FINAL DRAINAGE REPORT

for

OWL MARKETPLACE FILNG NO. 1

Falcon, Colorado

June 2024

Prepared for:

Meridian & Owl X, LLC
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El Paso County File No. VR2321

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APPENDICES

FINAL DRAINAGE REPORT

for

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Falcon, Colorado

1.0 CERTIFICATION STATEMENTS

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 El Paso County for drainage reports, and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omission on my part in preparing this report.

June 15, 2024

Katherine G. Varnum, P.E. Date
Colorado P.E. License No. 53459
For and on Behalf of Drexel, Barrell & Co.

DEVELOPER'S STATEMENT

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

Business Name: Meridian & Owl X, LLC.

By: 6.17.2024

Brian Zurek Date

Address: 450 N McClintock Drive
Chandler, AZ 85226

EL PASO COUNTY

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

For the County Engineer Date
CONDITIONS:

FINAL DRAINAGE REPORT

for

OWL MARKETPLACE FILING NO. 1

Falcon, Colorado

2.0 PURPOSE

This report is prepared by Drexel, Barrel & Co in support of the Owl Marketplace Filing No. 1 project. The purpose of this report is to identify onsite and offsite drainage patterns, storm sewer, inlet locations, and areas tributary to the site, and to safely route developed storm water runoff to adequate outfall facilities.

3.0 GENERAL SITE DESCRIPTION

Location and Existing Site Conditions

The site is located at the southwest corner of Owl Place and Meridian Road at 11745 Owl Pl. Lot 15 Falcon Ranchettes – SE ¼ of the SE ¼ of Section 1, Township 13S, Range 65W of the 6th P.M., El Paso County, Colorado. 11685 Owl Place, Lot 14 Falcon Ranchettes is also being replatted as part of this development in order to provide for public right-of-way in alignment with that directly existing to the south and proposed to the north.

There is one small home on the 11745 Owl Place portion of the property as well as a few minor out buildings. The site is bounded to the south by the Falcon Marketplace development, to the east by Meridian Road, and to the north and west by large-lot residential Falcon Ranchettes Subdivision. The lots immediately adjacent have recently been rezoned to commercial service (CS) for future development. The existing house is served by well and septic, that are to be removed/abandoned in accordance with CDPHE regulations. There are no existing irrigation facilities on the project site. The house and outbuildings located on 11685 Owl Place will remain.

The site is approximately 9.6 acres in size and is currently generally covered by native grass and vegetation. The eastern portion of the site gently slopes from the northeast to the southwest corner of the site. The East Branch of the Middle Tributary of Upper Black Squirrel Creek currently discharges flows from the roadside ditch along Meridian Road to the north, southwest across the property before discharging into the sub-regional detention facility SR4 to the south. A CLOMR to contain the floodplain, within a 10'x6' concrete box culvert across this portion of the property has been approved by FEMA (Case No. 22-08-0669R, December 21, 2022). The western portion of the property (11685 Owl Place) generally slopes from north to south. The West Branch of the Middle Tributary of Upper Black Squirrel Creek currently discharges flow from northwest to southeast across the property. The aforementioned CLOMR does not affect this portion of the property, and the floodplain will remain until future development and subsequent CLOMR/LOMR applications occur.

Proposed Site Conditions

Owl Marketplace is a proposed commercial development replatted to provide for four individual pad sites, serviced by an adjacent collector roadway – Meridian Park Drive. As previously mentioned, the adjacent property will also be included in this replat solely to provide for public right-of-way in alignment with adjacent developments. Meridian Park Drive is proposed to be extended from the Eastonville roundabout on the Falcon Marketplace property to Owl Place where future extension to the Bent Grass subdivision will take place by others. Dedication of right-of-way for Meridian Park Drive is proposed to straddle the current property line, by agreement with the adjacent landowner.

Soils

According to the Soil Survey of El Paso County Area, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the site is completely underlain by Columbine Gravelly Sandy Loam (Soil No. 19) All soils are type 'A' hydrologic soil group. See appendix for map.

Climate

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

Floodplain Statement

The effective floodplain, Zone A limits, for the Unnamed Tributary to Black Squirrel Creek (UTBSC), in the vicinity of the Owl Marketplace project, are defined on the FIRM for El Paso County, Colorado and Unincorporated Areas, Map Number 8041CO553G, Effective Date December 7, 2018.

A CLOMR to modify the effective floodplain was approved by FEMA, Case No. 22-08-0669R (December 21, 2022).

Drainage Basin

This property is located with the Falcon Drainage Basin, and was studied as part of the following basin planning studies and subsequent reports for neighboring developments.

Falcon Drainage Basin Planning Study, September 2015 **(DPBS – Matrix)**

Bent Grass MDDP Amendment & DBPS Amendment, September 2021
(DBPS Amendment – Galloway)

Request for Conditional Letter of Map Revision, Unnamed Tributary to Black Squirrel Creek, Falcon Owl Place, October 2022 (**CLOMR)**

Request for Letter of Map Revision, Unnamed Tributary to Black Squirrel Creek, Falcon Marketplace, March 2021. **(LOMR)**

Final Drainage Report for Falcon Marketplace, November 2019

Final Drainage Report, Falcon Ranchettes Filing No. 1A Meridian Storage, October 2023.

Relevant excerpts from previous drainage studies and reports and included in the appendix, and further discussed below.

Geotechnical Recommendations

Geologic conditions identified for the property will be those associated with the potentially expansive soils, shallow bedrock, seasonally shallow groundwater, and the currently mapped floodplain. These conditions can be satisfactorily mitigated through proper engineering design and construction practices. Refer to the Soils and Geology Study for the property by Entech Engineering, Inc. June 2023 for more information.

4.0 DRAINAGE CRITERIA

This drainage analysis has been prepared in accordance with the current El Paso County Drainage Criteria Manual. Calculations were performed to determine runoff quantities during the 5-year and 100-year frequency storms for historic and developed conditions using the Rational Method as required for basins containing less than 100-acres.

Hydraflow was utilized to determine the hydraulic capacity of the proposed storm system and the MHFD UD-Inlet v.4.06 worksheet was utilized to size the proposed inlet structures.

5.0 EXISTING CLOMR ANALYSIS

The Middle Branch of the UTBSC is currently conveyed under Owl Place via two 36" CMP near the northeast corner of the site. The 2-36" CMP culverts are severely undersized and partially filled with sediment. The culverts only convey 86-95 cfs, depending on tailwater depth. The remaining flow (approximately 825-834 cfs) in the 100-year event overtops Owl Place. See excepts in the appendix.

Under existing and proposed conditions, the East Branch of the UTBSC leaving the Owl Marketplace site discharges to Pond SR4 on the Falcon Marketplace development to the south. The pond was designed for a 100-year discharge of 1,016 cfs, which includes both West and East branches of the UTBSC.

6.0 EXISTING ONSITE CONDITION

Rational Method Existing Runoff Summary

EXISTING				
BASIN	**DP**	**Area (Ac.)**	**Q_5 (CFS)**	**Q_{100} (CFS)**
RMT064	X1		288.5	920.0
OSE1	E1	1.26	0.9	3.1
E2		1.95	0.5	3.7
	E2	3.21	1.4	6.9
E3	E3	2.34	0.6	4.4
E4	E4	0.33	0.1	0.7
MT060	X2		60.1	196.8

Offsite flows reaching Owl Place from the roadside ditch along Meridian Road to the north are represented by **Design Point X1.** These flows are established by the DBPS (Matrix) and subsequent DBPS Amendment (Galloway) studies as DBPS Reach RMT064. The most recent CLOMR study determined rates of Q_5=288.5. cfs and Q_{100}=920 cfs for this section. See further description below.

An offsite basin for adjacent Lot 14 Falcon Ranchettes has not been delineated on the existing conditions map, but excerpts from the Falcon DBPS (Matrix) and DBPS Amendment (Galloway) have been included in the appendix to establish the existing flows entering Pond SR4 at the south of the lot, at **Design Point X2**. These flows are represented by DBPS Reach MT060 and consist of rates of Q_5=60.1 cfs and Q_{100}=196.8 cfs.

Basin OSE1 represents an offsite 1.26-acre basins to the north of Owl Place. Runoff rates of Q_5=0.9 cfs and Q_{100}=3.1 cfs are generated by this basin, and generally travel to the south towards the low point in Owl Place **(Design Point E1)** before discharging on to the Owl Marketplace property.

Basin E2 represents a 1.95 acre basin on the north side of the Owl Marketplace property to the south of Owl Place. This basin contains the Upper Black Squirrel Creek Tributary and as such flow generated by this basin (Q_5=0.5 cfs and Q_{100}=3.7 cfs) combine with those from offsite basin OSE1 and travel towards the center of the basin before following the tributary and discharging out the southwest property line at **Design Point E2.**

Basin E3 represents 3.21-acres at the south of the Owl Marketplace property. Runoff rates of Q_5=0.6 cfs and Q_{100}=4.4 cfs are generated by this basin, and generally travel to the southwest towards the property corner at **Design Point E3** before discharging into the adjacent subregional pond SR4 on the Falcon Marketplace property.

Basin E4 covers 0.33-acres along Meridian Road at the eastern boundary of the Owl Marketplace property. Runoff rates of Q_5=0.1 cfs and Q_{100}=0.7 cfs are generated by this basin, and generally travel to the east and south towards Meridian Road and **Design Point E4.**

7.0 PROPOSED CONDITION CLOMR ANALYSIS

The Middle Branch of the UTBSC flows southwest across the property and is proposed to be contained within a 10'x6' box culvert that will discharge into the Subregional Pond SR4 recently constructed on the Falcon Marketplace property.

Pond SR4 was designed for a 100-year discharge of 1,016 cfs, which includes both West and Middle branches of the UTBSC. The 100-year water surface elevation upstream of the pond as shown in the LOMR is 6902.5 (NAVD88), or 6898.7 (NGVD29). The starting HGL for the box culvert analysis was conservatively placed at the top of pipe elevation of 6895.84 feet (NGVD29) for analyzing flows to the East branch only. However, an additional analysis was performed with a starting HGL of 6898.7, to evaluate the backwater effects from the pond.

The proposed box culvert will convey the entire 100-year event (920 cfs), as established by the Falcon DBPS with an HGL of 6911.31 at the proposed headwall upstream of Owl Place, which is more than one foot below Owl Place and contained within the existing and proposed channel upstream. Channel grading will be required for approximately 30 feet to tie into the existing creek profile upstream. The channel side slopes will be reduced from approximately 5.5H:1V to 1.8H:1V and protected with Type M grouted riprap. A proposed Type VI stilling basin and additional riprap slope protection is proposed at the outfall into Pond SR4. An extension of the existing trickle channel will provide connection to the existing low flow path through the facility.

8.0 PROPOSED ONSITE CONDITION

As noted in Section 6.0 of this report, offsite flows reaching Owl Place from the roadside ditch along Meridian Road to the north are represented by **Design Point X1.** These flows are established by the DBPS (Matrix) and subsequent DBPS Amendment (Galloway) studies as DBPS Reach RMT064 and consist of rates of Q_5=288.5. cfs and Q_{100}=920 cfs. As noted above in Section 7.0 a proposed public 10'x6' box culvert will convey the full 100-year event without overtopping Owl Place from this point to Pond SR4 to the south.

An offsite basin for adjacent Lot 14 Falcon Ranchettes has not been delineated on the developed conditions map, as no changes - beyond those already incorporated into the following developed condition analysis – are proposed for Lot 14. The lot will remain in its current residential condition and any further development of Lot 14 (or Lot 5 as replatted with Owl Marketplace) will require additional drainage analysis and possible CLOMR to remove portions of the lot from the remaining floodplain. Flows reaching Pond SR4 to the south will remain as described in the existing condition as **Design Point X2** (Q_5=60.1 cfs and Q_{100}=196.8 cfs).

Basins A through D represent each of the 4 commercial pad sites within the Owl Marketplace property. For this initial stage of overlot development, each lot/pad site will be graded to direct flows towards its southwest corner, where runoff will be intercepted by a temporary sediment basins, before discharging into the proposed private 18" RCP storm sewer stubs provided to each lot. The storm sewer stubs will remain in place for use by the individual lot users.

Design Point 2 is located at the manhole where Basin B combines with **Design Point DP1** (Basin A). Flows continue south from this manhole via proposed public 24" RCP storm sewer.

Design Point 3 is located at the manhole where Basin C combines with Design Point DP2. Flows continue south from this manhole via proposed public 24" RCP storm sewer.

Rational Method Runoff Summary

DEVELOPED				
BASIN	**DP**	**Area (Ac.)**	**Q_5 (CFS)**	**Q_{100} (CFS)**
A	1	1.21	5.0	9.1
B		0.69	2.8	5.2
	2	1.89	7.7	14.1
C		1.09	4.5	8.2
	3	2.98	12.0	22.0
D	4	1.11	4.6	8.4
	5	0.00	0.6	1.5
	6	0.00	1.0	2.1
E		0.75	3.0	5.5
	7	1.86	7.8	14.6
F		0.54	2.4	4.3
	8	0.54	3.4	6.4
	9	5.38	22.1	40.9
G	10	0.23	0.1	0.6
H	11	1.46	4.1	8.2

Design Point 4 is located at the proposed temporary sediment basin and subsequent private 18" RCP storm sewer stub for the southernmost basin D.

Due to the concurrent development to the north (Falcon Ranchettes Filing No. 1a – Meridian Storage), the flowrates entering this property from the north are based on those defined in the aforementioned report for Falcon Ranchettes Filing No. 1a, by Galloway & Co. See appendix for excerpts and further information. **Design Point 5** receives rates of Q_5=0.6 cfs and Q_{100}=1.5 cfs (identified as DP12 in Galloway report) and **Design Point 6** (identified as DP13 in the Galloway report) receives flows of Q_5=1.0 cfs and Q_{100}=2.1 cfs. These design points are located at the north end of Meridian Park Drive at Owl Place. These flows are inclusive of any bypass flow from the proposed upstream at-grade inlets, and are straight added to the downstream design points further described in this report.

Basin E covers 0.75-acres and includes Owl Place along the property boundary to the north, as well as the eastern half of the proposed Meridian Park Drive. Within the basin, flows will travel west along proposed curb and gutter on Owl Place, before combining with those flows from Design Point 5, turning south and traveling along the proposed easterly curb and gutter of Meridian Park Drive. Flows will be captured in their entirety by a proposed public 10' Type R sump inlet located at **Design Point 7.** Emergency overflow for this inlet is to the east behind the curb, and south to the existing inlet on Eastonville Road.

Basin F represents the western half of Meridian Park Drive and a small portion of the southwestern part of Owl Place. Runoff from this basin, which totals 0.54 acres in size, will combine with that from Design Point 6 and travel to the south along the westerly curb line

of Meridian Park Drive towards a proposed low point and public 10' Type R sump inlet located at **Design Point 8.** Emergency overflow for this inlet is to the west behind the curb.

Design Point 9 represents the piped flows captured by the proposed sump inlet at Design Point 8 and piped flows from Design Point 3 and Design Point 7. Flows continue to the south from this manhole via proposed public 30" RCP storm sewer. Flows will ultimately discharge into the easterly modified forebay of the existing Pond SR4 to the southwest.

Basin G is 0.23 acres located to the west of Meridian Park Drive. Flows within this basin will sheet flow overland towards **Design Point 10** and discharge directly into the subregional detention facility SR4 to the southwest.

Basin H covers 1.46 acres which contains the western side of Meridian Road and the area separating the site and roadway. Flows within this basin will sheet flow are contained within Meridian Road before continuing to the south via curb and gutter, and turning west on Eastonville Road to be captured by the existing curb inlet. This basin covers the entire area tributary to this existing inlet confirming that it has capacity for the additional developed flows.

No portion of the proposed area of disturbance (Basins A-H) will be treated for water quality prior to discharge into Pond SR4. As described below in section 9.0 below, Pond SR4 provides treatment for the upstream watershed through a modified outlet plate. All disturbed areas are ultimately tributary to Pond SR4.

9.0 DETENTION & WATER QUALITY TREATMENT

The existing subregional detention facility Pond SR4 to the southwest was designed to detain for the upstream watershed, and appears to be functioning as intended. Pond SR4 also provides water quality treatment for the same watershed through a modified outlet structure with orifice plate designed to release the WQCV over a 40-hour period. The impervious percentage used in the original design calculations for the upstream watershed will increase by 0.5% with the commercial development of Owl Marketplace Lots 1-4. Pond SR4 has sufficient capacity to accommodate the increase in flows without modification, other than that described below, as detailed by updated calculations in the appendix. Therefore, no further detention or treatment for water quality is required for the development of Owl Marketplace Lots 1-4.

Future development in the watershed, including Owl Marketplace Lot 5, will require analysis of the existing Pond SR4 to determine any necessary modifications and/or provide for onsite detention and water quality treatment as required by El Paso County drainage criteria.

Modifications will be made to Pond SR4 to allow for the incoming flow from the Owl Marketplace project to be received in a safe and controlled manner. The box culvert will discharge into a Type VI stilling basin before being discharged into a proposed short section of concrete trickle channel, which will then tie into the existing trickle channel. The site storm sewer will discharge directly into the existing forebay, modified with a new baffle.

Stilling basin, forebay and trickle channel calculations are included in the appendix.

10.0 FOUR-STEP PROCESS

This project conforms to the El Paso County Four Step Process. The process for this site focuses on reducing runoff volumes, accounting for water quality capture volume treatment (WQCV), stabilizing drainage ways and implementing long-term source controls.

1. ***Employ Runoff Reduction Practices***: Proposed impervious areas on this site (roofs, asphalt/sidewalk) will sheet flow across landscaped ground as much as possible to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets and storm sewer system. This will minimize directly connected impervious areas within the project site.

2. **Implement BMP's that provide a Water Quality Capture Volume with slow release:** Runoff from this project will be routed through the sub-regional detention facility Pond SR4 immediately to the southwest of the Owl Marketplace property. Water quality treatment is provided for the upstream watershed as described above.

3. ***Stabilize Drainage Ways:*** The existing tributary that bisects the site and subsequent floodplain will be modified by installing a 10'x6' box culvert to intercept the upstream flows and direct towards the existing sub-regional detention facility SR4 to the southwest.

4. ***Implement Site Specific and Other Source Control BMP's***: Standard commercial source control will be utilized in order to minimize potential pollutants entering the storm system. Example source control measures consist of: indoor storage of household chemicals; and trash receptacles in common areas.

11.0 DBPS ANALYSIS

Falcon DPBS (Matrix)

The Falcon DBPS watershed establishes three major basins, including the "Middle Tributary" which covers this property. The unnamed tributary to Black Squirrel Creek (UTBSC) located in the "Middle Tributary" consists of an "East Branch" and "West Branch". The "East Branch" enters this property at the northeast corner, after passing through existing culverts at Owl Place. The "West Branch" is located on the adjacent property to the west. The two converge just north of the Falcon Marketplace site before discharging into existing sub-regional detention facility SR4. The Falcon DBPS identifies junctions north and south of the project site, JMT050 and JMT060. These are summarized below, and excerpts are provided in the appendix.

The Falcon DBPS specifies reach improvements between junctions JMT050 and JMT060, specifically identified as reach RMT064. These improvements include a recommendation for small drop structures with toe protection.

Future Land Use Condition - Peak Discharge				
Model Location	**Physical Location**	**Branch**	**Proximity to Owl Place**	**Future Flow Q100 (cfs)**
JMT050	Bent Grass Meadows Drive & Meridian Road	East Branch	Upstream of site	850
JMT060	Eastonville Road & Meridian Road	East and West Convergence	Downstream of site	1000

Bent Grass DPBS Amendment (Galloway)

The Bent Grass DBPS Amendment addresses a drainage diversion took place as part of the Bent Grass Residential Filing No. 1 development, specifically the rerouting of the UTBSC West Tributary to the east towards the intersection of Meridian Road and Bent Grass Meadows Drive. As a result of this diversion, a new junction was created in the Middle Tributary – JMT060a. This junction is located just south of JMT050 from the Falcon DPBS (Matrix) and is summarized below.

Future Land Use Condition - Peak Discharge				
Model Location	**Physical Location**	**Branch**	**Proximity to Owl Place**	**Future Flow Q100 (cfs)**
JMT060a	Bent Grass Meadows Drive & Meridian Road	East Branch	Upstream of site	909.3

The Bent Grass DBPS Amendment recommends a 15' wide bottom channel with 4:1 side slopes at 6.5' deep with a longitudinal slope of 0.30% for reach RMT064.

Falcon Ranchettes Filing No. 1a – Meridian Storage (Galloway)

The Falcon Ranchettes Filing No. 1a development located directly north of Owl Place, includes regrading a portion of the UTBSC East Branch along Meridian Road with small drop structures with toe protection. The channel has been designed for a 925-cfs design flow as specified in the Bent Grass DBPS Amendment.

The improvements are intended to be intercepted by the 10'x6' box culvert proposed with this development. Per discussions with the adjacent developer, construction is expected to run concurrently with the Owl Marketplace project and design has been coordinated accordingly.

Owl Place CLOMR Analysis

This Owl Marketplace development includes regrading and rerouting a portion of the UTBSC East Branch. The improvements intercept the existing creek immediately north of Owl Place and convey is via 10'x6' box culvert to the subregional detention facility SR4 directly to the south. The box culvert is designed to convey the full 100-year discharge.

The Falcon DBPS did not include a junction on the East Branch immediately upstream of the convergence at pond SR4. Therefore, the Owl Place CLOMR modified the HMS model to create a new junction located at the southern boundary of this development. This junction is summarized below.

Future Land Use Condition - Peak Discharge				
Model Location	**Physical Location**	**Branch**	**Proximity to Owl Place**	**Future Flow Q100 (cfs)**
JMT051	Immediately upstream of Pond SR4	East Branch	Downstream of site	920

As mentioned above, a Conditional Letter of Map Revision (CLOMR) was approved by FEMA (Case No. 22-08-0669R) on December 21, 2022.

Referenced portions of the CLOMR are included in the appendix.

DBPS Analysis conclusions

Per the Falcon DBPS, channel improvements are required to stabilize RMT064 of the UTBSC East Branch. The table below compares the proposed design flow against previous reports.

Future Land Use Condition - Peak Discharge				
Model Location	**Physical Location**	**Branch**	**Proximity to Owl Place**	**Future Flow Q100 (cfs)**
RMT064	North of Owl Place, South of Bent Grass Meadows Drive	East Branch	-	925
JMT050 (Falcon DBPS)	Bent Grass Meadows Drive & Meridian Road	East Branch	Upstream of site	850
JMT060a (Bent Grass Amendment)	Bent Grass Meadows Drive & Meridian Road	East Branch	Upstream of site	909.3
JMT051 (Owl Place CLOMR)	Immediately upstream of Pond SR4	East Branch	Downstream of site	920

Due to the added junctions (JMT060a and JMT051), no revisions to the existing HMS models are needed for identifying the proposed design flow for RMT064.

There are no proposed changes to the West Tributary proposed as part of this project. The property encumbered by this tributary and associated floodplain (Lot 14 Falcon Ranchettes – Lot 5, Owl Marketplace as replatted), will be required to undergo additional drainage analysis in the future at time of development.

12.0 OWNERSHIP AND MAINTENANCE

It is anticipated that all public drainage facilities are to be owned and maintained by El Paso County. All private drainage facilities are to be owned and maintained initially by CD Meridian & Owl X, LLC, until such time that the individual lots transfer ownership upon development.

13.0 DRAINAGE/BRIDGE FEES

The project lies within the Falcon Drainage Basin. The property is already platted, but since there will be an increase in impervious acreage payment of additional drainage fees shall be required. Lots 14 and 15 of Falcon Ranchettes were platted as 5-acre residential lots. The Falcon DBPS estimated that 3% of the lot acreage would be considered as impervious acreage. The difference between the existing 3% impervious coverage and the proposed is listed in the table below.

		Existing	Proposed	
Location	Acreage	5-acre residential (3% Impervious) Acres	Commercial area (95% Impervious) Acres	Additional Impervious Acres
Lot 15 (Lots 1-4 Replat)	4.61	0.15	4.23	4.08
Lot 14 (Lot 5 Replat)	5.00	0.15	4.00	3.85

The additional impervious acreage equates to 7.93-acres, and as such the following fees will be required at final plat recording.

2023 Drainage Fee
$37,256 x 7.93 Impervious Acres = $295,440.08

2023 Bridge Fee
$5,118 x 7.93 Impervious Acres = $40.585.74

14.0 REIMBURSABLE COSTS

The Falcon DBPS – Fee Development categorizes improvements into Developer Costs, County Costs, and Metro District Costs. Items identified as Developer Costs (those incurred by the Developer) are eligible for reimbursement. County Costs and Metro District Costs are not eligible for reimbursement. The applicable reach is classified in the DBPS as follows:

Reach/Feature	Reach Length (ft)	Improvement	Cost Category	Eligible for Reimbursement	Cost As Shown in Falcon DBPS
RMT064	3,358	Small Drop Structures w/Toe Protection	County	No	$1,231,110 ($366/LF)

The developer intends to amend the Falcon DBPS to allow for the costs of 1,020-LF of RMT064 to become reimbursable by the process outlined in County criteria.

15.0 COST ESTIMATE

An Engineering Opinion of Probably Cost for all drainage improvements is provided below:

ITEM	QUANTITY	UNIT	UNIT COST	COST
REIMBURSABLE PUBLIC FACILITIES ESTIMATE				
10'X6' CONCRETE BOX CULVERT	1020	LF	$ 1,000.00	$ 1,020,000.00
10'X6' 45° BEND W/MH ACCESS	3	EA	$ 12,500.00	$ 37,500.00
10'X6' 45° BEND	2	EA	$ 8,500.00	$ 17,000.00
TYPE M GROUTED RIPRAP DROP WITH TOEWALL	135	CY	$ 225.00	$ 30,375.00
HEADWALL WITH HANDRAIL	1	EA	$ 10,000.00	$ 10,000.00
GUARD RAIL	75	LF	$ 150.00	$ 11,250.00
Improvements within Pond SR4				
TYPE VI STILLING BASIN	1	EA	$ 15,000.00	$ 15,000.00
CONCRETE TRICKLE CHANNEL EXTENSION	50	LF	$ 35.00	$ 1,750.00
REMOVE AND REPLACE EX. TYPE M GROUTED RIPRAP	1	LS	$ 10,000.00	$ 10,000.00
REIMBURSABLE PUBLIC DRAINAGE FACILITIES TOTAL				**$ 1,152,875.00**
NON-REIMBURSABLE PRIVATE DRAINAGE FACILITIES				
18" RCP STORM SEWER	152	LF	$ 76.00	$ 11,552.00
24" RCP STORM SEWER	417	LF	$ 91.00	$ 37,947.00
30" RCP STORM SEWER	126	LF	$ 114.00	$ 14,364.00
30"X45° RC BEND	1	EA	$ 500.00	$ 500.00
TYPE II STORM MANHOLE	4	EA	$ 3,500.00	$ 14,000.00
10' TYPE R CURB INLET	2	EA	$ 5,500.00	$ 11,000.00
FOREBAY BAFFLE MODIFICATIONS	1	LS	$ 2,500.00	$ 2,500.00
NON-REIMBURSABLE PRIVATE DRAINAGE FACILITIES TOTAL				**$ 91,863.00**

16.0 CONCLUSIONS

The Owl Marketplace Filing No. 1 Final Drainage Report has been prepared in accordance with El Paso County criteria. The downstream facilities are adequate to receive runoff from this development and are functioning as intended. The site runoff will not adversely affect the downstream and surrounding developments. This report is in general conformance with all previously prepared reports for this area.

After grading and the installation of the box culvert is complete, a LOMR will be submitted to FEMA to revise the FIRM map and remove the floodplain from the eastern portion of the site (Lots 1-4 Owl Marketplace, as replatted). The floodplain will remain on Lot 14 Falcon Ranchettes (Lot 5 Owl Marketplace as replatted) until such time that property develops and a separate CLOMR/LOMR process is completed.

Onsite detention and/or treatment of runoff for water quality will not be required for the commercial development of Lots 1-4 of this subdivision.

17.0 REFERENCES

The sources of information used in the development of this study are listed below:

1. City of Colorado Springs/El Paso County Drainage Criteria Manual, May 2014.

2. Urban Storm Drainage Criteria Manuals, Urban Drainage and Flood Control District. June 2001, Revised April 2008.

3. Request for Conditional Letter of Map Revision, Unnamed Tributary to Black Squirrel Creek, Prepared by Drexel, Barrell & Co., October 25, 2022.

5. Natural Resources Conservation Service (NRCS) Web Soil Survey

7. EL Paso County Board Resolution No 15-042: El Paso County adoption of Chapter 6 and Section 3.2.1, Chapter 13 of the City of Colorado Springs Drainage Criteria Manual, May 2014.

8. Falcon Drainage Basin Planning Study. Prepared by Matrix Design Group, September 2015.

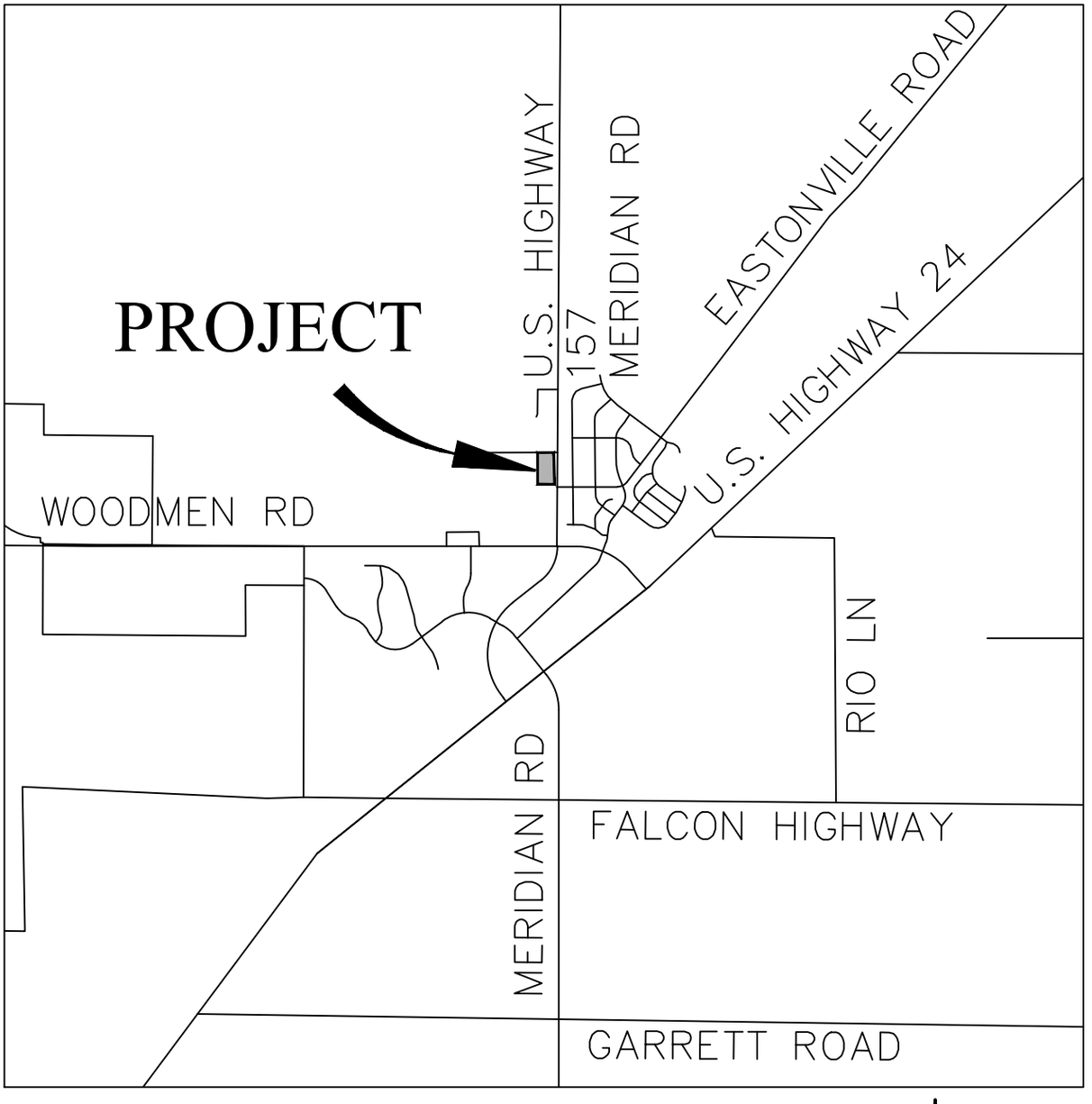
9. Final Drainage Report for Falcon Marketplace. Prepared by Drexel, Barrell & Co. November 2019.

10. El Paso County Engineering Criteria Manual , July 18, 2023.

11. MDDP & DBPS Amendment Bent Grass Development. Prepared by Galloway & Co. February 2021.

APPENDIX

VICINITY MAP



Vicinity Map
Not to scale

-N-

OWL PLACE
EL PASO COUNTY, CO
VICINITY MAP

Drexel, Barrell & Co.
Engineers • Surveyors

DATE:

JOB NO: **21611-00CSCV**

DWG. NO. **VMAP**

SHEET 1 OF 1

APPENDIX
SOILS MAP

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,180 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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 20, Sep 2, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	5.2	100.0%
Totals for Area of Interest		**5.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Fans, fan terraces, flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

APPENDIX
FLOODPLAIN MAP

National Flood Hazard Layer FIRMette

FEMA

104°36'50"W 38°56'57"N

104°36'12"W 38°56'29"N

Feet

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

1:6,000

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
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- 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 1/25/2023 at 12:53 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.

APPENDIX
HYDROLOGY CALCULATIONS

PROJECT INFORMATION

PROJECT:	Owl Marketplace
PROJECT NO:	21611-01CSCV
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	3/11/2024

Drexel, Barrell & Co.

	C2*	C5*	C10*	C100*	% IMPERV
Business - Commercial Area		0.81		0.88	95
Pasture/Meadow/Lawn		0.08		0.35	0
Streets - Gravel		0.90		0.96	100
Streets - Paved		0.90		0.96	100

*C-Values and Basin Imperviousness based on Table 6-6, City of Colorado Springs Drainage Criteria Manual

SUB-BASIN	SURFACE DESIGNATION	AREA ACRE	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	% IMPERV
EXISTING							
OSE1	Business - Commercial Area	*0.00*		*0.81*		*0.88*	*95*
	Pasture/Meadow/Lawn	*0.94*		*0.08*		*0.35*	*0*
	Streets - Gravel	*0.20*		*0.90*		*0.96*	*100*
	Streets - Paved	*0.12*		*0.90*		*0.96*	*100*
OSE1 TOTAL	*WEIGHTED AVERAGE*	1.26		0.20		0.41	16
E2	Business - Commercial Area	*0.00*		*0.81*		*0.88*	*95*
	Pasture/Meadow/Lawn	*1.95*		*0.08*		*0.35*	*0*
	Streets - Paved	*0.00*		*0.90*		*0.96*	*100*
E2 TOTAL	*WEIGHTED AVERAGE*	1.95		0.08		0.35	0
E3	Business - Commercial Area	*0.00*		*0.81*		*0.88*	*95*
	Pasture/Meadow/Lawn	*2.34*		*0.08*		*0.35*	*0*
	Streets - Paved	*0.00*		*0.90*		*0.96*	*100*
E3 TOTAL	*WEIGHTED AVERAGE*	2.34		0.08		0.35	0
E4	Business - Commercial Area	*0.00*		*0.81*		*0.88*	*95*
	Pasture/Meadow/Lawn	*0.33*		*0.08*		*0.35*	*0*
	Streets - Paved	*0.00*		*0.90*		*0.96*	*100*
E4 TOTAL	*WEIGHTED AVERAGE*	0.33		0.08		0.35	0
DEVELOPED							
A	Business - Commercial Area	*1.21*		*0.81*		*0.88*	*95*
	Pasture/Meadow/Lawn	*0.00*		*0.08*		*0.35*	*0*
	Streets - Paved	*0.00*		*0.90*		*0.96*	*100*
A TOTAL	*WEIGHTED AVERAGE*	1.21		0.81		0.88	95
B	Business - Commercial Area	*0.69*		*0.81*		*0.88*	*95*
	Pasture/Meadow/Lawn	*0.00*		*0.08*		*0.35*	*0*
	Streets - Paved	*0.00*		*0.90*		*0.96*	*100*
B TOTAL	*WEIGHTED AVERAGE*	0.69		0.81		0.88	95

PROJECT INFORMATION

PROJECT:	Owl Marketplace
PROJECT NO:	21611-01CSCV
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	3/11/2024

Drexel, Barrell & Co.

