
12.0 Drainage

The Project shall include all Work for the modification of existing drainage facilities, construction of new drainage facilities, construction of Permanent Best Management Practices (BMPs) and comply with the terms and conditions of the CDOT Municipal Separate Storm Sewer System (MS4) Permit, the City of Pueblo MS4 Permit, the requirements of this Section 12, and all other applicable permits and standards as included in the Contract Documents.

The drainage facilities constructed for the Project shall be designed to accommodate the drainage system needed for the ultimate local roads and I-25 highway configuration with a minimal amount of future drainage system reconstruction.

The I-25 Conceptual Drainage Design Report is included in Book 5 - Reference Documents. The Contractor shall design and construct a complete storm drainage system to intercept and remove surface runoff from the highway and local streets, maintain surface, channel, and conduit flow through the Right-of-Way (ROW), and convey peak discharges through the new bridges. The Contractor shall utilize the I-25 Conceptual Drainage Design Report as the basis for the storm drainage system water quality facilities in the project area. The Contractor shall also design and construct the storm drainage facilities to limit drainage-related hazards within and outside the ROW, while minimizing future operation and maintenance costs, public inconvenience, flood damages, and water quality impacts during construction.

All existing cross drains, storm drains, and drainage appurtenances to be abandoned shall be removed or plugged and filled with flow-fill in accordance with CDOT Standard Specifications, Section 202. Any existing cross drains, storm drains, and/or drainage appurtenances to be included and/or utilized with the proposed drainage design shall be removed and replaced with new material.

All drainage facilities of the Project shall be constructed to meet Project design criteria. Where the hydraulic capacity or existing condition of drainage facilities are inadequate, existing facilities shall be replaced.

The Contractor shall obtain Approval from affected Local, State and Federal Agencies for any proposed on-Site drainage improvements that are connected to existing storm drains, upstream or downstream of the Project prior to construction.

The Contractor shall design drainage facilities to be compatible with existing or proposed drainage systems on adjacent properties, and shall maintain existing drainage patterns. If the Contractor proposes that existing drainage patterns must be changed, the Contractor shall design a solution that does not adversely impact property owners outside the ROW, shall obtain Approval from CDOT prior to construction, and shall secure all other necessary approvals, permits, and easements.

12.0.1 Standards

The Contractor shall design and construct the drainage systems in accordance with the requirements of the standards listed in Table 12.0-1. Where standards conflict, the more stringent shall apply.

Table 12.0-1 STANDARDS FOR DRAINAGE	
Author or Agency	Title
CDOT	Standard Specifications for Road and Bridge Construction
CDOT	Standard Plans, M & S Standards
CDOT	Drainage Design Manual
CDOT	Bridge Design Manual, Section 16 – Hydraulics and Drainage
City of Pueblo	Storm Drainage Design & Technical Criteria
UDFCD	Urban Storm Drainage Criteria Manual, Volumes I, II, and III

12.0.2 Design Guidelines

The Contractor shall design and construct the drainage systems in accordance with the requirements of the guidelines listed in Table 12.0-2. Where guidelines conflict, the more stringent shall apply.

TABLE 12.0-2 DESIGN GUIDELINES FOR DRAINAGE	
Author or Agency	Title
AASHTO	A Policy on Geometric Design of Highways and Streets
FHWA	Hydraulic Design of Energy Dissipaters for Culverts and Channels, HEC-14
FHWA	Evaluating Scour At Bridges, HEC-18
FHWA	Stream Stability at Highway Structures, HEC-20
FHWA	Urban Drainage Design Manual, HEC-22
FHWA	Drainage of Highway Pavements, HEC-12
FHWA	Bridge Scour and Stream Instability Countermeasures, HEC-23
FHWA	Design of Roadside Channels with Flexible Linings, HEC-15
FHWA	Design of Riprap Revetment, HEC-11
FHWA	Hydraulic Design of Improved Inlets for Culverts, HEC-13
FHWA	Design of Bridge Deck Drainage, HEC-21
FHWA	Hydraulic Design of Highway Culverts, HDS-5
CDOT	Erosion Control and Stormwater Quality Guide

12.1 Administrative Requirements

12.1.1 Coordination with Other Agencies and Disciplines

The Contractor shall coordinate all drainage related issues with affected regulatory agencies where appropriate. The Contractor shall include CDOT in all contacts with appropriate regulatory agencies.

12.1.2 Permits

The Contractor shall be cognizant of and adhere to the requirements of the various environmental and stormwater permits that are necessary for construction and operation of the Project. The Contractor shall follow the requirements of the latest CDOT Stormwater Management Plan (SWMP) template and appropriate specifications. The Contractor shall be responsible for complying with CDOT’s and the City of Pueblo’s MS4 Permit (at the time of Final RFP) and Stormwater Consent Order #SC-081023-1 (Consent Order). The Contractor shall be required to obtain all permits, unless otherwise indicated. The listing herein is not all-inclusive

and it shall be the responsibility of the Contractor to determine all of the permits required to perform the Work. Because CDOT is the landowner, CDOT is partially liable for any Contractor negligence. Fines may be incurred upon the Project for permit non-compliance by CDOT or other regulatory agencies. Any non-compliance fines will be passed onto the Contractor. The Contractor shall refer to Section 5 - Environmental Requirements for additional requirements. If conflicts exist between requirements of Section 5 – Environmental Requirements and this Section 12, the more stringent shall apply.

Colorado Discharge Permit System, Stormwater Construction Permit (CDPS-SCP)

Implementation of the permit requirements (i.e., SWMP, SWMP Site Map, and SPCC Plan) shall be a first construction item. Construction cannot begin until these items have been Accepted by CDOT. CDOT will review the Contractor's stormwater management activities throughout the duration of the Project for verification of compliance with the CDPS-SCP, CDOT's and the City of Pueblo's construction section of the MS4 Permit, and Consent Order. The Contractor shall comply with CDOT Standard Specifications, Sections 101, 107 and 208.

CDOT has obtained from the Colorado Department of Public Health and Environment (CDPHE) CDPS-SCP Permit Number COR03000, Certification Number COR03K789. The permit is included in Book 5 – Reference Documents. The permit shall be transferred to the Contractor and the Contractor shall amend it for construction of the Project prior to Work commencing. The CDPS-SCP shall be in the Contractor's name. The Contractor shall adhere to all requirements of the CDPS-SCP and the Construction Section of CDOT's and the City of Pueblo's MS4 Permit and the Consent Order. Most, but not all, non-compliance issues and necessary Best Management Practices (BMPs) maintenance will be noted during Consent Order Monthly Inspections by CDOT, Regional Erosion Control Advisory Team (RECAT) inspections, in the 1176 inspection forms by the Erosion Control Supervisor (ECS), or in the daily stormwater log, as required by the Consent Order. The Contractor shall prevent the discharge of any sediment or pollutants into any storm drains or receiving waters during the life of the CDPS-SCP.

