	1.030	82,092	1.885
6904.25	--	5.25	--	--	--	48,650	1.117	93,779	2.153
6904.50	--	5.50	--	--	--	52,450	1.204	106,417	2.443
6904.75	--	5.75	--	--	--	56,251	1.291	120,004	2.755
6905.00	--	6.00	--	--	--	60,051	1.379	134,542	3.089
6905.25	--	6.25	--	--	--	63,851	1.466	150,030	3.444
6905.50	--	6.50	--	--	--	67,652	1.553	166,468	3.822
6905.75	--	6.75	--	--	--	71,452	1.640	183,856	4.221
6906.00	--	7.00	--	--	--	75,252	1.728	202,194	4.642


20
15
10
5
0
Length, Width (ft.)
75600
56700
37800
18900
0
Area (sq.ft.)
0.00
2.00
4.00
6.00
8.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

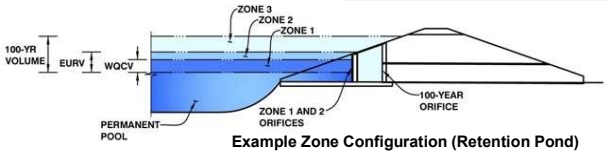

1.740
1.305
0.870
0.435
0.000
Area (acres)
4.660
3.495
2.330
1.165
0.000
Volume (ac-ft)
0.00
2.00
4.00
6.00
8.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **WATERBURY**

Basin ID: **TEMPORARY POND 2 DP 18**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.22	0.243	Orifice Plate
Zone 2 (EURV)	3.06	0.264	Orifice Plate
Zone 3 (100-year)	4.28	0.720	Weir&Pipe (Restrict)
Total (all zones)		1.227	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	9.306E-03	ft^2
Depth at top of Zone using Orifice Plate =	3.06	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	12.20	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.34	sq. inches (diameter = 1-5/16 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.02	2.04					
Orifice Area (sq. inches)	1.34	1.34	1.34					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.06	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.06	N/A	feet
Overflow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	8.95	N/A	
Overflow Grate Open Area w/o Debris =	11.20	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.60	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	12.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.25	N/A	ft^2
Outlet Orifice Centroid =	0.56	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.91	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.47	feet
Spillway Crest Length =	20.00	feet	Stage at Top of Freeboard =	6.47	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	1.54	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.78	acre-ft

Calculated Parameters for Spillway

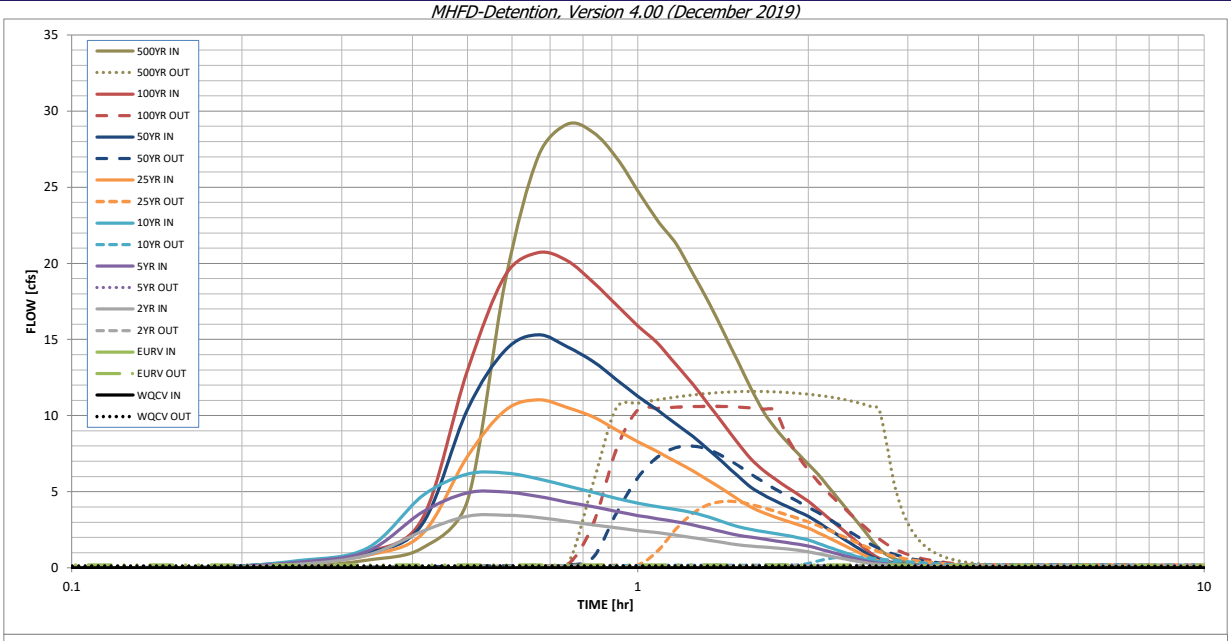
Routed Hydrograph Results

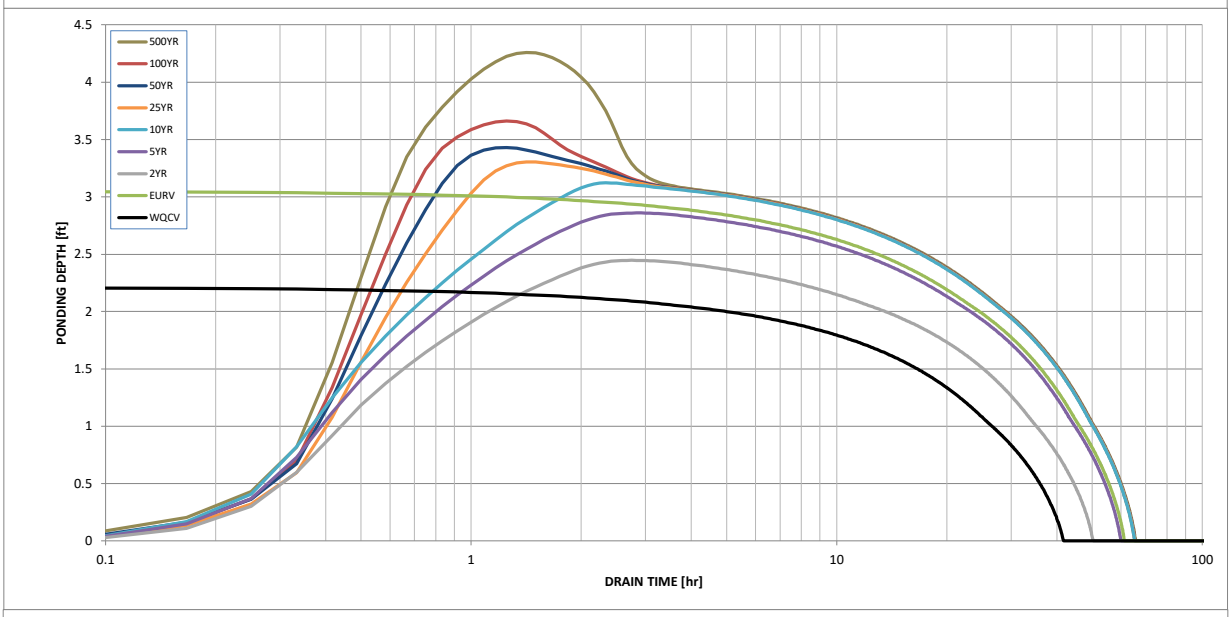
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

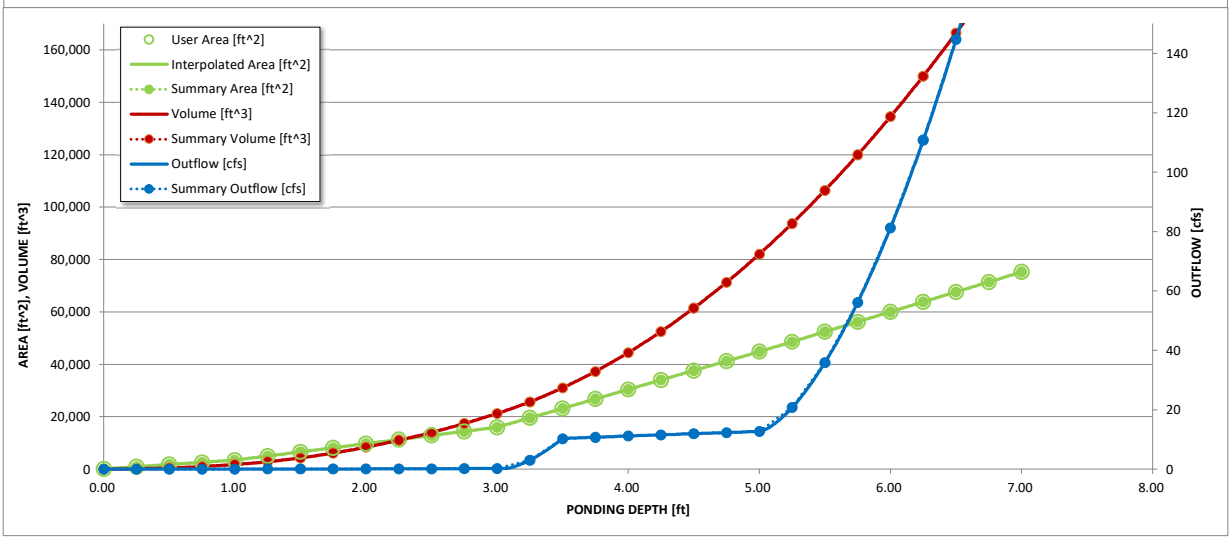
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	0.243	0.507	0.337	0.474	0.597	0.949	1.281	1.730	2.464
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.337	0.474	0.597	0.949	1.281	1.730	2.464
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.3	0.4	3.8	7.5	12.3	19.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.17	0.34	0.56	0.90
Peak Inflow Q (cfs) =	N/A	N/A	3.5	5.0	6.2	11.0	15.3	20.7	29.1
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.2	0.7	4.4	8.0	10.6	11.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	1.8	1.2	1.1	0.9	0.6
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.4	0.7	0.9	1.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	54	45	53	57	54	51	48	44
Time to Drain 99% of Inflow Volume (hours) =	**40**	58	48	57	62	60	59	58	55
Maximum Ponding Depth (ft) =	2.22	3.06	2.45	2.86	3.12	3.30	3.43	3.66	4.26
Area at Maximum Ponding Depth (acres) =	0.26	0.39	0.29	0.35	0.41	0.47	0.51	0.59	0.78
Maximum Volume Stored (acre-ft) =	0.245	0.510	0.305	0.434	0.534	0.613	0.676	0.802	1.213

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.07
	0:15:00	0.00	0.00	0.23	0.37	0.46	0.31	0.39	0.38	0.52
	0:20:00	0.00	0.00	0.84	1.11	1.31	0.83	0.98	1.04	1.30
	0:25:00	0.00	0.00	2.40	3.66	4.73	2.23	2.87	3.24	4.42
	0:30:00	0.00	0.00	3.39	4.92	6.15	7.31	10.40	12.97	18.83
	0:35:00	0.00	0.00	3.46	4.97	6.23	10.35	14.30	19.22	27.01
	0:40:00	0.00	0.00	3.31	4.69	5.84	11.03	15.31	20.70	29.14
	0:45:00	0.00	0.00	3.05	4.32	5.38	10.53	14.52	20.17	28.62
	0:50:00	0.00	0.00	2.82	4.01	4.95	9.91	13.57	18.77	26.95
	0:55:00	0.00	0.00	2.62	3.70	4.57	9.06	12.37	17.27	24.77
	1:00:00	0.00	0.00	2.45	3.44	4.25	8.28	11.27	15.90	22.81
	1:05:00	0.00	0.00	2.31	3.23	4.02	7.63	10.36	14.75	21.31
	1:10:00	0.00	0.00	2.15	3.04	3.82	6.98	9.46	13.37	19.34
	1:15:00	0.00	0.00	1.98	2.82	3.63	6.37	8.64	12.07	17.47
	1:20:00	0.00	0.00	1.82	2.58	3.34	5.74	7.76	10.73	15.50
	1:25:00	0.00	0.00	1.66	2.35	3.01	5.14	6.90	9.45	13.61
	1:30:00	0.00	0.00	1.52	2.14	2.72	4.53	6.05	8.23	11.81
	1:35:00	0.00	0.00	1.42	2.02	2.53	3.99	5.30	7.16	10.27
	1:40:00	0.00	0.00	1.36	1.89	2.38	3.62	4.79	6.40	9.17
	1:45:00	0.00	0.00	1.30	1.77	2.25	3.33	4.39	5.82	8.29
	1:50:00	0.00	0.00	1.25	1.66	2.12	3.08	4.04	5.31	7.52
	1:55:00	0.00	0.00	1.15	1.55	1.99	2.84	3.71	4.83	6.81
	2:00:00	0.00	0.00	1.06	1.44	1.83	2.61	3.39	4.38	6.14
	2:05:00	0.00	0.00	0.93	1.26	1.60	2.30	2.98	3.84	5.37
	2:10:00	0.00	0.00	0.80	1.09	1.38	2.00	2.57	3.31	4.63
	2:15:00	0.00	0.00	0.68	0.92	1.16	1.70	2.18	2.81	3.91
	2:20:00	0.00	0.00	0.57	0.76	0.96	1.41	1.80	2.31	3.21
	2:25:00	0.00	0.00	0.46	0.62	0.78	1.14	1.44	1.84	2.54
	2:30:00	0.00	0.00	0.36	0.48	0.61	0.88	1.09	1.37	1.88
	2:35:00	0.00	0.00	0.28	0.37	0.48	0.64	0.77	0.94	1.27
	2:40:00	0.00	0.00	0.23	0.30	0.39	0.45	0.54	0.64	0.86
	2:45:00	0.00	0.00	0.19	0.26	0.33	0.34	0.40	0.46	0.62
	2:50:00	0.00	0.00	0.16	0.21	0.28	0.27	0.32	0.35	0.46
	2:55:00	0.00	0.00	0.14	0.18	0.23	0.22	0.25	0.26	0.34
	3:00:00	0.00	0.00	0.11	0.15	0.19	0.17	0.20	0.20	0.26
	3:05:00	0.00	0.00	0.10	0.12	0.16	0.14	0.16	0.16	0.19
	3:10:00	0.00	0.00	0.08	0.10	0.13	0.12	0.13	0.12	0.15
	3:15:00	0.00	0.00	0.07	0.08	0.11	0.09	0.11	0.10	0.12
	3:20:00	0.00	0.00	0.05	0.07	0.08	0.08	0.09	0.08	0.09
	3:25:00	0.00	0.00	0.04	0.05	0.07	0.06	0.07	0.06	0.07
	3:30:00	0.00	0.00	0.03	0.04	0.05	0.05	0.05	0.05	0.06
	3:35:00	0.00	0.00	0.02	0.03	0.04	0.04	0.04	0.04	0.04
	3:40:00	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.03
	3:45:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.02
	3:50:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	3:55:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Worksheet Protected

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.43	inches
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer:	**QNA**
Company:	**Terra Nova Engineering**
Date:	**March 3, 2022**
Project:	**WATERBURY FILING 1 POND 3**
Location:	**POND 3 Design Point 29 Full Spectrum Detention**

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	**DP 29 FSD**													
Receiving Pervious Area Soil Type	Loamy Sand													
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	82.02													
Directly Connected Impervious Area (DCIA, acres)	19.50													
Unconnected Impervious Area (UIA, acres)	22.09													
Receiving Pervious Area (RPA, acres)	8.68													
Separate Pervious Area (SPA, acres)	31.74													
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C													

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	82.016													
Directly Connected Impervious Area (DCIA, %)	23.8%													
Unconnected Impervious Area (UIA, %)	26.9%													
Receiving Pervious Area (RPA, %)	10.6%													
Separate Pervious Area (SPA, %)	38.7%													
A_R (RPA / UIA)	0.393													
I_a Check	0.720													
f / I for WQCV Event:	4.5													
f / I for 5-Year Event:	0.5													
f / I for 100-Year Event:	0.4													
f / I for Optional User Defined Storm CUHP:														
IRF for WQCV Event:	0.73													
IRF for 5-Year Event:	0.93													
IRF for 100-Year Event:	0.95													
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I_{total}	50.7%													
Effective Imperviousness for WQCV Event:	43.5%													
Effective Imperviousness for 5-Year Event:	48.8%													
Effective Imperviousness for 100-Year Event:	49.3%													
Effective Imperviousness for Optional User Defined Storm CUHP:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	9.2%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	2.8%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	**50.7%**
Total Site Effective Imperviousness for WQCV Event:	**43.5%**
Total Site Effective Imperviousness for 5-Year Event:	**48.8%**
Total Site Effective Imperviousness for 100-Year Event:	**49.3%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

REMOVED

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: **Waterbury Filing No. 1 & 2 EDB Pond 3 DP 29**

Facility Location & Jurisdiction: **Stapleton Dr. & Bandernero Dr Intersection**

User Input: Watershed Characteristics

Watershed Slope =	0.022	ft/ft
Watershed Length =	2265	ft
Watershed Area =	84.64	acres
Watershed Imperviousness =	49.3%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent

Location for 1-hr Rainfall Depths (use dropdown):

User Input

WQCV Treatment Method = Extended Detention

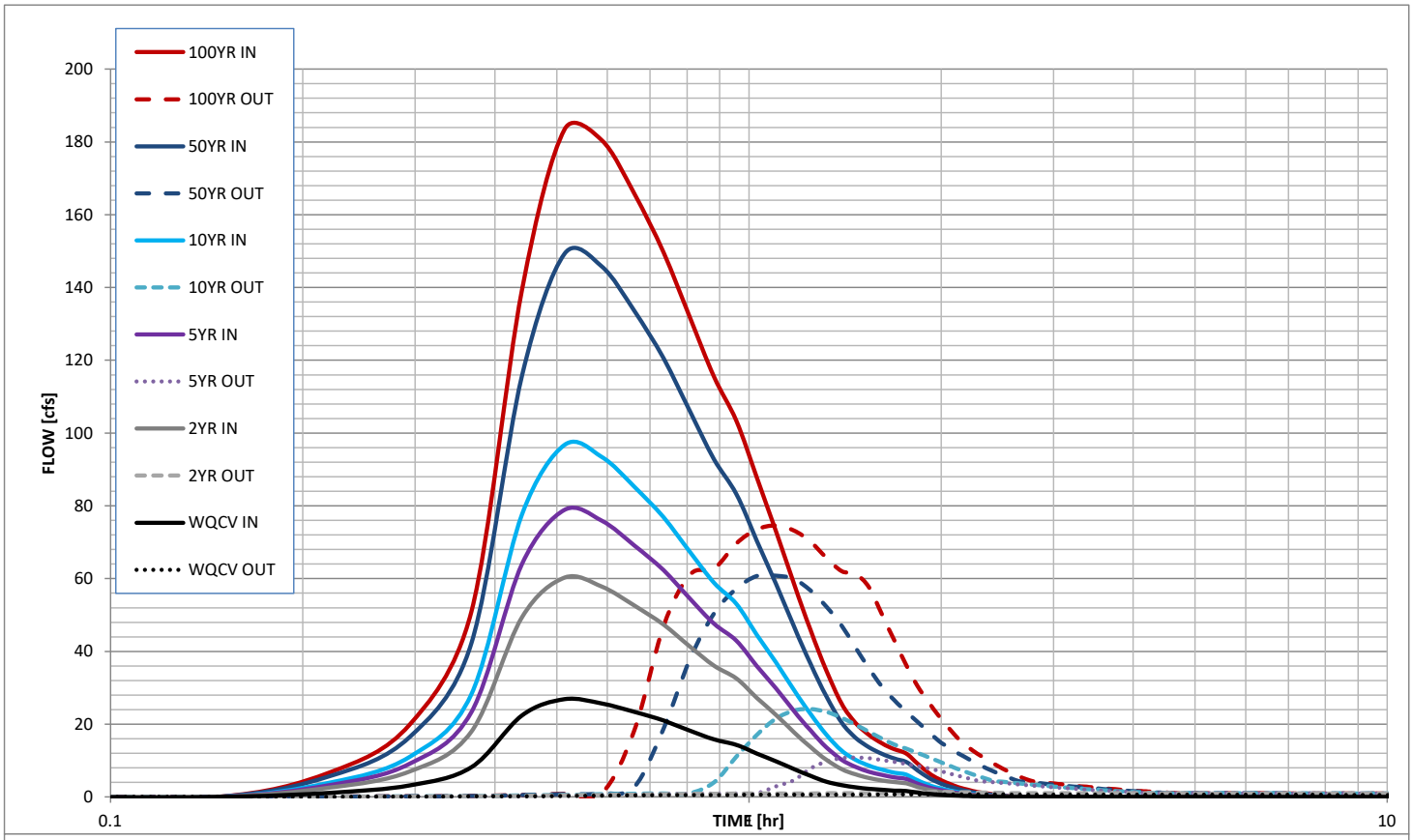
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	100	0.00	0.00
0.25	2,785	0.25	0.10
0.50	5,470	0.50	0.14
0.75	8,155	0.75	0.18
1.00	10,840	1.00	0.20
1.25	13,525	1.25	0.23
1.50	16,210	1.50	0.25
1.75	18,895	1.75	0.37
2.00	21,580	2.00	0.43
2.25	26,334	2.25	0.48
2.50	31,088	2.50	0.53
2.75	35,842	2.75	0.57
3.00	40,596	3.00	0.60
3.25	45,530	3.25	0.73
3.50	50,105	3.50	0.81
3.75	54,895	3.75	0.87
4.00	59,613	4.00	0.93
4.25	62,301	4.25	0.98
4.50	64,989	4.50	1.03
4.75	67,677	4.75	4.39
5.00	70,365	5.00	14.71
5.25	73,504	5.25	28.91
5.50	75,742	5.50	46.13
5.75	78,430	5.75	60.71
6.00	81,118	6.00	62.35
6.25	82,113	6.25	74.47
6.50	83,503	6.50	111.77
6.75	84,696	6.75	163.81
7.00	85,888	7.00	227.74
7.25	87,081	7.25	302.17
7.50	88,274	7.50	386.27
7.75	89,466	7.75	479.48
8.00	90,659	8.00	581.41

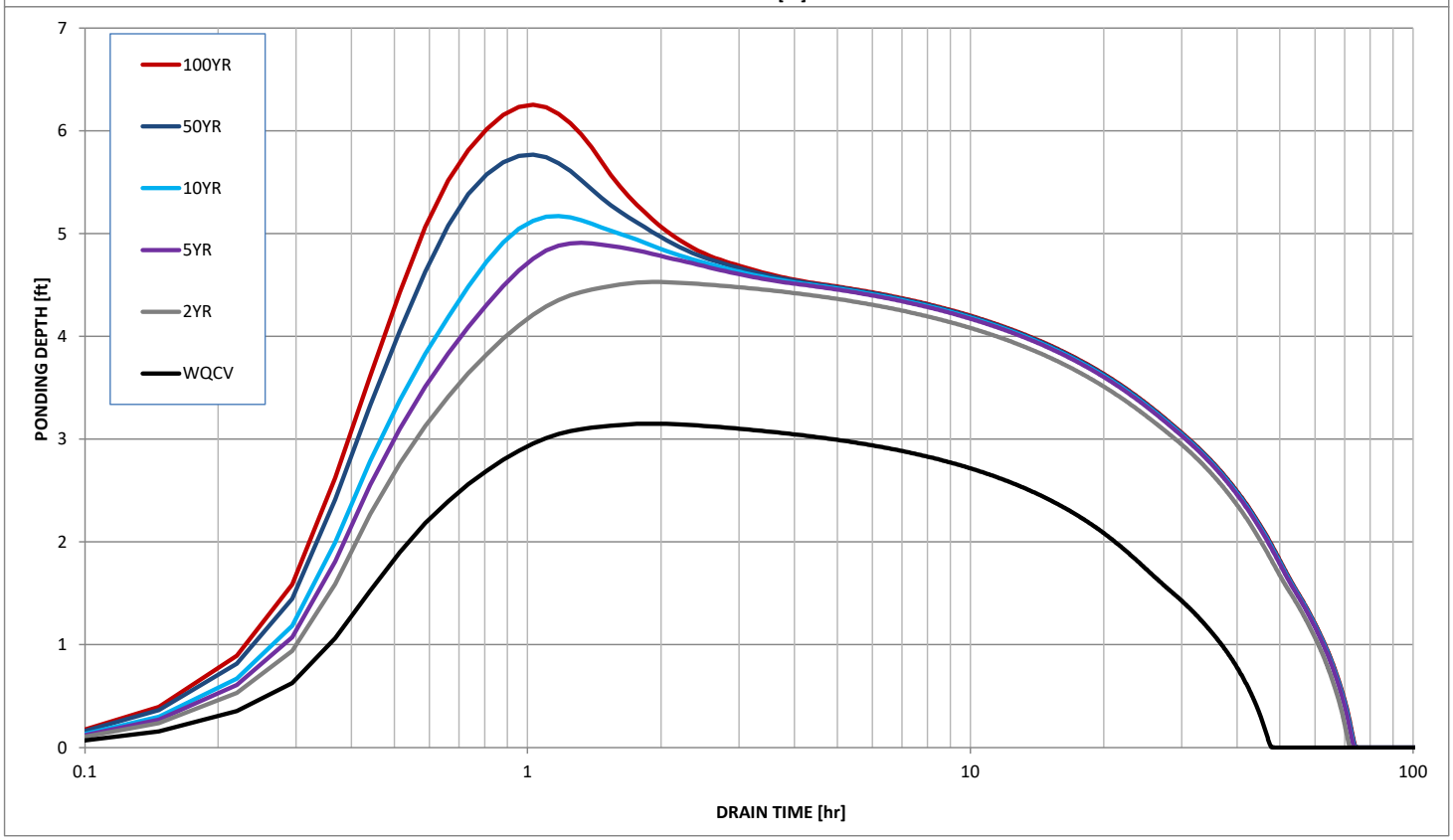
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	1.19	1.50	1.75	2.25	2.52	in
Calculated Runoff Volume =	1.441	3.266	4.295	5.293	8.263	10.226	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	1.441	3.265	4.295	5.291	8.258	10.218	acre-ft
Time to Drain 97% of Inflow Volume =	42.4	62.8	**62.5**	60.9	56.4	53.8	hours
Time to Drain 99% of Inflow Volume =	45.0	67.4	68.2	67.6	65.8	**64.6**	hours
Maximum Ponding Depth =	3.15	4.53	4.91	5.17	5.77	6.25	ft
Maximum Ponded Area =	1.00	1.50	1.59	1.66	1.80	**1.89**	acres
Maximum Volume Stored =	1.350	3.111	3.701	4.123	5.152	6.062	acre-ft

Stormwater Detention and Infiltration Design Data Sheet



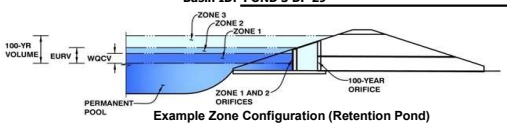


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: **WATERBURY**

Basin ID: **POND 3 DP 29**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	82.02	acres
Watershed Length =	2,265	ft
Watershed Length to Centroid =	850	ft
Watershed Slope =	0.022	ft/ft
Watershed Imperviousness =	49.28%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

REVISED

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

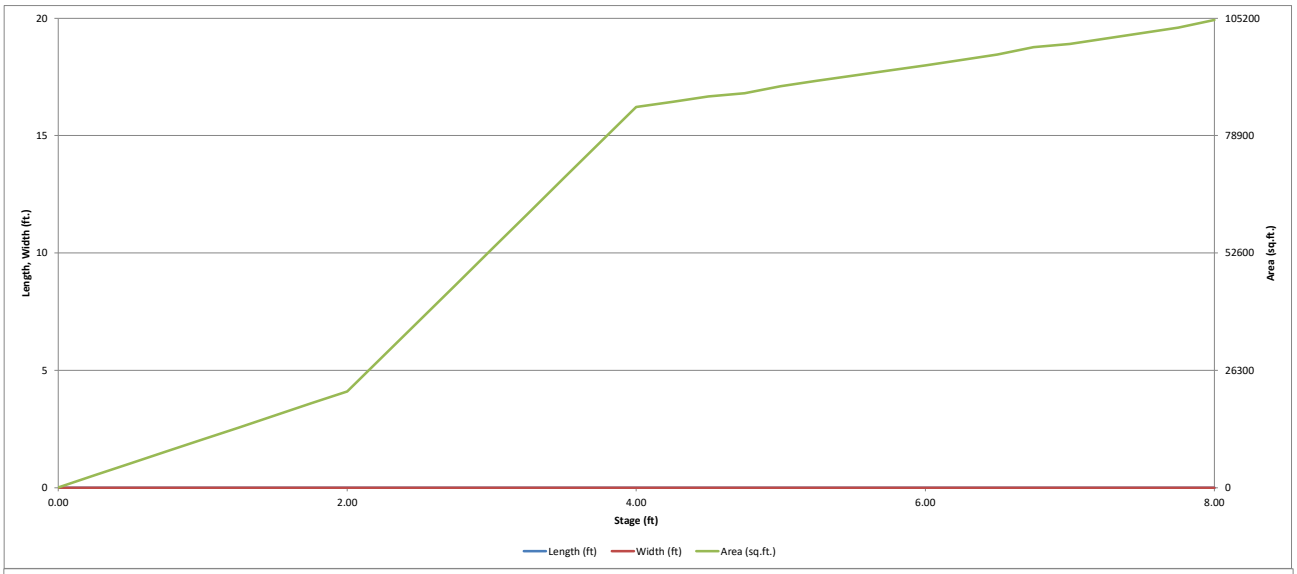
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.396	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.641	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	3.480	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	4.628	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	5.544	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	7.011	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	8.441	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	10.262	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3 in.) =	13.270	acre-feet	3.00	inches
Approximate 2-yr Detention Volume =	2.982	acre-feet		
Approximate 5-yr Detention Volume =	3.927	acre-feet		
Approximate 10-yr Detention Volume =	4.796	acre-feet		
Approximate 25-yr Detention Volume =	5.873	acre-feet		
Approximate 50-yr Detention Volume =	6.560	acre-feet		
Approximate 100-yr Detention Volume =	7.405	acre-feet		

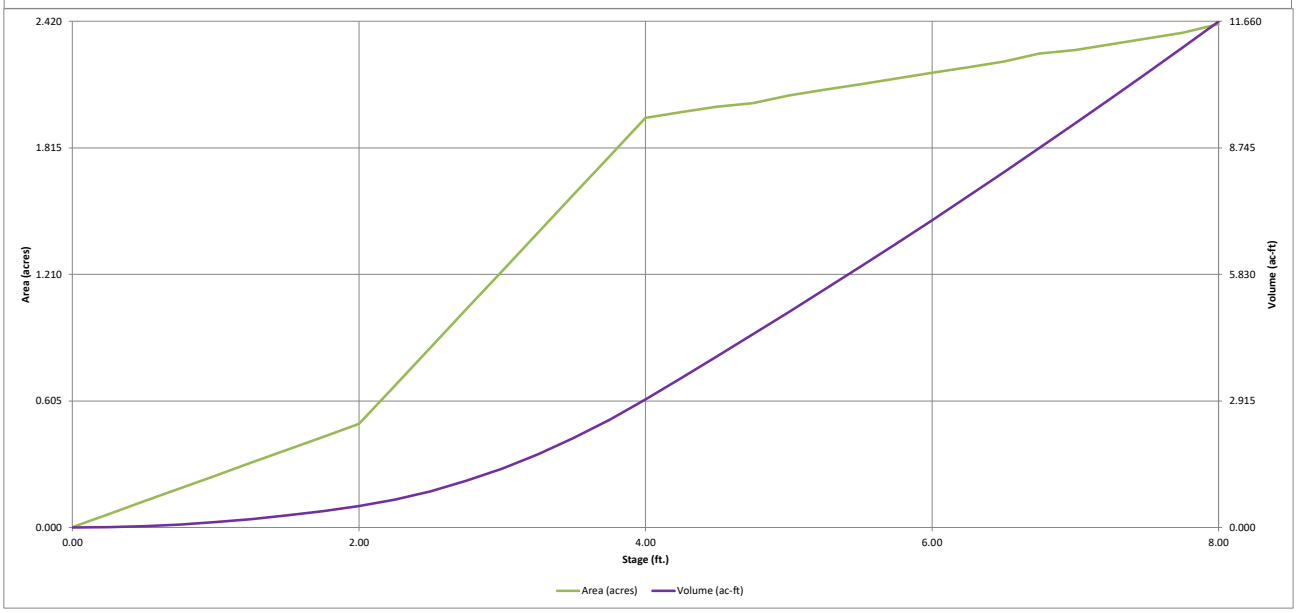
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.396	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.245	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.764	acre-feet
Total Detention Basin Volume =	7.405	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	100	0.002		
6922.25	--	0.25	--	--	--	2,785	0.064	360	0.008
6922.50	--	0.50	--	--	--	5,470	0.126	1,392	0.032
6922.75	--	0.75	--	--	--	8,155	0.187	3,095	0.071
6923.00	--	1.00	--	--	--	10,844	0.249	5,470	0.126
6923.25	--	1.25	--	--	--	13,525	0.310	8,516	0.196
6923.50	--	1.50	--	--	--	16,210	0.372	12,233	0.281
6923.75	--	1.75	--	--	--	18,895	0.434	16,621	0.382
6924.00	--	2.00	--	--	--	21,580	0.495	21,681	0.498
6924.25	--	2.25	--	--	--	29,550	0.678	28,072	0.644
6924.50	--	2.50	--	--	--	37,520	0.861	36,456	0.837
6924.75	--	2.75	--	--	--	45,490	1.044	46,832	1.075
6925.00	--	3.00	--	--	--	53,460	1.227	59,201	1.359
6925.25	--	3.25	--	--	--	61,430	1.410	73,562	1.689
6925.50	--	3.50	--	--	--	69,399	1.593	89,915	2.064
6925.75	--	3.75	--	--	--	77,369	1.776	108,261	2.485
6926.00	--	4.00	--	--	--	85,339	1.959	128,600	2.952
6926.25	--	4.25	--	--	--	86,506	1.986	150,081	3.445
6926.50	--	4.50	--	--	--	87,672	2.013	171,853	3.945
6926.75	--	4.75	--	--	--	88,389	2.029	193,860	4.450
6927.00	--	5.00	--	--	--	90,005	2.066	216,160	4.962
6927.25	--	5.25	--	--	--	91,172	2.093	238,807	5.482
6927.50	--	5.50	--	--	--	92,338	2.120	261,746	6.009
6927.75	--	5.75	--	--	--	93,505	2.147	284,976	6.542
6928.00	--	6.00	--	--	--	94,671	2.173	308,498	7.082
6928.25	--	6.25	--	--	--	95,873	2.201	332,316	7.629
6928.50	--	6.50	--	--	--	97,075	2.229	356,434	8.183
6928.75	--	6.75	--	--	--	98,726	2.266	380,910	8.744
6929.00	--	7.00	--	--	--	99,478	2.284	405,685	9.313
6929.25	--	7.25	--	--	--	100,680	2.311	430,705	9.888
6929.50	--	7.50	--	--	--	101,881	2.339	456,025	10.469
6929.75	--	7.75	--	--	--	103,083	2.366	481,645	11.057
6930.00	--	8.00	--	--	--	104,825	2.406	507,634	11.654


20
15
10
5
0
Length, Width (ft.)
105200
78900
52600
26300
0
Area (sq.ft.)
0.00
2.00
4.00
6.00
8.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

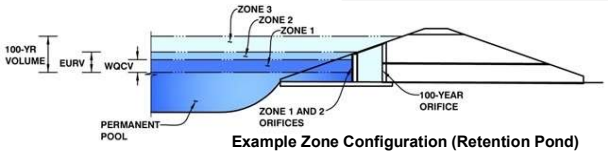

2.420
1.815
1.210
0.605
0.000
Area (acres)
11.660
8.745
5.830
2.915
0.000
Volume (ac-ft)
0.00
2.00
4.00
6.00
8.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **WATERBURY**

Basin ID: **POND 3 DP 29**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.04	1.396	Orifice Plate
Zone 2 (EURV)	4.85	3.245	Orifice Plate
Zone 3 (100-year)	6.15	2.764	Weir&Pipe (Restrict)
Total (all zones)		7.405	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	4.778E-02	ft^2
Depth at top of Zone using Orifice Plate =	4.85	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	19.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	6.88	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.62	3.23					
Orifice Area (sq. inches)	6.88	6.88	6.88					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.85	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	7.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	7.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.85	N/A	feet
Overflow Weir Slope Length =	7.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	6.25	N/A	
Overflow Grate Open Area w/o Debris =	34.30	N/A	ft^2
Overflow Grate Open Area w/ Debris =	17.15	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.10	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	36.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	26.10		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	5.49	N/A	ft^2
Outlet Orifice Centroid =	1.21	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.04	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.20	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	75.00	feet
Spillway End Slopes =	3.00	H:V
Freeboard above Max Water Surface =	0.89	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.91	feet
Stage at Top of Freeboard =	8.00	feet
Basin Area at Top of Freeboard =	2.41	acres
Basin Volume at Top of Freeboard =	11.65	acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

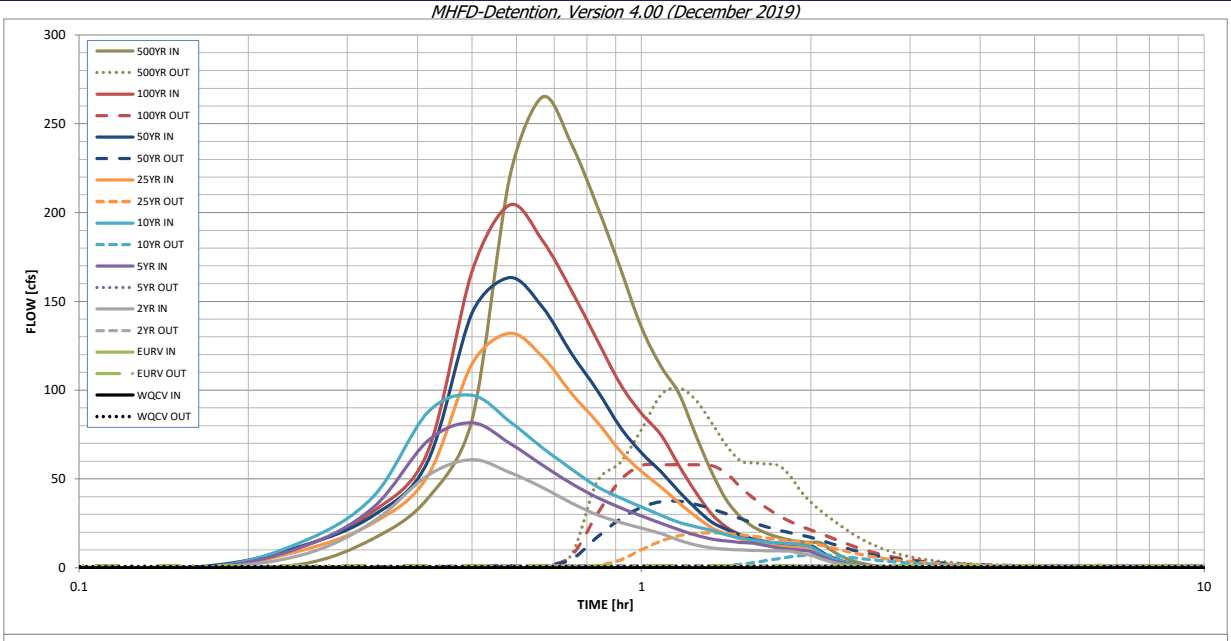
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	1.396	4.641	3.480	4.628	5.544	7.011	8.441	10.262	13.270
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.480	4.628	5.544	7.011	8.441	10.262	13.270
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.8	1.5	2.1	19.5	38.7	63.3	100.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.24	0.47	0.77	1.23
Peak Inflow Q (cfs) =	N/A	N/A	60.8	81.5	97.1	132.0	163.4	204.3	265.1
Peak Outflow Q (cfs) =	0.7	1.2	1.1	1.2	7.2	19.7	37.4	58.1	101.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	3.4	1.0	1.0	0.9	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.2	0.5	1.1	1.7	1.7
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	73	63	73	76	74	72	70	67
Time to Drain 99% of Inflow Volume (hours) =	**40**	78	67	78	82	81	80	79	78
Maximum Ponding Depth (ft) =	3.03	4.85	4.18	4.74	5.06	5.30	5.56	5.94	6.51
Area at Maximum Ponding Depth (acres) =	1.25	2.04	1.98	2.03	2.07	2.10	2.13	2.17	2.23
Maximum Volume Stored (acre-ft) =	1.396	4.654	3.307	4.430	5.087	5.587	6.115	6.930	8.205

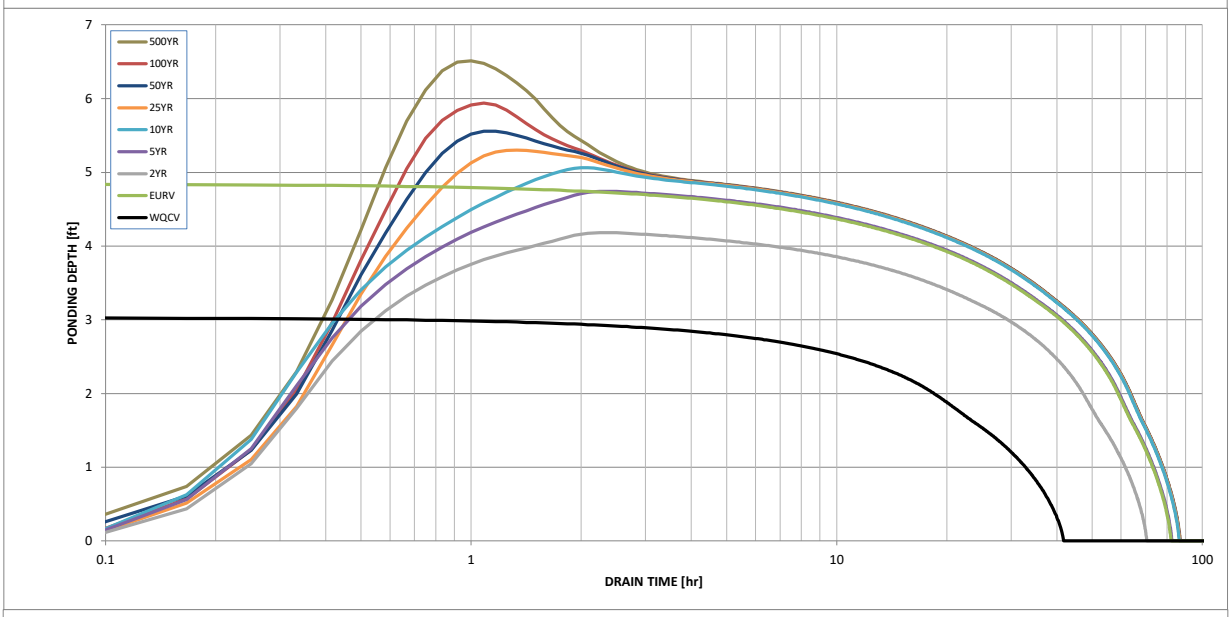
(same comment as Pond 1 - should be closer to 88 cfs minus IRF %)

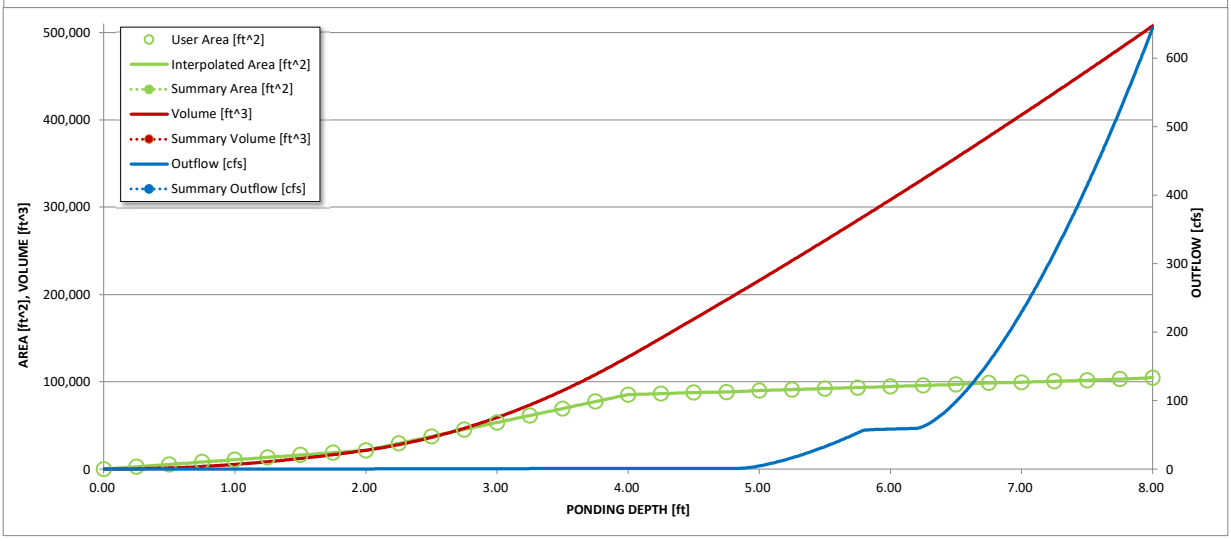
REVISED

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.08	2.09
	0:15:00	0.00	0.00	7.26	11.80	14.69	9.91	12.40	12.14	16.27
	0:20:00	0.00	0.00	25.84	33.86	39.93	25.25	29.41	31.61	38.94
	0:25:00	0.00	0.00	51.92	71.23	87.34	51.44	59.65	65.08	83.29
	0:30:00	0.00	0.00	60.78	81.53	97.10	114.81	143.33	166.86	220.00
	0:35:00	0.00	0.00	53.62	70.13	82.33	131.98	163.37	204.31	265.10
	0:40:00	0.00	0.00	45.21	57.76	67.52	118.82	146.82	184.31	238.98
	0:45:00	0.00	0.00	36.55	47.45	55.70	98.34	120.90	156.32	204.07
	0:50:00	0.00	0.00	29.88	39.62	45.73	82.26	100.19	128.64	168.93
	0:55:00	0.00	0.00	25.56	33.80	39.32	65.76	79.24	103.49	135.20
	1:00:00	0.00	0.00	22.27	29.16	34.26	54.11	64.71	86.88	113.34
	1:05:00	0.00	0.00	19.24	24.96	29.56	45.42	54.02	74.77	97.93
	1:10:00	0.00	0.00	15.47	21.41	25.59	36.46	42.89	57.37	74.34
	1:15:00	0.00	0.00	12.66	18.25	23.08	28.80	33.31	42.27	53.87
	1:20:00	0.00	0.00	11.20	16.18	20.95	22.56	25.77	30.15	38.14
	1:25:00	0.00	0.00	10.44	15.01	18.52	18.97	21.52	22.81	28.55
	1:30:00	0.00	0.00	9.98	14.26	16.71	16.16	18.26	18.57	22.91
	1:35:00	0.00	0.00	9.74	13.75	15.48	14.25	16.06	15.98	19.49
	1:40:00	0.00	0.00	9.55	12.35	14.62	13.01	14.65	14.25	17.21
	1:45:00	0.00	0.00	9.41	11.19	14.04	12.22	13.75	13.10	15.69
	1:50:00	0.00	0.00	9.32	10.38	13.62	11.67	13.11	12.33	14.68
	1:55:00	0.00	0.00	8.07	9.80	12.95	11.32	12.73	11.96	14.23
	2:00:00	0.00	0.00	6.99	9.10	11.71	11.11	12.49	11.83	14.07
	2:05:00	0.00	0.00	5.05	6.62	8.41	8.10	9.09	8.63	10.25
	2:10:00	0.00	0.00	3.43	4.50	5.73	5.50	6.16	5.88	6.97
	2:15:00	0.00	0.00	2.32	3.03	3.90	3.75	4.20	4.01	4.75
	2:20:00	0.00	0.00	1.54	1.98	2.59	2.49	2.78	2.65	3.13
	2:25:00	0.00	0.00	0.97	1.27	1.67	1.61	1.80	1.71	2.02
	2:30:00	0.00	0.00	0.58	0.82	1.04	1.04	1.15	1.09	1.28
	2:35:00	0.00	0.00	0.30	0.47	0.57	0.59	0.65	0.61	0.71
	2:40:00	0.00	0.00	0.12	0.21	0.25	0.27	0.29	0.27	0.31
	2:45:00	0.00	0.00	0.04	0.06	0.06	0.07	0.07	0.07	0.07
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RUNOFF REDUCTION

Missing table for "Area not tributary to WQ Ponds for Runoff Reduction" Please add back into report

ADDED

Unresolved comment from Review #2: These sub-basins of I and J are not delineated on any of the drainage maps. Show on one of the maps, or created a new map.

V3 Update: it is still unclear which UIA/RPA region on the map (on pdf pg 277) corresponds with which Area ID on this spreadsheet . There is also RR in Basin P, V, and Y which should be shown on this spreadsheet too...

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer:	Quentin Armijo
Company:	Terra Nova Engineering, Inc.
Date:	March 8, 2022
Project:	Waterbury Filings 1 & 2
Location:	BASIN I, J & N WESTERN CHANNEL DIRECT RELEASE BROKE DOWN TO MEET 80,000 SQ FT

AS STATED IN PREVIOUS RESPONSE THERE ARE NO SUBBASINS THE SPREADSHEET DOES NOT ALLOW YOU TO ENTER MORE THAN 80,000 SQ FT SO I DIVIDED THESE BASINS UP. THE HEADING EXPLAINS THIS. ADDED TO MDDP MAP

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches

Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Fig

Area Type	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA
Area ID	IA	IB	IC	ID	JA	JB	N
Downstream Design Point ID	WEST CH	WEST CH	WEST CH	WEST CH	WEST CH	WEST CH	WEST CH
Downstream BMP Type	None	None	None	None	None	None	None
DCIA (ft^2)	--	--	--	--	--	--	--
UIA (ft^2)	8,328	8,328	8,328	8,328	9,530	9,530	5,505
RPA (ft^2)	7,177	7,177	7,177	7,177	2,520	2,520	2,174
SPA (ft^2)	--	--	--	--	--	--	--
HSG A (%)	100%	100%	100%	100%	100%	100%	100%
HSG B (%)	0%	0%	0%	0%	0%	0%	0%
HSG C/D (%)	0%	0%	0%	0%	0%	0%	0%
Average Slope of RPA (ft/ft)	0.020	0.020	0.020	0.020	0.020	0.020	0.020
UIA:RPA Interface Width (ft)	60.00	60.00	60.00	60.00	60.00	60.00	60.00

CALCULATED RUNOFF RESULTS

Area ID	IA	IB	IC	ID	JA	JB	N
UIA:RPA Area (ft^2)	15,505	15,505	15,505	15,505	12,050	12,050	7,678
L / W Ratio	4.31	4.31	4.31	4.31	3.35	3.35	2.13
UIA / Area	0.5371	0.5371	0.5371	0.5371	0.7909	0.7909	0.7169
Runoff (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Runoff (ft^3)	0	0	0	0	0	0	0
Runoff Reduction (ft^3)	347	347	347	347	397	397	229

CALCULATED WQCV RESULTS

Area ID	IA	IB	IC	ID	JA	JB	N
WQCV (ft^3)	347	347	347	347	397	397	229
WQCV Reduction (ft^3)	347	347	347	347	397	397	229
WQCV Reduction (%)	100%	100%	100%	100%	100%	100%	100%
Untreated WQCV (ft^3)	0	0	0	0	0	0	0

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	WEST CH
DCIA (ft^2)	0
UIA (ft^2)	57,879
RPA (ft^2)	35,920
SPA (ft^2)	0
Total Area (ft^2)	93,799
Total Impervious Area (ft^2)	57,879
WQCV (ft^3)	2,412
WQCV Reduction (ft^3)	2,412
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	93,799
Total Impervious Area (ft^2)	57,879
WQCV (ft^3)	2,412
WQCV Reduction (ft^3)	2,412
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

Unresolved comment from Review #2: These sub-basins of M are not delineated on any of the drainage maps. Show on one of the maps, or created a new map.

V3 Update: it is still unclear which UIA/RPA region on the map (on pdf pg 277) corresponds with which Area ID on this spreadsheet . There is also RR in Basin P, V, and Y which should be shown on this spreadsheet too...

Design Procedure Form: Runoff Re

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 1

NO LONGER BROKE DOWN, ACERAGE IS NOW LESS THAN MAX

Designer:	QUENTIN ARMIJO
Company:	TERRA NOVA ENGINEERING, INC.
Date:	March 8, 2022
Project:	WATERBURY FILING 1 & 2
Location:	BASIN M1 STAPELTON DRIVE DIRECT RELEASE

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches

Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA										
Area ID	M1A	M1B										
Downstream Design Point ID	M1	M1										
Downstream BMP Type	None	None										
DCIA (ft^2)	--	--										
UIA (ft^2)	7,083	7,083										
RPA (ft^2)	12,171	12,171										
SPA (ft^2)	--	--										
HSG A (%)	100%	100%										
HSG B (%)	0%	0%										
HSG C/D (%)	0%	0%										
Average Slope of RPA (ft/ft)	0.040	0.020										
UIA:RPA Interface Width (ft)	70.00	70.00										

CALCULATED RUNOFF RESULTS

Area ID	M1A	M1B										
UIA:RPA Area (ft^2)	19,254	19,254										
L / W Ratio	3.93	3.93										
UIA / Area	0.3679	0.3679										
Runoff (in)	0.00	0.00										
Runoff (ft^3)	0	0										
Runoff Reduction (ft^3)	295	295										

NOW HAVE ALL SPA

Is 0 correct?