	C2*	C5*	C10*	C100*	% IMPERV
Business - Commercial Area		0.81		0.88	95
Pasture/Meadow/Lawn		0.08		0.35	0
Streets - Gravel		0.90		0.96	100
Streets - Paved		0.90		0.96	100

*C-Values and Basin Imperviousness based on Table 6-6, City of Colorado Springs Drainage Criteria Manual

C	Business - Commercial Area	*1.09*		*0.81*		*0.88*	*95*
	Pasture/Meadow/Lawn	*0.00*		*0.08*		*0.35*	*0*
	Streets - Paved	*0.00*		*0.90*		*0.96*	*100*
C TOTAL	*WEIGHTED AVERAGE*	1.09		0.81		0.88	95
D	Business - Commercial Area	*1.11*		*0.81*		*0.88*	*95*
	Pasture/Meadow/Lawn	*0.00*		*0.08*		*0.35*	*0*
	Streets - Paved	*0.00*		*0.90*		*0.96*	*100*
D TOTAL	*WEIGHTED AVERAGE*	1.11		0.81		0.88	95
E	Business - Commercial Area	*0.20*		*0.81*		*0.88*	*95*
	Pasture/Meadow/Lawn	*0.00*		*0.08*		*0.35*	*0*
	Streets - Paved	*0.55*		*0.90*		*0.96*	*100*
E TOTAL	*WEIGHTED AVERAGE*	0.75		0.88		0.94	99
F	Business - Commercial Area	*0.12*		*0.81*		*0.88*	*95*
	Pasture/Meadow/Lawn	*0.00*		*0.08*		*0.35*	*0*
	Streets - Paved	*0.42*		*0.90*		*0.96*	*100*
F TOTAL	*WEIGHTED AVERAGE*	0.54		0.88		0.94	99
G	Business - Commercial Area	*0.00*		*0.81*		*0.88*	*95*
	Pasture/Meadow/Lawn	*0.23*		*0.08*		*0.35*	*0*
	Streets - Paved	*0.00*		*0.90*		*0.96*	*100*
G TOTAL	*WEIGHTED AVERAGE*	0.23		0.08		0.35	0
H	Business - Commercial Area	*0.00*		*0.81*		*0.88*	*95*
	Pasture/Meadow/Lawn	*0.47*		*0.08*		*0.35*	*0*
	Streets - Paved	*0.99*		*0.90*		*0.96*	*100*
H TOTAL	*WEIGHTED AVERAGE*	1.46		0.63		0.76	68

PROJECT INFORMATION

PROJECT: Owl Marketplace
PROJECT NO: 21611-01CSCV
DESIGN BY: KGV
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Final
DATE: 3/11/2024

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

DEVELOPED TIME OF CONCENTRATION STANDARD FORM SF-2

SUB-BASIN DATA					INITIAL/OVERLAND TIME (t_i)			TRAVEL TIME (t_t)				TIME OF CONC. t_c		FINAL t_c
BASIN	DESIGN PT:	C_5	C_{100}	AREA	LENGTH	SLOPE	t_i	LENGTH	SLOPE	VEL.	t_t	COMP.	*MINIMUM*	
				Ac	Ft	%	Min	Ft	%	FPS	Min	t_c	t_c	Min
EXISTING														
RMT064	**X1**	Flow directly added												
OSE1	**E1**	0.20	0.41	1.26	100	3.0	11.7	150	1.0	1.5	1.7	13.3	*5.0*	**13.3**
E2		0.08	0.35	1.95	100	2.0	15.1	340	3.0	4.3	1.3	16.5	*5.0*	**16.5**
OS1+E2	**E2**	0.13	0.37	3.21	From OSE1		13.3	350	3.0	4.3	1.4	14.7	*5.0*	**14.7**
E3	**E3**	0.08	0.35	2.34	100	2.0	15.1	410	3.0	4.3	1.6	16.7	*5.0*	**16.7**
E4	**E4**	0.08	0.35	0.33	50	2.0	10.7	550	2.0	3.8	2.4	13.1	*5.0*	**13.1**
MT060	**X2**	Flow directly added												
DEVELOPED														
A	**1**	0.81	0.88	1.21	50	3.0	2.7	366	2.3	4.3	1.4	4.1	*5.0*	**5.0**
B		0.81	0.88	0.69	50	3.0	2.7	291	2.5	4.3	1.1	3.8	*5.0*	**5.0**
DP1+B	**2**	0.81	0.88	1.89	From DP1		5.0	110	1.4	11.3	0.2	5.2	*5.0*	**5.2**
C		0.81	0.88	1.09	50	3.0	2.7	318	2.5	4.3	1.2	3.9	*5.0*	**5.0**
DP2+C	**3**	0.81	0.88	2.98	From DP2		5.2	167	1.3	11.3	0.2	5.4	*5.0*	**5.4**
D	**4**	0.81	0.88	1.11	50	3.0	2.7	270	2.3	4.3	1.0	3.7	*5.0*	**5.0**
Offsite	**5**	Flow directly added from offsite basin - Falcon Ranchettes #1A DP12												
Offsite 2	**6**	Flow directly added from offsite basin - Falcon Ranchettes #1A DP13												
E		0.88	0.94	0.75	50	2.0	2.4	1043	2.0	3.8	4.6	6.9	*5.0*	**6.9**
DP4+DP5+E	**7**	0.84	0.90	1.86	From Basin E		6.9					6.9	*5.0*	**6.9**
F		0.88	0.94	0.54	50	2.0	2.3	617	1.5	3.8	2.7	5.0	*5.0*	**5.0**
DP6+F	**8**	0.88	0.94	0.54	From Basin F		5.0				0.0	5.0	*5.0*	**5.0**
DP3+DP7+DP8	**9**	0.83	0.89	5.38	From DP7		6.9	45	1.2	11.3	0.1	7.0	*5.0*	**7.0**
G	**10**	0.08	0.35	0.23	50	20.0	5.0	669	1.7	3.8	2.9	7.9	*5.0*	**7.9**
H	**11**	0.63	0.76	1.46	50	3.4	4.1	909	2.2	3.8	4.0	8.1	*5.0*	**8.1**

PROJECT INFORMATION

PROJECT:	Owl Marketplace
PROJECT NO:	21611-01CSCV
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	3/11/2024

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

DEVELOPED RUNOFF — **5 YR STORM** — **P1= 1.50**

BASIN (S)	DIRECT RUNOFF						
	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)
EXISTING							
RMT064	X1						**288.5**
OSE1	E1	1.26	0.20	13.3	0.25	3.60	**0.9**
E2		1.95	0.08	16.5	0.16	3.26	**0.5**
	E2	3.21	0.13	14.7	0.41	3.44	**1.4**
E3	E3	2.34	0.08	16.7	0.19	3.23	**0.6**
E4	E4	0.33	0.08	13.1	0.03	3.62	**0.1**
MT060	X2						**60.1**
DEVELOPED							
A	1	1.21	0.81	5.0	0.98	5.09	**5.0**
B		0.69	0.81	5.0	0.56	5.09	**2.8**
	2	1.89	0.81	5.2	1.53	5.04	**7.7**
C		1.09	0.81	5.0	0.88	5.09	**4.5**
	3	2.98	0.81	5.4	2.41	4.98	**12.0**
D	4	1.11	0.81	5.0	0.90	5.09	**4.6**
	5						**0.6**
	6						**1.0**
E		0.75	0.88	6.9	0.66	4.63	**3.0**
	7	1.86	0.84	6.9	1.56	4.63	**7.8**
F		0.54	0.88	5.0	0.47	5.08	**2.4**
	8	0.54	0.88	5.0	0.47	5.08	**3.4**
	9	5.38	0.83	7.0	4.45	4.61	**22.1**
G	10	0.23	0.08	7.9	0.02	4.43	**0.1**
H	11	1.46	0.63	8.1	0.93	4.39	**4.1**

PROJECT INFORMATION

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PROJECT NO:	21611-01CSCV
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AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	3/11/2024

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

DEVELOPED RUNOFF **100 YR STORM** **P1= 2.52**

BASIN (S)	DIRECT RUNOFF						
	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)
EXISTING							
RMT064	X1						**920.0**
OSE1	E1	1.26	0.41	13.3	0.52	6.04	**3.1**
E2		1.95	0.35	16.5	0.68	5.47	**3.7**
	E2	3.21	0.37	14.7	1.20	5.78	**6.9**
E3	E3	2.34	0.35	16.7	0.82	5.43	**4.4**
E4	E4	0.33	0.35	13.1	0.12	6.08	**0.7**
MT060	X2						**196.8**
DEVELOPED							
A	1	1.21	0.88	5.0	1.06	8.55	**9.1**
B		0.69	0.88	5.0	0.60	8.55	**5.2**
	2	1.89	0.88	5.2	1.67	8.48	**14.1**
C		1.09	0.88	5.0	0.96	8.55	**8.2**
	3	2.98	0.88	5.4	2.62	8.37	**22.0**
D	4	1.11	0.88	5.0	0.98	8.55	**8.4**
	5						**1.5**
	6						**2.1**
E		0.75	0.94	6.9	0.71	7.77	**5.5**
	7	1.86	0.90	6.9	1.68	7.77	**14.6**
F		0.54	0.94	5.0	0.51	8.54	**4.3**
	8	0.54	0.94	5.0	0.51	8.54	**6.4**
	9	5.38	0.89	7.0	4.81	7.75	**40.9**
G	10	0.23	0.35	7.9	0.08	7.44	**0.6**
H	11	1.46	0.76	8.1	1.11	7.38	**8.2**

APPENDIX
HYDRAULIC CALCULATIONS

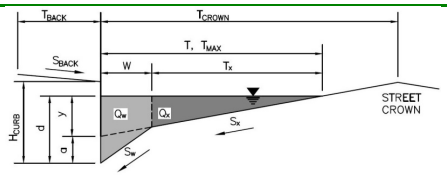
Version 4.06 Released August 2018

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Owl Marketplace

Inlet ID: DP7



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

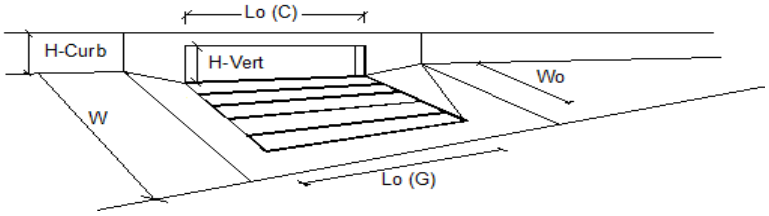
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**18.4**	**35.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.06 Released August 2018



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Inlet Management*)	**Q_o =**	**7.8**	**14.6**	cfs
Water Spread Width	T =	13.2	17.1	ft
Water Depth at Flowline (outside of local depression)	d =	4.7	5.6	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.450	0.349	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	4.3	9.5	cfs
Discharge within the Gutter Section W	Q_w =	3.5	5.1	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.61	0.77	sq ft
Velocity within the Gutter Section W	V_W =	5.7	6.6	fps
Water Depth for Design Condition	d_{LOCAL} =	7.7	8.6	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.105	0.086	ft/ft
Required Length L_T to Have 100% Interception	L_T =	17.91	27.06	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	10.00	10.00	ft
Interception Capacity	Q_i =	6.0	8.2	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	8.75	8.75	ft
Actual Interception Capacity	**Q_a =**	**5.8**	**7.9**	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**2.0**	**6.7**	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.8**	**7.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**2.0**	**6.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**74**	**54**	**%**

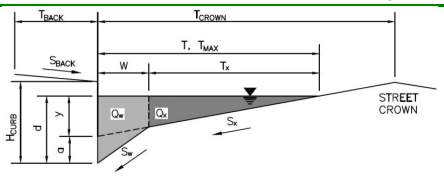
Version 4.06 Released August 2018

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Owl Marketplace

Inlet ID: DP8



Gutter Geometry (Enter data in the blue cells)

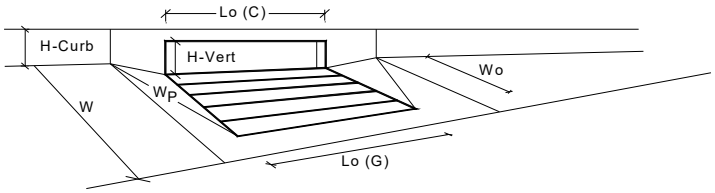
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft	
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft	
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches	
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft	
Warning 1 Gutter Width	W =	2.00	ft	
Street Transverse Slope	S_X =	0.020	ft/ft	
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft	
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft	
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012		

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.06 Released August 2018



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	7.3	inches
Grate Information			MINOR	MAJOR	Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.44	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.57	0.69	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**8.3**	**13.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	3.4	6.4	cfs

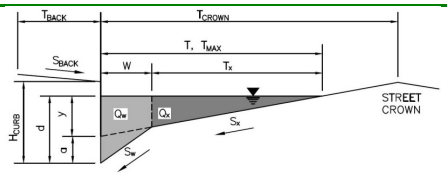
Version 4.06 Released August 2018

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Owl Marketplace

Inlet ID: DP11



Gutter Geometry (Enter data in the blue cells)

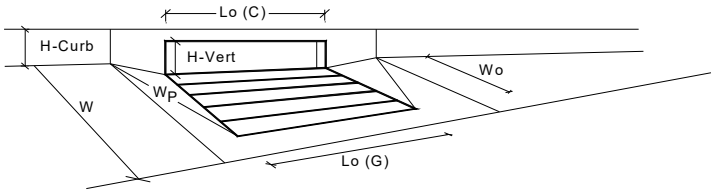
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

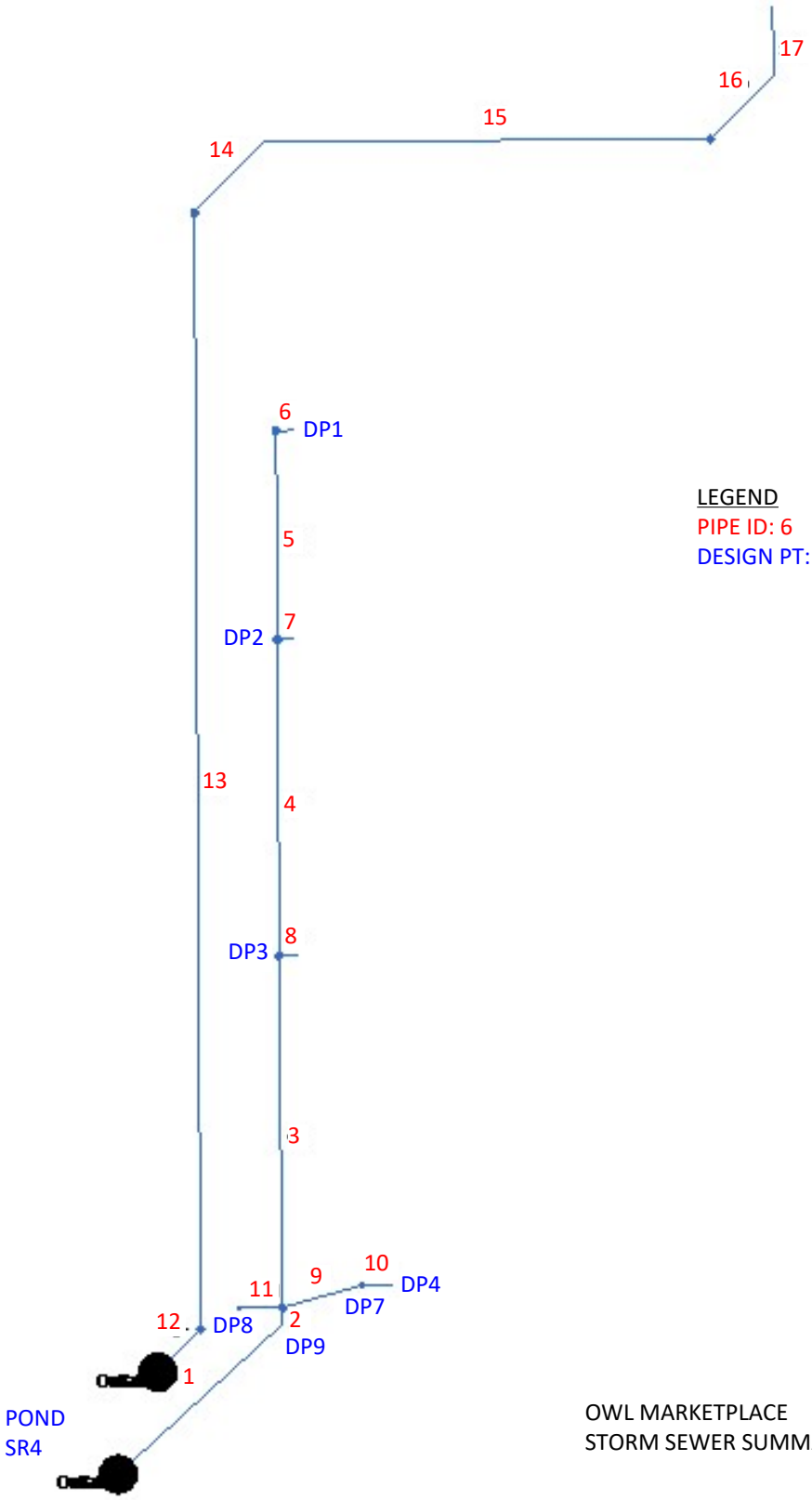
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.06 Released August 2018



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	8.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.57	0.75	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.93	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**8.3**	**16.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	6.1	14.9	cfs



LEGEND
PIPE ID: 6
DESIGN PT: DP1

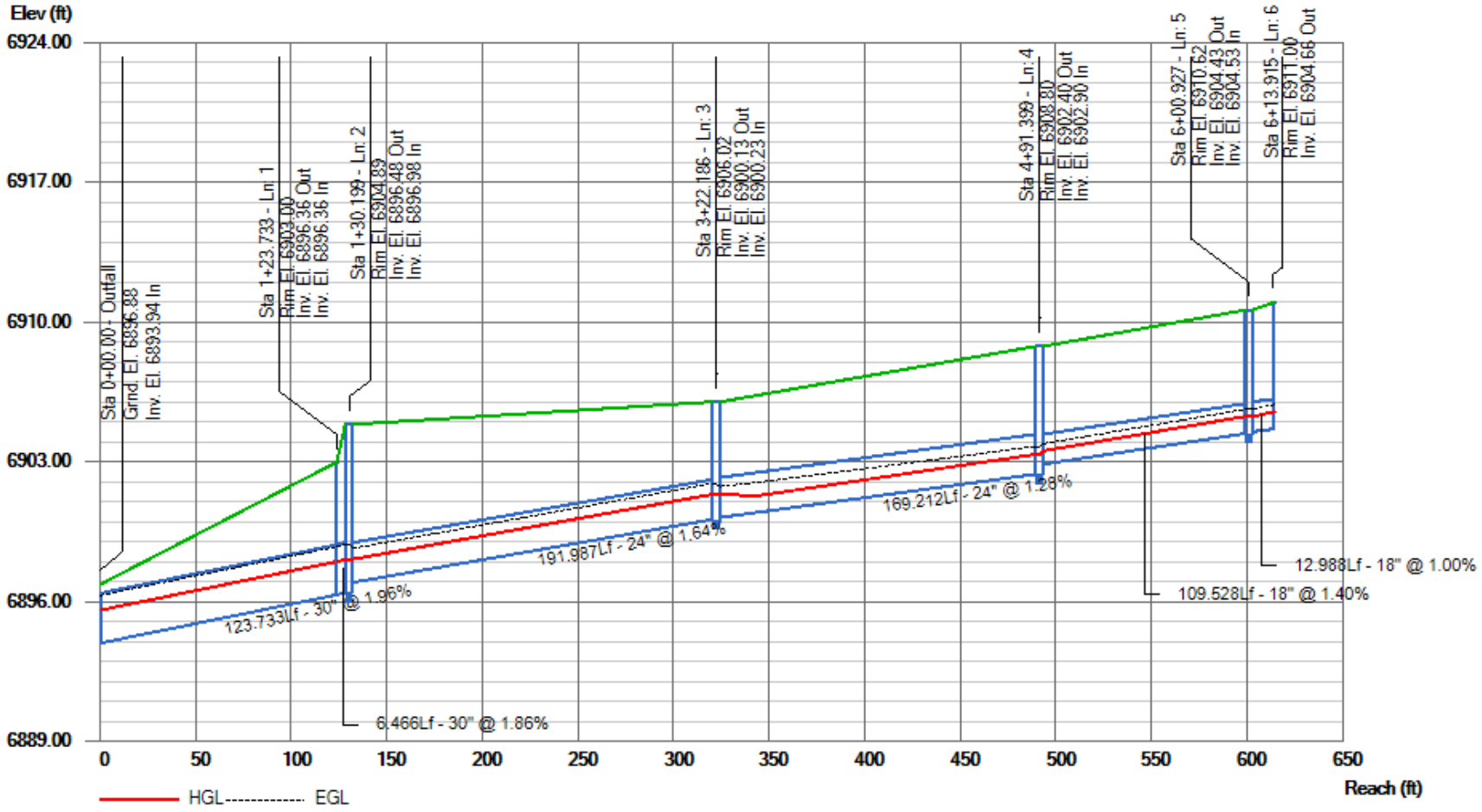
OWL MARKETPLACE
STORM SEWER SUMMARY MAP

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
(1)	(in) (2)	(cfs) (3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(ft) (12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(K) (23)	(ft) (24)
1	30	23.90	6893.94	6895.59	1.65	3.44	6.95	0.74	6896.33	0.000	123.733	6896.36	6898.02	1.66**	3.47	6.89	0.74	6898.76	0.000	0.000	n/a	0.79	0.58
2	30	23.90	6896.36	6898.02	1.66*	3.47	6.89	0.74	6898.76	0.000	6.466	6896.48	6898.14	1.66**	3.47	6.89	0.74	6898.88	0.000	0.000	n/a	1.00	0.74
3	24	12.30	6896.98	6898.14	1.16	1.90	6.49	0.54	6898.69	0.000	191.987	6900.13	6901.39	1.26**	2.08	5.90	0.54	6901.93	0.000	0.000	n/a	1.00	0.54
4	24	7.80	6900.23	6901.39	1.16	1.56	4.13	0.39	6901.78	0.000	169.212	6902.40	6903.39 j	0.99**	1.56	5.01	0.39	6903.78	0.000	0.000	n/a	1.00	n/a
5	18	5.00	6902.90	6903.56	0.66*	0.75	6.64	0.35	6903.92	0.000	109.528	6904.43	6905.29	0.86**	1.05	4.78	0.35	6905.64	0.000	0.000	n/a	1.00	n/a
6	18	5.00	6904.53	6905.29	0.76	0.90	5.57	0.35	6905.64	0.000	12.988	6904.66	6905.52	0.86**	1.05	4.78	0.35	6905.87	0.000	0.000	n/a	1.00	n/a
7	18	2.80	6902.90	6903.43	0.53*	0.56	5.04	0.24	6903.67	0.000	12.855	6903.03	6903.67	0.63**	0.71	3.94	0.24	6903.91	0.000	0.000	n/a	1.00	0.24
8	18	4.50	6900.73	6901.41	0.68*	0.78	5.77	0.33	6901.74	0.000	12.649	6900.86	6901.67	0.81**	0.98	4.60	0.33	6902.00	0.000	0.000	n/a	1.00	0.33
9	24	8.20	6896.98	6898.14	1.16	1.61	4.32	0.40	6898.55	0.000	49.487	6897.72	6898.74 j	1.02**	1.61	5.10	0.40	6899.14	0.000	0.000	n/a	0.38	n/a
10	18	4.60	6898.22	6898.92	0.69*	0.80	5.75	0.33	6899.25	0.000	26.955	6898.49	6899.31	0.82**	0.99	4.63	0.33	6899.65	0.000	0.000	n/a	1.00	n/a
11	24	3.40	6896.98	6898.14	1.16	0.87	1.79	0.24	6898.38	0.000	29.472	6897.52	6898.16 j	0.64**	0.87	3.89	0.24	6898.40	0.000	0.000	n/a	1.00	n/a
12	72 120 B	288.5	6894.07	6900.07	6.00*	60.00	4.81	0.36	6900.43	0.076	31.966	6894.39	6900.08	5.69	56.91	5.07	0.40	6900.48	0.053	0.065	0.021	0.75	0.30
13	72 120 B	288.5	6894.39	6900.38	5.99	59.91	4.82	1.48	6901.86	0.000	609.769	6900.75	6903.71 j	2.95**	29.55	9.76	1.48	6905.19	0.000	0.000	n/a	0.75	n/a
14	72 120 B	288.5	6900.75	6903.71	2.95*	29.55	9.76	1.48	6905.19	0.000	52.499	6901.76	6904.71	2.95**	29.55	9.76	1.48	6906.20	0.000	0.000	n/a	0.75	n/a
15	72 120 B	288.5	6901.76	6904.71	2.95*	29.55	9.76	1.48	6906.20	0.000	235.000	6906.30	6909.25	2.95**	29.55	9.76	1.48	6910.74	0.000	0.000	n/a	0.75	n/a
16	72 120 B	288.5	6906.30	6909.25	2.95*	29.55	9.76	1.48	6910.74	0.000	47.000	6907.20	6910.16	2.95**	29.55	9.76	1.48	6911.64	0.000	0.000	n/a	0.75	n/a
17	72 120 B	288.5	6907.20	6910.16	2.95*	29.55	9.76	1.48	6911.64	0.000	15.500	6907.50	6910.46	2.95**	29.55	9.76	1.48	6911.94	0.000	0.000	n/a	1.00	n/a

Project File: OP 5-YR REV3.stm | Number of lines: 17 | Run Date: 5/23/2024

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box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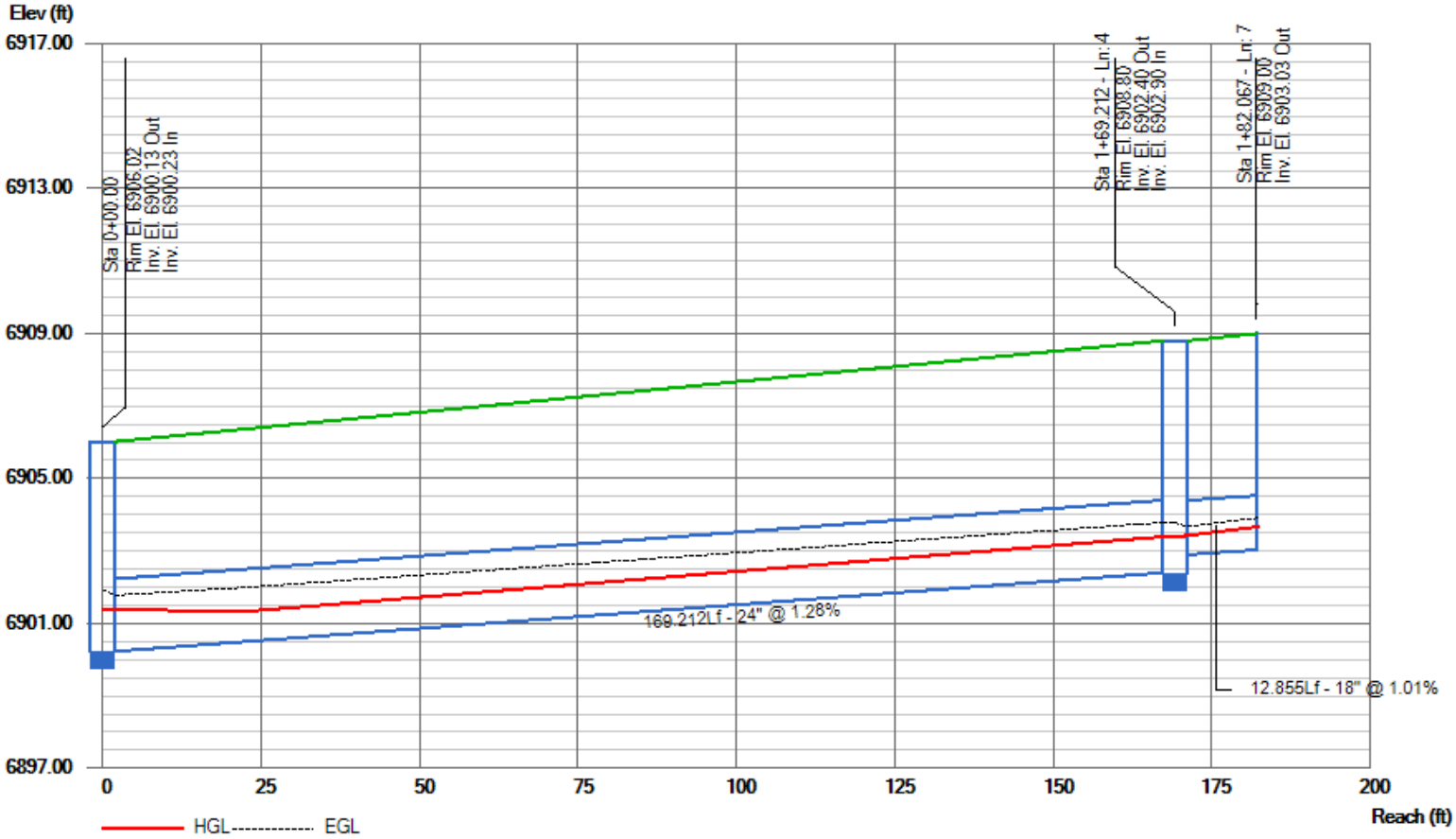
6917.00
6910.00
6903.00
6896.00
6889.00
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Reach (ft)
HGL
EGL
Sta 0+00.00 - Outfall
Grnd. El. 6836.88
Inv. El. 6893.94 In
Sta 1+23.733 - Ln: 1
Rim El. 6903.00
Inv. El. 6896.36 Out
Inv. El. 6896.36 In
Sta 1+30.199 - Ln: 2
Rim El. 6904.89
Inv. El. 6896.48 Out
Inv. El. 6896.98 In
Sta 3+22.186 - Ln: 3
Rim El. 6906.02
Inv. El. 6900.13 Out
Inv. El. 6900.23 In
Sta 4+91.399 - Ln: 4
Rim El. 6908.80
Inv. El. 6902.40 Out
Inv. El. 6902.90 In
Sta 6+00.927 - Ln: 5
Rim El. 6910.62
Inv. El. 6904.43 Out
Inv. El. 6904.53 In
Sta 6+13.915 - Ln: 6
Rim El. 6911.00
Inv. El. 6904.66 Out
123.733Lf - 30" @ 1.96%
6.466Lf - 30" @ 1.86%
191.987Lf - 24" @ 1.64%
169.212Lf - 24" @ 1.28%
109.528Lf - 18" @ 1.40%
12.988Lf - 18" @ 1.00%


Elev (ft)
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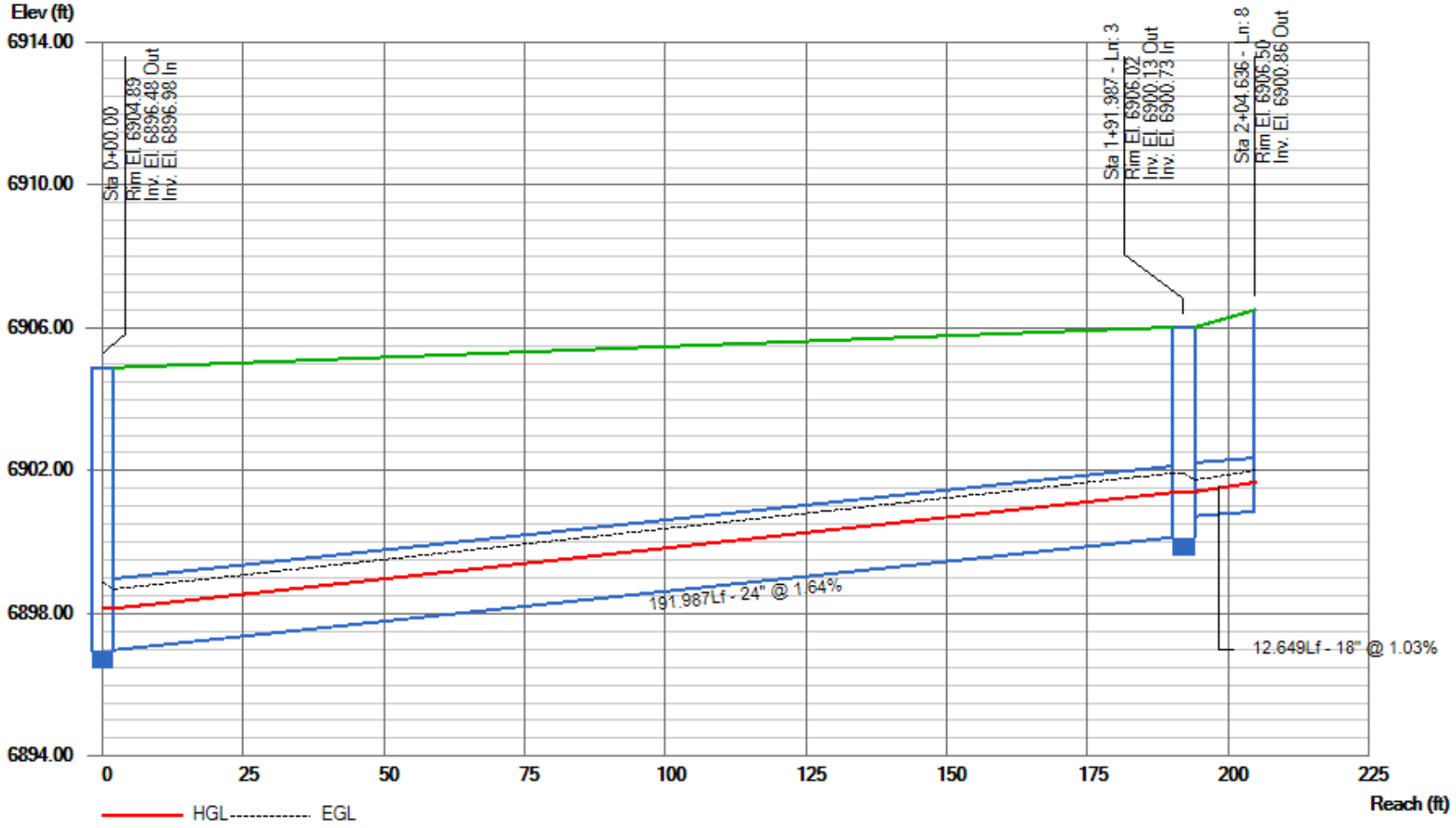
6909.00
6905.00
6901.00
6897.00
Sta 0+00.00
Rim El. 6906.02
Inv. El. 6900.13 Out
Inv. El. 6900.23 In
Sta 1+69.212 - Ln: 4
Rim El. 6908.80
Inv. El. 6902.40 Out
Inv. El. 6902.90 In
Sta 1+82.067 - Ln: 7
Rim El. 6909.00
Inv. El. 6903.03 Out
169.212Lf - 24" @ 1.28%
12.855Lf - 18" @ 1.01%
0
25
50
75
100
125
150
175
200
Reach (ft)
HGL
EGL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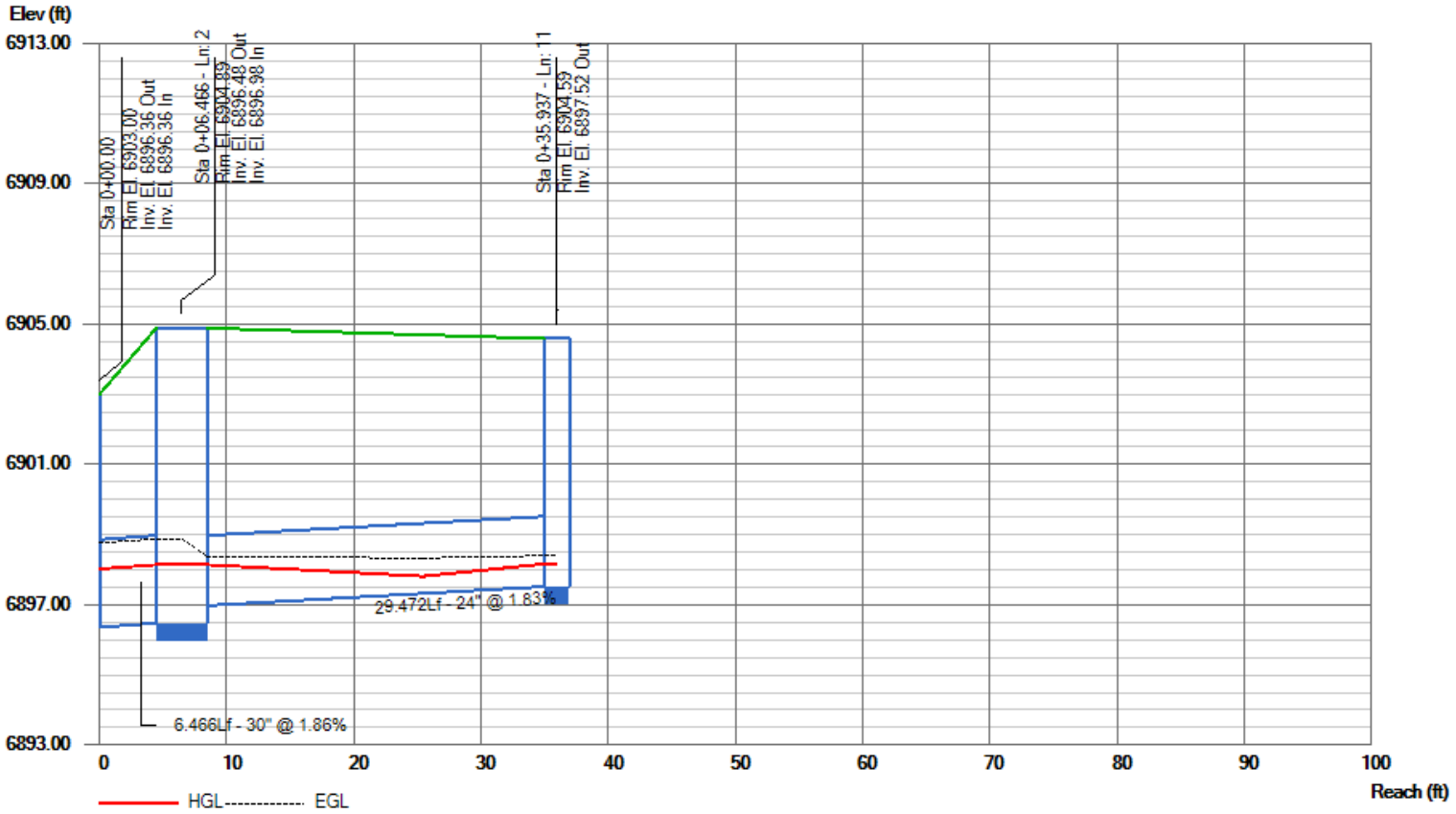
6906.00
6902.00
6898.00
6894.00
Sta 0+00.00
Rim El. 6904.89
Inv. El. 6896.48 Out
Inv. El. 6896.98 In
Sta 1+91.987 - Ln: 3
Rim El. 6906.02
Inv. El. 6900.13 Out
Inv. El. 6900.73 In
Sta 2+04.636 - Ln: 8
Rim El. 6906.50
Inv. El. 6900.86 Out
191.987Lf - 24" @ 1.64%
12.649Lf - 18" @ 1.03%
0
25
50
75
100
125
150
175
200
225
Reach (ft)
HGL
EGL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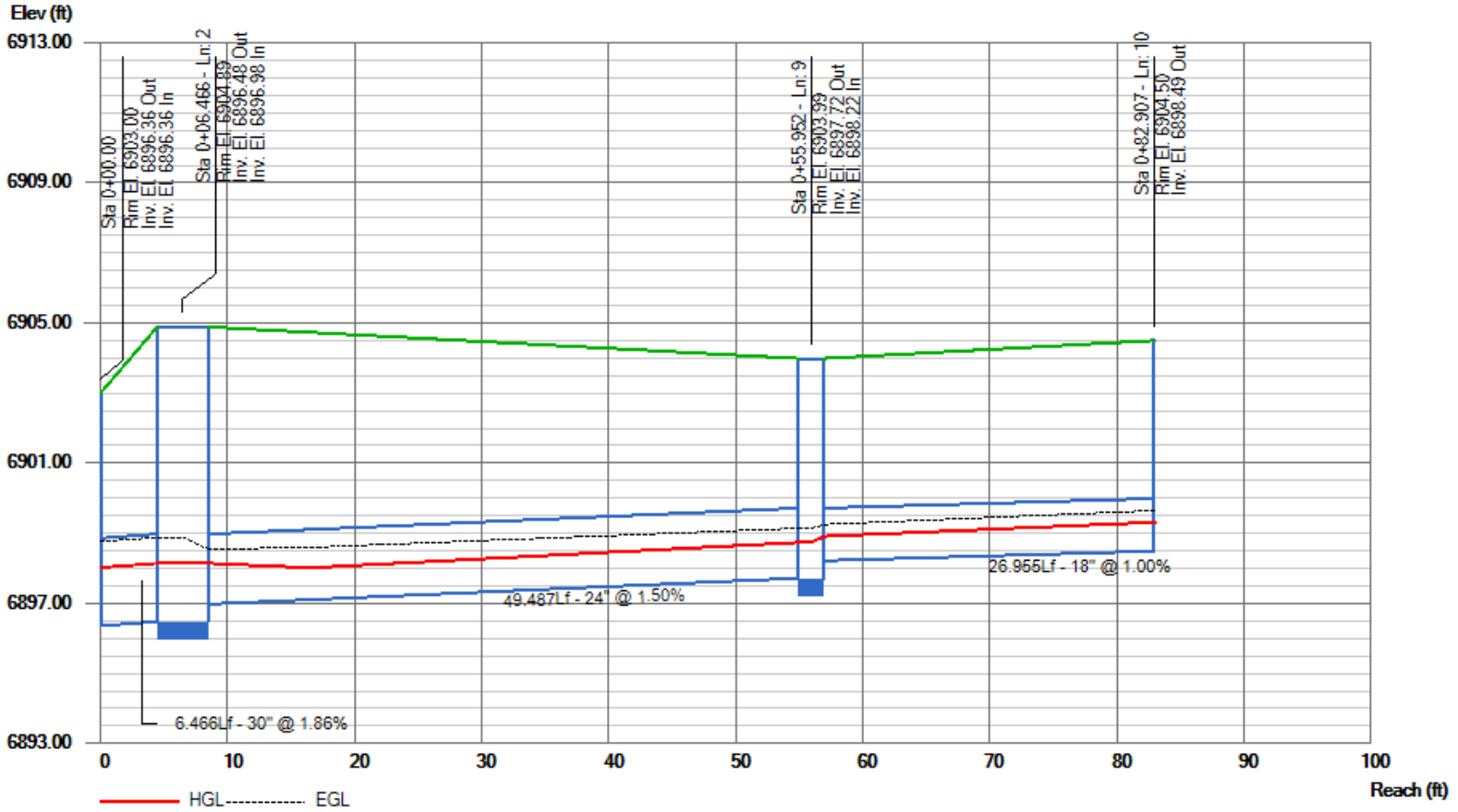
6909.00
6905.00
6901.00
6897.00
6893.00
Sta 0+00.00
Rim El. 6903.00
Inv. El. 6896.36 Out
Inv. El. 6896.36 In
Sta 0+06.466 - Ln: 2
Rim El. 6904.89
Inv. El. 6896.48 Out
Inv. El. 6896.98 In
Sta 0+35.937 - Ln: 11
Rim El. 6904.59
Inv. El. 6897.52 Out
29.472Lf - 24" @ 1.83%
6.466Lf - 30" @ 1.86%
0
10
20
30
40
50
60
70
80
90
100
Reach (ft)
HGL
EGL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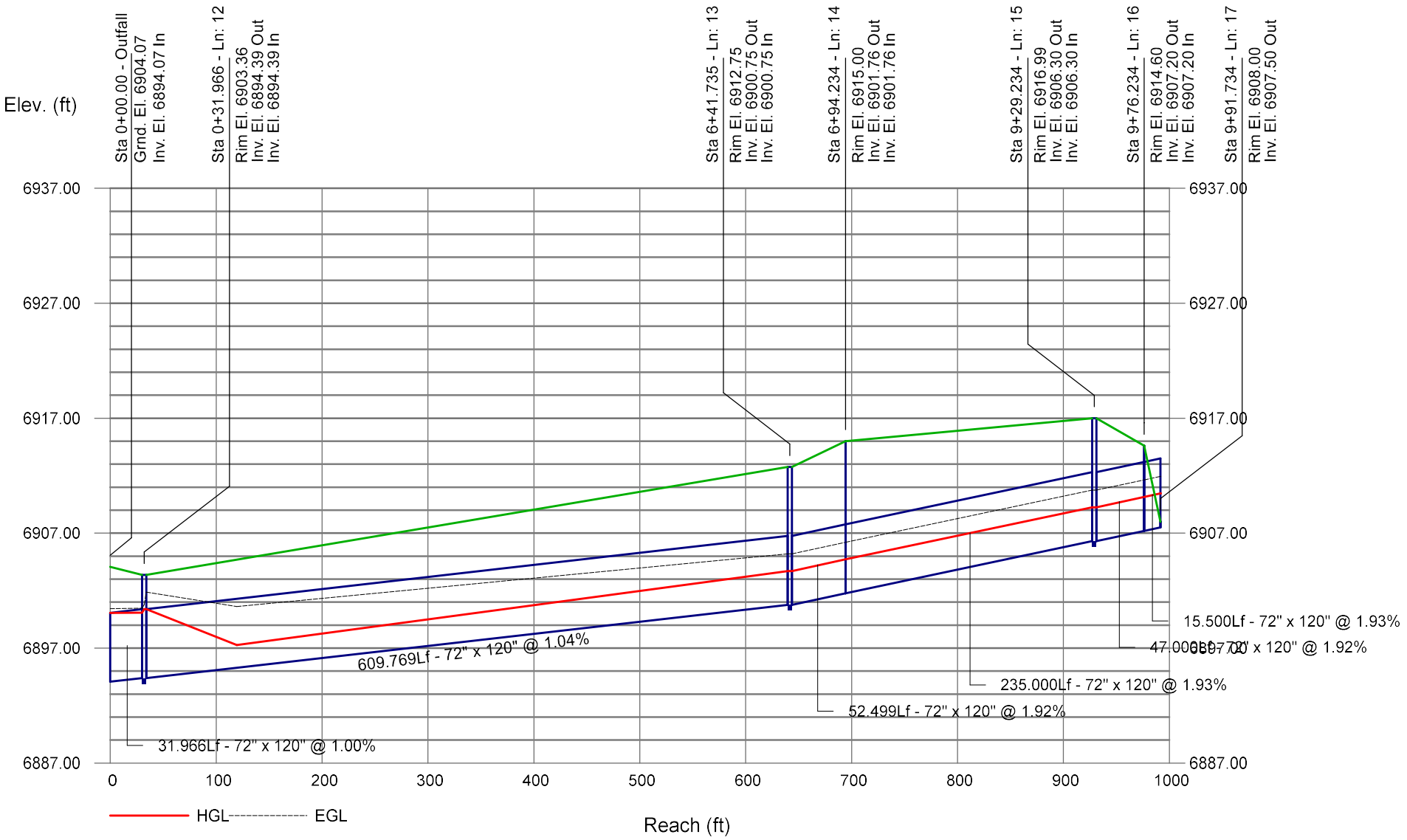
6905.00
6901.00
6897.00
6893.00
0
10
20
30
40
50
60
70
80
90
100
Reach (ft)
Sta 0+00.00
Rim El. 6903.00
Inv. El. 6896.36 Out
Inv. El. 6896.36 In
Sta 0+06.466 - Ln: 2
Rim El. 6904.89
Inv. El. 6896.48 Out
Inv. El. 6896.98 In
Sta 0+55.952 - Ln: 9
Rim El. 6903.99
Inv. El. 6897.72 Out
Inv. El. 6898.22 In
Sta 0+82.907 - Ln: 10
Rim El. 6904.50
Inv. El. 6898.49 Out
6.466Lf - 30" @ 1.86%
49.487Lf - 24" @ 1.50%
26.955Lf - 18" @ 1.00%
HGL
EGL