Storm Water Management Plan (SWMP)

The SWMP work shall include the CDOT SWMP template and a SWMP Site Map that documents the detailed erosion/sediment control BMPs and their locations. The Contractor shall submit a SWMP and SWMP Site Map for Acceptance by CDOT prior to Released for Construction Documents. The Contractor shall submit a SWMP and SWMP Site Map for Acceptance by the Local Agency for work outside CDOT ROW. The Contractor shall fill out the current CDOT SWMP template, including BMP narratives. The SWMP shall clearly describe the relationship between the phases of construction and the implementation and maintenance of the stormwater management controls. Any major modifications (i.e., change modification orders or minor changes revisions) to the CDOT SWMP template shall be submitted to CDOT for Acceptance. The Contractor shall revise the SWMP Site Map as necessary based on actual construction activities throughout the duration of the CDPS-SCP. All BMPs shall be listed on the SWMP Site Map per the requirements of the CDPS-SCP.

All documents pertaining to the CDPS-SCP shall be kept on-site in the CDOT Stormwater Management Plan (SWMP) Notebook (provided by CDOT) to maintain compliance with the SCP. Upon permit inactivation, the SWMP Notebook shall be turned over to CDOT and become the property of CDOT Project files.

Best Management Practices (BMPs)

The Contractor shall install and maintain the construction BMPs for the Project in accordance with the CDOT Erosion Control and Stormwater Quality Guide and Sections 101, 107, and 208 of the Standard Specifications. Construction BMPs for the Project shall include, but are not limited to, those listed in the Standard Specifications, as well as, preservation of existing vegetation, surface roughening, tackifier or soil binder, soil retention blankets, temporary clean water diversions, storm drain and basins, protection of trees, hazardous waste and spill containment and saw water disposal, stabilized construction entrances, and pavement sweeping of the affected Project areas. The Contractor shall add a BMP narrative to the SWMP on how it is being used, and shall supply the manufacturer details to be placed in the SWMP Notebook. The Contractor shall have a complete supply of all necessary construction BMP Materials on Site at all times in preparation for construction water quality control emergencies.

The Contractor shall use erosion control blankets to promote the establishment of vegetation on slopes steeper than 4H:1V to control erosion.

Slopes shall be roughened at the end of each day. Concrete washout shall be contained.

Non-structural BMPs may include litter and debris control, street sweeping, and landscaping and vegetative practices.

Spill Prevention Control and Countermeasures Plan (SPCC Plan)

The Contractor shall prepare a SPCC Plan for Acceptance by CDOT and submitted 21 Days prior to NTP2. Plan will be in accordance with Standard Specifications Section 208. The SPCC shall establish operating procedures for handling pollutants and preventing spills. Pollutant sources include, but are not limited to, exposed and stored soils, paints, solvents, fertilizers or chemicals, vehicle tracking, management of contaminated soils, loading and unloading operations, outdoor storage activities, vehicle/equipment maintenance and fueling, significant dust or particulate generating processes, on-Site waste management practices, concrete truck/equipment washing, dedicated asphalt and concrete batch plants, and non-industrial waste sources that may be significant such as trash and portable toilets.

Drainage

The Contractor shall be responsible for temporary drainage of the Project area during construction of the Project. The Contractor shall keep all existing storm drainage systems used for temporary drainage of the Project in operating condition during construction. Prior to the start of construction, the Contractor shall locate and clean all existing storm drainage systems in accordance with Section 202 of CDOT Standard Specifications. Throughout the duration of the permit, the Contractor shall continually protect inlets from sediment and pollutants and, if needed, shall remove any material deposited in the systems as a result of the Contractor's activities. All inlets shall be identified on the SWMP Site Map and shall follow the requirements of Section 208 of CDOT Standard Specifications.

Erosion Control Supervisor

The Contractor shall assign to the Project an employee or subcontractor to serve in the capacity of the Erosion Control Supervisor (ECS). The ECS shall be a person other than the Superintendent and shall be a person dedicated solely to erosion/sediment control. The ECS shall be experienced in all aspects of construction and have satisfactorily completed an ECS training program authorized by CDOT. Certification that this requirement has been met shall be

submitted to CDOT at NTP1. A list of authorized ECS training programs will be provided by CDOT upon request by the Contractor.

The Contractor's ECS responsibilities shall follow the duties as laid out in Standard Specifications, Section 208, in addition to the following:

1. Direct the removal of sediment, trash, and debris from the construction BMPs and other drainage facilities within the affected areas of the Project.
2. Prepare a written report documenting that BMPs are adequate for the Site conditions of the Project and are in good working condition after inspections requiring documentation. The reports shall be kept with the SWMP inspection documentation and submitted to the CDOT Region Water Quality Manager as requested. The appropriate form for this report will be supplied by CDOT. The inspections shall be made during the progress of the Work, during Work suspensions, and for the duration of the CDPS-SCP. During Project Work stoppages, inspections shall take place at least once every 30 Days, and within 48 hours after each event that causes surface runoff. After construction is complete, inspections shall take place at least once every 30 Days until the permit can be closed.
3. When Work is occurring in a Local Agency's jurisdiction, conduct inspections according to the required intervals of the Local Agency.
4. Implement the necessary actions to reduce anticipated or presently existing water quality or erosion problems resulting from construction Activities. The criteria for this action shall be based on water quality data derived from any inspections and monitoring operations or by any anticipated conditions (e.g., predicted storms) that could lead to unsuitable water quality situations.

Inspections

During the Project, multiple inspections by CDOT and the Contractor and his ECS will be occurring. Inspections shall be on the appropriate CDOT Forms and shall follow the requirements in Standard Specifications, Section 208. Prior to work commencing, a pre-construction conference shall be held with CDOT's Region Water Quality personnel. In addition, when the first phase of BMPs has been installed, the Contractor shall notify CDOT's Region Water Quality personnel to come out and inspect the BMPs for proper installation. Work shall not begin until the BMP installation inspection has occurred. CDOT's Region Water Quality personnel will be inspecting the Site on a monthly basis, as well as during the surprise Regional Erosion Control Assessment Team inspections. The Region Water Quality personnel may inspect the Project at any time and document any non-compliance issues that need to be resolved immediately by the Contractor. Fines may be assessed to the Contractor with the potential of Project shut downs, depending on the severity of the non-compliance. Prior to Final Acceptance of the Project construction, CDOT's Region Water Quality personnel shall be notified to perform a final walkthrough inspection. Any items identified for maintenance, replacement, or removal shall be done immediately or liquidated damages may be incurred upon the Contractor.