CALCULATED WQCV RESULTS

Area ID	M1A	M1B										
WQCV (ft^3)	295	295										
WQCV Reduction (ft^3)	295	295										
WQCV Reduction (%)	100%	100%										
Untreated WQCV (ft^3)	0	0										

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	M1	M1										
DCIA (ft^2)	0	0										
UIA (ft^2)	7,083	7,083										
RPA (ft^2)	12,171	12,171										
SPA (ft^2)	0	0										
Total Area (ft^2)	19,254	19,254										
Total Impervious Area (ft^2)	7,083	7,083										
WQCV (ft^3)	295	295										
WQCV Reduction (ft^3)	295	295										
WQCV Reduction (%)	100%	100%										
Untreated WQCV (ft^3)	0	0										

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	38,507
Total Impervious Area (ft^2)	14,166
WQCV (ft^3)	590
WQCV Reduction (ft^3)	590
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

Unresolved comment from Review #2: These sub-basins of M are not delineated on any of the drainage maps. Show on one of the maps, or created a new map.

V3 Update: it is still unclear which UIA/RPA region on the map (on pdf pg 277) corresponds with which Area ID on this spreadsheet . There is also RR in Basin P, V, and Y which should be shown on this spreadsheet too...

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

WHAT SUBBASIN, M2 IS A STAND ALONE BASIN ON MAP

Designer:	QUENTIN ARMIJO
Company:	TERRA NOVA ENGINEERING, INC.
Date:	March 8, 2022
Project:	WATERBURY FILING 1 & 2
Location:	BASINS M2 DIRECT RELEASE

P & V used to be on here with the last submittal...

ADDED BACK IN

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches

Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA											
Area ID	M2											
Downstream Design Point ID	EAST CH											
Downstream BMP Type	None											
DCIA (ft^2)	--											
UIA (ft^2)	10,366											
RPA (ft^2)	9,084											
SPA (ft^2)	--											
HSG A (%)	100%											
HSG B (%)	0%											
HSG C/D (%)	0%											
Average Slope of RPA (ft/ft)	0.020											
UIA:RPA Interface Width (ft)	60.00											

CALCULATED RUNOFF RESULTS

Area ID	M2											
UIA:RPA Area (ft^2)	19,450											
L / W Ratio	5.40											
UIA / Area	0.5329											
Runoff (in)	0.00											
Runoff (ft^3)	0											
Runoff Reduction (ft^3)	432											

CALCULATED WQCV RESULTS

Area ID	M2											
WQCV (ft^3)	432											
WQCV Reduction (ft^3)	432											
WQCV Reduction (%)	100%											
Untreated WQCV (ft^3)	0											

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

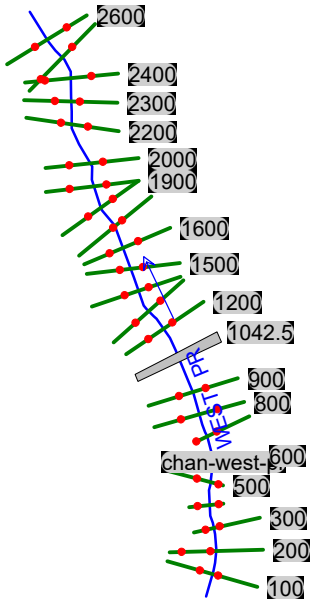
Downstream Design Point ID	EAST CH											
DCIA (ft^2)	0											
UIA (ft^2)	10,366											
RPA (ft^2)	9,084											
SPA (ft^2)	0											
Total Area (ft^2)	19,450											
Total Impervious Area (ft^2)	10,366											
WQCV (ft^3)	432											
WQCV Reduction (ft^3)	432											
WQCV Reduction (%)	100%											
Untreated WQCV (ft^3)	0											

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	19,450
Total Impervious Area (ft^2)	10,366
WQCV (ft^3)	432
WQCV Reduction (ft^3)	432
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

HEC-RAS ANALYSIS

WEST CHANNEL



Plan: Plan 01 WEST PR chan-west-pr RS: 2600 Profile: PF 1

E.G. Elev (ft)	6967.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.030	
W.S. Elev (ft)	6967.61	Reach Len. (ft)	140.00	100.00	85.90
Crit W.S. (ft)	6967.61	Flow Area (sq ft)		57.48	
E.G. Slope (ft/ft)	0.018361	Area (sq ft)		57.48	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	140.10	Top Width (ft)		140.10	
Vel Total (ft/s)	3.71	Avg. Vel. (ft/s)		3.71	
Max Chl Dpth (ft)	0.79	Hydr. Depth (ft)		0.41	
Conv. Total (cfs)	1571.9	Conv. (cfs)		1571.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		140.12	
Min Ch El (ft)	6966.82	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)		1.74	
Frctn Loss (ft)	1.39	Cum Volume (acre-ft)	0.06	3.14	0.03
C & E Loss (ft)	0.02	Cum SA (acres)	0.19	4.89	0.14

Plan: Plan 01 WEST PR chan-west-pr RS: 2500 Profile: PF 1

E.G. Elev (ft)	6965.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.		0.030	
W.S. Elev (ft)	6965.55	Reach Len. (ft)	148.70	100.00	20.00
Crit W.S. (ft)		Flow Area (sq ft)		66.40	
E.G. Slope (ft/ft)	0.010826	Area (sq ft)		66.40	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	135.18	Top Width (ft)		135.18	
Vel Total (ft/s)	3.21	Avg. Vel. (ft/s)		3.21	
Max Chl Dpth (ft)	0.90	Hydr. Depth (ft)		0.49	
Conv. Total (cfs)	2047.1	Conv. (cfs)		2047.1	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		135.20	
Min Ch El (ft)	6964.65	Shear (lb/sq ft)		0.33	
Alpha	1.00	Stream Power (lb/ft s)		1.06	
Frctn Loss (ft)	1.38	Cum Volume (acre-ft)	0.06	3.00	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.19	4.58	0.14

Plan: Plan 01 WEST PR chan-west-pr RS: 2400 Profile: PF 1

E.G. Elev (ft)	6964.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.030	
W.S. Elev (ft)	6964.11	Reach Len. (ft)	119.30	100.00	96.70
Crit W.S. (ft)	6964.11	Flow Area (sq ft)		57.47	
E.G. Slope (ft/ft)	0.018200	Area (sq ft)		57.47	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	139.08	Top Width (ft)		139.08	
Vel Total (ft/s)	3.71	Avg. Vel. (ft/s)		3.71	
Max Chl Dpth (ft)	0.64	Hydr. Depth (ft)		0.41	
Conv. Total (cfs)	1578.9	Conv. (cfs)		1578.9	
Length Wtd. (ft)	100.06	Wetted Per. (ft)		139.09	
Min Ch El (ft)	6963.47	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)		1.74	
Frctn Loss (ft)	1.72	Cum Volume (acre-ft)	0.06	2.86	0.03
C & E Loss (ft)	0.00	Cum SA (acres)	0.19	4.26	0.14

Plan: Plan 01 WEST PR chan-west-pr RS: 2300 Profile: PF 1

E.G. Elev (ft)	6962.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6962.32	Reach Len. (ft)	113.10	100.00	97.60
Crit W.S. (ft)	6962.32	Flow Area (sq ft)	1.58	53.00	1.49
E.G. Slope (ft/ft)	0.016174	Area (sq ft)	1.58	53.00	1.49
Q Total (cfs)	213.00	Flow (cfs)	1.65	209.53	1.82
Top Width (ft)	128.81	Top Width (ft)	12.75	106.60	9.46
Vel Total (ft/s)	3.80	Avg. Vel. (ft/s)	1.04	3.95	1.22
Max Chl Dpth (ft)	0.96	Hydr. Depth (ft)	0.12	0.50	0.16
Conv. Total (cfs)	1674.9	Conv. (cfs)	12.9	1647.6	14.3
Length Wtd. (ft)	100.04	Wetted Per. (ft)	12.75	106.62	9.46
Min Ch El (ft)	6961.36	Shear (lb/sq ft)	0.12	0.50	0.16
Alpha	1.07	Stream Power (lb/ft s)	0.13	1.98	0.19
Frctn Loss (ft)	1.63	Cum Volume (acre-ft)	0.06	2.73	0.03
C & E Loss (ft)	0.00	Cum SA (acres)	0.17	3.98	0.13

Plan: Plan 01 WEST PR chan-west-pr RS: 2200 Profile: PF 1

E.G. Elev (ft)	6959.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.		0.030	
W.S. Elev (ft)	6959.60	Reach Len. (ft)	170.39	200.00	195.20
Crit W.S. (ft)	6959.60	Flow Area (sq ft)		49.95	
E.G. Slope (ft/ft)	0.016348	Area (sq ft)		49.95	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	90.36	Top Width (ft)		90.36	
Vel Total (ft/s)	4.26	Avg. Vel. (ft/s)		4.26	
Max Chl Dpth (ft)	1.06	Hydr. Depth (ft)		0.55	
Conv. Total (cfs)	1665.9	Conv. (cfs)		1665.9	
Length Wtd. (ft)	200.00	Wetted Per. (ft)		90.39	
Min Ch El (ft)	6958.54	Shear (lb/sq ft)		0.56	
Alpha	1.00	Stream Power (lb/ft s)		2.40	
Frctn Loss (ft)	2.62	Cum Volume (acre-ft)	0.05	2.61	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.15	3.76	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 2000 Profile: PF 1

E.G. Elev (ft)	6955.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.030	
W.S. Elev (ft)	6955.67	Reach Len. (ft)	99.70	100.00	116.50
Crit W.S. (ft)	6955.58	Flow Area (sq ft)		51.70	
E.G. Slope (ft/ft)	0.010768	Area (sq ft)		51.70	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	71.98	Top Width (ft)		71.98	
Vel Total (ft/s)	4.12	Avg. Vel. (ft/s)		4.12	
Max Chl Dpth (ft)	1.39	Hydr. Depth (ft)		0.72	
Conv. Total (cfs)	2052.7	Conv. (cfs)		2052.7	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		72.04	
Min Ch El (ft)	6954.28	Shear (lb/sq ft)		0.48	
Alpha	1.00	Stream Power (lb/ft s)		1.99	
Frctn Loss (ft)	1.29	Cum Volume (acre-ft)	0.05	2.38	0.03
C & E Loss (ft)	0.00	Cum SA (acres)	0.15	3.38	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1900 Profile: PF 1

E.G. Elev (ft)	6954.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.		0.030	
W.S. Elev (ft)	6954.37	Reach Len. (ft)	674.00	100.00	141.40
Crit W.S. (ft)	6954.37	Flow Area (sq ft)		50.23	
E.G. Slope (ft/ft)	0.015744	Area (sq ft)		50.23	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	88.96	Top Width (ft)		88.96	
Vel Total (ft/s)	4.24	Avg. Vel. (ft/s)		4.24	
Max Chl Dpth (ft)	1.70	Hydr. Depth (ft)		0.56	
Conv. Total (cfs)	1697.5	Conv. (cfs)		1697.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		89.11	
Min Ch El (ft)	6952.67	Shear (lb/sq ft)		0.55	
Alpha	1.00	Stream Power (lb/ft s)		2.35	
Frctn Loss (ft)	1.52	Cum Volume (acre-ft)	0.05	2.26	0.03
C & E Loss (ft)	0.02	Cum SA (acres)	0.15	3.20	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1800 Profile: PF 1

E.G. Elev (ft)	6951.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.		0.030	
W.S. Elev (ft)	6951.49	Reach Len. (ft)	99.30	100.00	113.30
Crit W.S. (ft)	6951.49	Flow Area (sq ft)		39.83	
E.G. Slope (ft/ft)	0.014715	Area (sq ft)		39.83	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	47.02	Top Width (ft)		47.02	
Vel Total (ft/s)	5.35	Avg. Vel. (ft/s)		5.35	
Max Chl Dpth (ft)	2.20	Hydr. Depth (ft)		0.85	
Conv. Total (cfs)	1755.9	Conv. (cfs)		1755.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		47.45	
Min Ch El (ft)	6949.29	Shear (lb/sq ft)		0.77	
Alpha	1.00	Stream Power (lb/ft s)		4.12	
Frctn Loss (ft)	1.42	Cum Volume (acre-ft)	0.05	2.16	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.15	3.04	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1700 Profile: PF 1

E.G. Elev (ft)	6949.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.51	Wt. n-Val.		0.030	
W.S. Elev (ft)	6949.19	Reach Len. (ft)	113.00	100.00	112.30
Crit W.S. (ft)	6949.19	Flow Area (sq ft)		37.03	
E.G. Slope (ft/ft)	0.013784	Area (sq ft)		37.03	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	37.04	Top Width (ft)		37.04	
Vel Total (ft/s)	5.75	Avg. Vel. (ft/s)		5.75	
Max Chl Dpth (ft)	2.15	Hydr. Depth (ft)		1.00	
Conv. Total (cfs)	1814.2	Conv. (cfs)		1814.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		37.63	
Min Ch El (ft)	6947.04	Shear (lb/sq ft)		0.85	
Alpha	1.00	Stream Power (lb/ft s)		4.87	
Frctn Loss (ft)	1.12	Cum Volume (acre-ft)	0.05	2.07	0.03
C & E Loss (ft)	0.05	Cum SA (acres)	0.15	2.95	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1600 Profile: PF 1

E.G. Elev (ft)	6948.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.		0.030	
W.S. Elev (ft)	6947.71	Reach Len. (ft)	113.20	100.00	83.60
Crit W.S. (ft)		Flow Area (sq ft)		44.92	
E.G. Slope (ft/ft)	0.009246	Area (sq ft)		44.92	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	45.01	Top Width (ft)		45.01	
Vel Total (ft/s)	4.74	Avg. Vel. (ft/s)		4.74	
Max Chl Dpth (ft)	1.87	Hydr. Depth (ft)		1.00	
Conv. Total (cfs)	2215.1	Conv. (cfs)		2215.1	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		45.21	
Min Ch El (ft)	6945.84	Shear (lb/sq ft)		0.57	
Alpha	1.00	Stream Power (lb/ft s)		2.72	
Frctn Loss (ft)	1.16	Cum Volume (acre-ft)	0.05	1.98	0.03
C & E Loss (ft)	0.00	Cum SA (acres)	0.15	2.85	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1500 Profile: PF 1

E.G. Elev (ft)	6946.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.34	Wt. n-Val.		0.030	
W.S. Elev (ft)	6946.56	Reach Len. (ft)	110.50	100.00	89.00
Crit W.S. (ft)	6946.56	Flow Area (sq ft)		45.68	
E.G. Slope (ft/ft)	0.015089	Area (sq ft)		45.68	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	67.91	Top Width (ft)		67.91	
Vel Total (ft/s)	4.66	Avg. Vel. (ft/s)		4.66	
Max Chl Dpth (ft)	1.69	Hydr. Depth (ft)		0.67	
Conv. Total (cfs)	1734.0	Conv. (cfs)		1734.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		68.07	
Min Ch El (ft)	6944.87	Shear (lb/sq ft)		0.63	
Alpha	1.00	Stream Power (lb/ft s)		2.95	
Frctn Loss (ft)	1.56	Cum Volume (acre-ft)	0.05	1.87	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.15	2.72	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1400 Profile: PF 1

E.G. Elev (ft)	6945.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.		0.030	
W.S. Elev (ft)	6944.86	Reach Len. (ft)	75.60	100.00	125.50
Crit W.S. (ft)	6944.86	Flow Area (sq ft)		47.75	
E.G. Slope (ft/ft)	0.016056	Area (sq ft)		47.75	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	79.66	Top Width (ft)		79.66	
Vel Total (ft/s)	4.46	Avg. Vel. (ft/s)		4.46	
Max Chl Dpth (ft)	1.07	Hydr. Depth (ft)		0.60	
Conv. Total (cfs)	1681.0	Conv. (cfs)		1681.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		79.71	
Min Ch El (ft)	6943.79	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		2.68	
Frctn Loss (ft)	1.64	Cum Volume (acre-ft)	0.05	1.77	0.03
C & E Loss (ft)	0.02	Cum SA (acres)	0.15	2.55	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1300 Profile: PF 1

E.G. Elev (ft)	6942.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.		0.030	
W.S. Elev (ft)	6942.09	Reach Len. (ft)	107.40	100.00	88.80
Crit W.S. (ft)	6942.09	Flow Area (sq ft)		53.37	
E.G. Slope (ft/ft)	0.016728	Area (sq ft)		53.37	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	108.51	Top Width (ft)		108.51	
Vel Total (ft/s)	3.99	Avg. Vel. (ft/s)		3.99	
Max Chl Dpth (ft)	0.64	Hydr. Depth (ft)		0.49	
Conv. Total (cfs)	1646.9	Conv. (cfs)		1646.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		108.53	
Min Ch El (ft)	6941.45	Shear (lb/sq ft)		0.51	
Alpha	1.00	Stream Power (lb/ft s)		2.05	
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	0.05	1.65	0.03
C & E Loss (ft)	0.07	Cum SA (acres)	0.15	2.34	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1200 Profile: PF 1

E.G. Elev (ft)	6942.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.030	0.045
W.S. Elev (ft)	6942.09	Reach Len. (ft)	313.70	300.00	276.40
Crit W.S. (ft)	6939.49	Flow Area (sq ft)		301.81	0.10
E.G. Slope (ft/ft)	0.000053	Area (sq ft)		301.81	0.10
Q Total (cfs)	213.00	Flow (cfs)		213.00	0.00
Top Width (ft)	111.08	Top Width (ft)		109.26	1.81
Vel Total (ft/s)	0.71	Avg. Vel. (ft/s)		0.71	0.04
Max Chl Dpth (ft)	3.56	Hydr. Depth (ft)		2.76	0.06
Conv. Total (cfs)	29326.1	Conv. (cfs)		29325.6	0.5
Length Wtd. (ft)	300.00	Wetted Per. (ft)		109.85	1.83
Min Ch El (ft)	6938.53	Shear (lb/sq ft)		0.01	0.00
Alpha	1.00	Stream Power (lb/ft s)		0.01	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	0.05	1.24	0.03
C & E Loss (ft)		Cum SA (acres)	0.15	2.09	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 900 Profile: PF 1

E.G. Elev (ft)	6936.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.		0.030	
W.S. Elev (ft)	6936.25	Reach Len. (ft)	104.20	100.00	101.80
Crit W.S. (ft)		Flow Area (sq ft)		74.22	
E.G. Slope (ft/ft)	0.005198	Area (sq ft)		74.22	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	102.95	Top Width (ft)		102.95	
Vel Total (ft/s)	2.87	Avg. Vel. (ft/s)		2.87	
Max Chl Dpth (ft)	0.88	Hydr. Depth (ft)		0.72	
Conv. Total (cfs)	2954.2	Conv. (cfs)		2954.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		103.03	
Min Ch El (ft)	6935.37	Shear (lb/sq ft)		0.23	
Alpha	1.00	Stream Power (lb/ft s)		0.67	
Frctn Loss (ft)	0.53	Cum Volume (acre-ft)	0.05	0.90	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.15	1.36	0.11

Plan: Plan 01 WEST PR chan-west-pr RS: 800 Profile: PF 1

E.G. Elev (ft)	6935.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.030	
W.S. Elev (ft)	6935.73	Reach Len. (ft)	96.40	100.00	114.30
Crit W.S. (ft)	6935.50	Flow Area (sq ft)		80.27	
E.G. Slope (ft/ft)	0.005448	Area (sq ft)		80.27	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	129.67	Top Width (ft)		129.67	
Vel Total (ft/s)	2.65	Avg. Vel. (ft/s)		2.65	
Max Chl Dpth (ft)	1.31	Hydr. Depth (ft)		0.62	
Conv. Total (cfs)	2885.7	Conv. (cfs)		2885.7	
Length Wtd. (ft)	99.58	Wetted Per. (ft)		129.82	
Min Ch El (ft)	6934.42	Shear (lb/sq ft)		0.21	
Alpha	1.00	Stream Power (lb/ft s)		0.56	
Frctn Loss (ft)	0.94	Cum Volume (acre-ft)	0.05	0.72	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.15	1.09	0.11

Plan: Plan 01 WEST PR chan-west-pr RS: 700 Profile: PF 1

E.G. Elev (ft)	6934.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6934.68	Reach Len. (ft)	114.30	100.00	85.80
Crit W.S. (ft)	6934.68	Flow Area (sq ft)	19.28	40.94	0.05
E.G. Slope (ft/ft)	0.020420	Area (sq ft)	19.28	40.94	0.05
Q Total (cfs)	213.00	Flow (cfs)	49.48	163.47	0.05
Top Width (ft)	144.97	Top Width (ft)	48.02	96.60	0.35
Vel Total (ft/s)	3.53	Avg. Vel. (ft/s)	2.57	3.99	1.04
Max Chl Dpth (ft)	0.72	Hydr. Depth (ft)	0.40	0.42	0.15
Conv. Total (cfs)	1490.6	Conv. (cfs)	346.3	1143.9	0.4
Length Wtd. (ft)	100.94	Wetted Per. (ft)	48.08	96.61	0.50
Min Ch El (ft)	6933.96	Shear (lb/sq ft)	0.51	0.54	0.13
Alpha	1.10	Stream Power (lb/ft s)	1.31	2.16	0.14
Frctn Loss (ft)	1.75	Cum Volume (acre-ft)	0.03	0.58	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.10	0.83	0.11

Plan: Plan 01 WEST PR chan-west-pr RS: 600 Profile: PF 1

E.G. Elev (ft)	6932.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6931.98	Reach Len. (ft)	110.80	100.00	88.00
Crit W.S. (ft)	6931.98	Flow Area (sq ft)	2.92	40.77	15.25
E.G. Slope (ft/ft)	0.014832	Area (sq ft)	2.92	40.77	15.25
Q Total (cfs)	213.00	Flow (cfs)	4.29	182.83	25.88
Top Width (ft)	133.02	Top Width (ft)	13.18	63.58	56.26
Vel Total (ft/s)	3.61	Avg			
Max Chl Dpth (ft)	1.12	Hyc			
Conv. Total (cfs)	1749.0	Cor			
Length Wtd. (ft)	99.38	We			
Min Ch El (ft)	6930.86	She			
Alpha	1.35	Stre			
Frctn Loss (ft)	1.52	Cur			
C & E Loss (ft)	0.00	Cur			

ONLY 4 X-SECTIONS HAVE CRITICAL FLOW NOW. WE ARE STABELIZING 1500 TO 1400 W/ DROP STRUCTURE. STA 200 HAS ESTABLISEHD CATTAILS AND A VELOCITY OF 1.99 FPS, SHEAR OF 1.03 & A FROUD OF 1.03 LB/SQ FT ALL ALLOWABLE. NO NEED TO DISTURB ESTABLISHED CHANNEL WITH SIGNIFICANT VEGETATION. SECTION 100 IS THE LAST STATION WHICH IS ALWAY CRITICAL DUE TO NO DOWNSTREAM TO RUN CALCS IN HECRAS

All of the highlighted values indicate supercritical flows

Plan: Plan 01 WEST PR chan-west-pr RS: 500 Profile: PF 1

E.G. Elev (ft)	6929.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.		0.030	
W.S. Elev (ft)	6929.52	Reach Len. (ft)	85.20	100.00	105.50
Crit W.S. (ft)	6929.52	Flow Area (sq ft)		46.76	
E.G. Slope (ft/ft)	0.015820	Area (sq ft)		46.76	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	74.75	Top Width (ft)		74.75	
Vel Total (ft/s)	4.56	Avg. Vel. (ft/s)		4.56	
Max Chl Dpth (ft)	1.12	Hydr. Depth (ft)		0.63	
Conv. Total (cfs)	1693.5	Conv. (cfs)		1693.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		74.79	
Min Ch El (ft)	6928.40	Shear (lb/sq ft)		0.62	
Alpha	1.00	Stream Power (lb/ft s)		2.81	
Frctn Loss (ft)	1.52	Cum Volume (acre-ft)	0.00	0.38	
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.49	

Plan: Plan 01 WEST PR chan-west-pr RS: 400 Profile: PF 1

E.G. Elev (ft)	6927.37	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.		0.030	
W.S. Elev (ft)	6926.98	Reach Len. (ft)	95.20	100.00	105.50
Crit W.S. (ft)	6926.98	Flow Area (sq ft)		42.65	
E.G. Slope (ft/ft)	0.014589	Area (sq ft)		42.65	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	55.48	Top Width (ft)		55.48	
Vel Total (ft/s)	4.99	Avg. Vel. (ft/s)		4.99	
Max Chl Dpth (ft)	2.01	Hydr. Depth (ft)		0.77	
Conv. Total (cfs)	1763.4	Conv. (cfs)		1763.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		55.92	
Min Ch El (ft)	6924.97	Shear (lb/sq ft)		0.69	
Alpha	1.00	Stream Power (lb/ft s)		3.47	
Frctn Loss (ft)	1.41	Cum Volume (acre-ft)	0.00	0.28	
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.34	

Plan: Plan 01 WEST PR chan-west-pr RS: 300 Profile: PF 1

E.G. Elev (ft)	6924.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.		0.030	
W.S. Elev (ft)	6924.27	Reach Len. (ft)	113.50	100.00	139.70
Crit W.S. (ft)	6924.27	Flow Area (sq ft)		37.57	
E.G. Slope (ft/ft)	0.013593	Area (sq ft)		37.57	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	38.43	Top Width (ft)		38.43	
Vel Total (ft/s)	5.67	Avg. Vel. (ft/s)		5.67	
Max Chl Dpth (ft)	1.93	Hydr. Depth (ft)		0.98	
Conv. Total (cfs)	1826.9	Conv. (cfs)		1826.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		38.63	
Min Ch El (ft)	6922.34	Shear (lb/sq ft)		0.83	
Alpha	1.00	Stream Power (lb/ft s)		4.68	
Frctn Loss (ft)	1.39	Cum Volume (acre-ft)	0.00	0.19	
C & E Loss (ft)	0.02	Cum SA (acres)	0.00	0.23	

Plan: Plan 01 WEST PR chan-west-pr RS: 200 Profile: PF 1

E.G. Elev (ft)	6921.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.42	Wt. n-Val.	0.000	0.030	
W.S. Elev (ft)	6921.37	Reach Len. (ft)	109.50	100.00	110.20
Crit W.S. (ft)	6921.37	Flow Area (sq ft)	0.00	41.06	
E.G. Slope (ft/ft)	0.014171	Area (sq ft)	0.00	41.06	
Q Total (cfs)	213.00	Flow (cfs)	0.00	213.00	
Top Width (ft)	50.39	Top Width (ft)	0.73	49.66	
Vel Total (ft/s)	5.19	Avg. Vel. (ft/s)	0.13	5.19	
Max Chl Dpth (ft)	1.39	Hydr. Depth (ft)	0.01	0.83	
Conv. Total (cfs)	1789.3	Conv. (cfs)	0.0	1789.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)	0.73	49.76	
Min Ch El (ft)	6919.98	Shear (lb/sq ft)		0.73	
Alpha	1.00	Stream Power (lb/ft s)		3.79	
Frctn Loss (ft)	1.36	Cum Volume (acre-ft)	0.00	0.10	
C & E Loss (ft)	0.03	Cum SA (acres)	0.00	0.13	

Plan: Plan 01 WEST PR chan-west-pr RS: 100 Profile: PF 1

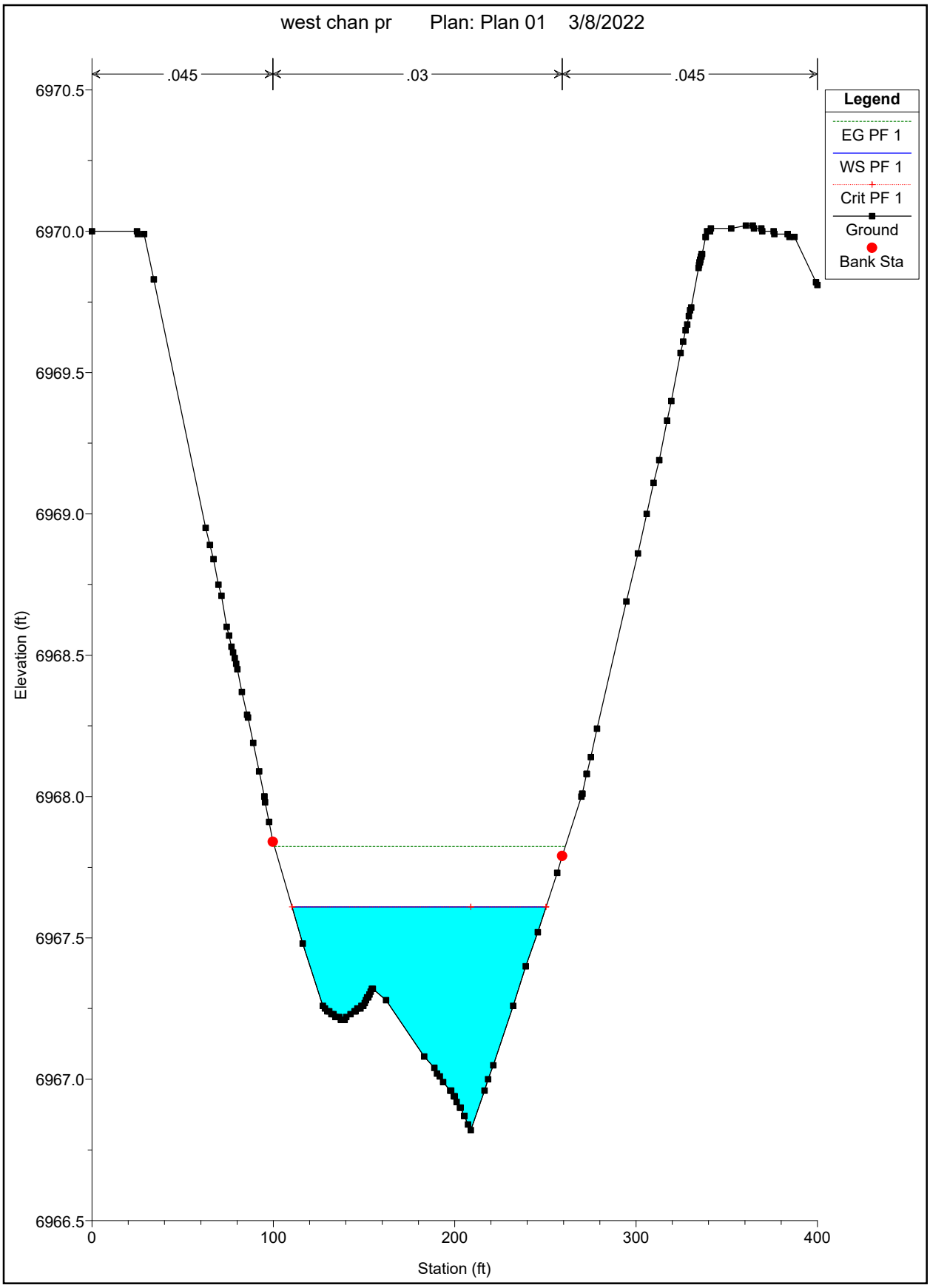
E.G. Elev (ft)	6919.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.		0.030	
W.S. Elev (ft)	6918.84	Reach Len. (ft)			
Crit W.S. (ft)	6918.81	Flow Area (sq ft)		45.94	
E.G. Slope (ft/ft)	0.013007	Area (sq ft)		45.94	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	61.67	Top Width (ft)		61.67	
Vel Total (ft/s)	4.64	Avg. Vel. (ft/s)		4.64	
Max Chl Dpth (ft)	0.84	Hydr. Depth (ft)		0.74	
Conv. Total (cfs)	1867.6	Conv. (cfs)		1867.6	
Length Wtd. (ft)		Wetted Per. (ft)		61.77	
Min Ch El (ft)	6918.00	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		2.80	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

HEC-RAS Plan: Plan 01 River: WEST PR Reach: chan-west-pr Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-west-pr	2600	PF 1	213.00	6966.82	6967.61	6967.61	6967.82	0.018361	3.71	57.48	140.10	1.02
chan-west-pr	2500	PF 1	213.00	6964.65	6965.55		6965.71	0.010826	3.21	66.40	135.18	0.81
chan-west-pr	2400	PF 1	213.00	6963.47	6964.11	6964.11	6964.32	0.018200	3.71	57.47	139.08	1.02
chan-west-pr	2300	PF 1	213.00	6961.36	6962.32	6962.32	6962.56	0.016174	3.95	56.07	128.81	0.99
chan-west-pr	2200	PF 1	213.00	6958.54	6959.60	6959.60	6959.88	0.016348	4.26	49.95	90.36	1.01
chan-west-pr	2000	PF 1	213.00	6954.28	6955.67	6955.58	6955.94	0.010768	4.12	51.70	71.98	0.86
chan-west-pr	1900	PF 1	213.00	6952.67	6954.37	6954.37	6954.65	0.015744	4.24	50.23	88.96	0.99
chan-west-pr	1800	PF 1	213.00	6949.29	6951.49	6951.49	6951.93	0.014715	5.35	39.83	47.02	1.02
chan-west-pr	1700	PF 1	213.00	6947.04	6949.19	6949.19	6949.70	0.013784	5.75	37.03	37.04	1.01
chan-west-pr	1600	PF 1	213.00	6945.84	6947.71		6948.06	0.009246	4.74	44.92	45.01	0.84
chan-west-pr	1500	PF 1	213.00	6944.87	6946.56	6946.56	6946.90	0.015089	4.66	45.68	67.91	1.00
chan-west-pr	1400	PF 1	213.00	6943.79	6944.86	6944.86	6945.17	0.016056	4.46	47.75	79.66	1.02
chan-west-pr	1300	PF 1	213.00	6941.45	6942.09	6942.09	6942.34	0.016728	3.99	53.37	108.51	1.00
chan-west-pr	1200	PF 1	213.00	6938.53	6942.09	6939.49	6942.10	0.000053	0.71	301.92	111.08	0.07
chan-west-pr	1042.5		Culvert									
chan-west-pr	900	PF 1	213.00	6935.37	6936.25		6936.38	0.005198	2.87	74.22	102.95	0.60
chan-west-pr	800	PF 1	213.00	6934.42	6935.73	6935.50	6935.84	0.005448	2.65	80.27	129.67	0.59
chan-west-pr	700	PF 1	213.00	6933.96	6934.68	6934.68	6934.89	0.020420	3.99	60.27	144.97	1.08
chan-west-pr	600	PF 1	213.00	6930.86	6931.98	6931.98	6932.25	0.014832	4.48	58.94	133.02	0.99
chan-west-pr	500	PF 1	213.00	6928.40	6929.52	6929.52	6929.85	0.015820	4.56	46.76	74.75	1.02
chan-west-pr	400	PF 1	213.00	6924.97	6926.98	6926.98	6927.37	0.014589	4.99	42.65	55.48	1.00
chan-west-pr	300	PF 1	213.00	6922.34	6924.27	6924.27	6924.77	0.013593	5.67	37.57	38.43	1.01
chan-west-pr	200	PF 1	213.00	6919.98	6921.37	6921.37	6921.79	0.014171	5.19	41.06	50.39	1.01
chan-west-pr	100	PF 1	213.00	6918.00	6918.84	6918.81	6919.18	0.013007	4.64	45.94	61.67	0.95