Storm Sewer Profile

Proj. file: OP 5-YR REV3.stm

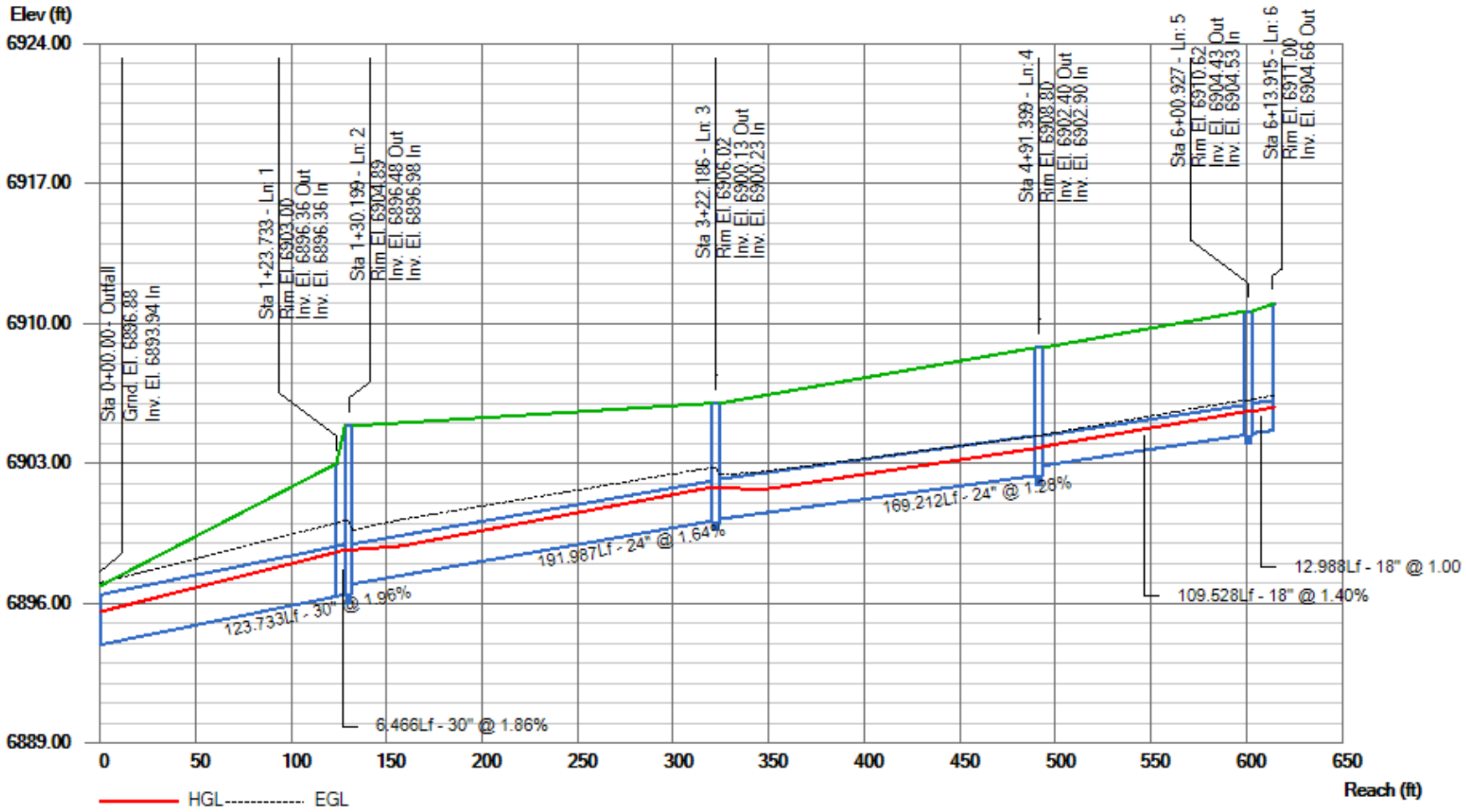


Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
(1)	(in) (2)	(cfs) (3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(ft) (12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(K) (23)	(ft) (24)
1	30	44.30	6893.94	6895.59	1.65	3.44	12.89	1.45	6897.04	0.000	123.733	6896.36	6898.57	2.21**	4.59	9.64	1.45	6900.02	0.000	0.000	n/a	0.79	n/a
2	30	44.30	6896.36	6898.57	2.21*	4.59	9.64	1.45	6900.02	0.000	6.466	6896.48	6898.69	2.21**	4.59	9.64	1.45	6900.14	0.000	0.000	n/a	1.00	n/a
3	24	22.50	6896.98	6898.69	1.71	2.83	7.86	0.98	6899.67	0.000	191.987	6900.13	6901.82 j	1.69**	2.83	7.95	0.98	6902.80	0.000	0.000	n/a	1.00	0.98
4	24	14.30	6900.23	6901.82	1.59	2.28	5.34	0.61	6902.43	0.000	169.212	6902.40	6903.76 j	1.36**	2.28	6.28	0.61	6904.37	0.000	0.000	n/a	1.00	0.61
5	18	9.10	6902.90	6903.85	0.95*	1.19	7.67	0.59	6904.45	0.000	109.528	6904.43	6905.60	1.17**	1.47	6.17	0.59	6906.19	0.000	0.000	n/a	1.00	0.59
6	18	9.10	6904.53	6905.61	1.08*	1.36	6.70	0.59	6906.20	0.000	12.988	6904.66	6905.83	1.17**	1.47	6.17	0.59	6906.42	0.000	0.000	n/a	1.00	0.59
7	18	5.20	6902.90	6903.76	0.86	1.05	4.95	0.36	6904.13	0.000	12.855	6903.03	6903.91	0.88**	1.07	4.84	0.36	6904.27	0.000	0.000	n/a	1.00	0.36
8	18	8.20	6900.73	6901.82	1.09	1.38	5.96	0.53	6902.35	0.000	12.649	6900.86	6901.97	1.11**	1.40	5.86	0.53	6902.50	0.000	0.000	n/a	1.00	0.53
9	24	15.40	6896.98	6898.69	1.71	2.37	5.38	0.65	6899.35	0.000	49.487	6897.72	6899.13 j	1.41**	2.37	6.49	0.65	6899.79	0.000	0.000	n/a	0.38	0.25
10	18	8.40	6898.22	6899.23	1.01*	1.27	6.61	0.55	6899.78	0.000	26.955	6898.49	6899.61	1.12**	1.42	5.93	0.55	6900.16	0.000	0.000	n/a	1.00	0.55
11	24	6.40	6896.98	6898.69	1.71	1.36	2.24	0.34	6899.04	0.000	29.472	6897.52	6898.42	0.90**	1.36	4.70	0.34	6898.76	0.000	0.000	n/a	1.00	0.34
12	72 120 B	920.0	6894.07	6900.07	6.00*	60.00	15.33	3.66	6903.73	0.778	31.966	6894.39	6900.39	6.00**	60.00	15.33	3.66	6904.05	0.778	0.778	n/a	0.75	n/a
13	72 120 B	920.0	6894.39	6900.39	6.00*	60.00	15.33	3.66	6904.05	0.778	609.769	6900.75	6906.75	6.00**	60.00	15.33	3.66	6910.41	0.778	0.778	n/a	0.75	n/a
14	72 120 B	920.0	6900.75	6906.75	6.00*	60.00	15.33	3.66	6910.41	0.778	52.499	6901.76	6907.76	6.00**	60.00	15.33	3.66	6911.42	0.778	0.778	n/a	0.75	n/a
15	72 120 B	920.0	6901.76	6907.76	6.00*	60.00	15.33	3.66	6911.42	0.778	235.000	6906.30	6912.30	6.00**	60.00	15.33	3.66	6915.96	0.778	0.778	n/a	0.75	n/a
16	72 120 B	920.0	6906.30	6912.30	6.00*	60.00	15.33	3.66	6915.96	0.778	47.000	6907.20	6913.20	6.00**	60.00	15.33	3.66	6916.86	0.778	0.778	n/a	0.75	n/a
17	72 120 B	920.0	6907.20	6913.20	6.00*	60.00	15.33	3.66	6916.86	0.778	15.500	6907.50	6913.50	6.00**	60.00	15.33	3.66	6917.16	0.778	0.778	n/a	1.00	n/a

Project File: OP 100-YR REV3.stm | Number of lines: 17 | Run Date: 5/23/2024

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box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6910.00
6903.00
6896.00
6889.00
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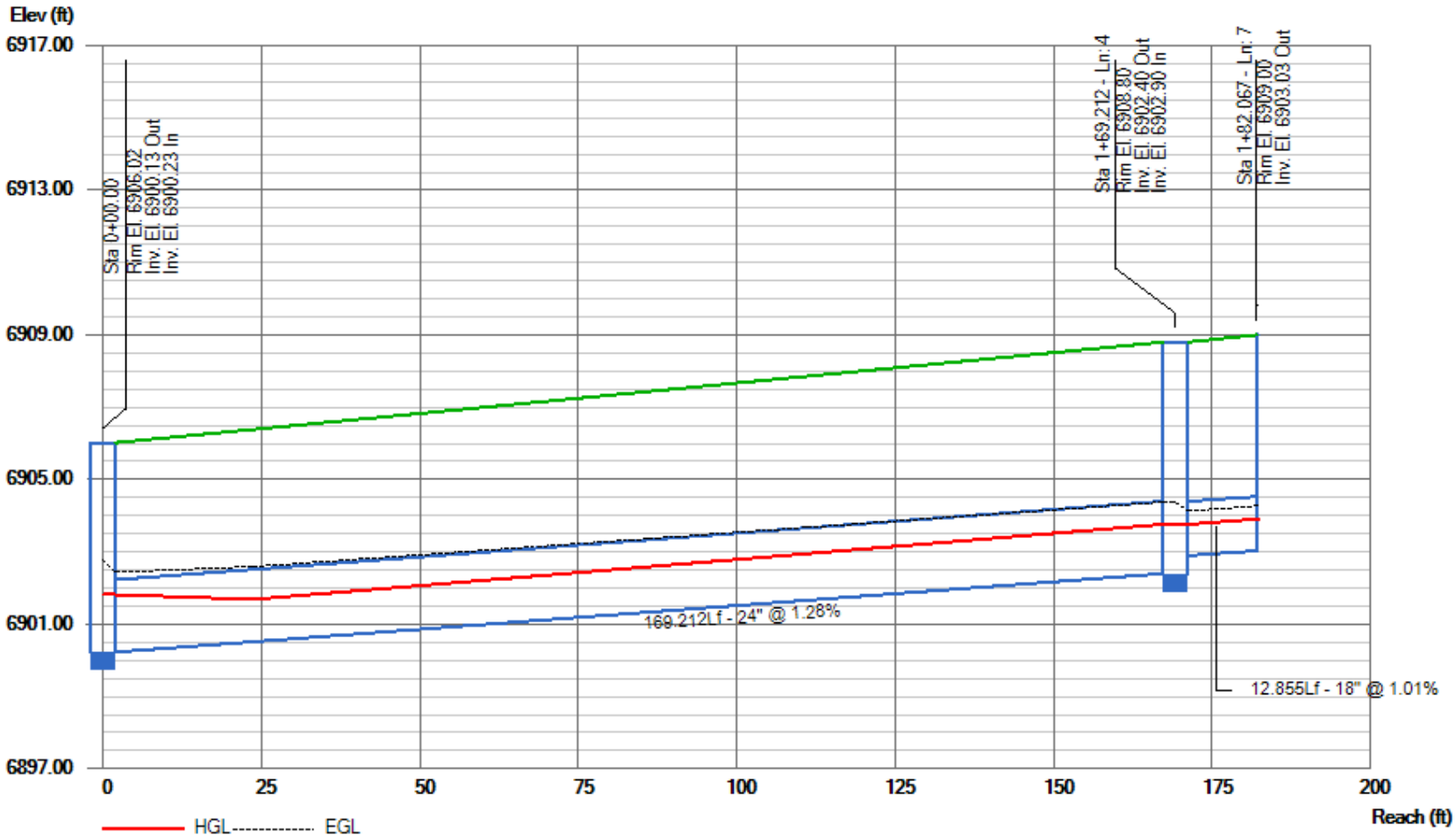
100
150
200
250
300
350
400
450
500
550
600
650
Reach (ft)
Sta 0+00.00 - Outfall
Grnd. El. 6896.88
Inv. El. 6893.94 In
Sta 1+23.733 - Ln: 1
Rim El. 6903.00
Inv. El. 6896.36 Out
Inv. El. 6896.36 In
Sta 1+30.199 - Ln: 2
Rim El. 6904.89
Inv. El. 6896.48 Out
Inv. El. 6896.98 In
Sta 3+22.186 - Ln: 3
Rim El. 6906.02
Inv. El. 6900.13 Out
Inv. El. 6900.23 In
Sta 4+91.399 - Ln: 4
Rim El. 6908.80
Inv. El. 6902.40 Out
Inv. El. 6902.90 In
Sta 6+00.927 - Ln: 5
Rim El. 6910.62
Inv. El. 6904.43 Out
Inv. El. 6904.53 In
Sta 6+13.915 - Ln: 6
Rim El. 6911.00
Inv. El. 6904.68 Out
123.733Lf - 30" @ 1.96%
6.466Lf - 30" @ 1.86%
191.987Lf - 24" @ 1.64%
169.212Lf - 24" @ 1.28%
12.988Lf - 18" @ 1.00
109.528Lf - 18" @ 1.40%
HGL
EGL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6913.00
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6905.00
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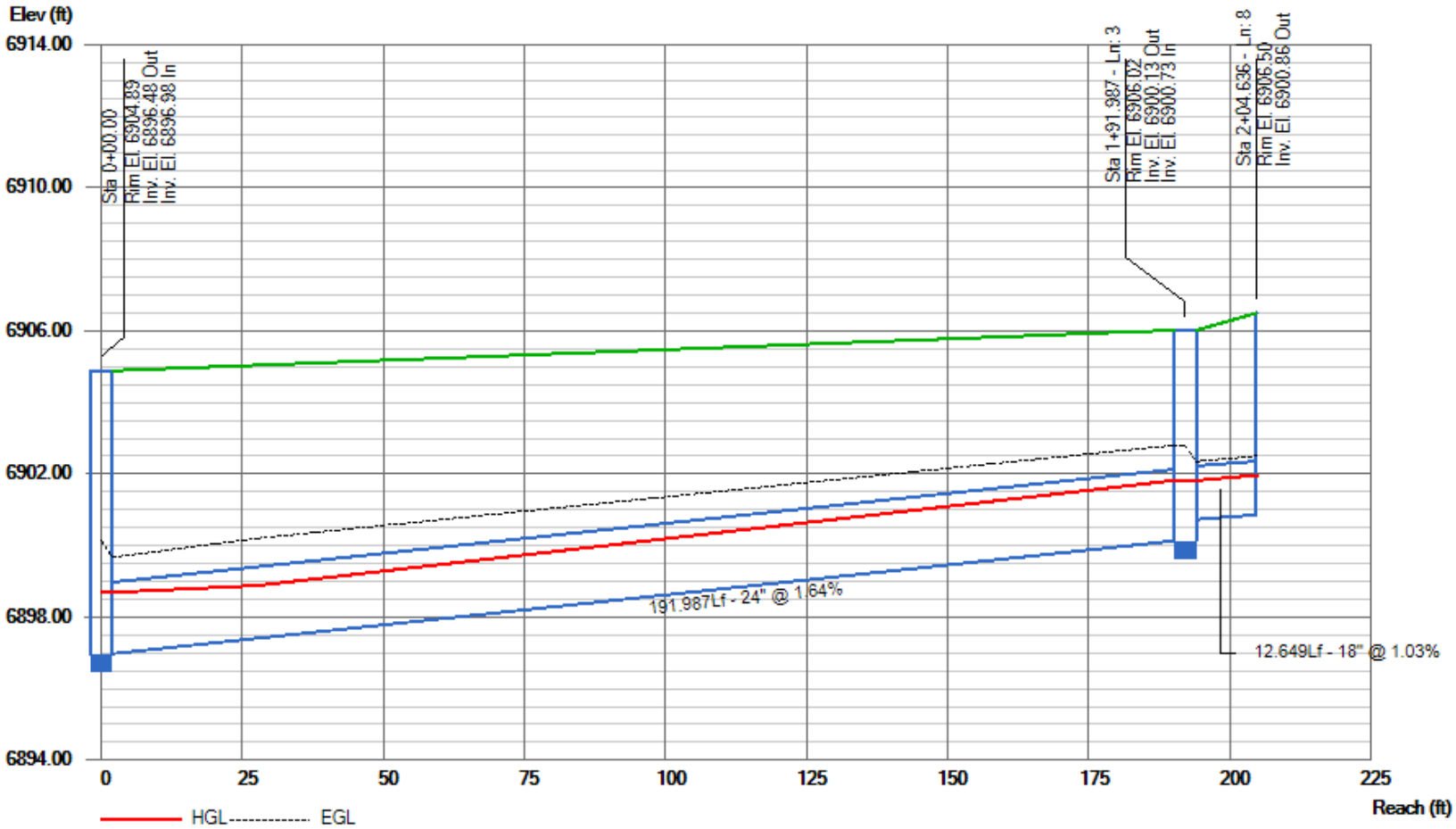
6897.00
0
25
50
75
100
125
150
175
200
Reach (ft)
Sta 0+00.00
Rim El. 6906.02
Inv. El. 6900.13 Out
Inv. El. 6900.23 In
Sta 1+69.212 - Ln: 4
Rim El. 6908.80
Inv. El. 6902.40 Out
Inv. El. 6902.90 In
Sta 1+82.067 - Ln: 7
Rim El. 6909.00
Inv. El. 6903.03 Out
169.212Lf - 24" @ 1.28%
12.855Lf - 18" @ 1.01%
HGL
EGL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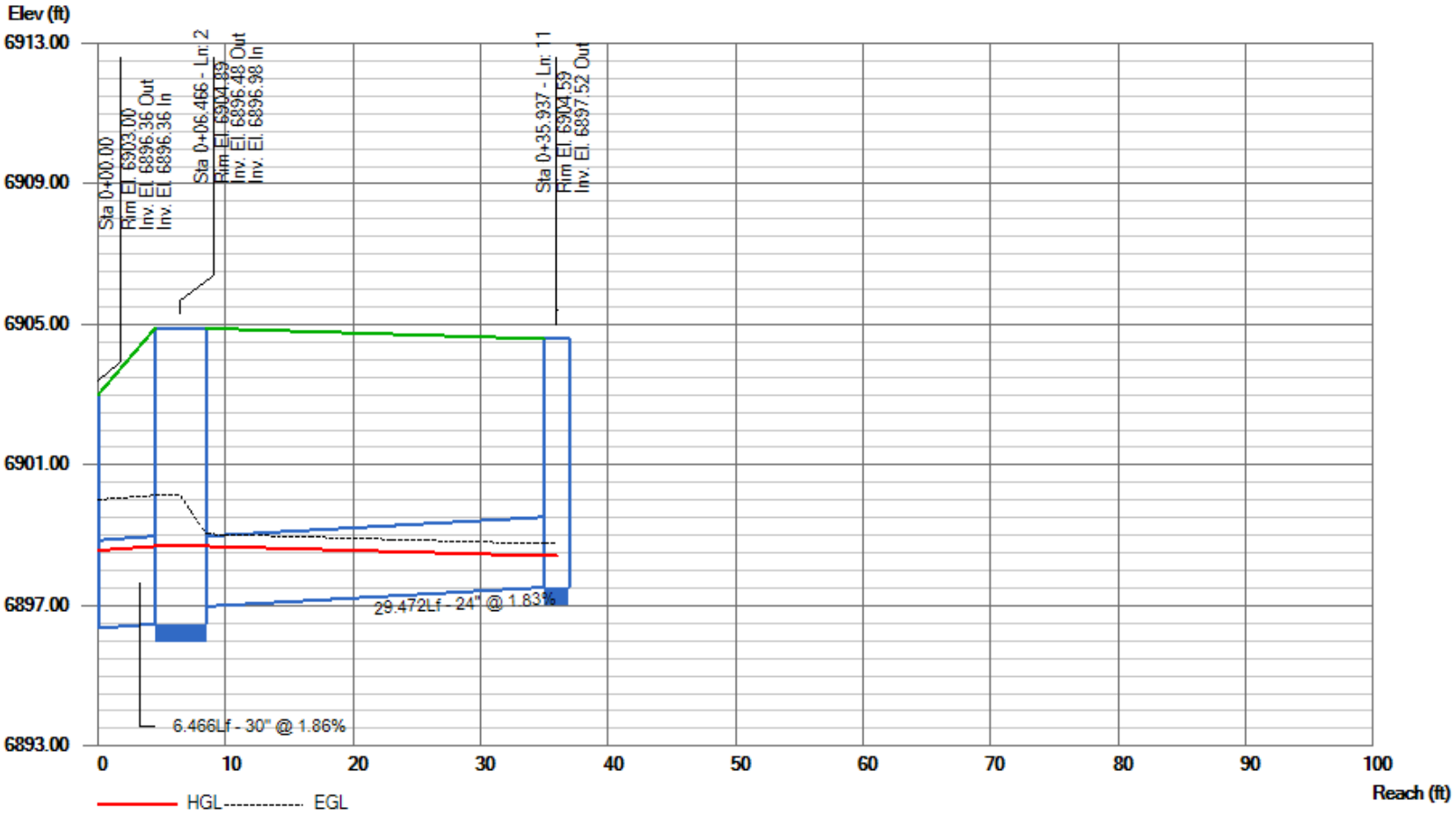
Sta 0+00.00
Rim El. 6904.89
Inv. El. 6896.48 Out
Inv. El. 6896.98 In
Sta 1+91.987 - Ln: 3
Rim El. 6906.02
Inv. El. 6900.13 Out
Inv. El. 6900.73 In
Sta 2+04.636 - Ln: 8
Rim El. 6906.50
Inv. El. 6900.86 Out
191.987Lf - 24" @ 1.64%
12.649Lf - 18" @ 1.03%
0
25
50
75
100
125
150
175
200
225
Reach (ft)
HGL
EGL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6893.00
Sta 0+00.00
Rim El. 6903.00
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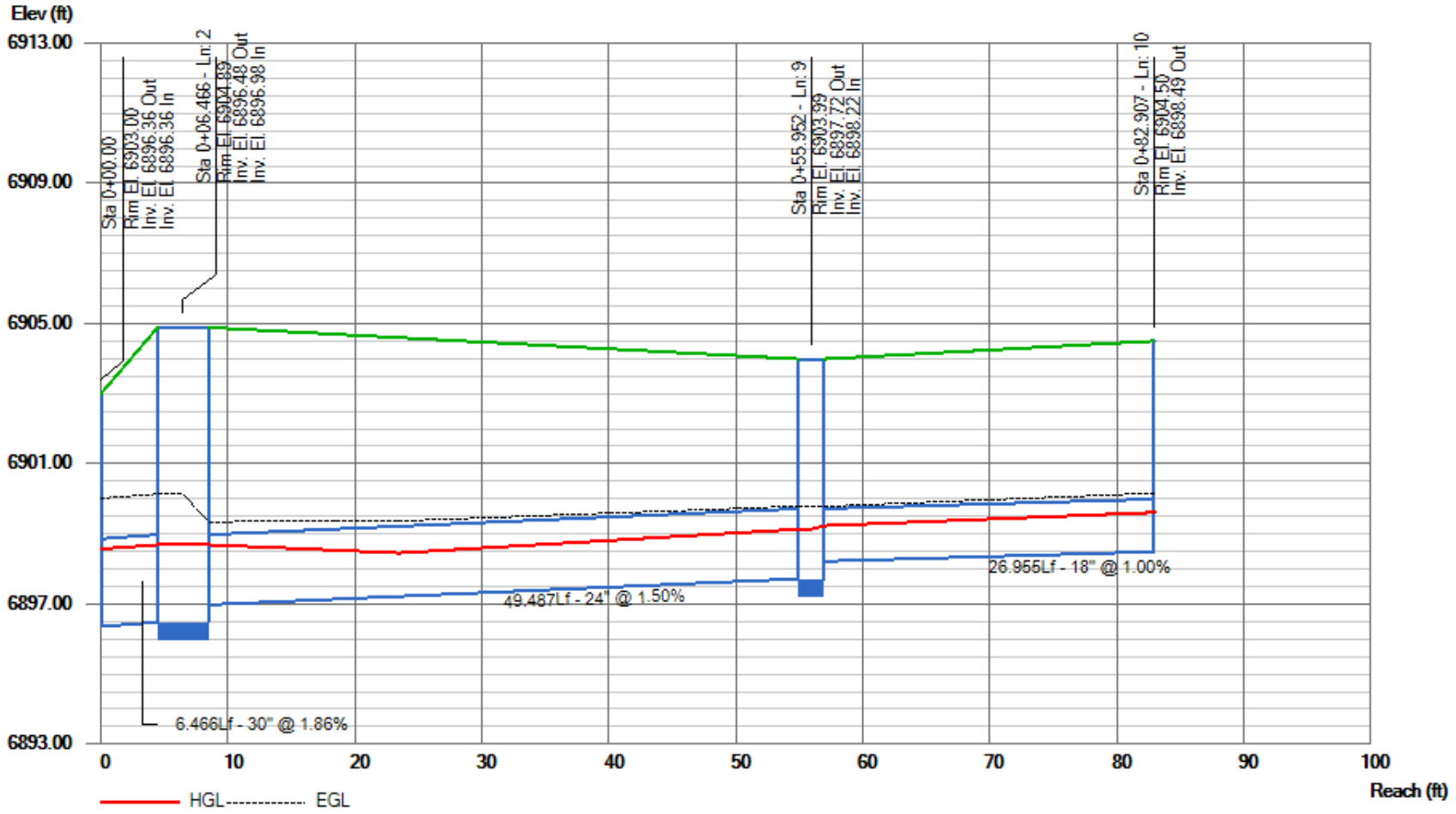
Inv. El. 6896.36 In
Sta 0+06.466 - Ln: 2
Rim El. 6904.89
Inv. El. 6896.48 Out
Inv. El. 6896.98 In
Sta 0+35.937 - Ln: 11
Rim El. 6904.59
Inv. El. 6897.52 Out
29.472Lf - 24" @ 1.83%
6.466Lf - 30" @ 1.86%
0
10
20
30
40
50
60
70
80
90
100
Reach (ft)
HGL
EGL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Sta 0+00.00
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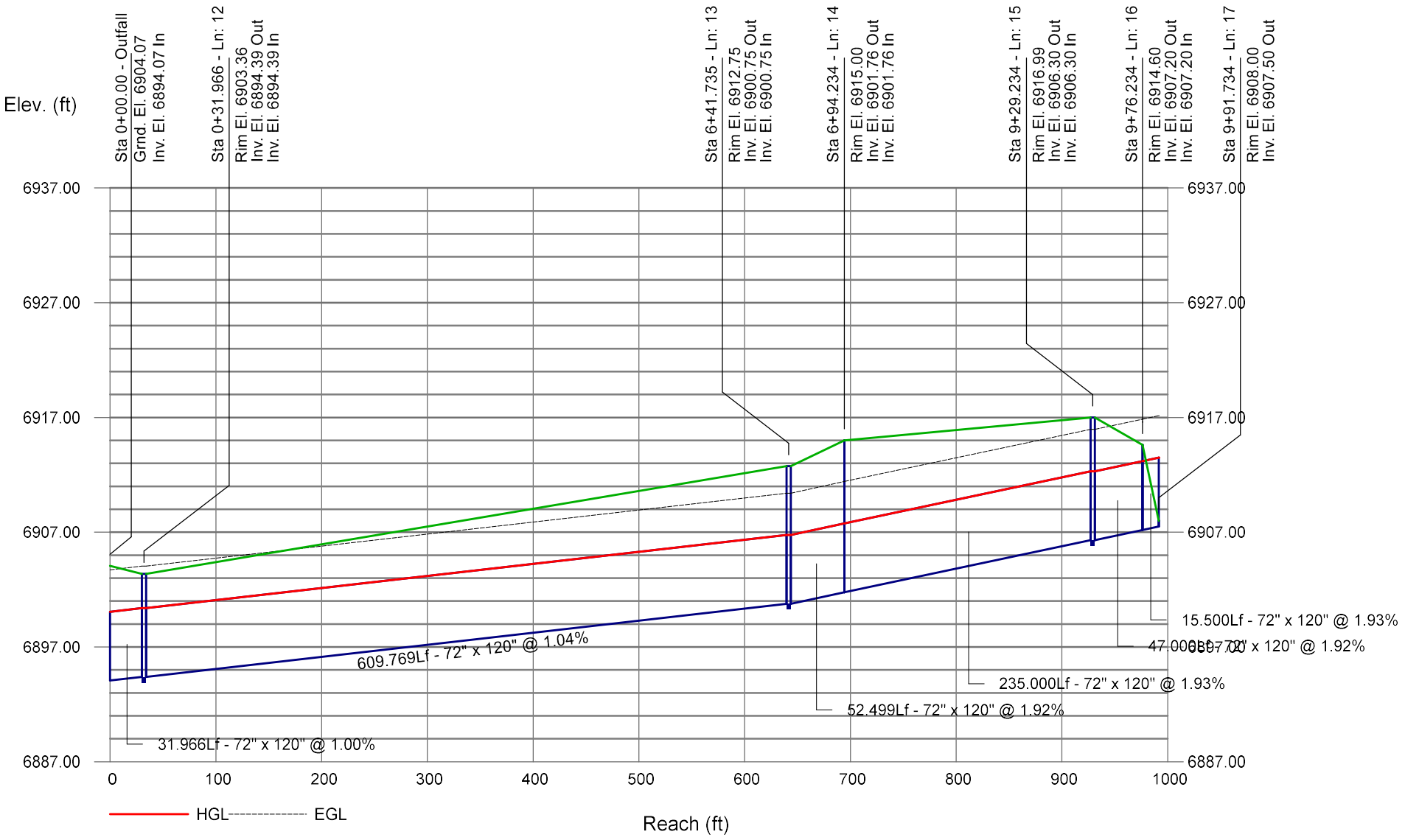
Inv. El. 6896.36 Out
Inv. El. 6896.36 In
Sta 0+06.466 - Ln: 2
Rim El. 6904.89
Inv. El. 6896.48 Out
Inv. El. 6896.98 In
Sta 0+55.952 - Ln: 9
Rim El. 6903.99
Inv. El. 6897.72 Out
Inv. El. 6898.22 In
Sta 0+82.907 - Ln: 10
Rim El. 6904.50
Inv. El. 6898.49 Out
6.466Lf - 30" @ 1.86%
49.487Lf - 24" @ 1.50%
26.955Lf - 18" @ 1.00%
0
10
20
30
40
50
60
70
80
90
100
Reach (ft)
HGL
EGL

Storm Sewer Profile

Proj. file: OP 100-YR REV3.stm



PROJECT INFORMATION

PROJECT: Owl Marketplace
PROJECT NO: 21611-01CSCV
DESIGN BY: KGV
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Final
DATE: 9/28/2023

Drexel, Barrell & Co.