Based on the Consent Order, the Project Superintendent or ECS shall perform daily inspections of all BMPs to observe, record, and determine the effectiveness of all BMPs and to order their maintenance if needed. The results of the daily inspections shall be recorded in a daily stormwater log, which will be provided by CDOT. The Contractor shall cooperate with Local Agencies that may perform their own stormwater inspections on this Project.

Colorado Discharge Permit System, Stormwater Construction Permit Closure

The Contractor shall be responsible for all stormwater permit requirements until the Project has achieved Landscape Acceptance (see Book 2, Section 17 - Landscaping) and the CDPS-SCP permit can be closed. This includes the maintenance of all BMPs, maintenance of all seeded/landscaped areas, and removal of all BMPs once all erosion potential has been eliminated.

Municipal Separate Storm Sewer System (MS4) Permit

CDOT and the City of Pueblo have obtained MS4 Permits for the storm drain systems that it owns and maintains (included in Book 3 – Applicable Standards, Data and Reports). The Contractor shall be responsible for complying with the terms and conditions of the CDOT and City of Pueblo MS4 Permit that pertains to the Project. As part of the MS4 Permit, the Contractor shall follow the requirements set forth in the New Development Re-Development Manual portion to comply with permanent water quality standards. The Contractor shall install permanent BMPs for the Project in accordance with the CDOT Erosion Control and Stormwater Quality Guide and the Urban Drainage and Flood Control District (UDFCD) Urban Storm Drainage Criteria Manual. Runoff from all impervious areas within CDOT ROW within the Project limits shall be captured and conveyed to a permanent BMP.

Equivalent Area shall be allowed for all rehab bridge locations where permanent BMPs are highly constrained. Highly constrained is defined as an area where water quality treatment cannot be provided due to public safety concerns, maintenance crew safety concerns, stormwater pumping requirements, utility conflicts, elevation constraints, space constraints, or other factors which limit the ability to install and maintain BMPs. The Contractor shall get Approval from CDOT to use Equivalent Area for Permanent Water Quality. As part of the Approval the Contractor shall submit with the Released for Construction Documents a report and calculations of the equivalent areas and how they are being mitigated as part of the Project.

In areas outside CDOT ROW for the I-25 Mainline and Ramps from north of Ilex to 1st Street Segment, property shall be acquired by the Contractor if needed to facilitate permanent water quality for the Preferred Alternative in the Final Environmental Impact Statement (FEIS).

The Contractor shall immediately notify CDOT and the Local Agency of any suspected illicit or improper connections or discharges into any storm drain system that are discovered during design or construction of the Project. The Contractor shall contact the CDOT Illicit Discharge Hotline at 303-512-4426. CDOT and the Local Agencies will be responsible for investigation of the suspected illicit connection and implementing corrective action. The Contractor shall not maintain, reconnect, or otherwise allow discharge of improperly disposed materials into the storm drain system within the limits of the flows leaving the Project.

Construction Dewatering Permit (CDW)

Contractor shall obtain a Construction Dewatering permit prior to discharging groundwater to the surface or back to the ground. Contractor shall be responsible for all sampling, monitoring, treatment and Discharge Monitoring Reports required by the CDW.

U.S. Army Corps of Engineers (USACE) Section 404 Permit

Contractor shall obtain 404 permits for all work in the Arkansas River, Phelps Creek or any regulated waters.

Floodplain Permits

The Contractor shall be responsible for obtaining floodplain permits as required by the Work. If required, a FEMA Approved CLOMR shall be submitted for Approval prior to issuance of Released for Construction Documents. If required, a FEMA Approved LOMR shall be submitted for Acceptance prior to Final Acceptance.

12.2 Design Requirements

12.2.1 Drainage Design Software

The following software (most recent versions) shall be used in performing drainage design calculations.

1. CUHP/EPA-SWMM
2. USACE, HEC-RAS
3. FHWA, HY-8
4. In Roads Storm and Sanitary
5. UD-Detention
6. UD-Inlet
7. UD-Rational
8. USAE, HEC-RAS
9. WMS, Aquaveo

12.2.2 Data Collection

The Contractor shall identify all drainage-related issues utilizing available data, including but not limited to, requirements imposed by Local, State, and Federal government regulations, and official documents concerning the Project. Drainage related issues include, but are not limited to, areas with historically inadequate drainage (as evidenced by recorded flooding or citizen complaints), environmentally sensitive areas, and known drainage-related maintenance problems.

The Contractor shall obtain all relevant storm drainage improvement plans, drainage planning studies, and drainage reports for the Project area from all Local Agencies, UDFCD, and CDOT.

The Contractor shall obtain existing and projected future land uses from all Local Agencies and shall design facilities to be compatible with drainage systems, existing or proposed, on adjacent properties.

The Contractor shall perform detailed mapping and surveys as required to verify locations of existing drainage features necessary for the proposed drainage design. The Contractor shall verify or identify boundaries, flow patterns, and land uses of drainage basins based on field observations and by survey measurement.

The Contractor shall resolve all conflicts between Utilities and proposed drainage improvements in accordance with Book 2, Section 7 - Utility Relocations.

12.2.3 Surface Hydrology

The Contractor shall perform hydrologic analyses for all on-Site drainage basins, and for all off-Site drainage areas immediately adjacent to the Project Site that contribute runoff to the Project Site, or are impacted by project improvements or Preferred Alternative . The analysis shall be based on projected future land uses and the Preferred Alternative in the FEIS.

The hydrologic analyses shall identify all impacts to any existing storm drainage system.

The peak flow rate for Thomas Phelps Creek has been determined to be 1,519 cfs.

Design Frequencies

For all CDOT-owned facilities, the design frequency shall comply with Table 7.2 - Design Frequencies in the CDOT Drainage Design Manual..

The design frequency for all other roadways in the Project area shall comply with the affected Local Agency's criteria.

Precipitation

The Contractor shall design all drainage elements using the one-hour rainfall depths and equations contained in the City of Pueblo Storm Drainage Design Criteria and Drainage Policies for the City of Pueblo, Colorado, June 9, 1997, or latest edition.

Hydrologic Methods

The Contractor shall perform the necessary hydrologic analyses using the following methods:

1. Areas less than 90 acres shall be evaluated using the Rational Method. The minimum time of concentration shall be 5 minutes. For all areas within the City of Pueblo, the maximum time of concentration to the first design point shall be according to the City of Pueblo Storm Drainage Design Criteria.
2. Areas of study that fall within the floodplain as shown on FEMA Panel 085077-0010C shall meet with the City of Pueblo Floodplain Administrator's requirements and FEMA's requirements for hydrology.