Stabilization / modification needs to be provided where flows are supercritical

ALL FROUDE #S ARE LESS THAN 1 EXCEPT AT DROP STRUCTURE STA 14+20 AND STA 1+00 WHERE HECRAS ALWAYS HAS CRITICAL FLOW AT LAST STATION DO TO NO DOWNSTREAM SECTION TO RUN THE CALCS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.045
.03
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Legend
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WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6970.5
6970.0
6969.5
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6967.0
6966.5
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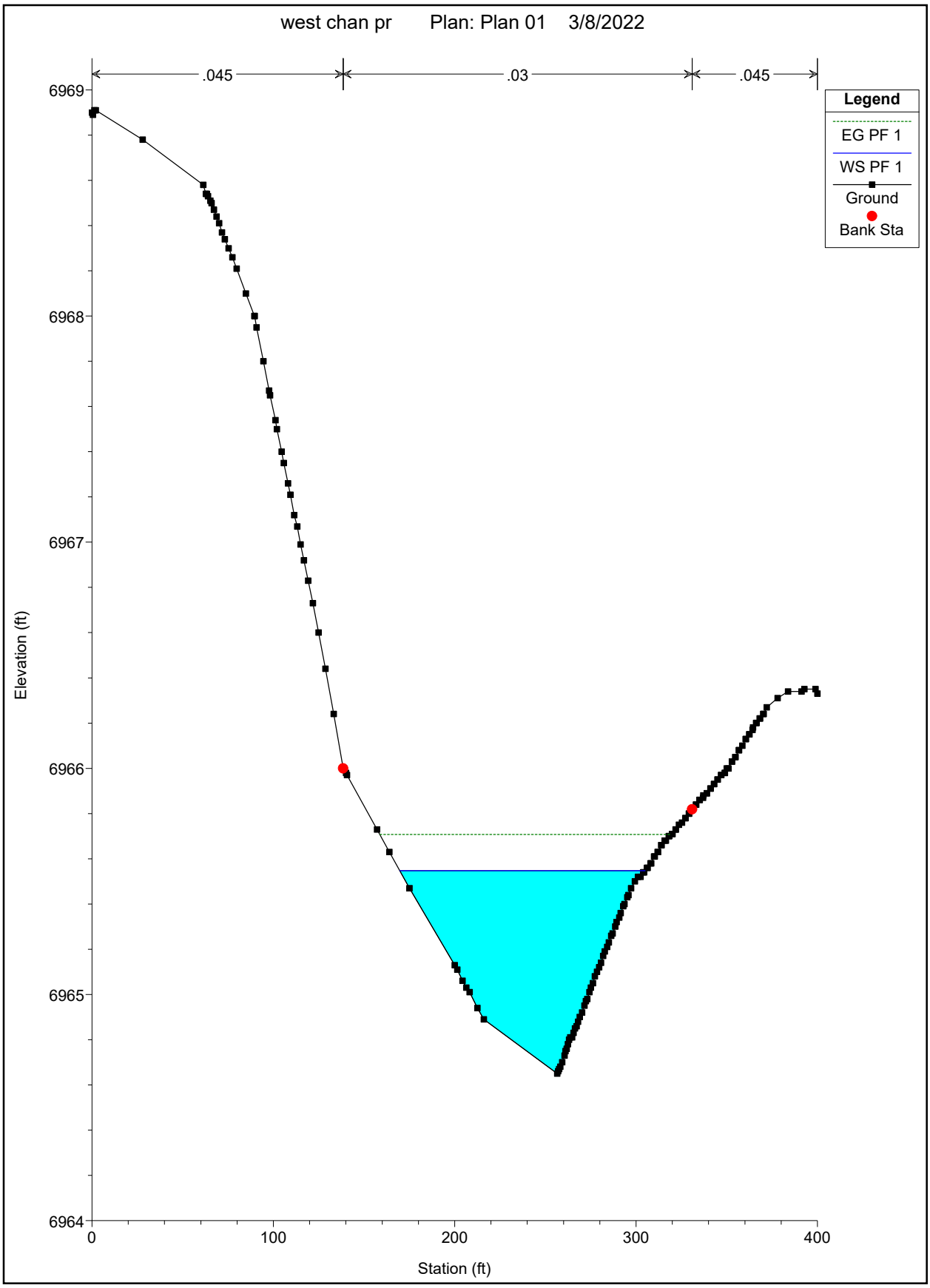
200
300
400
Station (ft)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WS PF 1
Ground
Bank Sta
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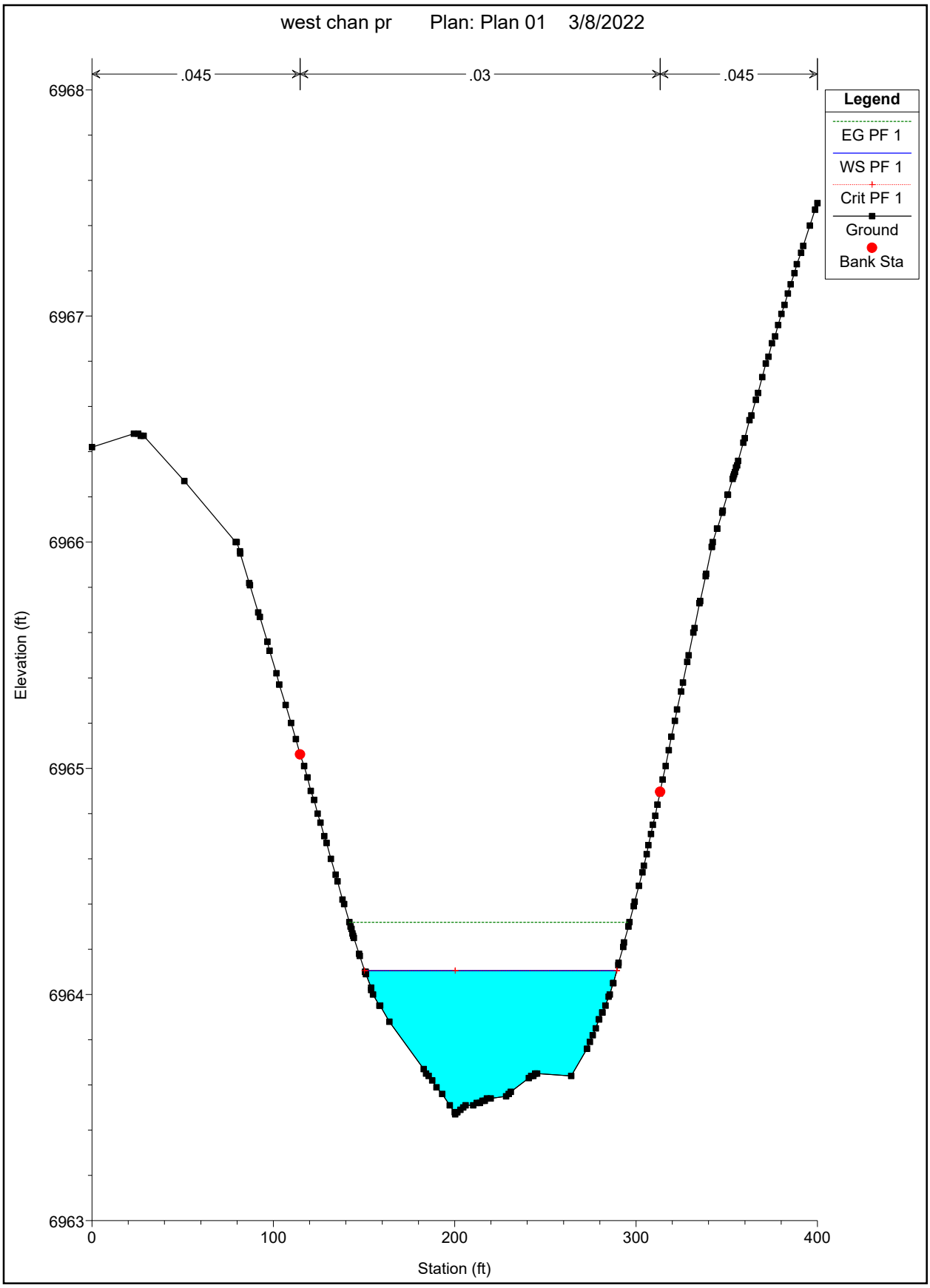
200
300
400
Station (ft)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Crit PF 1
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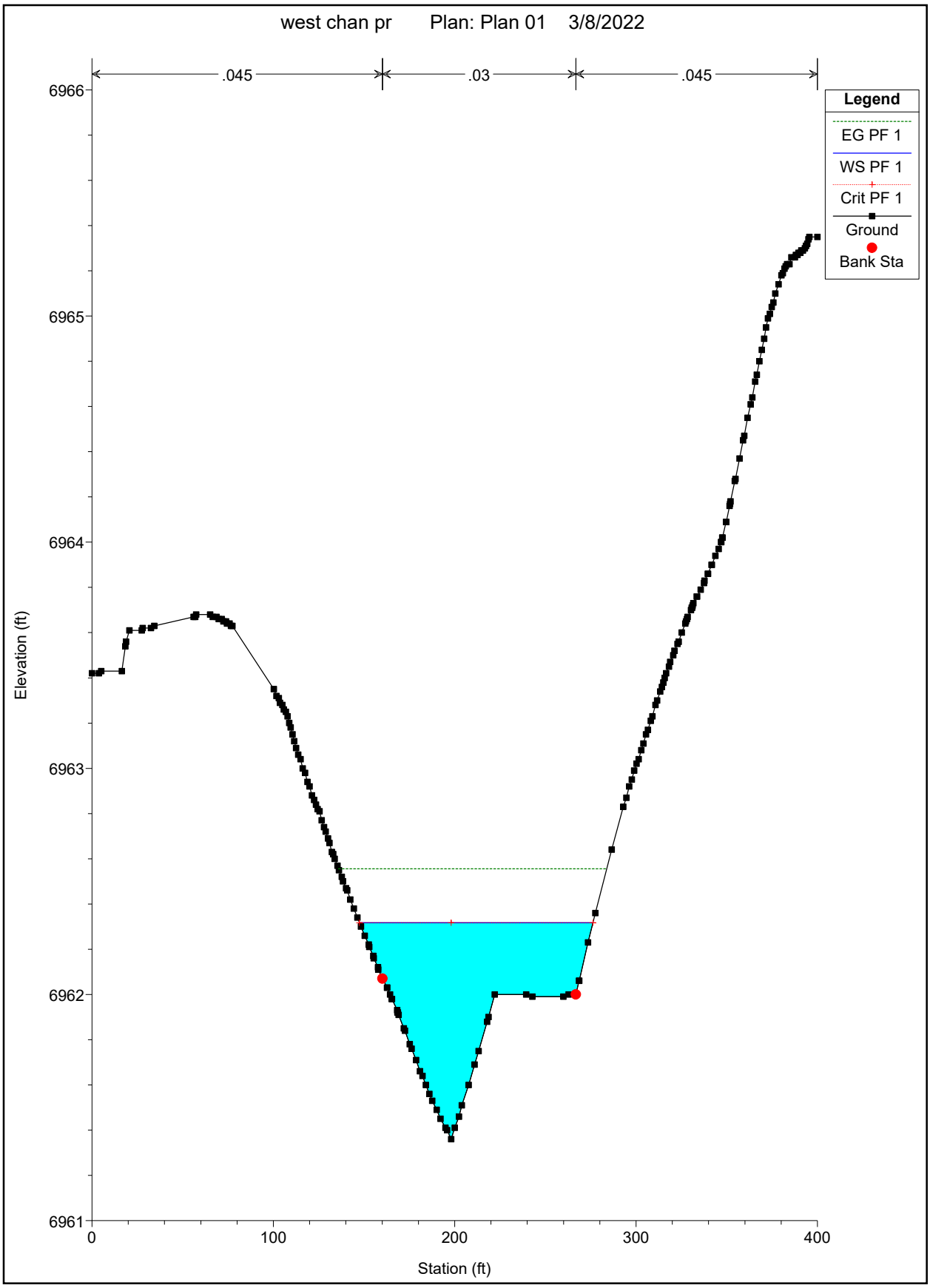
300
400
Station (ft)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WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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6961
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200
300
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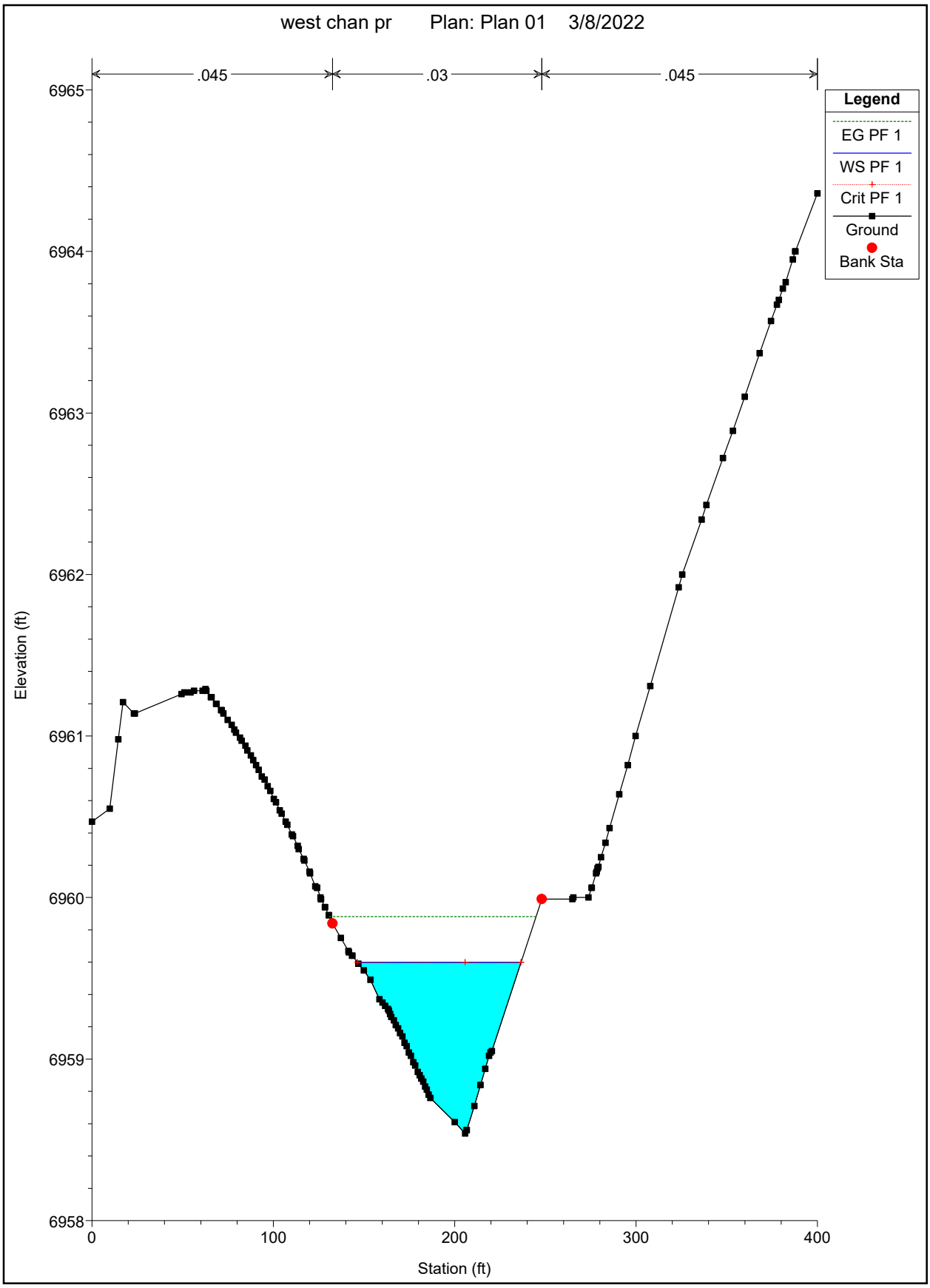
Station (ft)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WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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6958
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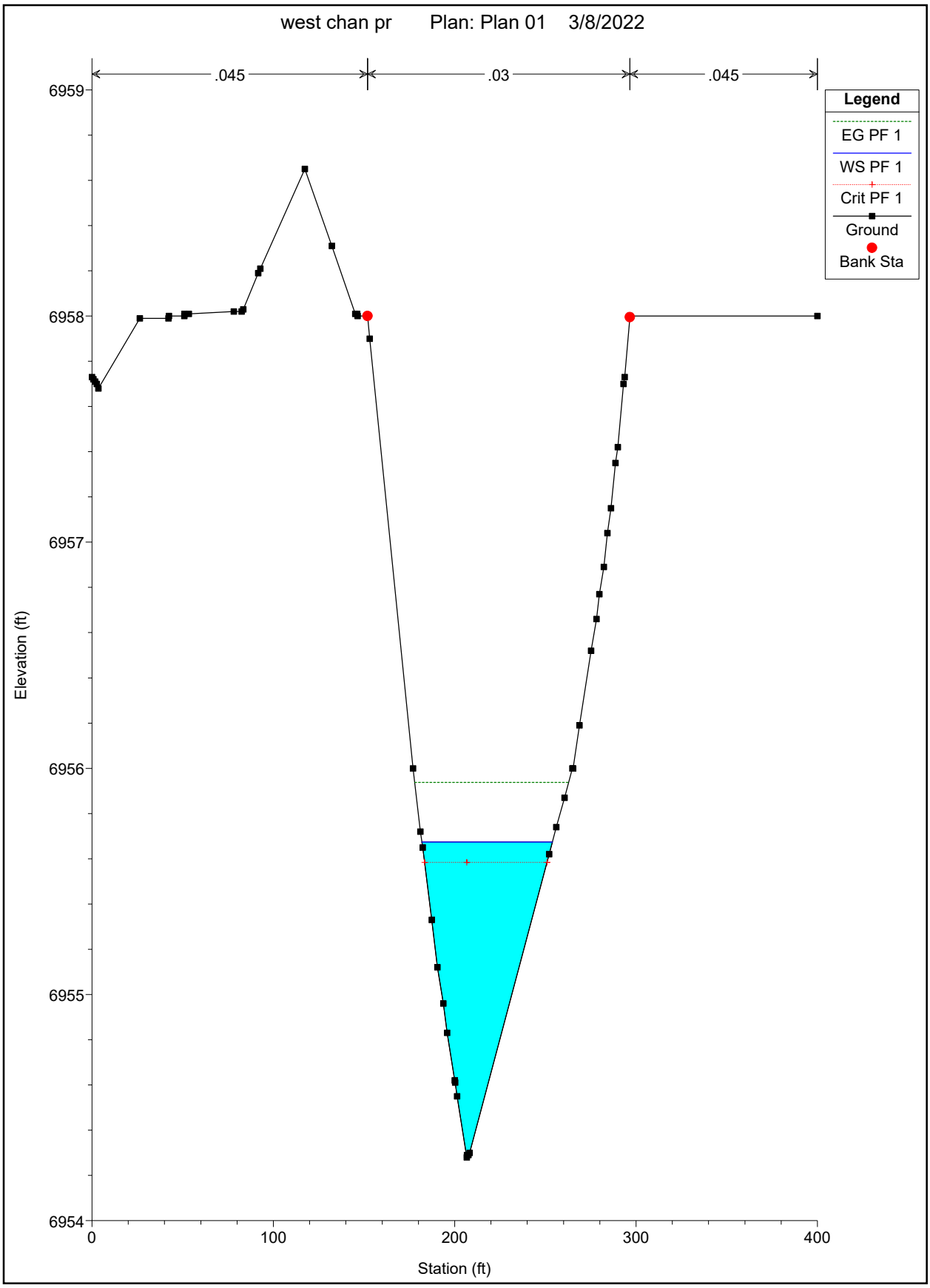
200
300
400
Station (ft)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.045
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WS PF 1
Crit PF 1
Ground
Bank Sta
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6958
6957
6956
6955
6954
Elevation (ft)
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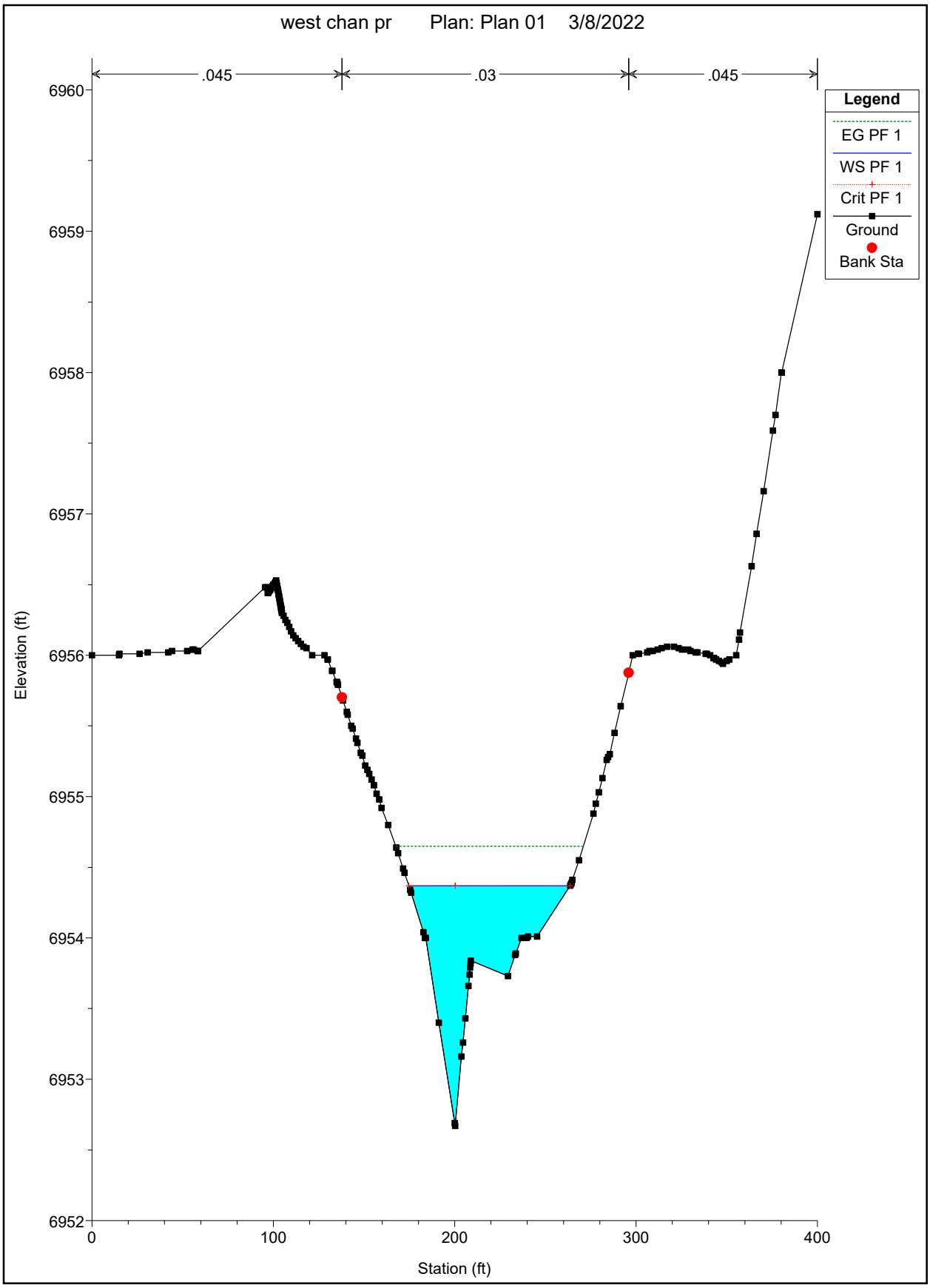
100
200
300
400
Station (ft)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.045
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WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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6952
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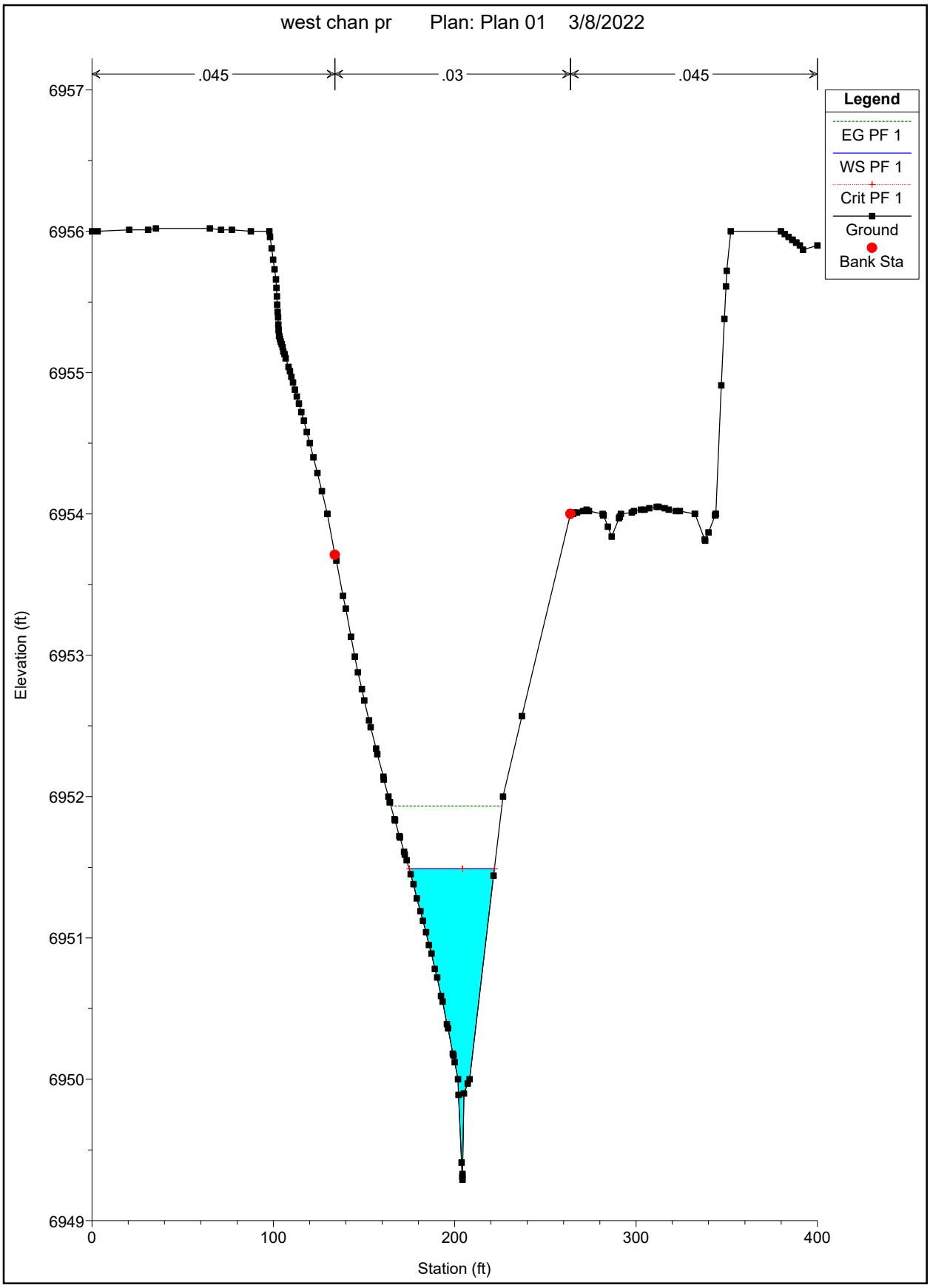
200
300
400
Station (ft)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Crit PF 1
Ground
Bank Sta
Elevation (ft)
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6949
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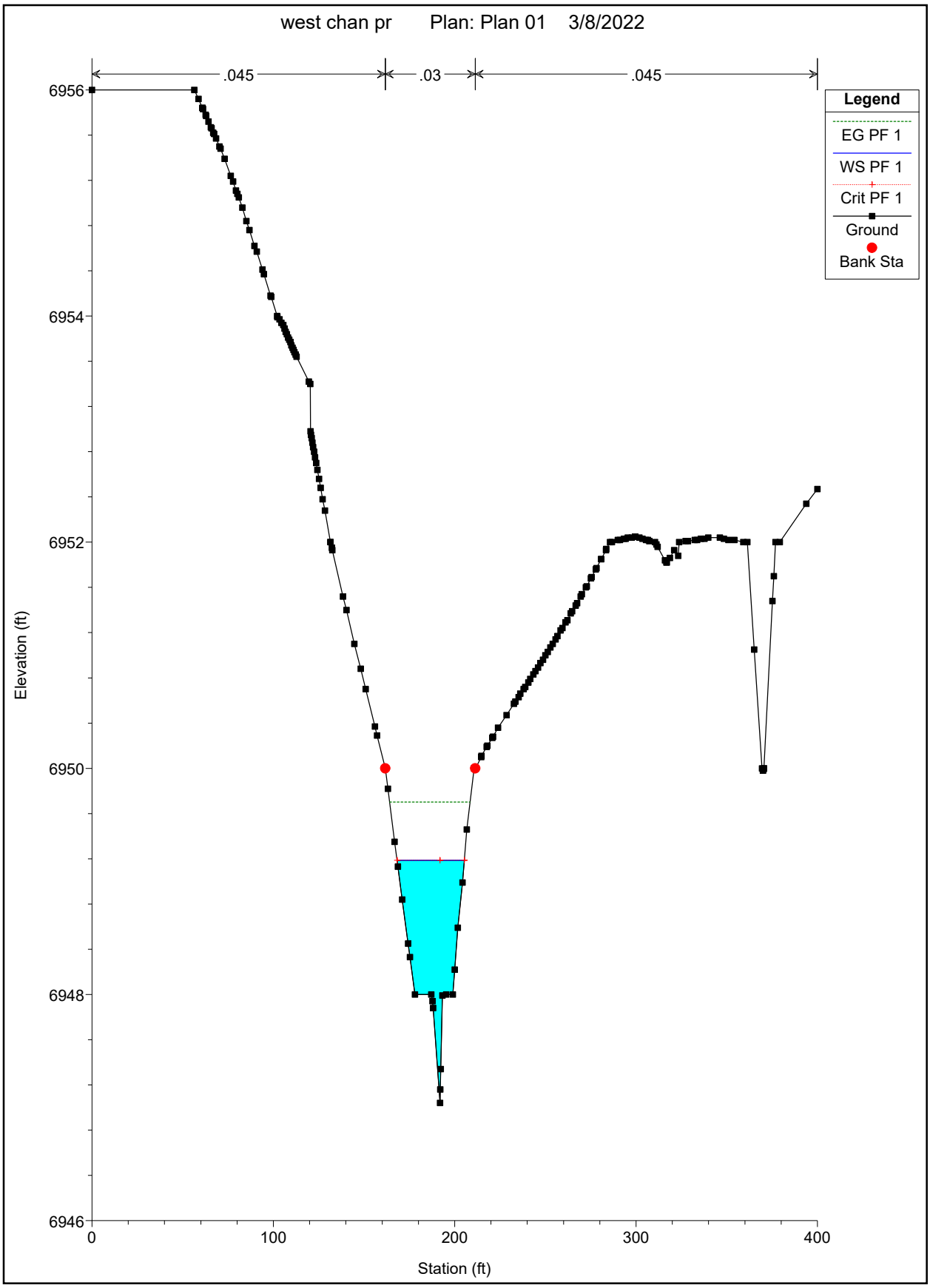
200
300
400
Station (ft)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WS PF 1
Crit PF 1
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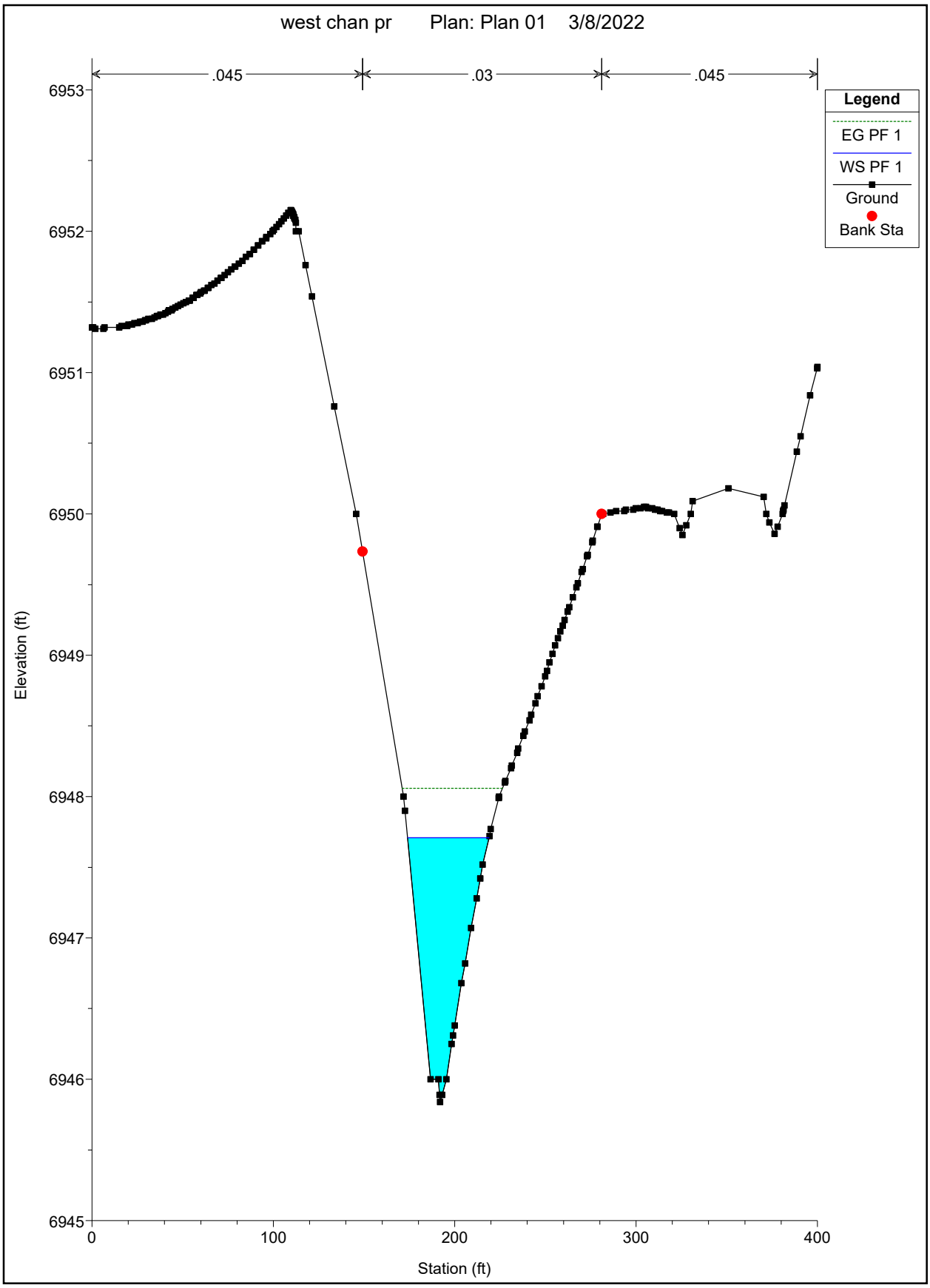
6946
Elevation (ft)
0
100
200
300
400
Station (ft)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.03
.045
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
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6951
6950
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6948
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6946
6945
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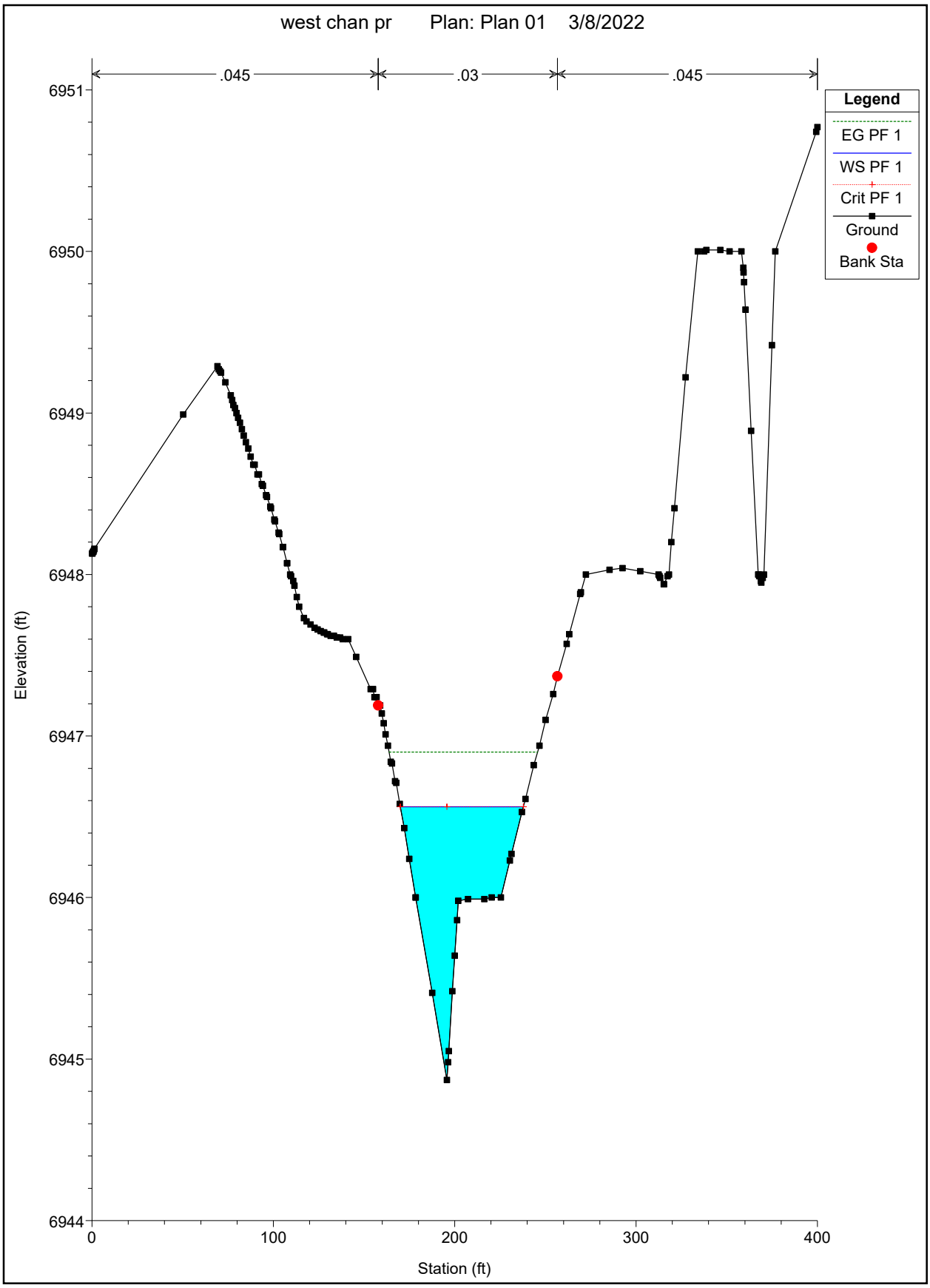
100
200
300
400
Station (ft)


west chan pr Plan: Plan 01 3/8/2022
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.03
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Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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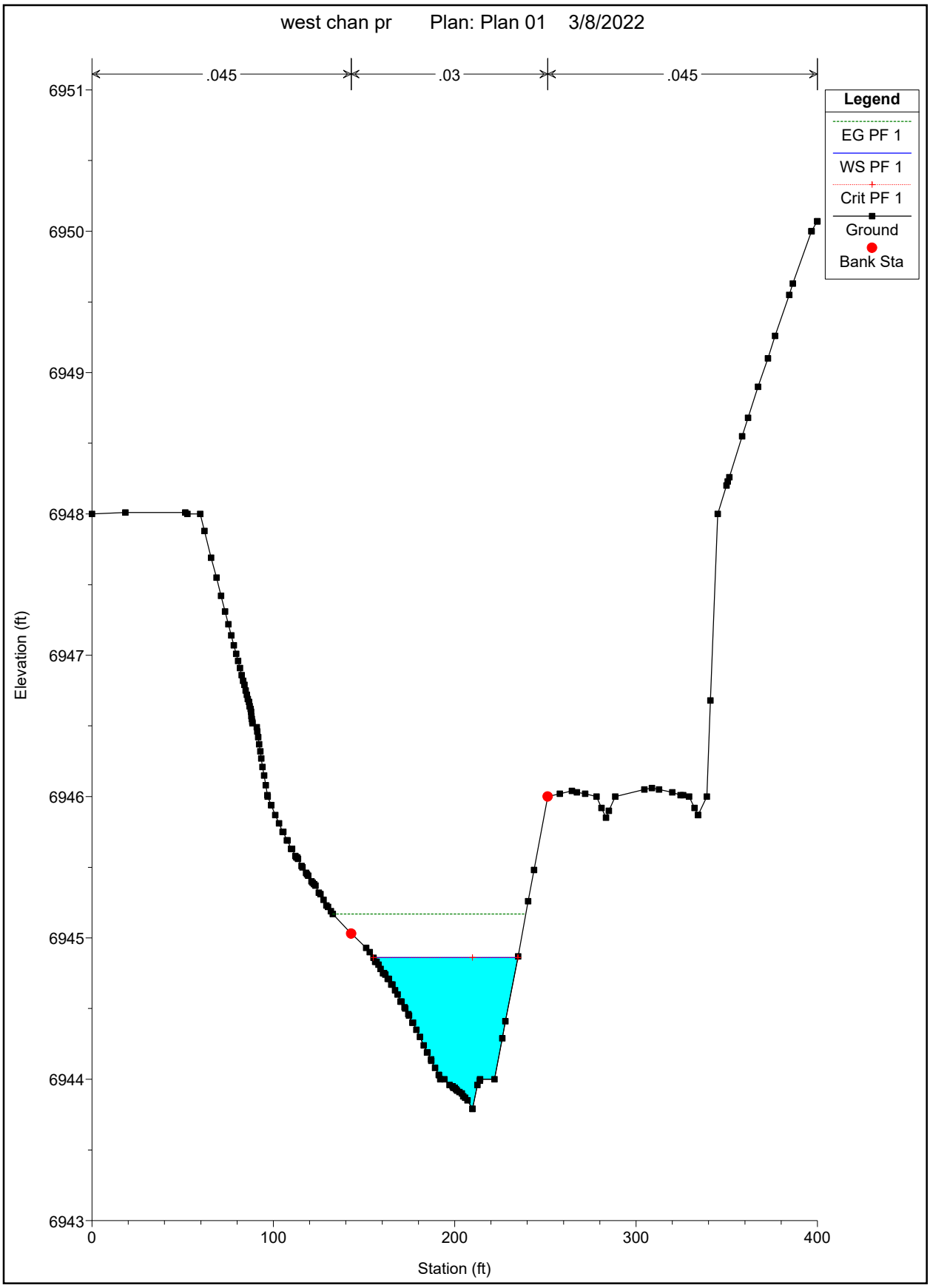
6944
0
100
200
300
400
Station (ft)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.045
.03
.045
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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6943
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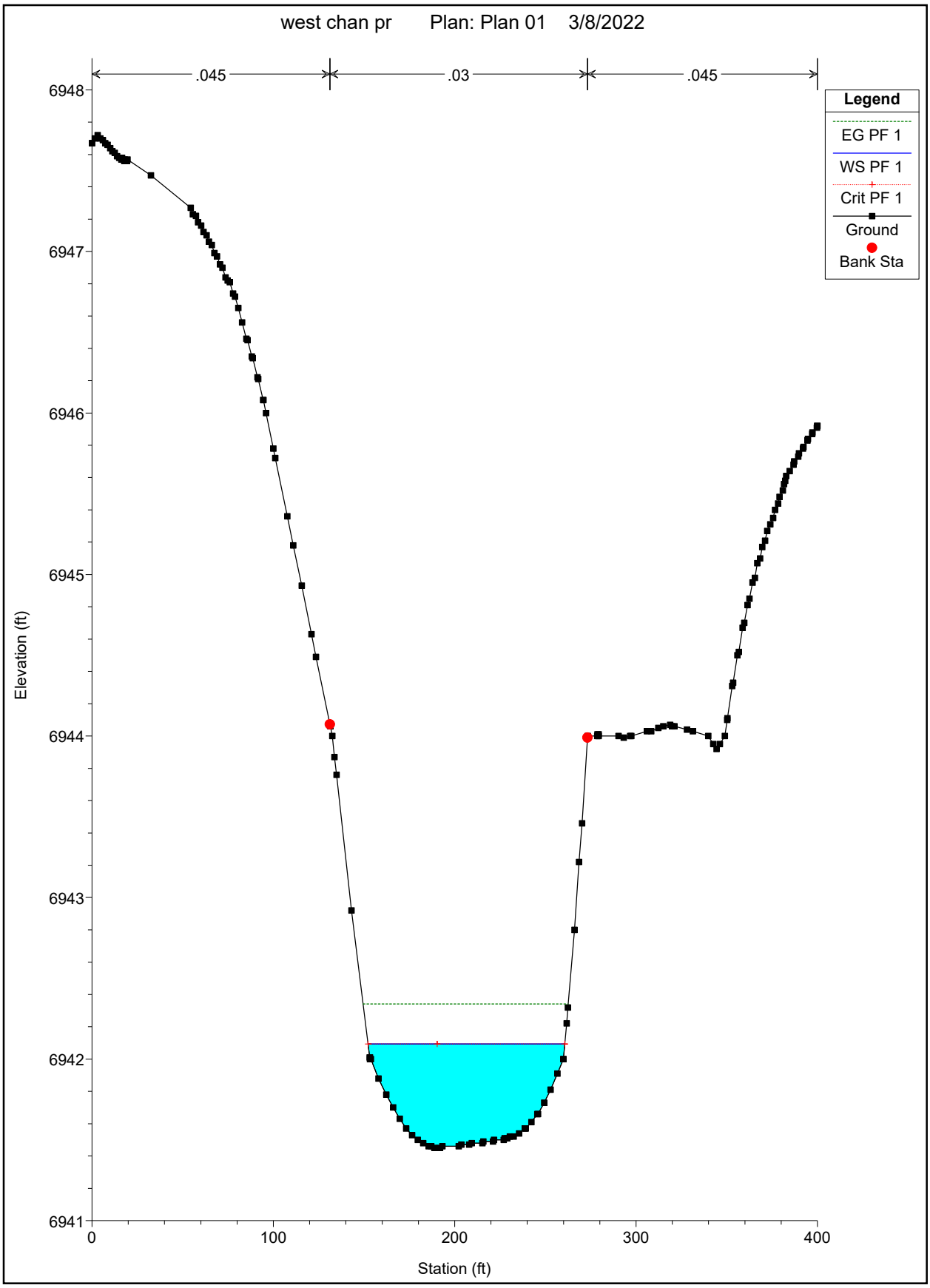
200
300
400
Station (ft)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Legend
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WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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6944
6943
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6941
0
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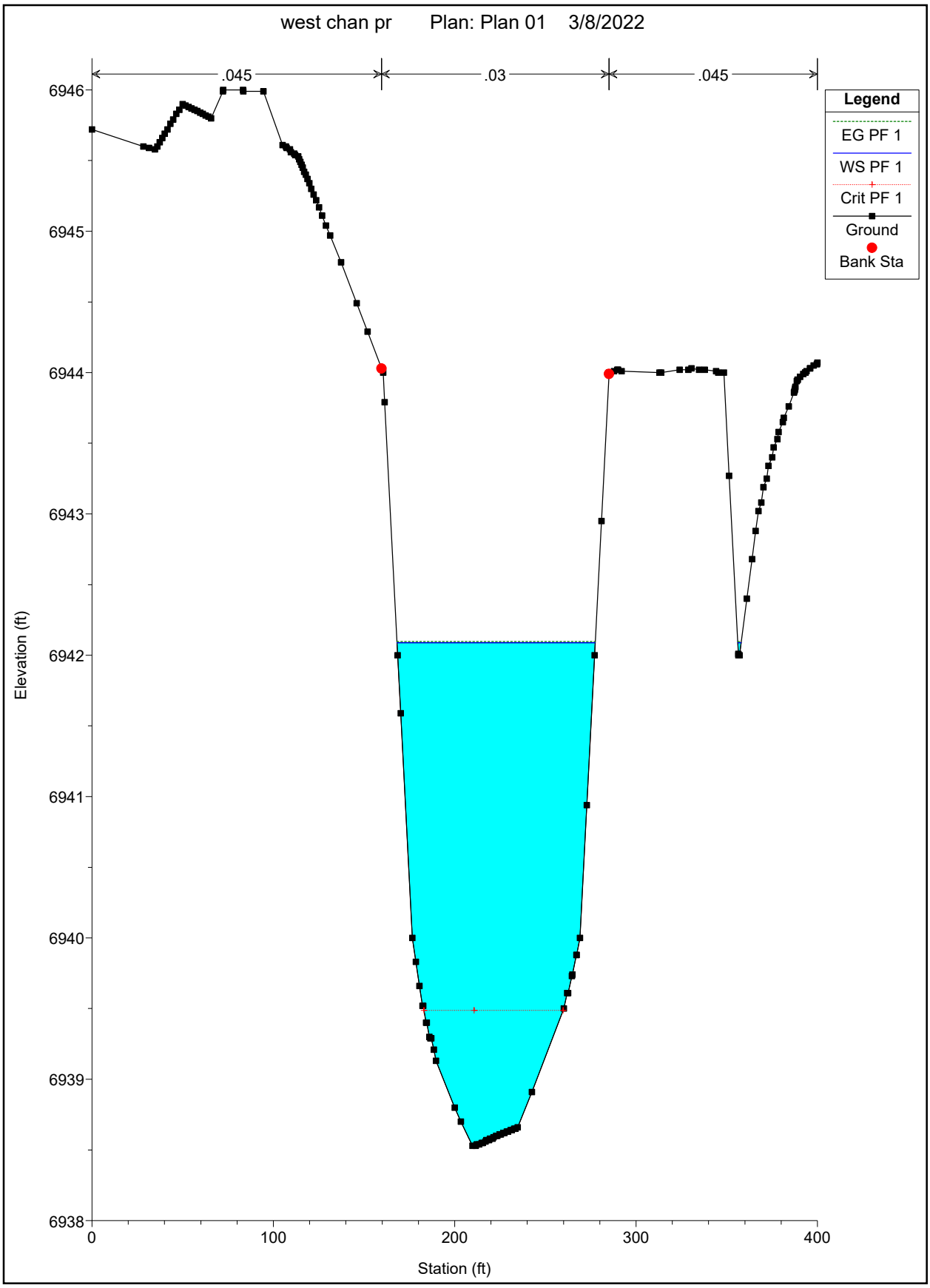
200
300
400
Station (ft)


west chan pr Plan: Plan 01 3/8/2022
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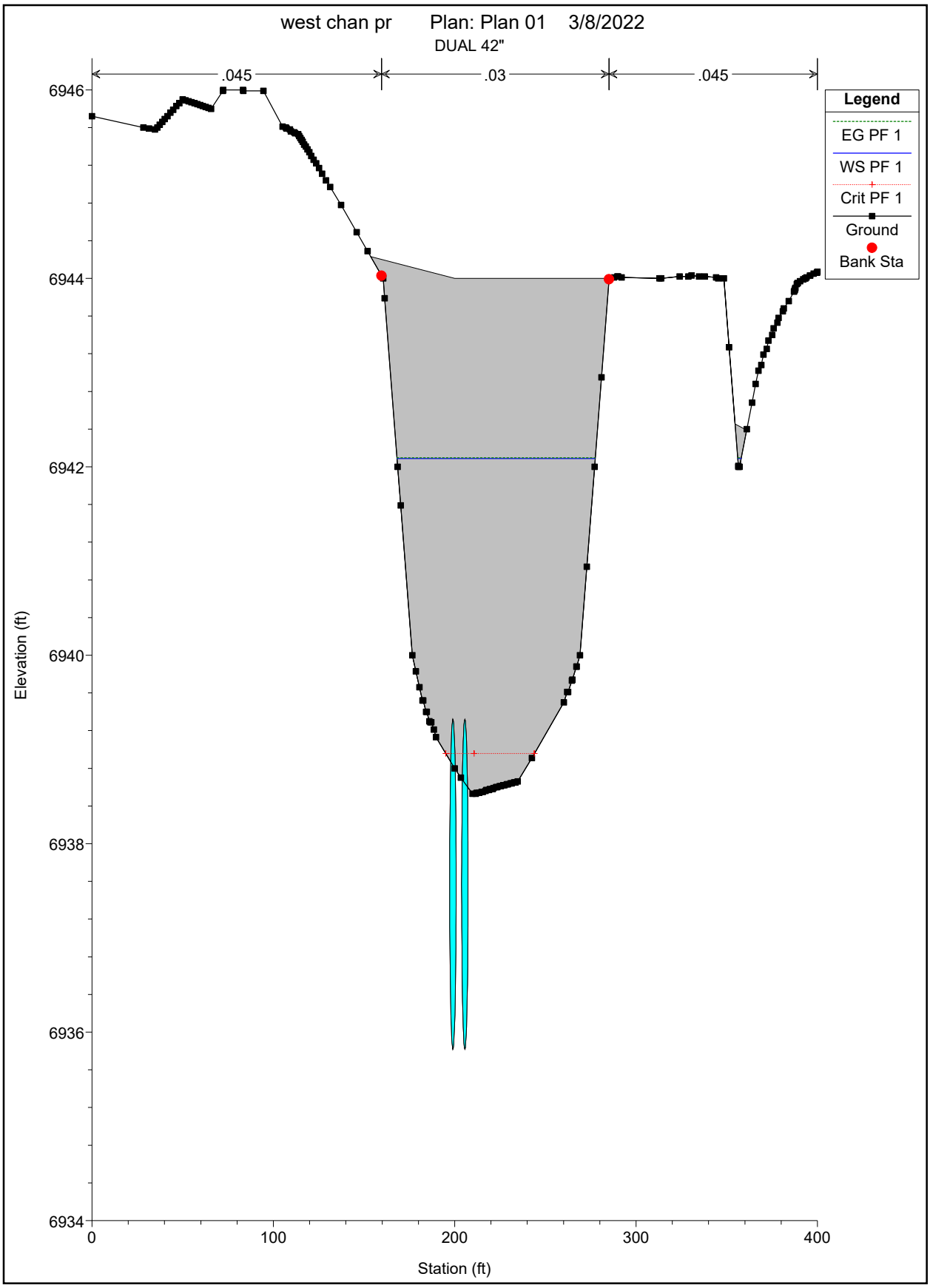
.03
.045
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6946
6945
6944
6943
6942
6941
6940
6939
6938
0
100
200
300
400
Station (ft)


west chan pr Plan: Plan 01 3/8/2022
DUAL 42"
.045
.03
.045
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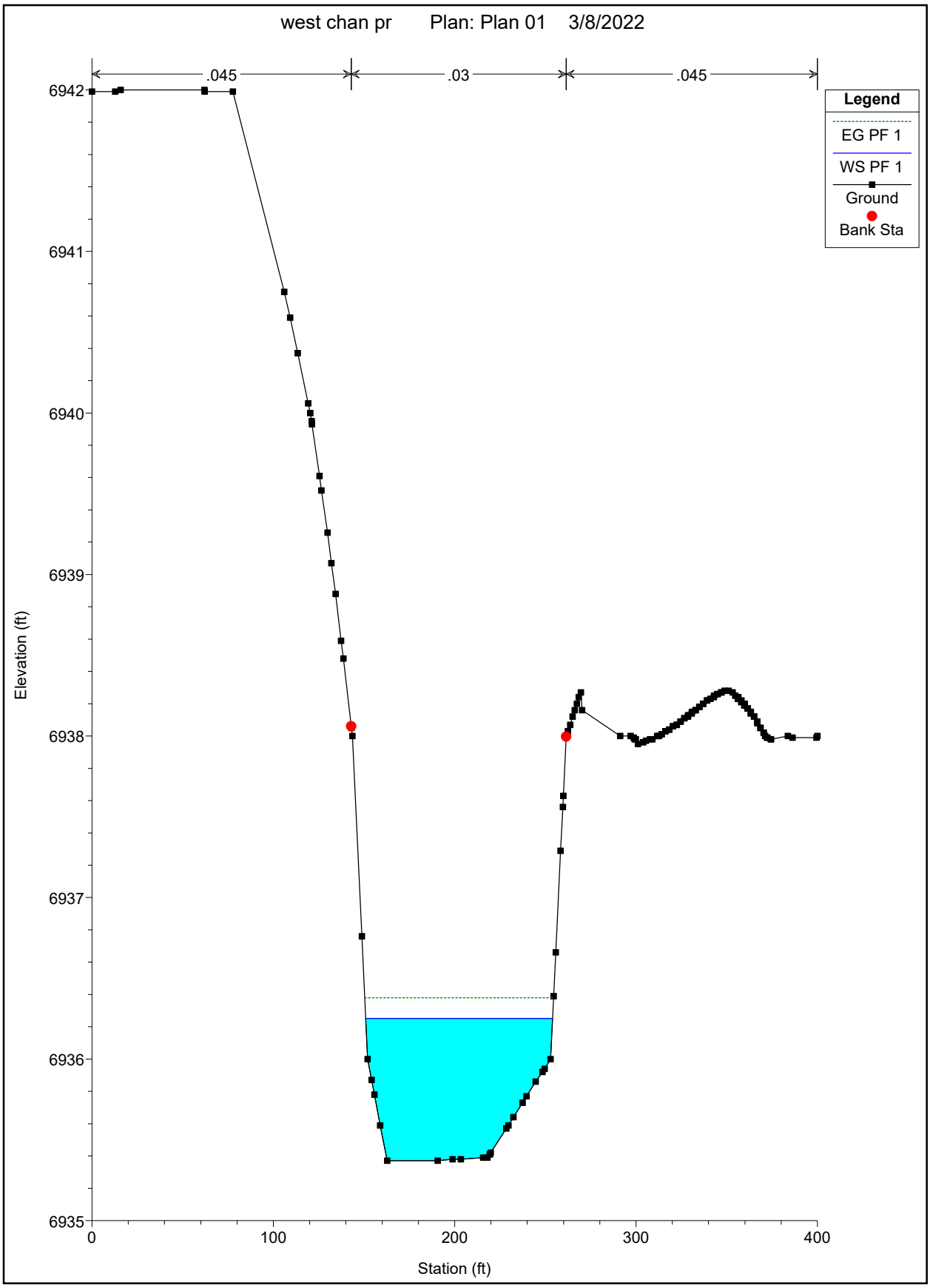
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6946
6944
6942
6940
6938
6936
6934
0
100
200
300
400
Station (ft)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.03
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Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
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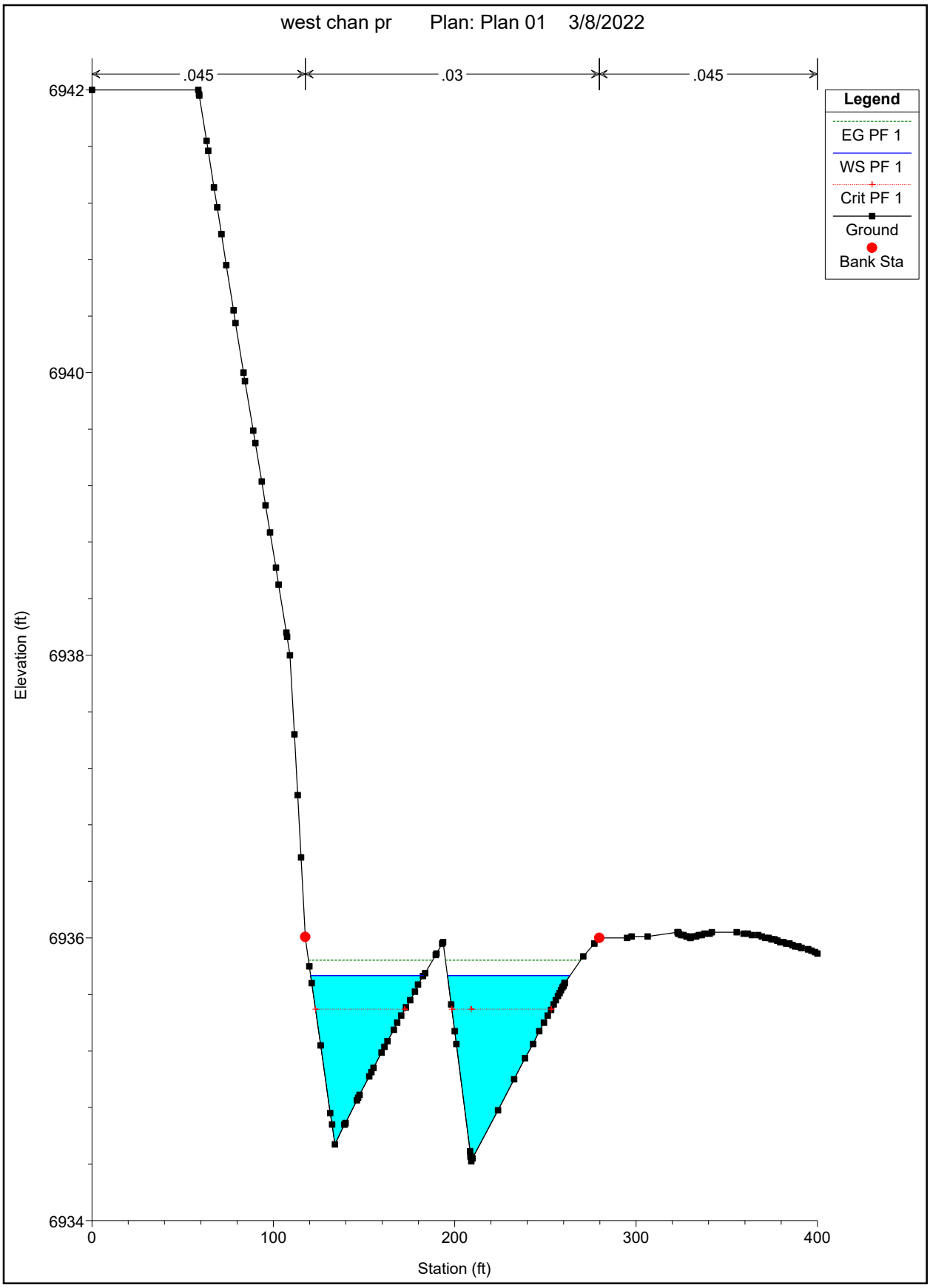
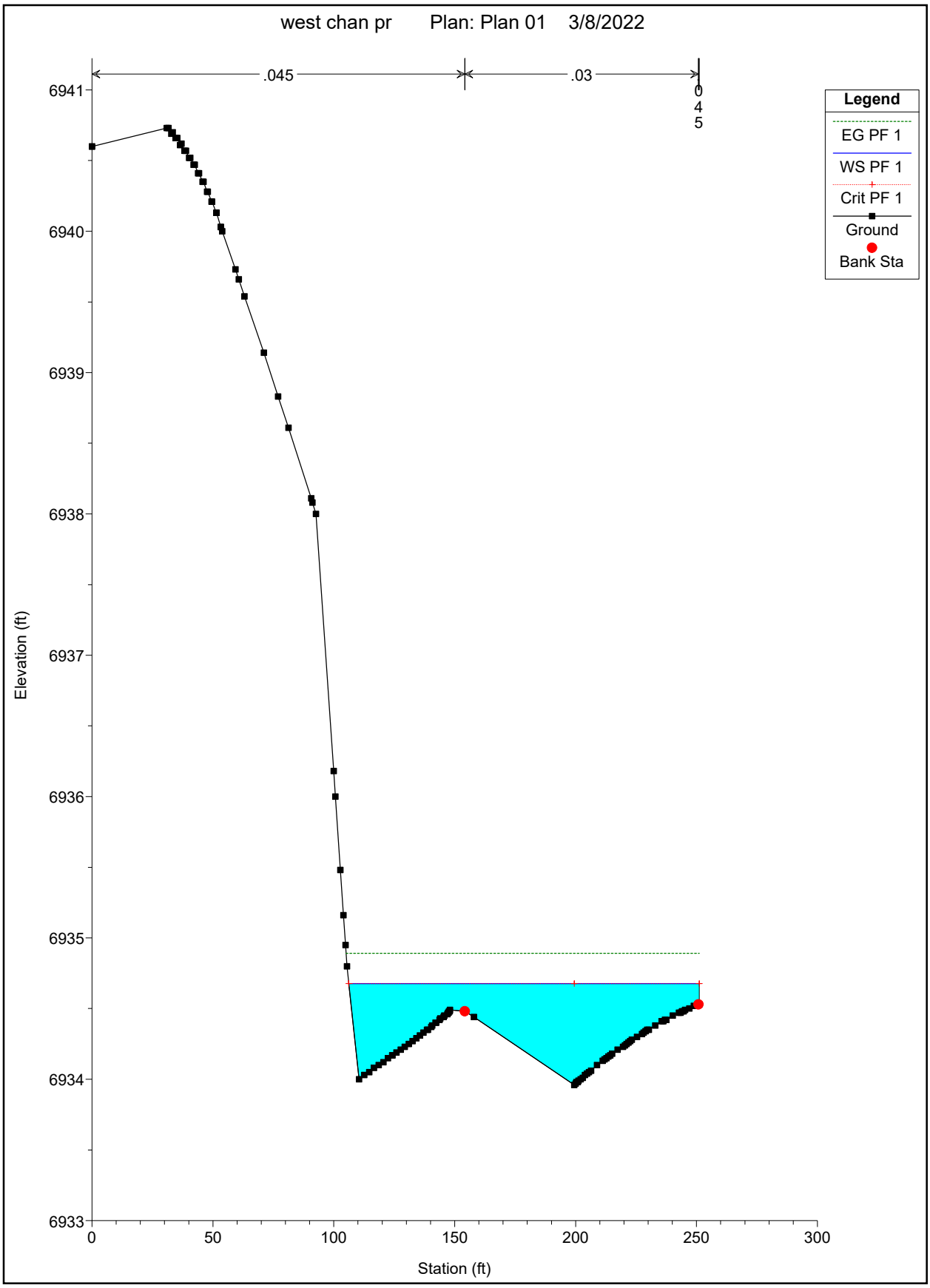
6939
6938
6937
6936
6935
0
100
200
300
400
Station (ft)