STILLING BASIN

mannings, n	0.013	
Culvert width, W	10	ft
Culvert height, H	6	ft
Culvert slope	1.00	%
Q_{100}	920	cfs
Depth of flow	4.5	ft
Velocity	15.33	fps
Froude	1.28	
Reference MHFD Figure 9-45 in appendix		
D	6.71	ft
W	20.22	ft
H	15.17	ft
L	26.97	ft
a	10.11	ft
b	7.58	ft
c	10.11	ft
d	3.37	ft
e	1.69	ft
f	2.53	ft
t	1.69	ft

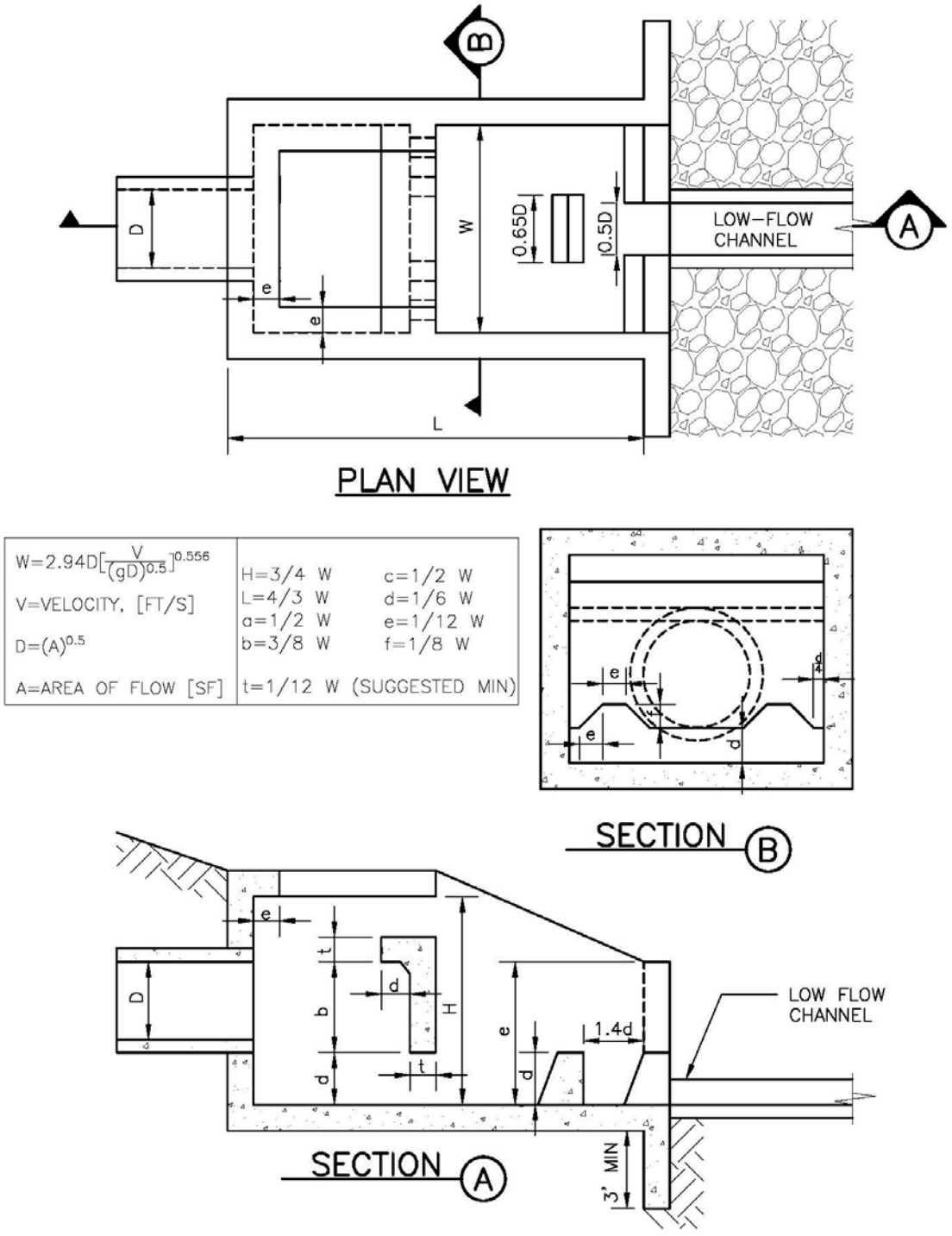
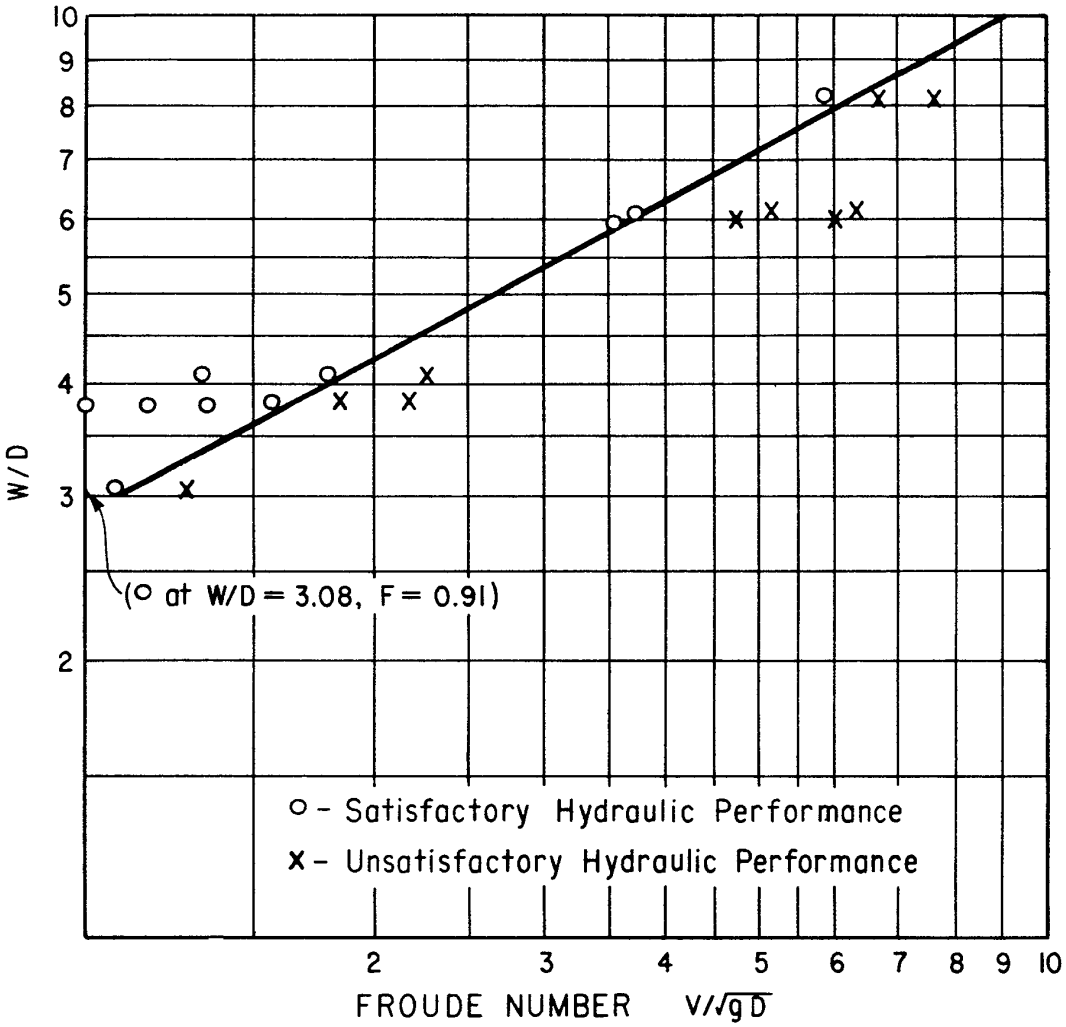


Figure 9-45. UDFCD modified USBR type VI impacts stilling basin (general design dimensions)



"W" is the inside width of the basin.
"D" represents the depth of flow entering the basin and is the square root of the flow area at the conduit outlet.
"V" is the velocity of the incoming flow.
The tailwater depth is uncontrolled.

Figure 9-46. Basin width diagram for the USBR type VI impact stilling basin

STILLING BASIN FOREBAY VOLUME

Req'd V=3% x WQCV

WQCV=	1.04	ac-ft	
V=	0.0312	ac-ft	
Actual V	0.0344	ac-ft	

FOREBAY RELEASE NOTCH WIDTH

$Q=CLH^{3/2}$

Q_{100}=	920	cfs	
2% of Q=	18.40	cfs	
C=	2.6		
H (height of forebay wall)=	1.65	ft	
L*=	3.34	ft	
	3	in min.	

* L is dictated by the Type VI low impact basin design. This notch width will allow for 1.65' of ponding in the forebay - less than the 2.5' max for this size of tributary area.

TRICKLE CHANNEL CAPACITY

Channel Slope	0.01	ft/ft	
Bottom Width	8	feet	
Curb height	6	inches	
Notch release capacity	18.40	cfs	
Flow capacity, Q	21.64	cfs	OK

EXISTING POND SR4 EAST FOREBAY VOLUME

Req'd V=3% x WQCV

WQCV=	0.19	ac-ft	
V=	0.0057	ac-ft	
Actual V	0.0115	ac-ft	OK

EXISTING FOREBAY RELEASE NOTCH WIDTH

$Q=CLH^{3/2}$

Q_{100}=	48.6	cfs	Owl Marketplace + Falcon Marketplace Flows
2% of Q=	0.97	cfs	
C=	2.6		
H (height of forebay wall)=	1	ft	
L=	4	in	6" existing
	3	in min.	

TRICKLE CHANNEL CAPACITY

Channel Slope	0.005	ft/ft	
Bottom Width	6	feet	
Curb height	6	inches	
Notch release capacity x 2,	1.944281	cfs	
Flow capacity, Q	11.2	cfs	OK

APPENDIX

REPORT EXCERPTS & UPDATED CALCULATIONS

FALCON MARKETPLACE FINAL DRAINAGE REPORT

FALCON MARKETPLACE POND SR4
ORIGINAL APPROVED DESIGN

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: FALCON MARKETPLACE POND SR4

Basin ID:

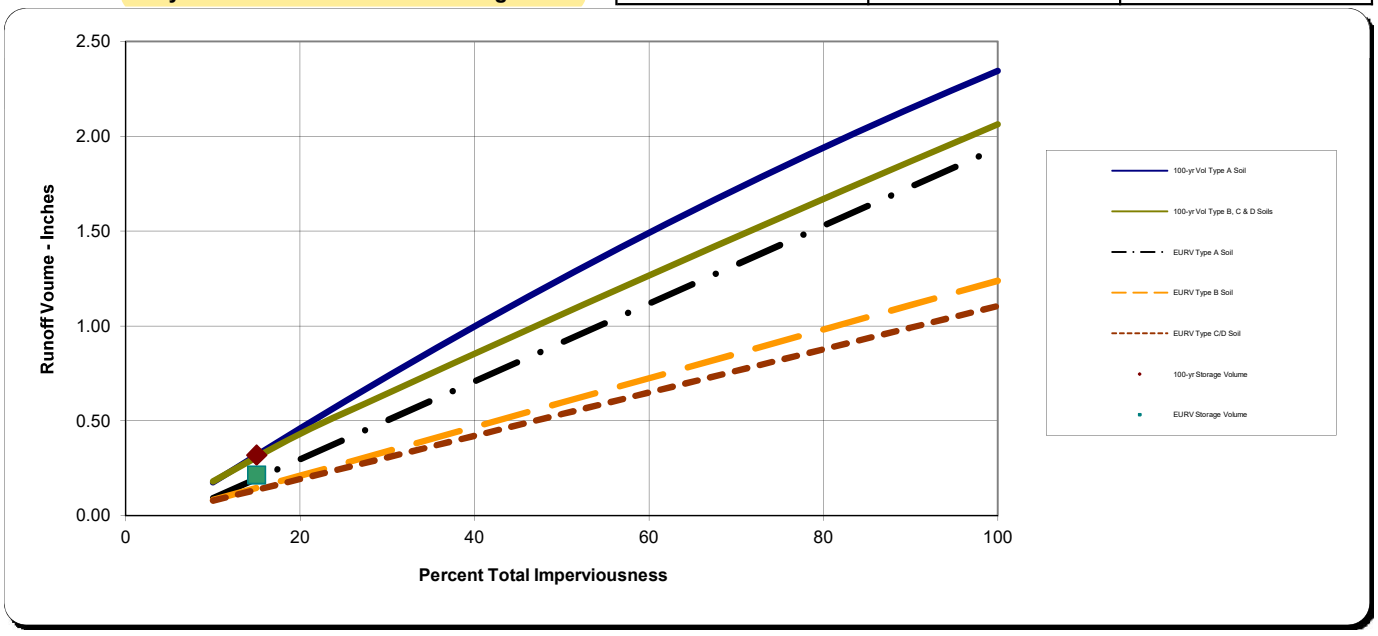
* User input data shown in blue.

Area of Watershed (acres)	740.00	
Subwatershed Imperviousness	15.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	15.0%	

Hydrologic Soil Type	**Percentage of Area**	**Area (acres)**
Type A	100.0%	740.0
Type B		0.0
Type C or D		0.0

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		**Decay Coefficient--α**
Initial--f_i	**Final--fo**	
5	1.0	0.0007

	Detention Volumes [2,5]		
	(watershed inches)	**(acre-feet)**	**Maximum Allowable Release Rate, cfs**[3]
Excess Urban Runoff Volume[4]	0.22	13.30	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.32	19.72	370.00



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

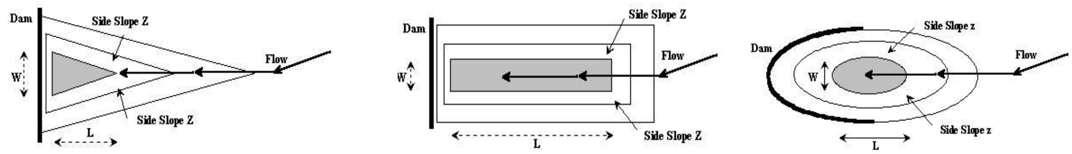
4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

FALCON MARKETPLACE POND SR4
ORIGINAL APPROVED DESIGN

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



Design Information (Input):

Width of Basin Bottom, W =		ft
Length of Basin Bottom, L =		ft
Dam Side-slope (H:V), Z_d =		ft/ft

Check Basin Shape

Right Triangle		OR…
Isosceles Triangle		OR…
Rectangle		OR…
Circle / Ellipse		OR…
Irregular		(Use Overide values in cells G32:G52)

Stage-Storage Relationship:

	MINOR	MAJOR	
Storage Requirement from Sheet 'Modified FAA':			acre-ft.
Storage Requirement from Sheet 'Hydrograph':			acre-ft.
Storage Requirement from Sheet 'Full-Spectrum':	13.30	19.72	acre-ft.

Labels for WQCV, Minor, & Major Storage Stages (input)	Water Surface Elevation ft (input)	Side Slope (H:V) ft/ft Below El. (input)	Basin Width at Stage ft (output)	Basin Length at Stage ft (output)	Surface Area at Stage ft^2 (output)	Surface Area at Stage ft^2 User Overide	Volume Below Stage ft^3 (output)	Surface Area at Stage acres (output)	Volume Below Stage acre-ft (output)	Target Volumes for WQCV, Minor, & Major Storage Volumes (for goal seek)
	6882.00					531		0.012	0.000	
	6883.00		0.00	0.00		531	531	0.012	0.012	
	6884.00		0.00	0.00		531	1,062	0.012	0.024	
	6885.00		0.00	0.00		886	1,771	0.020	0.041	
	6886.00		0.00	0.00		9,189	6,808	0.211	0.156	
	6887.00		0.00	0.00		27,880	25,343	0.640	0.582	
	6888.00		0.00	0.00		60,263	69,414	1.383	1.594	
	6889.00		0.00	0.00		85,329	142,210	1.959	3.265	
	6890.00		0.00	0.00		103,874	236,812	2.385	5.436	
	6891.00		0.00	0.00		111,922	344,710	2.569	7.913	
	6892.00		0.00	0.00		116,616	458,979	2.677	10.537	
WQCV	6893.00		0.00	0.00		128,472	581,523	2.949	13.350	
	6894.00		0.00	0.00		136,926	714,222	3.143	16.396	
	6895.00		0.00	0.00		145,498	855,434	3.340	19.638	
	6896.00		0.00	0.00		154,188	1,005,277	3.540	23.078	
	6896.50		0.00	0.00		158,590	1,083,471	3.641	24.873	
100-YR	6897.00		0.00	0.00		162,992	1,163,867	3.742	26.719	
	6897.50		0.00	0.00		167,639	1,246,524	3.848	28.616	
	6898.00		0.00	0.00		172,286	1,331,506	3.955	30.567	
	6899.00		0.00	0.00		181,155	1,508,226	4.159	34.624	
	6900.00		0.00	0.00		190,124	1,693,866	4.365	38.886	
	6901.00		0.00	0.00		199,194	1,888,525	4.573	43.355	
							#N/A		#N/A	
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							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
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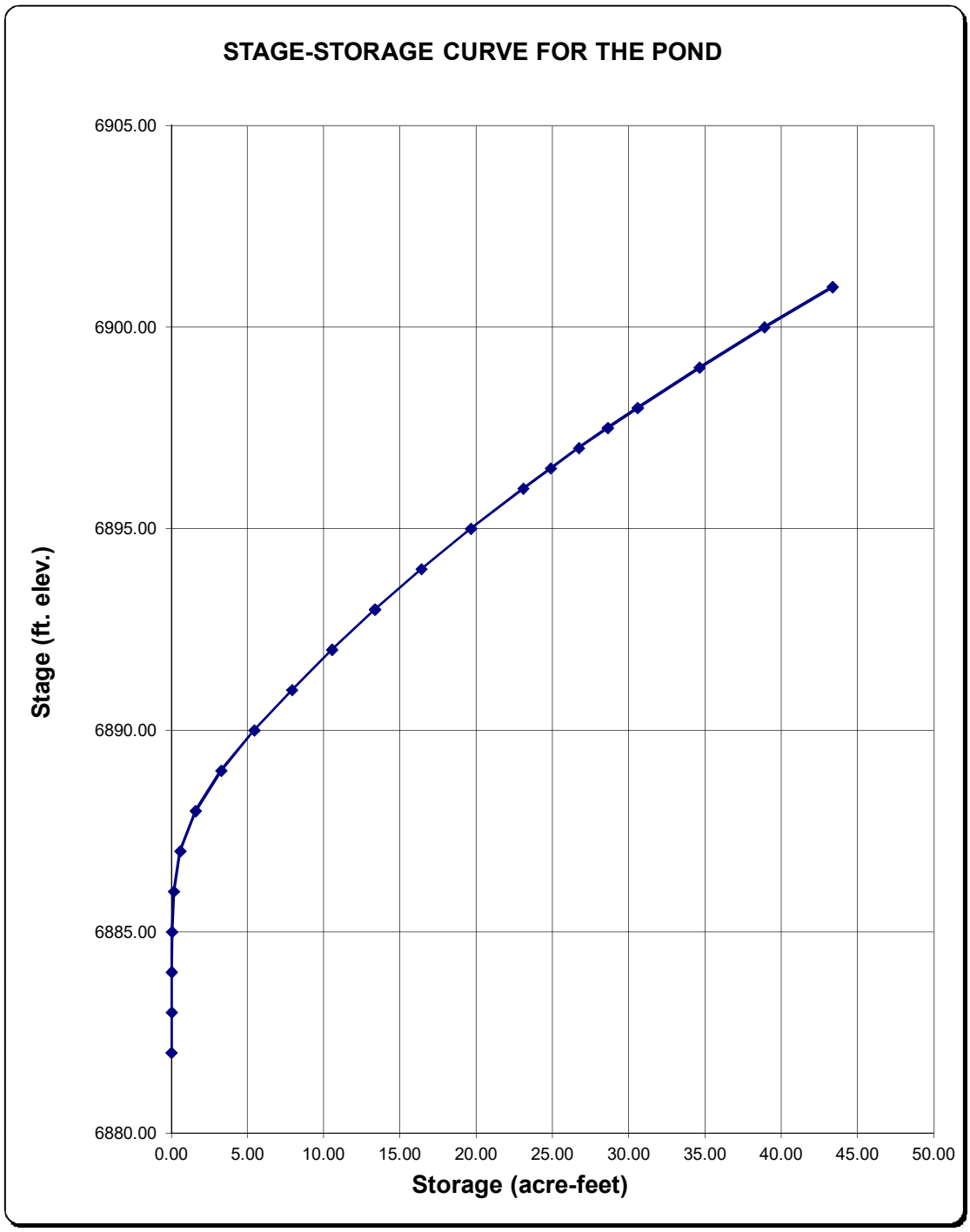
							#N/A		#N/A	

FALCON MARKETPLACE POND SR4
ORIGINAL APPROVED DESIGN

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: _____

Basin ID: _____



STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: FALCON MARKETPLACE

Basin ID: NORTH POND #1

WQCV Design Volume (Input):

Catchment Imperviousness, I_a =	15.0	percent
Catchment Area, A =	740.00	acres
Depth at WQCV outlet above lowest perforation, H =	8	feet
Vertical distance between rows, h =	30.00	inches
Number of rows, NL =	3.00	
Orifice discharge coefficient, C_o =	0.50	
Slope of Basin Trickle Channel, S =	0.005	ft / ft
Time to Drain the Pond =	40	hours

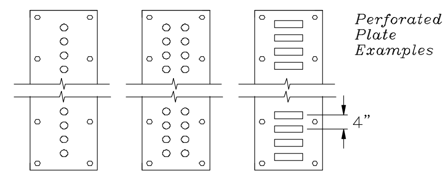
Diameter of holes, D =	5.000	inches
Number of holes per row, N =	1	
	OR	
Height of slot, H =		inches
Width of slot, W =		inches

Watershed Design Information (Input):

Percent Soil Type A =	100	%
Percent Soil Type B =		%
Percent Soil Type C/D =		%

Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet')	0.216	watershed inches
	N/A	
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet')	**13.300**	**acre-feet**
Outlet area per row, Ao =	69.21	square inches
Total opening area at each row based on user-input above, Ao =	19.63	square inches
Total opening area at each row based on user-input above, Ao =	0.136	square feet



3

Central Elevations of Rows of Holes in feet / Collection Capacity for Each Row of Holes in cfs

	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23	Row 23	Σ Flow
	6885.00	6887.50	6890.00																						
6882.00	0.0000	0.0000	0.0000																						0.00
6883.00	0.0000	0.0000	0.0000																						0.00
6884.00	0.0000	0.0000	0.0000																						0.00
6885.00	0.0000	0.0000	0.0000																						0.00
6886.00	0.5457	0.0000	0.0000																						0.55
6887.00	0.7717	0.0000	0.0000																						0.77
6888.00	0.9452	0.3859	0.0000																						1.33
6889.00	1.0914	0.6683	0.0000																						1.76
6890.00	1.2202	0.8628	0.0000																						2.08
6891.00	1.3367	1.0209	0.5457																						2.90
6892.00	1.4438	1.1576	0.7717																						3.37
6893.00	1.5435	1.2798	0.9452																						3.77
6894.00	1.6371	1.3913	1.0914																						4.12
6895.00	1.7256	1.4945	1.2202																						4.44
6896.00	1.8099	1.5910	1.3367																						4.74
6896.50	1.8505	1.6371	1.3913																						4.88
6897.00	1.8904	1.6820	1.4438																						5.02
6897.50	1.9293	1.7256	1.4945																						5.15
6898.00	1.9675	1.7683	1.5435																						5.28
6899.00	2.0418	1.8505	1.6371																						5.53
6900.00	2.1135	1.9293	1.7256																						5.77
6901.00	2.1828	2.0050	1.8099																						6.00
	#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	#N/A																						#N/A
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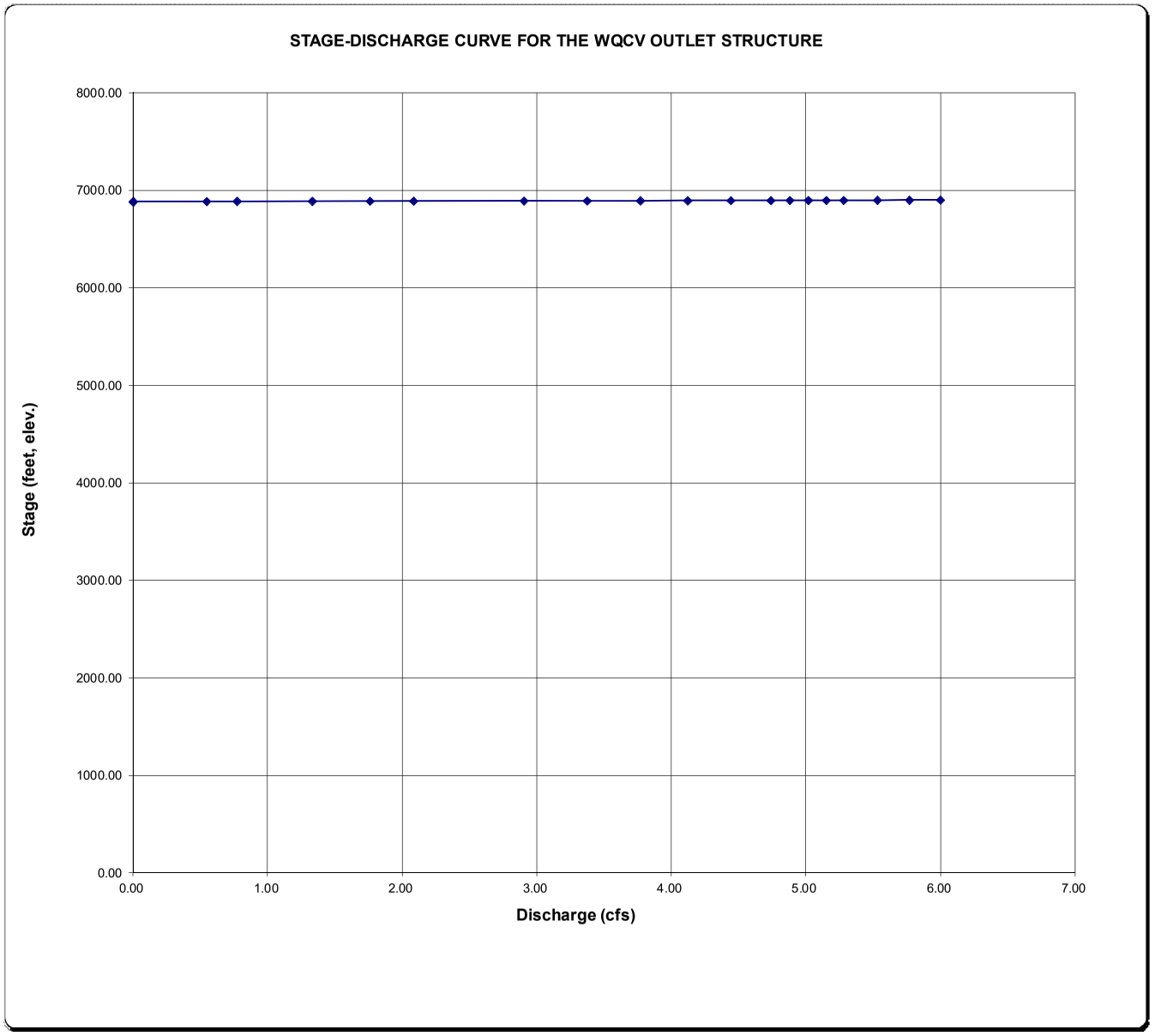
	#N/A	#N/A	#N/A																						#N/A
	Override Area Row 1	Override Area Row 2	Override Area Row 3	Override Area Row 4	Override Area Row 5	Override Area Row 6	Override Area Row 7	Override Area Row 8	Override Area Row 9	Override Area Row 10	Override Area Row 11	Override Area Row 12	Override Area Row 13	Override Area Row 14	Override Area Row 15	Override Area Row 16	Override Area Row 17	Override Area Row 18	Override Area Row 19	Override Area Row 20	Override Area Row 21	Override Area Row 22	Override Area Row 23	Override Area Row 24	
	0.14	0.14	0.14																						

STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

Project: FALCON MARKETPLACE

Basin ID: NORTH POND #1

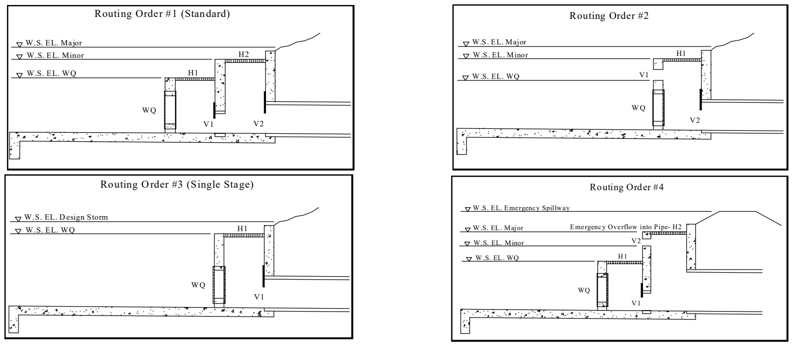


FALCON MARKETPLACE POND SR4
ORIGINAL APPROVED DESIGN

FALCON MARKETPLACE POND SR4
ORIGINAL APPROVED DESIGN

STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: Falcon Marketplace #1
Basin ID: NORTH POND #1



Current Routing Order is #3

Design Information (Input):

			#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Circular Opening:	Diameter in Inches	Dia. =			96.00		inches
OR							
Rectangular Opening:	Width in Feet	W =	8.00				ft.
	Length (Height for Vertical)	L or H =	12.00				ft.
	Percentage of Open Area After Trash Rack Reduction	% open =	80		100		%
	Orifice Coefficient	C_o =	0.75		0.75		
	Weir Coefficient	C_w =	3.00				
	Orifice Elevation (Bottom for Vertical)	E_o =	6893.80		6,881.97		ft.
Calculation of Collection Capacity:							
	Net Opening Area (after Trash Rack Reduction)	A_o =	76.80		50.27		sq. ft.
	OPTIONAL: User-Overide Net Opening Area	A_o =					sq. ft.
	Perimeter as Weir Length	L_w =	36.80	ft.			
	OPTIONAL: User-Overide Weir Length	L_w =		ft.			
	Top Elevation of Vertical Orifice Opening, Top =				6889.97		ft.
	Center Elevation of Vertical Orifice Opening, Cen =				6885.97		ft.

Routing 3: Single Stage - Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow will be applied to culvert sheet (#2 vertical & horizontal openings is not used).

			Horizontal Orifices				Vertical Orifices			
Labels for WQCV, Minor, & Major Storage W.S. Elevations (input)	Water Surface Elevation ft (linked)	WQCV Plate/Riser Flow cfs (User-linked)	#1 Horiz. Weir Flow cfs (output)	#1 Horiz. Orifice Flow cfs (output)	#2 Horiz. Weir Flow cfs (output)	#2 Horiz. Orifice Flow cfs (output)	#1 Vert. Collection Capacity cfs (output)	#2 Vert. Collection Capacity cfs (output)	**Total Collection Capacity cfs (output)**	Target Volumes for WQCV, Minor, & Major Storage Volumes (link for goal seek)
	6882.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	**0.00**	
	6883.00	0.00	0.00	0.00	0.00	0.00	27.95	0.00	**0.00**	
	6884.00	0.00	0.00	0.00	0.00	0.00	77.34	0.00	**0.00**	
	6885.00	0.00	0.00	0.00	0.00	0.00	141.04	0.00	**0.00**	
	6886.00	0.55	0.00	0.00	0.00	0.00	216.33	0.00	**0.55**	
	6887.00	0.77	0.00	0.00	0.00	0.00	301.66	0.00	**0.77**	
	6888.00	1.33	0.00	0.00	0.00	0.00	395.95	0.00	**1.33**	
	6889.00	1.76	0.00	0.00	0.00	0.00	498.43	0.00	**1.76**	
	6890.00	2.08	0.00	0.00	0.00	0.00	607.33	0.00	**2.08**	
	6891.00	2.90	0.00	0.00	0.00	0.00	678.51	0.00	**2.90**	
	6892.00	3.37	0.00	0.00	0.00	0.00	742.90	0.00	**3.37**	
WQCV	6893.00	3.77	0.00	0.00	0.00	0.00	802.14	0.00	**3.77**	
	6894.00	4.12	9.87	206.72	0.00	0.00	857.30	0.00	**13.99**	
	6895.00	4.44	145.12	506.36	0.00	0.00	909.11	0.00	**149.56**	
	6896.00	4.74	360.25	685.61	0.00	0.00	958.13	0.00	**364.99**	
	6896.50	4.88	489.80	759.53	0.00	0.00	981.72	0.00	**494.67**	
100-YR	6897.00	5.02	631.97	826.88	0.00	0.00	1004.76	0.00	**636.98**	
	6897.50	5.15	785.73	889.13	0.00	0.00	1027.28	0.00	**790.88**	
	6898.00	5.28	950.26	947.31	0.00	0.00	1049.32	0.00	**952.58**	
	6899.00	5.53	1309.10	1054.06	0.00	0.00	1092.06	0.00	**1059.59**	
	6900.00	5.77	1704.34	1150.96	0.00	0.00	1133.19	0.00	**1133.19**	
	6901.00	6.00	2132.89	1240.31	0.00	0.00	1172.88	0.00	**1172.88**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
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		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
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		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
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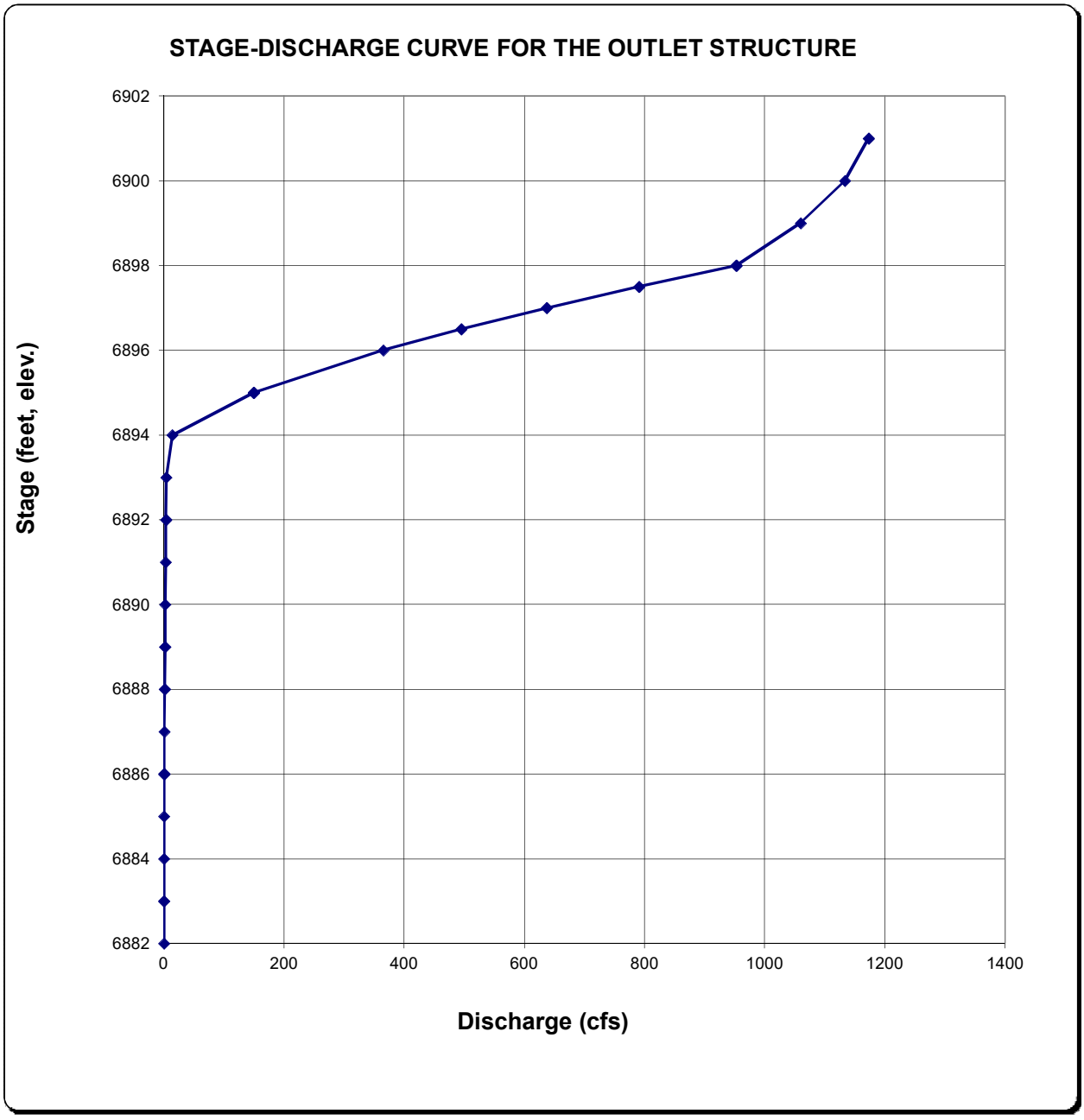
FALCON MARKETPLACE POND SR4
ORIGINAL APPROVED DESIGN

STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: Falcon Marketplace #1
Basin ID: NORTH POND #1

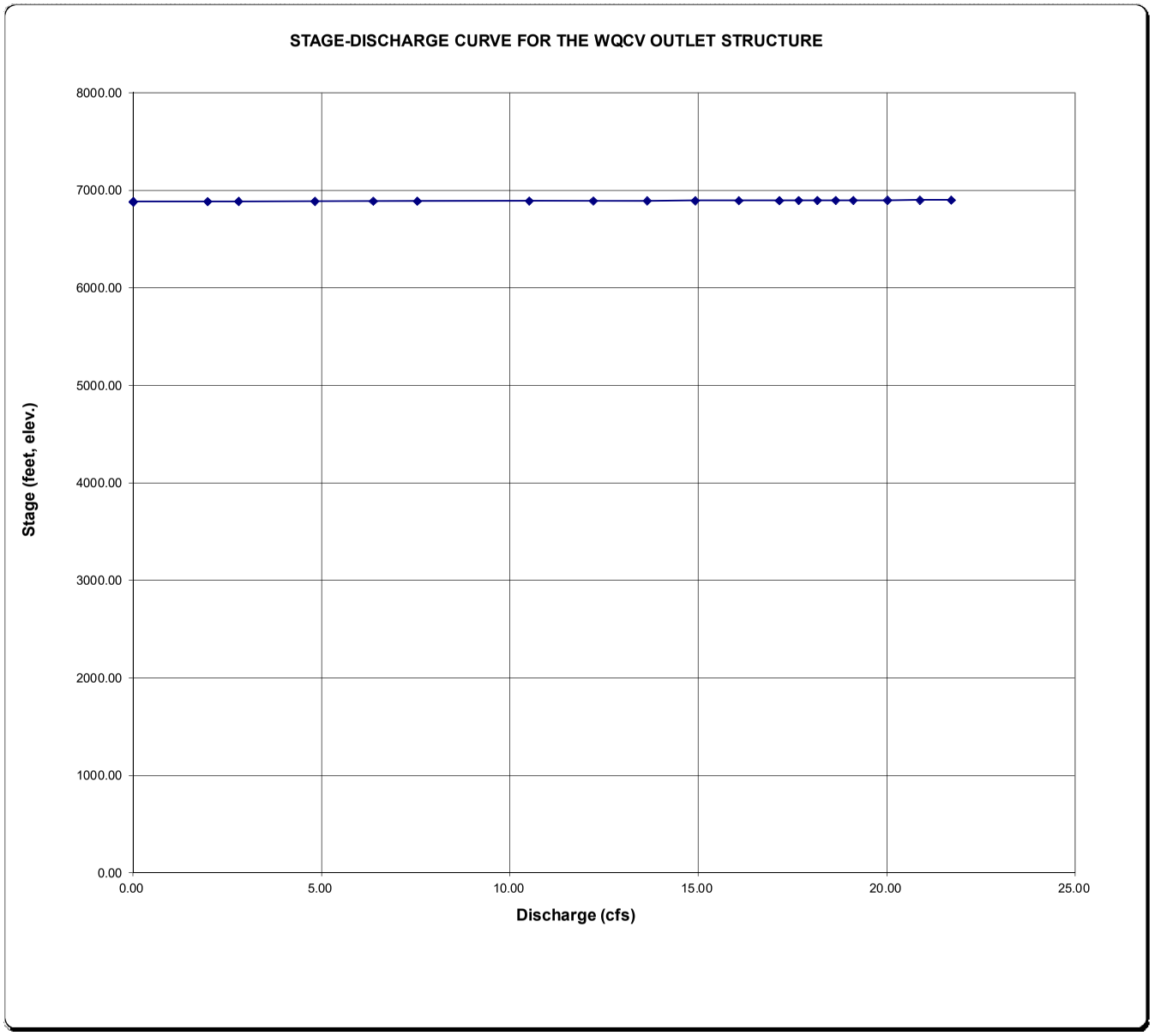


STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

Project: FALCON MARKETPLACE

Basin ID: NORTH POND #1

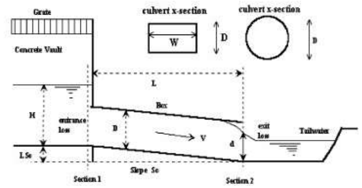


FALCON MARKETPLACE POND SR4
ORIGINAL APPROVED DESIGN

FALCON MARKETPLACE POND SR4
ORIGINAL APPROVED DESIGN

STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



Status: Culvert Data is valid!