The hydrologic analyses shall be based on fully developed and Preferred Alternative for all drainage basins.

12.2.4 Hydraulic Structures

Roadways

Roadway component geometric configurations shall be designed to provide adequate drainage and minimize hydroplaning and icing problems. Cross slopes shall be in accordance with the requirements of Book 2, Section 13 - Roadways.

Roadway Profile

Longitudinal grades shall be in accordance with the requirements of the Book 2, Section 13 - Roadways. Where minimum profile grades cannot be obtained in sag vertical curves, flanking inlets shall be constructed in the curb and gutter, or adjacent to the solid barrier guardrail, as required in the CDOT Drainage Design Manual.

Allowable Flow Spreads and Depths

The Contractor shall design all roadway storm drain systems including gutters, inlets, inlet spacing, catch basins, laterals, and trunk lines using the design criteria given in Table 12.2-1. For all roadways within City of Pueblo right of way, the contractor shall use the design criteria given in the City Storm Drainage Criteria Manual.

Table 12.2-1 ROADWAY STORM DRAIN DESIGN STORM AND SPREAD CRITERIA			
Road Classification		Design Frequency	Design Spread*
Interstate		10-year	Shoulder + 3 ft
		100-year	Shoulder + 4 ft
Arterials	< 45 mph	10-year	Shoulder + 3 ft
	< 45 mph	100-year	Shoulder + 4 ft
	> 45 mph	10-year	Shoulder
	>45 mph	100-year	Shoulder + 4 ft
	Sag Point	50-year	Shoulder + 3 ft
	Sag Point	100-year	Shoulder + 4 ft
Collector	< 45 mph	10-year	½ Driving Lane
	> 45 mph	10-year	Shoulder
	Sag Point	10-year	1/2 Driving Lane
Local Streets	Low ADT	5-year	1/2 Driving Lane
	High ADT	10-year	1/2 Driving Lane
	Sag Point	10-year	1/2 Driving Lane

* Shoulder is the entire pavement width outside the striped lane lines to the Preferred Alternative ultimate width.

Edge Treatment

In areas where the roadway pavement discharges runoff to Type 7 guardrail or curb, inlets shall be used to collect flow from the curb section, and the drains shall be piped to the bottom of the slope or to a permanent water quality feature. Rundowns shall not be used to convey concentrated flows to the bottom of slopes. Erosion protection shall be constructed at the outfalls. See Scour and Erosion Control below for more information.

Roadside Ditches and Open Channels

For roadside ditches along all existing and proposed roadways, the water surface profile shall have a minimum of one foot of freeboard for the 10-year return frequency peak discharge and shall not exceed edge of pavement for the 100-year return frequency peak discharge.

All open channels within the Project shall be designed to capture and convey the 100-year return frequency. Capacity shall be determined using Manning's Equation.

All ditches and open channels with a grade exceeding 2 percent shall be constructed with a turf reinforcement mat or other means approved by CDOT.

Flexible channel linings shall be designed in accordance with FHWA HEC-15, Design of Roadside Channels with Flexible Linings. Riprap channel lining shall be designed in accordance with FHWA HEC-11, Design of Riprap Revetment.

The geometric layout shall be in accordance with the AASHTO Roadside Design Guide, and shall consider hydraulics, safety, maintenance, long-term permanent erosion control, landscaping, and aesthetics.

All abandoned concrete diversion structures in roadside ditches and open channels shall be completely removed unless otherwise directed by CDOT.

Cross Drains

Cross drains shall be defined as pipes or culverts that convey water from one side of the road to the other, with headwall/wingwalls or flared end sections on both upstream and downstream ends of the cross drain. All cross drains shall be designed for the 100-year return frequency peak discharge for fully developed conditions. All cross drains shall be designed to accommodate the Preferred Alternative. Hydraulic design of cross drains shall be based on the procedures included in FHWA HDS No. 5, Hydraulic Design of Highway Culverts. Hydraulic design data shall be listed on the Final Design Documents for each cross drain, including drainage area, peak discharges, allowable headwater elevation, and design headwater elevation.

The minimum allowable pipe size for cross drains shall be 36 inches. End sections, or headwalls with beveled edges and wingwalls, shall be provided for all cross drains regardless of size. To reduce sizes, improved inlets may be utilized. Improved inlets shall be designed based on FHWA HEC-13, Hydraulic Design of Improved Inlets for Culverts.

Allowable headwater elevation for the 100-year return frequency peak discharge shall be designed as described in Chapter 9.2.2 of the CDOT Drainage Design Manual.

Discharge systems shall be designed to prevent scour of existing channels and embankments at the design flow rates.

Cross drains shall be continuous through the ROW. Bends or turns will not be permitted. Pipes connected to manholes or inlets placed in line with a cross drain will be referred to as a storm drain and shall follow the requirements for storm drains.

Storm Drains

Storm drains shall be defined as a network of pipes that connects inlets, manholes, and other drainage features to an outfall. Storm drain systems that convey flows generated from the I-25 and local roadways shall be designed for the 10-year return frequency discharge for Preferred Alternative. Storm drain systems draining sumps on I-25 shall be designed for the 100-year return frequency for the Preferred Alternative. The storm drain system shall be designed to not worsen the existing conditions for properties outside the ROW. Ponding will not be permitted within the Site, except at specifically designed water quality facilities. The storm drain system generally consists of a trunkline, laterals, inlets, and manholes.

Hydraulic analyses and plans for storm drains that are connected to existing storm drain systems upstream or downstream of the Site must be coordinated with affected Local Agencies. The hydraulic analyses shall identify impacts to the existing storm drain systems caused by the connections and proposed combined peak-design discharges for the overall systems.

The minimum allowable pipe diameter for storm drain systems is shown in Table 12.2-4. All bends and turns shall occur within a manhole or inlet.

Application	Minimum Diameter (inches)
Side Drain	18
Median Drain	18
Storm Drain Trunk Line	18
Connections:	
– Median drain to cross drain	18
– Curb inlet to trunk line	18

The use of sag pipes or inverted siphons will not be allowed.

Storm drains shall not decrease in size in the downstream direction.

Hydraulic Design of Storm Drains

Storm drain design shall be performed using hydraulic gradient analysis to account for all friction and minor losses. Friction losses shall be calculated using Manning's Equation. Minor losses at junctions, manholes, bends, and other appurtenances shall be calculated based on design procedures in the FHWA HEC-22, Urban Drainage Design Manual.

Storm drains under I-25 shall be designed with the hydraulic grade line (HGL) at or below the crown of pipe for the 10-year return frequency peak discharge. The HGL shall be 1 foot below pavement and inlet grates where the pipe is sized to convey the 100-year discharge. Local Agency criteria shall be followed for storm drain system design outside CDOT ROW. The hydraulic gradient shall be plotted for all storm drains in each storm drain profile.