ADDED

provide station labels

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WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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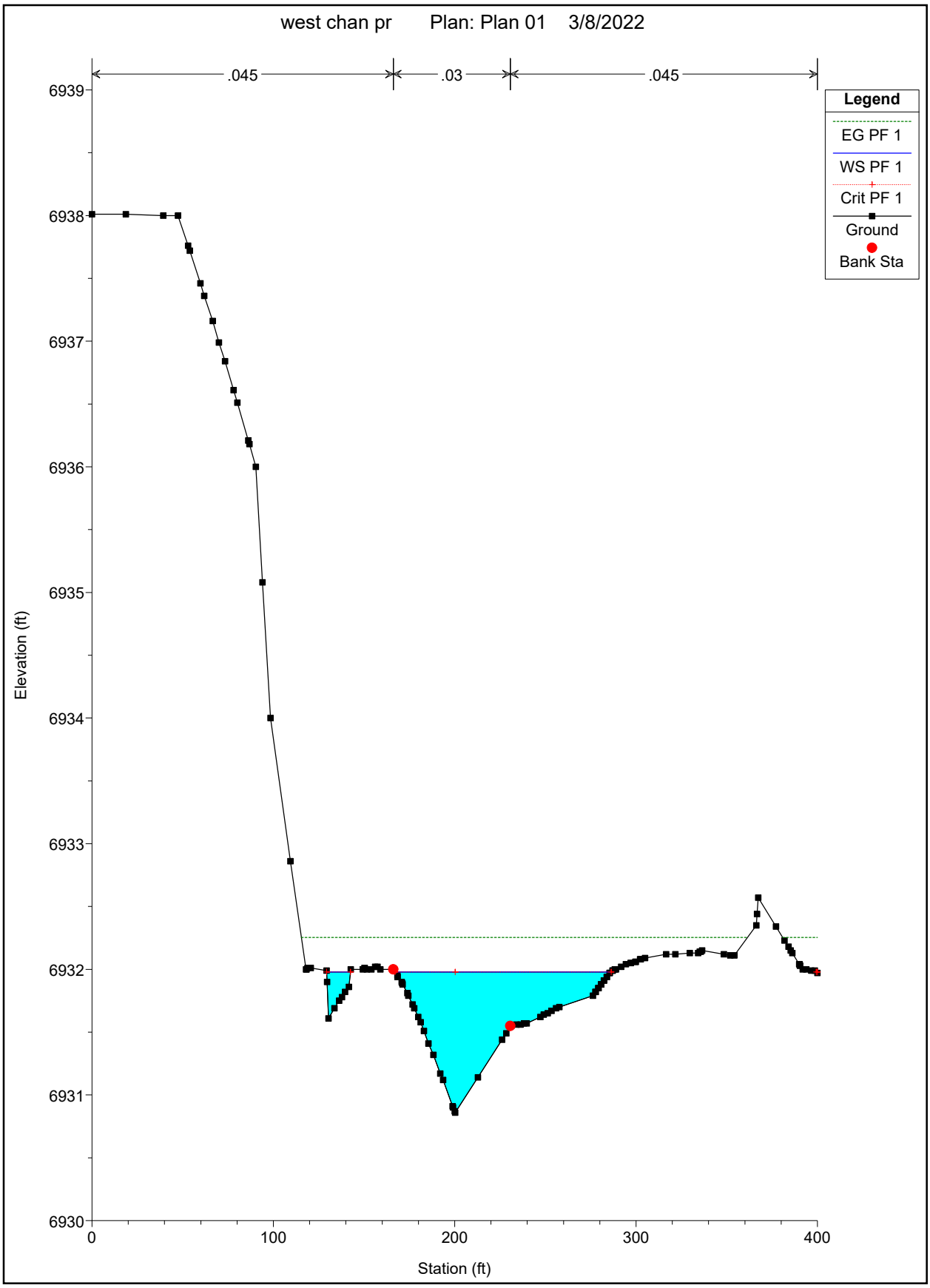
6936
6935
6934
6933
0
50
100
150
200
250
300
Station (ft)


west chan pr Plan: Plan 01 3/8/2022
.045
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Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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6936
6935
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6930
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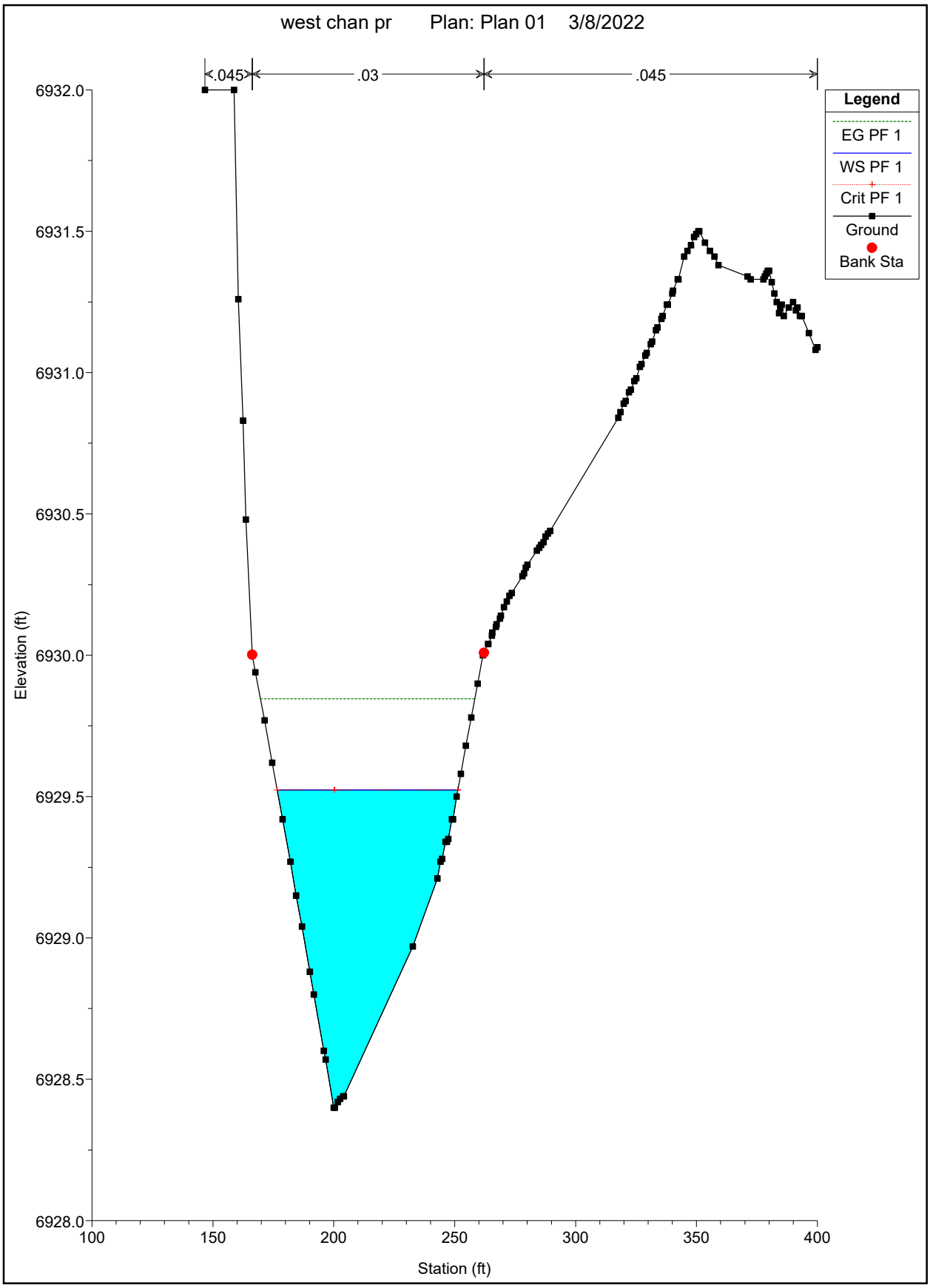
Station (ft)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Legend
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WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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6931.5
6931.0
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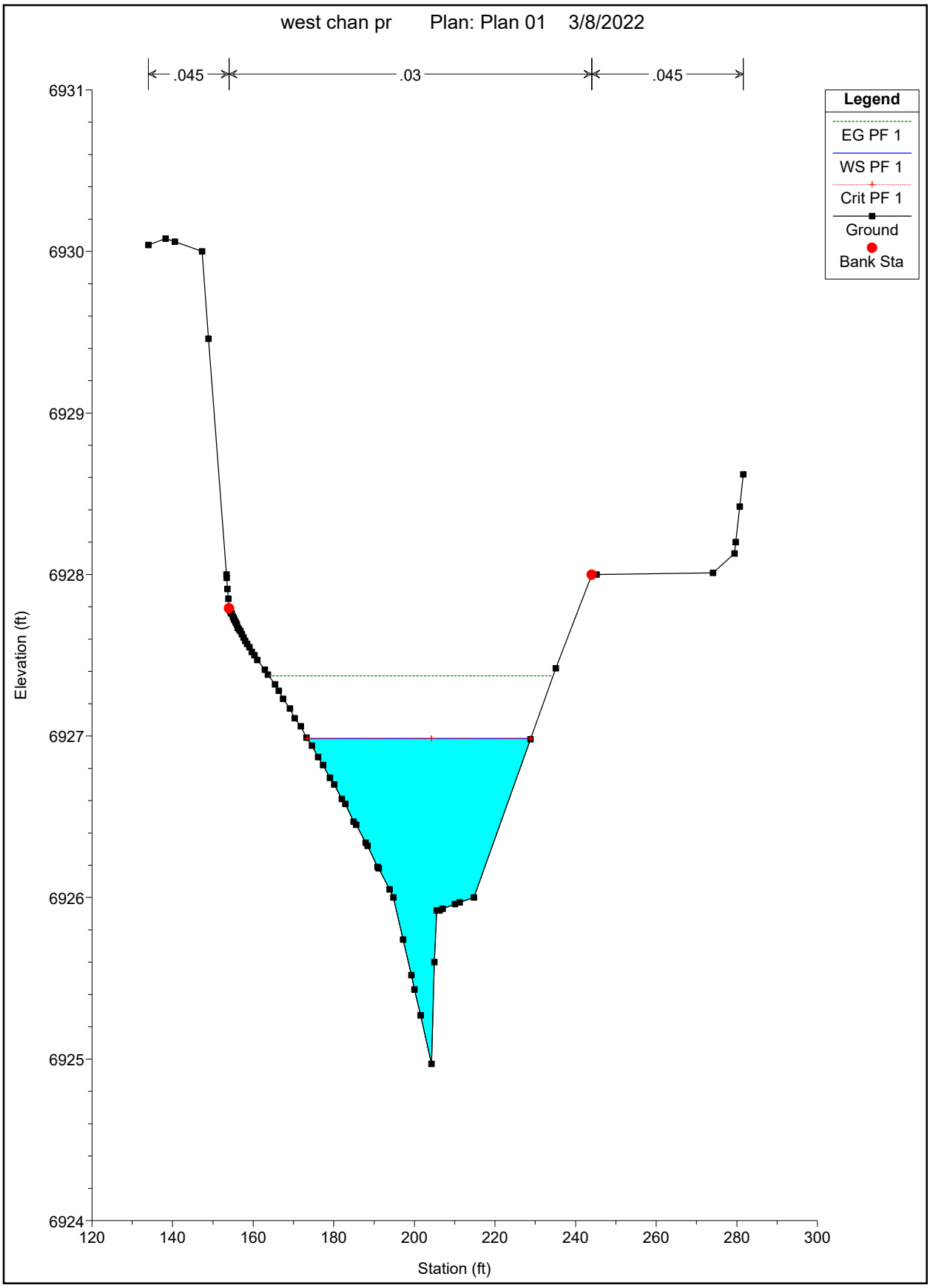
150
200
250
300
350
400
Station (ft)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.03
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Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6931
6930
6929
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6925
6924
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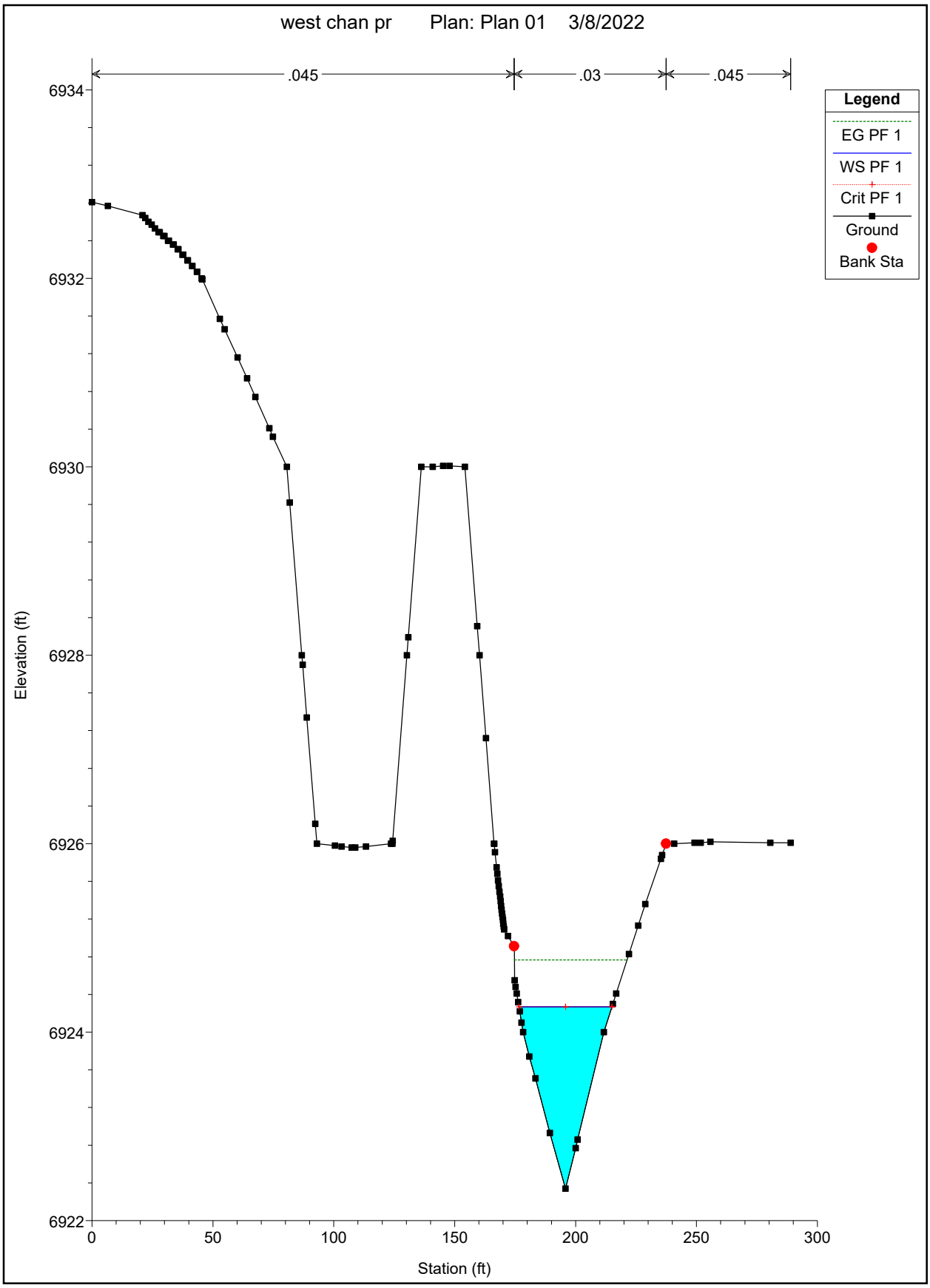
140
160
180
200
220
240
260
280
300
Station (ft)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Crit PF 1
Ground
Bank Sta
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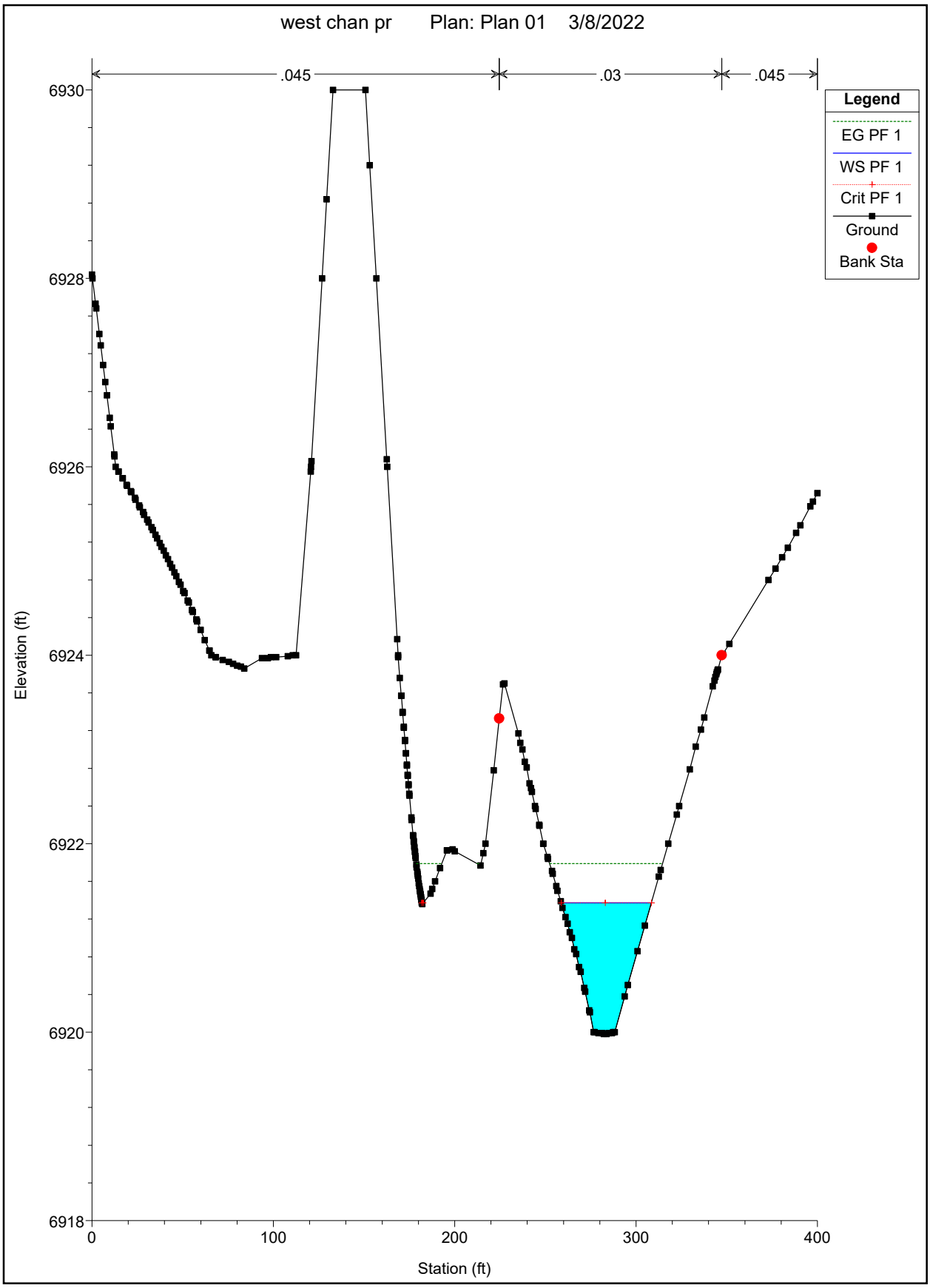
Station (ft)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Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
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6928
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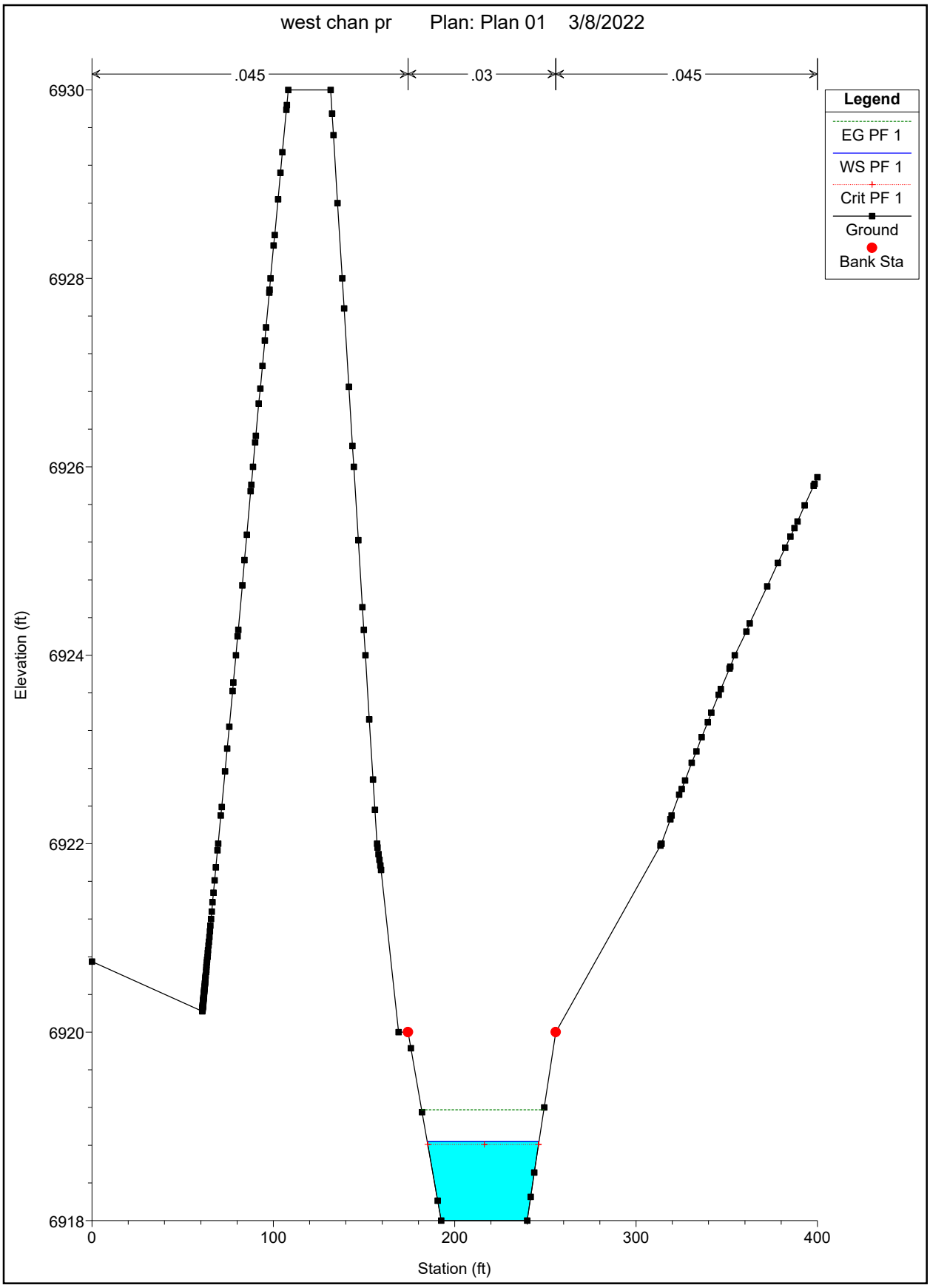
6918
0
100
200
300
400
Station (ft)


west chan pr Plan: Plan 01 3/8/2022
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.03
.045
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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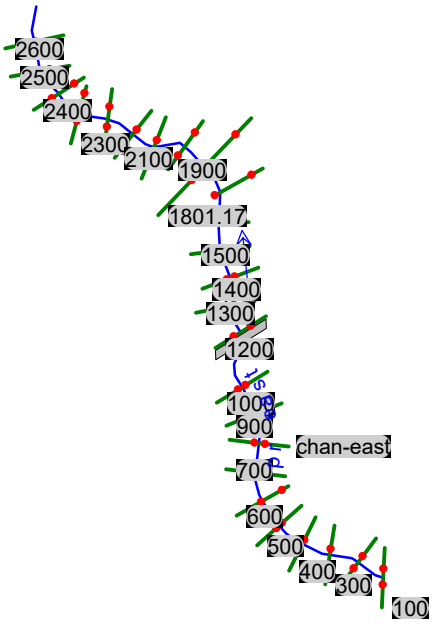
6926
6924
6922
6920
6918
0
100
200
300
400
Station (ft)

EAST CHANNEL



NO LONGER HAVE

Plan: Plan 01 WEST PR chan-west-pr RS: 2600 Profile: PF 1

E.G. Elev (ft)	6967.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.030	
W.S. Elev (ft)	6967.61	Reach Len. (ft)	140.00	100.00	85.90
Crit W.S. (ft)	6967.61	Flow Area (sq ft)		57.48	
E.G. Slope (ft/ft)	0.018361	Area (sq ft)		57.48	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	140.10	Top Width (ft)		140.10	
Vel Total (ft/s)	3.71	Avg. Vel. (ft/s)		3.71	
Max Chl Dpth (ft)	0.79	Hydr. Depth (ft)		0.41	
Conv. Total (cfs)	1571.9	Conv. (cfs)		1571.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		140.12	
Min Ch El (ft)	6966.82	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)		1.74	
Frctn Loss (ft)	1.39	Cum Volume (acre-ft)	0.06	3.14	0.03
C & E Loss (ft)	0.02	Cum SA (acres)	0.19	4.89	0.14

Plan: Plan 01 WEST PR chan-west-pr RS: 2500 Profile: PF 1

E.G. Elev (ft)	6965.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.		0.030	
W.S. Elev (ft)	6965.55	Reach Len. (ft)	148.70	100.00	20.00
Crit W.S. (ft)		Flow Area (sq ft)		66.40	
E.G. Slope (ft/ft)	0.010826	Area (sq ft)		66.40	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	135.18	Top Width (ft)		135.18	
Vel Total (ft/s)	3.21	Avg. Vel. (ft/s)		3.21	
Max Chl Dpth (ft)	0.90	Hydr. Depth (ft)		0.49	
Conv. Total (cfs)	2047.1	Conv. (cfs)		2047.1	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		135.20	
Min Ch El (ft)	6964.65	Shear (lb/sq ft)		0.33	
Alpha	1.00	Stream Power (lb/ft s)		1.06	
Frctn Loss (ft)	1.38	Cum Volume (acre-ft)	0.06	3.00	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.19	4.58	0.14

Plan: Plan 01 WEST PR chan-west-pr RS: 2400 Profile: PF 1

E.G. Elev (ft)	6964.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.030	
W.S. Elev (ft)	6964.11	Reach Len. (ft)	119.30	100.00	96.70
Crit W.S. (ft)	6964.11	Flow Area (sq ft)		57.47	
E.G. Slope (ft/ft)	0.018200	Area (sq ft)		57.47	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	139.08	Top Width (ft)		139.08	
Vel Total (ft/s)	3.71	Avg. Vel. (ft/s)		3.71	
Max Chl Dpth (ft)	0.64	Hydr. Depth (ft)		0.41	
Conv. Total (cfs)	1578.9	Conv. (cfs)		1578.9	
Length Wtd. (ft)	100.06	Wetted Per. (ft)		139.09	
Min Ch El (ft)	6963.47	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)		1.74	
Frctn Loss (ft)	1.72	Cum Volume (acre-ft)	0.06	2.86	0.03
C & E Loss (ft)	0.00	Cum SA (acres)	0.19	4.26	0.14

Plan: Plan 01 WEST PR chan-west-pr RS: 2300 Profile: PF 1

E.G. Elev (ft)	6962.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6962.32	Reach Len. (ft)	113.10	100.00	97.60
Crit W.S. (ft)	6962.32	Flow Area (sq ft)	1.58	53.00	1.49
E.G. Slope (ft/ft)	0.016174	Area (sq ft)	1.58	53.00	1.49
Q Total (cfs)	213.00	Flow (cfs)	1.65	209.53	1.82
Top Width (ft)	128.81	Top Width (ft)	12.75	106.60	9.46
Vel Total (ft/s)	3.80	Avg. Vel. (ft/s)	1.04	3.95	1.22
Max Chl Dpth (ft)	0.96	Hydr. Depth (ft)	0.12	0.50	0.16
Conv. Total (cfs)	1674.9	Conv. (cfs)	12.9	1647.6	14.3
Length Wtd. (ft)	100.04	Wetted Per. (ft)	12.75	106.62	9.46
Min Ch El (ft)	6961.36	Shear (lb/sq ft)	0.12	0.50	0.16
Alpha	1.07	Stream Power (lb/ft s)	0.13	1.98	0.19
Frctn Loss (ft)	1.63	Cum Volume (acre-ft)	0.06	2.73	0.03
C & E Loss (ft)	0.00	Cum SA (acres)	0.17	3.98	0.13

Plan: Plan 01 WEST PR chan-west-pr RS: 2200 Profile: PF 1

E.G. Elev (ft)	6959.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.		0.030	
W.S. Elev (ft)	6959.60	Reach Len. (ft)	170.39	200.00	195.20
Crit W.S. (ft)	6959.60	Flow Area (sq ft)		49.95	
E.G. Slope (ft/ft)	0.016348	Area (sq ft)		49.95	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	90.36	Top Width (ft)		90.36	
Vel Total (ft/s)	4.26	Avg. Vel. (ft/s)		4.26	
Max Chl Dpth (ft)	1.06	Hydr. Depth (ft)		0.55	
Conv. Total (cfs)	1665.9	Conv. (cfs)		1665.9	
Length Wtd. (ft)	200.00	Wetted Per. (ft)		90.39	
Min Ch El (ft)	6958.54	Shear (lb/sq ft)		0.56	
Alpha	1.00	Stream Power (lb/ft s)		2.40	
Frctn Loss (ft)	2.62	Cum Volume (acre-ft)	0.05	2.61	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.15	3.76	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 2000 Profile: PF 1

E.G. Elev (ft)	6955.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.030	
W.S. Elev (ft)	6955.67	Reach Len. (ft)	99.70	100.00	116.50
Crit W.S. (ft)	6955.58	Flow Area (sq ft)		51.70	
E.G. Slope (ft/ft)	0.010768	Area (sq ft)		51.70	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	71.98	Top Width (ft)		71.98	
Vel Total (ft/s)	4.12	Avg. Vel. (ft/s)		4.12	
Max Chl Dpth (ft)	1.39	Hydr. Depth (ft)		0.72	
Conv. Total (cfs)	2052.7	Conv. (cfs)		2052.7	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		72.04	
Min Ch El (ft)	6954.28	Shear (lb/sq ft)		0.48	
Alpha	1.00	Stream Power (lb/ft s)		1.99	
Frctn Loss (ft)	1.29	Cum Volume (acre-ft)	0.05	2.38	0.03
C & E Loss (ft)	0.00	Cum SA (acres)	0.15	3.38	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1900 Profile: PF 1

E.G. Elev (ft)	6954.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.		0.030	
W.S. Elev (ft)	6954.37	Reach Len. (ft)	674.00	100.00	141.40
Crit W.S. (ft)	6954.37	Flow Area (sq ft)		50.23	
E.G. Slope (ft/ft)	0.015744	Area (sq ft)		50.23	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	88.96	Top Width (ft)		88.96	
Vel Total (ft/s)	4.24	Avg. Vel. (ft/s)		4.24	
Max Chl Dpth (ft)	1.70	Hydr. Depth (ft)		0.56	
Conv. Total (cfs)	1697.5	Conv. (cfs)		1697.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		89.11	
Min Ch El (ft)	6952.67	Shear (lb/sq ft)		0.55	
Alpha	1.00	Stream Power (lb/ft s)		2.35	
Frctn Loss (ft)	1.52	Cum Volume (acre-ft)	0.05	2.26	0.03
C & E Loss (ft)	0.02	Cum SA (acres)	0.15	3.20	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1800 Profile: PF 1

E.G. Elev (ft)	6951.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.		0.030	
W.S. Elev (ft)	6951.49	Reach Len. (ft)	99.30	100.00	113.30
Crit W.S. (ft)	6951.49	Flow Area (sq ft)		39.83	
E.G. Slope (ft/ft)	0.014715	Area (sq ft)		39.83	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	47.02	Top Width (ft)		47.02	
Vel Total (ft/s)	5.35	Avg. Vel. (ft/s)		5.35	
Max Chl Dpth (ft)	2.20	Hydr. Depth (ft)		0.85	
Conv. Total (cfs)	1755.9	Conv. (cfs)		1755.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		47.45	
Min Ch El (ft)	6949.29	Shear (lb/sq ft)		0.77	
Alpha	1.00	Stream Power (lb/ft s)		4.12	
Frctn Loss (ft)	1.42	Cum Volume (acre-ft)	0.05	2.16	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.15	3.04	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1700 Profile: PF 1

E.G. Elev (ft)	6949.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.51	Wt. n-Val.		0.030	
W.S. Elev (ft)	6949.19	Reach Len. (ft)	113.00	100.00	112.30
Crit W.S. (ft)	6949.19	Flow Area (sq ft)		37.03	
E.G. Slope (ft/ft)	0.013784	Area (sq ft)		37.03	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	37.04	Top Width (ft)		37.04	
Vel Total (ft/s)	5.75	Avg. Vel. (ft/s)		5.75	
Max Chl Dpth (ft)	2.15	Hydr. Depth (ft)		1.00	
Conv. Total (cfs)	1814.2	Conv. (cfs)		1814.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		37.63	
Min Ch El (ft)	6947.04	Shear (lb/sq ft)		0.85	
Alpha	1.00	Stream Power (lb/ft s)		4.87	
Frctn Loss (ft)	1.12	Cum Volume (acre-ft)	0.05	2.07	0.03
C & E Loss (ft)	0.05	Cum SA (acres)	0.15	2.95	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1600 Profile: PF 1

E.G. Elev (ft)	6948.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.		0.030	
W.S. Elev (ft)	6947.71	Reach Len. (ft)	113.20	100.00	83.60
Crit W.S. (ft)		Flow Area (sq ft)		44.92	
E.G. Slope (ft/ft)	0.009246	Area (sq ft)		44.92	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	45.01	Top Width (ft)		45.01	
Vel Total (ft/s)	4.74	Avg. Vel. (ft/s)		4.74	
Max Chl Dpth (ft)	1.87	Hydr. Depth (ft)		1.00	
Conv. Total (cfs)	2215.1	Conv. (cfs)		2215.1	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		45.21	
Min Ch El (ft)	6945.84	Shear (lb/sq ft)		0.57	
Alpha	1.00	Stream Power (lb/ft s)		2.72	
Frctn Loss (ft)	1.16	Cum Volume (acre-ft)	0.05	1.98	0.03
C & E Loss (ft)	0.00	Cum SA (acres)	0.15	2.85	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1500 Profile: PF 1

E.G. Elev (ft)	6946.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.34	Wt. n-Val.		0.030	
W.S. Elev (ft)	6946.56	Reach Len. (ft)	110.50	100.00	89.00
Crit W.S. (ft)	6946.56	Flow Area (sq ft)		45.68	
E.G. Slope (ft/ft)	0.015089	Area (sq ft)		45.68	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	67.91	Top Width (ft)		67.91	
Vel Total (ft/s)	4.66	Avg. Vel. (ft/s)		4.66	
Max Chl Dpth (ft)	1.69	Hydr. Depth (ft)		0.67	
Conv. Total (cfs)	1734.0	Conv. (cfs)		1734.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		68.07	
Min Ch El (ft)	6944.87	Shear (lb/sq ft)		0.63	
Alpha	1.00	Stream Power (lb/ft s)		2.95	
Frctn Loss (ft)	1.56	Cum Volume (acre-ft)	0.05	1.87	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.15	2.72	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1400 Profile: PF 1

E.G. Elev (ft)	6945.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.		0.030	
W.S. Elev (ft)	6944.86	Reach Len. (ft)	75.60	100.00	125.50
Crit W.S. (ft)	6944.86	Flow Area (sq ft)		47.75	
E.G. Slope (ft/ft)	0.016056	Area (sq ft)		47.75	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	79.66	Top Width (ft)		79.66	
Vel Total (ft/s)	4.46	Avg. Vel. (ft/s)		4.46	
Max Chl Dpth (ft)	1.07	Hydr. Depth (ft)		0.60	
Conv. Total (cfs)	1681.0	Conv. (cfs)		1681.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		79.71	
Min Ch El (ft)	6943.79	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		2.68	
Frctn Loss (ft)	1.64	Cum Volume (acre-ft)	0.05	1.77	0.03
C & E Loss (ft)	0.02	Cum SA (acres)	0.15	2.55	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1300 Profile: PF 1

E.G. Elev (ft)	6942.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.		0.030	
W.S. Elev (ft)	6942.09	Reach Len. (ft)	107.40	100.00	88.80
Crit W.S. (ft)	6942.09	Flow Area (sq ft)		53.37	
E.G. Slope (ft/ft)	0.016728	Area (sq ft)		53.37	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	108.51	Top Width (ft)		108.51	
Vel Total (ft/s)	3.99	Avg. Vel. (ft/s)		3.99	
Max Chl Dpth (ft)	0.64	Hydr. Depth (ft)		0.49	
Conv. Total (cfs)	1646.9	Conv. (cfs)		1646.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		108.53	
Min Ch El (ft)	6941.45	Shear (lb/sq ft)		0.51	
Alpha	1.00	Stream Power (lb/ft s)		2.05	
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	0.05	1.65	0.03
C & E Loss (ft)	0.07	Cum SA (acres)	0.15	2.34	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 1200 Profile: PF 1

E.G. Elev (ft)	6942.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.030	0.045
W.S. Elev (ft)	6942.09	Reach Len. (ft)	313.70	300.00	276.40
Crit W.S. (ft)	6939.49	Flow Area (sq ft)		301.81	0.10
E.G. Slope (ft/ft)	0.000053	Area (sq ft)		301.81	0.10
Q Total (cfs)	213.00	Flow (cfs)		213.00	0.00
Top Width (ft)	111.08	Top Width (ft)		109.26	1.81
Vel Total (ft/s)	0.71	Avg. Vel. (ft/s)		0.71	0.04
Max Chl Dpth (ft)	3.56	Hydr. Depth (ft)		2.76	0.06
Conv. Total (cfs)	29326.1	Conv. (cfs)		29325.6	0.5
Length Wtd. (ft)	300.00	Wetted Per. (ft)		109.85	1.83
Min Ch El (ft)	6938.53	Shear (lb/sq ft)		0.01	0.00
Alpha	1.00	Stream Power (lb/ft s)		0.01	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	0.05	1.24	0.03
C & E Loss (ft)		Cum SA (acres)	0.15	2.09	0.12

Plan: Plan 01 WEST PR chan-west-pr RS: 900 Profile: PF 1

E.G. Elev (ft)	6936.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.		0.030	
W.S. Elev (ft)	6936.25	Reach Len. (ft)	104.20	100.00	101.80
Crit W.S. (ft)		Flow Area (sq ft)		74.22	
E.G. Slope (ft/ft)	0.005198	Area (sq ft)		74.22	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	102.95	Top Width (ft)		102.95	
Vel Total (ft/s)	2.87	Avg. Vel. (ft/s)		2.87	
Max Chl Dpth (ft)	0.88	Hydr. Depth (ft)		0.72	
Conv. Total (cfs)	2954.2	Conv. (cfs)		2954.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		103.03	
Min Ch El (ft)	6935.37	Shear (lb/sq ft)		0.23	
Alpha	1.00	Stream Power (lb/ft s)		0.67	
Frctn Loss (ft)	0.53	Cum Volume (acre-ft)	0.05	0.90	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.15	1.36	0.11

Plan: Plan 01 WEST PR chan-west-pr RS: 800 Profile: PF 1

E.G. Elev (ft)	6935.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.030	
W.S. Elev (ft)	6935.73	Reach Len. (ft)	96.40	100.00	114.30
Crit W.S. (ft)	6935.50	Flow Area (sq ft)		80.27	
E.G. Slope (ft/ft)	0.005448	Area (sq ft)		80.27	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	129.67	Top Width (ft)		129.67	
Vel Total (ft/s)	2.65	Avg. Vel. (ft/s)		2.65	
Max Chl Dpth (ft)	1.31	Hydr. Depth (ft)		0.62	
Conv. Total (cfs)	2885.7	Conv. (cfs)		2885.7	
Length Wtd. (ft)	99.58	Wetted Per. (ft)		129.82	
Min Ch El (ft)	6934.42	Shear (lb/sq ft)		0.21	
Alpha	1.00	Stream Power (lb/ft s)		0.56	
Frctn Loss (ft)	0.94	Cum Volume (acre-ft)	0.05	0.72	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.15	1.09	0.11

Plan: Plan 01 WEST PR chan-west-pr RS: 700 Profile: PF 1

E.G. Elev (ft)	6934.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6934.68	Reach Len. (ft)	114.30	100.00	85.80
Crit W.S. (ft)	6934.68	Flow Area (sq ft)	19.28	40.94	0.05
E.G. Slope (ft/ft)	0.020420	Area (sq ft)	19.28	40.94	0.05
Q Total (cfs)	213.00	Flow (cfs)	49.48	163.47	0.05
Top Width (ft)	144.97	Top Width (ft)	48.02	96.60	0.35
Vel Total (ft/s)	3.53	Avg. Vel. (ft/s)	2.57	3.99	1.04
Max Chl Dpth (ft)	0.72	Hydr. Depth (ft)	0.40	0.42	0.15
Conv. Total (cfs)	1490.6	Conv. (cfs)	346.3	1143.9	0.4
Length Wtd. (ft)	100.94	Wetted Per. (ft)	48.08	96.61	0.50
Min Ch El (ft)	6933.96	Shear (lb/sq ft)	0.51	0.54	0.13
Alpha	1.10	Stream Power (lb/ft s)	1.31	2.16	0.14
Frctn Loss (ft)	1.75	Cum Volume (acre-ft)	0.03	0.58	0.03
C & E Loss (ft)	0.01	Cum SA (acres)	0.10	0.83	0.11

Plan: Plan 01 WEST PR chan-west-pr RS: 600 Profile: PF 1

E.G. Elev (ft)	6932.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	6931.98	Reach Len. (ft)	110.80	100.00	88.00
Crit W.S. (ft)	6931.98	Flow Area (sq ft)	2.92	40.77	15.25
E.G. Slope (ft/ft)	0.014832	Area (sq ft)	2.92	40.77	15.25
Q Total (cfs)	213.00	Flow (cfs)	4.29	182.83	25.88
Top Width (ft)	133.02	Top Width (ft)	13.18	63.58	56.26
Vel Total (ft/s)	3.61	Avg. Vel. (ft/s)	1.47	4.48	1.70
Max Chl Dpth (ft)	1.12	Hydr. Depth (ft)	0.22	0.64	0.27
Conv. Total (cfs)	1749.0	Conv. (cfs)	35.2	1501.2	212.5
Length Wtd. (ft)	99.38	Wetted Per. (ft)	13.25	63.61	56.27
Min Ch El (ft)	6930.86	Shear (lb/sq ft)	0.20	0.59	0.25
Alpha	1.35	Stream Power (lb/ft s)	0.30	2.66	0.43
Frctn Loss (ft)	1.52	Cum Volume (acre-ft)	0.00	0.49	0.02
C & E Loss (ft)	0.00	Cum SA (acres)	0.02	0.64	0.06

Plan: Plan 01 WEST PR chan-west-pr RS: 500 Profile: PF 1

E.G. Elev (ft)	6929.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.		0.030	
W.S. Elev (ft)	6929.52	Reach Len. (ft)	85.20	100.00	105.50
Crit W.S. (ft)	6929.52	Flow Area (sq ft)		46.76	
E.G. Slope (ft/ft)	0.015820	Area (sq ft)		46.76	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	74.75	Top Width (ft)		74.75	
Vel Total (ft/s)	4.56	Avg. Vel. (ft/s)		4.56	
Max Chl Dpth (ft)	1.12	Hydr. Depth (ft)		0.63	
Conv. Total (cfs)	1693.5	Conv. (cfs)		1693.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		74.79	
Min Ch El (ft)	6928.40	Shear (lb/sq ft)		0.62	
Alpha	1.00	Stream Power (lb/ft s)		2.81	
Frctn Loss (ft)	1.52	Cum Volume (acre-ft)	0.00	0.38	
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.49	

Plan: Plan 01 WEST PR chan-west-pr RS: 400 Profile: PF 1

E.G. Elev (ft)	6927.37	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.		0.030	
W.S. Elev (ft)	6926.98	Reach Len. (ft)	95.20	100.00	105.50
Crit W.S. (ft)	6926.98	Flow Area (sq ft)		42.65	
E.G. Slope (ft/ft)	0.014589	Area (sq ft)		42.65	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	55.48	Top Width (ft)		55.48	
Vel Total (ft/s)	4.99	Avg. Vel. (ft/s)		4.99	
Max Chl Dpth (ft)	2.01	Hydr. Depth (ft)		0.77	
Conv. Total (cfs)	1763.4	Conv. (cfs)		1763.4	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		55.92	
Min Ch El (ft)	6924.97	Shear (lb/sq ft)		0.69	
Alpha	1.00	Stream Power (lb/ft s)		3.47	
Frctn Loss (ft)	1.41	Cum Volume (acre-ft)	0.00	0.28	
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.34	

Plan: Plan 01 WEST PR chan-west-pr RS: 300 Profile: PF 1

E.G. Elev (ft)	6924.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.		0.030	
W.S. Elev (ft)	6924.27	Reach Len. (ft)	113.50	100.00	139.70
Crit W.S. (ft)	6924.27	Flow Area (sq ft)		37.57	
E.G. Slope (ft/ft)	0.013593	Area (sq ft)		37.57	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	38.43	Top Width (ft)		38.43	
Vel Total (ft/s)	5.67	Avg. Vel. (ft/s)		5.67	
Max Chl Dpth (ft)	1.93	Hydr. Depth (ft)		0.98	
Conv. Total (cfs)	1826.9	Conv. (cfs)		1826.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		38.63	
Min Ch El (ft)	6922.34	Shear (lb/sq ft)		0.83	
Alpha	1.00	Stream Power (lb/ft s)		4.68	
Frctn Loss (ft)	1.39	Cum Volume (acre-ft)	0.00	0.19	
C & E Loss (ft)	0.02	Cum SA (acres)	0.00	0.23	

Plan: Plan 01 WEST PR chan-west-pr RS: 200 Profile: PF 1

E.G. Elev (ft)	6921.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.42	Wt. n-Val.	0.000	0.030	
W.S. Elev (ft)	6921.37	Reach Len. (ft)	109.50	100.00	110.20
Crit W.S. (ft)	6921.37	Flow Area (sq ft)	0.00	41.06	
E.G. Slope (ft/ft)	0.014171	Area (sq ft)	0.00	41.06	
Q Total (cfs)	213.00	Flow (cfs)	0.00	213.00	
Top Width (ft)	50.39	Top Width (ft)	0.73	49.66	
Vel Total (ft/s)	5.19	Avg. Vel. (ft/s)	0.13	5.19	
Max Chl Dpth (ft)	1.39	Hydr. Depth (ft)	0.01	0.83	
Conv. Total (cfs)	1789.3	Conv. (cfs)	0.0	1789.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)	0.73	49.76	
Min Ch El (ft)	6919.98	Shear (lb/sq ft)		0.73	
Alpha	1.00	Stream Power (lb/ft s)		3.79	
Frctn Loss (ft)	1.36	Cum Volume (acre-ft)	0.00	0.10	
C & E Loss (ft)	0.03	Cum SA (acres)	0.00	0.13	

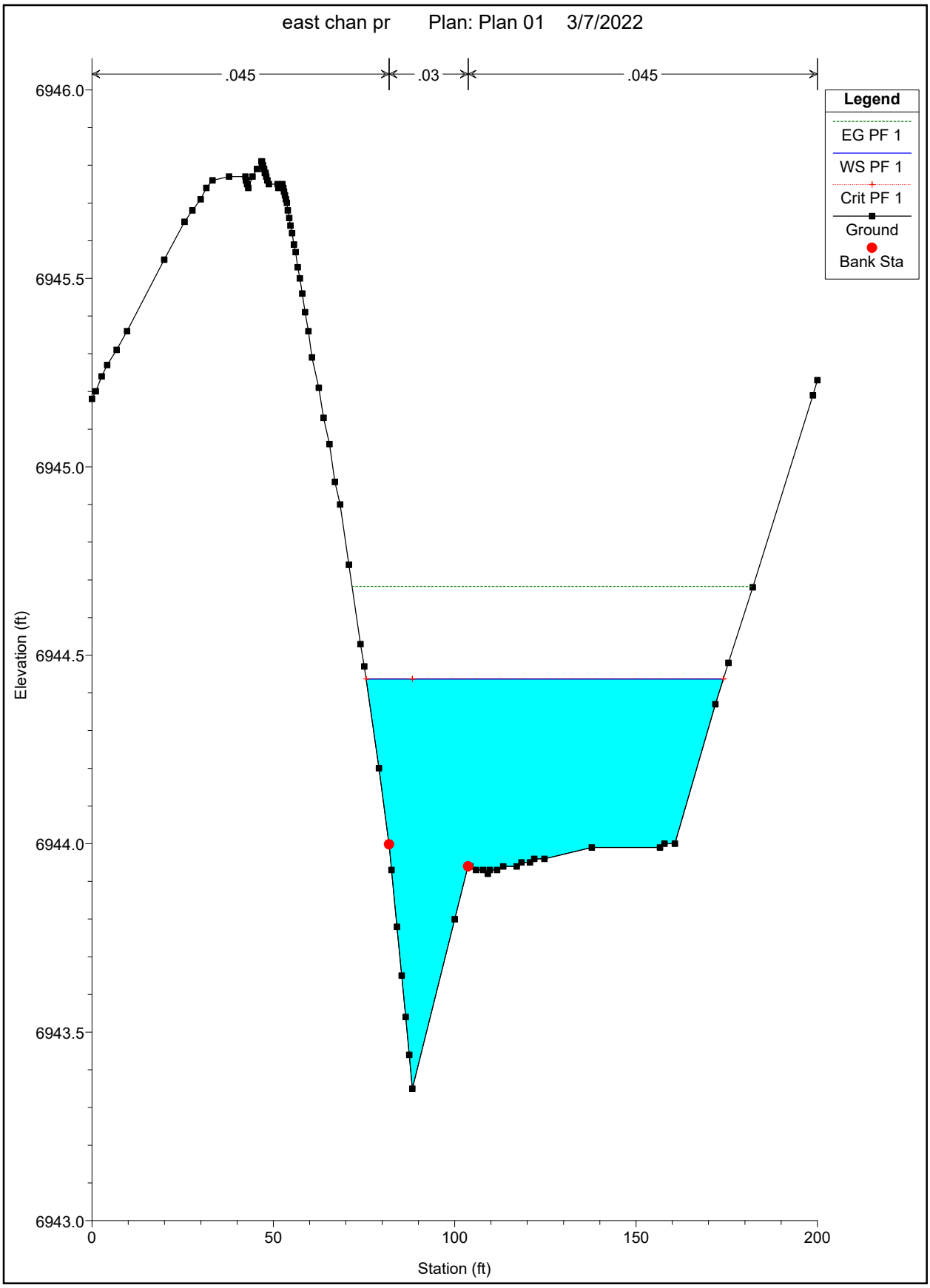
Plan: Plan 01 WEST PR chan-west-pr RS: 100 Profile: PF 1

E.G. Elev (ft)	6919.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.		0.030	
W.S. Elev (ft)	6918.84	Reach Len. (ft)			
Crit W.S. (ft)	6918.81	Flow Area (sq ft)		45.94	
E.G. Slope (ft/ft)	0.013007	Area (sq ft)		45.94	
Q Total (cfs)	213.00	Flow (cfs)		213.00	
Top Width (ft)	61.67	Top Width (ft)		61.67	
Vel Total (ft/s)	4.64	Avg. Vel. (ft/s)		4.64	
Max Chl Dpth (ft)	0.84	Hydr. Depth (ft)		0.74	
Conv. Total (cfs)	1867.6	Conv. (cfs)		1867.6	
Length Wtd. (ft)		Wetted Per. (ft)		61.77	
Min Ch El (ft)	6918.00	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		2.80	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