Design Information (Input):

Circular Culvert: Barrel Diameter in Inches	D =	96	in.
Circular Culvert: Inlet Edge Type (choose from pull-down list)		Grooved End with Headwall	
OR:			
Box Culvert: Barrel Height (Rise) in Feet	Height (Rise) =		ft.
Box Culvert: Barrel Width (Span) in Feet	Width (Span) =		ft.
Box Culvert: Inlet Edge Type (choose from pull-down list)		Square Edge w/ 90-15 deg. Flared Wingwall	
Number of Barrels	No =	1	
Inlet Elevation at Culvert Invert	I_{elev} =	6881.97	ft. elev.
Outlet Elevation at Culvert Invert	O_{elev} =	6880.85	ft. elev.
Culvert Length in Feet	L =	78.0	ft.
Manning's Roughness	n =	0.0120	
Bend Loss Coefficient	K_b =	0.00	
Exit Loss Coefficient	K_x =	1.00	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.13
Sum of All Loss Coefficients	K_s =	1.33
Orifice Inlet Condition Coefficient	C_d =	0.99
Minimum Energy Condition Coefficient	KE_{low} =	-0.04

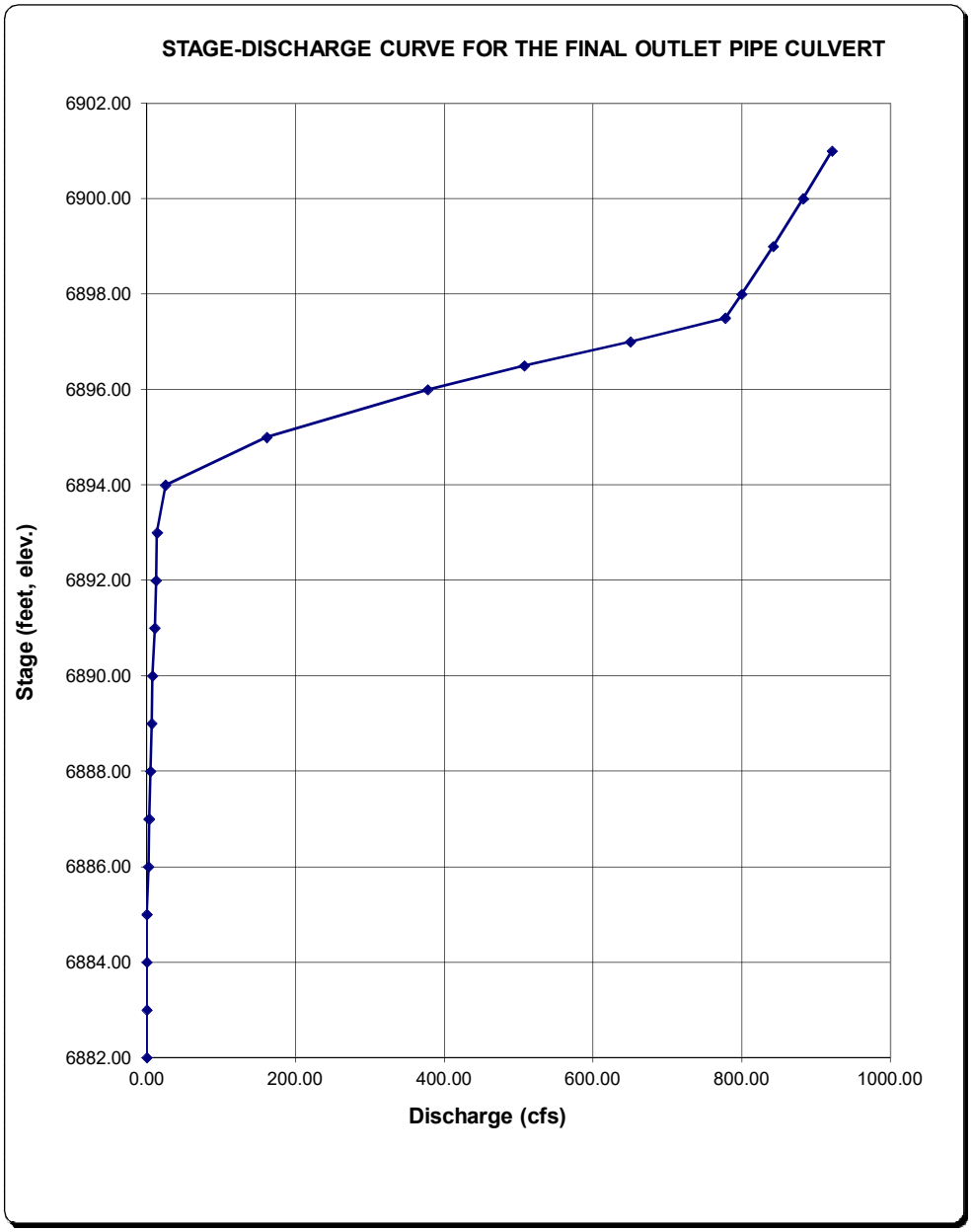
Calculations of Culvert Capacity (output):

Water Surface Elevation From Sheet "Basin" (ft., linked)	Tailwater Surface Elevation ft (input if known)	Culvert Inlet-Control Flowrate cfs (output)	Culvert Outlet-Control Flowrate cfs (output)	Flowrate Into Culvert From Sheet "Outlet" (cfs, linked)	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used (output)
6882.00	0.00	0.10	73.88	0.00	0.00	Min. Energy. Eqn.
6883.00	0.00	8.20	127.58	0.00	0.00	Min. Energy. Eqn.
6884.00	0.00	38.80	179.44	0.00	0.00	Min. Energy. Eqn.
6885.00	0.00	83.70	227.39	0.00	0.00	Min. Energy. Eqn.
6886.00	0.00	142.70	253.50	1.98	1.98	Regression Eqn.
6887.00	0.00	207.40	260.30	2.79	2.79	Regression Eqn.
6888.00	0.00	284.50	274.34	4.82	4.82	Regression Eqn.
6889.00	0.00	370.40	296.59	6.37	6.37	Regression Eqn.
6890.00	0.00	456.70	327.85	7.54	7.54	Regression Eqn.
6891.00	0.00	537.00	401.74	10.51	10.51	Regression Eqn.
6892.00	0.00	609.70	475.03	12.21	12.21	Regression Eqn.
6893.00	0.00	675.30	541.57	13.64	13.64	Regression Eqn.
6894.00	0.00	735.40	601.48	24.79	24.79	Regression Eqn.
6895.00	0.00	790.90	656.53	161.20	161.20	Regression Eqn.
6896.00	0.00	843.00	707.57	377.40	377.40	Regression Eqn.
6896.50	0.00	867.90	731.66	507.45	507.45	Regression Eqn.
6897.00	0.00	892.20	755.10	650.12	650.12	Regression Eqn.
6897.50	0.00	915.90	777.72	804.36	777.72	Regression Eqn.
6898.00	0.00	939.10	799.86	966.41	799.86	Regression Eqn.
6899.00	0.00	984.10	842.42	1074.08	842.42	Regression Eqn.
6900.00	0.00	1027.50	882.74	1133.19	882.74	Regression Eqn.
6901.00	0.00	1069.50	921.46	1172.88	921.46	Regression Eqn.
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)

FALCON MARKETPLACE POND SR4
ORIGINAL APPROVED DESIGN

STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

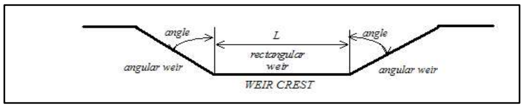
Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



FALCON MARKETPLACE POND SR4
ORIGINAL APPROVED DESIGN

STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



Design Information (input):

Bottom Length of Weir	L =	160.00	feet
Angle of Side Slope Weir	Angle =	75.96	degrees
Elev. for Weir Crest	EL. Crest =	6,898.00	feet
Coef. for Rectangular Weir	C_w =		
Coef. for Trapezoidal Weir	C_t =	3.50	

Calculation of Spillway Capacity (output):

Water Surface Elevation ft. (linked)	Rect. Weir Flowrate cfs (output)	Triangle Weir Flowrate cfs (output)	Total Spillway Release cfs (output)	Total Pond Release cfs (output)
6882.00	0.00	0.00	0.00	0.00
6883.00	0.00	0.00	0.00	0.00
6884.00	0.00	0.00	0.00	0.00
6885.00	0.00	0.00	0.00	0.00
6886.00	0.00	0.00	0.00	1.98
6887.00	0.00	0.00	0.00	2.79
6888.00	0.00	0.00	0.00	4.82
6889.00	0.00	0.00	0.00	6.37
6890.00	0.00	0.00	0.00	7.54
6891.00	0.00	0.00	0.00	10.51
6892.00	0.00	0.00	0.00	12.21
6893.00	0.00	0.00	0.00	13.64
6894.00	0.00	0.00	0.00	24.79
6895.00	0.00	0.00	0.00	161.20
6896.00	0.00	0.00	0.00	377.40
6896.50	0.00	0.00	0.00	507.45
6897.00	0.00	0.00	0.00	650.12
6897.50	0.00	0.00	0.00	777.72
6898.00	0.00	0.00	0.00	799.86
6899.00	0.00	14.00	14.00	856.42
6900.00	0.00	79.17	79.17	961.91
6901.00	0.00	218.18	218.18	1,139.63
#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	#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	#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	#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	#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
#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	#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	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A

PROJECT INFORMATION

PROJECT:	Falcon Marketplace
PROJECT NO:	20988-00CSCV
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Preliminary
DATE:	6/19/2017

Drexel, Barrell & Co.

SPILLWAY CALCULATIONS

Q=CL(H^(2/3))

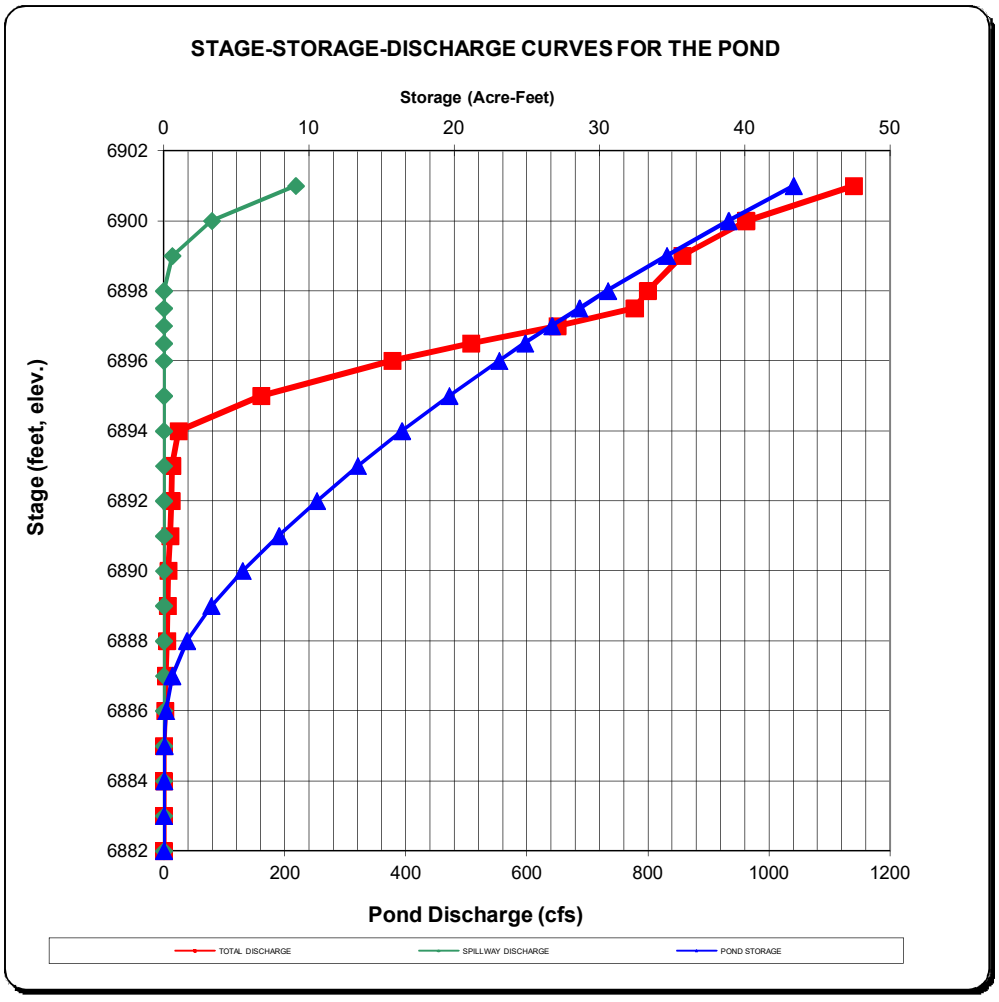
Weir coefficient C:	3.5
Depth H, ft:	1.5
Flowrate Q. cfs:	1016
Required L, ft:	**158.01**

FALCON MARKETPLACE POND SR4
ORIGINAL APPROVED DESIGN

FALCON MARKETPLACE POND SR4
ORIGINAL APPROVED DESIGN

STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



FALCON MARKETPLACE POND SR4
UPDATED WITH OWL MARKETPLACE

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: FALCON MARKETPLACE POND SR4
Basin ID:

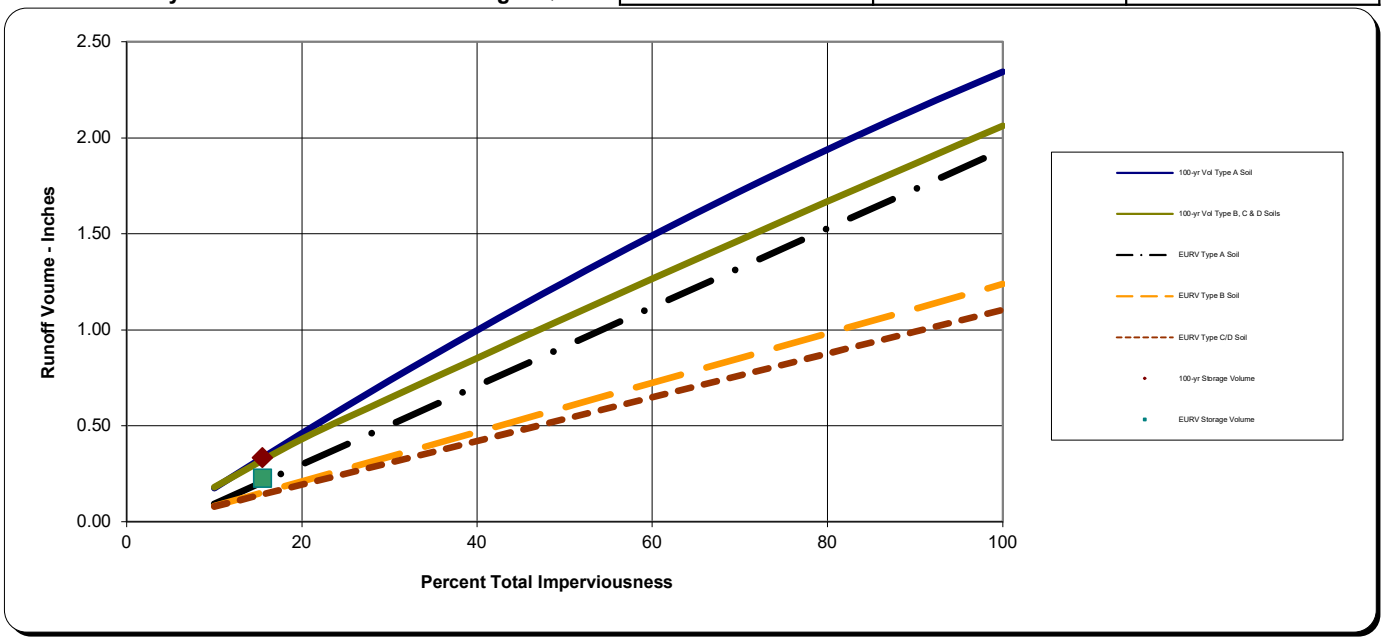
* User input data shown in blue.

Area of Watershed (acres)	740.00	
Subwatershed Imperviousness	15.5%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	15.5%	

Hydrologic Soil Type	**Percentage of Area**	**Area (acres)**
Type A	100.0%	740.0
Type B		0.0
Type C or D		0.0

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		**Decay Coefficient--α**
Initial--f_i	**Final--fo**	
5	1.0	0.0007

	Detention Volumes [2,5]		
	(watershed inches)	**(acre-feet)**	**Maximum Allowable Release Rate, cfs**[3]
Excess Urban Runoff Volume[4]	0.23	13.99	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.33	20.60	370.00



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

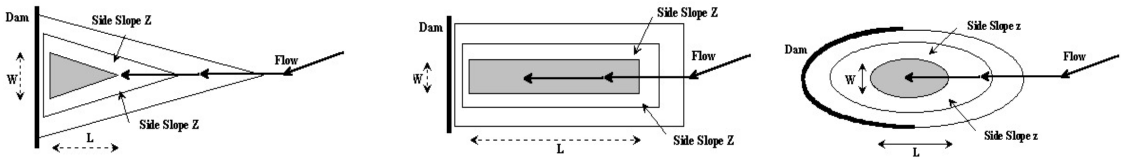
4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

FALCON MARKETPLACE POND SR4
UPDATED WITH OWL MARKETPLACE

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



Design Information (Input):

Width of Basin Bottom, W = ft
Length of Basin Bottom, L = ft
Dam Side-slope (H:V), Z_d = ft/ft

Check Basin Shape

Right Triangle OR…
Isosceles Triangle OR…
Rectangle OR…
Circle / Ellipse OR…
Irregular (Use Overide values in cells G32:G52)

Stage-Storage Relationship:

	MINOR	MAJOR	
Storage Requirement from Sheet 'Modified FAA':			acre-ft.
Storage Requirement from Sheet 'Hydrograph':			acre-ft.
Storage Requirement from Sheet 'Full-Spectrum':	13.99	20.60	acre-ft.

Labels for WQCV, Minor, & Major Storage Stages (input)	Water Surface Elevation ft (input)	Side Slope (H:V) ft/ft Below El. (input)	Basin Width at Stage ft (output)	Basin Length at Stage ft (output)	Surface Area at Stage ft² (output)	Surface Area at Stage ft² User Overide	Volume Below Stage ft³ (output)	Surface Area at Stage acres (output)	Volume Below Stage acre-ft (output)	Target Volumes for WQCV, Minor, & Major Storage Volumes (for goal seek)
	6882.00					531		0.012	0.000	
	6883.00		0.00	0.00		531	531	0.012	0.012	
	6884.00		0.00	0.00		531	1,062	0.012	0.024	
	6885.00		0.00	0.00		886	1,771	0.020	0.041	
	6886.00		0.00	0.00		9,189	6,808	0.211	0.156	
	6887.00		0.00	0.00		27,880	25,343	0.640	0.582	
	6888.00		0.00	0.00		60,263	69,414	1.383	1.594	
	6889.00		0.00	0.00		85,329	142,210	1.959	3.265	
	6890.00		0.00	0.00		103,874	236,812	2.385	5.436	
	6891.00		0.00	0.00		111,922	344,710	2.569	7.913	
	6892.00		0.00	0.00		116,616	458,979	2.677	10.537	
	6893.00		0.00	0.00		128,472	581,523	2.949	13.350	
	6894.00		0.00	0.00		136,926	714,222	3.143	16.396	
	6895.00		0.00	0.00		145,498	855,434	3.340	19.638	
	6896.00		0.00	0.00		154,188	1,005,277	3.540	23.078	
	6896.50		0.00	0.00		158,590	1,083,471	3.641	24.873	
	6897.00		0.00	0.00		162,992	1,163,867	3.742	26.719	
	6897.50		0.00	0.00		167,639	1,246,524	3.848	28.616	
	6898.00		0.00	0.00		172,286	1,331,506	3.955	30.567	
	6899.00		0.00	0.00		181,155	1,508,226	4.159	34.624	
	6900.00		0.00	0.00		190,124	1,693,866	4.365	38.886	
	6901.00		0.00	0.00		199,194	1,888,525	4.573	43.355	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
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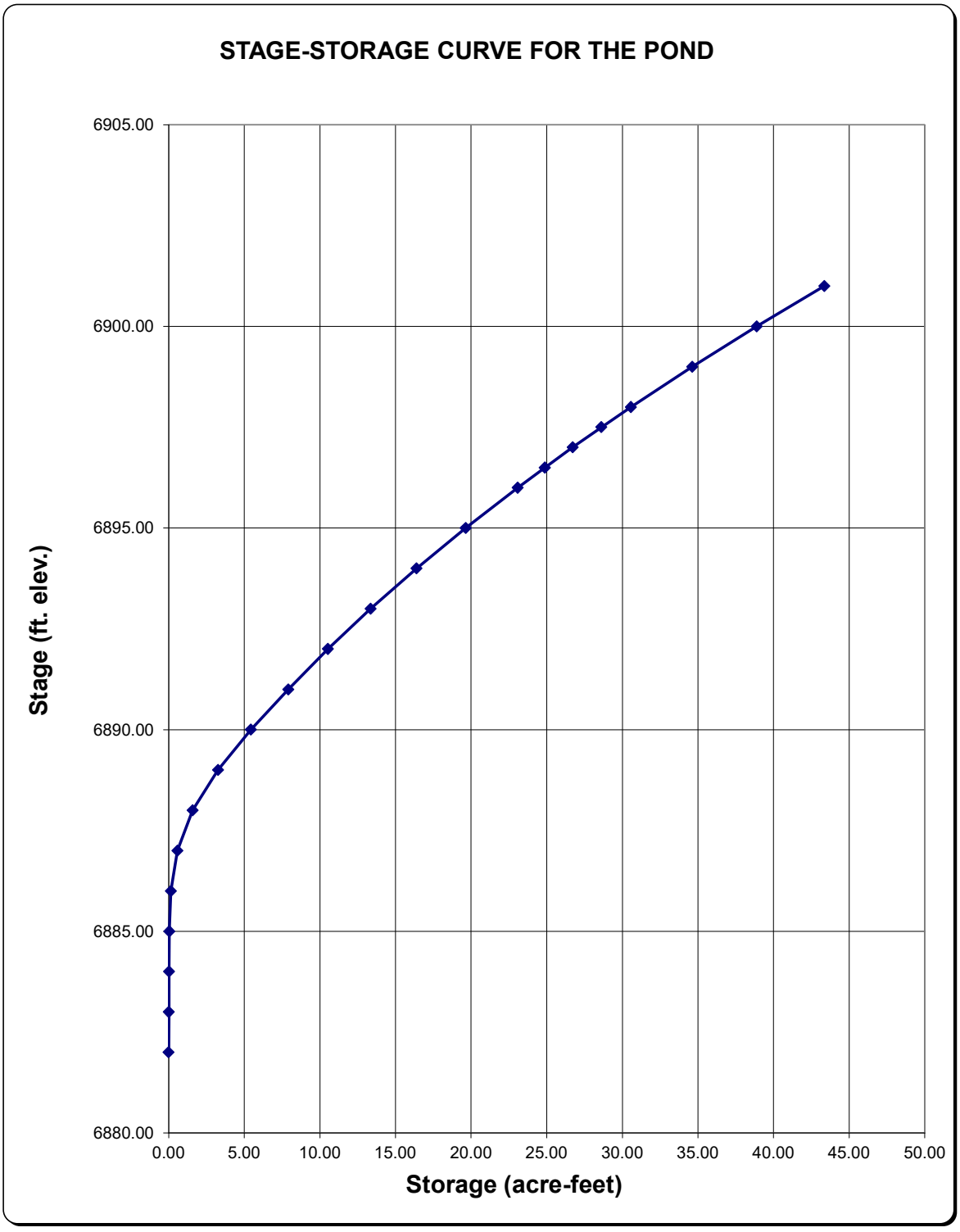
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	

FALCON MARKETPLACE POND SR4
UPDATED WITH OWL MARKETPLACE

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: _____

Basin ID: _____



FALCON MARKETPLACE POND SR4
UPDATED WITH OWL MARKETPLACE

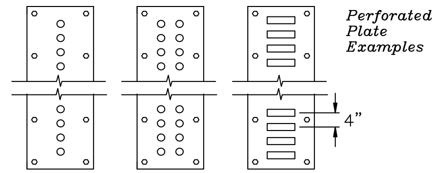
STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1

WQCV Design Volume (Input):

Catchment Imperviousness, I_a = 15.5 percent
Catchment Area, A = 740.00 acres
Depth at WQCV outlet above lowest perforation, H = 8 feet
Vertical distance between rows, h = 30.00 inches
Number of rows, NL = 3.00
Orifice discharge coefficient, C_o = 0.50
Slope of Basin Trickle Channel, S = 0.005 ft / ft
Time to Drain the Pond = 40 hours

Diameter of holes, D = 5.000 inches
Number of holes per row, N = 1
OR
Height of slot, H = inches
Width of slot, W = inches



Watershed Design Information (Input):

Percent Soil Type A = 100 %
Percent Soil Type B = %
Percent Soil Type C/D = %

Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') 0.227 watershed inches
N/A
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') 13.995 acre-feet
Outlet area per row, Ao = 72.08 square inches
Total opening area at each row based on user-input above, Ao = 19.63 square inches
Total opening area at each row based on user-input above, Ao = 0.136 square feet

3	Central Elevations of Rows of Holes in feet																								
	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23	Row 23	Σ Flow
	6885.00	6887.50	6890.00																						
	Collection Capacity for Each Row of Holes in cfs																								
6882.00	0.0000	0.0000	0.0000																						0.00
6883.00	0.0000	0.0000	0.0000																						0.00
6884.00	0.0000	0.0000	0.0000																						0.00
6885.00	0.0000	0.0000	0.0000																						0.00
6886.00	0.5471	0.0000	0.0000																						0.55
6887.00	0.7737	0.0000	0.0000																						0.77
6888.00	0.9476	0.3869	0.0000																						1.33
6889.00	1.0942	0.6701	0.0000																						1.76
6890.00	1.2234	0.8651	0.0000																						2.09
6891.00	1.3402	1.0236	0.5471																						2.91
6892.00	1.4475	1.1606	0.7737																						3.38
6893.00	1.5475	1.2831	0.9476																						3.78
6894.00	1.6414	1.3949	1.0942																						4.13
6895.00	1.7301	1.4983	1.2234																						4.45
6896.00	1.8146	1.5951	1.3402																						4.75
6896.50	1.8554	1.6414	1.3949																						4.89
6897.00	1.8953	1.6863	1.4475																						5.03
6897.50	1.9344	1.7301	1.4983																						5.16
6898.00	1.9727	1.7729	1.5475																						5.29
6899.00	2.0471	1.8554	1.6414																						5.54
6900.00	2.1190	1.9344	1.7301																						5.78
6901.00	2.1885	2.0102	1.8146																						6.01
	#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	#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
	#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	#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
	#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	#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
	#N/A	#N/A	#N/A																						#N/A
	Override Area Row 1	Override Area Row 2	Override Area Row 3	Override Area Row 4	Override Area Row 5	Override Area Row 6	Override Area Row 7	Override Area Row 8	Override Area Row 9	Override Area Row 10	Override Area Row 11	Override Area Row 12	Override Area Row 13	Override Area Row 14	Override Area Row 15	Override Area Row 16	Override Area Row 17	Override Area Row 18	Override Area Row 19	Override Area Row 20	Override Area Row 21	Override Area Row 22	Override Area Row 23	Override Area Row 24	

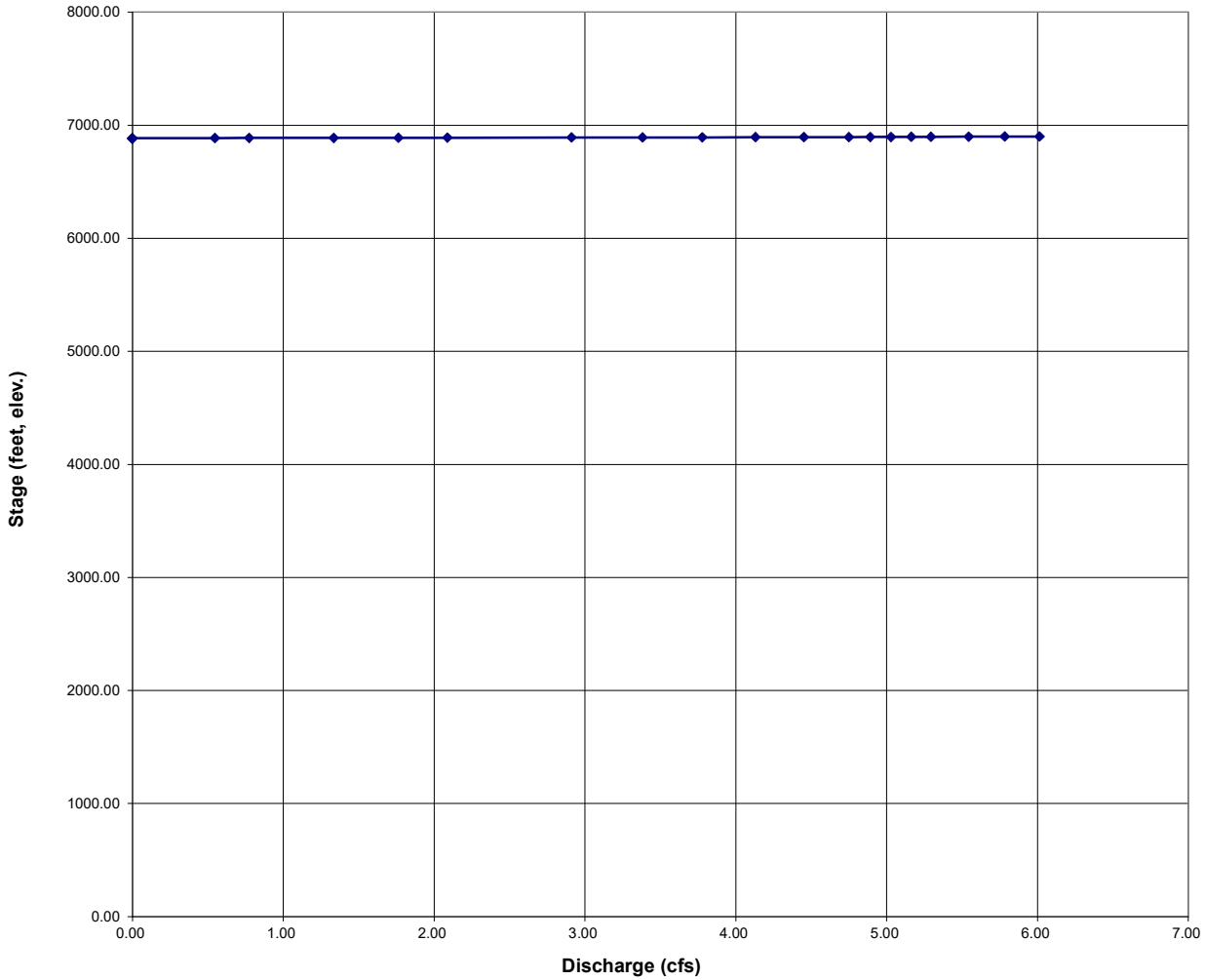
FALCON MARKETPLACE POND SR4
UPDATED WITH OWL MARKETPLACE

STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1

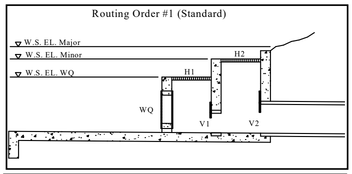
STAGE-DISCHARGE CURVE FOR THE WQCV OUTLET STRUCTURE

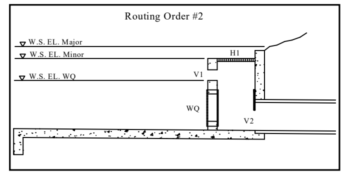


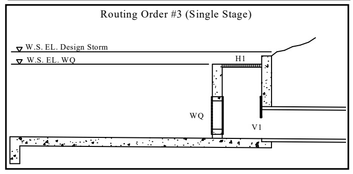
FALCON MARKETPLACE POND SR4
UPDATED WITH OWL MARKETPLACE

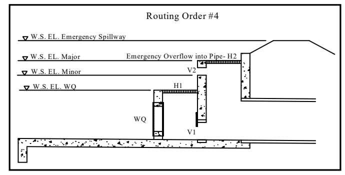
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: Falcon Marketplace #1
Basin ID: NORTH POND #1









Current Routing Order is #3

Design Information (Input):

			#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Circular Opening:	Diameter in Inches	Dia. =			96.00		inches
OR							
Rectangular Opening:	Width in Feet	W =	8.00				ft.
	Length (Height for Vertical)	L or H =	12.00				ft.
	Percentage of Open Area After Trash Rack Reduction	% open =	80		100		%
	Orifice Coefficient	C_o =	0.75		0.75		
	Weir Coefficient	C_w =	3.00				
	Orifice Elevation (Bottom for Vertical)	E_o =	6893.80		6,881.97		ft.

Calculation of Collection Capacity:

		#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Net Opening Area (after Trash Rack Reduction)	A_o =	76.80		50.27		sq. ft.
OPTIONAL: User-Overide Net Opening Area	A_o =					sq. ft.
Perimeter as Weir Length	L_w =	36.80	ft.			
OPTIONAL: User-Overide Weir Length	L_w =		ft.			
Top Elevation of Vertical Orifice Opening, Top =				6889.97		ft.
Center Elevation of Vertical Orifice Opening, Cen =				6885.97		ft.