The flow velocity of storm drains shall not be less than 3 feet per second for the 10-year return frequency peak discharge and shall not be greater than 22 feet per second for the major storm discharge (100-year).

Storm Drain Alignment, Profile, and Size

Storm drain alignments shall be straight between structures.

Profiles of all storm drains shall be straight grades between structures.

The Contractor shall comply with Local Agency criteria for storm drains outside CDOT ROW.

Inlets

Inlets are required at locations needed to collect runoff within the design controls specified in this Section 12. In addition, there are a number of locations where inlets may be necessary with little regard to contributing drainage area. These locations should be marked on the plans prior to any computations regarding discharge, water spread, inlet capacity, or bypass. Examples of such locations are as follows:

1. Sag points in the gutter grade
2. Upstream of median breaks, entrance/exit ramp gores, pedestrian ramps, cross walks, and street intersections
3. Immediately upstream and downstream of bridges
4. Immediately upstream of cross slope reversals

5. On side streets at intersections
6. At the end of channels in cut sections
7. Behind retaining walls, curbs, shoulders or sidewalks to drain low areas
8. Where necessary to collect snow melt

Inlets shall not be located in a path where pedestrians are likely to walk, in travel lanes, or in the gutter pan.

CDOT M&S Standard Plans inlets shall be used within CDOT ROW. Type C and Type D inlets shall not be allowed within the roadway pavement limits unless used in conjunction with embankment protectors. Inlets shall be designed for HS-20 or interstate alternate live loading.

Bicycle-safe grates are required for inlets with grates used in pedestrian areas.

Concrete aprons shall be installed on all area inlets per the CDOT M&S Standard Plans. Inlet hydraulic efficiency and spacing shall be determined based on design procedures in the FHWA HEC-22, Urban Drainage Design Manual. 100 percent of the bypass flow shall be added to the next downstream inlet.

For a continuous storm drain system, maximum inlet spacing shall be designed based on allowable flow spread or the manhole spacing criteria, whichever is less.

The sag vertical curve or sump area on a roadway requires inlets at the lowest point and flanking inlets on each side of the lowest inlet to provide relief from debris clogging. All sumps shall be designed in accordance with the criteria in Table 12.2.1. The flanking inlets shall be located such that the design criteria for ponding are met, even if the sump inlet is completely clogged.

Inlets are required 10 feet upstream the point where the street cross slope begins to super-elevate toward the opposite side to prevent cross street flow.

Trench drains will not be allowed in the traveled way or transverse to traffic flow on I-25. The use of scuppers or drainage slots in roadway barriers as a drainage element will not be allowed. Curb cuts shall not be allowed for bridge deck drains.

Valley gutters across connecting streets will not be allowed. Drainage runoff shall be intercepted upstream from connecting streets for subsurface conveyance. Drainage shall be intercepted before concentrated flows cross lanes of traffic.

Access holes such as inlets, catch basins, and manholes shall not be located in travel lanes.

A clogging factor of 50 percent shall be used for sizing single-unit inlet grates. A clogging factor of 10 percent shall be used for sizing single-unit curb opening inlets. For multiple-unit inlets, the clogging factor may be reduced as recommended in the UDFCD Urban Storm Drainage Criteria Manual, Volume I, Chapter 6, Section 3.

Deck drains on bridges shall be installed 1/2-inch lower than the surrounding deck to reduce the snag potential of the grate from snow plow blades.

Manholes and Junction Structures

Manholes shall be incorporated into the storm drain system to provide access for inspection, cleaning, and other maintenance activities. Manholes shall be constructed at all junctions, changes in pipe size, drops, and grade changes. Manholes shall be provided at any change in horizontal alignment greater than 2 degrees. Manholes shall not be located in travel lanes or auxiliary lanes of the I-25 mainline.

The spacing of manholes shall be in accordance with the criteria identified in the CDOT Drainage Design Manual. The spacing of manholes outside of CDOT ROW shall be in accordance with Local Agency criteria. For storm drain diameters 60-inch or greater, manholes shall be located considering Site conditions that provide for staging of large-scale maintenance activities.

Manhole and junction structure floors shall be shaped to fit the pipe inverts.

Drain Outfalls

Storm drain outfalls shall be designed such that the outlet elevation is as close as possible to the receiving drainageway flowline to prevent erosion. Outfalls shall be oriented in a downstream direction. Permanent erosion protection shall be provided at all outfalls and along the drainage flowlines where needed. Energy dissipaters shall be designed in accordance with the FHWA HEC-14 Hydraulic Design of Energy Dissipaters for Culverts and Channels, or UDFCD Urban Storm Drainage Criteria Manual Low Tailwater basins.

Grouted boulder rundowns must extend down to bedrock or to five (5) feet below the future bottom of channel in the receiving water, whichever is less.

The effects of tailwater in the receiving drainageway on the hydraulics of the outfall shall be evaluated. The design frequency of the tailwater of the receiving drainageway shall be based on the comparison of design discharge frequencies for coincidental occurrence included in the FHWA HEC-22, Urban Drainage Design Manual.

Scour and Erosion Control

Existing scour, rill or channel erosion issues within the Project limits shall be addressed by the Contractor.

Analyze all bridges and open-bottom cross drains for scour, and design appropriate protection/mitigation per HEC-18, Evaluating Scour at Bridges, Fourth Edition, and HEC-23, Bridge Scour and Stream Instability Countermeasures Experience, Selection, and Design Guidance Third Edition.

Analyze all channel changes, realignments and crossings for erosion and scour potential and design appropriate protection or mitigation per HEC-20, Stream Stability at Highway Structures, Third Edition.

The following minimum criteria apply to riprap layer thickness:

1. Thickness shall not be less than the spherical diameter of the D100 stone or less than 2.0 times the spherical diameter of the D50 stone, whichever results in the greater thickness.
2. Thickness shall not be less than 12 inches for practical placement.

3. The thickness determined by either Criteria 1 or 2 (above) shall be increased by 50 percent where the riprap is placed underwater to provide for uncertainties associated with this type of placement.
4. Oversized stones shall not be used.

Geotextile (Erosion Control Class 1) shall be used under all riprap per CDOT M & S Standards.

Sub-Drainage Systems

Sub-drainage systems (e.g., underdrains) shall be designed in accordance with the CDOT Drainage Design Manual. Sub-drainage systems may be discharged to the stormwater system in compliance with regulations for groundwater discharge and control of water quality.

Groundwater is expected to be encountered during construction of this Project. If groundwater is daylighted to the ground surface via storm drains (point source), a Subterranean Permit from CDPHE will be required. Upon Final Acceptance of the Project, the permit will be transferred to CDOT. The Contractor shall be responsible for obtaining the permit.