HEC-RAS Plan: 1 River: pr east Reach: chan-east Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
chan-east	2600	PF 1	151.00	6943.35	6944.44	6944.44	6944.68	0.013890	4.95	48.02	98.53	0.99
chan-east	2500	PF 1	151.00	6941.98	6942.70	6942.67	6942.92	0.013525	3.80	40.09	81.26	0.92
chan-east	2400	PF 1	151.00	6939.99	6941.15	6941.15	6941.46	0.015451	4.52	33.44	53.18	1.00
chan-east	2300	PF 1	151.00	6938.00	6939.10	6939.07	6939.35	0.013613	3.98	37.93	65.99	0.93
chan-east	2200	PF 1	151.00	6937.26	6938.16		6938.32	0.007658	3.29	48.99	94.76	0.71
chan-east	2100	PF 1	151.00	6935.98	6936.90	6936.90	6937.27	0.014805	4.90	30.80	41.81	1.01
chan-east	2010.89	PF 1	151.00	6934.00	6935.24	6935.24	6935.57	0.015841	4.65	32.47	50.32	1.02
chan-east	1900	PF 1	151.00	6932.00	6933.27		6933.41	0.005601	3.08	49.03	64.67	0.62
chan-east	1801.17	PF 1	151.00	6931.95	6932.32	6932.32	6932.46	0.020436	3.03	49.89	178.48	1.01
chan-east	1694.83	PF 1	151.00	6930.00	6930.68		6930.79	0.008061	2.63	57.35	125.77	0.69
chan-east	1600	PF 1	151.00	6928.61	6929.43	6929.43	6929.71	0.016551	4.25	35.51	65.13	1.02
chan-east	1500	PF 1	151.00	6924.50	6925.95	6925.95	6926.40	0.013890	5.37	28.14	31.77	1.01
chan-east	1400	PF 1	151.00	6922.61	6924.19	6924.19	6924.58	0.010327	5.12	32.60	52.79	0.89
chan-east	1300	PF 1	151.00	6921.96	6924.02		6924.06	0.000737	1.60	94.47	73.05	0.25
chan-east	1200	PF 1	151.00	6919.97	6924.04	6920.69	6924.04	0.000019	0.52	347.77	125.66	0.05
chan-east	1111.15		Culvert									
chan-east	1000	PF 1	151.00	6917.10	6918.32	6918.32	6918.77	0.012125	5.38	29.49	39.48	0.96
chan-east	900	PF 1	151.00	6915.94	6918.21		6918.27	0.000741	1.96	77.46	48.70	0.26
chan-east	800	PF 1	151.00	6913.99	6918.22		6918.24	0.000098	1.11	170.28	80.01	0.11
chan-east	700	PF 1	151.00	6913.94	6918.22		6918.23	0.000038	0.72	268.56	167.89	0.07
chan-east	600	PF 1	151.00	6917.00	6917.95	6917.95	6918.19	0.016742	3.95	38.22	80.42	1.00
chan-east	500	PF 1	151.00	6909.99	6912.09		6912.39	0.005142	4.36	34.70	26.53	0.65
chan-east	400	PF 1	151.00	6909.92	6911.08	6911.08	6911.58	0.013780	5.64	26.76	27.67	1.01
chan-east	300	PF 1	151.00	6907.98	6909.39	6909.39	6909.86	0.013560	5.51	27.40	29.10	1.00
chan-east	200	PF 1	151.00	6905.98	6907.55	6907.55	6908.10	0.013390	5.97	25.29	23.44	1.01
chan-east	100	PF 1	151.00	6904.03	6905.75	6905.75	6906.27	0.013509	5.76	26.23	25.97	1.01

verify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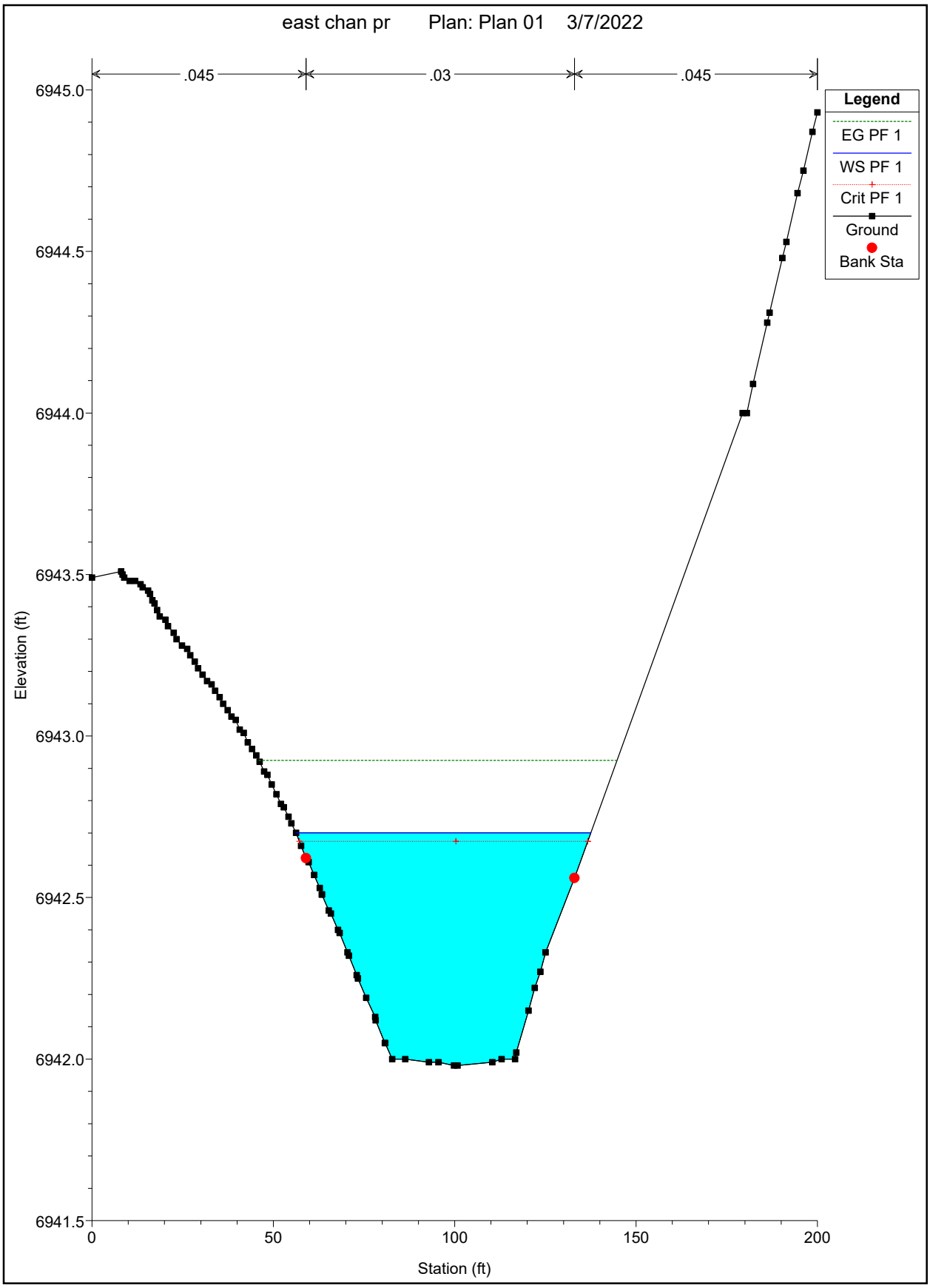
Station (ft)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Bank Sta
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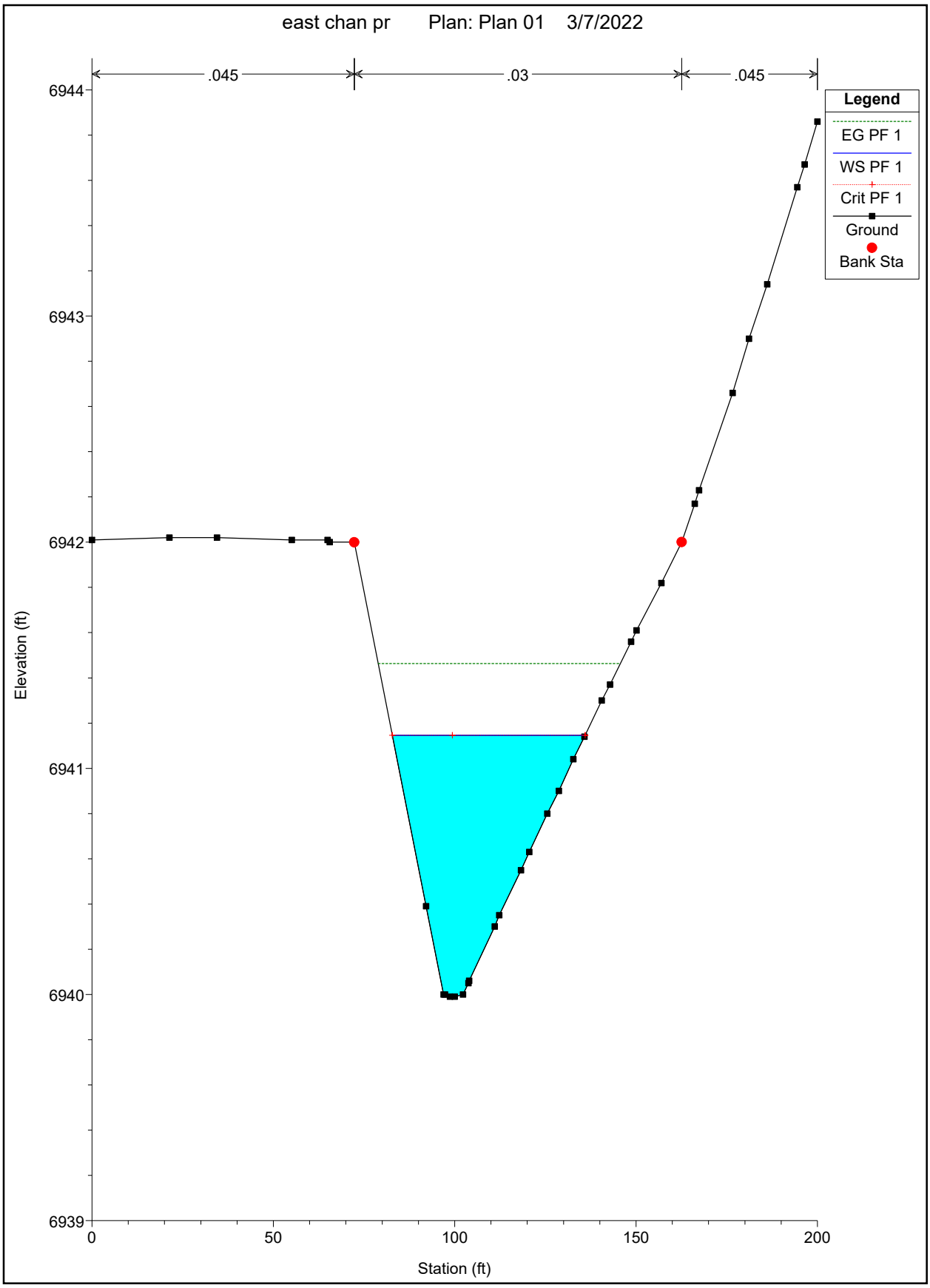
100
150
200
Station (ft)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Crit PF 1
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6939
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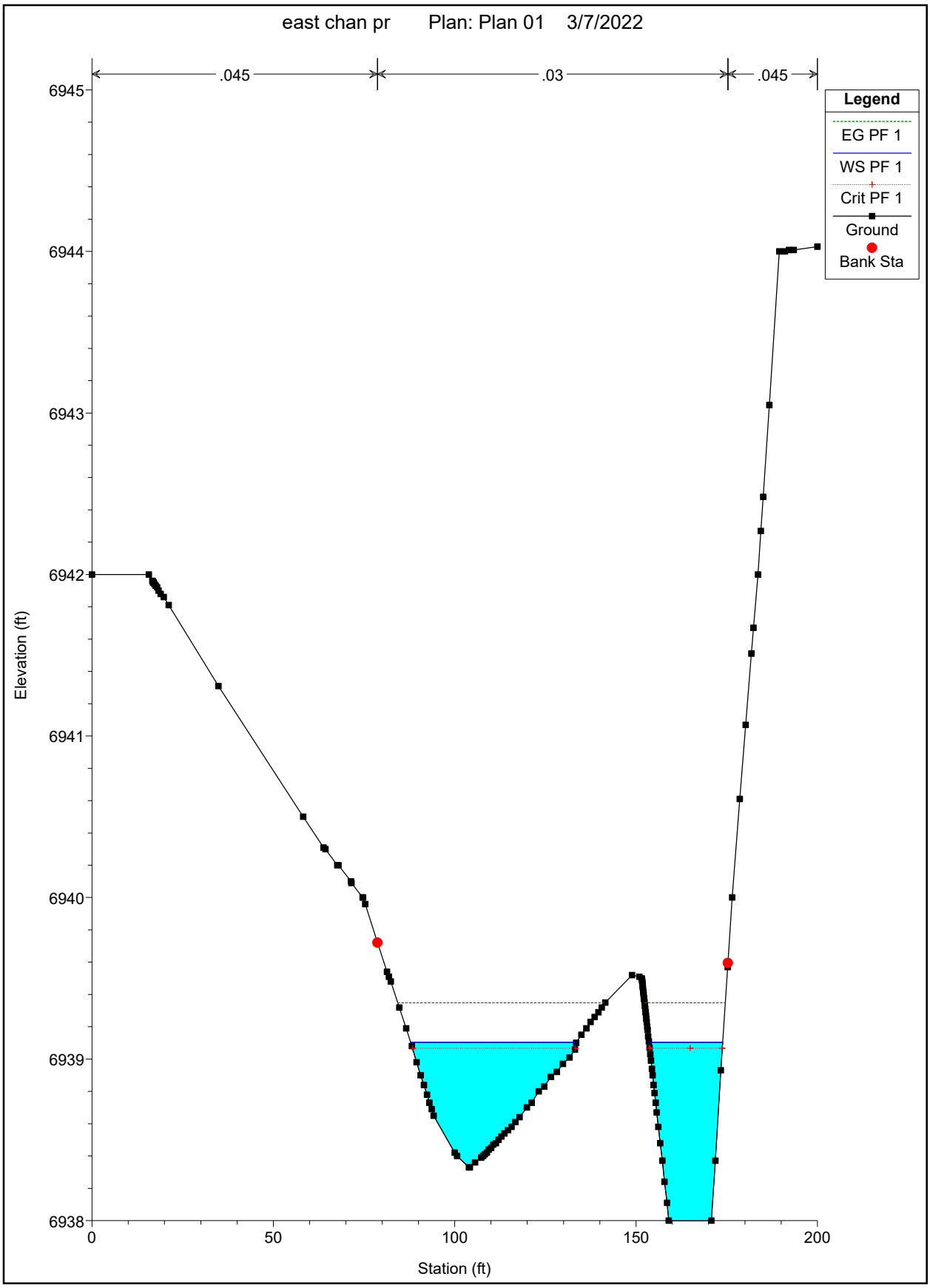
100
150
200
Station (ft)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Crit PF 1
Ground
Bank Sta
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6943
6942
6941
6940
6939
6938
0
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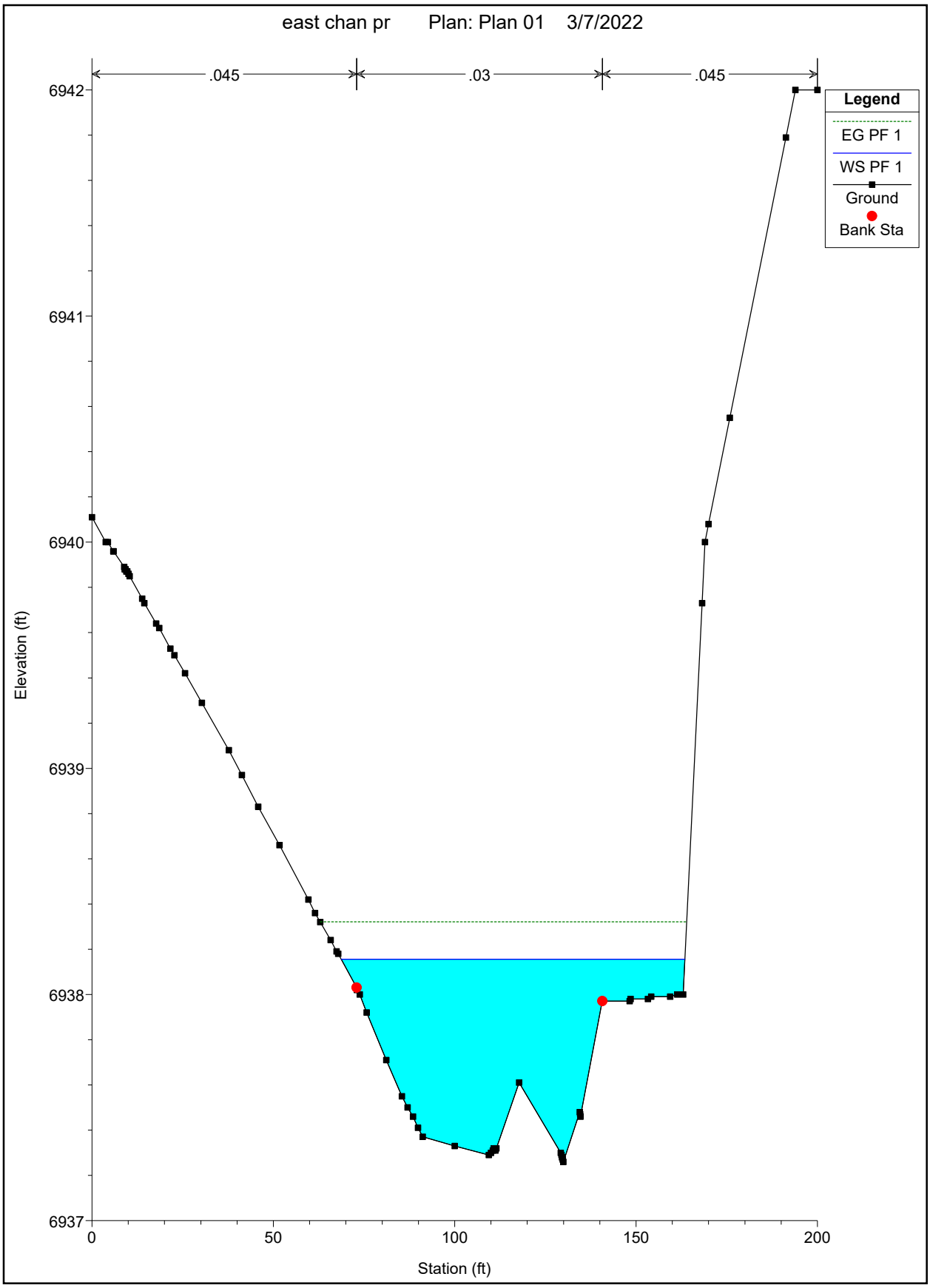
100
150
200
Station (ft)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Elevation (ft)
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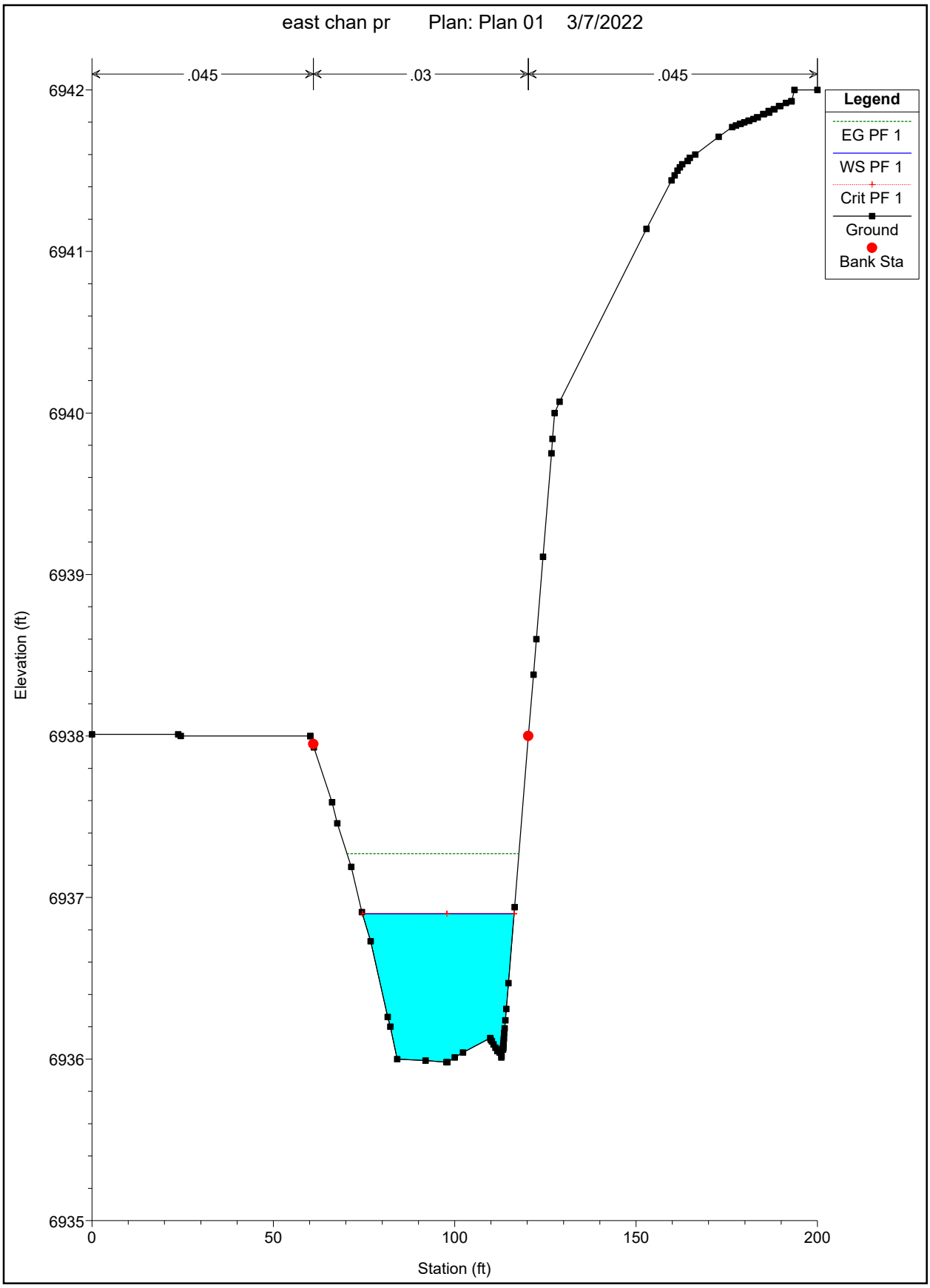
150
200
Station (ft)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Bank Sta
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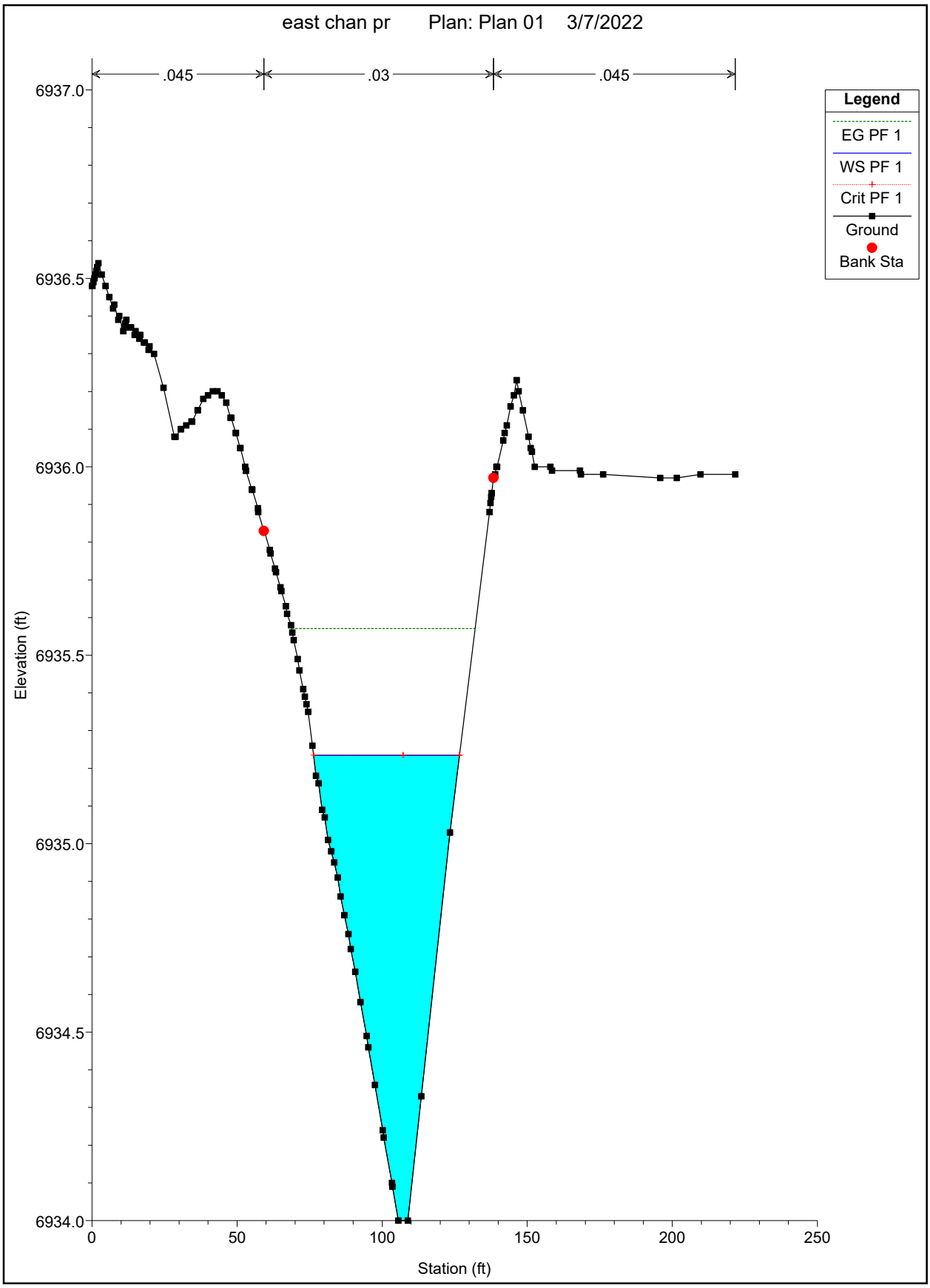
100
150
200
Station (ft)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Bank Sta
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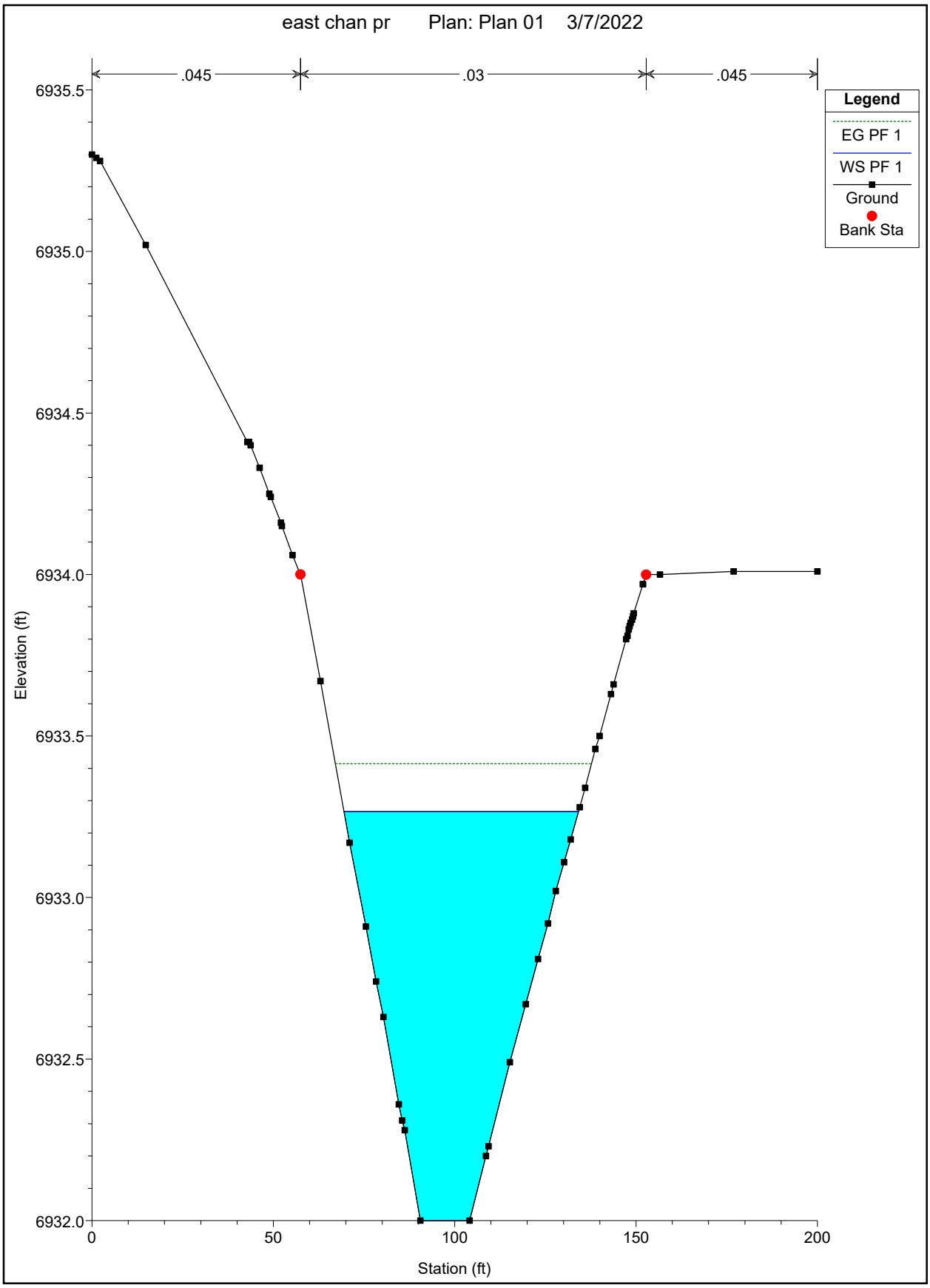
0
50
100
150
200
250
Station (ft)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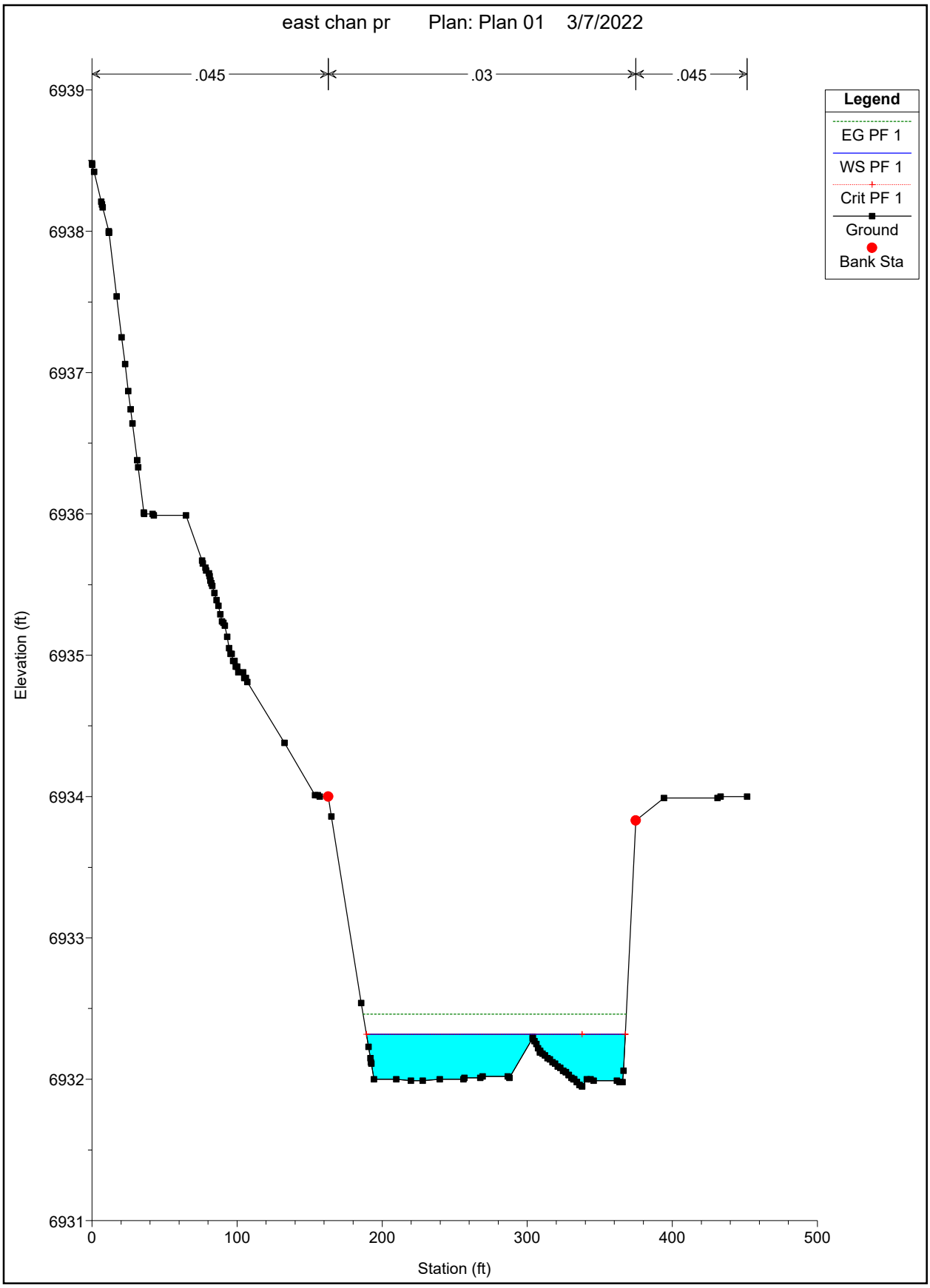
Station (ft)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Bank Sta
Elevation (ft)
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6933
6932
6931
0
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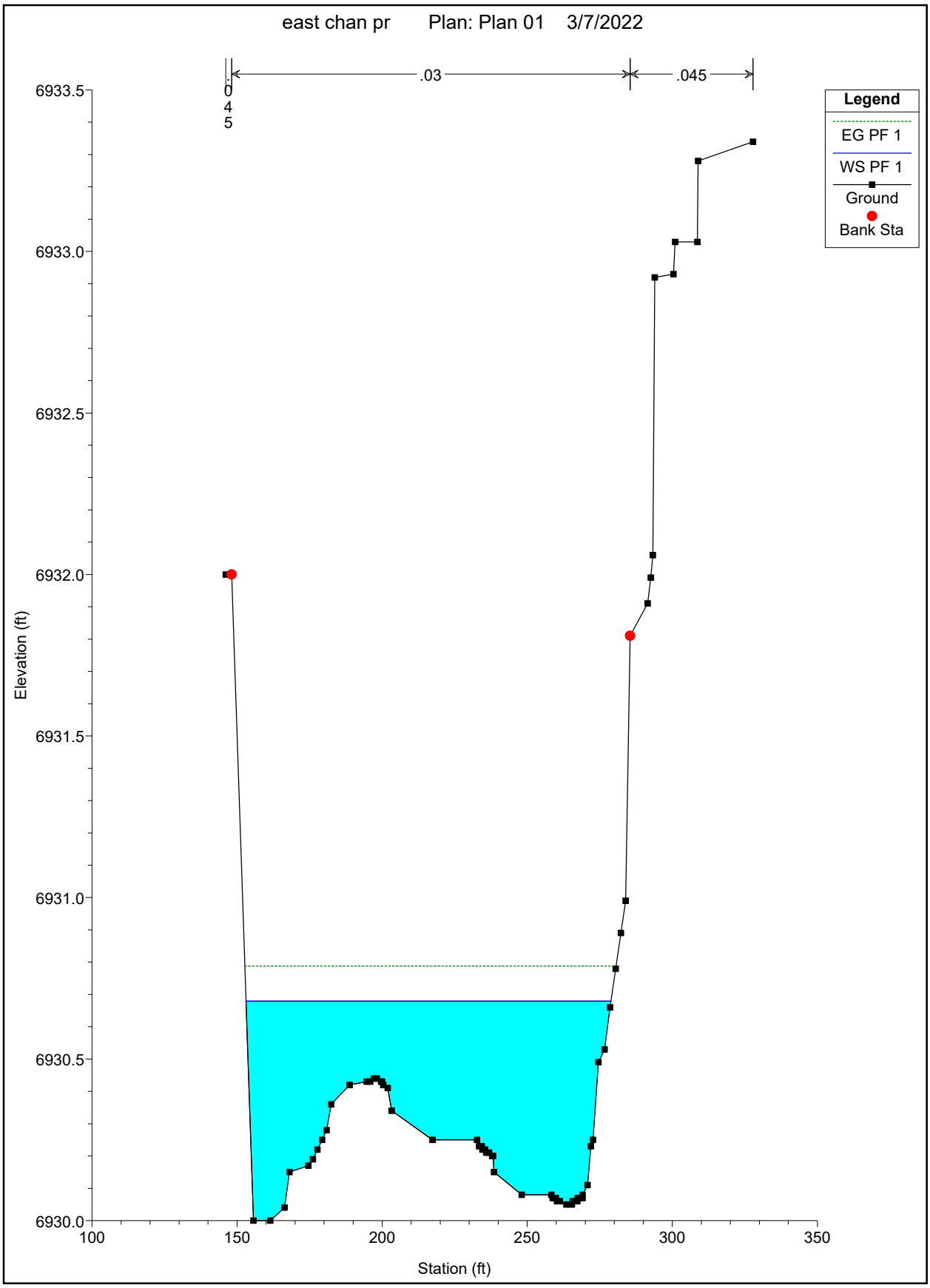
200
300
400
500
Station (ft)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WS PF 1
Ground
Bank Sta
Elevation (ft)
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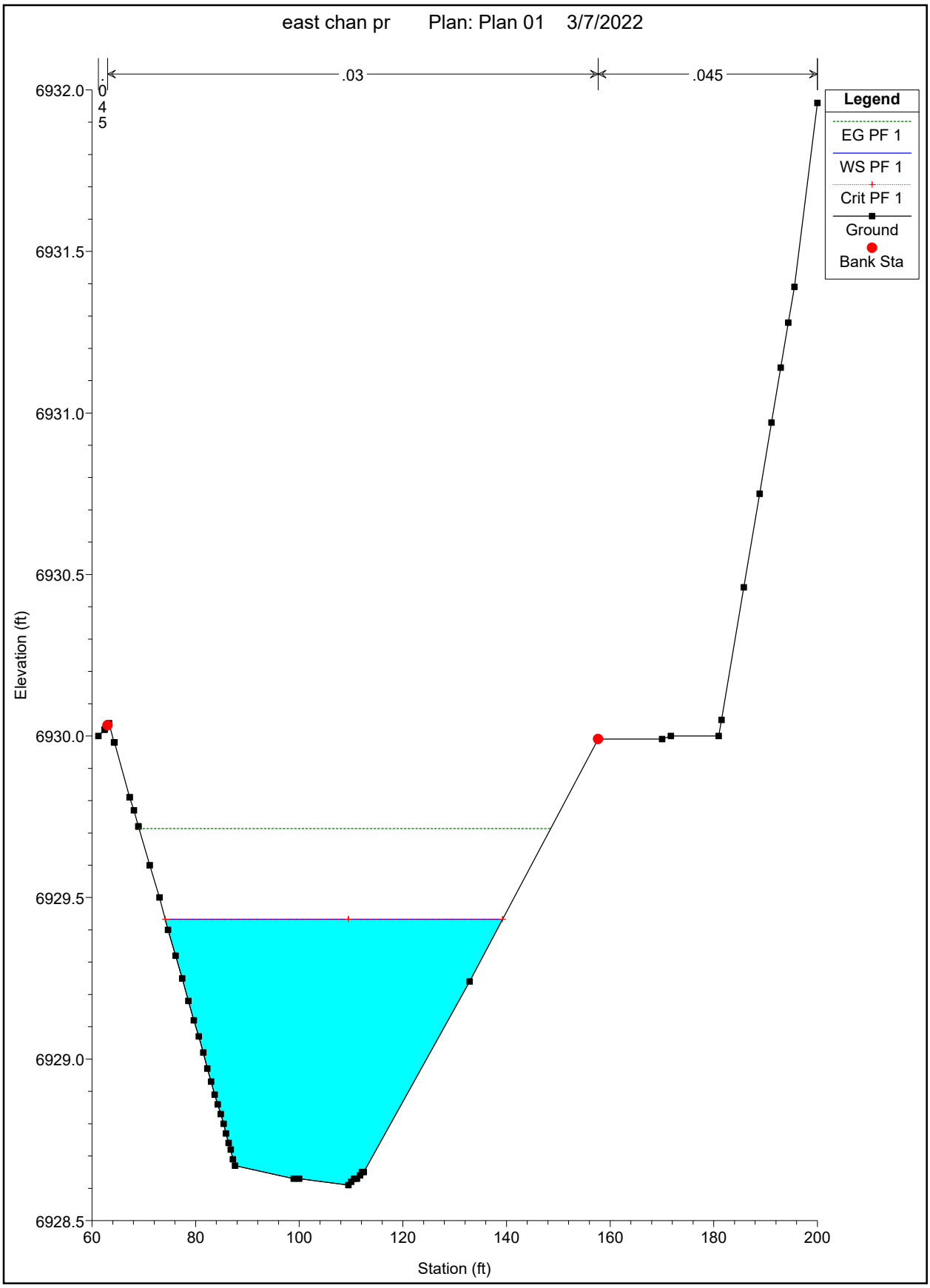
300
350
Station (ft)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WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
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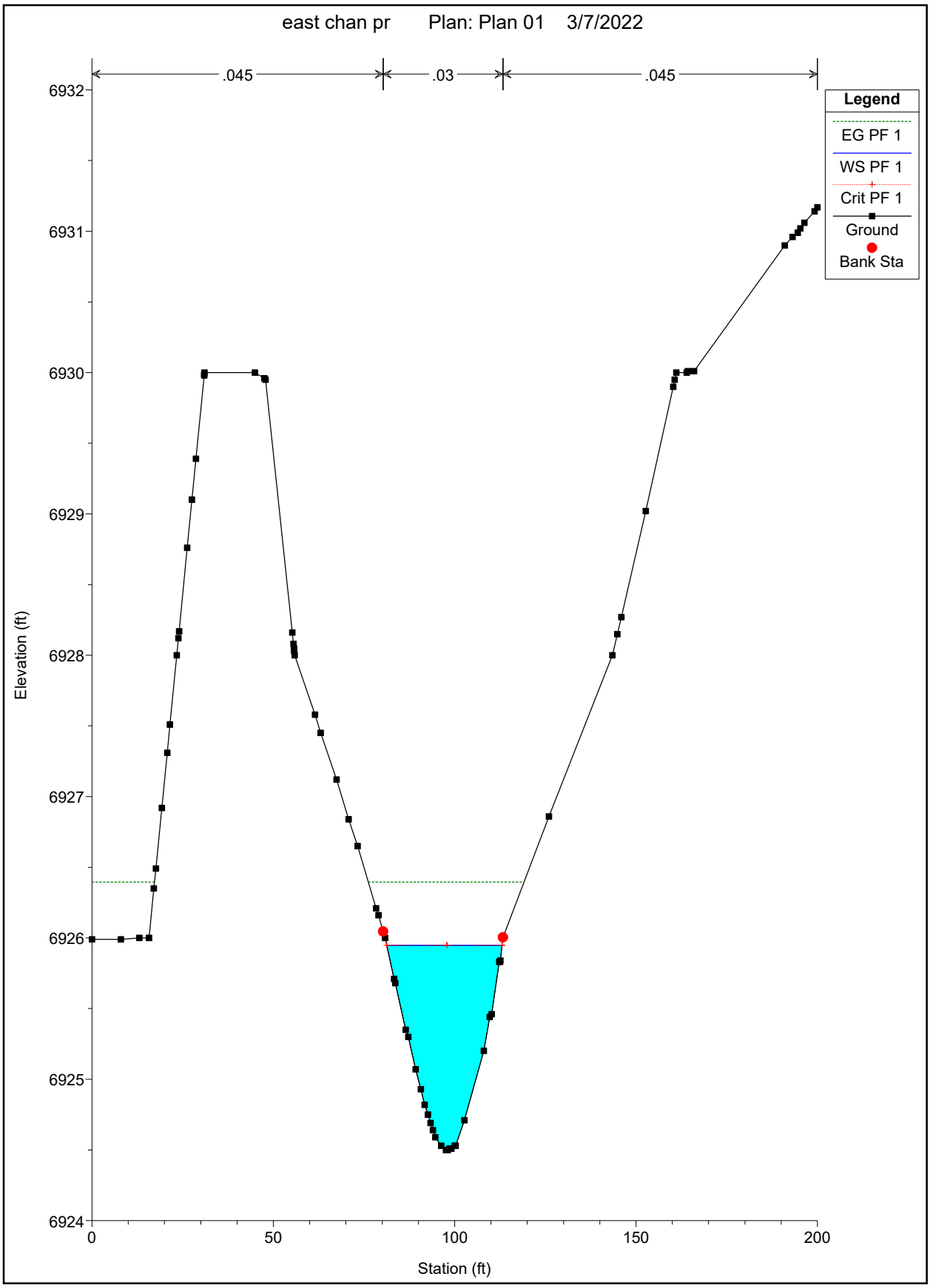
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Bank Sta
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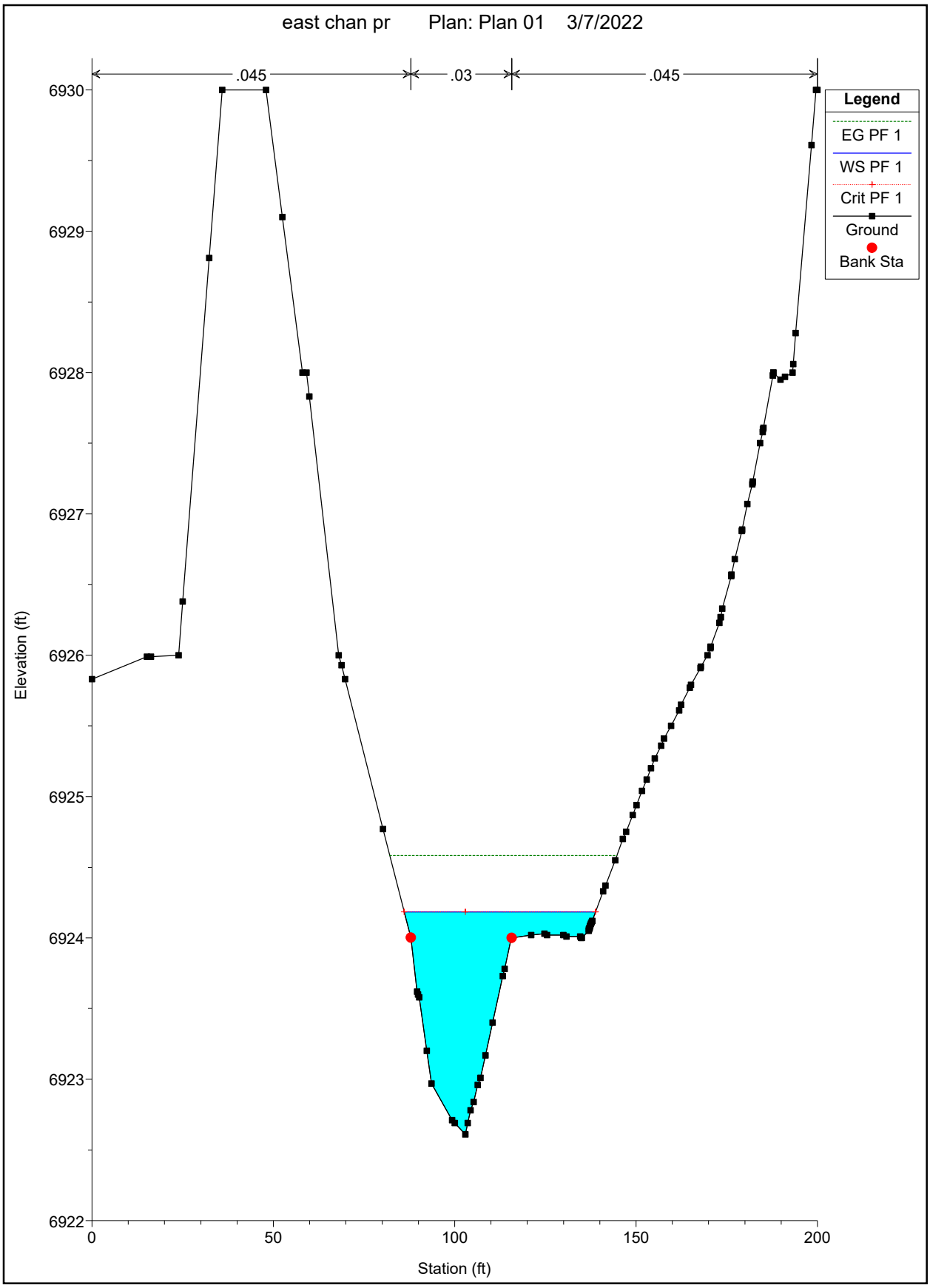
0
50
100
150
200
Station (ft)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EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6930
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6925
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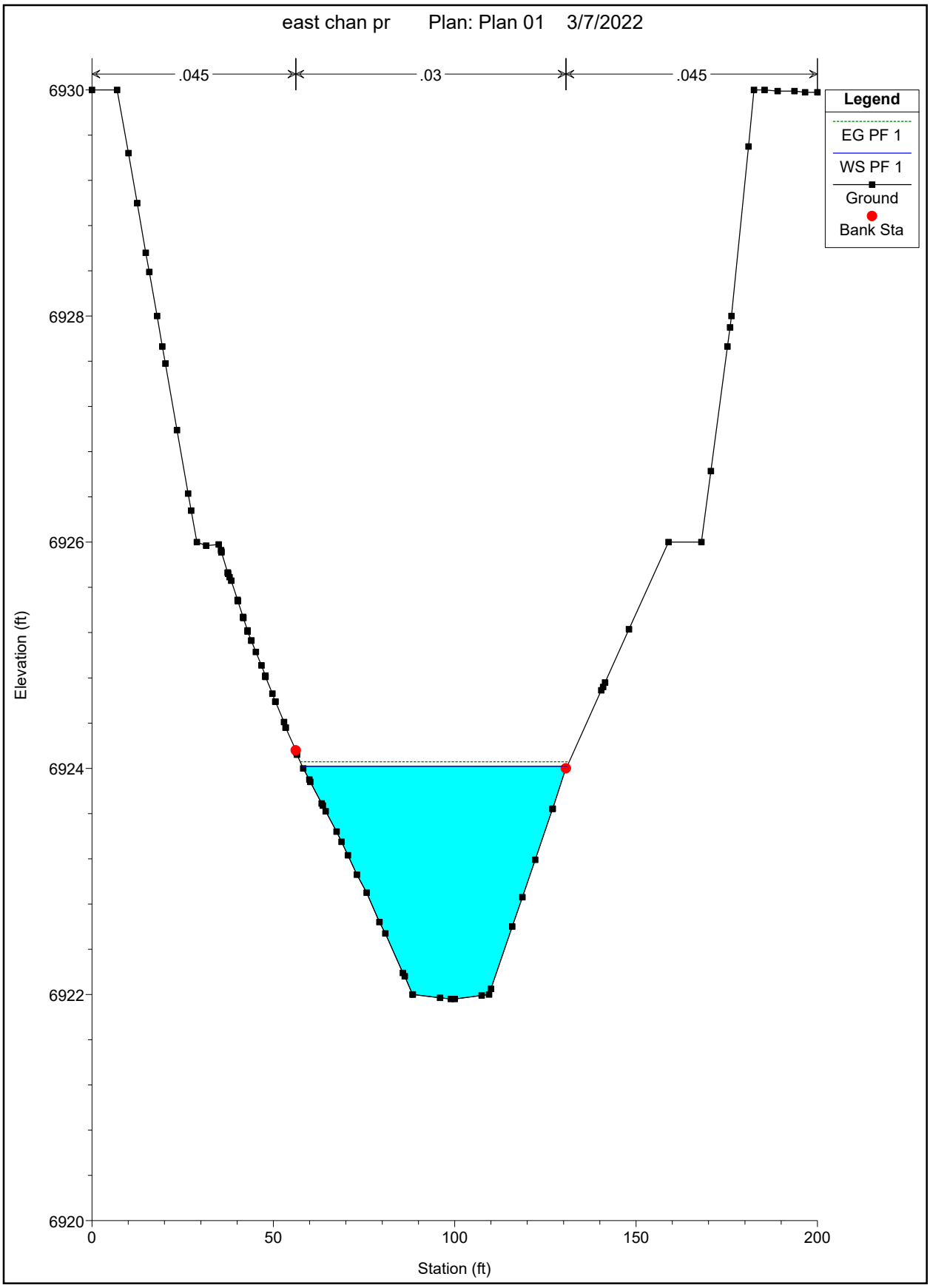
6922
0
50
100
150
200
Station (ft)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.045
.03
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Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
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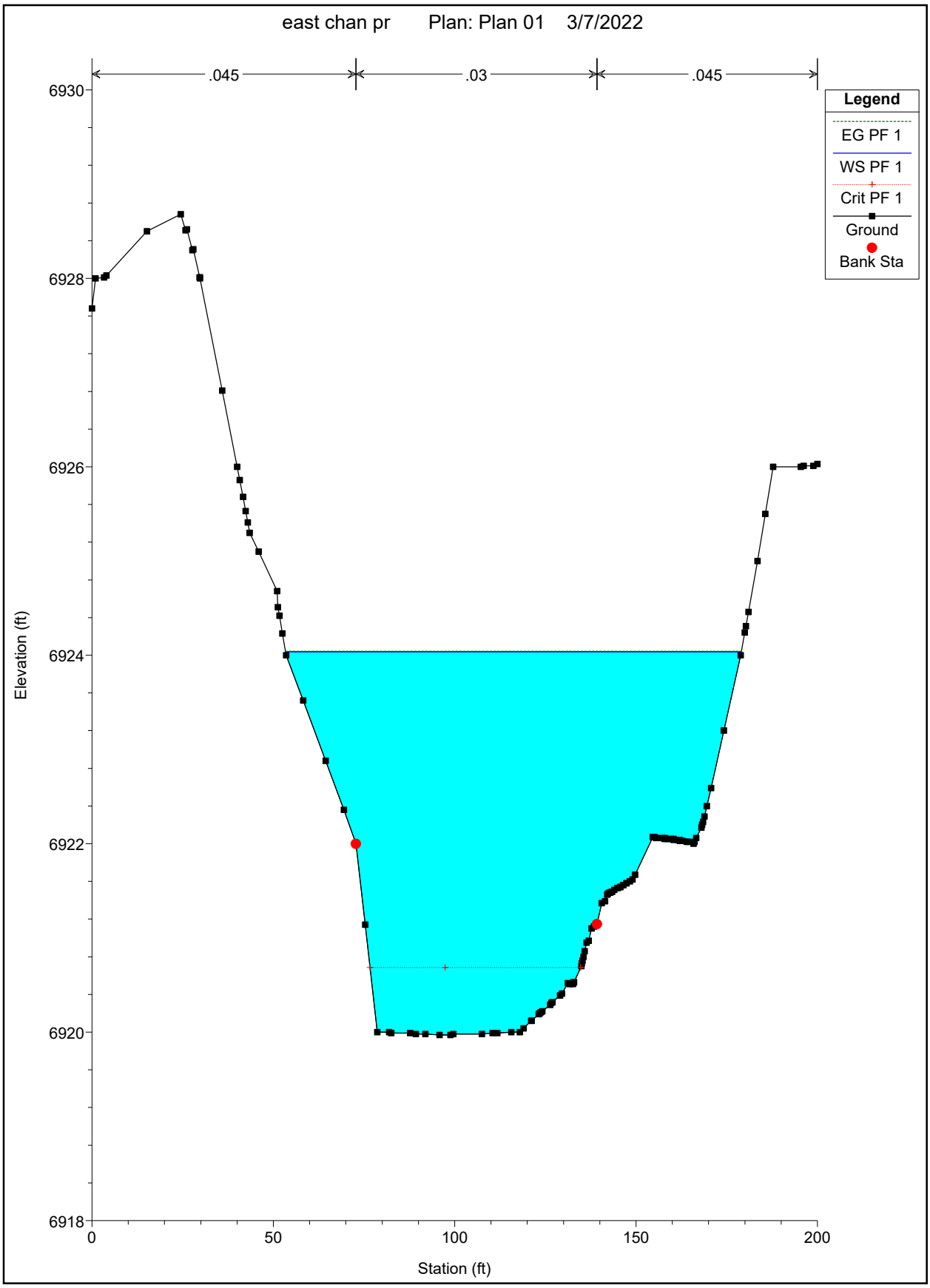
6928
6926
6924
6922
6920
0
50
100
150
200
Station (ft)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.045
.03
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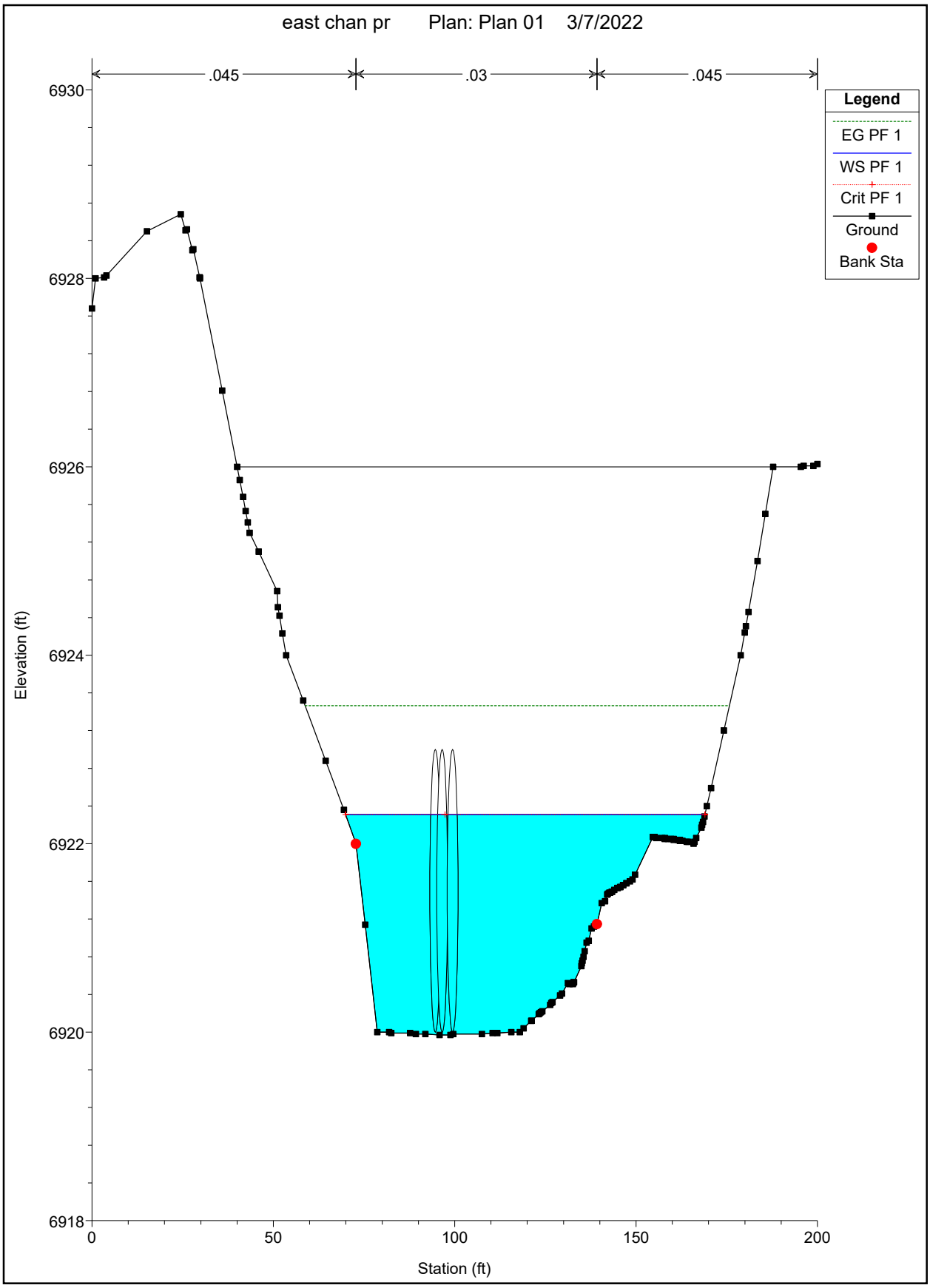
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6930
6928
6926
6924
6922
6920
6918
0
50
100
150
200
Station (ft)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.045
.03
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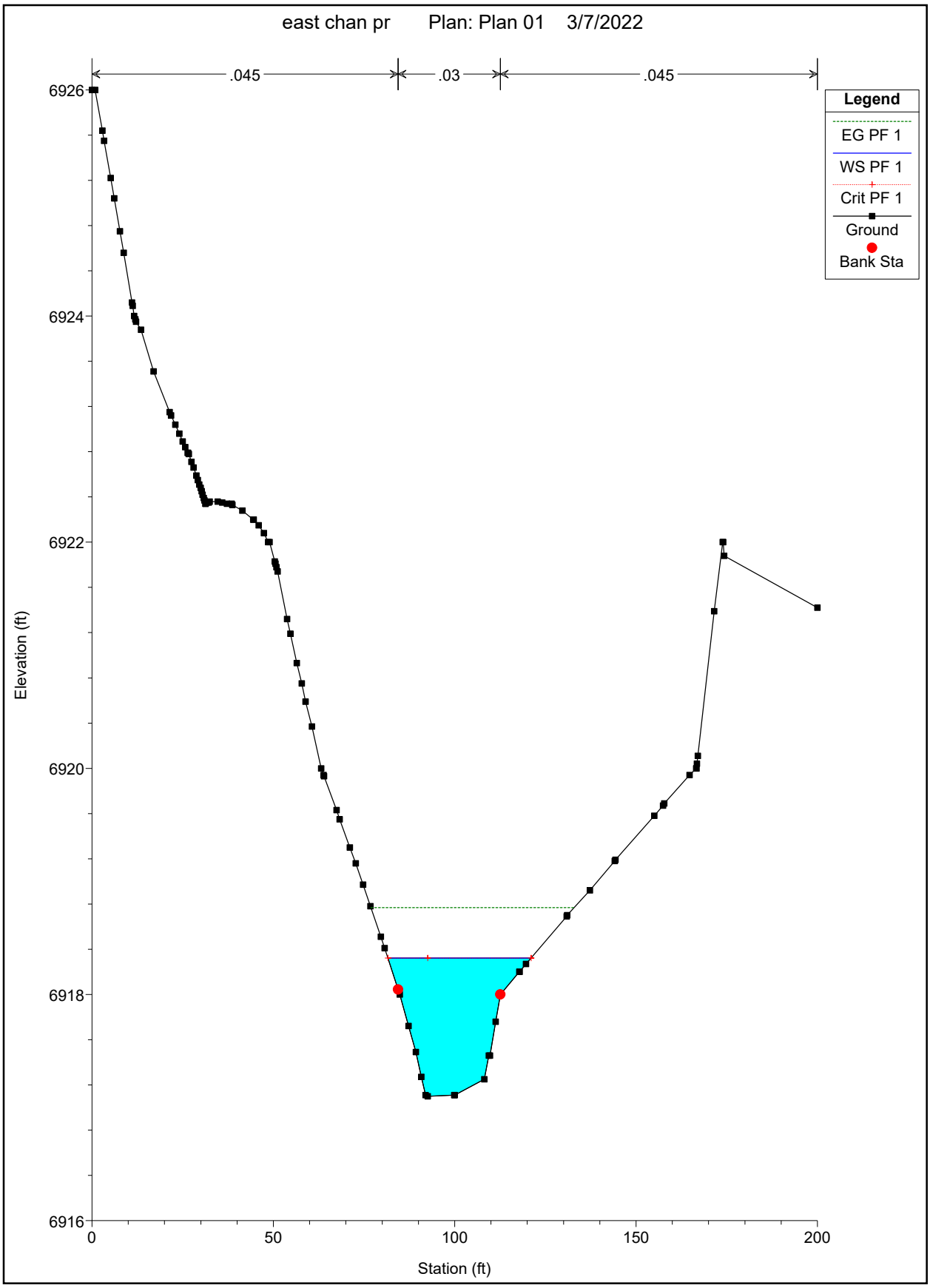
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6930
6928
6926
6924
6922
6920
6918
0
50
100
150
200
Station (ft)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.045
.03
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Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6926
6924
6922
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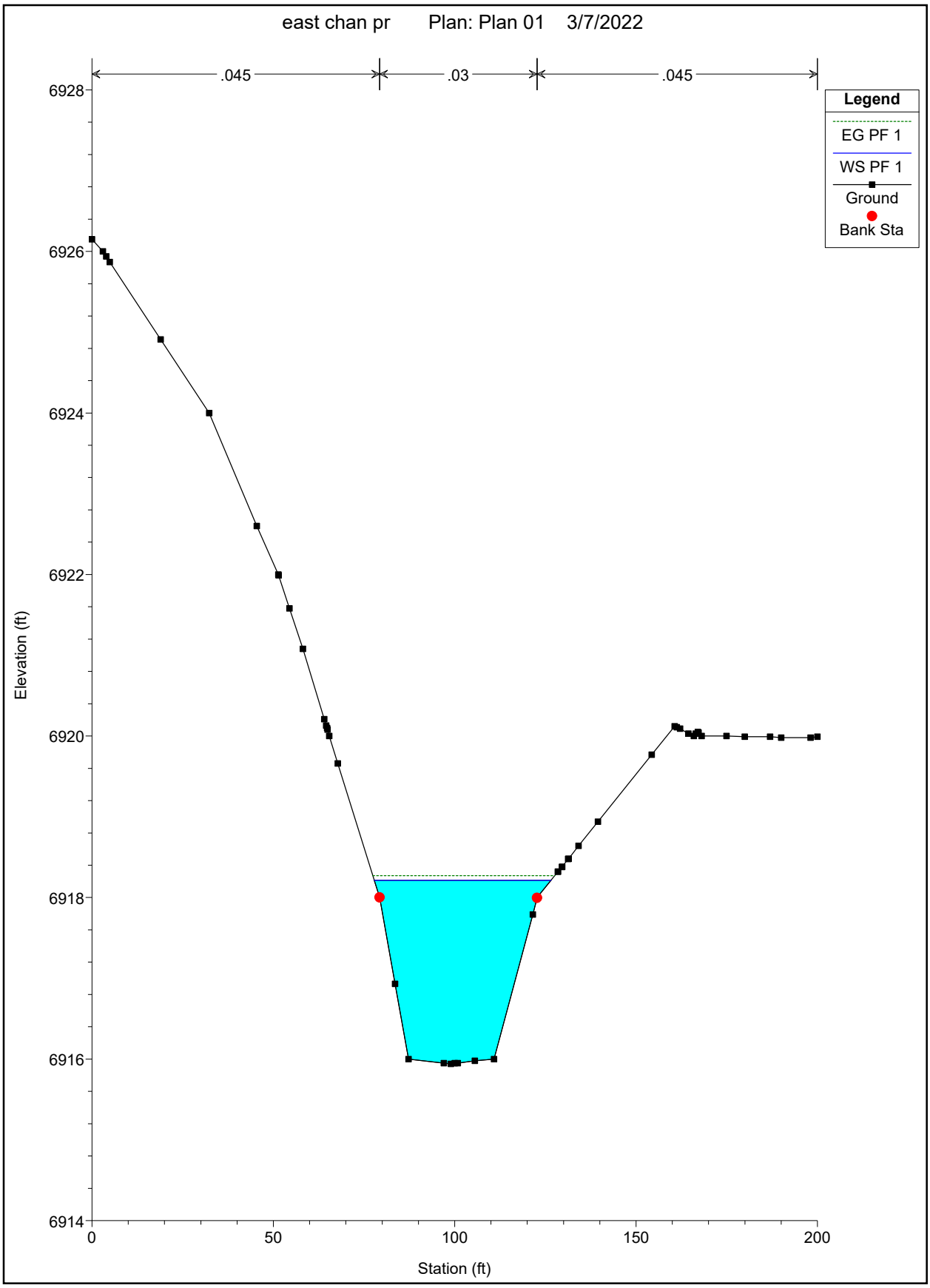
6918
6916
0
50
100
150
200
Station (ft)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.03
.045
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6928
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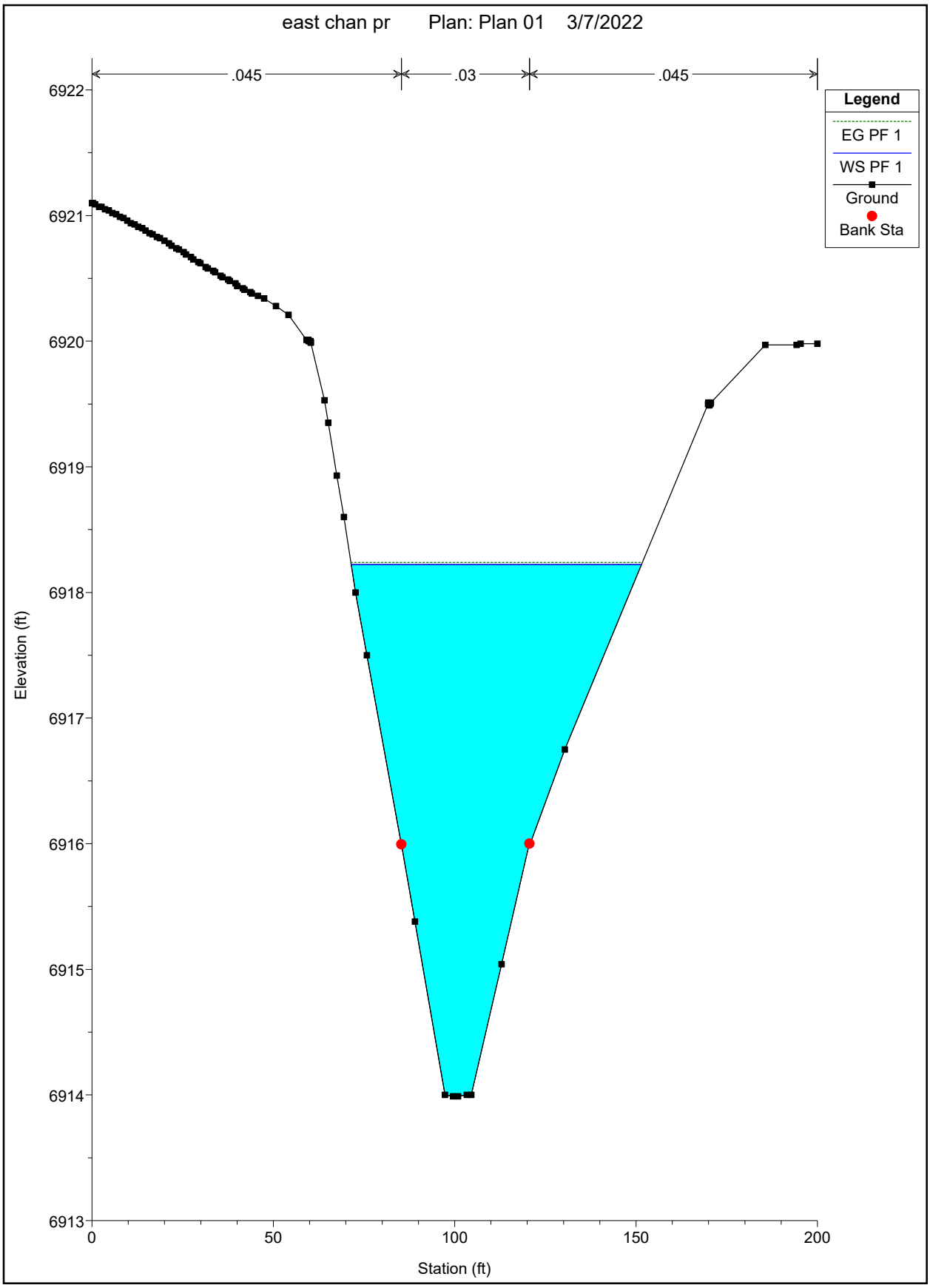
6922
6920
6918
6916
6914
Elevation (ft)
0
50
100
150
200
Station (ft)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.045
.03
.045
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
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6921
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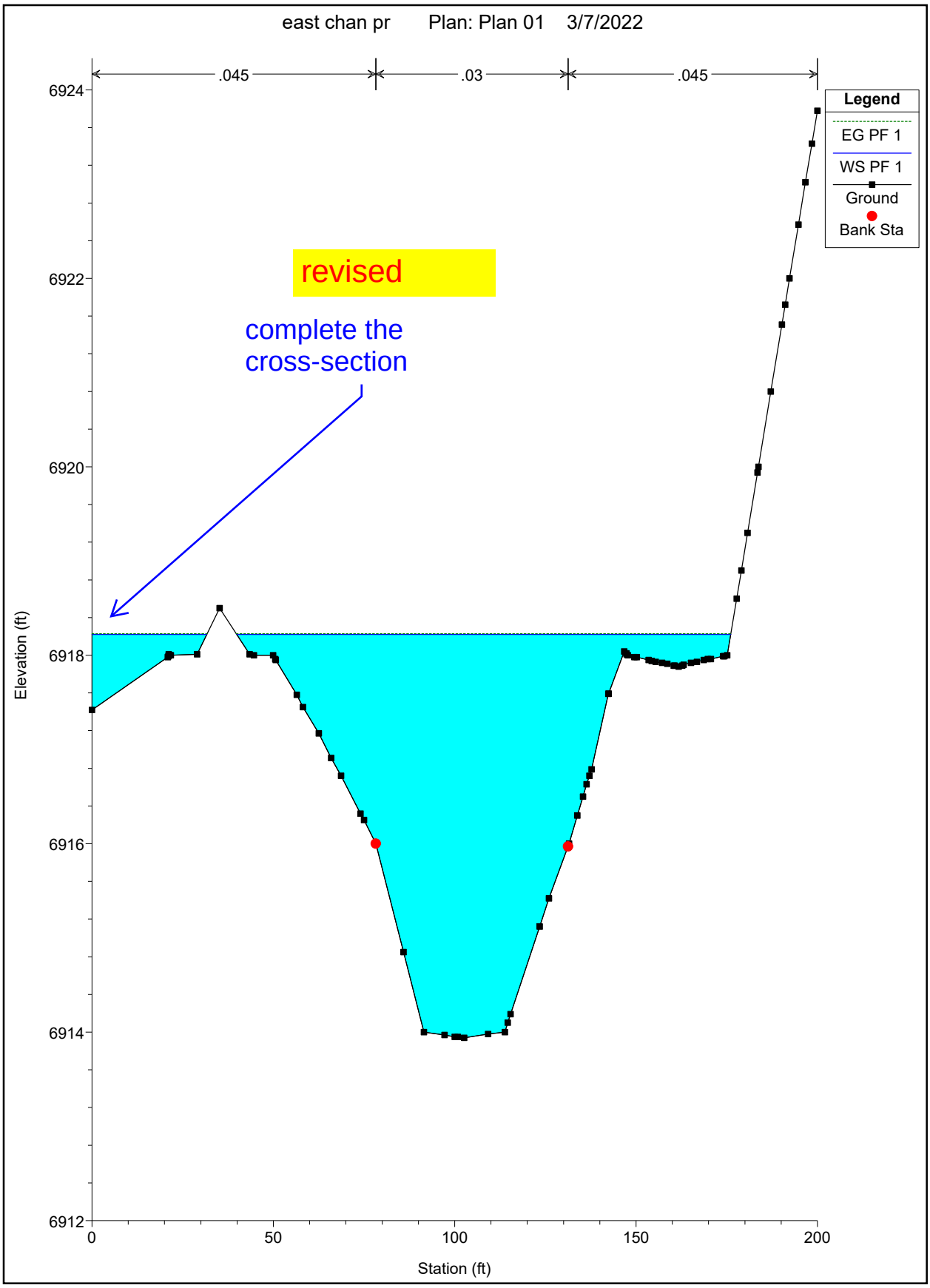
6918
6917
6916
6915
6914
6913
0
50
100
150
200
Station (ft)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.03
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Legend
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WS PF 1
Ground
Bank Sta
revised
complete the
cross-section
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6922
6920
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6916
6914
6912
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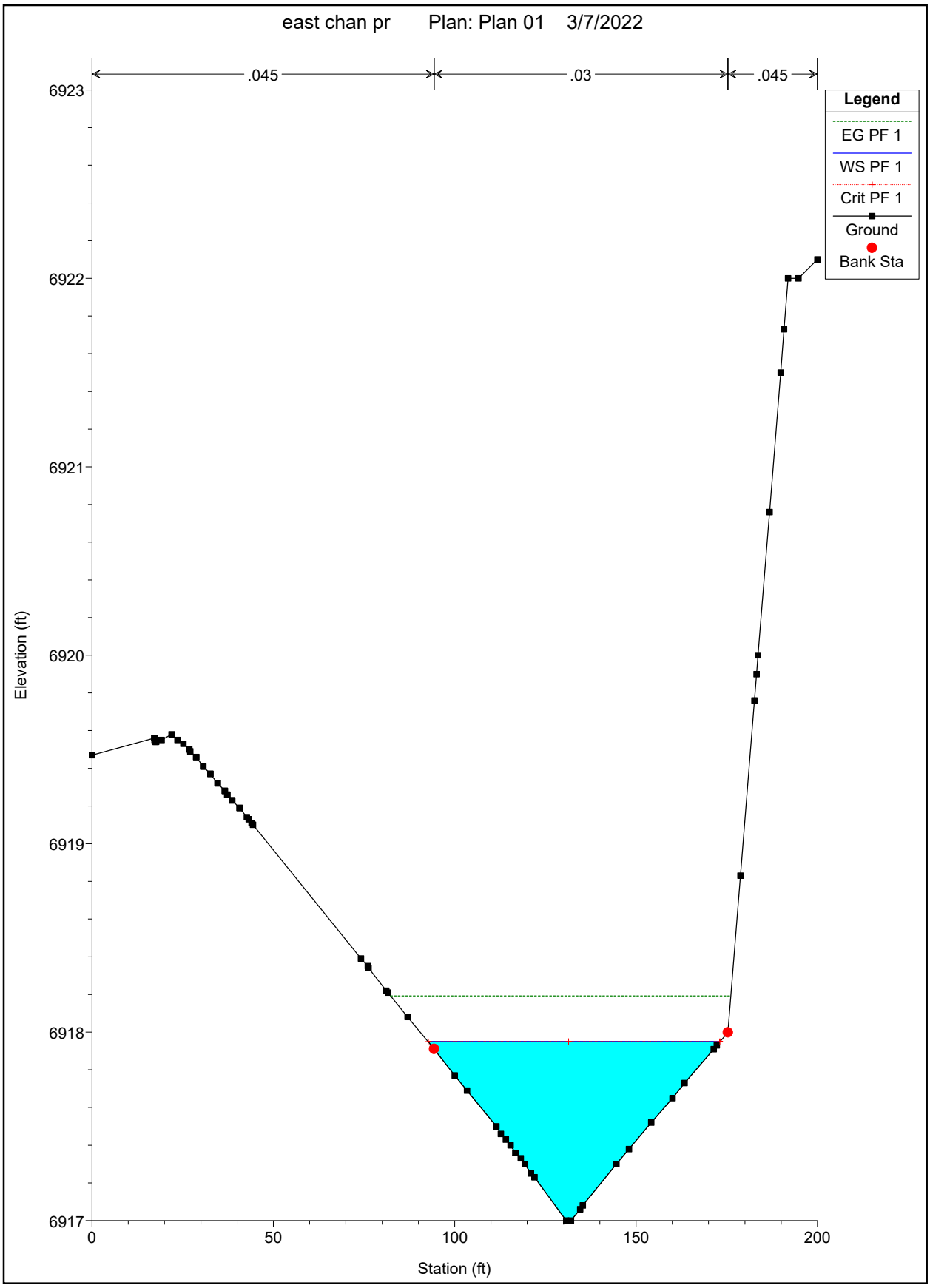
100
150
200
Station (ft)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Crit PF 1
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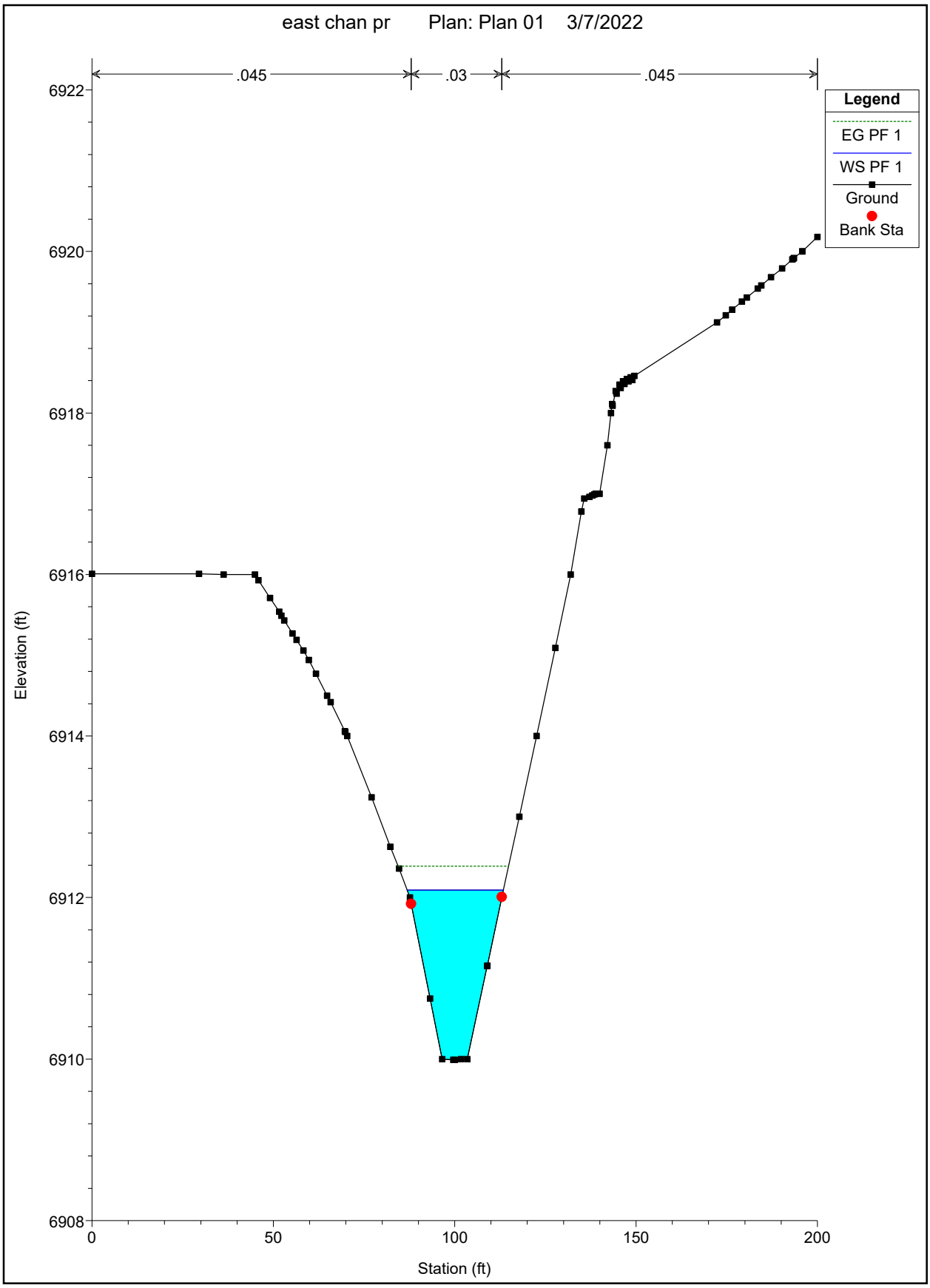
Elevation (ft)
6923
6922
6921
6920
6919
6918
6917
0
50
100
150
200
Station (ft)