Routing 3: Single Stage - Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow will be applied to culvert sheet (#2 vertical & horizontal openings is not used).

			Horizontal Orifices				Vertical Orifices			
Labels for WQCV, Minor, & Major Storage W.S. Elevations (input)	Water Surface Elevation ft (linked)	WQCV Plate/Riser Flow cfs (User-linked)	#1 Horiz. Weir Flow cfs (output)	#1 Horiz. Orifice Flow cfs (output)	#2 Horiz. Weir Flow cfs (output)	#2 Horiz. Orifice Flow cfs (output)	#1 Vert. Collection Capacity cfs (output)	#2 Vert. Collection Capacity cfs (output)	**Total Collection Capacity cfs (output)**	Target Volumes for WQCV, Minor, & Major Storage Volumes (link for goal seek)
	6882.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	**0.00**	
	6883.00	0.00	0.00	0.00	0.00	0.00	27.95	0.00	**0.00**	
	6884.00	0.00	0.00	0.00	0.00	0.00	77.34	0.00	**0.00**	
	6885.00	0.00	0.00	0.00	0.00	0.00	141.04	0.00	**0.00**	
	6886.00	0.55	0.00	0.00	0.00	0.00	216.33	0.00	**0.55**	
	6887.00	0.77	0.00	0.00	0.00	0.00	301.66	0.00	**0.77**	
	6888.00	1.33	0.00	0.00	0.00	0.00	395.95	0.00	**1.33**	
	6889.00	1.76	0.00	0.00	0.00	0.00	498.43	0.00	**1.76**	
	6890.00	2.09	0.00	0.00	0.00	0.00	607.33	0.00	**2.09**	
	6891.00	2.91	0.00	0.00	0.00	0.00	678.51	0.00	**2.91**	
	6892.00	3.38	0.00	0.00	0.00	0.00	742.90	0.00	**3.38**	
	6893.00	3.78	0.00	0.00	0.00	0.00	802.14	0.00	**3.78**	
	6894.00	4.13	9.87	206.72	0.00	0.00	857.30	0.00	**14.00**	
	6895.00	4.45	145.12	506.36	0.00	0.00	909.11	0.00	**149.58**	
	6896.00	4.75	360.25	685.61	0.00	0.00	958.13	0.00	**365.00**	
	6896.50	4.89	489.80	759.53	0.00	0.00	981.72	0.00	**494.69**	
	6897.00	5.03	631.97	826.88	0.00	0.00	1004.76	0.00	**637.00**	
	6897.50	5.16	785.73	889.13	0.00	0.00	1027.28	0.00	**790.89**	
	6898.00	5.29	950.26	947.31	0.00	0.00	1049.32	0.00	**952.60**	
	6899.00	5.54	1309.10	1054.06	0.00	0.00	1092.06	0.00	**1059.61**	
	6900.00	5.78	1704.34	1150.96	0.00	0.00	1133.19	0.00	**1133.19**	
	6901.00	6.01	2132.89	1240.31	0.00	0.00	1172.88	0.00	**1172.88**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
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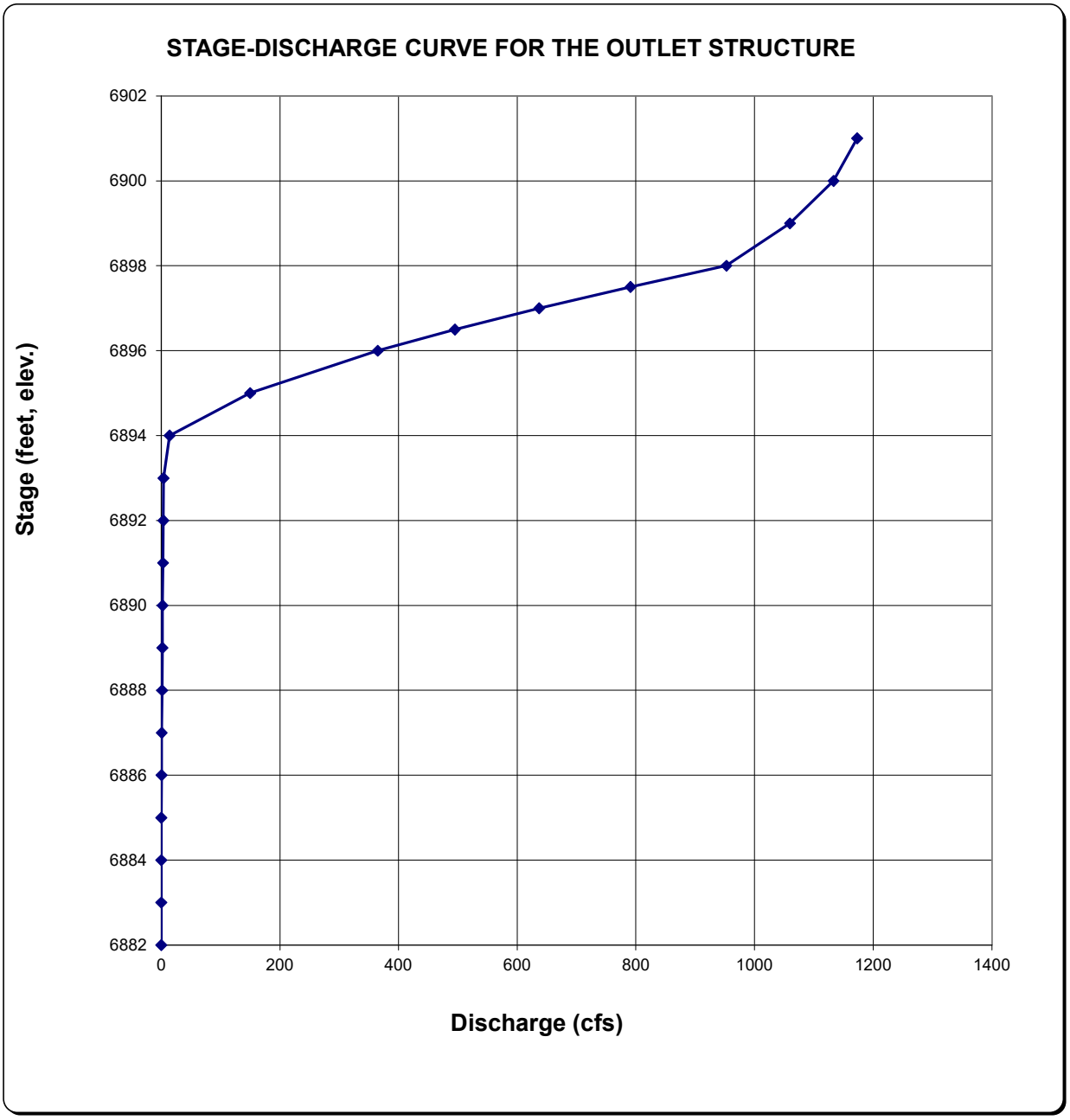
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	

FALCON MARKETPLACE POND SR4
UPDATED WITH OWL MARKETPLACE

STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

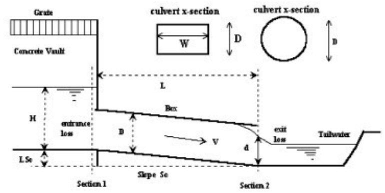
Project: Falcon Marketplace #1
Basin ID: NORTH POND #1



FALCON MARKETPLACE POND SR4
UPDATED WITH OWL MARKETPLACE

STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: **FALCON MARKETPLACE**
Basin ID: **NORTH POND #1**



Status: Culvert Data is valid!

Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	96	in.
Circular Culvert:	Inlet Edge Type (choose from pull-down list)		Grooved End with Headwall	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	Height (Rise) =		ft.
Box Culvert:	Barrel Width (Span) in Feet	Width (Span) =		ft.
Box Culvert:	Inlet Edge Type (choose from pull-down list)		Square Edge w/ 90-15 deg. Flared Wingwall	
	Number of Barrels	No =	1	
	Inlet Elevation at Culvert Invert	I_{elev} =	6881.97	ft. elev.
	Outlet Elevation at Culvert Invert	O_{elev} =	6880.85	ft. elev.
	Culvert Length in Feet	L =	78.0	ft.
	Manning's Roughness	n =	0.0120	
	Bend Loss Coefficient	K_b =	0.00	
	Exit Loss Coefficient	K_x =	1.00	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.13
Sum of All Loss Coefficients	K_s =	1.33
Orifice Inlet Condition Coefficient	C_d =	0.99
Minimum Energy Condition Coefficient	KE_{low} =	-0.04

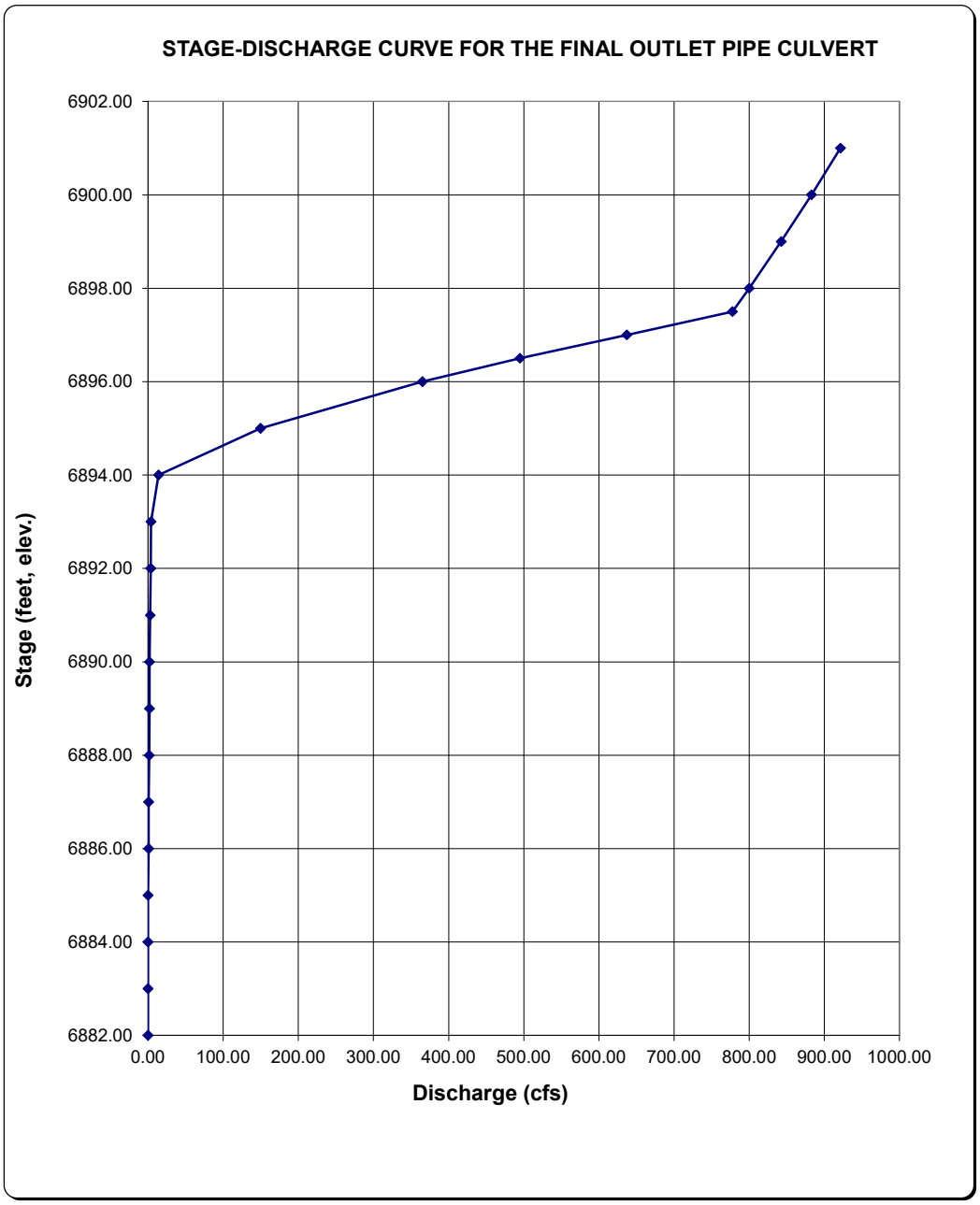
Calculations of Culvert Capacity (output):

Water Surface Elevation From Sheet "Basin" (ft., linked)	Tailwater Surface Elevation ft (input if known)	Culvert Inlet-Control Flowrate cfs (output)	Culvert Outlet-Control Flowrate cfs (output)	Flowrate Into Culvert From Sheet "Outlet" (cfs, linked)	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used (output)
6882.00	0.00	0.10	73.88	0.00	0.00	Min. Energy. Eqn.
6883.00	0.00	8.20	127.58	0.00	0.00	Min. Energy. Eqn.
6884.00	0.00	38.80	179.44	0.00	0.00	Min. Energy. Eqn.
6885.00	0.00	83.70	227.39	0.00	0.00	Min. Energy. Eqn.
6886.00	0.00	142.70	253.50	0.55	0.55	Regression Eqn.
6887.00	0.00	207.40	260.30	0.77	0.77	Regression Eqn.
6888.00	0.00	284.50	274.34	1.33	1.33	Regression Eqn.
6889.00	0.00	370.40	296.59	1.76	1.76	Regression Eqn.
6890.00	0.00	456.70	327.85	2.09	2.09	Regression Eqn.
6891.00	0.00	537.00	401.74	2.91	2.91	Regression Eqn.
6892.00	0.00	609.70	475.03	3.38	3.38	Regression Eqn.
6893.00	0.00	675.30	541.57	3.78	3.78	Regression Eqn.
6894.00	0.00	735.40	601.48	14.00	14.00	Regression Eqn.
6895.00	0.00	790.90	656.53	149.58	149.58	Regression Eqn.
6896.00	0.00	843.00	707.57	365.00	365.00	Regression Eqn.
6896.50	0.00	867.90	731.66	494.69	494.69	Regression Eqn.
6897.00	0.00	892.20	755.10	637.00	637.00	Regression Eqn.
6897.50	0.00	915.90	777.72	790.89	777.72	Regression Eqn.
6898.00	0.00	939.10	799.86	952.60	799.86	Regression Eqn.
6899.00	0.00	984.10	842.42	1059.61	842.42	Regression Eqn.
6900.00	0.00	1027.50	882.74	1133.19	882.74	Regression Eqn.
6901.00	0.00	1069.50	921.46	1172.88	921.46	Regression Eqn.
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	#N/A	#N/A	No Flow (WS < inlet)

FALCON MARKETPLACE POND SR4
UPDATED WITH OWL MARKETPLACE

STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

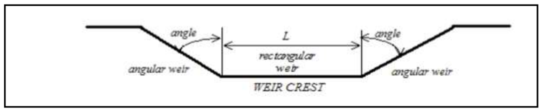
Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



FALCON MARKETPLACE POND SR4
UPDATED WITH OWL MARKETPLACE

STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



Design Information (input):

Bottom Length of Weir	L =	160.00	feet
Angle of Side Slope Weir	Angle =	75.96	degrees
Elev. for Weir Crest	EL. Crest =	6,898.00	feet
Coef. for Rectangular Weir	C_w =		
Coef. for Trapezoidal Weir	C_t =	3.50	

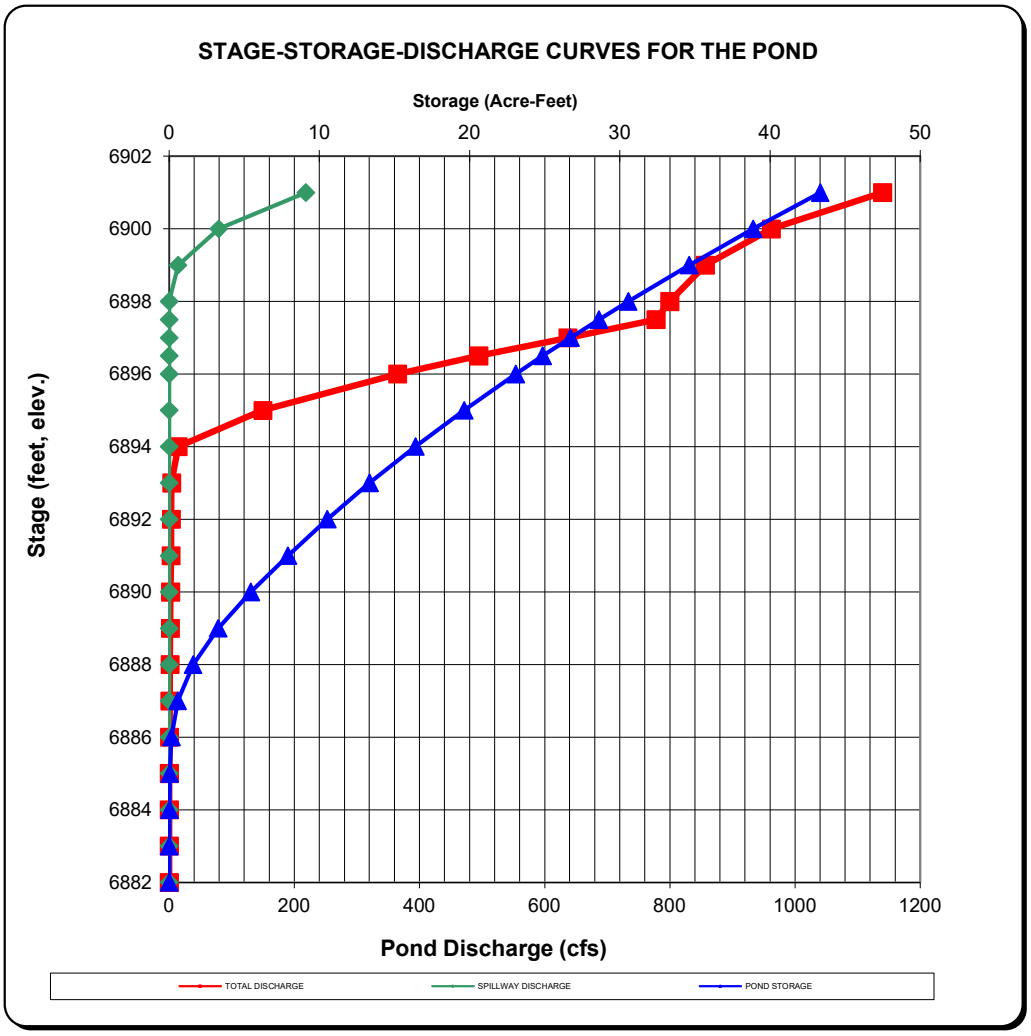
Calculation of Spillway Capacity (output):

Water Surface Elevation ft. (linked)	Rect. Weir Flowrate cfs (output)	Triangle Weir Flowrate cfs (output)	Total Spillway Release cfs (output)	Total Pond Release cfs (output)
6882.00	0.00	0.00	0.00	0.00
6883.00	0.00	0.00	0.00	0.00
6884.00	0.00	0.00	0.00	0.00
6885.00	0.00	0.00	0.00	0.00
6886.00	0.00	0.00	0.00	0.55
6887.00	0.00	0.00	0.00	0.77
6888.00	0.00	0.00	0.00	1.33
6889.00	0.00	0.00	0.00	1.76
6890.00	0.00	0.00	0.00	2.09
6891.00	0.00	0.00	0.00	2.91
6892.00	0.00	0.00	0.00	3.38
6893.00	0.00	0.00	0.00	3.78
6894.00	0.00	0.00	0.00	14.00
6895.00	0.00	0.00	0.00	149.58
6896.00	0.00	0.00	0.00	365.00
6896.50	0.00	0.00	0.00	494.69
6897.00	0.00	0.00	0.00	637.00
6897.50	0.00	0.00	0.00	777.72
6898.00	0.00	0.00	0.00	799.86
6899.00	0.00	14.00	14.00	856.42
6900.00	0.00	79.17	79.17	961.91
6901.00	0.00	218.18	218.18	1,139.63
#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	#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	#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	#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	#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
#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	#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	#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	#N/A	#N/A	#N/A

FALCON MARKETPLACE POND SR4
UPDATED WITH OWL MARKETPLACE

STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



APPENDIX
REPORT EXCERPTS
FALCON DBPS

FALCON DRAINAGE BASIN PLANNING STUDY

SELECTED PLAN REPORT

FINAL - SEPTEMBER 2015

Prepared for:

El Paso County Public Services Department
3275 Akers Drive
Colorado Springs, CO 80922

Prepared By:

Matrix Design Group
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920

Matrix Project No. 10.122.003

LEGEND

«-- Subbasin ID
«-- Subbasin Area (square miles)

Existing Watershed Boundary
Historical and Future Watershed Boundary

Tributary Basin Boundary

East Tributary
Middle Tributary
West Tributary
Subbasin Boundary
Major Tributary
Elevation Contour (feet)

Falcon Drainage Basin	
Total Basin Area	10.7 mi^2
Average Subbasin Area	0.16 mi^2
Minimum Subbasin Area	0.03 mi^2
Maximum Subbasin Area	0.33 mi^2

East Tributary

West Tributary

Middle Tributary

BURGESS RD
GOODSON RD
MERIDIAN RD
RAYGOR RD
STAPLETON DR
EASTONVILLE RD
JUDGE ORR RD
WOODMEN RD
TAMLIN RD
FALCON HWY
GARRETT RD
MERIDIAN RD

WT020 0.07
WT010 0.14
WT030 0.08
WT040 0.19
WT050 0.19
WT070 0.17
WT060 0.20
WT080 0.07
WT090 0.15
WT110 0.19
WT100 0.19
WT140 0.13
WT150 0.23
WT120 0.05
WT130 0.10
WT160 0.11
WT170 0.12
WT180 0.10
WT190 0.06
WT200 0.30
WT210 0.27
WT220 0.19
WT230 0.20
WT240 0.08
WT250 0.15
WT260 0.14
WT270 0.03
WT280 0.27
WT290 0.10
WT300 0.10
WT310 0.28
WT320 0.21
WT330 0.33
WT340 0.28
WT350 0.30
WT360 0.07
WT370 0.21

ET010 0.15
ET020 0.21
MT020 0.09
MT040 0.31
ET030 0.20
MT010 0.29
MT030 0.16
ET040 0.15
ET060 0.29
ET050 0.12
MT050 0.12
MT060 0.19
ET070 0.25
ET090 0.12
ET080 0.29
MT070 0.20
MT080 0.06
MT090 0.04
ET130 0.13
ET100 0.05
MT100 0.06
ET110 0.23
ET140 0.27
MT110 0.12
ET120 0.11
ET150 0.18
ET160 0.19
FS010 0.12

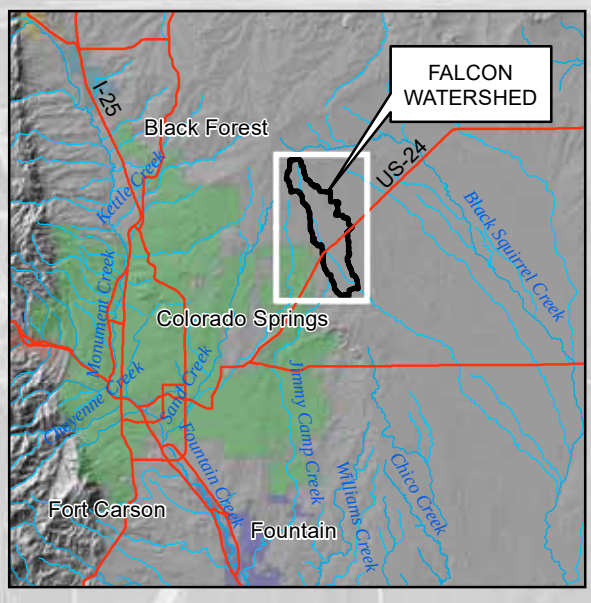


Figure 3-2
Drainage Basin Map
Falcon DBPS
El Paso County, CO

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Miles

NOTE: FIGURE MUST BE VIEWED IN COLOR

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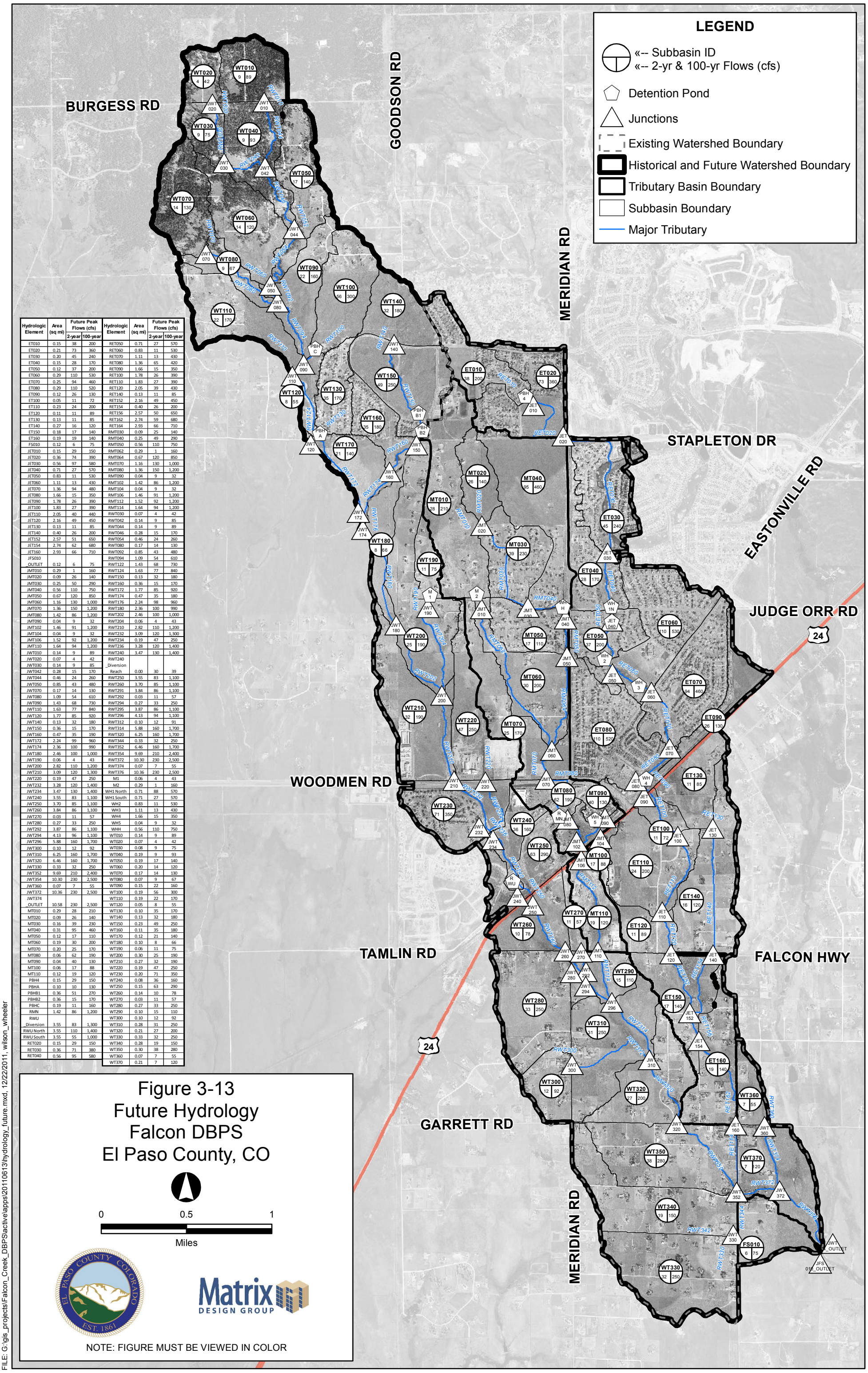

Hydrologic Element	Area (sq mi)	Future Peak Flows (cfs)	
		2-year	100-year
ET010	0.15	38	200
ET020	0.21	73	360
ET030	0.20	45	240
ET040	0.15	28	170
ET050	0.12	37	200
ET060	0.29	110	530
ET070	0.25	94	460
ET080	0.29	110	520
ET090	0.12	26	130
ET100	0.05	11	72
ET110	0.23	24	200
ET120	0.11	11	89
ET130	0.13	11	85
ET140	0.27	16	120
ET150	0.18	17	140
ET160	0.19	19	140
FS010	0.12	6	75
JET010	0.15	29	150
JET020	0.36	74	390
JET030	0.56	97	580
JET040	0.71	27	570
JET050	0.83	11	530
JET060	1.11	13	430
JET070	1.36	94	480
JET080	1.66	15	350
JET090	1.78	26	390
JET100	1.83	27	390
JET110	2.05	40	440
JET120	2.16	49	450
JET130	0.13	11	85
JET140	0.40	26	200
JET152	2.57	51	650
JET154	2.74	62	680
JET160	2.93	66	710
JFS010 _OUTLET	0.12	6	75
JMT010	0.29	1	160
JMT020	0.09	26	140
JMT030	0.25	50	290
JMT040	0.56	110	750
JMT050	0.67	120	850
JMT060	1.16	130	1,000
JMT070	1.36	150	1,200
JMT080	1.42	86	1,200
JMT090	0.04	9	32
JMT102	1.46	91	1,200
JMT104	0.04	9	32
JMT106	1.52	92	1,200
JMT112	1.64	94	1,200
JWT010	0.14	9	89
JWT020	0.07	4	42
JWT030	0.14	9	85
JWT042	0.28	15	170
JWT044	0.46	24	260
JWT050	0.85	43	480
JWT070	0.17	14	130
JWT080	1.09	54	610
JWT090	1.43	68	730
JWT110	1.63	77	840
JWT120	1.77	85	920
JWT140	0.13	32	180
JWT150	0.36	15	170
JWT160	0.47	35	190
JWT172	2.24	99	960
JWT174	2.36	100	990
JWT180	2.46	100	1,000
JWT190	0.06	4	43
JWT200	2.82	110	1,200
JWT210	3.09	120	1,300
JWT220	0.19	47	250
JWT232	3.28	120	1,400
JWT234	3.47	130	1,400
JWT240	3.55	83	1,100
JWT250	3.70	85	1,100
JWT260	3.84	86	1,100
JWT270	0.03	11	57
JWT280	0.27	33	250
JWT292	3.87	86	1,100
JWT294	4.13	96	1,100
JWT296	5.88	160	1,700
JWT300	0.10	12	92
JWT310	6.25	160	1,700
JWT320	6.46	160	1,700
JWT330	0.33	32	250
JWT352	9.69	210	2,400
JWT354	10.30	230	2,500
JWT360	0.07	7	55
JWT372	10.36	230	2,500
JWT374 _OUTLET	10.58	230	2,500
MT010	0.29	28	210
MT020	0.09	26	140
MT030	0.16	39	230
MT040	0.31	95	460
MT050	0.12	17	110
MT060	0.19	30	200
MT070	0.20	25	170
MT080	0.06	62	190
MT090	0.04	40	130
MT100	0.06	17	88
MT110	0.12	19	120
PBH4	0.15	29	150
PBHA	0.10	10	130
PBHB1	0.36	51	270
PBHB2	0.36	15	170
PBHC	0.19	11	160
RMN	1.42	86	1,200
RWU Diversion	3.55	83	1,300
RWU North	3.55	110	1,400
RWU South	3.55	55	1,000
RET020	0.15	29	150
RET030	0.36	71	380
RET040	0.56	95	580
RET050	0.71	27	570
RET060	0.83	11	530
RET070	1.11	13	430
RET080	1.36	65	420
RET090	1.66	15	350
RET100	1.78	26	390
RET110	1.83	27	390
RET120	2.05	39	430
RET140	0.13	11	85
RET152	2.16	49	450
RET154	0.40	26	200
RET156	2.57	50	650
RET162	2.74	59	680
RET164	2.93	66	710
RMT030	0.09	25	140
RMT040	0.25	49	290
RMT050	0.56	110	750
RMT062	0.29	1	160
RMT064	0.67	120	850
RMT070	1.16	130	1,000
RMT080	1.36	150	1,200
RMT090	0.04	9	32
RMT102	1.42	86	1,200
RMT104	0.04	9	32
RMT106	1.46	91	1,200
RMT112	1.52	92	1,200
RMT114	1.64	94	1,200
RWT030	0.07	4	42
RWT042	0.14	9	85
RWT044	0.14	9	89
RWT046	0.28	15	170
RWT054	0.46	24	260
RWT080	0.17	14	130
RWT092	0.85	43	480
RWT094	1.09	54	610
RWT122	1.43	68	730
RWT124	1.63	77	840
RWT150	0.13	32	180
RWT160	0.36	15	170
RWT172	1.77	85	920
RWT174	0.47	35	180
RWT176	2.24	98	960
RWT180	2.36	100	990
RWT202	2.46	100	1,000
RWT204	0.06	4	43
RWT210	2.82	110	1,200
RWT232	3.09	120	1,300
RWT234	0.19	47	250
RWT236	3.28	120	1,400
RWT240	3.47	130	1,400
RWT240 _Diversion Reach	0.00	30	39
RWT250	3.55	83	1,100
RWT260	3.70	85	1,100
RWT291	3.84	86	1,100
RWT292	0.03	11	57
RWT294	0.27	33	250
RWT295	3.87	86	1,100
RWT296	4.13	96	1,100
RWT312	0.10	12	91
RWT314	5.88	160	1,700
RWT320	6.25	160	1,700
RWT344	6.46	160	1,700
RWT352	9.69	210	2,400
RWT372	10.30	230	2,500
RWT376	10.36	230	2,500
M1	0.06	4	43
M2	0.29	1	160
WH1 North	0.71	88	570
WH1 South	0.71	27	570
WH2	0.83	11	530
WH3	1.11	13	430
WH4	1.66	15	350
WH5	0.04	9	32
WHH	0.56	110	750
WT010	0.14	9	89
WT020	0.07	4	42
WT030	0.08	9	75
WT040	0.19	9	93
WT050	0.19	17	140
WT060	0.20	14	120
WT070	0.17	14	130
WT080	0.07	9	67
WT090	0.15	22	160
WT100	0.19	56	300
WT110	0.19	22	170
WT120	0.05	8	55
WT130	0.10	35	170
WT140	0.13	32	180
WT150	0.23	49	250
WT160	0.11	35	180
WT170	0.12	21	140
WT180	0.10	8	66
WT190	0.06	11	75
WT200	0.30	25	190
WT210	0.27	32	190
WT220	0.19	47	250
WT230	0.20	71	350
WT240	0.08	36	160
WT250	0.15	63	290
WT260	0.14	10	78
WT270	0.03	11	57
WT280	0.27	33	250
WT290	0.10	15	110
WT300	0.10	12	92
WT310	0.28	31	250
WT320	0.21	27	200
WT330	0.33	32	250
WT340	0.28	19	150
WT350	0.30	38	280
WT360	0.07	7	55
WT370	0.21	7	120

Figure 3-13
Future Hydrology
Falcon DBPS
El Paso County, CO

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NOTE: FIGURE MUST BE VIEWED IN COLOR

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Sub Regional Detention Alternative[1]						
Pond		Q_2 In (cfs)	Q_2 Out (cfs)	Q_{100} In (cfs)	Q_{100} Out (cfs)	Required Volume (AF)[2]
Paint Brush Hills Pond #4	PBH 4	38	29	200	150	1.34
Paint Brush Hills Pond A	PBH A	35	7	170	140	2.62
Paint Brush Hills Pond B1	PBH B1	80	51	420	270	9.17
Paint Brush Hills Pond B2	PBH B2	51	10	270	180	12.09
Paint Brush Hills Pond C	PBH C	56	3	300	140	6.77
Regional Pond MN	R MN	65	32	850	820	7.53
Regional Pond R1	R R1	110	77	1,600	1,500	25.00
Regional Pond R2	R R2	140	140	2,200	2,200	3.13
Regional Pond WU South	R WUs	47	22	1,100	930	39.54
Sub Regional Pond SR1	SR 1	54	42	610	510	11.03
Sub Regional Pond SR2	SR 2	65	65	840	840	2.05
Sub Regional Pond SR3	SR 3	72	72	910	910	1.03
Sub Regional Pond SR4	SR 4	130	27	1,000	730	19.37
Sub Regional Pond SR6	SR 6	74	9	390	200	11.82
The Meadows Pond #1	M 1	11	0	70	0	3.25
The Meadows Pond #2	M 2	28	5	210	100	7.94
Woodmen Hills Pond #1 North	WH 1N	65	61	390	260	7.13
Woodmen Hills Pond #1 South	WH 1S	61	10	260	260	8.78
Woodmen Hills Pond #2	WH 2	37	10	270	250	9.18
Woodmen Hills Pond #3	WH 3	110	13	530	360	8.35
Woodmen Hills Pond #4	WH 4	110	15	790	260	40.45
Woodmen Hills Pond #5	WH 5	40	1	130	20	4.10
Woodmen Hills Pond H	WH H	140	110	750	750	2.66

Notes

1: Represents future hydrology with retrofit existing detention ponds and 7 new sub regional detention ponds

2: Required volume to highest WSE not including embankment

Reach Alternative	Total (ft)
Natural Channel Design	13,216
Protect in Place	64,325
Roadside Ditch Improvement	7,519
Small Drop Structures w/ Toe Protection	50,750

BURGESS RD

GOODSON RD

MERIDIAN RD

STAPLETON DR

EASTONVILLE RD

JUDGE ORR RD

DIVERSION

WOODMEN RD

TAMLIN RD

FALCON HWY

GARRETT RD

MERIDIAN RD

24

LEGEND

Detention Pond

- Existing
- Proposed
- Existing Watershed Boundary
- Historical and Future Watershed Boundary
- Tributary Basin Boundary
- Subbasin Boundary
- Major Tributary
- Immediate Action Required to Preserve Existing Condition

Reach Alternative

- Natural Channel Design
- Protect In Place
- Roadside Ditch Improvement
- Small Drop Structures w/ Toe Protection

Note:
Infrastructure and channel improvements shown may vary slightly from the final list published in the accompanying report as a result of fee revisions that have occurred following the preparation of this figure. For current information as of September 2015, please see tables in Section 6 of the accompanying report.