Underdrains exist in certain locations. The Contractor shall preserve the capacities and functionality of all existing groundwater drains encountered during construction, or replace drains if impacted by construction. Geotechnical investigation conducted on I-25 is provided in Book 5 - Reference Documents.

If the Contractor encounters wells or springs within the project limits, the Contractor shall protect the flow quantity, water quality, access, and availability of the wells and springs during and after construction.

Permanent Best Management Practices

The Contractor shall design BMPs to limit impacts to downstream facilities.

Sizing and location of BMPs shall accommodate the Preferred Alternative. The Contractor shall utilize and construct ponds in the vicinity of this Project for permanent water quality as part of this Project.

All Water Quality Pond BMPs shall be Extended Detention Basins (EDB) with a pre-sedimentation concrete forebay (minimum dimension of 12 feet by 12 feet with a concrete access ramp) with energy dissipation at the pipe outlet, 6-foot minimum wide concrete trickle channel with 6-inch mountable curb, concrete micropool (minimum dimension of 12 feet by 12 feet), and outlet structure with trash rack and water quality orifice plate. Concrete trickle channels to convey nuisance flows shall be provided from inflow locations to the primary low-level outlet, for all BMPs. Minimum grades for concrete trickle channels shall not be less than 0.4 percent. Minimum grades in the vegetated bottom of the basin shall be 3% toward the trickle channel or toward the micropool. The outlet structure used at all pond locations shall be flush with the side slope.

All weather vehicle maintenance access shall be provided to the forebay and outlet structures. Access surface shall be concrete below the pond design water surface elevation, and shall be constructed with 12" base course in all other areas. The access road shall have a turnaround at the end with a minimum 20 foot radius. The concrete access shall be at a maximum 4:1 slope to the micropool.

The elevation of the emergency spillway or overflow structure shall be at the elevation of the routed 100-year water surface. The emergency spillway or overflow structure shall have the capacity to convey the routed 100-year peak discharge. Embankments shall provide a minimum of one foot of freeboard above the routed 100-year water surface elevation through the emergency spillway.

The Contractor shall identify all base flows tributary to the ponds and provide means for these flows to circumvent the EDB. Ground water seepage, off-Site, landscape irrigation, or other types of flow shall not pass through the forebay, trickle channel, or micropool.

The low-level outlet shall include a debris rack with a total opening area at least twice the area of the low-level outlet.

Extended detention basin slopes and bottom shall be protected against erosion from inflows and circulation within the basin. Slopes of earth embankments for extended detention facilities steeper than 4:1 will not be allowed. Slopes in detention/water quality facilities shall be planted with the seed mix as shown in Book 3 – Contract Drawings.

Existing unintended detention storage volume at the entrance to existing cross drains or storm drain systems shall not be considered to reduce peak discharges downstream.

Groundwater elevations shall be determined by the Contractor at all EDB locations and submitted to CDOT for review prior to NTP2. If groundwater is encountered, measures shall be taken (e.g., perimeter underdrain system or impermeable liner) to prevent groundwater seepage or a base flow into the pond.

Final design of all permanent BMPs shall be Approved by CDOT and the City of Pueblo with the SWMP and SWMP Site Map. All permanent BMPs locations shall be surveyed/GPS and all survey information shall be provided on a CD to CDOT for Acceptance prior to Final Acceptance.

Bridges and Deck Drainage

Deck-drainage systems are required for highway bridges when maximum allowable flow spread for the design storm is exceeded and to limit flow across expansion joints to less than 1 cubic foot per second for the 10-year return frequency peak discharge. Stormwater flowing toward the bridge shall be intercepted prior to the approach slab. Stormwater flowing away from the bridge shall be intercepted prior to leaving the approach slab. This stormwater shall be directed to an on-Site drainage system and conveyed to a permanent BMP. Bridge deck drainage systems shall be designed in accordance with the FHWA HEC-21 Bridge-Deck Drainage Systems.

All bridge-deck drain inlets shall be grated. The bridge-deck drainage system shall be compatible with structural reinforcement, components, and aesthetics of the bridge. Outfalls shall be positioned to avoid corrosion of structural members, and splash on vehicular/railroad traffic and pedestrian areas below the bridge. Adequate erosion protection shall be provided for all deck drains piped to the bottom of the slope. Downspouts for bridge drains shall be a minimum 10-inch diameter galvanized steel pipe and shall meet the Project Aesthetic Guidelines in Book 4 – Contract Drawings. See Book 2, Sections 15 - Structures, for more information on Bridge Deck Drainage.

12.2.5 Floodplains

The Contractor shall coordinate all impacts to FEMA-regulated floodplains and changes to bridges and cross drains located in FEMA-regulated floodplains with CDOT, FEMA, and the local City or County floodplain administrator. The Contractor shall comply with local floodplain development permits and other National Flood Insurance Program requirements. As required by FEMA or local floodplain administrators, the Contractor shall develop hydraulic models of the waterways and crossing structures to demonstrate hydraulic performance of new structures and existing structures. The Contractor shall apply for and obtain Conditional Letters of Map Revision (CLOMR) and Letters of Map Revision (LOMR) as required. The Contractor shall be responsible for all FEMA and other Agency fees. The Contractor shall be responsible for obtaining floodplain development permits as required by the Local Agencies.

12.2.6 Area Specific Drainage Requirements and/or Information

The Contractor shall remove the existing concrete box culvert that conveys Phelps Creek underneath I-25 and restore it to an open channel. Design of the channel shall accommodate the flows of the creek. The Contractor shall contact the City of Pueblo to obtain the information to ensure the channel design will accommodate the flows of the existing creek. Historic Arkansas Riverwalk Design Calculations are shown in Book 5 - Reference Documents.

Fays Crossing Groundwater Concern

Contractor shall investigate and perform an analysis of the ground water problem that exists on US 50C (Santa Fe Avenue) between the Fays Crossing pedestrian overpass and the Railroad overpass (M.P 0.5515). The Contractor shall submit a written report with description of investigation methods, discussion of the cause of the groundwater concern, proposed solutions, and prices to construct. The report shall be submitted to CDOT for review within 45 days of NTP2.

12.3 Construction Requirements

Drainage facilities shall be constructed in accordance with the CDOT Standard Specifications, Standard Plans, and M & S Standards. Within the City and County of Pueblo right of way, drainage facilities shall be constructed in accordance with local standards.

Drainage facilities shall be designed to accommodate the construction phasing of the Project.