east chan pr Plan: Plan 01 3/7/2022
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Legend
EG PF 1
WS PF 1
Ground
Bank Sta
6922
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Elevation (ft)
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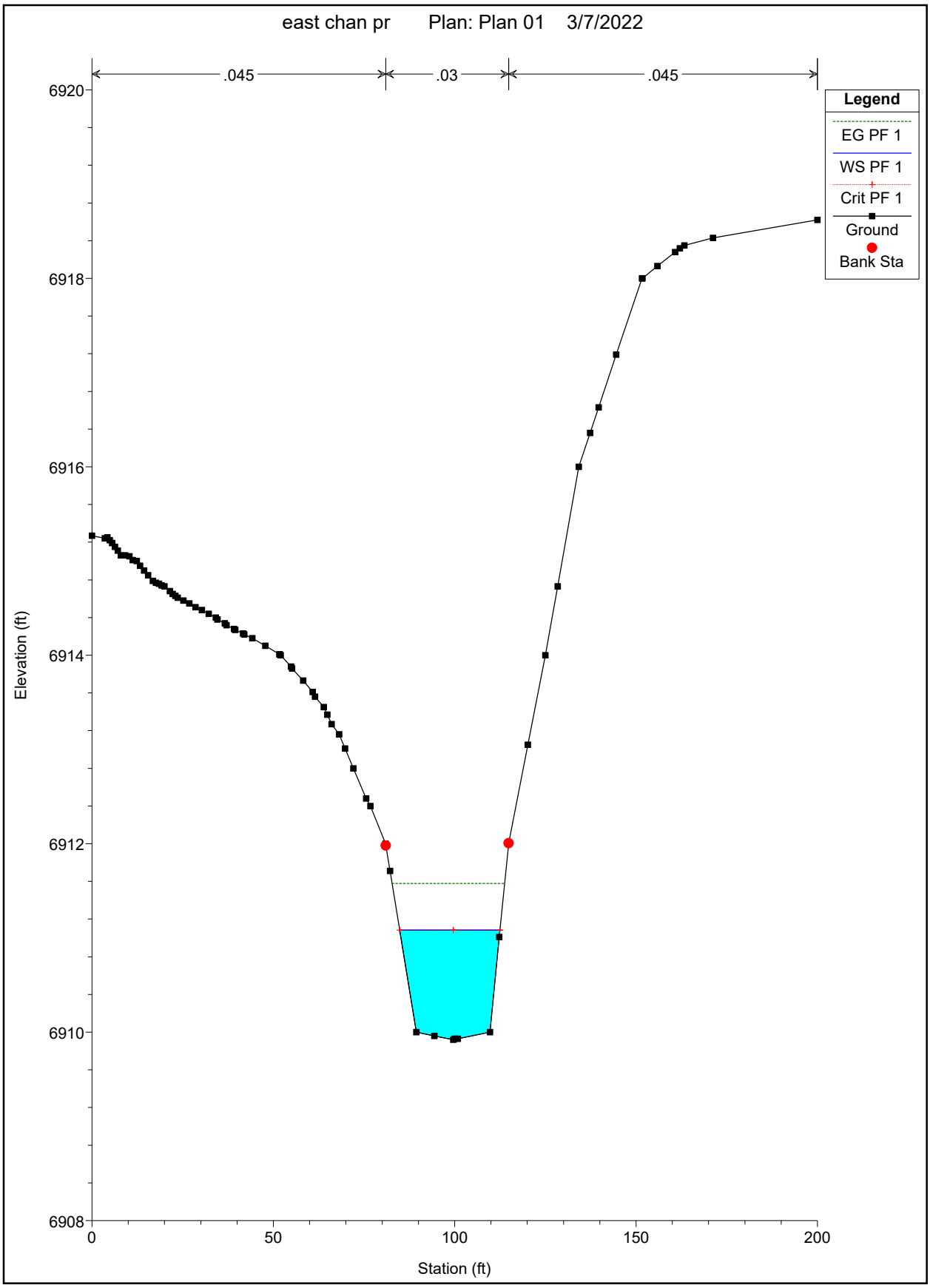
Station (ft)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Crit PF 1
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Elevation (ft)
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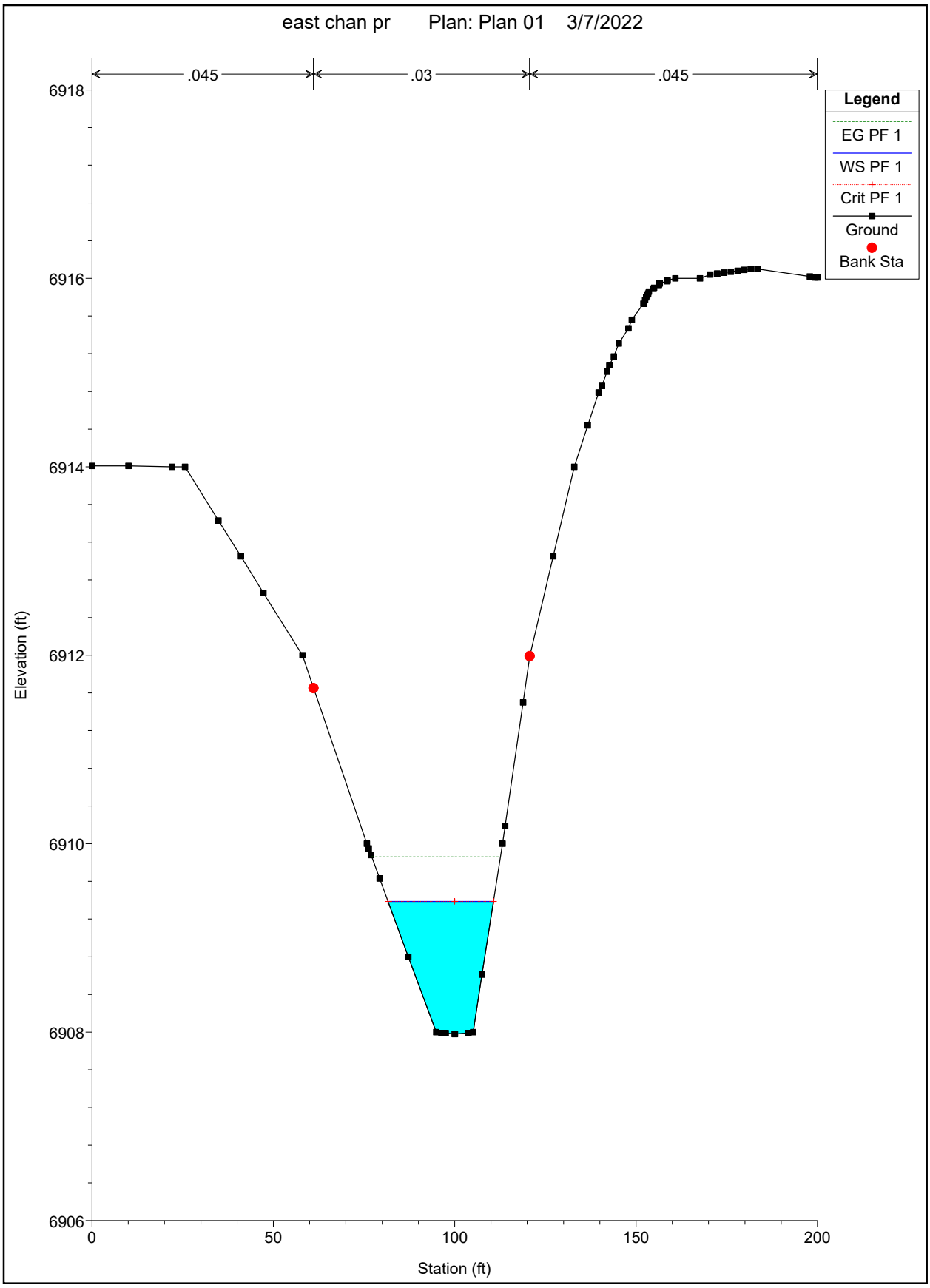
Station (ft)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EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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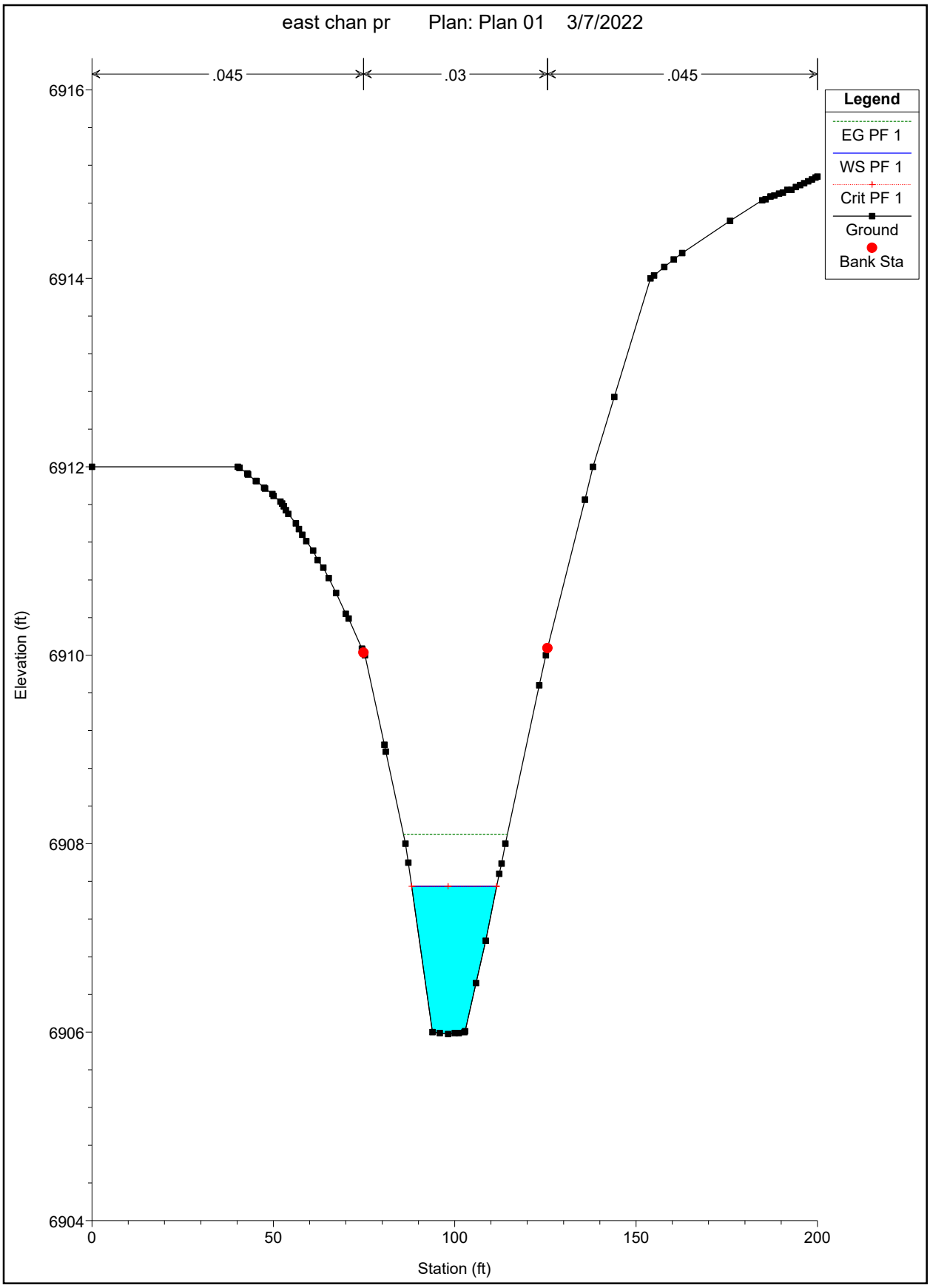
Station (ft)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EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
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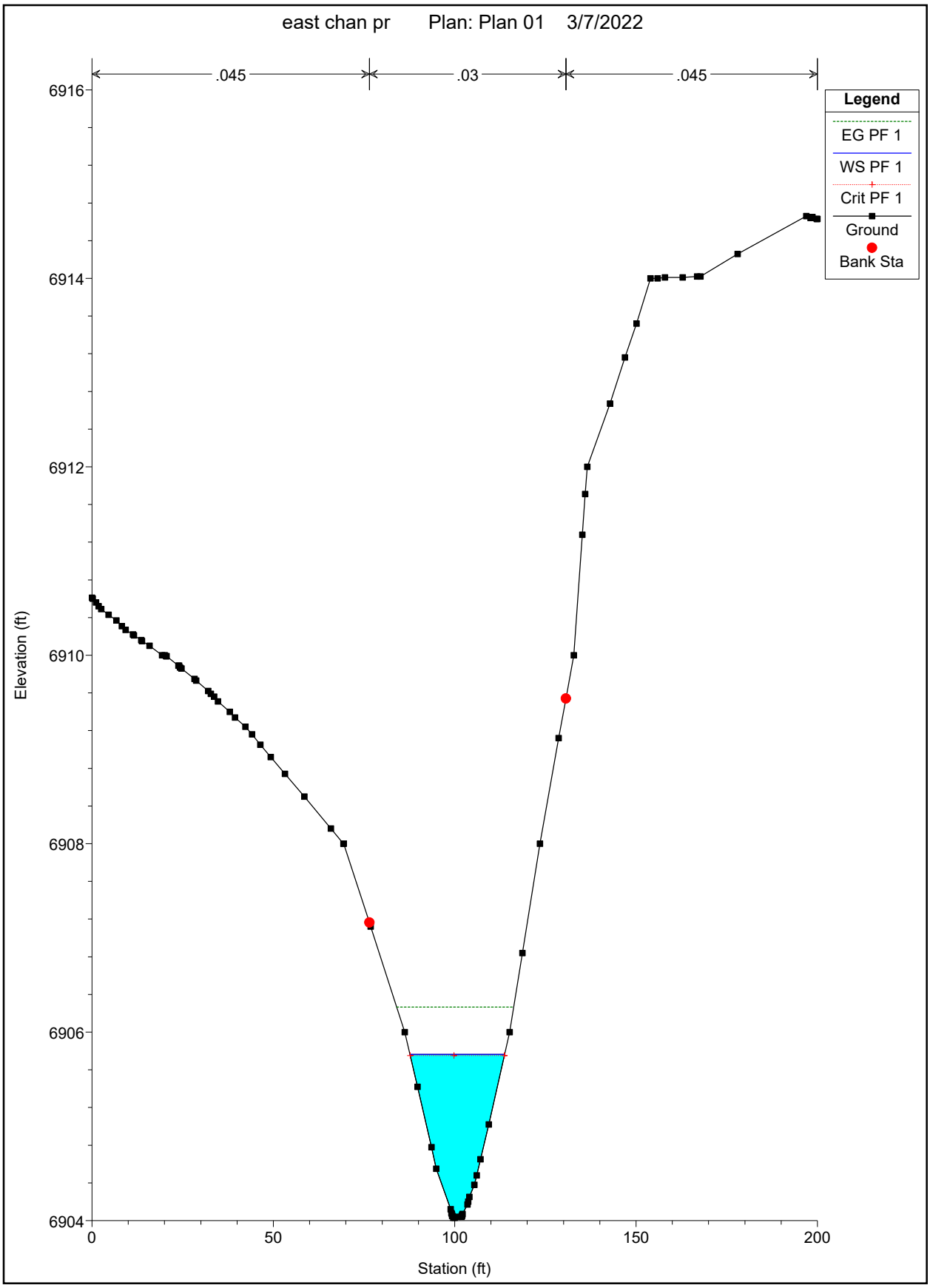
Station (ft)


east chan pr Plan: Plan 01 3/7/2022
.045
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Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
6916
6914
6912
6910
6908
6906
6904
0
50
100
150
200
Station (ft)

fixed

revised

Verify that cross-sections are correct

Adjust lot to be out of floodplain

revised

FIXED

NO

Are contours missing?

STAPLETON DRIVE (130' R.O.W.) PRINCIPAL ARTERIAL

SCALE: 1"=100'

REVISIONS		
NO.	DESCRIPTION	DATE

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WATERBURY FILING NO. 1 & 2

GRADING AND UTILITIES PLAN

DESIGNED BY DLF
DRAWN BY QNA
CHECKED BY QNA
H-SCALE 1" = 100'
V-SCALE N/A
JOB NO. 1715.00
DATE ISSUED 3/3/22
SHEET NO. 1 OF 1

DRAINAGE MAPS

MDDP DRAINAGE REPORT ~ EXISTING BASIN RUNOFF COEFFICIENT SUMMARY

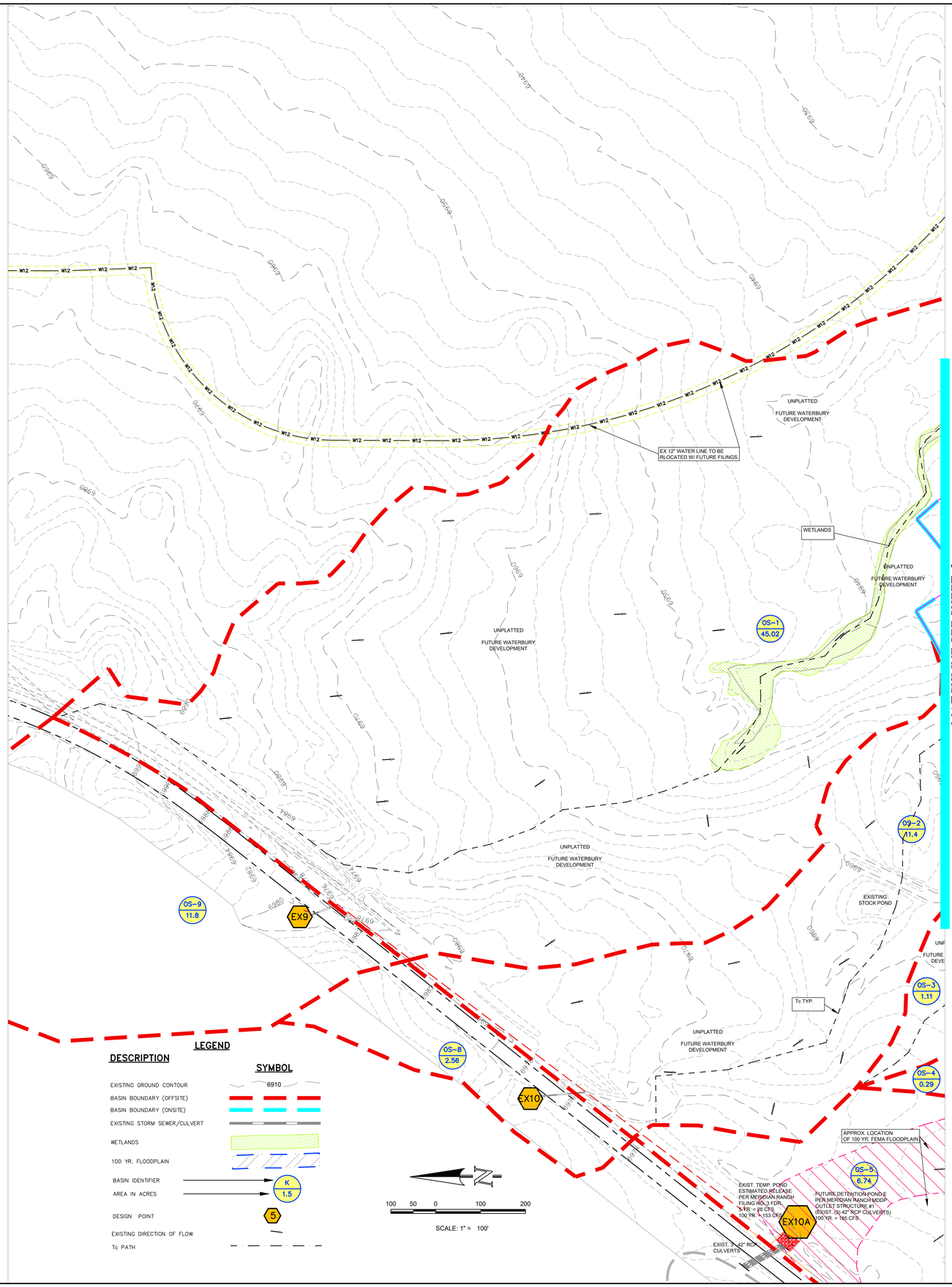
BASIN	TOTAL AREA (AC)	IMPERVIOUS / DEVELOPED AREA			NONIMPERVIOUS / UNDEVELOPED AREA			WEIGHTED		WEIGHTED CA	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	CA(5)	CA(100)
EXA	9.62	0.00	0.45	0.59	9.62	0.09	0.36	0.09	0.36	**0.87**	**3.46**
EXB	4.09	0.00	0.45	0.59	4.09	0.09	0.36	0.09	0.36	**0.37**	**1.47**
EXC	24.80	0.00	0.45	0.59	24.80	0.09	0.36	0.09	0.36	**2.23**	**8.93**
EXD	15.87	0.00	0.45	0.59	15.87	0.09	0.36	0.09	0.36	**1.43**	**5.71**
EXE	5.83	0.00	0.45	0.59	5.83	0.09	0.36	0.09	0.36	**0.52**	**2.10**
EXF	1.62	0.00	0.45	0.59	1.62	0.09	0.36	0.09	0.36	**0.15**	**0.58**
OS-1	45.02	0.00	0.45	0.59	45.02	0.09	0.36	0.09	0.36	**4.05**	**16.21**
OS-2	11.40	0.00	0.45	0.59	11.40	0.09	0.36	0.09	0.36	**1.03**	**4.11**
OS-3	1.11	0.00	0.45	0.59	1.11	0.09	0.36	0.09	0.36	**0.10**	**0.40**
OS-4	0.29	0.00	0.45	0.59	0.29	0.09	0.36	0.09	0.36	**0.03**	**0.11**
OS-5	6.74	0.00	0.45	0.59	6.74	0.09	0.36	0.09	0.36	**0.61**	**2.43**
OS-8	2.56	FLOW TAKEN FROM MERIDAIN RANCH MDDP									
OS-9	11.80	FLOW TAKEN FROM MERIDAIN RANCH MDDP									
OS-10A	12.80	FLOW TAKEN FROM MERIDAIN RANCH MDDP									

MDDP ~ EXISTING BASIN RUNOFF SUMMARY

BASIN	WEIGHTED		OVERLAND				STREET / CHANNEL FLOW				Tc	INTENSITY		TOTAL FLOWS	
	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL (min)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)
EXA	0.87	3.46	0.25	100	3	11.1	1193	1.7%	4.5	4.4	15.4	3.43	5.81	**3**	**20**
EXB	0.37	1.47	0.25	100	2	12.6	623	2.2%	5.2	2.0	14.6	3.51	5.96	**1**	**9**
EXC	2.23	8.93	0.25	100	2.5	11.7	2420	1.7%	4.6	8.9	20.6	3.01	5.01	**7**	**45**
EXD	1.43	5.71	0.25	100	2	12.6	1615	2.6%	5.6	4.8	17.4	3.25	5.47	**5**	**31**
EXE	0.52	2.10	0.25	100	8	8.0	1063	2.1%	5.0	3.5	11.5	3.86	6.66	**2**	**14**
EXF	0.15	0.58	0.25	100	6	8.8	400	2.5%	5.5	1.2	10.0	4.06	7.07	**1**	**4**
OS-1	4.05	16.21	0.25	100	6	8.8	3219	2.3%	5.3	10.1	18.9	3.13	5.24	**13**	**85**
OS-2	1.03	4.11	0.25	100	2	12.6	1203	1.0%	3.5	5.7	18.4	3.17	5.32	**3**	**22**
OS-3	0.10	0.40	0.25	100	2	12.6	330	2.6%	5.6	1.0	13.6	3.61	6.17	**0**	**2**
OS-4	0.03	0.11	0.25	100	2	12.6	230	2.6%	5.7	0.7	13.3	3.64	6.23	**0**	**1**
OS-5	0.61	2.43	0.25	80	5	7.8	1000	2.5%	5.5	3.0	10.8	3.96	6.85	**2**	**17**
OS-8	FLOW TAKEN FROM MERIDAN RANCH MDDP													**5**	**11**
OS-9	FLOW TAKEN FROM MERIDAN RANCH MDDP													**8**	**19**

MDDP ~ EXISTING SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Facility Size
						I(5)	I(100)	Q(5)	Q(100)	
EX1	EXA, OS-5, & DP-EX10A	18.92	1.47	5.89	15.4	3.43	5.81	33	219	3-42" CULVERTS
EX2	EXB	4.09	0.37	1.47	14.6	3.51	5.96	1	9	STAPLETON ROAD
EX3	EXC & OS-4	25.10	2.26	9.03	20.6	3.01	5.01	7	45	EAST BOUNDARY
EX4	EXD & OS-3	16.98	1.53	6.11	17.4	3.25	5.47	5	33	EAST BOUNDARY
EX5	EXE, OS-2 & OS-8	17.23	1.55	6.20	18.4	3.17	5.32	10	44	EAST BOUNDARY
EX6	EXF	1.62	0.15	0.58	13.8	3.59	6.12	1	4	EAST BOUNDARY
EX7	EXE, EXF, OS-1, OS-2, OS-8 & OS-9	78.24	5.75	23.00	18.9	3.13	5.24	31	151	DP 30 PROP CONDITION
EX9	OS-9	11.80						8	19	DP 30 PROP CONDITION
EX10	OS-8	2.56						5	11	DP 30 PROP CONDITION
EX10A	MERIDIAN POND E RELEASE	Meridaian Ranch Filing 3 FDR Calculated Flows						28	185	EX 3-42" RCP Culverts



REVISIONS

NO.	DESCRIPTION	DATE

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www.tnesinc.com

WATERBURY FILING 1 & 2

EXISTING MDDP DRAINAGE MAP 1
OFFSITE MAP

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	
H-SCALE	1"=100'
V-SCALE	
JOB NO.	1715.00
DATE ISSUED	3/3/22
SHEET NO.	1 OF 2

MATCHLINE SEE SHEET 1

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY (TRIB. TO POND)	
BASIN BOUNDARY (OFFSITE)	
BASIN BOUNDARY (ONSITE)	
EX STORM SEWER/CULVERT	
WETLANDS	
100 YR. FLOODPLAIN	
BASIN IDENTIFIER	K
AREA IN ACRES	1.5
DESIGN POINT	5
EXISTING DIRECTION OF FLOW	
Tc PATH	

100 50 0 100 200

SCALE: 1" = 100'

removed filing 1 & 2 boundary has no purpose

This linetype is not labeled or shown in the Legend.

no there is not, just a spillway

Is there a pipe here?

UNPLATTED
FUTURE WATERBURY DEVELOPMENT

WETLANDS

EXISTING STOCK POND

OS-1 45.02

OS-2 11.4

OS-3 1.11

OS-4 0.29

EXA 9.62

EXB 4.09

EXC 24.5

EXD 15.87

EXE 5.83

EXF 1.62

EX1

EX2

EX3

EX4

EX5

EX6

EX7

Tc TYP.

APPROX. LOCATION OF 100 YR. FEMA FLOODPLAIN

EXIST. OFF-SITE SWQ POND 1
0.52 AC-FT. WQCV REQ.
0.66 AC-FT. WQCV PROVIDED WITH INSTALLED CONCRETE OUTLET BOX AND ORIFICE PLATE

EXIST. IN-FLOW
5-YR. = 18 CFS
100-YR. = 133 CFS

EXIST. RELEASE
5-YR. = 13 CFS
100 YR. = 131 CFS

EX. 4'x4' CONC. OUTLET BOX W/ INTEGRAL MICROPOOL AND 24" RCP OUTLET PIPE

EXIST. DRAINAGE ESMT. (BY SEPARATE INSTRUMENT)

EXIST. OFF-SITE SWQ POND 2
0.34 AC-FT. WQCV REQ.
0.60 AC-FT. WQCV PROVIDED WITH INSTALLED CONCRETE OUTLET BOX AND ORIFICE PLATE

PROPOSED IN-FLOW
5-YR. = 10 CFS
100-YR. = 53 CFS

PROPOSED RELEASE
5-YR. = 0.4 CFS
100 YR. = 51 CFS

EXIST. (2) 8'x4' CBC

EXIST OFF-SITE SWQ POND 3 (IN-LINE)
0.66 AC-FT. WQCV REQ.
1.2 AC-FT. WQCV PROVIDED WITHIN THE EXIST. STOCK POND

PROPOSED IN-FLOW
5-YR. = 69 CFS
100-YR. = 397 CFS

PROPOSED RELEASE
5-YR. = 69 CFS
100 YR. = 396 CFS

HISTORIC RELEASE
5-YR. = 76 CFS
100 YR. = 437 CFS

EX. 4'x4' CONC. OUTLET BOX W/ INTEGRAL MICROPOOL AND 24" RCP OUTLET PIPE AND E/C BLANKET AT SPILLWAY

EXIST. DRAINAGE ESMT. (REC.# 214087198)

EXIST. STOCK POND CONVERTED TO SWQ FOREBAY FOR MITIGATION OF 4-WAY RANCH FIL. 1 AND PORTIONS OF WATERBURY DEVELOPMENT

UNPLATTED
FUTURE 4-WAY RANCH COMMERCIAL DEVELOPMENT

4 -WAY RANCH FILING NO. 1

LOT 14

LOT 15

LOT 35

LOT 36

LOT 37

PROPERTY LINE

BANDANERO DRIVE (80' ROW)

OLBERS DRIVE (70' ROW)

THATCHER COURT (70' ROW)

TRAPPER TRAIL (70' ROW)

SEE APPENDIX FOR ALL OFF-SITE SWQ BASINS TRIBUTARY TO THE PROPOSED SWQ PONDS.