Figure 6-1
Selected Plan
Falcon DBPS
El Paso County, CO

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Miles

NOTE: FIGURE MUST BE VIEWED IN COLOR

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Sheet 6-23
Falcon DBPS
Conceptual Plan
Middle Tributary
El Paso County, CO

MT 6 - Woodmen Rd.
EX Size: 4' Circular RCP (x3)
PR Size: 5' Circular RCP (x3)
* Sub-Regional Pond SR4 will be designed to mitigate capacity issues.

Floodplain Enters Underground Storm System

Sub Regional Pond SR4
WQCV = 7.3 AF
100-yr Volume = 19 AF
$Q_{2\ in}$ = 130 cfs
$Q_{2\ out}$ = 27 cfs
$Q_{100\ in}$ = 1000 cfs
$Q_{100\ out}$ = 730 cfs
See Detail on Sheet 6-55

MT 7 - Owl Place
EX Size: 1.75' (W) x 1.25' (H) CMP Elliptical (x4)
PR Size: 4' (W) x 2' (H) Concrete Box (x9)
* Road profile would need to be raised to implement a feasible solution.

MT 6-2 - Woodmen Rd.
EX Size: 4' Circular RCP (x3)
PR Size: 5' Circular RCP (x3)
* Sub-Regional Pond SR4 will be designed to mitigate capacity issues.

Small Drop Structure
See Detail on Sheet 6-54

Future conveyance from Meridian Rd roadside ditch TBD

Note:
Infrastructure and channel improvements shown may vary slightly from the final list published in the accompanying report as a result of fee revisions that have occurred following the preparation of this figure. For current information as of September 2015, please see tables in Section 6 of the accompanying report.

Drainageway Crossing
Stream Centerline
Existing Approximate 100-yr Floodplain*
Floodplain Study Limit

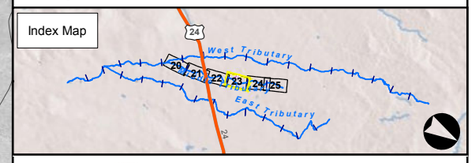
Storm Sewer
Inlet
Manhole
Pipe

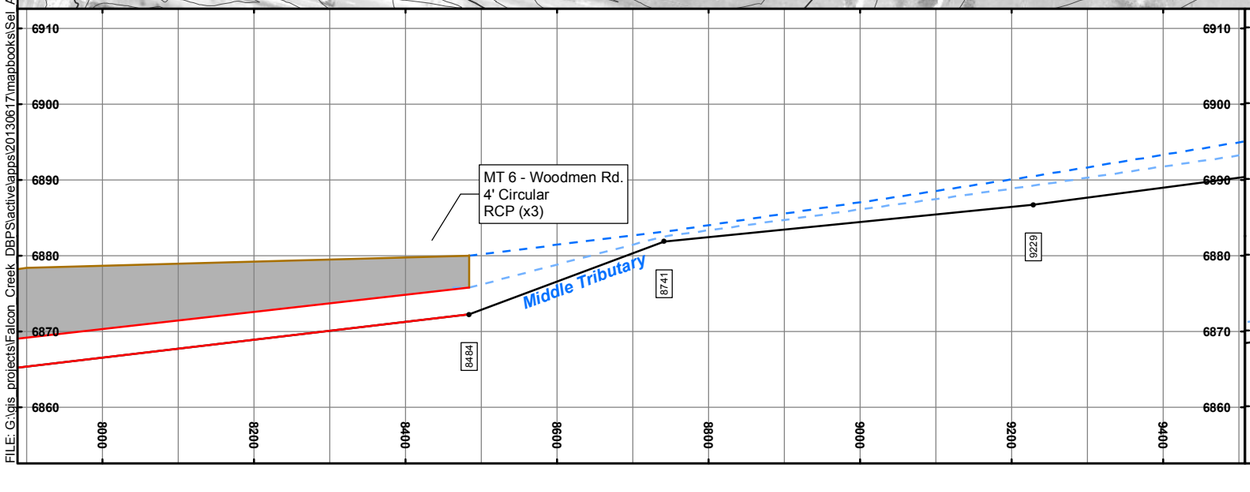
Reach Improvements
Natural Channel Design
Protect In Place
Roadside Ditch Improvement
Small Drop Structures w/ Toe Protection
Existing Detention
Proposed Detention
Proposed Detention Grading
Small Drop Structure
Cross Vane
Immediate Action Required to Preserve Existing Condition

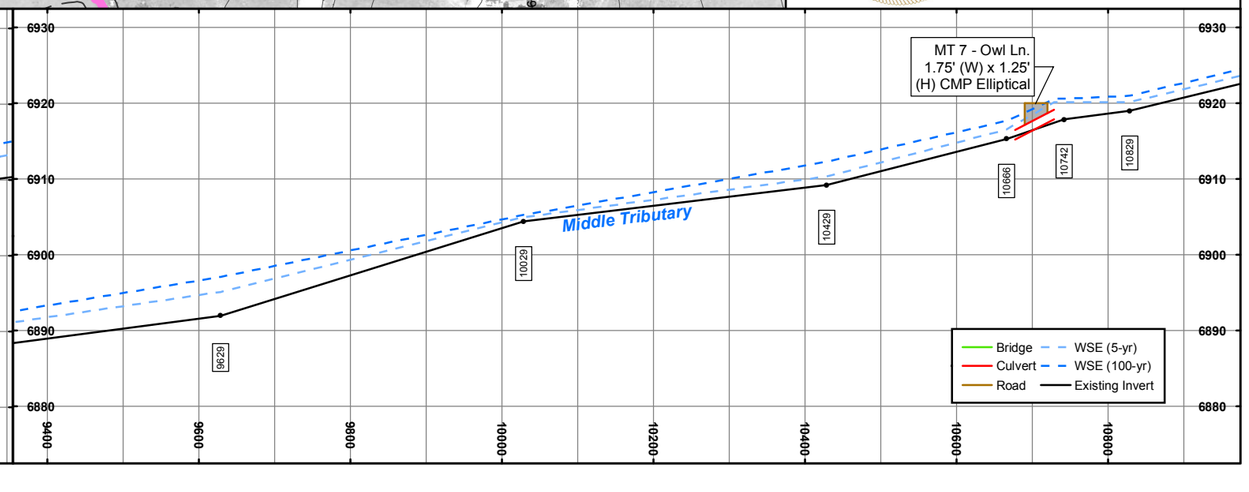
0 100 200 Feet

* These approximate 100-yr floodplain boundaries are for planning purposes only. This information is not intended to replace the information provided on the FEMA Flood Insurance Rate Maps for this area.
** These are conceptual design drawings and are subject to change. These drawings are not intended for construction purposes.

Index Map







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Sheet 6-24
Falcon DBPS
Conceptual Plan
Middle Tributary
El Paso County, CO

Drainageway Crossing
Stream Centerline
Existing Approximate 100-yr Floodplain*
Floodplain Study Limit

Storm Sewer
Inlet
Manhole
Pipe

Reach Improvements
Natural Channel Design
Protect In Place
Roadside Ditch Improvement
Small Drop Structures w/ Toe Protection
Existing Detention
Proposed Detention
Proposed Detention Grading
Small Drop Structure
Cross Vane
Immediate Action Required to Preserve Existing Condition

0 100 200 Feet

* These approximate 100-yr floodplain boundaries are for planning purposes only. This information is not intended to replace the information provided on the FEMA Flood Insurance Rate Maps for this area.
** These are conceptual design drawings and are subject to change. These drawings are not intended for construction purposes.

Index Map

Small Drop Structure
See Detail on Sheet 6-54

Approximate Limits of Split Flow for Existing 100-yr Floodplain

Note:
Infrastructure and channel improvements shown may vary slightly from the final list published in the accompanying report as a result of fee revisions that have occurred following the preparation of this figure. For current information as of September 2015, please see tables in Section 6 of the accompanying report.

matchline - see Sheet 6-23

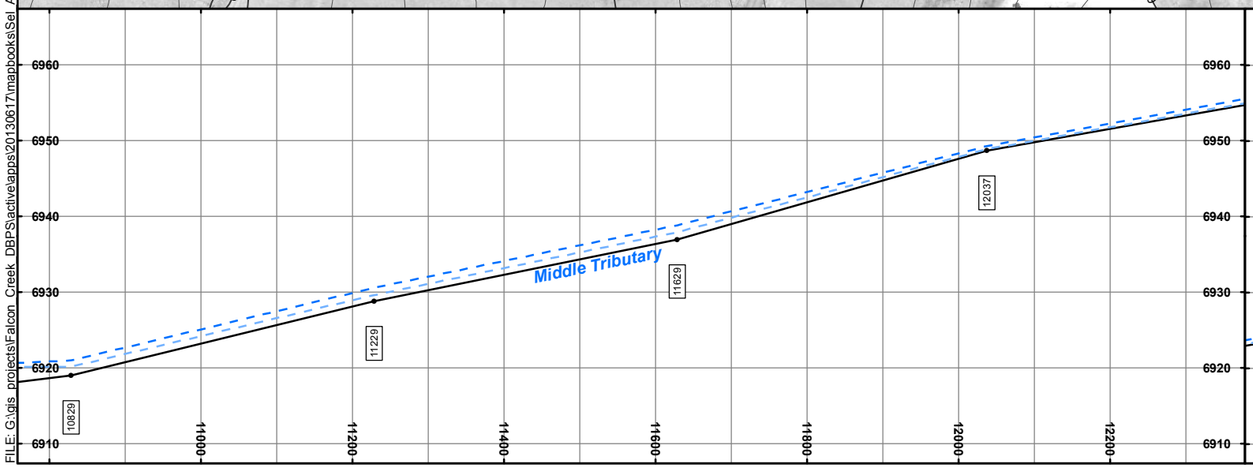
matchline - see Sheet 6-25

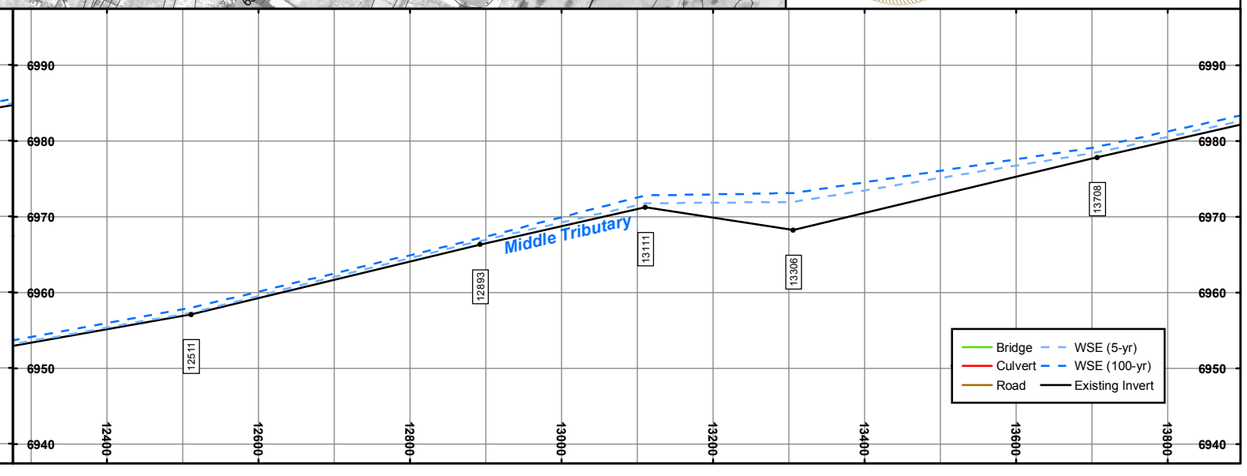
Middle Tributary

RMT062

Cow Palace Rd

Salinas Rd





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7.0 FEE DEVELOPMENT

7.1. Introduction

The objective of the fee development exercise was to determine the equitable share of drainage improvement costs that a developer is responsible for paying to El Paso County if they wish to plat a property. This fee is a function of the total cost for the selected plan outlined in Section 6 and will be used by the County to pay for drainage improvements that are necessary as a result of development. The product of this calculation is a unit fee (cost/impervious acre) that is a one-time charge to the developer based on the number of impervious acres within the platted property.

7.2. Developable Land

The Falcon Watershed has a total area of 6,847 acres. The entirety of the watershed is within the County with 1,969 acres unplatted, according to the GIS dataset received from the County. This dataset also includes unplatted areas that can't be developed because of specific land use designations. Table 7-1 provides a summary of land classifications in the Falcon Watershed. A complete summary of unplatted area land use is provided in Appendix E.

Table 7-1. Land Classification

Classification	Area (acres)
Platted	3,670
Unplatted	1,969
Other	1,208
Total	**6,847**

The projected impervious acreage within unplatted areas totals 645.58 acres. A summary of land classification within the Falcon Watershed is provided in Figure 7-3.

7.3. Fee Calculation & County Cost

The total cost for the Selected Plan was separated into a Development Fee, County Cost, Metropolitan District Cost, and Drainage and Bridge Funds. A description of how the aforementioned were defined is as follows:

- **County Cost** – Drainage improvement costs that are the responsibility of the County as shown in Figure 7-1.
- **Metropolitan District Cost** – Drainage improvement costs that are the responsibility of a metropolitan district as shown in Figure 7-2.
- **Development Fee** – All drainage improvement costs that are directly associated with new development.
- **Drainage and Bridge Funds** – The balance of drainage and bridge funds as of August 2015 was $584,134 and $510,777, respectively, with a liability of $300,000 cost for this DBPS (an additional contract amendment increased the cost of this DBPS to $339,088).

The anticipated reimbursements due for work completed in the Falcon Watershed are approximately equivalent to the available drainage and bridge funds. As a result, reimbursements were not included in the fee calculation. Drainage improvements that are required as a result of new development are listed in Appendix E.

The costs apportioned to County and metropolitan district drainage improvements are provided in Table 7-2 and Table 7-3. The bridge improvement fees shown in Table 7-2 and Table 7-3 were determined by classification of the crossing as either a bridge or a culvert. This classification was based on the DCM criteria.

Table 7-2. County Cost

Drainage Improvements	$ 24,051,349
Bridge Improvements	$ 2,887,437
Total Cost	**$ 26,938,786**

Table 7-3. Metropolitan District Cost

Drainage Improvements	$ 3,972,407
Bridge Improvements	$ 1,855,620
Total Cost	**$ 5,828,027**

The development cost and corresponding fee calculations based on impervious acreage are provided in Table 7-4 and 7-5.

Table 7-4. Development Drainage Cost and Fee

Drainage Improvements	$ 14,649,163
DBPS Cost	$ 339,088
Total Cost	**$ 14,988,251**
Drainage Fee (per imp. ac.)	**$ 23,217**

Table 7-5. Development Bridge Cost and Fee

Bridge Improvements	$ 2,058,474
Total Cost	**$ 2,058,474**
Bridge Fee (per imp. ac.)	**$ 3,189**

LEGEND

- Public Cost Reach Improvement
- Public Cost Detention Pond
- Public Cost Crossing
- Crossing

Detention Pond

- Existing
- Proposed
- Existing Watershed Boundary
- Historical and Future Watershed Boundary
- Tributary Basin Boundary
- Subbasin Boundary
- Major Tributary

Figure 7-1
County Cost Improvements
Falcon DBPS
El Paso County, CO

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Miles

NOTE: FIGURE MUST BE VIEWED IN COLOR

FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\Fig_7-1_County_Costs_20151229_JKC.mxd, 12/29/2015, jeff_clonts

Falcon DBPS
County Costs

Drainage Fees			
Reach/Pond	**Reach Length (ft)**	**Improvement**	**Cost**
RWT344	1,379	Roadside Ditch Improvement	$ 167,006
RET140	4,052	Roadside Ditch Improvement	$ 295,914
RET164	2,072	Roadside Ditch Improvement	$ 132,703
RET100	1,791	Small Drop Structures w/Toe Protection	$ 1,342,120
RET110	2,751	Small Drop Structures w/Toe Protection	$ 1,055,516
RET152	2,030	Small Drop Structures w/Toe Protection	$ 1,081,390
RET120	1,379	Natural Channel Design	$ 72,798
RET162	3,256	Small Drop Structures w/Toe Protection	$ 656,460
RMT050	1,568	Small Drop Structures w/Toe Protection	$ 814,189
RMT062	5,688	Small Drop Structures w/Toe Protection	$ 2,381,127
RMT064	3,358	Small Drop Structures w/Toe Protection	$ 1,231,110
RMT112	3,372	Small Drop Structures w/Toe Protection	$ 1,276,142
RWT054	2,497	Small Drop Structures w/Toe Protection	$ 1,414,531
RWT080	3,494	Small Drop Structures w/Toe Protection	$ 2,345,153
RWT092	626	Small Drop Structures w/Toe Protection	$ 414,434
RWT372	1,377	Small Drop Structures w/Toe Protection	$ 947,221
RMT102	1,021	Small Drop Structures w/Toe Protection	$ 636,082
RMT104	874	Small Drop Structures w/Toe Protection	$ 186,349
RET154	2,357	Natural Channel Design	$ 468,927
RET156	942	Natural Channel Design	$ 73,722
WT 5	43	Crossing - Culvert	$ 8,651
ET 13	50	Crossing - Culvert	$ 113,991
ET 11	40	Crossing - Culvert	$ 84,348
ET 9	40	Crossing - Culvert	$ 84,102
ET 4	61	Crossing - Culvert	$ 106,060
Sub Regional Pond SR1		Detention Pond	$ 405,769
The Meadows Pond #2		Detention Pond	$ 20,000
		Subtotal	$ 17,815,814
		Engineering/Construction Admin (15%)	$ 2,672,372
		Contingency (20%)	$ 3,563,163
		Total	**$ 24,051,349**

Bridge Fees			
Reach/Pond	**Reach Length (ft)**	**Improvement**	**Cost**
WT 6	43	Crossing - Bridge	$ 249,775
WT 4	48	Crossing - Bridge	$ 528,324
WT 3	46	Crossing - Bridge	$ 218,292
WT 1	40	Crossing - Bridge	$ 636,648
MT 2	83	Crossing - Bridge	$ 343,147
ET 10	44	Crossing - Bridge	$ 162,656
		Subtotal	$ 2,138,842
		Engineering/Construction Admin (15%)	$ 320,826
		Contingency (20%)	$ 427,768
		Total	**$ 2,887,437**

MDDP & DBPS AMENDMENT

BENT GRASS DEVELOPMENT

El Paso County, Colorado

PREPARED FOR:
Challenger Communities, LLC
8605 Explorer Dr., Suite 250
Colorado Springs, CO 80920

PREPARED BY:
Galloway & Company, Inc.
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920

DATE:
January 2021
Revised: March 2021
Revised: April 2021
Revised: June 2021
Revised: August 2021
Revised: September 2021

PUDSP-20-005

recommendations from the Falcon DBPS, when additional land is obtained to expand the ROW along the southbound portion of Meridian Road.

In the interim condition, it has been proposed to add a temporary lining to the existing channel to handle the excess velocities and depth associated with the DBPS flows and Bent Grass development re-routed flows. This analysis has been included in the Appendix.

The West Tributary Channel will be natural, vegetated facility, helping to ensure that the overall velocities will be reduced, flow depth will not exceed 5' and minimize any potential for scour. If needed, grade control structures may be designed as proposed in the DBPS to ensure these criteria are met.

3. Implement BMPs That Provide a Water Quality Capture Volume with Slow Release

This step utilizes formalized water quality capture volume to slow the release of runoff from the site. The WQCV will release in no less than 40 hours. On-site water quality control volume detention ponds will provide water quality treatment prior to the runoff being released into the channel. WQCV facilities will be designed as Extended Detention Basins.

The Falcon Meadows at Bent Grass development, west of Bent Grass Residential, Filing No. 1 and No. 2, will include several water quality ponds throughout the site to ensure flows will be treated prior to being released into the West Tributary Channel, running through the site. Only a small area, less than 1.0 acres will not be treated prior to releasing into the channel.

Currently, the existing Meridian Road roadside ditch, ultimately conveys runoff to the existing detention and water quality pond MN, as shown and discussed in the Falcon DBPS. The Falcon DBPS also shows a future detention and water quality pond SR-4 that is to receive flows from basin MT060 and discharge into basin MT070, ultimately routing to existing Pond MN. Flows from Bent Grass Meadows Drive are listed in basin MT060 but are being routed to the existing roadside ditch along Meridian Road, which is in basin MT070. The flows from the "School Site" and upstream basins will release into the east side of Pond SR-4 (west of Falcon Market Place). Pond SR-4 is currently under construction. The proposed improvements impact on the existing drainage basin and both Pond MN and Pond SR-4 are discussed later in the report.

4. Consider Need for Industrial and Commercial BMPs

Source control BMPs for homeowners include the use of garages as the primary area where pollutants can be stored. The single-family detached homes provide garages which can act as storage areas. The proposed development does not include outdoor storage or the potential for introduction of contaminants to the Counties' MS4, thus no targeted source control BMPs are necessary. The biggest source control BMP is public education and discuss topics such as: pet waste, car washing, lawn care, fall leaves, and snow melt and deicer.

Bent Grass East Commercial Filing No. 1 contains commercial development. This area will need to consider the need for Industrial & Commercial BMPs. No industrial uses or outside storage is proposed for this area. Drainage will be routed through water quality ponds prior to leaving the site to minimize contaminants into the public system.

VII. Future Drainage Conditions

MIDDLE TRIBUTARY

Design Point 30 and Basins OS-25 and OS-26 are as described under Existing Drainage Conditions. However, Basins OS-25 and OS-26 now route through proposed “future” detention pond, on what’s been previously referred to as the “School Site”, north of Bent Grass Meadows Drive and just west of Bent Grass Filing No. 2. This “future” pond will replace the current sedimentation pond on the “School Site”. Upon any additional development within the Middle Tributary area of the Bent Grass Development and north of Bent Grass Meadows Drive, this pond will need to be constructed to accommodate the re-routed flows from the Meadows Pond #2 at DP 30.

This future facility will need to provide 2.76 ac-ft of water quality, 6.26 ac-ft for EURV and 11.98 ac-ft for 100-year storage volume. Preliminary release rates for the 5 and 100-year storms are 3.8 cfs and 32.2 cfs. These flows were then routed to Bent Grass Meadows to the south. With the decrease in flows, flows will not overtop Bent Grass Meadows Drive and continue east to the future box culvert under Bent Grass Meadows Drive at DP BG20 (5-year flow=292.5 cfs, 100-year flow=909.3 cfs). Flows were still checked against street capacity on the north and south side of Bent Grass Meadows Drive, as it continues to the east. With the construction of the future pond, Bent Grass Meadows Drive will be able to adequately handle the flows and no additional storm infrastructure would need to be built to carry these future developed flows. Any area north of Bent Grass Meadows Drive that will develop in the future will need to provide its own on-site detention. Should future development not be able to release flows into Bent Grass Meadows Drive, a 42” RCP would be able to convey the flows of DP BG 15n (Q100=40.9 cfs, Q5=8.8 cfs) to the northwest corner of the Bent Grass Meadows Drive and Meridian Road intersection. Analysis for this culvert sizing has been included in the appendix.

At the Bent Grass Meadows Drive/Meridian Road intersection, the elliptical rcp’s will need to be replaced with a double 16’ x 4’ rcbc. The future roadside ditch will have a 15’ wide bottom channel with 4:1 side slope, 6.5’ deep and a longitudinal slope of 0.30%. This will result is a flow depth of 5.15’ and velocity of 5.04 fps. This channel will direct flows to Owl Place where the existing twin cmp’s will be replaced with a 20’ x 4’ rcbc or equivalent. This structure will need to be built when any development west of Meridian Road at the intersection of Owl Place happens. With future development, it is anticipated that the existing channel conveying flows to the south will be removed to accommodate the new development. The new channel will need to be a 35’ wide bottom channel with 4:1 sides, 5’ deep and a longitudinal slope of 0.30%. This will produce a flow depth of 3.7’ and a velocity of 4.6 fps. If the channel option is not viable, twin 78” rcp’s at a minimum 0.50% slope would be able to handle this future flow. Analysis for this design option has been included in the appendix.

Calculations are provided in Appendix C for the future culverts and roadside channel.

WEST TRIBUTARY

Offsite flows entering the west tributary location of Bent Grass have not changed from what was discussed under Current Conditions. Reach RWT202 at the northwest corner of the development has a 100-year flow of 1000 cfs and Reach RWT204 has a flow of 43 cfs. These were obtained from the DBPS by Matrix. The Flood Insurance Study (FIS) by FEMA does not have flows evaluated this far north. The have a flow of 1482 cfs beginning at RWT210. The 8 undeveloped on-site basins for Bent Grass West have been replaced with 17 developed basins. These basins are found in the Falcon Meadows for Bent Grass PDR. A summary of these basins is provided below and are part of the hydrology analysis provided in Appendix B.

Sub Regional Detention Alternative[1]						
Pond		Q_2 In (cfs)	Q_2 Out (cfs)	Q_{100} In (cfs)	Q_{100} Out (cfs)	Required Volume (AF)[2]
Paint Brush Hills Pond #4	PBH 4	38	29	200	150	1.34
Paint Brush Hills Pond A	PBH A	35	7	170	140	2.62
Paint Brush Hills Pond B1	PBH B1	80	51	420	270	9.17
Paint Brush Hills Pond B2	PBH B2	51	10	270	180	12.09
Paint Brush Hills Pond C	PBH C	56	3	300	140	6.77
Regional Pond MN	R MN	65	32	850	820	7.53
Regional Pond R1	R R1	110	77	1,600	1,500	25.00
Regional Pond R2	R R2	140	140	2,100	2,100	7.90
Regional Pond WU South	R WU	47	22	1,070	930	39.54
Sub Regional Pond SR1	SR 1	54	42	610	510	11.03
Sub Regional Pond SR2	SR 2	65	65	840	840	2.05
Sub Regional Pond SR3	SR 3	72	72	910	910	1.03
Sub Regional Pond SR4	SR 4	130	27	1,000	730	19.37
Sub Regional Pond SR6	SR 6	74	9	390	200	11.82
The Meadows Pond #1	M 1	11	0	75	2	3.25
The Meadows Pond #2	M 2	28	5	210	99	7.94
Woodmen Hills Pond #1 North	WH 1N	65	61	390	260	7.13
Woodmen Hills Pond #1 South	WH 1S	61	10	260	260	8.78
Woodmen Hills Pond #2	WH 2	37	10	270	250	9.18
Woodmen Hills Pond #3	WH 3	105	13	530	360	8.35
Woodmen Hills Pond #4	WH 4	110	15	790	260	40.45
Woodmen Hills Pond #5	WH 5	40	1	130	19	4.10
Woodmen Hills Pond H	WH H	140	110	750	750	2.66

Notes
1: Represents future hydrology with retrofit existing detention ponds and 5 new subregional detention ponds
2: Required volume to highest WSE

Reach Alternative	Total (ft)
Protect In Place	30,066
Natural Channel Design	32,359
Small Drop Structures w/ Toe Protection	76,812
Large Drop Structures w/ Toe Protection	0

BURGESS RD
GOODSON RD
STAPLETON DR
EASTONVILLE RD
JUDGE ORR RD
WOODMEN RD
TAMLIN RD
FALCON HWY
GARRETT RD
MERIDIAN RD
24

DIVERSION

CHANGE DUE TO BENT GRASS R2 (RWT200)

DELETE POND WITH WQCV REPLACEMENTS & CHANNEL IMPROVEMENTS

CHANGE DUE TO BENT GRASS R1 (RMT063)

LEGEND

Detention Pond
- Existing
- Proposed
- Existing Watershed Boundary
- Historical and Future Watershed Boundary
- Tributary Basin Boundary
- Subbasin Boundary
- Major Tributary
- Immediate Action Required to Preserve Existing Condition

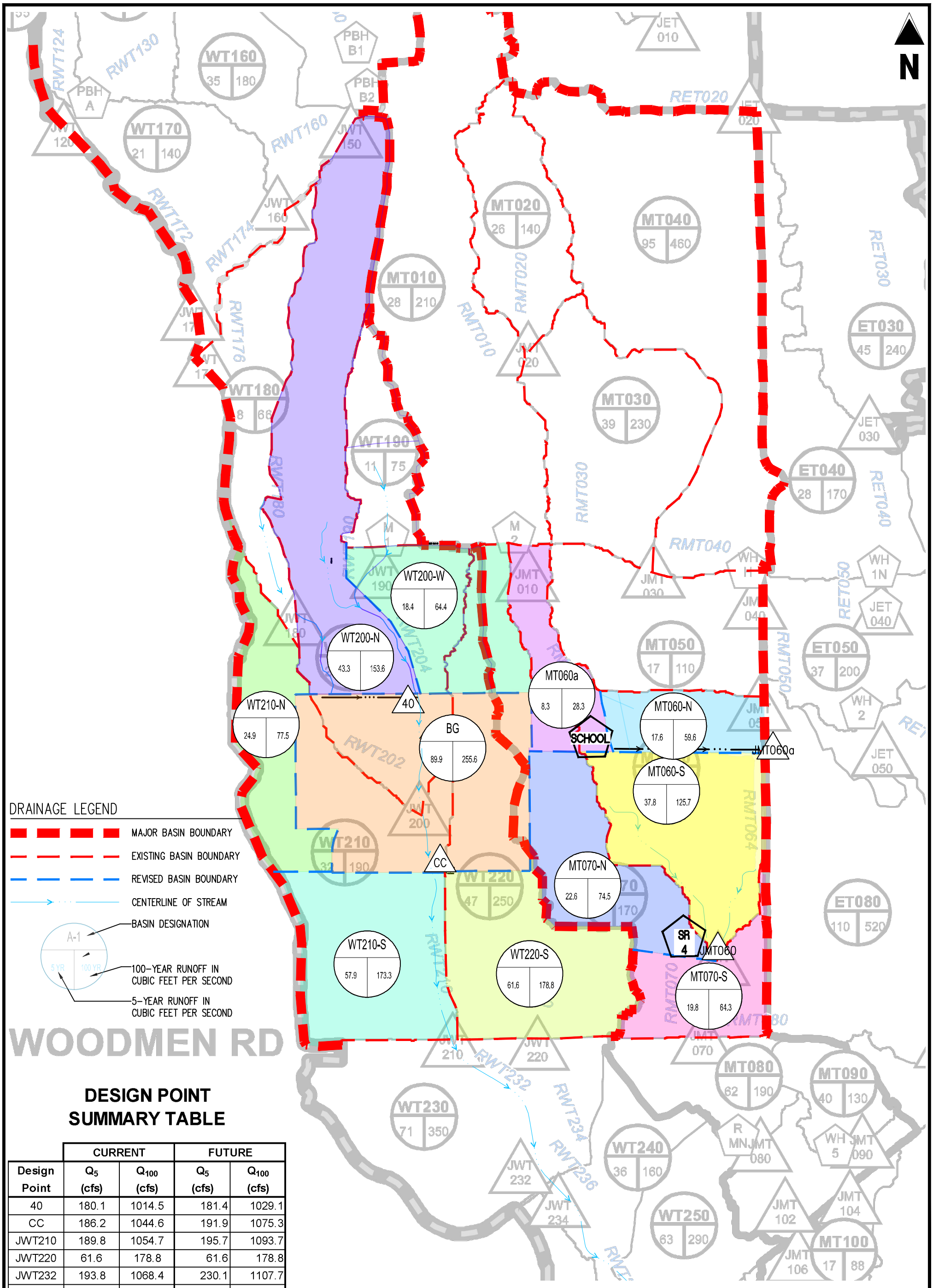
Reach Alternative
- Protect In Place
- Natural Channel Design
- Small Drop Structures w/ Toe Protection

Figure 5-3
Sub-Regional Detention Alternative
Falcon DBPS
El Paso County, CO

0 0.5 1
Miles

NOTE: FIGURE MUST BE VIEWED IN COLOR

FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\20111215_alternatives\subregional_detention_alt.mxd, 12/19/2011, ron_ramold



DESIGN POINT SUMMARY TABLE

	CURRENT		FUTURE	
Design Point	Q_5 (cfs)	Q_{100} (cfs)	Q_5 (cfs)	Q_{100} (cfs)
40	180.1	1014.5	181.4	1029.1
CC	186.2	1044.6	191.9	1075.3
JWT210	189.8	1054.7	195.7	1093.7
JWT220	61.6	178.8	61.6	178.8
JWT232	193.8	1068.4	230.1	1107.7
JMT060a	292.1	908.7	292.1	908.9
JMT060	43.3	700.4	43.7	700.3
JMT070	44.9	717.6	45.3	717.5
JMT080	47.3	692.3	47.8	691.7

FALCON MEADOWS AT BENT GRASS
MDDP

REVISED BASIN HYDROLOGY - HMS MODEL

Project No:	CLH0017
Drawn By:	CMD
Checked By:	GD
Date:	06/16/21

Galloway
6162 S. Willow Drive, Suite 320
Greenwood Village, CO 80111
303.770.8884 • GallowayUS.com

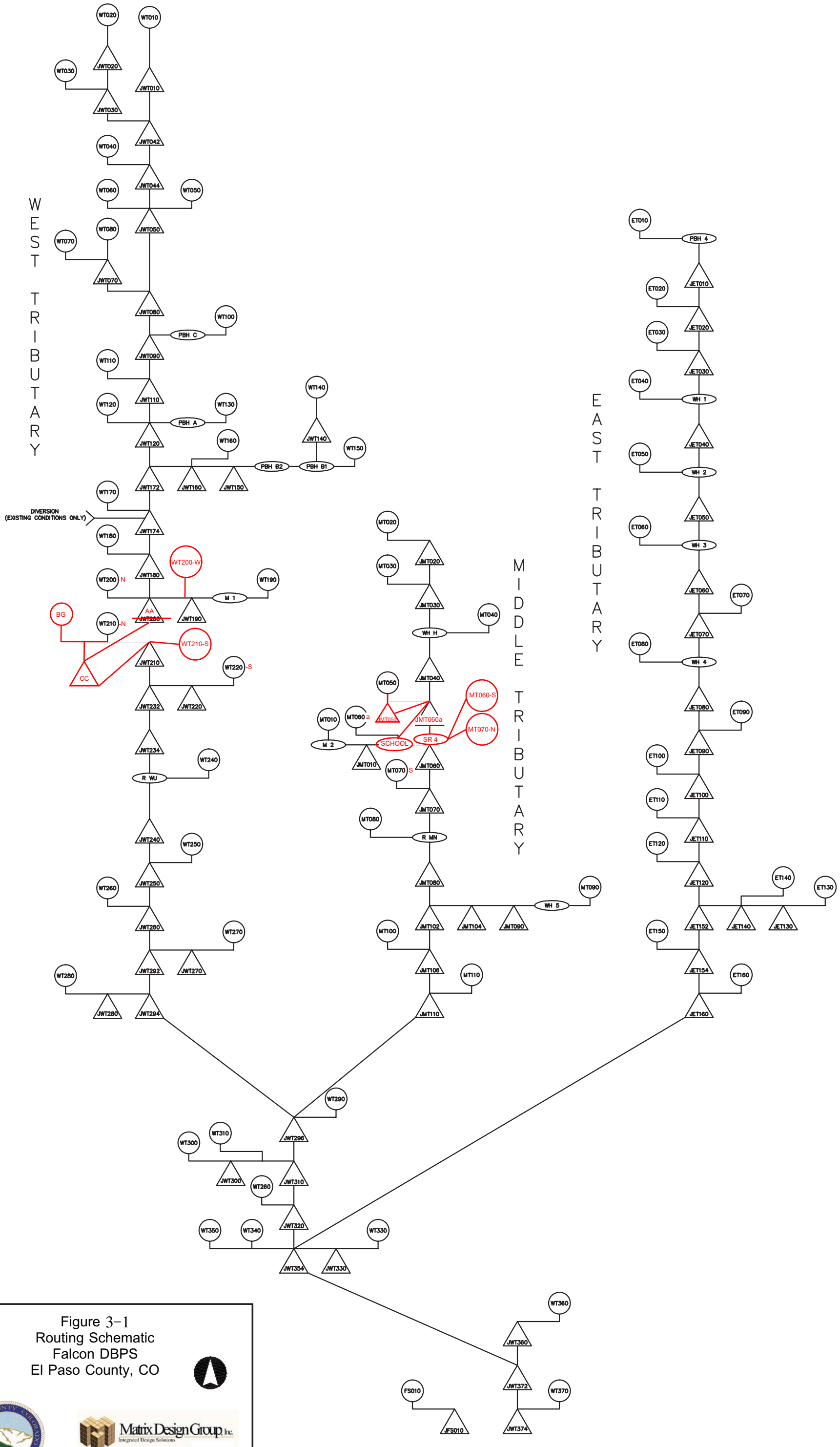


Figure 3-1
Routing Schematic
Falcon DBPS
El Paso County, CO

DRAWING NOT TO SCALE

MERIDIAN ROAD

Worksheet for Fut Channel - Pr 100 Yr Flow-MR

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.30	%
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	15.00	ft
Discharge	925.00	ft³/s