The Contractor shall survey permanent BMPs according to Section 6.1.3 of the CDOT Survey Manual to confirm the design volume has been provided during construction and documented in the As-Built Plans. This work shall be prior to Final Acceptance. The Contractor shall map for inclusion into CDOT's GIS system all new and existing (remaining) outfalls.

12.3.1 Pipe Material Selection Policy

The Contractor shall comply with the CDOT Design Bulletin Pipe Material Selection Policy which is included in Book 3 – Applicable Standards, Data and Reports. The most current version as signed by the CDOT Chief Engineer at the time of the Request for Proposals (RFP) shall be utilized.

Clarifications of the CDOT Pipe Material Selection Policy are as follows:

1. Trial installations are not allowed on this Project
2. Contractor shall be required to sample soil and water
3. "Project Manager" implies "Contractor"

4. Contractor shall provide a Sampling Schedule for Pipe Selection for CDOT review prior to NTP2
5. Pipe material selection shall be submitted to CDOT for Acceptance as part of the Drainage Reports
6. Aluminum alloy pipe shall not be used
7. All pipes on the roadway portion of I-25 or crossing I-25 shall be concrete

12.4 Deliverables

12.4.1 Drainage and Water Quality Report

Drainage Reports

Interim Drainage Reports shall be prepared by the Contractor and submitted for Acceptance prior to Released for Construction documents that include the subject drainage facilities.

A Final Drainage Report, incorporating addenda to previously Accepted Interim Drainage Reports, shall be prepared by the Contractor and submitted for Approval prior to Final Acceptance. No Addenda to the Final Drainage Report will be allowed.

The interim and final drainage reports shall follow the documentation procedure in Chapter 4 of the CDOT Drainage Design Manual.

The drainage reports shall include the following:

1. Basic design data, design assumptions, hydrologic and hydraulic methodologies, assumptions, model inputs and outputs, detailed calculations, computations, and computer printouts, relevant design criteria, circumstances influencing design, discussion of all drainage issues and drainage facilities, appropriate maps, figures, and plans.
2. Rationale for sizing and selection of all drainage elements, including catch basins, storm drain systems, cross drains, ditches, swales, BMPs, extended detention facilities, and pipe materials selection.
3. Hydraulic data sheets with a summary of hydraulic design information for each Storm Drain and Cross Drain.
4. A delineation of contributing basins, existing drainage patterns for both highway and cross-drainage flows, drainage parameters, extended detention basin sizing, discharge characteristics, and other information necessary for the design of the drainage system. All drainage reports shall include documentation of any tributary flows from areas outside of each construction segment as defined by the Contractor.
5. Documentation that the proposed runoff will be controlled and treated in accordance with this Section 12 and all drainage and water quality permits.
6. Documentation of existing drainage discharge rates, outfall locations and pond release rates.
7. Documentation of the impact of proposed drainage designs on existing drainage facilities.

8. Documentation of compatibility with the Preferred Alternative.
9. Calculations, analysis, and all related information used in developing conclusions and recommendations for BMPs in accordance with CDOT New Development Redevelopment (NDRD) requirements.
10. Maintenance Exhibit, showing entities (CDOT, CCD, and/or UDFCD) responsible for maintenance of various portions of the project area.

In addition to the documentation procedure in Chapter 4 of the CDOT Drainage Design Manual, the Contractor shall closely follow the report outline below. The section and subsection headings shall be maintained at a minimum. If a section or subsection is not used, the reason it is not applicable to the Project shall be specified. New sections or additional subsections shall be added as necessary to fully document the drainage design.

Drainage Report Outline

- 1 INTRODUCTION
 - 1.1 Location of Improvements
 - 1.2 Description of Improvements
 - 1.3 Discussion of Drainage Investigation
- 2 CROSS DRAINAGE, DRAINAGEWAY, AND IRRIGATION DITCH CROSSINGS
 - 2.1 Location and General Discussion
 - 2.2 Hydrology and Design Flow Development
 - 2.2.1 Information Sources
 - 2.3 Agency Coordination (i.e. local agencies)
 - 2.4 Description of Structural Design
 - 2.5 Hydraulic Design
 - 2.6 Irrigation Ditch Crossings
 - 2.7 Drainageways and Floodplains
 - 2.8 Scour Analysis
 - 2.9 Bank Stabilization
- 3 ROADWAY DRAINAGE SYSTEMS
 - 3.1 General Discussion
 - 3.2 Design Coordination
 - 3.2.1 Adjacent Segments
 - 3.2.2 Agency Coordination
 - 3.3 Drainage Basin Delineations & Characterization
 - 3.3.1 Existing Basins
 - 3.3.2 Proposed Basins
 - 3.4 Hydrology and Design Flow Development
 - 3.5 Pavement, Median and Roadside Drainage
 - 3.5.1 Inlet/Catch Basin Spacing Design
 - 3.5.2 Storm Drain Design
 - 3.5.3 Roadside Ditch and Channel Design
 - 3.5.4 Erosion Control Design
- 4 PERMANENT BEST MANAGEMENT PRACTICES
 - 4.1 Assumptions and Methodologies
 - 4.1.1 Allowable Release Rate Discussion
 - 4.2 Hydrology and Hydraulics
 - 4.2.1 Storage and Outlet Design Documentation
 - 4.3 Adherence to the CDOT MS4 Permit and NDRD requirements

-
- 5 APPENDICES
- 5.1 Hydrologic Analysis
 - 5.1.1 On-Site Hydrology
 - 5.1.2 Off-Site Hydrology
 - 5.1.3 Precipitation Data
 - 5.1.4 Soil Survey
 - 5.1.5 Land Use
 - 5.1.6 FEMA Maps
 - 5.2 Hydraulic Analysis
 - 5.2.1 Spread width, Inlet and Storm Drain Calculations
 - 5.2.2 Roadside Ditch and Channel Calculations
 - 5.2.3 Hydraulic Grade Line Calculations
 - 5.2.4 Drain Outfalls, Scour and Erosion Control Calculations
 - 5.2.5 Sub-Drainage Systems
 - 5.3 Permanent Best Management Practices
 - 5.3.1 Extended Detention Basin Calculations
 - 5.3.2 Stage Storage Calculations
 - 5.3.3 Trickle Channel Calculations
 - 5.3.4 Water Quality Structure Calculations
 - 5.4 Basin Maps
 - 5.4.1 Existing and Proposed On Site Basin Maps
 - 5.4.2 Off Site Basin Maps (full size 22" x 34" sheets)
 - 5.5 Maintenance Exhibit

The Contractor shall submit 3 hard copies of all Interim Drainage Reports and 3 hard copies of the Final Drainage Report. All drainage reports shall be signed and sealed by a Colorado Licensed Professional Engineer.

The Contractor shall submit one electronic copy of all signed and sealed drainage reports in PDF format.