REVISIONS

NO.	DESCRIPTION	DATE

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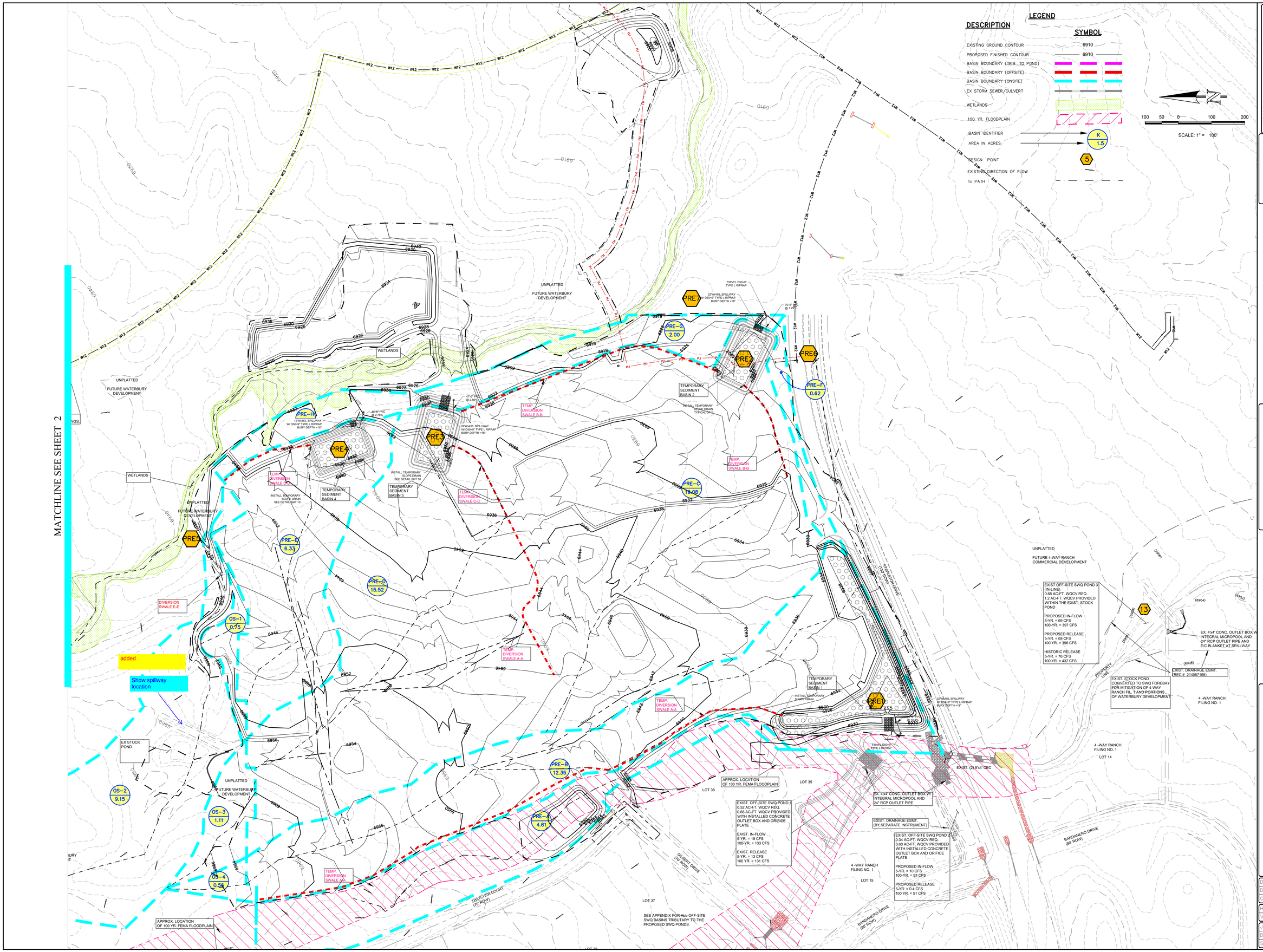
WATERBURY FILING 1 & 2

EXISITING MDDP DRAINAGE MAP 2
ONSITE MAP

DESIGNED BY QNA
DRAWN BY QNA
CHECKED BY
H-SCALE 1"=100'
V-SCALE
JOB NO. 1715.00
DATE ISSUED 3/3/22
SHEET NO. 2 OF 2



REVISIONS

NO.	DESCRIPTION	DATE

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FAX: 719-635-6426
www.tnesinc.com

WATERBURY FILING 1 & 2

EARLY GRADING DRAINAGE MAP 2
ONSITE MAP

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	
H-SCALE	1"=100'
V-SCALE	
JOB NO.	1715.00
DATE ISSUED	3/3/22
SHEET NO.	1 OF 2

MDDP DRAINAGE REPORT ~ EARLY GRADING BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS / DEVELOPED AREA			NONIMPERVIOUS / UNDEVELOPED AREA			WEIGHTED		WEIGHTED CA	
		AREA (AC)	C(5)	C(100)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	CA(5)	CA(100)
PRE-A	4.61	0.00	0.45	0.59	4.61	0.09	0.36	0.09	0.36	0.41	1.66
PRE-B	12.35	0.00	0.45	0.59	12.35	0.09	0.36	0.09	0.36	1.11	4.45
PRE-C	19.08	0.00	0.45	0.59	19.08	0.09	0.36	0.09	0.36	1.72	6.87
PRE-D	15.52	0.00	0.45	0.59	15.52	0.09	0.36	0.09	0.36	1.40	5.59
PRE-E	6.33	0.00	0.45	0.59	6.33	0.09	0.36	0.09	0.36	0.57	2.28
PRE-F	0.62	0.00	0.45	0.59	0.62	0.09	0.36	0.09	0.36	0.06	0.22
PRE-G	2.00	0.00	0.45	0.59	2.00	0.09	0.36	0.09	0.36	0.18	0.72
PRE-H	1.33	0.00	0.45	0.59	1.33	0.09	0.36	0.09	0.36	0.12	0.48
OS-1	0.75	0.00	0.45	0.59	0.75	0.09	0.36	0.09	0.36	0.07	0.27
OS-2	11.15	0.00	0.45	0.59	11.15	0.09	0.36	0.09	0.36	1.00	4.01
OS-3	1.11	0.00	0.45	0.59	1.11	0.09	0.36	0.09	0.36	0.10	0.40
OS-4	0.56	0.00	0.45	0.59	0.56	0.09	0.36	0.09	0.36	0.05	0.20
OS-8	2.56	FLOW TAKEN FROM MERIDAIN RANCH MDDP									

MDDP ~ EARLY GRADING BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	CA(100)	OVERLAND C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)
PRE-A	0.41	1.66	0.25	100	2.5	11.7	909	1.4%	4.2	3.6	15.4	3.43	5.82	1	10
PRE-B	1.11	4.45	0.25	100	2.5	11.7	1612	1.3%	4.0	6.7	18.5	3.16	5.31	4	24
PRE-C	1.72	6.87	0.25	100	2.5	11.7	1308	1.3%	4.0	5.5	17.2	3.27	5.50	6	38
PRE-D	1.40	5.59	0.25	100	2	12.6	1297	1.6%	4.5	4.9	17.5	3.24	5.46	5	30
PRE-E	0.57	2.28	0.25	100	8	8.0	752	2.1%	5.1	2.5	10.5	4.00	6.94	2	16
PRE-F	0.06	0.22	0.25	64	2	8.7					8.7	4.26	7.47	0	2
PRE-G	0.18	0.72	0.25	161	5	13.9					13.9	3.58	6.12	1	4
PRE-H	0.12	0.48	0.25	67	2	9.1					9.1	4.21	7.36	1	4
OS-1	0.07	0.27	0.25	85	2	11.0	75	1.3%	4.0	0.3	11.4	3.88	6.70	0	2
OS-2	1.00	4.01	0.25	76	2	10.1	1427	2.1%	5.1	4.7	14.8	3.49	5.94	4	24
OS-3	0.10	0.40	0.25	100	9	7.7	329	2.5%	5.5	1.0	8.7	4.27	7.49	0	3
OS-4	0.05	0.20	0.25	100	2	12.6	127	2.4%	5.4	0.4	13.0	3.68	6.30	0	1
OS-8	FLOW TAKEN FROM MERIDAIN RANCH MDDP													5	11

took of Basin OS-9 off from map as it does not come onto the graded property or is routed through early grading TSBs also not discussed in text

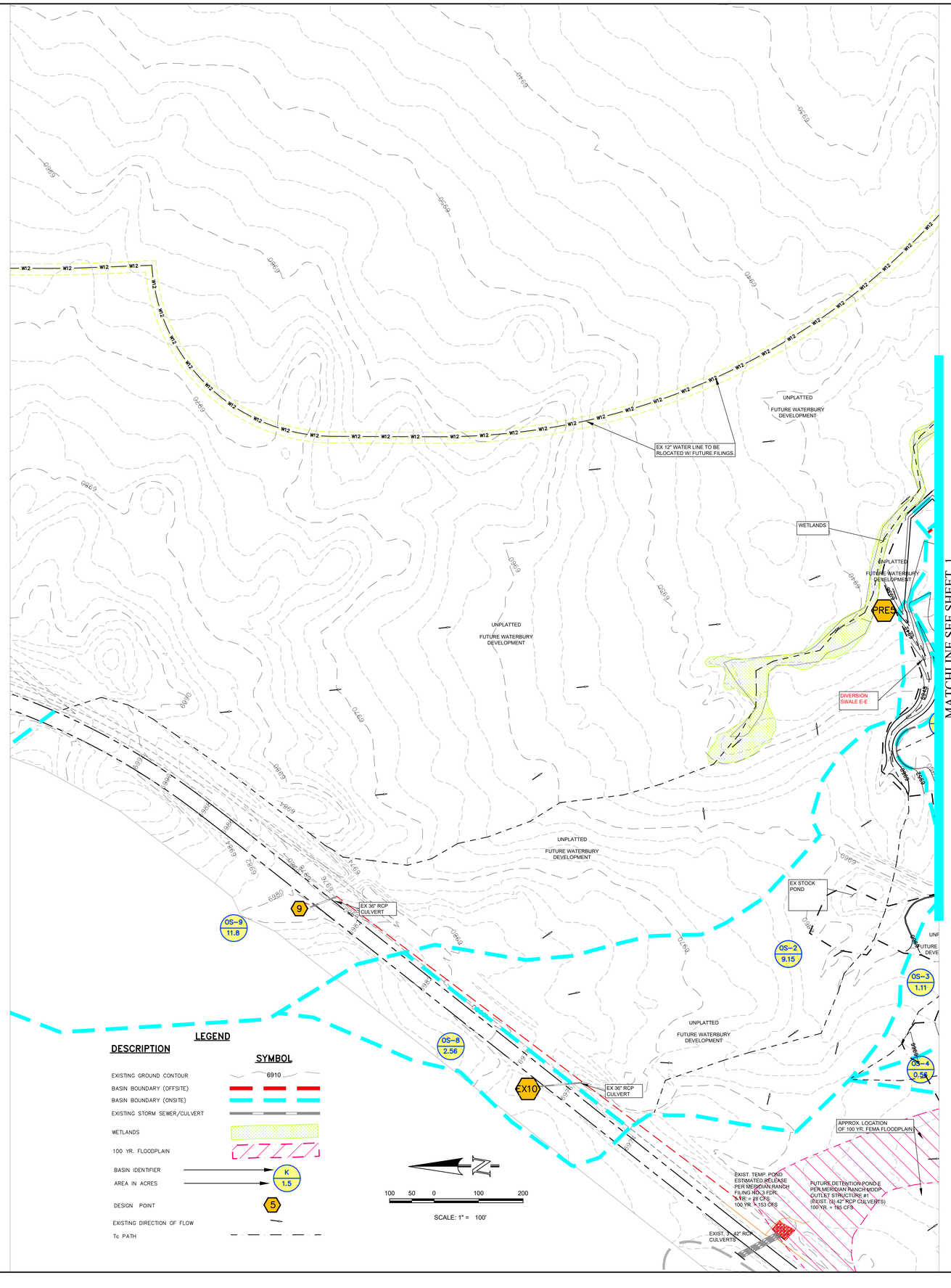
Missing Basin OS-9 in table & hydrology spreadsheet

MDDP ~ EARLY GRADING SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Facility Size
PRE1	PRE-B & OS-4	4.65	1.16	4.65	18.5	3.16	5.31	4	25	TSB 1
PRE2	PRE-C	19.08	1.72	6.87	17.2	3.27	5.50	6	38	TSB 2
PRE3	PRE-D & OS-3	16.63	1.50	5.99	17.5	3.24	5.46	5	33	TSB 3
PRE4	PRE-E & OS-1	7.07	0.64	2.55	10.5	4.00	6.94	3	18	TSB 4
PRE5	OS-8 & OS-2	13.71	1.00	4.01	14.8	3.49	5.94	9	35	EASTERN CHANNEL
PRE6	PRE-F	0.62	0.06	0.22	8.7	4.26	7.47	0	2	STAPLETON ROAD
PRE7	PRE-G, PRE-H & DPS PRE2-PRE5	59.82	5.15	20.61	17.5	3.24	5.46	25	147	EX GEICK RANCH CHANNEL

Missing Design Points EX10, 9 & 13

added DP EX 10 took DP- 9 & 13 off from map as it does not come onto the graded property or is routed through early grading TSBs also not discussed in text



REVISIONS

NO.	DESCRIPTION	DATE

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WATERBURY FILING 1 & 2

EARLY GRADING DRAINAGE MAP 2
OFFSITE MAP

DESIGNED BY QNA
DRAWN BY QNA
CHECKED BY
H-SCALE 1"=100'
V-SCALE
JOB NO. 1715.00
DATE ISSUED 3/3/22
SHEET NO. 2 OF 2

MDDP ~ PROPOSED SURFACE ROUTING SUMMARY

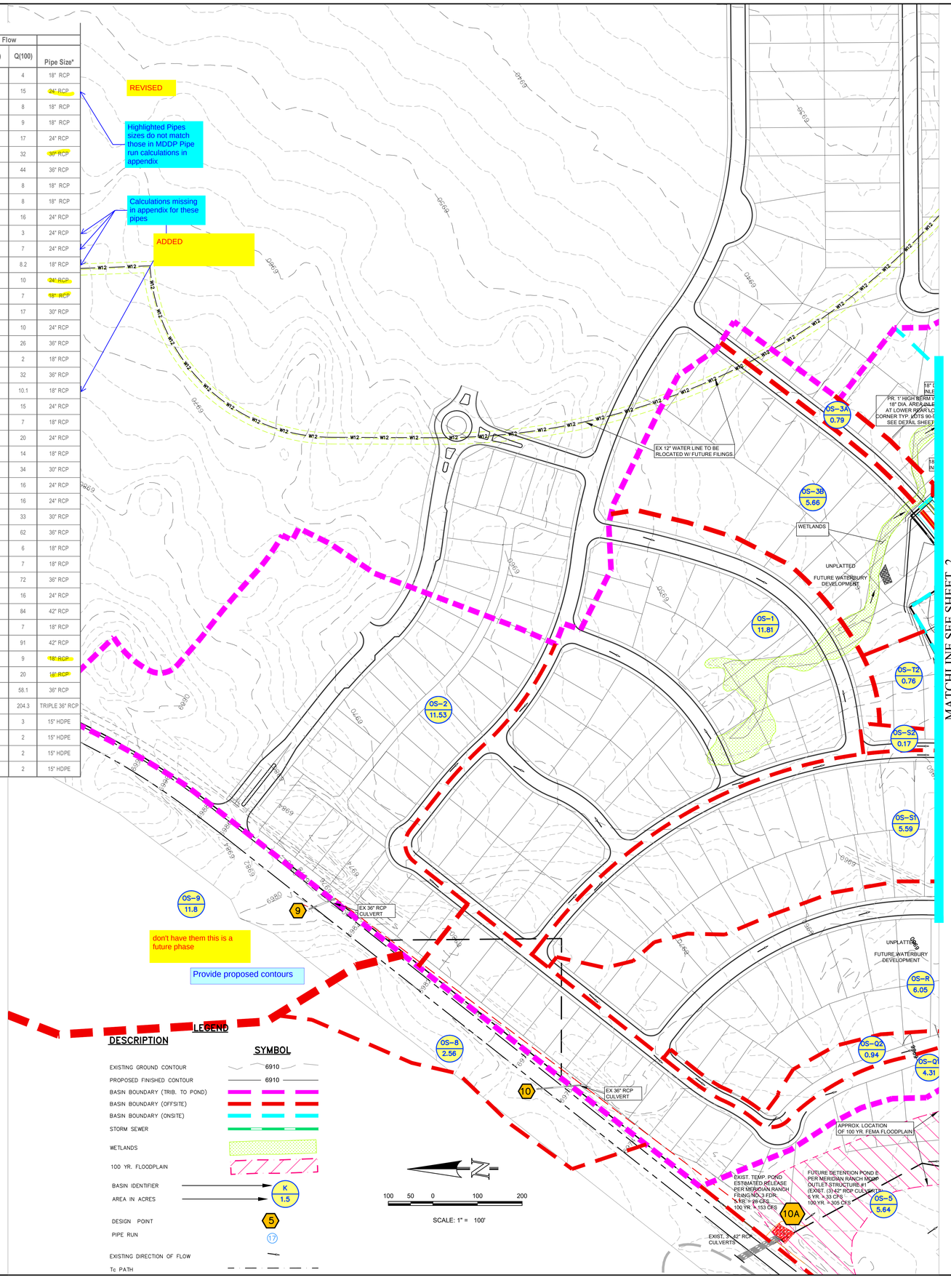
Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Facility Size
1	A	3.39	1.52	2.00	14.3	3.54	6.03	5	12	10' Type R Sump Inlet
2	C	0.86	0.39	0.51	6.9	4.58	8.14	2	4	5' Type R Sump Inlet
3	B1	2.30	1.03	1.36	14.2	3.55	6.05	4	8	5' Type R Sump Inlet
4	B2	2.69	1.21	1.59	14.8	3.49	5.93	4	9	5' Type R Sump Inlet
5	F & H	3.31	1.49	1.95	9.5	4.14	7.22	6	14	10' Type R Sump Inlet
6	D	2.11	0.95	1.24	11.4	3.87	6.69	4	8	5' Type R Sump Inlets
7	E	2.18	0.98	1.29	13.8	3.59	6.12	4	8	5' Type R Sump Inlets
7A	G1	0.53	0.24	0.31	5.0	5.00	9.06	1	3	5' Type R At-grade Inlet
7B	G2	0.69	0.31	0.41	5.0	5.00	9.06	2	4	5' Type R At-grade Inlet
8	DESIGN POINTS 1-7 & K	16.84	7.58	9.94	14.8	3.49	5.93	26	59	FSD Pond 1
9	OS-9	11.80						8	19	EX 36" CMP Culvert
10	OS-8	2.56						5	11	EX 36" CMP Culvert
10A	MERIDIAN POND E RELEASE	Meridaian Ranch Filing 3 FDR Calculated Flows						28	185	EX 3-42" RCP Culverts
11	OS-5, I, DP10A (MERIDIAN POND E RELEASE)	Sum of Basins						36	213	PR 2-42" RCP Culverts
12	OS-6	1.06	0.48	0.63	10.1	4.05	7.04	2	4	18" RCP Culvert
13	TOTAL OFFSITE EX. STOCK POND INFLOW	Per "Final Drainage Report for Waterbury Filing No. 1" dated September 2016, by Classic Consulting						69	396	EX STOCK POND
14	L1	3.04	1.37	1.79	16.1	3.36	5.69	5	10	10' Type R Sump Inlet
15	L2	2.00	0.90	1.18	12.8	3.70	6.34	3	7	5' Type R Sump Inlet
16	O1	2.82	1.27	1.66	13.5	3.62	6.19	5	10	10' Type R Sump Inlet
17	O2	0.71	0.32	0.42	15.5	3.42	5.80	1	2	5' Type R Sump Inlet
18	DESIGN POINTS 14-17 & BASIN OS-4	19.48	4.84	5.06	16.1	3.36	5.69	16	29	Interim FSD Pond 2
19	Q1 & OS-Q1	5.37	2.41	3.17	22.4	2.88	4.78	7	15	10' Type R Sump Inlet
20	Q2 & OS-Q2	1.89	0.85	1.12	12.4	3.75	6.43	3	7	5' Type R Sump Inlet
21	R & OS-R	7.06	3.18	4.17	11.4	3.87	6.69	12	28	10' Type R At-grade Inlet
22	S1 & OS-S1 & DP 21 FLOW BY	8.34	4.42	5.64	16.7	3.32	5.60	15	32	10' Type R Sump Inlet
23	S2 & OS-S2	0.31	0.14	0.18	12.6	3.72	6.39	1	1	10' Type R Sump Inlet
22 & 23 SPLIT	S1, OS-S1, S2, OS-S2, & DP 21 FLOW BY	8.65	4.56	5.82	16.7	3.32	5.60	8	16	2-10' Type R Sump Inlets
24	T1	1.42	0.64	0.84	10.7	3.97	6.88	3	6	5' Type R Sump Inlets
25	T2 & OS-T2	1.99	0.90	1.18	13.5	3.63	6.20	3	7	5' Type R Sump Inlets
26	U1	4.38	1.97	2.58	14.3	3.54	6.03	7	16	10' Type R Sump Inlets
27	U2	1.89	0.85	1.11	13.8	3.59	6.12	3	7	5' Type R Sump Inlets
28	W	5.20	2.34	3.07	15.0	3.47	5.89	8	18	2-10' Type R Sump Inlets
29	DPS 19-26, 31-32, OFFSITE BASINS OS-1, 2, 3A, 3B, T, & 9	82.02	35.91	47.46	22.4	2.88	4.78	112	246	FSD POND
30	Y & OS-10	3.76	0.46	1.43	13.5	3.62	6.19	2	9	Triple 36" RCP Culverts
30	FSD POND 3 EMERGCNEY SPILLWAY RELEASE	MHFD DETENTION 100Y PEAK INFLOW							204	Triple 36" RCP Culverts
31	V	0.54	0.24	0.32	5.0	5.00	9.06	1	3	18" DIA INLETS
32	X	0.43	0.19	0.25	5.0	5.00	9.06	1	2	18" DIA INLETS
33	O-3	0.45	0.20	0.27	5.0	5.00	9.06	1	2	18" DIA INLETS
34	O-4	0.38	0.17	0.23	5.0	5.00	9.06	1	2	18" DIA INLETS

MDDP ~ PROPOSED BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	WEIGHTED CA(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	STREET / CHANNEL FLOW Slope (%)	STREET / CHANNEL FLOW Velocity (fps)	STREET / CHANNEL FLOW Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	TOTAL FLOWS Q(100) (cfs)
A	1.52	2.00	0.25	100	2	12.6	400	1.5%	4.3	1.6	14.3	3.54	6.03	5	12
B1	1.03	1.36	0.25	100	2	12.6	400	1.5%	4.3	1.6	14.2	3.55	6.05	4	8
B2	1.21	1.59	0.25	100	2	12.6	550	1.5%	4.3	2.1	14.8	3.49	5.93	4	9
C	0.39	0.51	0.25	20	0.5	5.3	500	2.0%	4.9	1.7	6.9	4.58	8.14	2	4
D	0.95	1.24	0.25	80	2	10.5	300	2.5%	5.5	0.9	11.4	3.87	6.69	4	8
E	0.98	1.29	0.25	100	2	12.6	400	2.5%	5.5	1.2	13.8	3.59	6.12	4	8
F	0.98	1.29	0.25	50	2	7.1	620	1.5%	4.3	2.4	9.5	4.14	7.22	4	9
G1	0.24	0.31	0.25								5.0	5.00	9.06	1	3
G2	0.31	0.41	0.25								5.0	5.00	9.06	2	4
H	0.51	0.67	0.25	50	2	7.1	525	1.5%	4.3	2.0	9.2	4.19	7.33	2	5
I	1.43	2.72	0.25	80	4	8.4	250	2.0%	4.9	0.8	9.2	4.18	7.32	6	14
J	0.90	1.17	0.25	90	6	8.1	850	2.0%	4.9	2.9	10.9	3.94	6.81	4	8
K	0.69	1.37	0.25	100	18	6.1	80	1.0%	3.5	0.4	6.5	4.67	8.33	3	11
L1	1.37	1.79	0.25	100	2	12.6	860	1.4%	4.1	3.5	16.1	3.36	5.69	5	10
L2	0.90	1.18	0.25	55	1.1	9.4	860	1.4%	4.1	3.5	12.8	3.70	6.34	3	7
M1	0.74	0.97	0.25	70	1.5	10.3	200	2.0%	4.9	0.7	11.0	3.92	6.79	3	7
M2	0.20	0.26	0.25	65	3	7.7	0	0.0%	0.0	0.0	7.7	4.43	7.83	1	2
N	0.10	0.13	0.25								5.0	5.00	9.06	1	1
O1	1.27	1.66	0.25	100	2.5	11.7	460	1.5%	4.3	1.8	13.5	3.62	6.19	5	10
O2	0.32	0.42	0.25	100	2	12.6	850	2.0%	4.9	2.9	15.5	3.42	5.80	1	2
O3	0.20	0.27	0.25								5.0	5.00	9.06	1	2
O4	0.17	0.23	0.25								5.0	5.00	9.06	1	2
P	0.06	0.25	0.25								5.0	5.00	9.06	0	2
Q1	0.48	0.62	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	2	4
Q2	0.43	0.56	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	2	4
R	0.46	0.60	0.25	100	4	10.1	700	2.0%	4.9	2.4	12.4	3.75	6.44	2	4
S1	0.70	0.91	0.25	100	6	8.8	175	2.0%	4.9	0.6	9.4	4.16	7.20	3	7
S2	0.06	0.08	0.25								5.0	5.00	9.06	0	1
T1	0.64	0.84	0.25	55	1.1	9.4	390	2.0%	4.9	1.3	10.7	3.97	6.88	3	6
T2	0.55	0.73	0.25	100	2	12.6	245	2.0%	5.0	0.8	13.5	3.63	6.20	2	5
U1	1.97	2.58	0.25	100	2	12.6	520	2.3%	5.3	1.6	14.3	3.54	6.03	7	16
U2	0.85	1.11	0.25	100	2	12.6	385	2.3%	5.4	1.2	13.8	3.59	6.12	3	7
V	0.24	0.32	0.25								5.0	5.00	9.06	1	3
W	2.34	3.07	0.25	100	2	12.6	630	1.6%	4.4	2.4	15.0	3.47	5.89	8	18
X	0.19	0.25	0.25								5.0	5.00	9.06	1	2
Y	0.16	0.21	0.25								5.0	5.00	9.06	1	2
OS-1	5.31	6.97	0.25	100	2	12.6	690	2.0%	5.0	2.3	15.0	3.47	5.90	18	41
OS-2	5.19	6.80	0.25	100	2	12.6	1700	1.8%	4.6	6.1	18.7	3.14	5.27	16	36
OS-3A	0.35	0.47	0.25	55	1.1	9.4	480	1.3%	3.9	2.0	11.4	3.87	6.68	1	3
OS-3B	2.55	3.34	0.25	100	2	12.6	480	1.3%	3.9	2.0	14.7	3.50	5.95	9	20
OS-4	0.98	3.92	0.25	800	26	30.5					30.5	2.46	4.01	2	16
OS-5	0.51	2.03	0.25	80	5	7.8	1000	2.5%	5.5	3.0	10.8	3.96	6.85	2	14
OS-6	0.48	0.63	0.25	30	0.6	6.9	900	1.8%	4.7	3.2	10.1	4.05	7.04	2	4
OS-7	0.25	1.01									5.0	5.00	9.06	1	9
OS-8	FLOW TAKEN FROM MERIDAN RANCH MDDP													5	11
OS-9	FLOW TAKEN FROM MERIDAN RANCH MDDP													8	19
OS-10	0.31	1.23	0.25	100	2	12.6	300	2.7%	5.7	0.9	13.5	3.62	6.19	1	8
OS-Q1	1.94	2.54	0.25	200	5	16.6	1500	1.5%	4.3	5.8	22.4	2.88	4.78	6	12
OS-Q2	0.42	0.55	0.25	50	1	8.9	900	1.5%	4.3	3.5	12.4	3.75	6.43	2	4
OS-R	2.72	3.57	0.25	50	1	8.9	850	2.7%	5.8	2.5	11.4	3.87	6.69	11	24
OS-S1	2.51	3.30	0.25	100	2	12.6	920	1.2%	3.8	4.0	16.7	3.32	5.60	8	18
OS-S2	0.08	0.10	0.25	100	2	12.6					12.6	3.72	6.39	0	1
OS-T2	0.34	0.45	0.25	100	2	12.6					12.6	3.72	6.39	1	3

MDDP ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Pipe Size*
1	DP 2	0.39	0.51	6.9	4.58	8.14	2	4	18" RCP
2	DP 1 & 2	1.91	2.51	14.3	3.54	6.03	7	15	24" RCP
3	DP 3	1.03	1.36	14.2	3.55	6.05	4	8	18" RCP
4	DP-4	1.21	1.59	14.8	3.49	5.93	4	9	18" RCP
5	DP 3 & 4	2.25	2.94	14.8	3.49	5.93	8	17	24" RCP
6	DP 1-4	4.16	5.45	14.8	3.49	5.93	15	32	30" RCP
7	DP-1-5	5.65	7.41	14.8	3.49	5.93	20	44	36" RCP
8	DP-6	0.95	1.24	11.4	3.87	6.69	4	8	18" RCP
9	DP-7	0.98	1.29	13.8	3.59	6.12	4	8	18" RCP
10	DP-6 & 7	1.97	2.58	13.8	3.59	6.12	7	16	24" RCP
10A	DP-7A	0.24	0.31	5.0	5.00	9.06	1	3	24" RCP
10B	DP-7A & 7B	0.55	0.72	5.0	5.00	9.06	3	7	24" RCP
10C	POND 1 RELEASE	2.95	3.87	13.8	3.59	6.12	0.4	8.2	18" RCP
11	DP-14	1.37	1.79	16.1	3.36	5.69	5	10	24" RCP
12	DP-15	0.90	1.18	12.8	3.70	6.34	3	7	18" RCP
13	DP 14 & 15	2.27	2.98	16.1	3.36	5.69	8	17	30" RCP
14	DP 16	1.27	1.66	13.5	3.62	6.19	5	10	24" RCP
15	DP 14, 15 & 16	3.54	4.64	16.1	3.36	5.69	12	26	36" RCP
16	DP 17	0.32	0.42	15.5	3.42	5.80	1	2	18" RCP
17	DP 14, 15, 16, 17, 33, & 34	4.24	5.55	16.1	3.36	5.69	14	32	36" RCP
17A	POND 2 RELEASE						0.2	10.1	18" RCP
18	DP 19	2.41	3.17	22.4	2.88	4.78	7	15	24" RCP
19	DP 20	0.85	1.12	12.4	3.75	6.43	3	7	18" RCP
20	DP 18 & 19	3.27	4.28	22.4	2.88	4.78	9	20	24" RCP
21	DP 21 PICK UP						8	14	18" RCP
22	DP 19, 20 & 21	6.04	7.21	22.4	2.88	4.78	17	34	30" RCP
23	DP 22	2.28	2.91	16.7	3.32	5.60	8	16	24" RCP
24	DP 23	2.28	2.91	16.7	3.32	5.60	8	16	24" RCP
25	DP 22 & 23	4.56	5.82	16.7	3.32	5.60	15	33	30" RCP
26	DP 19 -23	10.60	13.03	22.4	2.88	4.78	31	62	36" RCP
27	DP 24	0.64	0.84	10.7	3.97	6.88	3	6	18" RCP
28	DP 25	0.90	1.18	13.5	3.63	6.20	3	7	18" RCP
29	DP 19-25	12.13	15.05	22.4	2.88	4.78	35	72	36" RCP
30	DP 26	1.97	2.58	14.3	3.54	6.03	7	16	24" RCP
31	DP 19-26	14.10	17.63	22.4	2.89	4.79	41	84	42" RCP
32	DP 27	0.85	1.11	13.8	3.59	6.12	3	7	18" RCP
33	DP 19-27, & 31	15.19	19.06	22.4	2.88	4.78	44	91	42" RCP
34	DP 28 SPLIT	1.17	1.53	15.0	3.47	5.89	4	9	18" RCP
34A	29 & 32	2.53	3.32	15.0	3.47	5.89	9	20	18" RCP
35	Pond 3 Release	MHFD UD-DETENTION POND RELEASE					1.2	58.1	36" RCP
36	DP 30	FSD POND 3 EMERGCNEY SPILLWAY RELEASE						204.3	TRIPLE 36" RCP
37	DP 31	0.24	0.32	5.00	5.00	9.06	1.2	3	15" HDPE
38	DP 32	0.19	0.25	5.00	5.00	9.06	1.2	2	15" HDPE
39	DP 33	0.20	0.27	5.00	5.00	9.06	1.2	2	15" HDPE
40	DP 34	0.17	0.23	5.00	5.00	9.06	1.2	2	15" HDPE



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NO.	DESCRIPTION	DATE

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WATERBURY FILING 1 & 2

MDDP
PROPOSED MDDP DRAINAGE MAP 1
OFFSITE MAP

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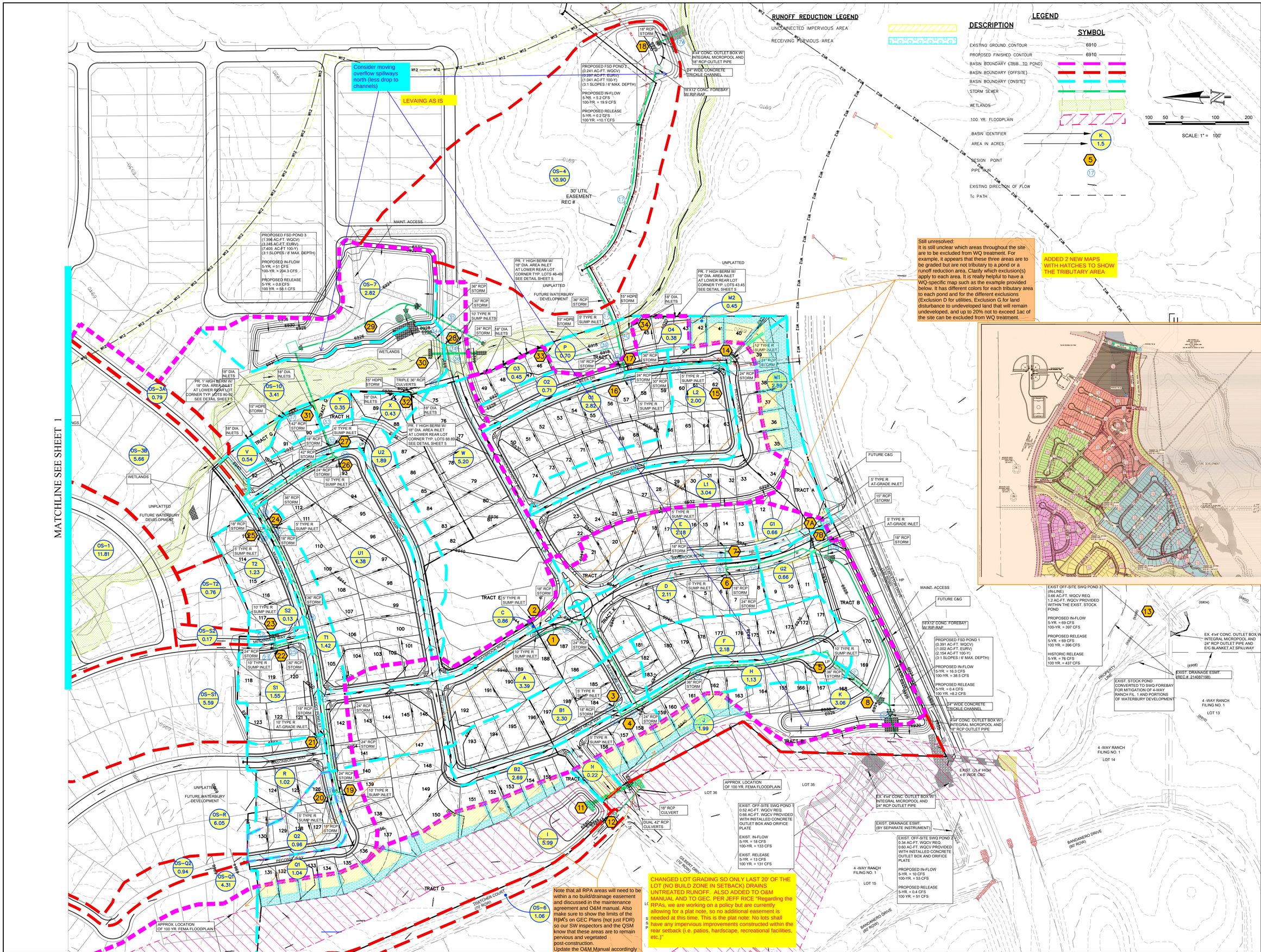

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WATERBURY FILING 1 & 2

MDDP
PROPOSED MDDP DRAINAGE MAP 2
ONSITE MAP

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SHEET NO. 2 OF 2	

PELIMINARY DRAINAGE REPORT ~ PIPE ROUTING SUMMARY

Pipe Run	Contributing Design Points/Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Pipe Size*
1	DP 2	0.39	0.51	6.9	4.58	8.14	2	4	18" RCP
2	DP 1 & 2	1.91	2.51	14.3	3.54	6.03	7	15	24" RCP
3	DP 3	1.03	1.36	14.2	3.55	6.05	4	8	18" RCP
4	DP-4	1.21	1.59	14.8	3.49	5.93	4	9	18" RCP
5	DP 3 & 4	2.25	2.94	14.8	3.49	5.93	8	17	24" RCP
6	DP 1-4	4.16	5.45	14.8	3.49	5.93	15	32	30" RCP
7	DP-1-5	5.65	7.41	14.8	3.49	5.93	20	44	36" RCP
8	DP-6	0.95	1.24	11.4	3.87	6.69	4	8	18" RCP
9	DP-7	0.98	1.29	13.8	3.59	6.12	4	8	18" RCP
10	DP-6 & 7	1.93	2.53	13.8	3.59	6.12	7	15	24" RCP
10A	DP-7A						1.2	2.8	24" RCP
10B	DP-7A & 7B						1.2	2.8	24" RCP
10C	Pond 1 Release						1.2	2.8	18" RCP
11	DP-14	1.37	1.79	16.1	3.36	5.69	5	10	24" RCP
12	DP-15	0.90	1.18	16.1	3.36	5.69	3	7	18" RCP
13	DP 14 & 15	2.27	2.98	16.1	3.36	5.69	8	17	30" RCP
14	DP 16	1.27	1.66	5.0	5.00	9.06	6	15	24" RCP
15	DP 14, 15 & 16	3.54	4.64	16.1	3.36	5.69	12	26	36" RCP
16	DP 17	0.32	0.42	13.5	3.62	6.19	1	3	18" RCP
17	DP 14, 15, 16, & 17	3.86	5.06	16.1	3.36	5.69	13	29	36" RCP
17A	Pond 2 Release						1.1	2.4	18" RCP
18*	**DP 19**	**0.51**	**0.74**	**13.2**	**3.66**	**6.27**	**2**	**5**	**24" RCP**
19*	**DP 20**	**0.45**	**0.65**	**9.5**	**4.14**	**7.24**	**2**	**5**	**18" RCP**
20*	**DP 19 & 20**	**0.96**	**1.39**	**13.2**	**3.66**	**6.27**	**4**	**9**	**24" RCP**
21*	**DP 21 PICK UP**						**2**	**6**	**18" RCP**
22*	**DP 19, 20 & 21**	**1.50**	**2.35**	**13.2**	**3.66**	**6.27**	**6**	**15**	**24" RCP**
23*	**DP 22**	**0.72**	**1.02**	**12.4**	**3.75**	**6.44**	**3**	**7**	**24" RCP**
24*	**DP 23**	**0.07**	**0.13**	**5.0**	**5.00**	**9.06**	**0**	**1**	**24" RCP**
25*	**DP 22 & 23**	**0.80**	**1.15**	**12.4**	**3.75**	**6.44**	**3**	**7**	**30" RCP**
26*	**DP 19 -23**	**2.30**	**3.50**	**13.2**	**3.66**	**6.27**	**8**	**22**	**36" RCP**
27*	**DP 24**	**0.64**	**0.84**	**10.7**	**3.97**	**6.88**	**3**	**6**	**18" RCP**
28*	**DP 25**	**0.58**	**0.84**	**13.5**	**3.63**	**6.20**	**2**	**5**	**18" RCP**
29*	**DP 19-25**	**3.52**	**5.17**	**13.5**	**3.63**	**6.20**	**13**	**32**	**36" RCP**
30*	**DP 26**	**1.97**	**2.58**	**14.3**	**3.54**	**6.03**	**7**	**16**	**24" RCP**
31*	**DP 19-26**	**5.49**	**7.75**	**14.3**	**3.54**	**6.03**	**19**	**47**	**42" RCP**
32*	**DP 27**	**0.85**	**1.11**	**13.8**	**3.59**	**6.12**	**3**	**7**	**18" RCP**
33*	**DP 19-27 & 31**	**6.58**	**9.18**	**14.3**	**3.54**	**6.03**	**23**	**55**	**42" RCP**
34	DP 28	2.34	3.07	21.1	2.97	4.94	7	15	18" RCP
34A	29 & 32	2.43	4.02	14.3	3.54	6.03	9	24	18" RCP
35	Pond 3 Release	MHFD UD-DETENTION POND RELEASE					1	58	36" RCP
36*	DP 30	SUM OF BASINS					36	120	TRIPLE 36" RCP
37	DP 31	0.24	0.32	5.00	5.00	9.06	1	3	15" HDPE
38	DP 32	0.19	0.25	5.00	5.00	9.06	1	2	15" HDPE
39	DP 33	0.20	0.27	5.00	5.00	9.06	1	2	15" HDPE
40	DP 34	0.17	0.23	5.00	5.00	9.06	1	2	15" HDPE

PIPE RUN* = PIPE RUN REVISED FROM MDDP IN PRELIMINARY CONDITION DUE TO UNDEVELOPED UPSTREAM

Highlighted pipe sizes do not match pipe sizes in appendix

FIXED

using pipe run
culations in
endix

ADDED

changed PR to 18"

PELIMINARY DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	WEIGHTED CA(5)	WEIGHTED CA(100)	C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	TOTAL FLOWS Q(100) (cfs)
A	1.52	2.00	0.25	100	2	12.6	420	1.5%	4.3	1.6	14.3	3.54	6.03	5	12
B1	1.03	1.36	0.25	100	2	12.6	400	1.5%	4.3	1.6	14.2	3.55	6.05	4	8
B2	1.21	1.59	0.25	100	2	12.6	550	1.5%	4.3	2.1	14.8	3.49	5.93	4	9
[illegible]	[illegible]	[illegible]	0.25	20	0.5	5.3	500	2.0%	4.9	1.7	6.9	4.58	8.14	2	4
[illegible]	[illegible]	[illegible]	0.25	80	2	10.5	300	2.5%	5.5	0.9	11.4	3.87	6.69	4	8
[illegible]	[illegible]	[illegible]	0.25	100	2	12.6	400	2.5%	5.5	1.2	13.8	3.59	6.12	4	8
[illegible]	0.98	1.29	0.25	50	2	7.1	620	1.5%	4.3	2.4	9.5	4.14	7.22	4	9
G1	0.24	0.31	0.25								5.0	5.00	9.06	1	3
G2	0.31	0.41	0.25								5.0	5.00	9.06	2	4
H	0.51	0.67	0.25	50	2	7.1	525	1.5%	4.3	2.0	9.2	4.19	7.33	2	5
I	1.43	2.72	0.25	80	4	8.4	250	2.0%	4.9	0.8	9.2	4.18	7.32	6	20
J	0.90	1.17	0.25	90	6	8.1	850	2.0%	4.9	2.9	10.9	3.94	6.81	4	8
K	0.69	1.37	0.25	100	18	6.1	80	1.0%	3.5	0.4	6.5	4.67	8.33	3	11
L1	1.37	1.79	0.25	100	2	12.6	860	1.4%	4.1	3.5	16.1	3.36	5.69	5	10
L2	0.90	1.18	0.25	55	1.1	9.4	860	1.4%	4.1	3.5	12.8	3.70	6.34	3	7
M1	0.74	0.97	0.25	70	1.5	10.3	200	2.0%	4.9	0.7	11.0	3.92	6.79	3	7
[illegible]	[illegible]	0.26	0.25	65	3	7.7	0	0.0%	0.0	0.0	7.7	4.43	7.83	1	2
[illegible]	[illegible]	0.13	0.25								5.0	5.00	9.06	1	1
O1	1.27	1.66	0.25	100	3	11.1	460	1.5%	4.3	1.8	12.8	3.70	6.34	5	11
O2	0.32	0.42	0.25	100	2	12.6	850	2.0%	4.9	2.9	15.5	3.42	5.80	1	2
O3	0.20	0.27	0.25								5.0	5.00	9.06	1	2
O4	0.17	0.23	0.25								5.0	5.00	9.06	1	2
P	0.06	0.25	0.25								5.0	5.00	9.06	0	2
Q1	0.48	0.62	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	2	4
Q2	0.43	0.56	0.25	55	1.3	8.9	445	2.0%	5.0	1.5	10.4	4.01	6.97	2	4
R	0.46	0.60	0.25	100	4	10.1	700	2.0%	4.9	2.4	12.4	3.75	6.44	2	4
S1	0.70	0.91	0.25	100	6	8.8	175	2.0%	4.9	0.6	9.4	4.16	7.26	3	7
S2	0.06	0.08	0.25								5.0	5.00	9.06	0	1
T1	0.64	0.84	0.25	55	1.1	9.4	390	2.0%	4.9	1.3	10.7	3.97	6.88	3	6
[illegible]	0.55	0.73	0.25	100	2	12.6	245	2.0%	5.0	0.8	13.5	3.63	6.20	2	5
[illegible]	1.97	2.58	0.25	100	2	12.6	520	2.3%	5.3	1.6	14.3	3.54	6.03	7	16
U2	0.85	1.11	0.25	100	2	12.6	385	2.3%	5.4	1.2	13.8	3.59	6.12	3	7
V	0.24	0.32	0.25	100	2	12.6	630	1.6%	4.4	2.4	15.0	3.47	5.89	1	2
W	2.34	3.07	0.25	100	2	12.6	630	1.6%	4.4	2.4	15.0	3.47	5.89	8	18
X	0.19	0.25	0.25	95	6	8.4					8.4	4.31	7.58	1	2
Y	0.16	0.21	0.25	95	6	8.4					8.4	4.31	7.58	1	2
OS-1*	**3.70**	**14.79**	**0.25**	**100**	**2**	**12.6**	**2700**	**2.3%**	**5.3**	**8.5**	**21.1**	**2.97**	**4.94**	**11**	**73**
OS-2*	**1.08**	**4.33**	**0.25**	**100**	**2**	**12.6**	**1203**	**1.0%**	**3.5**	**5.7**	**18.4**	**3.17**	**5.32**	**3**	**23**
OS-4	0.98	3.92	0.25	800	26	30.5					30.5	2.46	4.01	2	16
OS-5	0.51	2.03	0.25	600	18	27.1					27.1	2.62	4.30	1	9
OS-6	0.48	0.63	0.25	30	0.6	6.9	900	1.8%	4.7	3.2	10.1	4.05	7.04	2	4
OS-7*	**0.33**	**1.31**	**0.25**								**5.0**	**5.00**	**9.06**	**2**	**12**
OS-8	FLOW TAKEN FROM MERIDIAN RANCH MDDP													**5**	**11**
OS-9	FLOW TAKEN FROM MERIDIAN RANCH MDDP													**8**	**19**
OS-R*	**0.03**	**0.12**	**0.25**	**100**	**2**	**12.6**	**135**	**1.5%**	**4.3**	**0.5**	**13.2**	**3.66**	**6.27**	**0**	**1**
	0.02	**0.08**	**0.25**	**50**	**1**	**8.9**	**135**	**1.5%**	**4.3**	**0.5**	**9.5**	**4.14**	**7.24**	**0**	**1**
OS-R*	**0.09**	**0.38**	**0.25**	**100**	**2**	**12.6**	**50**	**2.7%**	**5.8**	**0.1**	**12.8**	**3.70**	**6.35**	**0**	**2**
OS-S1*	**0.03**	**0.11**	**0.25**								**5.0**	**5.00**	**9.06**	**0**	**1**
OS-S2*	**0.01**	**0.05**	**0.25**								**5.0**	**5.00**	**9.06**	**0**	**0**
OS-T2*	**0.03**	**0.11**	**0.25**								**5.0**	**5.00**	**9.06**	**0**	**1**

BASIN* = BASIN AREA REVISED FROM MDDP IN PRELIMINARY CONDITION DUE TO UNDEVELOPED UPSTREAM

FIXED

FIXED

PELIMINARY DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Area (AC)	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity I(5)	Intensity I(100)	Flow Q(5)	Flow Q(100)	Facility Size
1	A	3.39	1.52	2.00	14.3	3.54	6.03	5	12	10' Type R Sump Inlet
2	C	0.86	0.39	0.51	6.9	4.58	8.14	2	4	5' Type R Sump Inlet
3	B1	2.30	1.03	1.36	14.2	3.55	6.05	4	8	5' Type R Sump Inlet
4	B2	2.69	1.21	1.59	14.8	3.49	5.93	4	9	5' Type R Sump Inlet
5	F & H	3.31	1.49	1.95	9.5	4.14	7.22	6	14	10' Type R Sump Inlet
6	D	2.11	0.95	1.24	11.4	3.87	6.69	4	8	5' Type R Sump Inlets
7	E	2.18	0.98	1.29	13.8	3.59	6.12	4	8	5' Type R Sump Inlets
7A	G1	0.53	0.24	0.31	5.0	5.00	9.06	1	3	5' Type R At-grade Inlet
7B	G2	0.69	0.31	0.41	5.0	5.00	9.06	2	4	5' Type R At-grade Inlet
8	DESIGN POINTS 1-7 & K	16.84	7.58	9.94	14.8	3.49	5.93	26	59	FSD Pond 1
9	OS-9	0.31	0.03	0.11	5.0	5.00	9.06	0	1	EX 36" CMP Culvert
10	OS-8	1.04	0.09	0.38	12.8	3.70	6.35	0	2	EX 36" CMP Culvert
10A	MERIDIAN POND E RELEASE	Meridian Ranch Filing 3 FDR Calculated Flows						28	185	EX 3-42" RCP Culverts
11	OS-5, I, OS-& MERIDIAN POND E RELEASE	Sum of Basins						35	214	PR 2-42" RCP Culverts
12	OS-6	0.33	5.19	6.80	18.7	3.14	5.27	16	36	18" RCP Culvert
13	TOTAL OFFISITE EX. STOCK POND INFLOW	Per "Final Drainage Report for Waterbury Filing No. 1" dated September 2016, by Classic Consulting						69	396	EX STOCK POND
14	L1	3.04	1.37	1.79	16.1	3.36	5.69	5	10	10' Type R Sump Inlet
15	L2	2.00	0.90	1.18	16.1	3.36	5.69	3	7	5' Type R Sump Inlet
16	O1	2.82	1.27	1.66	5.0	5.00	9.06	6	15	10' Type R Sump Inlet
17	O2	0.71	0.32	0.42	13.5	3.62	6.19	1	3	5' Type R Sump Inlet
18	DESIGN POINTS 14-17 & BASIN OS-4	19.48	3.86	5.06	16.1	3.36	5.69	13	29	Interim FSD Pond 2
19*	**Q1 & OS-Q1**	**1.39**	**0.51**	**0.74**	**13.2**	**3.66**	**6.27**	**2**	**5**	**10' Type R Sump Inlet**
20*	**Q2 & OS-Q2**	**1.18**	**0.45**	**0.65**	**9.5**	**4.14**	**7.24**	**2**	**5**	**5' Type R Sump Inlet**
21*	**R & OS-R**	**2.06**	**0.55**	**0.98**	**12.4**	**3.75**	**6.44**	**2**	**6**	**10' Type R At-grade Inlet**
22*	**S1 & OS-S1**	**1.86**	**0.72**	**1.02**	**12.4**	**3.75**	**6.44**	**3**	**7**	**10' Type R Sump Inlet**
23*	**S2 & OS-S2**	**0.27**	**0.07**	**0.13**	**5.0**	**5.00**	**9.06**	**0**	**1**	**10' Type R Sump Inlet**
24*	**T1**	**1.42**	**0.64**	**0.84**	**10.7**	**3.97**	**6.88**	**3**	**6**	**2-10' Type R Sump Inlets**
25*	**T2 & OS-T2**	**1.54**	**0.58**	**0.84**	**13.5**	**3.63**	**6.20**	**2**	**5**	**5' Type R Sump Inlets**
26*	**U1**	**4.38**	**1.97**	**2.58**	**14.3**	**3.54**	**6.03**	**7**	**16**	**5' Type R Sump Inlets**
27*	**U2**	**1.89**	**0.85**	**1.11**	**13.8**	**3.59**	**6.12**	**3**	**7**	**10' Type R Sump Inlets**
28	**W**	**2.34**	**2.34**	**3.07**	**15.0**	**3.47**	**5.89**	**8**	**18**	**5' Type R Sump Inlets**
29*	**DESIGN POINTS 19-28 & OS-7**	**5.20**	**11.02**	**15.02**	**15.0**	**3.47**	**5.89**	**38**	**88**	**2-10' Type R Sump Inlets**
E-E*	**OS-2 & OS-8**	**14.58**	**2.66**	**6.20**	**18.4**	**3.17**	**5.32**	**8**	**33**	**DIVERSION SWALE E-E**
30*	**Y, OS-1, OS-2, OS-8 & OS-9**	**67.82**	**9.32**	**20.34**	**21.1**	**2.97**	**4.94**	**36**	**120**	**Triple 36" RCP Culverts**
31	V	0.54	0.24	0.32	5.0	5.00	9.06	1	3	18" DIA INLETS
32	X	0.43	0.19	0.25	5.0	5.00	9.06	1	2	18" DIA INLETS
33	O-3	0.45	0.20	0.27	5.0	5.00	9.06	1	2	18" DIA INLETS
34	O-4	0.38	0.17	0.23	5.0	5.00	9.06	1	2	18" DIA INLETS

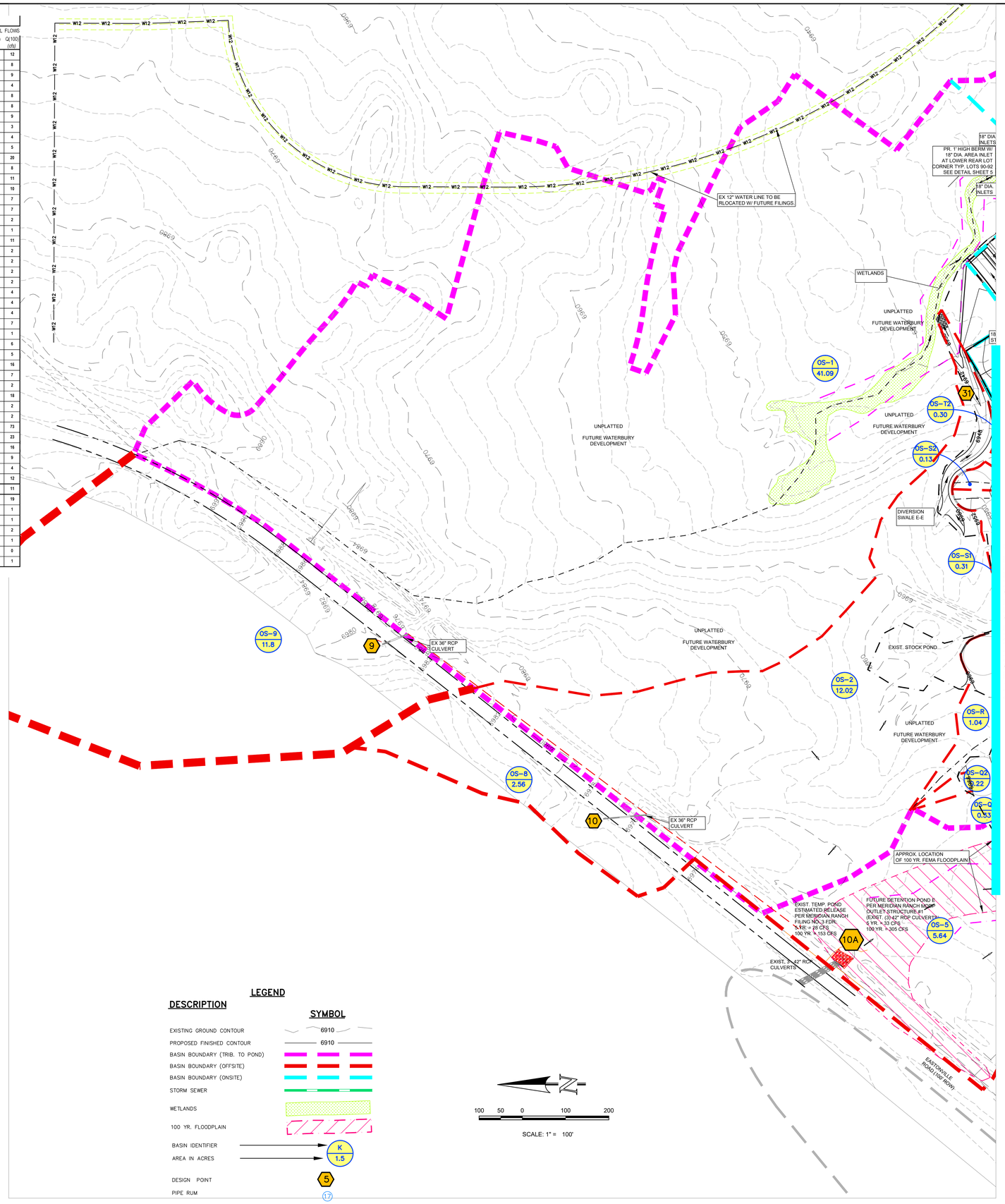
DESIGN POINT* = DESIGN POINT REVISED FROM MDDP IN PRELIMINARY CONDITION DUE TO UNDEVELOPED UPSTREAM

Adjust MHFD input to approximate this

done

Pond 3?