Results

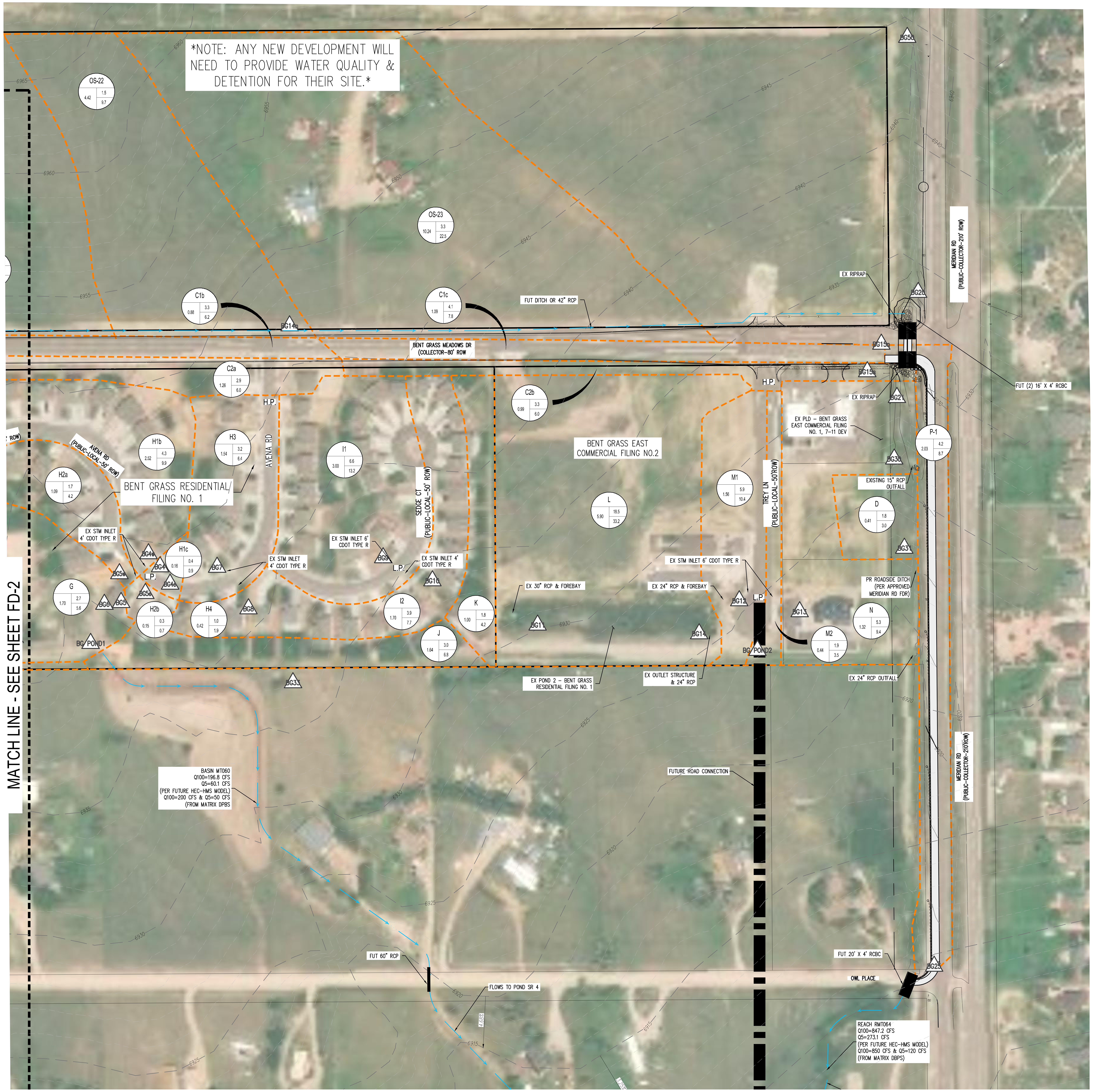
Normal Depth	5.15	ft
Flow Area	183.50	ft²
Wetted Perimeter	57.49	ft
Hydraulic Radius	3.19	ft
Top Width	56.22	ft
Critical Depth	3.58	ft
Critical Slope	0.01368	ft/ft
Velocity	5.04	ft/s
Velocity Head	0.39	ft
Specific Energy	5.55	ft
Froude Number	0.49	
Flow Type	Subcritical	

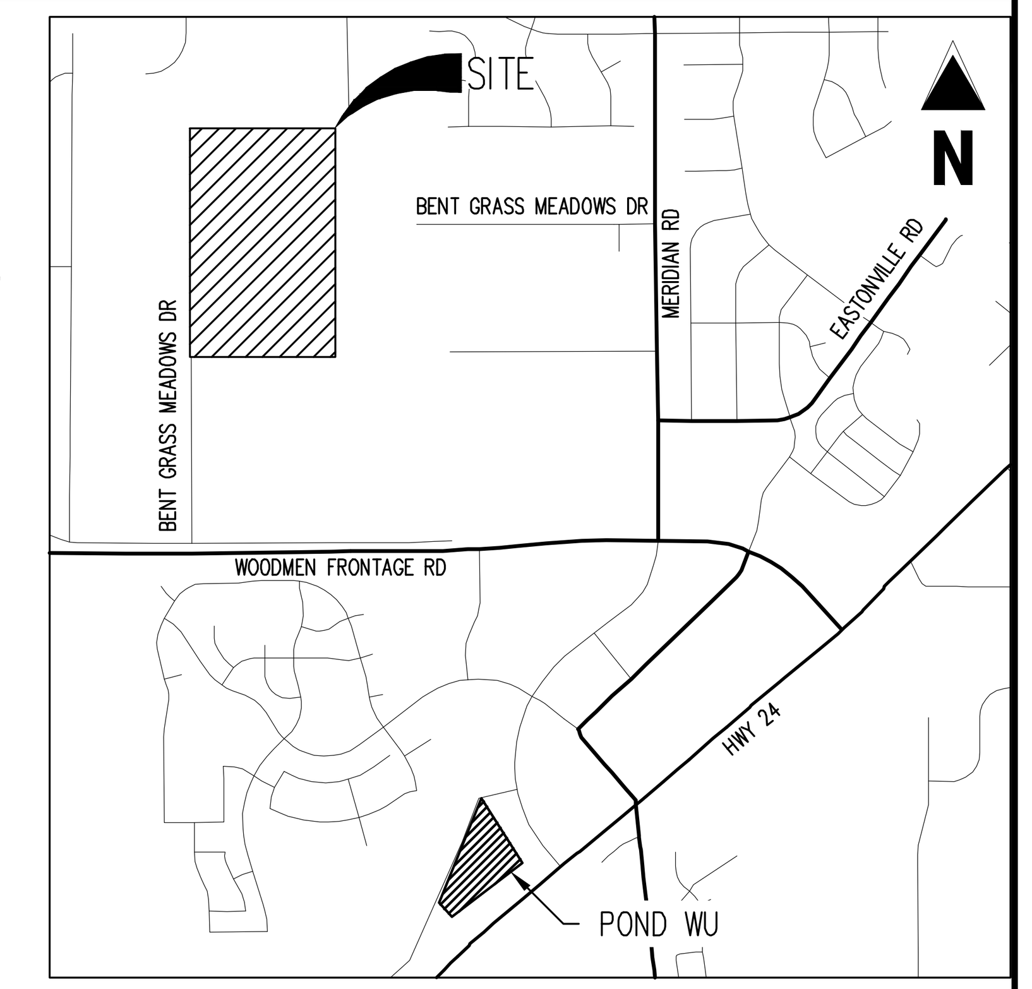
GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	5.15	ft
Critical Depth	3.58	ft
Channel Slope	0.30	%





VICINITY MAP
1"=2,000'

N
SCALE: 1"=100'

DRAINAGE LEGEND

- PROPERTY LINE
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED/FUTURE MAJOR CONTOUR
- PROPOSED/FUTURE MINOR CONTOUR
- BASIN BOUNDARY LINE
- FEMA EFFECTIVE 100-YR FLOODPLAIN
- CENTERLINE OF STREAM
- BASIN DESIGNATION
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- DIRECTION OF RUNOFF

RUNOFF SUMMARY TABLE

Basin ID	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)
RWT202	1574.40	220.0	1000.0
RWT204	38.40	7.0	43.0
WT200	192.00	52.0	190.0
OS-2	20.08	9.0	43.4
OS-3	10.62	4.7	22.7
OS-25	18.74	6.3	35.8
OS-26	5.81	1.9	12.6
H5	6.37	3.2	15.1
OS-22	4.42	1.5	9.7
OS-23	10.24	3.3	22.5
C1a	0.48	1.8	3.4
C1b	0.88	3.3	6.2
C1c	1.09	4.1	7.8
D1a	0.56	1.6	3.5
D1b	0.68	2.0	4.2
D1c	1.20	3.2	6.6
D1d	2.79	6.7	13.6
C2a	1.26	2.9	6.0
C2b	0.99	3.3	6.0
D2a	1.00	1.8	4.8
D2b	0.41	1.0	2.3
H1a	0.40	1.0	2.3
H1b	2.52	4.3	9.9
H1c	0.16	0.4	0.9
H2a	1.09	1.7	4.2
H2b	0.15	0.3	0.7
F	1.37	2.6	5.9
G	1.70	2.7	5.6
H3	1.54	3.2	6.4
H4	0.42	1.0	1.9
I1	3.00	6.6	13.2
I2	1.70	3.9	7.7
J	1.64	3.0	6.8
K	1.00	1.8	4.2
L	5.90	18.5	33.2
M1	1.56	5.9	10.4
M2	0.44	1.9	3.5
N	1.32	5.3	9.4
D	0.41	1.8	3.0
OS-1	33.07	15.5	66.7
OS-4	4.46	5.6	14.0
OS-5	0.46	1.1	2.3
OS-6	1.17	2.0	4.3
A-1	2.70	3.3	8.6
A-2	1.19	1.5	4.2
A-3	1.57	2.1	5.0
A-4	2.24	2.9	7.5
C-1	1.35	2.6	5.9
C-2	6.80	7.1	18.5
C-3	2.38	3.3	7.8
C-4	3.61	5.3	12.0
C-5	7.86	10.9	24.9
C-6	5.54	7.0	16.9
C-7	0.89	0.3	2.1
E-1	1.71	3.6	7.7
E-2	0.68	2.4	4.6
E-3	0.78	2.9	5.3
E-4	0.91	3.0	5.7
E-5	0.89	3.3	6.1
F-1	0.44	0.6	1.6
F-2	0.55	1.5	3.1
G-1	1.47	1.3	4.5
H-1	0.52	0.2	1.4
I-1	0.31	1.0	2.1
AA-1	2.57	4.2	9.9
AA-2	2.28	4.2	9.3
B-1	5.25	2.3	10.7
B-2	4.16	1.4	9.1
CC-1	9.07	16.9	36.0
CC-2	1.53	4.6	9.8
CC-3	1.88	6.4	12.1
CC-4	3.64	6.2	16.0
CC-5	0.45	0.2	1.4
D-1	9.07	11.2	26.6
D-2	7.42	15.5	32.2
D-3	2.03	0.8	2.3
D-4	4.38	7.8	16.6
D-5	1.08	2.2	4.6
D-6	4.01	8.2	17.2
D-7	6.39	3.2	14.8
D-8	1.69	1.3	4.5
P-1	2.03	4.2	8.7

DESIGN POINT SUMMARY TABLE

			REV HMS FLOWS	
Design Point	Q_5 (cfs)	Q_{100} (cfs)	Q_5 (cfs)	Q_{100} (cfs)
40	278.1	1227.8	181.4	1029.1
1	3.1	8.6		
2	4.3	11.9		
3	5.9	15.9		
4	8.3	22.3		
9	1.1	2.4		
11	6.0	15.5		
13	7.6	19.0		
5	10.9	27.1		
6	4.1	9.4		
7	2.9	5.5		
8	20.0	50.5		
12	4.6	10.2		
15	20.9	45.4		
10	23.9	52.7		
10A	6.0	21.9		
14	33.0	81.1		
14A	12.2	37.0		
AA	270.3	1188.7		
BB	269.5	1186.4		
16	16.6	39.4		
17	10.6	26.8		
18	13.5	39.2		
19	9.5	29.7		
20	1.3	4.6		
20A	18.4	57.1		
20B	21.3	66.0		
28	8.6	42.8		
29	12.2	60.9		
21	15.0	32.5		
22	10.5	26.0		
23	12.2	59.7		
24	2.1	15.9		
25	3.3	10.7		
26	8.0	41.7		
42	7.5	16.5		
43	10.0	21.8		
44	1.2	4.5		
45	53.8	173.9		
45A	1.1	45.8		
CC	268.2	1183.4	191.9	1075.3
30	2.1	63.5		
31	5.8	67.4		
32	6.5	64.8		
32A	4.9	34.5		
32A-N	4.9	33.2		
32A-S	12.5	3.6		
BG 1a-Os	0.0	0.0		
BG 1a-Ose	0.0	0.0		
BG 1a-Osw	0.0	0.0		
BG 4a	0.6	1.5		
BG 1b	1.3	2.8		
BG 1c	3.3	7.1		
BG 1	8.3	17.6		
BG 2e	1.8	5.0		
BG 2w	1.0	2.4		
BG 2	2.8	7.3		
BG 4e	0.4	0.9		
BG 4w	3.8	9.0		
BG 4	4.0	9.5		
BG 5e	0.3	0.7		
BG 5w	1.7	4.2		
BG 5	1.9	4.7		
BG 3	16.2	58.7		
BG 6	5.4	13.2		
BG POND1	0.3	2.9		
BG 14n	9.2	42.7		
BG 15n	8.8	40.9		
BG 50	280.0	850.0		
BG 20	292.5	909.3		
BG 14s	15.0	7.8		
BG 15s	16.8	12.4		
BG 21	304.6	915.3		
BG 32	2.6	6.1		
BG 33	2.9	7.0		
BG 7	3.1	6.4		
BG 8	1.0	2.0		
BG 9	6.5	13.4		
BG 10	3.8	7.9		
BG 11	13.5	27.8		
BG 12	5.8	10.7		
BG 13	7.0	13.0		
BG 14	12.3	22.8		
BG 15	42.2	82.0		
BG POND2	0.4	10.0		
BG 30	3.0	5.0		
BG 31	1.8	3.1		
BG 25	252.0	751.4		

Galloway
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Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

CHALLENGER HOMES

MASTER DRAINAGE DEVELOPMENT PLAN FALCON MEADOWS AT BENT GRASS FOR CHALLENGER COMMUNITIES, LLC

BENT GRASS MEADOWS DRIVE & MERDIAN ROAD
FALCON, CO 80831 - EL PASO COUNTY

#	Date	Issue / Description	Init.

Project No: CLH000014.20
Drawn By: CMWJ
Checked By: SMB
Date: OCTOBER 2019

FUTURE CONDITIONS DRAINAGE MAP

FD-3

APPENDIX

CLOMR APPROVAL

Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT

COMMUNITY INFORMATION		PROPOSED PROJECT DESCRIPTION	BASIS OF CONDITIONAL REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas)	CULVERT FILL	1D HYDRAULIC ANALYSIS UPDATED TOPOGRAPHIC DATA HYDROLOGIC ANALYSIS
	COMMUNITY NO.: 080059		
IDENTIFIER	Falcon Owl Place	APPROXIMATE LATITUDE AND LONGITUDE: 38.946, -104.609 SOURCE: OTHER DATUM: NAD 83	

AFFECTED MAP PANELS	
TYPE: FIRM* NO.: 08041C0553G DATE: December 7, 2018	*FIRM - Flood Insurance Rate Map

FLOODING SOURCE AND REACH DESCRIPTION

Unnamed Tributary to Black Squirrel Creek (East Branch) – From approximately 890 feet downstream of Owl Place to just upstream of Owl Place

PROPOSED PROJECT DESCRIPTION

Flooding Source	Proposed Project	Location of Proposed Project
Unnamed Tributary to Black Squirrel Creek (East Branch)	Two New 10' x 6' Box Culverts	From approximately 890 feet downstream of Owl Place to just upstream of Owl Place

SUMMARY OF IMPACTS TO FLOOD HAZARD DATA

Flooding Source	Effective Flooding	Proposed Flooding	Increases	Decreases
Unnamed Tributary to Black Squirrel Creek (East Branch)	Zone A	Contained	None	Yes

COMMENT

This document provides the Federal Emergency Management Agency's (FEMA's) comment regarding a request for a CLOMR for the project described above. This document is not a final determination; it only provides our comment on the proposed project in relation to the flood hazard information shown on the effective National Flood Insurance Program (NFIP) map. We reviewed the submitted data and the data used to prepare the effective flood hazard information for your community and determined that the proposed project meets the minimum floodplain management criteria of the NFIP. Your community is responsible for approving all floodplain development and for ensuring that all permits required by Federal or State/Commonwealth law have been received. State/Commonwealth, county, and community officials, based on their knowledge of local conditions and in the interest of safety, may set higher standards for construction in the Special Flood Hazard Area (SFHA), the area subject to inundation by the base flood). If the State/Commonwealth, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304. Additional Information about the NFIP is available on the FEMA website at https://www.fema.gov/flood-insurance.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

To determine the changes in flood hazards that will be caused by the proposed project, we compared the hydraulic modeling reflecting the proposed project (referred to as the proposed conditions model) to the hydraulic modeling reflecting the existing conditions.

The table below shows the changes in the base flood water-surface elevations (WSELs).

Base Flood WSEL Comparison Table

Flooding Source: Unnamed Tributary to Black Squirrel Creek (East Branch)		Base Flood WSEL Change (feet)	Location of maximum change
Proposed vs. Existing	Maximum increase	None	Not Applicable
	Maximum decrease	None	Not Applicable

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304. Additional Information about the NFIP is available on the FEMA website at https://www.fema.gov/flood-insurance.

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CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

DATA REQUIRED FOR FOLLOW-UP LOMR

Upon completion of the project, your community must submit the data listed below and request that we make a final determination on revising the effective FIRM. If the project is built as proposed and the data below are received, a revision to the FIRM would be warranted.

• Detailed application and certification forms must be used for requesting final revisions to the maps. Therefore, when the map revision request for the area covered by this letter is submitted, Form 1, entitled "Overview and Concurrence Form," must be included. A copy of this form may be accessed at https://www.fema.gov/flood-maps/change-your-flood-zone/paper-application-forms/mt-2.

• The detailed application and certification forms listed below may be required if as-built conditions differ from the proposed plans. If required, please submit new forms, which may be accessed at https://www.fema.gov/flood-maps/change-your-flood-zone/paper-application-forms/mt-2, or annotated copies of the previously submitted forms showing the revised information.

Form 2, entitled "Riverine Hydrology and Hydraulics Form." Hydraulic analyses for as-built conditions of the base flood must be submitted with Form 2.

Form 3, entitled "Riverine Structures Form."

• A certified topographic work map showing the revised and effective base floodplain boundaries. Please ensure that the revised information ties-in with the current effective information at the downstream and upstream ends of the revised reach.

• An annotated copy of the FIRM, at the scale of the effective FIRM, that shows the revised base floodplain boundary delineations shown on the submitted work map and how they tie-in to the base floodplain boundary delineations shown on the current effective FIRM at the downstream and upstream ends of the revised reach.

• As-built plans, certified by a registered Professional Engineer, of all proposed project elements.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304. Additional Information about the NFIP is available on the FEMA website at https://www.fema.gov/flood-insurance.

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CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

DATA REQUIRED FOR FOLLOW-UP LOMR (continued)

• FEMA's fee schedule for reviewing and processing requests for conditional and final modifications to published flood information and maps may be accessed at https://www.fema.gov/flood-maps/change-your-flood-zone/status/flood-map-related-fees. The fee at the time of the map revision submittal must be received before we can begin processing the request. Payment of this fee can be made through a check or money order, made payable in U.S. funds to the National Flood Insurance Program, or by credit card (Visa or MasterCard only). Please either forward the payment, along with the revision application, to the following address:

Colorado Water Conservation Board
Attention: Floodplain Mapping Program Manager
1313 Sherman Street, Rm 718
Denver, CO 80203

or submit the LOMR using the Online LOMC portal at: https://hazards.fema.gov/femaportal/onlinelomc/signin

After receiving appropriate documentation to show that the project has been completed, FEMA will initiate a revision to the FIRM. Because the flood hazard information (i.e., base flood elevations, base flood depths, SFHAs, zone designations, and/or regulatory floodways) will change as a result of the project, a 90-day appeal period will be initiated for the revision, during which community officials and interested persons may appeal the revised flood hazard information based on scientific or technical data.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional Information about the NFIP is available on the FEMA website at https://www.fema.gov/flood-insurance.

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Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

COMMUNITY REMINDERS

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:

Jeanine P. Petterson
Director, Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267
(303) 235-4830

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304. Additional Information about the NFIP is available on the FEMA website at https://www.fema.gov/flood-insurance.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

3.0 HYDROLOGIC ANALYSIS

3.1 Falcon DBPS

The Falcon DBPS completed hydrologic analysis for the Falcon Basin Watershed, using HEC-HMS v3.5 software, for historical, existing, and future land use conditions by applying a 24-hour storm event with 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals and current drainage infrastructure. Chapter 3 and Appendix A of the Falcon DBPS include a detailed discussion of the hydrologic analysis. An electronic copy of the HEC-HMS model (File: Aug15_Working_Falcon_DBPS_S.hms) is also provided.

The Falcon DBPS identified Subregional Pond SR4 to be installed on the Falcon Marketplace property. Pond SR4 was constructed in early 2021 and the property floodplain mapping was updated in LOMR Case Number 21-08-0534P.

El Paso County requires regional drainage infrastructure to be sized for future land use conditions. Therefore, peak discharges with existing drainage infrastructure and future land use conditions near Owl Place are summarized in Table 3-1.

Table 3-1. Future Land Use Conditions Peak Discharges near Falcon Owl Place on the Middle Tributary, Falcon DBPS

Model Location	Physical Location	Branch	Proximity to Owl Place	Q100 (cfs)
JMT050	Bent Grass Meadows Drive	Only East Branch	Upstream of Site	850
JMT060	Eastonville Road (Pond SR4 inflow)	Both East and West Branches	Downstream of Site	1,000

3.2 Falcon Owl Place

The Falcon DBPS HEC-HMS model with existing drainage infrastructure and future land use (Existing Conditions) was used as the basis for the Falcon Owl Place hydrologic analysis. The Existing Conditions model was replicated in HEC-HMS version 4.7.1, due to instabilities and runtime issues with the prior, outdated model version (3.5). The Existing model produced 100-year peak flows of 859 and 1,023 cfs upstream (JMT050) and downstream (JMT060) of the site, which are comparable to and more conservative than the 850 and 1,000 cfs in the DBPS. It should be noted that in Existing Conditions, JMT050 is on the East Branch of the Middle Tributary, whereas JMT060 includes flows from both the West and East Branches, immediately upstream of Pond SR4.

The Falcon watershed did not include a design point on the East Branch immediately upstream of Pond SR4. Therefore, it was necessary to modify the HMS model to obtain a design flow for Owl Place. In the Proposed Conditions basin model, the junction JMT051 was created on the East Branch of the UTBSC at the southern boundary of the Falcon Owl Place property, immediately upstream of Pond SR4.

The lag time and drainage area for Basin MT060 were reduced to 0.077 square miles and 17 minutes, respectively. The length and slope of Routing RMT060 were also updated. The NRCS soils for the proposed basin are Columbine gravelly sandy loam with a Hydrologic Soil Group (HSG) A. The basin is zoned for a combination of 5-acre residential, commercial, and planned unit development (PUD). The nearby PUD (Bent Grass Meadows) is residential with an average lot size of 0.22 acres. Based on TR-55 Table 2-2a, areas with 0.22-acre lots and HSG A have a Curve Number (CN) of 65. However, it is unknown how and when this area will develop in the future. For example, the Owl Place site is currently being rezoned from RR-5 to CS, which would increase the CN from 46 to 89. The future conditions CN of 66 used in the Falcon DBPS is a reasonable representation of the future development potential in the basin and was used in the proposed conditions model.

The hydrologic parameter calculations, base mapping, and select output from the HEC-HMS model is included in **Appendix 4,** and the model files (HEC-HMS file: Falcon_OwlCLOMR.hms) are provided. Proposed peak discharges used for the Falcon Owl Place development are summarized in Table 3-2.

Table 3-2. Proposed Peak Discharges at Falcon Owl Place (East Branch of the UTBSC)

Recurrence Interval	Q100 (cfs)
100-year	920
5-year	288.5

4.0 HYDRAULIC ANALYSIS

4.1 General

The effective FIRM identifies an approximate Zone A floodplain across the Falcon Owl Place property with no flood profiles, discharges, or BFE's defined. The Falcon Owl Place development includes filling and regrading the site and rerouting the East Branch of the UTBSC through a box culvert across the site.

4.2 Vertical Datum

The effective FIRM is on the North American Vertical Datum of 1988 (NAVD88). The ALTA survey completed for the site (Olsson, 2021) and the design and construction

drawings are on the National Geodetic Vertical Datum of 1929 (NGVD29). The Falcon DBPS and the hydraulic analysis for this CLOMR were both completed on the NGVD29. The difference between the NGVD29 and NAVD88 is 3.8 feet on the Falcon Owl Place.

4.3 Horizontal Datum

The field survey, design, construction drawings and hydraulic modeling for the Falcon Owl Place project were completed on the North American Datum of 1983 (NAD83), Colorado State Plane coordinate system, Central Zone.

4.4 Box Culvert Hydraulic Analysis

Under existing and proposed conditions, the East Branch of the UTBSC leaving the Falcon Owl Place site discharges to Pond SR4 on the Falcon Marketplace. The pond was designed for a 100-year discharge of 1,016 cfs, which includes both West and East branches of the UTBSC. The 100-year water surface elevation upstream of the pond as shown in the LOMR is 6902.5 (NAVD88), or 6898.7 (NGVD29). The starting HGL for the box culvert analysis was conservatively placed at the top of pipe elevation of 6895.84 feet (NGVD29) for analyzing flows to the East branch only. However, an additional analysis was performed with a starting HGL of 6898.7, to evaluate the backwater effects from the pond.

StormCAD was used to evaluate the hydraulic performance of the 10'x6' box culvert. The profile and output for the 100-year storm event is included in **Appendix 5**, and the model files are provided.

4.5 Existing and Proposed Owl Place Culverts

The East Branch of the UTBSC is currently conveyed under Owl Place via two 36" CMP near the northeast corner of the site. The HY-8 software was used to analyze the existing culverts for the 100-year storm event.

The 2-36" CMP culverts are severely undersized and partially filled with sediment as shown in the photo below. The culverts only convey 86-95 cfs, depending on tailwater depth. The remaining flow (approximately 825-834 cfs) in the 100-year event overtops Owl Place. The proposed box culvert will convey the entire 100-year event (920 cfs) with an HGL of 6911.31 at the proposed headwall upstream of Owl Place, which is more than one foot below Owl Place and contained within the existing and proposed channel upstream. Channel grading will be required for approximately 30 feet to tie into the existing creek profile upstream. The channel side slopes will be reduced from approximately 5.5H:1V to 1.8H:1V and protected with riprap.

The HY-8 output is included in **Appendix 5** and the model file (Owl Place.hy8) is provided.

Existing 2-36” CMP under Owl Place (Upstream Inlets)

5.0 NFIP REGULATION COMPLIANCE

5.1 Floodplain Work Map and Annotated FIRM

The effective Zone AE 100-year floodplain delineation for the UTBSC terminates at the boundary between the Falcon Marketplace and Falcon Owl Place properties and represents flows from both West and East branches. No changes are proposed to the Zone AE floodplain. The 100-year flood discharge for the East Branch is contained in the proposed culvert. Therefore, the Zone A floodplain for this branch has been removed, and the split between the Zone A floodplains for the West and East branches is denoted in the Annotated FIRM. The effective and proposed UTBSC floodplains are delineated on the Floodplain Work Map and Annotated FIRM in **Appendix 7**.

5.2 Forms and Notifications

The appropriate FEMA forms are located in **Appendix 6**. Modifications to 100-year floodplain elevations and delineations are limited to the Falcon Owl Place development. Furthermore, there are no proposed increases to the BFE's or floodplain extents. Therefore, individual legal notices are not required for this CLOMR submittal.

5.3 Compliance with Section 65.12

Although there are no increases to BFE's due to the proposed project, an alternatives evaluation was performed to evaluate options for closed conduit and open channel conveyance of the East Branch of the UTBSC. The alternatives evaluation can be provided upon request.

Furthermore, no structures are located in areas that would be impacted by the floodplain modifications proposed by this CLOMR.

5.4 Endangered Species Act (ESA)

ESA Compliance information is provided in **Appendix 8**.

6.0 CONCLUSIONS

The Falcon Owl Place development will relocate a portion of the East Branch of an Unnamed Tributary of Black Squirrel Creek (Middle Tributary). This report and supporting documentation are being submitted to FEMA for the purpose of requesting a CLOMR to conditionally change the floodplain in accordance with NFIP regulations.

APPENDIX
DRAINAGE MAPS

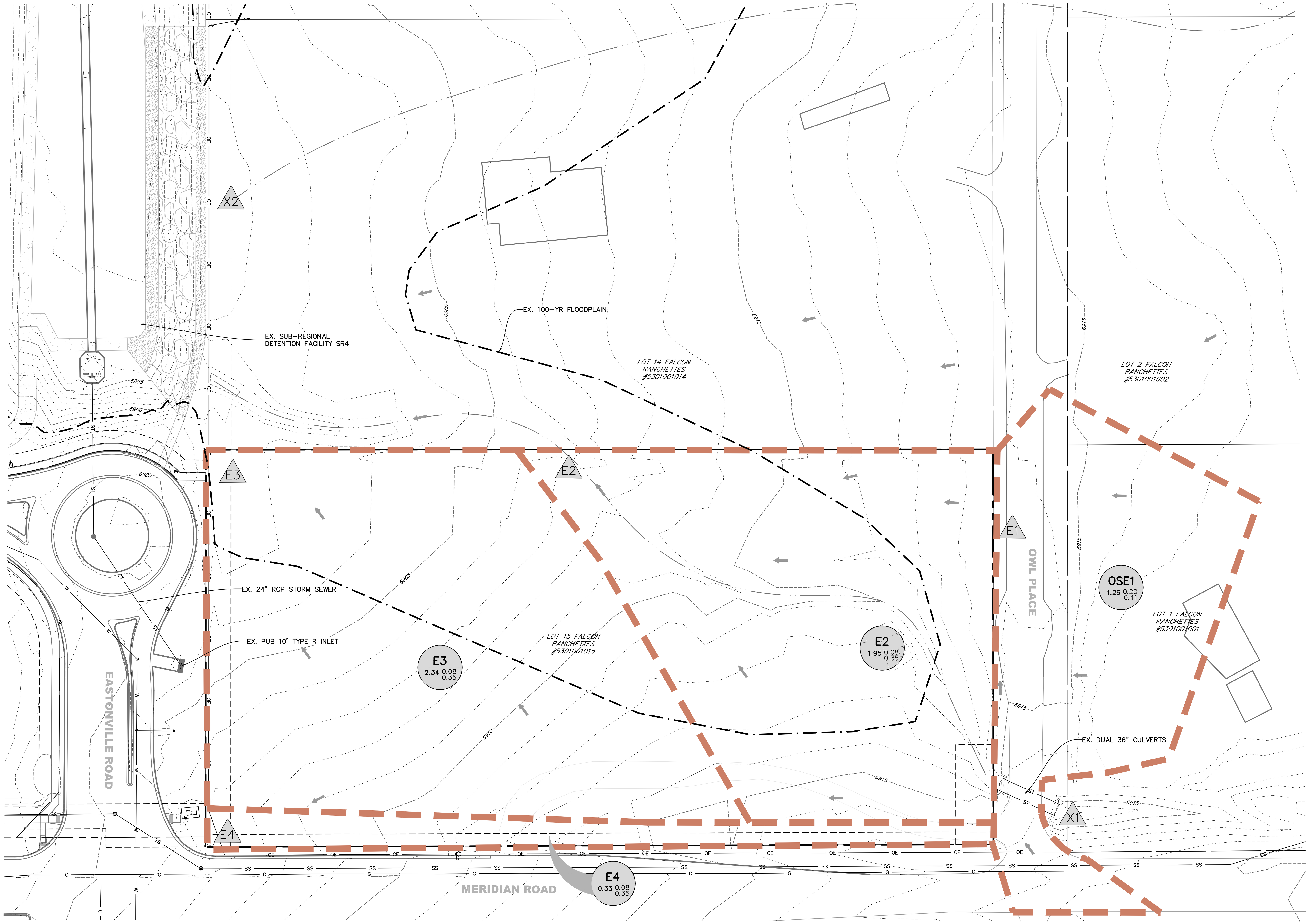
LEGEND

- EX. MINOR CONTOUR
- 6800 EX. MAJOR CONTOUR
- PR. MINOR CONTOUR
- 6800 PR. MAJOR CONTOUR
- ST EX. STORM DRAIN
- FLOODPLAIN BOUNDARY
- BASIN BOUNDARY
- FLOW DIRECTION
- D2 DESIGN POINT

AREA (ACRE) — OS-1 — BASIN, C5, C100

EXISTING				
BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
RMT064	X1		288.5	920.0
OSE1	E1	1.26	0.9	3.1
E2		1.95	0.5	3.7
	E2	3.21	1.4	6.9
E3	E3	2.34	0.6	4.4
E4	E4	0.33	0.1	0.7
MT060	X2		60.1	196.8

SCALE: 1"=40'



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DRAINAGE PLANS FOR:
OWL MARKETPLACE
FALCON, COLORADO

ISSUE	DATE
INITIAL ISSUE	9-29-2023
RESUBMITTAL	3-11-2024

DESIGNED BY:	KGV
DRAWN BY:	CGH
CHECKED BY:	TDM
FILE NAME:	21611-DRN-EX

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1" = 40'
VERTICAL: N/A

EXISTING DRAINAGE MAP

PROJECT NO. 21611-01CSCV

DRAWING NO.

DRN

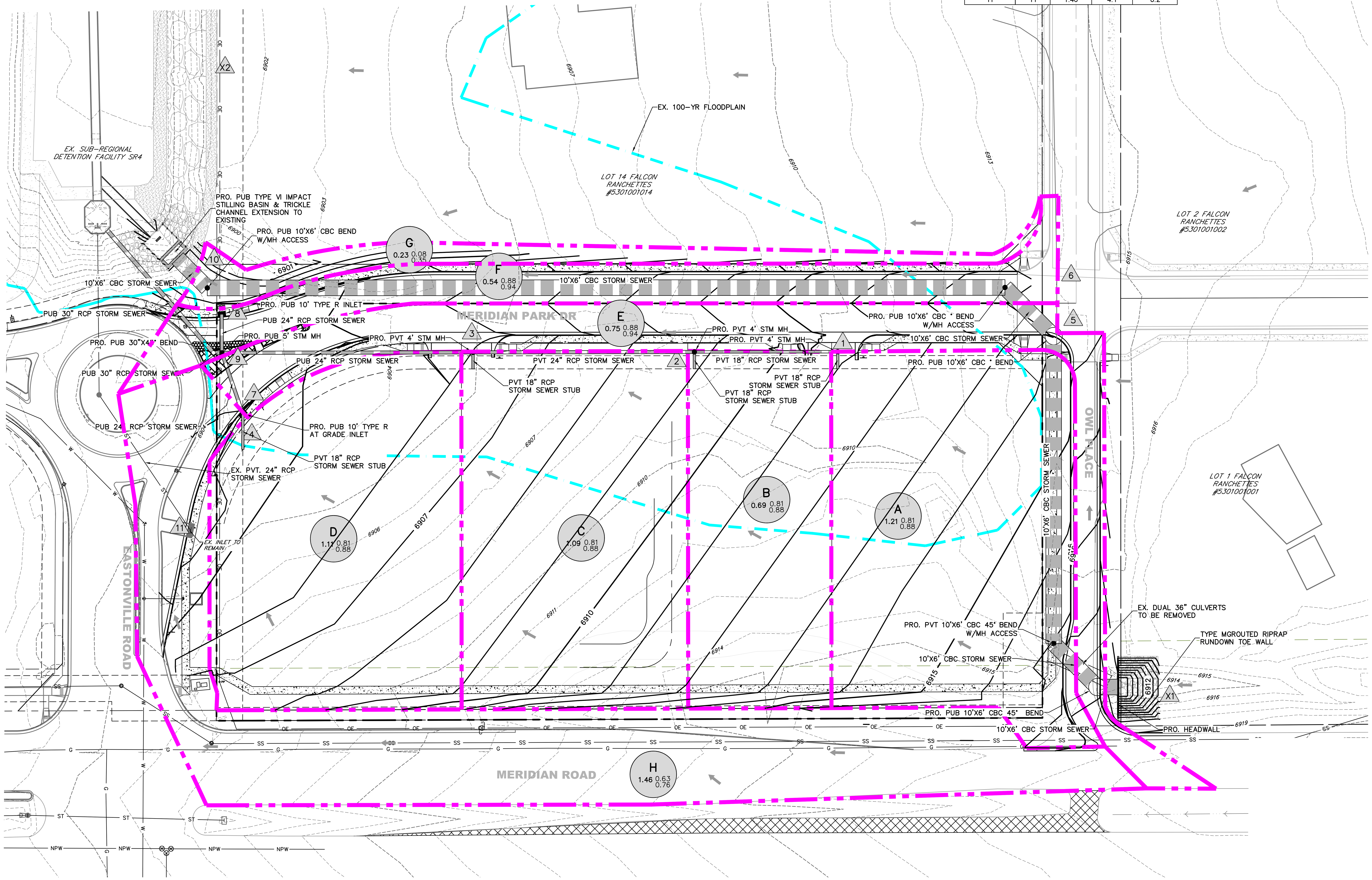
SHEET: 1 OF 2

LEGEND

EX. MINOR CONTOUR	FLOODPLAIN BOUNDARY
6800 EX. MAJOR CONTOUR	BASIN BOUNDARY
PR. MINOR CONTOUR	FLOW DIRECTION
6800 PR. MAJOR CONTOUR	DESIGN POINT
STORM DRAIN	BASIN / AREA (ACRE) / C5 / C100
ST EX. STORM DRAIN	

DEVELOPED				
BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
A	1	1.21	5.0	9.1
B		0.69	2.8	5.2
	2	1.89	7.7	14.1
C		1.09	4.5	8.2
	3	2.98	12.0	22.0
D	4	1.11	4.6	8.4
	5	0.00	0.6	1.5
	6	0.00	1.0	2.1
E		0.75	3.0	5.5
	7	1.86	7.8	14.6
F		0.54	2.4	4.3
	8	0.54	3.4	6.4
	9	5.38	22.1	40.9
G	10	0.23	0.1	0.6
H	11	1.46	4.1	8.2

40 0 40 80
SCALE: 1"=40'



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DRAINAGE PLANS FOR:
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FALCON, COLORADO

ISSUE	DATE
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DESIGNED BY:	KGV
DRAWN BY:	CGH
CHECKED BY:	TDM
FILE NAME:	21611-DRN-PP

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1" = 40'
VERTICAL: N/A

PROPOSED DRAINAGE MAP

PROJECT NO. 21611-01CSCV
DRAWING NO.
DRN

SHEET: 2 OF 2