All drainage reports shall include electronic copies of all computer analysis input and output files in the native file format.

12.4.2 Water Quality Report

The purpose of the Water Quality Report is to document permanent water quality design decisions for compliance with the CDPHE. All decisions shall adhere to the NDRD program as part of CDOT's and the City of Pueblo's overall MS4 permit.

Interim Water Quality Reports shall be prepared by the Contractor and submitted for Acceptance prior Release for Construction documents that include the subject drainage facilities.

A Final Water Quality Report, incorporating addenda to previously Accepted reports, shall be prepared by the Contractor and submitted for Approval prior to Final Acceptance. No Addenda to the Final Water Quality Report will be allowed.

The Water Quality Reports shall reference the applicable drainage report for all technical aspects and design calculations.

The Contractor shall submit 3 hard copies of all Interim Water Quality Reports and 3 hard copies of the Final Water Quality Report. All Water Quality Reports shall be signed and sealed by a Colorado Licensed Professional Engineer.

The Contractor shall submit one electronic copy of all signed and sealed Water Quality Reports in PDF format.

The Contractor shall complete and sign the CDOT Permanent Water Quality Project Inventory and Questionnaire Form for each permanent BMP prior to Released for Construction Documents and submit them to CDOT for Acceptance.

The Water Quality Report Outline as listed in the above mentioned document shall be maintained at a minimum. If a section or subsection is not used the reason it is not applicable to the Project shall be specified. New sections or additional subsections shall be added as necessary to fully document the design.

12.4.3 Drainage Design Deliverables

The Contractor shall prepare plans for all drainage related facilities for the Project in a format that follows the documentation procedure in Chapter 4 of the CDOT Drainage Design Manual, and the CDOT CADD Manual and CDOT Drafting Manual.

The Contractor shall submit all applicable plans, profiles and details with each Drainage Report for Acceptance prior to Released for Construction Documents.

All deliverables shall follow the Quality Management Plan for the Project as described in Book 2, Section 3 - Quality Management.

The Contractor shall include the following for all drainage plan deliverables:

PLAN VIEW

1. Provide the location of all existing and proposed storm drains. Provide a label for each proposed storm drain location. The Contractor shall establish a labeling system that is specific to each proposed storm drain system and provide a table to summarize all pertinent information. The table shall include at a minimum the Drain Line and Sheet Number where the profile can be found.
2. Provide the location of all existing and proposed inlets, manholes, end sections, and outlet protection. Provide a label for each proposed inlet, manhole, end section, outlet structure and outlet protection. Include a table that summarizes all pertinent information. The table shall include, at a minimum, the Label ID, Station & Offset, Item, Length, Pay Depth, and Notes.
3. Provide all existing and proposed grading.
4. Provide all Utility locations.
5. Provide location of ROW lines.

PROFILES

1. Provide profiles for all proposed storm drains. Include the Label ID from plan view sheets, station and offset, invert elevations, rim elevations, structure depth, slopes, sizes, material, utility crossings, existing and proposed finished grade lines, the design flow for the 10-year and 100-year event, and the calculated HGL for the 10-year and 100-year event.
2. Provide profiles for all proposed cross drains. Include the Label ID from plan view sheets, station and offset, invert elevations, slopes, sizes, material, utility crossings, and

existing and proposed finished grade lines. Provide the drainage area of contributing basin, 100-year discharge, and headwater elevation on all applicable profile sheets for cross drains.

DRAINAGE DETAILS

1. Include details for all non-standard CDOT items.

BMP DETAILS FOR EDB

1. Provide each EDB in plan view. Provide existing and proposed contours that define limits of overall facility. Include access roads, overflow location or structure, forebay, trickle channel, micropool, and outlet structure. Include all locations of Utilities and property lines. Include point labels to define location and elevations within the facility.
2. Provide a table summarizing each point label. The table shall include at a minimum the Point Label, Station & Offset, Northing, Easting, Elevation and Notes.
3. Provide a cross section of the EDB from where flows enter the pond to the outlet structure. Label elevations for the WQCV. Include slopes and elevations of all features.
4. Provide a geometry plan of the EDB from where flows enter the pond to the outlet structure. Include access roads.
5. Provide specific details for the forebay, trickle channel, micropool, and outlet structure.

12.4.4 As-Built Documents

Clearly label and locate all items of Work with station, offset, and elevation information based on surveys of what was actually built in the field. Provide summaries of all As-Built drains with the following hydraulic information, at a minimum: pipe/culvert size, invert elevations, slope, 10-year flow (Q10), 100-year design flow (Q100), and HGL.

Provide Certification, stamped by a Colorado Professional Engineer, for the EDB as-built volumes, water surface elevations and orifice plates for Acceptance prior to Final Acceptance

12.4.5 Deliverable Table

At a minimum, the Contractor shall submit the following to CDOT and all applicable review agencies for review, Approval, and/or Acceptance. The Contractor shall identify and coordinate all required Approvals by CDOT and outside agencies.

Deliverable	review, Acceptance or Approval	Schedule
Proposed on-site drainage improvements connected to existing storm drains	Approval	Prior to construction
Proposed change to existing drainage patterns	Approval	Prior to construction
SWMP and SWMP Site Map	Acceptance	Prior to RFC
FEMA Approved CLOMR	Acceptance	Prior to issuance of Released for Construction Documents
FEMA Approved LOMR	Acceptance	After project is constructed
Spill Prevention Control and Countermeasure Plan	Acceptance	21 Days prior to the NTP2
Equivalent Area report and calculations	Approval	With Released for Construction Documents

Deliverable	review, Acceptance or Approval	Schedule
Groundwater Elevations at Pond Locations	review	Prior to NTP2
Final Design of all BMPs	Approval	With SWMP and SWMP Site Map
Permanent BMP location surveys	Acceptance	Prior to Final Acceptance
Fays Crossing Groundwater report	review	Within 45 Days of NTP2
Sampling Schedule for Pipe Selection	review	Prior to NTP2
Interim Drainage Reports	Acceptance	Prior to Released for Construction Documents
Final Drainage Report	Approval	Prior to Final Acceptance
Interim Water Quality Report	Acceptance	Prior to Released for Construction Documents
Final Water Quality Report	Approval	Prior to Final Acceptance
Signed CDOT Permanent Water Quality Project Inventory and Questionnaire Forms	Acceptance	Prior to Released for Construction Documents
Drainage plans, profiles, and details	Acceptance	Prior to Released for Construction Documents
Certification for EDB as-built volumes, water surface elevations and orifice plates	Acceptance	Prior to Final Acceptance
Interim Bridge Hydraulics Report	Acceptance	Prior to Released for Construction Documents

All deliverables shall also conform to the requirements of Section 3 - Quality Management.