FIXED



REVISIONS

NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY ALL APPROPRIATE REVIEWING AGENCIES, THE ENGINEER OR SURVEYOR PROVIDING THESE DRAWINGS APPROVES THEIR USE ONLY FOR REVIEW PURPOSES, UNLESS DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
4-WAY RANCH JOINT VENTURE
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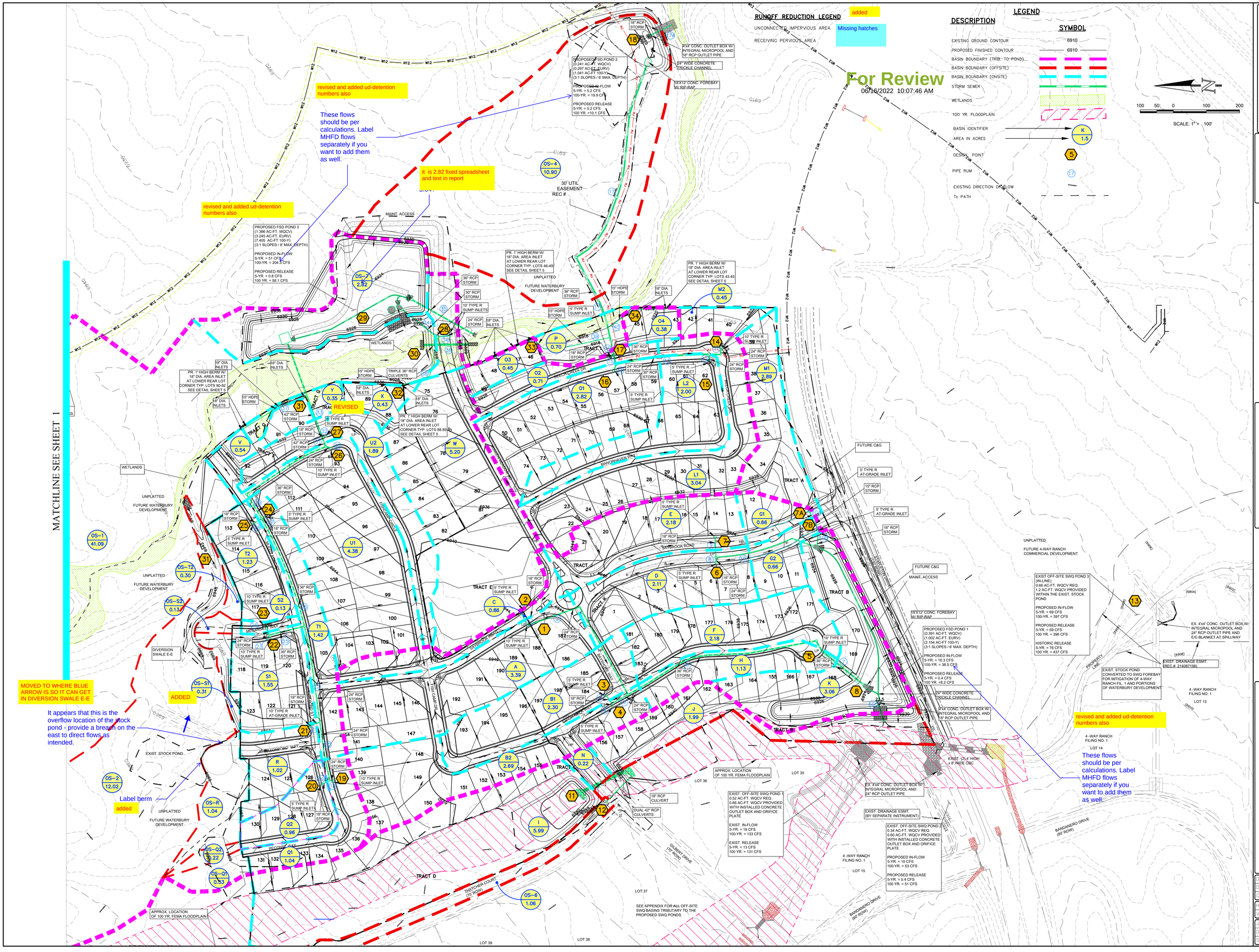
COLORADO SPRINGS, CO 80949
719-471-3150

Terra Nova Engineering, Inc.
Creative Civil Engineering Solutions
721 S. 23RD STREET
COLORADO SPRINGS, CO 80904
OFFICE: 719-635-6422
FAX: 719-635-6426
www.trenainc.com

WATERBURY FILING NO. 1

PRELIMINARY
PROPOSED FINAL DRAINAGE MAP
OFF-SITE

DESIGNED BY QNA
DRAWN BY QNA
CHECKED BY
H-SCALE 1"=100
V-SCALE NA
JOB NO. 1715.00
DATE ISSUED 3/3/22
SHEET NO. 1 OF 2



REVISIONS

NO.	DESCRIPTION	DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, TERRA NOVA ENGINEERING INC. DOES NOT ACCEPT OR APPROVE THEIR USE ONLY FOR THE PURPOSES OF REVIEW DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR:
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WATERBURY FILING NO. 1

PRELIMINARY
PROPOSED DRAINAGE MAP
ON-SITE

DESIGNED BY	QNA
DRAWN BY	QNA
CHECKED BY	
H-SCALE	1"=100
V-SCALE	NA
JOB NO.	1715.00
DATE ISSUED	3/3/22
SHEET NO.	2 OF 2

Y - Satisfies criteria

N - Needs to be addressed

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EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT

STORMWATER MANAGEMENT PLAN CHECKLIST

PUDSP-21-005

Site: Waterbury Filings 1& 2 **Location: Stapleton Rd. and Bandanero Dr.**

Revised: July 2019

		Applicant	PCD
1. STORMWATER MANAGEMENT PLAN (SWMP)			
1	Applicant (owner/designated operator), SWMP Preparer, Qualified Stormwater Manager, and Contractor Information. (On cover/title sheet)	X	Y
2	Table of Contents	X	Y
3	Site description and location to include: vicinity map with nearest street/crossroads description.	X	Y
4	Narrative description of construction activities proposed (e.g., may include clearing and grubbing, temporary stabilization, road grading, utility / storm installation, final grading, final stabilization, and removal of temporary control measures)	X	Y
5	Phasing plan – may require separate drawings indicating initial, interim, and final site phases for larger projects. Provide "living maps" that can be revised in the field as conditions dictate. N/A: This project has only one phase.	X	Y
6	Proposed sequence for major activities: Provide a construction schedule of anticipated starting and completion dates for each stage of land-disturbing activity depicting conservation measures anticipated, including the expected date on which the final stabilization will be completed.	X	Y
7	Estimates of the total site area and area to undergo disturbance; current area of disturbance must be updated on the SWMP as changes occur.	X	Y
8	Soil erosion potential and impacts on discharge that includes a summary of the data used to determine soil erosion potential	X	Y
9	A description of existing vegetation at the site and percent ground cover and method used to determine ground cover	X	Y
10	Location and description of all potential pollution sources including but not limited to: disturbed and stored soils; vehicle tracking; management of contaminated soils; loading and unloading operations; outdoor storage of materials; vehicle and equipment maintenance and fueling; significant dust generating process; routine maintenance activities involving fertilizers, pesticides, herbicides, detergents, fuels, solvents, oils, etc.; on-site waste management; concrete truck/equipment washing; dedicated asphalt, concrete batch plants and masonry mixing stations; non-industrial waste such as trash and portable toilets	X	Y
11	Material handling to include spill prevention and response plan and procedures.	X	Y
12	Spill prevention and pollution controls for dedicated batch plants N/A: No batch plants are proposed.	X	Y
13	Other SW pollutant control measures to include waste disposal and off site soil tracking	X	Y
14	Location and description of any anticipated allowable non-stormwater discharge (ground water, springs, irrigation, discharge covered by CDPHE Low Risk Guidance, etc.) N/A: No non-stormwater discharges are anticipated. This needs to be stated in the SWMP itself.	X	N
15	Name(s) of ultimate receiving waters; size, type and location of stormw ADDED TO LAST PAGE OF TEXT discharge		Y
16	Description of all stream crossings located within the project area or statement that no streams cross the project area	X	Y

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EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT

STORMWATER MANAGEMENT PLAN CHECKLIST
PUDSP-21-005

Site: Waterbury Filings 1& 2 **Location: Stapleton Rd. and Bandanero Dr.**

Revised: July 2019

		Applicant	PCD
17	SWMP Map to include: ADDED TO LEGEND		
17a	construction site boundaries	X	N
17b	flow arrows to depict stormwater flow directions	X	Y
17c	all areas of disturbance	X	Y
17d	areas of cut and fill	X	Y
17e	areas used for storage of building materials, soils (stockpiles) or wastes	X	Y
17f	location of any dedicated asphalt / concrete batch plants N/A: No batch plants are proposed.	X	Y
17g	location of all structural control measures	X	Y
17h	location of all non-structural control measures	X	Y
17i	springs, streams, wetlands and other surface waters, including areas that require maintenance of pre-existing vegetation within 50 feet of a receiving water	X	Y
18	Narrative description of all structural control measures to be used. Modifications to EPC standard control measures must meet or exceed County-approved details.	X	Y
19	Description of all non-structural control measures to be used including seeding, mulching, protection of existing vegetation, site watering, sod placement, etc.	X	Y
20	Technical drawing details for all control measure installation and maintenance; custom or other jurisdiction's details used must meet or exceed EPC standards	X	Y
21	Procedure describing how the SWMP is to be revised	X	Y
22	Description of Final Stabilization and Long-term Stormwater Quality (describe nonstructural and structural measures to control SW pollutants after construction operations have been completed, including detention, water quality control measure etc.)	X	Y
23	Specification that final vegetative cover density is to be 70% of pre-disturbed levels	X	Y
24	Outline of permit holder inspection procedures to install, maintain, and effectively operate control measures to manage erosion and sediment	X	Y
25	Record keeping procedures identified to include signature on inspection logs and location of SWMP records on-site	X	Y
26	If this project relies on control measures owned or operated by another entity, a documented agreement must be included in the SWMP that identifies location, installation and design specifications, and maintenance requirements and responsibility of the control measure(s). N/A: All control measures are being implemented by the owner/developer/contractor.	X	Y
	Please note: all items above must be addressed. If not applicable, explain why, simply identifying "not applicable" will not satisfy CDPHE requirement of explanation.	X	
2. ADDITIONAL REPORTS/PERMITS/DOCUMENTS			
a	Grading and Erosion Control Plan (signed)	P	Y
b	Erosion and Stormwater Quality Control Permit (ESQCP) (signed)	P	Y
3. Applicant Comments:			
a	Documents requiring design engineer's signature will be signed following County approval of the document (P = signature pending)		

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EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT

STORMWATER MANAGEMENT PLAN CHECKLIST
PUDSP-21-005

Site: Waterbury Filings 1& 2 **Location: Stapleton Rd. and Bandanero Dr.**

Revised: July 2019

		Applicant	PCD
b			
c			
4. Checklist Review Certifications:			
a	Engineer of Record: The Stormwater Management Plan was prepared under my direction and supervision and is correct to the best of my knowledge and belief. Said Plan has been prepared according to the criteria established by the County and State for Stormwater Management Plans. _____ _____ Engineer of Record Signature Date	X	
b	Review Engineer: The Stormwater Management Plan was reviewed and found to meet the checklist requirements except where otherwise noted or allowed by an approved deviation request. _____ _____ Review Engineer Date		

STORM WATER MANAGEMENT PLAN
FOR
WATERBURY FILING NO. 1 & 2
COLORADO SPRINGS, COLORADO

MARCH 2002

PCD Filing No.:PUDSP-21-005

Prepared For:

4 Prepared for:
4-**WAY RANCH JOINT VENTURE**
P.O. BOX 50223
COLORADO SPRINGS, CO 80949
Contact: Peter Martz

Prepared By:

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721 S. 23rd ST.
Colorado Springs, CO 80904

Job No. 1715.00

CONTACT INFORMATION

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CONTRACTOR:

EROSION CONTRO INSTALLER:

ENGINEER:
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(719) 635-6422 Office
quentin.armijo@tnesinc.com

EROSION CONTROL SUPERVISOR/ SWMP ADMINISTRATOR:

SWMP is to be maintained on site in the construction trailer whenever work is occurring. If construction trailer is not available, another alternative must be provided.

COLORADO DISCHARGE PERMIT SYSTEM (CDPS)

TO: Site Inspector Responsible for All CDPS Requirements

The following storm water pollution management plan (SWMP) is a detailed account of the requirements for the CDPS permit. The main objective of this plan is to prevent any contamination of the storm water while construction activity is taking place.

This document must be kept at the construction site at all times and be made available to the public and any representative of the Colorado Department of Health – Water Quality Control Division, if requested.

Enclosed are temporary erosion control details for the construction site and storm sewer outfall points (Detail A). The operation and maintenance inspection record should be used as a guideline for the inspection of permanent and temporary control devices. Items to be inspected are not limited to those listed. The inspections should be made at regular intervals and before and after storm events. The inspection records must be signed and kept in this binder for no less than three (3) years.

STORM WATER MANAGEMENT PLAN
FOR
WATERBURY FILING NO. 1 & 2

TABLE OF CONTENTS

APPENDIX

STORM WATER MANAGEMENT PLAN
FOR
WATERBURY FILING NO. 1 & 2

SITE DESCRIPTION & EXISTING CONDITIONS

This Stormwater Management Plan (SWMP) for Waterbury Filing No. 1 & 2 is an analysis of approximately 61.93 acres to be developed within a larger 322-acre master planned PUD Development site. and roughly 69 acres of grading disturbance. The Waterbury Filing No. 1 & 2 site consists of 203 proposed single-family homes. Clearing, Grubbing and Grading for both Filings will be completed at the same time and Filing 1 will be constructed right away, while filing 2 will be built at a later time. The construction activity consists of grading the site and installing 3 extended Detention Basins for water quality and full spectrum detention. Utilities will then be installed followed by curb and gutter and paving before construction of the house. Temporary sediment basins will be utilized in Filing 2 where the grading will be completed but utility/storm and road construction will be done at a later time. Erosion control measures in Filing 2 are to be left in place until it is developed and 70% of the vegetation is established.

The site is located in a portion of Sections 28, 29 and 33, Township 12 South, Range 64 West of the Sixth Principal Meridian, El Paso County, Colorado. The site is bounded on the north by unplatted property (future phases of the overall 4-Way Ranch property), to the east by unplatted property (Vorhes Ranch property), to the south by the recently constructed Stapleton Road and on the west by existing platted 2.5-acre residential lots (4-Way Ranch Filing No. 1) and Eastonville Road. The site also sits between 2 existing drainage channels paralleling it on the east and west. The east channel is in the Geick Ranch Basin and the west one is the Haegler Ranch Tributary 2. The site will have 2 proposed crossings one over each above-mentioned channel. The east channel will have a crossing where the existing Gilbert Road from 4-Way Ranch Filing 1 is extended to Waterbury Filing 1. It is proposed that dual 42" RCP culverts will be placed to pass the runoff. The second crossing is the crossing of Haegler Ranch Tributary 2 at the end east end of the proposed Sunken Meadow Road where 3-36" RCP will route the runoff under the roadway. The site is contained within the Geick Ranch & Haegler Ranch Basins. The receiving water downstream is Black Squirrel Creek to Chico Creek and ultimately the Arkansas River.

As mentioned above the site is bounded to the north by unplatted open space that will become future Waterbury single family filings. Currently runoff sheet flows south and into one of the 2 channels on the east

and west side of the site. Once Waterbury Filing 1 & 2 is developed this runoff will be captured in the proposed storm systems and routed to one of the 3 FSD ponds. A proposed berm will force the rest of this undeveloped offsite flow from the north to be routed into the eastern channel. To the east and west of our site sits existing drainage channels, therefore we have no off stie flow onto the site form the east or west. And to the south is Stapleton Road that drains away from the site.

The average soil condition reflects Hydrologic Groups "A" (Columbine gravelly sandy loam) and "B" (Stapleton sandy loam), as determined by the "Soil Survey of El Paso County Area," prepared by the Soil Conservation Service. Based upon the Preliminary Subsurface Soils Investigation done by Entech Engineering the soil boring encountered 6 types of soil and some bedrock. The soils were slightly silty to very silty sand and clayey sand and silty and clayey sandstone bedrock. Groundwater was present at 4' to 9.5' and should be accounted for during grading and construction. Based upon a site visit and Entech's description, the study area consists of undeveloped prairie land that has existing vegetation consisting of native grasses & shrubs with good to excellent coverage of 75% to 90%. The site slopes from the northwest to the southeast with slopes ranging from 2% to 10%. The site has an existing runoff coefficient of C5=0.09 and C100=0.36 and an average developed runoff coefficient of C5=0.60 and C100=0.70. The potential for erosion is substantial because loam soils have high amounts of silts and fine sands that can be carried away per the NRCS description. The CCM's installation will help to capture soil erosion and final landscaping will help to eliminate soil erosion. During the grading and utility installation of the site dewatering will need to be done. Dewatering activities should be done properly to avoid eroding the soil on the construction site. Pumped water should be routed to a Sediment Trap or equivalent BMP and swales used for routing the dewatering runoff must be stable and should have check dams installed. Discharge should be kept away from sloped areas and the contractor shall follow the CDPHE Low Risk Discharge Guidance for dewatering. All state, local, or federal permits and requirements should be obtained by the contractor prior to the start of work.

A portion of western piece of development is within a designated Zone A F.E.M.A. floodplain, as determined by Flood Insurance Rate Map No. 08041C0552 G dated December 7, 2018 (see appendix). No proposed lots are within the Floodplain. On March 19, 2004 a Letter of Map Revision (LOMR) was obtained to refine the floodplain in this unstudied area. In areas where channel improvements are proposed or roadway crossings affect the floodplain, a CLOMR application will be required.

CONSTRUCTION ACTIVITY AND STORAGE

No known toxic materials have been treated, stored, disposed, spilled or leaked onto the construction site. Practices to minimize contact of construction materials, equipment and vehicles within the storm water include installation of vehicle tracking control, sediment control logs, installation of straw bale barriers, sub-contractor cleaning and hauling of excess debris and material upon completion of work, the 3 Extended Detention Basins will also work to retain silts. Construction material loading and unloading, and access to such areas occur from gravel staging areas shown on the map. The concrete washout area will be removed and disposed of as required by this permit as well as the SWMP permit. Soils are not to be tracked offsite and any soils tracked offsite should be swept up. The use of a street cleaner is recommended.

No concrete or asphalt batch plants are planned for the construction site. There will be no on-site mobile fueling station but there will be onsite fueling of equipment. Contractor shall have the Hazardous Material emergency response number posted on the construction trailer on site. Potential pollutants such as paints, adhesives, porta potty runoff, and oil spills will also be dealt with as required. All paints, adhesives, ect. will be properly stored. There will always be a spill kit on site to deal with these pollutants. The porta potty will be placed at least 10 feet from any vehicle right-of-way, storm drain inlet, or waterway. The porta potty will be staked to the ground or fastened in a way that will prevent it from tipping over.

ADDED TO PARAGRAPH

50ft from state waters.

The site will be considered stabilized when all grading has been completed and site vegetation is at 70% established per the landscape plans and the DCM Volume 1 Chapter 14, and grading, and infrastructure construction have been completed. There will be 66 acres of disturbed soil with approximately 84,082 cubic yards of cut, 287,430 cubic yards of fill for a net of 203,308 net fill

BEST MANAGEMENT PRACTICES AND OTHER CONTROLS

Erosion control measures shall be implemented in a manner that will protect properties and public facilities from the adverse effects of erosion and sedimentation as a result of construction and earthwork activities.

Grading will begin in June of 2022 and the overall area graded for site will be considered stabilized in the

Spring 2023.

Before clearing and grubbing may begin the first level of BMP'S are to be installed. These measures include Silt Fence (SF), install vehicle tracking control (VTC) at all construction exit points onto paved roads. Install Inlet Protection (IP) on adjacent existing inlets. The Stabilized Staging Area (SSA) is also to be setup with appropriate measures to protect downstream (i.e., Silt Fence).

The Second level of BMP'S to be installed once roads and the site is graded, including Straw Bale Barriers (SBB), Stockpile Area (SP) and the installation of the Concrete Washout (CWA). During the installation of the utilities & storm the contractor shall also adjust Silt Fence and other BMPs to adhere to the changes caused by construction.

Third level of BMP'S is to check all installed BMP's for conformance and adjust appropriately. Inlet Protection (IP) on newly installed inlets & Temporary Sediment Basins (TSB) be installed as noted on the landscape and grading plans.

Fourth level of BMP'S to be installed once the previous BMP'S and construction is completed. This level includes any disturbed areas and stockpiles which are not at final grade, but will remain dormant for longer than 30 days to be mulched within 21 days after interim grading. An area that is going to remain in an interim state for more than 60 days shall also be seeded (SM). The permanent BMP's should have the pond re-vegetated (RP). All temporary soil erosion control measures and BMP'S shall be maintained until permanent soil erosion control measures are implemented and vegetation has been established to 70% on areas not to be covered with gravel. These temporary BMPS's are to be removed once the 70% vegetation has been established. At this point in the construction process, all landscaping should be in place and maintained for a period of time that allows for its establishment on the site.

POTENTIAL SOURCES OF POLLUTION

The potential sources of pollution associated with this development are:

- Disturbed and stored soils
- Vehicle tracking of sediments

- Management of contaminated soils (if exist)
- Loading and unloading operations
- Significant dust or particulate generating processes
- Onsite waste management practices (waste piles, liquid wastes, dumpsters)
- Non-industrial waste sources such as worker trash and portable toilets
- Vehicle/equipment fueling and maintenance

IMPLEMENTATION OF CONTROL MEASURES

BMP design specifications and implementation information can be found in the UDFCD BMP Description Sheets included in the Appendix. This project does not rely on control measures owned or operated by another entity.

MATERIALS HANDLING

All construction materials shall be handled in a manner to minimize the chance of stormwater contamination. Additional info is included in the Spill Prevention and Control Plan section.

WASTE MANAGEMENT AND DISPOSAL

All waste and debris created by construction activities at the site shall be disposed of in compliance with all laws, regulations, and ordinances of the federal, state and local agencies. Waste disposal bins should be checked weekly for leaks and overflowing capacity and should be emptied when they reach 75% of capacity.

SPILL PREVENTION AND CONTROL PLAN

The Site Superintendent will act as the point of contact for any spill that occurs at this jobsite. The Construction Manager will be responsible for implementation of prevention practices, spill containment / cleanup, worker training, reporting and complete documentation in the event of a spill. The Site Superintendent shall immediately notify the Owner, /Construction Manager, State and the Local Fire Department in addition to the legally required Federal, State, and Local reporting channels (including the National Response Center, 800.424.8802) if a reportable quantity is released to the environment.

SPILL PREVENTION BEST MANAGEMENT PRACTICES

This section describes spill prevention methods Best Management Practices (BMP) that will be practiced to eliminate spills before they happen.

Equipment Staging and Maintenance

- Store and maintain equipment in a designated area.
- Keep spill kits readily accessible.
- Check incoming vehicles for leaking oil and fluids.
- Inspect equipment routinely for leaks and spills.
- Repair equipment immediately, if necessary, implement a preventative maintenance schedule for equipment and vehicles.

Fueling Area

- Perform fueling in designated fueling area minimum 50' away from federal waters.
- Use secondary containment (drain pan) to catch spills.
- Use proper equipment (pumps, funnels) to transfer fluids.
- Keep spill kits readily accessible.
- Inspect fueling areas routinely for leaks and spills.
- Hazardous Material Storage Areas: Reduce the amount of hazardous materials by substituting non-hazardous or less hazardous materials.

Hazardous Material Storage Areas

- Minimize the quantity of hazardous materials brought onsite.
- Store hazardous materials in a designated area away from drainage points.

Unexpected Contaminated Soil and Water

- Investigate historical site use.
- Perform all excavation activities carefully and only after the Owner/Construction.

- Manager directs any activities.

Toilets

- Portable toilets will be located a minimum of 10 feet from stormwater inlets and 50 feet from state waters They shall be adequately staked and cleaned on a weekly basis. They will be inspected daily for spills.

SPILL CONTAINMENT METHODS

The following discussion identifies the types of secondary containment that will be used in the event of a spill. Table 1 summarizes the containment methods for each potential source.

- Equipment Staging and Maintenance Area: An equipment leak from a fuel tank, equipment seal, or hydraulic line will be contained within a spill containment cell placed beneath all stationary potential leak sources. An undetected leak from parked equipment will be cleaned up using hand shovels and containerized in a 55-gallon steel drum for offsite disposal.
- Fueling Area: A small spill during fueling operations will be contained using fuel absorbent pads at the nozzle. The transfer of fuel into portable equipment will be performed using a funnel and/or hand pump and a spill pad used to absorb any incidental spills/drips. Any leaking tanks or drums will have fluids removed and transferred to another tank, drum, or container for the fluids. A spill response kit will be located near the fueling area or on the fuel truck for easy access. The spill response kit will include plastic sheeting, tarps, over pack drums, absorbent litter, and shovels.
- Hazardous Material Storage Area: A spill from containers or cans in a hazardous material storage area will be contained within the storage cabinet these materials are kept in.
- Unexpected Contaminated Soil: If contaminated soil is encountered during the project, the Owner/Construction Manager will be notified immediately. Small quantities of suspected contaminated soil will be placed on a 6-mil plastic liner and covered with 6-mil plastic. A soil berm or silt fence will be used to contain the stockpile and prevent migration of contaminated liquids in the soil.

Table 1: Spill Prevention and Containment Methods

Potential Spill Source	Containment Method(s)
Equipment staging and maintenance area	Spill containment pad, spill kit, pumps, funnels
Fueling area (site equipment only)	Spill containment pad, spill kit, pumps, funnels
Hazardous material staging area	Spill containment pad, spill kit, pumps, funnels
Unexpected contaminated soil	Plastic liner, plastic cover, soil berm, hay bales, lined super sacks

SPILL COUNTERMEASURES

Every preventative measure shall be taken to keep contaminated or hazardous materials contained. If a release occurs, the following actions shall be taken:

1. **Stop the Spill**: The severity of a spill at the site is anticipated to be minimal as large containers/quantities of Hazardous Materials are not anticipated. The type of spill would occur while dispensing material at the hazardous materials storage facility and would likely be contained in secondary containment. Thus, the use spill kits or other available absorbent materials should stop the spill.

2. **Warn Others**: Notify co-workers and supervisory personnel of the release. Notify emergency responders if appropriate. For site personnel, an alarm system will consist of three one second blasts on an air horn sounded by the person discovering a spill or fire. In the event of any spill, the Superintendent and Project Manager shall be notified if the spill is 5 gallons or more the STATE will be contacted along with the Fire Department.

3. **Isolate the Area**: Prevent public access to the area and continue to minimize the spread of the material. Minimize personal exposure throughout emergency response actions.

4. **Containment**: A spill shall only be contained by trained personnel and if it is safe to do so. DO NOT PLACE YOURSELF IN DANGER. Attempt to extinguish a fire only if it is in the incipient stage; trash can size or smaller. For larger spills, wait for the arrival of emergency response personnel and provide directions to the location of the emergency site descion

5. **Complete a Spill and Incident Report**: For each spill of a Hazardous Material a spill and incident report shall be completed and submitted to the Owner/Construction Manager and if applicable to the Engineer and the State of Colorado Department of Public Health and Environment.

6. **Dewatering**: Dewatering activities should be done properly to avoid eroding the soil on the construction site. Pumped water should be routed to a Sediment Trap or equivalent BMP and swales used for routing the dewatering runoff must be stable and should have check dams installed. Discharge should be kept away from sloped areas and the contractor shall follow the CDPHE Low Risk Discharge Guidance for dewatering. If the groundwater is found to be contaminated then the contractor shall use the CDPHE Environmental Cleanup Web Page or the EPA Cleanups in My Community Maps and Lists**.**

MAINTENANCE, INSPECTION AND REPAIR

The owner or his representative shall inspect and monitor all drainage facilities using the enclosed "Monitoring and Maintenance Inspection Record" checklist in the appendix. In order to ensure that all graded surfaces, structures, vegetation, erosion and sediment control measures and other protective devices identified in the erosion control plan are maintained in good and effective condition, an Operation and Maintenance Inspection Monitoring Program will be implemented by the permit holder during the construction phase. A systematic inspection of all the above-mentioned protective devices will be performed by a qualified stormwater manager (who is sufficiently qualified for the required duties per the ECM Appendix 1.5) using the operation and maintenance inspection record form in the appendix every 14 days. Also, post-storm event inspections must be conducted within 24 hours after the end of any precipitation or snowmelt event that causes surface erosion. Provided the timing is appropriate, the post-storm inspections may be used to fulfill the 14-day routine inspection requirement. A more frequent

inspection schedule than the minimum inspections described may be necessary to ensure that BMPs continue to operate as needed to comply with the plan. All monitoring records are to be kept with the SWMP for a period of no less than three (3) years. The inspection logs shall be signed by the stormwater inspector. All maintenance of temporary and permanent erosion and sediment control facilities shall be per the details included in this report.

This lot will be considered stabilized when all construction activities have been completed and vegetation has been established to 70% of pre-disturbed levels. Erosion control measures such as sedimentation control log must be removed after final stabilization.

Any major revisions or modification to this Storm Water Management Plan will require a report addendum and erosion control map revision. Minor revisions may be made by the Stormwater Manager by redlining the Storm Water Management Plan or inserting additional pages. The SWMP should be viewed as a "living document" that is continuously being reviewed and modified as a part of the overall process of evaluating and managing stormwater quality issues at the site. The Qualified Stormwater Manager shall amend the SWMP when there is a change in design, construction, operation or maintenance of the site which would require the implementation of new or revised BMPs or if the SWMP proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with construction activity or when BMPs are no longer necessary and are removed.

The onsite SWMP will be located in a mailbox located north of Stapleton Drive on the southern boundary of the stie.

FINAL STABILIZATION AND LONGTERM STORMWATER MANAGEMENT

Permanent stabilization measures include seeding, and mulching. These temporary BMPS's are to be removed once the 70% of pre-disturbed levels vegetation has been established. The installed FSD basins will be long term solutions to eliminating potential pollutants and sediment being transported downstream.

STATE REQUIREMENTS THAT ARE NOT APPLICABLE

The requirement for a phasing plan is not applicable as only one construction phase is proposed.

The requirement for spill prevention and pollution controls for dedicated batch plants is not applicable as no batch plants are proposed.

The requirement to show the location of any dedicated asphalt / concrete batch plants is no applicable as no batch plants are proposed.

All control measures are being implemented by the owner/developer/contractor.

Unresolved comment: Item 14 - Also state that: No non-stormwater discharges are anticipated

PREPARED BY:

ADDED TO PARAGRAPH

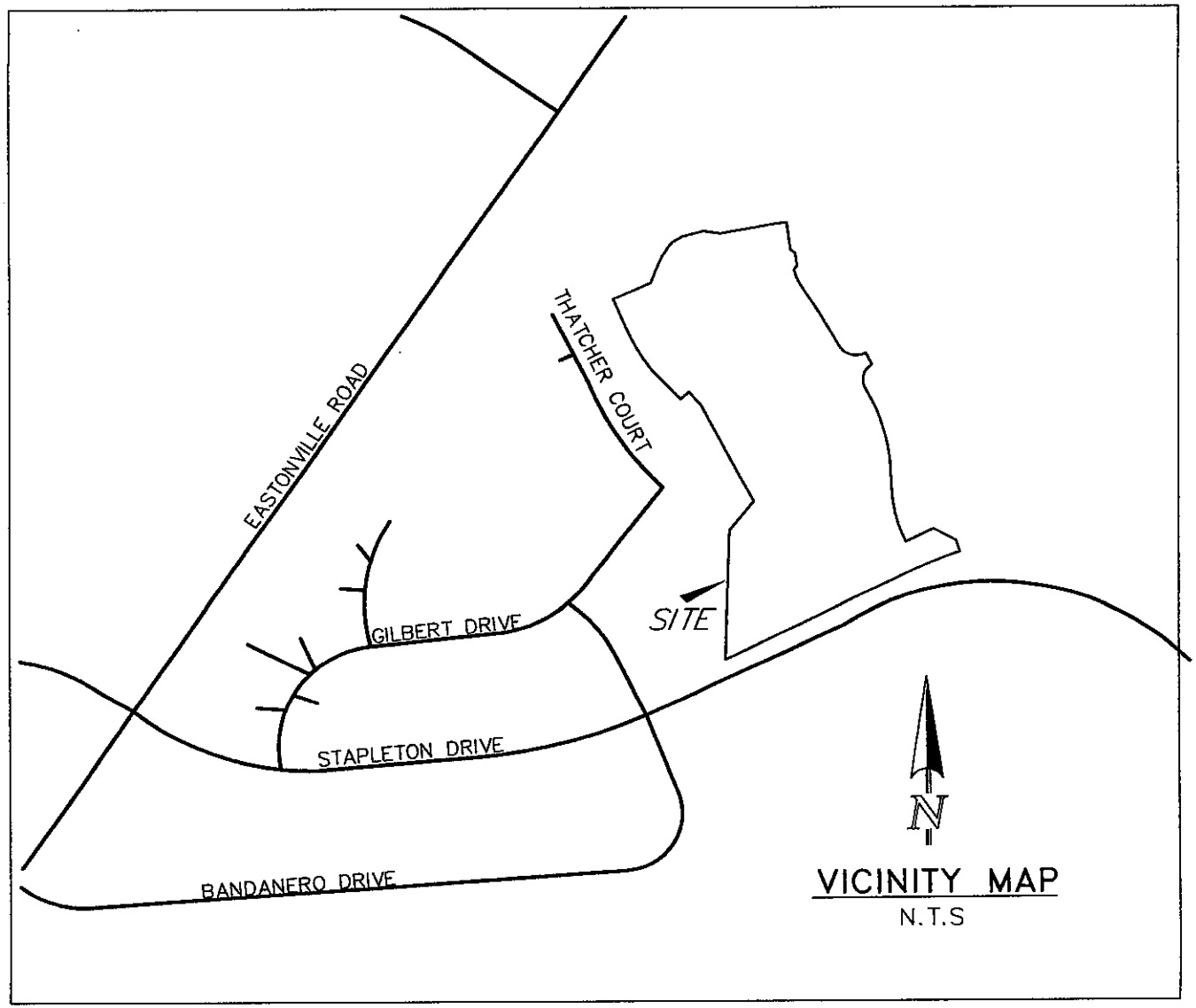
Terra Nova Engineering, Inc.

Quentin Armijo, P.E.
Vice President

Jobs/1715.00/word/Waterbury SWMP-RPT.doc

APPENDIX

GENERAL LOCATION MAP



VICINITY MAP
N.T.S

CONSTRUCTION SCHEDULE AND SEQUENCE

Erosion control measures shall be implemented in a manner that will protect properties and public facilities from the adverse effects of erosion and sedimentation as a result of construction and earthwork activities.

Grading will begin in January of 2022 and the overall area graded for site will be considered stabilized in the Spring 2023.

Before clearing and grubbing may begin the first level of BMP'S are to be installed. These measures include Silt Fence (SF), install vehicle tracking control (VTC) at all construction exit points onto paved roads. Install Inlet Protection (IP) on adjacent existing inlets. The Stabilized Staging Area (SSA) is also to be setup with appropriate measures to protect downstream (i.e., Silt Fence).

The Second level of BMP'S to be installed once roads and the site is graded, including Straw Bale Barriers (SBB), Stockpile Area (SP) and the installation of the Concrete Washout (CWA). During the installation of the utilities & storm the contractor shall also adjust Silt Fence and other BMPs to adhere to the changes caused by construction.

Third level of BMP'S is to check all installed BMP's for conformance and adjust appropriately. Inlet Protection (IP) on newly installed inlets & Temporary Sediment Basins (TSB) be installed as noted on the landscape and grading plans.

Fourth level of BMP'S to be installed once the previous BMP'S and construction is completed. This level includes any disturbed areas and stockpiles which are not at final grade, but will remain dormant for longer than 30 days to be mulched within 21 days after interim grading. An area that is going to remain in an interim state for more than 60 days shall also be seeded (SM). The permanent BMP's should have the pond re-vegetated (RP). All temporary soil erosion control measures and BMP'S shall be maintained until permanent soil erosion control measures are implemented and vegetation has been established to 70% on areas not to be covered with gravel. These temporary BMPS's are to be removed once the 70% vegetation has been established. At this point in the construction process, all landscaping should be in place and maintained for a period of time that allows for its establishment on the site

GENERAL PERMIT APPLICATION

OPERATION AND MAINTENANCE INSPECTION RECORD

The following inspection records are to be used at each bi-monthly stormwater management system inspection and after any precipitation or snowmelt event that causes surface runoff. As a result of these inspections, the SWMP may need to be revised. The inspection records and revised SWMP shall be made available to the division upon request. If the construction activity lasts more than 12 months, a copy of the inspection records and revised SWMP shall be sent to the division by May 1 of each year covering April 1 to March 31.

CONSTRUCTION STORMWATER SITE INSPECTION REPORT

Facility Name		Permittee	
Date of Inspection		Weather Conditions	
Permit Certification #		Disturbed Acreage	
Phase of Construction		Inspector Title	
Inspector Name			

	YES	NO
Is the above inspector a qualified stormwater manager? (permittee is responsible for ensuring that the inspector is a qualified stormwater manager)	☐	☐

INSPECTION FREQUENCY	
Check the box that describes the minimum inspection frequency utilized when conducting each inspection	
At least one inspection every 7 calendar days	☐
At least one inspection every 14 calendar days, with post-storm event inspections conducted within 24 hours after the end of any precipitation or snowmelt event that causes surface erosions	☐
• This is this a post-storm event inspection. Event Date: _____	☐
Reduced inspection frequency - Include site conditions that warrant reduced inspection frequency	☐
• Post-storm inspections at temporarily idle sites	☐
• Inspections at completed sites/area	☐
• Winter conditions exclusion	☐
Have there been any deviations from the minimum inspection schedule? If yes, describe below.	YES ☐ NO ☐

INSPECTION REQUIREMENTS*
i. Visually verify all implemented control measures are in effective operational condition and are working as designed in the specifications
ii. Determine if there are new potential sources of pollutants
iii. Assess the adequacy of control measures at the site to identify areas requiring new or modified control measures to minimize pollutant discharges
iv. Identify all areas of non-compliance with the permit requirements, and if necessary, implement corrective action
*Use the attached **Control Measures Requiring Routine Maintenance** and **Inadequate Control Measures Requiring Corrective Action** forms to document results of this assessment that trigger either maintenance or corrective actions

AREAS TO BE INSPECTED			
Is there evidence of, or the potential for, pollutants leaving the construction site boundaries, entering the stormwater drainage system or discharging to state waters at the following locations?			
	NO	YES	If "YES" describe discharge or potential for discharge below. Document related maintenance, inadequate control measures and corrective actions **Inadequate Control Measures Requiring Corrective Action** form
Construction site perimeter	☐	☐	
All disturbed areas	☐	☐	
Designated haul routes	☐	☐	
Material and waste storage areas exposed to precipitation	☐	☐	
Locations where stormwater has the potential to discharge offsite	☐	☐	
Locations where vehicles exit the site	☐	☐	
Other: _____	☐	☐	

CONTROL MEASURES REQUIRING ROUTINE MAINTENANCE

Definition: Any control measure that is still operating in accordance with its design and the requirements of the permit, but requires maintenance to prevent a breach of the control measure. These items are not subject to the corrective action requirements as specified in Part I.B.1.c of the permit.

Are there control measures requiring maintenance?	NO	YES	
	☐	☐	If "YES" document below

Date Observed	Location	Control Measure	Maintenance Required	Date Completed

INADEQUATE CONTROL MEASURES REQUIRING CORRECTIVE ACTION

Definition: Any control measure that is not designed or implemented in accordance with the requirements of the permit and/or any control measure that is not implemented to operate in accordance with its design. This includes control measures that have not been implemented for pollutant sources. If it is infeasible to install or repair the control measure immediately after discovering the deficiency the reason must be documented and a schedule included to return the control measure to effective operating condition as possible.

Are there inadequate control measures requiring corrective action?	NO	YES	
	☐	☐	If "YES" document below

Are there additional control measures needed that were not in place at the time of inspection?	NO	YES	
	☐	☐	If "YES" document below

Date Discovered	Location	Description of Inadequate Control Measure	Description of Corrective Action	Was deficiency corrected when discovered? YES/NO if "NO" provide reason and schedule to correct	Date Corrected

REPORTING REQUIREMENTS

The permittee shall report the following circumstances orally within twenty-four (24) hours from the time the permittee becomes aware of the circumstances, and shall mail to the division a written report containing the information requested within five (5) working days after becoming aware of the following circumstances. The division may waive the written report required if the oral report has been received within 24 hours.

All Noncompliance Requiring 24-Hour Notification per Part II.L.6 of the Permit

a. Endangerment to Health or the Environment

Circumstances leading to any noncompliance which may endanger health or the environment regardless of the cause of the incident (See Part II.L.6.a of the Permit)

This category would primarily result from the discharge of pollutants in violation of the permit

b. Numeric Effluent Limit Violations

- Circumstances leading to any unanticipated bypass which exceeds any effluent limitations (See Part II.L.6.b of the Permit)
- Circumstances leading to any upset which causes an exceedance of any effluent limitation (See Part II.L.6.c of the Permit)
- Daily maximum violations (See Part II.L.6.d of the Permit)

Numeric effluent limits are very uncommon in certifications under the COR400000 general permit. This category of noncompliance only applies if numeric effluent limits are included in a permit certification.

Has there been an incident of noncompliance requiring 24-hour notification?	NO	YES	
	☐	☐	If "YES" document below

Date and Time of Incident	Location	Description of Noncompliance	Description of Corrective Action	Date and Time of 24 Hour Oral Notification	Date of 5 Day Written Notification *

*Attach copy of 5 day written notification to report. Indicate if written notification was waived, including the name of the division personnel who granted waiver.

After adequate corrective action(s) and maintenance have been taken, or where a report does not identify any incidents requiring corrective action or maintenance, the individual(s) designated as the Qualified Stormwater Manager, shall sign and certify the below statement:

"I verify that, to the best of my knowledge and belief, all corrective action and maintenance items identified during the inspection are complete, and the site is currently in compliance with the permit."

Name of Qualified Stormwater Manager	Title of Qualified Stormwater Manager
Signature of Qualified Stormwater Manager	Date

Notes/Comments

GRADING AND EROSION CONTROL PLAN
& DETAILS

The Extended Detention Basin Pond 2 & 3 can be accessed from the end of Sunken Meadow Drive with a maintenance road to both. There is a gravel access ramp on the east corner of the Extended Detention Basin 3.

3. Inspections

Inspection and Frequency

 Annually inspect detention basin to insure that the basin continues to function as initially intended. The annual inspection should evaluate the forebay, pond side slopes, inflow channel, the spillway condition, the depth of sediment in the forebay, outlet structure, trash rack, downstream channel, and the condition of the downstream face of the pond. A site survey will be the best indication of excessive sediment buildup and degradation of the spillway. In addition, an inspection of the vegetation on the berm, inside the detention area and the downstream face of the spillway should be conducted. Any bare areas should be noted and repaired using native grasses. Any sloughing or erosion of the embankment should be noted and repaired. Items to record will include any items inspected and the mowing frequency of the vegetation on the facility.

 Just before annual storm seasons (that is, April and May) and following significant rainfall events, inspect for litter and debris that may plug outlets. Of notable importance, the inspections should also include the water quality orifice plate and trash rack to ensure plugging has not occurred.

 A baseline survey should be performed at the time of construction and comparison surveys conducted every ten to twenty years after to monitor overall performance of the pond. Results of inspections should be recorded and kept at a central location for review and recording by the district.

Inspection Personnel

A qualified engineer, surveyor, or certified storm water inspector should conduct inspections of the facility.

4.0 Operations

No specific operating instructions are required.

5.0 Maintenance

Maintenance of the Extended Detention Basin shall be in accordance with the guidelines included in Table EDB-1, below.

Table EDB-1		
Required Action	**Maintenance Objective**	**Frequency of Action**
Lawn mowing and lawn care	Occasional mowing to limit unwanted vegetation. Maintain irrigated turf	Routine – Depending on aesthetic requirements.

	grass as 2 to 4 inches tall and nonirrigated native turf grasses at 4 to 6 inches.	
Debris and litter removal	Remove debris and litter from the entire pond to minimize outlet clogging and improve aesthetics. Outlet structure trash racks should be clear of any blockage.	Routine – Including just before annual storm seasons (that is, April and May) and following significant rainfall events.
Erosion and sediment control	Repair and revegetate eroded areas in the basin and channels.	Nonroutine – Periodic and repair as necessary based on inspection.
Structural	Repair pond inlets, outlets, forebays, low flow channel liners, and energy dissipators whenever damage is discovered.	Nonroutine – Repair as needed based on regular inspections.
Inspections	Inspect basins to insure that the basin continues to function as initially intended. Examine the outlet for clogging, erosion, slumping, excessive sedimentation levels, overgrowth, embankment and spillway integrity, and damage to any structural element.	Routine – Annual inspection of hydraulic and structural facilities. Also check for obvious problems during routine maintenance visits, especially for plugging of outlets.
Nuisance control	Address odor, insects, and overgrowth issues associated with stagnant or standing water in the bottom zone.	Nonroutine – Handle as necessary per inspection or local complaints.
Sediment removal	Remove accumulated sediment from the forebay, micro-pool, and the bottom of the basin.	Nonroutine – Performed when sediment accumulation occupies 20 percent of the WQCV. This may vary considerably, but expect to do this every 10 to 20 years, as necessary per inspection if no construction activities take place in the tributary watershed. More often if they do. The forebay and

		the micro-pool will require more frequent cleanout than other areas of the basin, say every 1 or 2 years.

Maintenance of the Receiving Pervious Areas shall be in accordance with the guidelines included in Table EDB-1, below

Change table name, already used.

done

Table EDB-1

Required Action	Maintenance Objective	Frequency of Action
Inspection	Check for sediment accumulation and rill and gully development	Routine – at least twice annually for uniform cover and traffic impacts.
d litter removal	Remove litter and debris to prevent rill and gully development from preferential flow paths around accumulated debris, enhance aesthetics, and prevent floatables from being washed offsite.	Routine This should be done as needed based on inspection, but no less than two times per year.
Aeration	Aeration is done by punching holes in the ground using an aerator with hollow punches that pull the soil cores or "plugs" from the ground. Holes should be at least 2 inches deep and no more than 4 inches apart.	Routine – Should be performed at least once per year when the ground is not frozen.
Mowing	When starting from seed, mow native/drought-tolerant grasses only when required to deter weeds during the first three years. Following this period mowing of native/drought tolerant grass may stop or be reduced to maintain a length of no less than six inches.	Routine – Mowing of manicured grasses may vary from as frequently as weekly during the summer, to no mowing during the winter.

Inspect vegetation for uniform coverage.

done

addedFertilizer, Herbicide, and Pesticide Application	Use the minimum amount of biodegradable nontoxic fertilizers and herbicides needed to establish and maintain dense vegetation cover that is reasonably free of weeds. Fertilizer application may be significantly reduced or eliminated by the use of mulch-mowers, as opposed to bagging and removing clippings. To keep clippings out of receiving waters, maintain a 25-foot buffer adjacent to open water areas where clippings are bagged. Hand-pull the weeds in areas with limited weed problems.	Nonroutine – Frequency of fertilizer, herbicide, and pesticide application should be on an as-needed basis only and should decrease following establishment of vegetation.
Sediment removal	For Grass Buffers: Using a shovel, remove sediment at the interface between the impervious area and buffer For Grass Swales: Remove accumulated sediment near culverts and in channels to maintain flow capacity. Spot replace the grass areas as necessary.	Nonroutine – Remove sediment as needed based on inspection. Frequency depends on site-specific conditions. For planning purposes, it can be estimated that 3 to 10% of the swale length or buffer interface length will require sediment removal on an annual basis.

Include Irrigation scheduling and maintenance

done

done

Reseed and/or patch damage areas in buffer, sideslopes and/or channel to maintain healthy vegetative cover. Over time, and depending on pollutant load, portion of butter/sale may need to be rehabilitated due to sediment deposition. Periodic sediment removal will reduce the frequency of revegetation required. Expect turf replacement for the buffer interface area every 10 to 20 years.